รายงานวิจัยฉบับสมบูรณ์

โครงการ

1. การประเมินเทคโนโลยีและการใช้เทคโนโลยีอย่างเหมาะสมเพื่อคุณภาพการบริการในโรงพยาบาล **(Technology assessment and quality use in hospital setting)**
2. โครงการสหสาขาวิชาเพื่อแก้ปัญหาสาธารณสุขที่สำคัญของประเทศ **(Multi disciplinary research on important public health problem)**

โดย

ศาสตราจารย์ นายแพทย์จิตร สิทธีอมร

14 พฤษภาคม 2554

สัญญาเลขที่ RTA/08/2540

รายงานวิจัยฉบับสมบูรณ์

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   (Multi disciplinary research on important public health problem)

ศาสตราจารย์ นายแพทย์จิตร สิทธีอมร
จุฬาลงกรณ์มหาวิทยาลัย

สนับสนุนโดย สำนักงานกองทุนสนับสนุนการวิจัย

บทคัดย่อ

โครงการทุนส่งเสริมการวิจัย เมธีวิจัยอาวุโส สกว ศ. นพ. จิตร สิทธีอมร ประกอบด้วย 2 กลุ่มโครงการ คือ 1) กลุ่มโครงการการประเมินเทคโนโลยีและการใช้เทคโนโลยีอย่างเหมาะสมเพื่อคุณภาพการบริการในโรงพยาบาล และ 2) กลุ่มโครงการสหสาขาวิชาเพื่อแก้ปัญหาสาธารณสุขที่สำคัญของประเทศ โดยมีเป้าหมายรวม คือ การพัฒนาศักภาพนักวิจัยในการทำงาน และบริหารงานวิจัย เพื่อนำกระบวนการวิจัยมาแก้ไขปัญหาด้านสาธารณสุขในประเทศ มีโครงการวิจัยที่ได้รับทุนสนับสนุน รวมทั้งสิ้น 17 โครงการ จากหลากหลายหน่วยงานในประเทศ

กลุ่มโครงการประเมินเทคโนโลยีเพื่อการบริการระดับโรงพยาบาล ประกอบด้วยโครงการวิจัย 10 โครงการ อันได้แก่ 1) The cost effectiveness of early detection of bancroftion filarasis in Myanmar Migrants using antigen-capsule ELISA, IgG4 antibody assays and PCR technique ระยะที่ 1 และ ระยะที่ 2 2) รูปแบบการตรวจพาหะธาลัสซีเมียฮีโมโกลบินผิดปกติ 3) ประสิทธภาพของการดูแลร่วมกันสำหรับผู้ป่วยโรคลมชักในจังหวัดนครราชสีมา 4) การศึกษาเพื่อหาปัจจัยเสี่ยงของผู้ป่วยกล้ามเนื้อหัวใจวายตายเฉียบพลันกับกลุ่มควบคุม 5) การศึกษาครอบครัวไหลตาย 6) แนวโน้มการช่วยคืนชีพในผู้ป่วยระยะสุดท้าย และประสิทธิผลของการทำพินัยกรรมชีวิต เรื่องการช่วยคืนชีพในผู้ป่วยระยะสุดท้ายในโรงพยาบาลมหาวิทยาลัยเชียงใหม่ 7) ทัศนคติต่อการทำพินัยกรรมชีวิตและการให้ข้อมูลเรื่องผลของการช่วยคืนชีพในผู้ป่วยอายุรกรรม โรงพยาบาลมหาวิทยาลัย 8) โครงการตรวจสุขภาพประจำปี ของผู้สูงอายุในเขตชนบทของจังหวัดขอนแก่น 9) การศึกษาความเข้าใจ ความน่าเชื่อถือ ความสมบูรณ์ และความไวต่อการเปลี่ยนแปของแบบสอบถาม ฉบับภาษาไทย Health Assessment Questionnaire สำหรับผู้ป่วยโรคข้ออักเสบ และ 10) การศึกษาความชุก ภาวะความรุนแรง ปัจจัยและผลที่เกิดขึ้นจากเนื้อตายในผู้ป่วยถูกงูเห่าและงูกะปะกัด และการศึกษาการป้องกันภาวะเนื้อตายที่เกิดขึ้นในสัตว์ทดลอง

กลุ่มโครงการสหสาขาวิชาเพื่อแก้ปัญหาสาธารณสุขที่สำคัญของประเทศ ประกอบด้วยโครงการวิจัย 7 โครงการ อันได้แก่ 1) ผลของการปรับเปลี่ยนการบริโภคมาเป็นข้าวกล้อง งา ผัก ผลไม้ ตามฤดูกาลของประชาชนในเขตเทศบาลจังหวัดสุโขทัย 2) ความต้องการและ ปัญหาด้านสุขภาพ การเข้าถึงบริการ และคุณภาพชีวิตของวัยรุ่นกับการสร้างความร่วมมือ 3) การศึกษาผลกระทบของฝุ่นละอองขนาดเล็กต่อสุขภาพของประชาชนในจังหวัดเชียงใหม่ 4) สื่อสร้างสรรค์จากเพื่อนสู่เพื่อนเพื่อส่งเสริมพฤติกรรมป้องกันการเสพยาบ้าของวัยรุ่นในชุมชนแออัด 5) การมีส่วนร่วมของประชาสังคมในกลยุทธ์เพื่อส่งเสริมการใช้ยาอย่างเหมาะสมสำหรับการรักษาโรคติดต่อที่ระบบทางเดินหายใจส่วนบนของผู้ใหญ่ในระดับครัวเรือนและชุมชน: กรณีศึกษาชุมชนแออัดในกรุงเทพมหานคร 6) การวิเคราะห์ความเสี่ยงในการเกิดโรคหัวใจ ชัก และการเสียชีวิตจากการศึกษาระยะยาวในชุมชนแออัดคลองเตย และ 7) การติดต่อของเชื้อหวัดสายพันธุ์ A ระหว่างคนและสัตว์ในประเทศไทย

โครงการทุนส่งเสริมการวิจัย เมธีวิจัยอาวุโส สกว ศ. นพ. จิตร สิทธีอมร ได้กำหนดตัวชี้วัดของการบรรลุเป้าหมาย อันได้แก่ ผลงานวิจัยที่ผลิต การตีพิมพ์ในวารสารระดับชาติและนานาชาติ การที่นักวิจัยสามารถเขียนโครงการขอทุนด้วยตัวเอง การทำวิจัยร่วมระหว่างสถาบันและระหว่างนักวิจัยต่างสาขา ตลอดจนการที่ผลงานวิจัยได้ถูกนำไปใช้เป็นแนวทางในการวางนโยบายระดับนโยบายสาธารณะ และในระดับสถานบริการ พบว่าโครงส่วนใหญ่ที่ได้รับงบประมาณสนับสนุน ได้ดำเนินการบรรลุตามวัตถุประสงค์ และตัวชี้วัดที่ได้

กำหนดไว้ พบว่า จากจำนวนโครงการ 17 โครงการ มีการตีพิมพ์ในวารสารรวมทั้งสิ้น 16 บทความ เป็นการตีพิมพ์ในวารสารระดับนานาชาติ จำนวน 14 เรื่อง ตีพิมพ์ในวารสารระดับชาติ 2 จำนวน มีการนำเผยแพร่ผลงานวิชาการในการประชุมวิชาการ และการสัมมนาทั้งในระดับนานาชาติ และระดับชาติ รวม 5 เรื่อง มีการต่อยอดโครงการวิจัย โดยนักวิจัยสามารถเขียนโครงการขอทุนด้วยตัวเองได้ 4 เรื่อง มีการทำวิจัยร่วมระหว่างสถาบันและระหว่างนักวิจัยต่างสาขา จำนวน 4 เรื่อง มีนักวิจัย ที่มีความชำนาญ หรือเป็นผู้เชี่ยวชาญเพิ่มขึ้น 8 คน ในด้านการแพทย์ การพยาบาล การสาธารณสุข นักวิจัยจำนวน 3 คน ได้รับเข้าเป็นอาจารย์ในสถาบันการศึกษาของรัฐ ได้แก่ นพ.ธนินทร์ อัศววิเชียรจินดา เป็นอาจารย์คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ดร.รัตนา สำโรงทอง เป็นอาจารย์วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย และ ดร.ศิริตรี สุทธจิตต์ เป็นอาจารย์คณะเภสัชศาสตร์ มหาวิทยาลัยมหาสารคาม

นอกจากนี้ยังมีผลงานวิจัยจำนวนหนึ่ง ได้ถูกนำไปใช้เป็นแนวทางในตรวจโรคบางอย่างในโรงพยาบาล เช่น การพัฒนารูปแบบการตรวจพาหะธาลัสซีเมียฮีโมโกลบินผิดปกติและการศึกษาความคุ้มทุนของการตรวจ bancroftion filarasis ด้วยวิธีการต่างๆ และบางโครงการได้นำไปใช้เป็นแนวทางในแก้ปัญหาด้านสาธารณสุข ในเรื่องสุขภาพวัยรุ่น การส่งเสริมด้านโภชนาการ การใช้ยาอย่างเหมาะสม ได้มีนำผลการศึกษา ไปใช้เป็นแนวทางในการวางนโยบายระดับสาธารณะ เช่น เรื่องสุขภาพวัยรุ่นในชุมชนแออัด การใช้ยาอย่างเหมาะสมในชุมชน เป็นต้น

คำสำคัญ การใช้เทคโนโลยีอย่างเหมาะสม การบริการในโรงพยาบาล สหสาขาวิชา ปัญหาสาธารณสุข

Abstract

The Thailand Research Fund (TRF) has supported research projects through Prof. Chitr Sitthi-amorn, TRF Senior Research Scholar. The projects were classified into 2 clusters: 1) Technology assessment and appropriate technology for quality of care of the hospitals and 2) Multidisciplinary research for solving public health problems. These research projects aimed to strengthen research capacity and research management for solving public health problems Thailand. There were 17 research projects undertaken by various institutions.

The cluster of the technology assessment projects to improve quality of care in the hospitals composed of 10 sub-projects:

1) The cost effectiveness of early detection of bancroftion filarasis in Myanmar Migrants using antigen-capsule ELISA, IgG4 antibody assays and PCR technique (Phase I, II)
2) Screening models for Thalassemia and Hemoglobin patients
3) The effectiveness of shared care for patients with epilepsy in Nakhonratchasima province
4) INTER-HEART: a global study of risk factors in Acute Myocardial Infraction
5) A study of Unexpected Death Syndrome
6) Trend of cardiopulmonary resuscitation patients with terminal illness in Chiang Mai
7) Attitude towards advance directives and the impact of prognostic information on the preference for cardiopulmonary resuscitation on medical inpatients in CMU Hospital, Thailand
8) Annual health examination among elderly in rural areas of Khon Kaen Province
9) Comprehensibility, reliability, validity, and responsiveness of the Thai version of the Health Assessment Questionnaire in Thai patients with rheumatoid arthritis
10) Prevalence, severity, determinants and consequences of tissue necrosis among victims envenomed by Naja kaouthia (Thai Cobra) and Calloselasma rhodostoma (Malayan Pit Viper) and its prevention in an experimental model

The cluster of the multidisciplinary research projects which sought to identify solutions to public health problems consisted of 7 sub-projects:

1) Healthy food choices in accordance with seasonal diets in Sukothai province
2) Adolescent health needs and accessibility of services in congested community
3) A study of effect of PM_{10} and $PM_{2.5}$ of population in Chiang Mai
4) Friend media to prevent drug addict of adolescent in congested community
5) Partnership of civil society in a strategy to reduce the use of antibiotics in the treatment of adults with Upper Respiratory Infection (URIs) from viral origins at the household and community levels: A comparison study in congested community, Bangkok Thailand

6) An analysis of population cohort: Risk of Hypertension, Stroke, and Death of residence in Klong Toey Slum
7) Influenza A infections at the human animal interface.

The indicators of the achievement of these research projects included several research reports, national and international publications, fundraising and the utilization of findings to inform public policy and improve the quality of care. The results shown that many sub-projects supported by the TRF Senior Research Scholar (Prof. Chitr Sitthi-amorn) met the objectives. There were 16 publications from 17 research projects: 14 international publications and two national publications. In addition, five research projects were presented in international and national conferences; four research projects were awarded additional external funding to explore findings further; four projects have initiated institutional collaborations; eight principal investigators have become recognized experts in their area, and three principal investigators have since been appointed as university lecturers.

Furthermore, research findings of some TRF projects were applied to diagnose disease in hospitals, for example, the development of Thalassemia diagnosis and determination of the cost effectiveness of diagnosis bancroftion filarasis. In addition, some research projects have identified alternative methods to address community health issues, including improving adolescent health, improving nutritional status, better ensuring rational use of drugs and forming public health policy.

Keywords: Appropriate technology, Hospital care, Multidisciplinary, Health problem

สารบัญ

หน้า

รายงานผลการวิจัย

กลุ่มโครงการประเมินเทคโนโลยีเพื่อการบริการระดับโรงพยาบาล

กลุ่มโครงการสหสาขาวิชาเพื่อแก้ปัญหาสาธารณสุขที่สำคัญของประเทศ

กลุ่มโครงการประเมินเทคโนโลยีเพื่อการบริการระดับโรงพยาบาล 10 โครงการ

ชื่อโครงการ 1 The cost effectiveness of early detection of bancroftion filarasis in Myanmar Migrants using antigen-capsule ELISA, IgG4 antibody assays and PCR technique

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นักวิจัยในทีม นพ.สมชาย วงศ์ยงเจริญ

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล

ปัจจุบันการตรวจหาผู้ป่วยโรคเท้าช้างทำได้หลายวิธี วิธีที่นิยมใช้กันคือการใช้ฟิล์มส่องหาเชื้อ Microfilaria (Blood smear technique) ซึ่งให้ผลบวกต่อการตรวจ 3% (7/202) ในขณะที่วิธีตรวจ w. bancroftispecific circulating antigen (Ag) การตรวจ anti-filarial Ig4 antibody (Ab) และวิธี Polymerase Chain Reaction (PCR) ให้ผลบวกต่อการตรวจ 16% (34/202) และ 6% (13/202) ตามลำดับ โดยการตรวจด้วยวิธี Blood smear technique ยังไม่สามารถสรุปได้ว่าการตรวจไม่พบเชื้อ Microfilaria (Mf) จะไม่เป็นโรค เนื่องจากในการศึกษายังคงพบผู้ป่วยที่ตรวจไม่พบเชื้ออยู่จำนวนหนึ่ง ในการศึกษากลุ่มแรงงานชาวพม่าในเขตพื้นที่ อ.แม่สอด จ.ตาก จำนวน 202 ราย จึงกำหนดให้การตรวจพบ Microfilaria positive (Mf+) และ/หรือ Antigen positive (Ag+) เป็น Reference method ของการวินิจฉัยโรคเท้าช้าง ผลการศึกษาพบความชุกของโรค 17% (35/202) สำหรับการทดสอบความไวการตรวจหา Ag มีความไวสูงสุด (97%) รองลงมาเป็นการตรวจหา Ab (86%) วิธี PCR (37%) และวิธี Blood smear technique มีความไวในการตรวจพบผู้ป่วยต่ำสุด (20%) ในขณะที่ความจำเพาะต่อโรคของการตรวจหา Ab ต่ำกว่าวิธีอื่น (46%) ในการวิเคราะห์ต้นทุน-ประสิทธิผลแสดงให้เห็นว่าการใช้วิธี PCR โดยมีต้นทุน 52.99 บาทต่อคน 75.12 บาทต่อคน และ 205.03 บาทต่อคนตามลำดับ ดังนั้นการตรวจหา Ag จึงเป็นวิธีที่ cost effectiveness ที่สุด แม้จะมีค่าใช้จ่ายในการตรวจสูงกว่าวิธี Blood smear technique และการตรวจหา Ab ก็ตาม

วัตถุประสงค์

ศึกษาความไวและความจำเพาะของวิธีวินิจฉัยโรคเท้าช้างซึ่งเกิดจากเชื้อ Wuchereria bancrofti (W. bancrofti) โดยใช้ปฏิกิริยาลูกโซ่โพลีเมอร์เรส (Polymerase Chain Reaction, PCR) และการตรวจระดับ Specific circulating antigen (Mf) ในเลือดต่ำมากไม่สามารถตรวจพบในเลือดได้โดยวิธีการดูด้วยกล้องจุลทรรศน์ และศึกษาถึงต้นทุน-ประสิทธิผลของวิธีวินิจฉัยดังกล่าว

ขั้นตอนการศึกษา

1. การเก็บตัวอย่างสำหรับการวิเคราะห์ทางปฏิกิริยาลูกโซ่โพลิเมอร์เรสและการตรวจสอบทางน้ำเหลือง
2. ตัวอย่างสำหรับการตรวจทางปรสิตวิทยา
3. การตรวจด้วยวิธีปฏิกิริยาลูกโซ่โพลิเมอร์เรส
4. การตรวจ W. bancrofti-specific circulating anigen
5. การตรวจ anti-filarial IgG4 antibody

6. การวิเคราะห์ข้อมูล

ผลการศึกษา

จากการศึกษาต้นทุน-ประสิทธิผลของวิธีการตรวจหาผู้ป่วยโรคเท้าช้าง โดยการตรวจหาเชื้อ Mf ด้วยวิธี Blood smear technique การตรวจหา Ag และ Ab รวมทั้งการตรวจหาด้วยวิธี PCR ในกลุ่มแรงงานพม่าจำนววน 202 รายในจ.ตาก เป็นเพศชาย 47 ราย (23%) และเพศหญิง 155 ราย (77%) พบว่าการตรวจหา Ab ให้ผลบวกต่อการตรวจสูงถึง 59% รองลงมาเป็นการตรวจหา Ag ให้ผลบวกต่อการตรวจ 16% วิธี Blood smear technique ให้ผลบวกต่อการตรวจ 6% และวิธี PCR ให้ผลบวกต่อการตรวจต่ำสุดคือ 3% เมื่อจำแนกตามช่วงอายุ พบว่ากลุ่มที่ให้ผลบวกต่อการตรวจหา Ag การตรวจหา Ab และวิธี PCR สูงสุดคือ กลุ่มช่วงอายุ >15-30 ปี ในขณะที่การตรวจหาเชื้อ Mf (Blood smear technique) ให้ผลบวกต่อการตรวจสูงสุดในกลุ่มช่วงอายุ >30-45 ปี

การนำผลไปใช้ประโยชน์

การวิเคราะห์ต้นทุน-ประสิทธิภาพได้ใช้ Mf+ และ/หรือ Ag+ เป็น reference method เนื่องจากแม้ว่า Mf จะเป็นวิธีดั้งเดิมที่ใช้กันแต่ไม่สามารถวินิจฉัยผู้ป่วยที่มีเชื้อจำนวนน้อย หรือผู้ป่วยที่อยู่ระยะแรกเริ่ม (prepatient) ได้ ส่วนการตรวจหา Ab นั้น แม้ว่าจะวินิจฉัยผู้ป่วยได้จำนวนมาก แต่ไม่ได้แยกว่าผู้ป่วยเป็นโรคอยู่หรือเคยเป็นโรคแต่หายแล้ว ในขณะที่วิธี PCR มีราคาตรวจ/case สูงที่สุด แต่วินิจฉัยผู้ป่วยได้จำนวนไม่มากนัก ดังนั้นการตรวจหา Ag ซึ่งบ่งภาวะ active infection ร่วมกับวิธี Mf ซึ่งถือเป็น Gold standard จึงเหมาะสมที่จะใช้ในการวิเคราะห์ต้นทุน-ประสิทธิผล ซึ่งเป็นต้นทุนที่คำนวณเพื่อให้ได้วิธีที่มีประสิทธิผลที่สุด ในที่นี้หมายถึงความสามารถในการตรวจวินิจฉัยผู้ป่วยได้ถูกต้อง (true positive and true negative) โดยเสียค่าตรวจ ต่อ case ถูกที่สุด

อนึ่งการใช้วิธีการตรวจอื่นร่วมกับ Gold standard ส่งผลให้ค่า sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) และ accuracy รวมถึงต้นทุนการตรวจต่อ case เปลี่ยนตาม reference method ที่ใช้ การใช้ Mf+ และ/หรือ Ab+ เป็นตัวกำหนดการวินิจฉัยโรคว่าเป็นโรคเท้าช้างทำให้เสียค่าตรวจต่อ case ลดลงเป็น 28.21 บาทต่อ case แต่ก็มี false positive สูง ในขณะที่การวินิจฉัยโรคโดยใช้ Mf+ และ/หรือ PCR+ และการใช้ร่วมกันทั้ง 4 วิธี (Mf/Ag/Ab/PCR) มีค่าตรวจต่อ case 184.53 บาทและ 697.24 บาท ซึ่งมีราคาสูงกว่าวิธีตรวจอื่น ดังนั้นการใช้ Mf+ และ/หรือ Ag+ เป็นตัวกำหนดการวินิจฉัยโรคจึงน่าจะคุ้มทุน และมีประสิทธิผลในการวินิจฉัยโรคได้ถูกต้องมากที่สุดโดยค่าตรวจต่ำสุดคือ 75.12 บาทต่อ case

การนำไปใช้ประโยชน์และการเผยแพร่

ผลงานได้รับการเผยแพร่ในหน่วยงาน

ชื่อโครงการไทย 2 รูปแบบการตรวจกรองหาพาหะของธาลัสซีเมียและฮีโมโกลบินผิดปกติ

ชื่อโครงการอังกฤษ Screening models for Thalassemia and Hemoglobinpatients

นักวิจัยหลัก นพ.กิตติ ต่อจรัส

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล

โรคเลือดจางธาลัสซีเมีย (thalassemia) เป็นปัญหาใหญ่และสำคัญทางด้านสาธารณสุขของประเทศไทย เนื่องจากเป็นโรคพันธุกรรมซึ่งมีอุบัติการสูงมากในประเทศไทย ประมาณร้อยละ 20-30 ของประชากรมียีน α – thalassemia ร้อยละ 3-9 มียีน β- thalassemia และพบยีนของฮีโมโกบิลผืดปกติ 2 ชนิด ฮีโมโกบิลอี (Hb E) โดยเฉลี่ยพบประมาณร้อยละ 13 แต่ในชาวอีสานพบสูงถึงร้อยละ 30-40

คณะผู้วิจัยมีความประสงค์เสนอรูปแบบการตรวจกรองพาหะของธาลัสซีเมียและฮีโมโกลบินผิดปกติ วิธี OF test, DCIP (KKU-DCIP Clear) และ modified Hb inclusion โดยใช้การตรวจแบบ serial screening test ซึ่งสามารถประหยัดค่าใช้จ่าย มีขึ้นตอนไม่ยุ่งยากสามารถทำได้ในโรงพยาบาลชุมชนและยังนำรูปแบบการตรวจกรองที่เหมาะสมมาเป็นต้นแบบในการตรวจกรองสำหรับการป้องกันธาลัสซีเมียในประเทศไทยอย่างมีประสิทธิภาพ

วัตถุประสงค์การวิจัย

1. หา sensitivity ของ serial screening test ในการตรวจกรองพาหะของเบต้าธาลัสซีเมียอัลฟาธาลัสซีเมียและฮีโมโกบิลอี โดยวิธี OFT, DCIP และ modified Hb H inclusion test เปรียบเทียบกับวิธีมาตรฐาน
2. หารูปแบบที่เหมาะสมของการตรวจกรองผู้ที่เป็นพาหะของธาลัสซีเมียและฮีโมโกบิลผิดปกติ

ขอบเขตการวิจัยและวิธีการวิจัย

การศึกษาแบบ diagnostic study กลุ่มประชากรเป้าหมายคือ กำลังพลของกองพลทหารบก ประชากรตัวอย่างได้แก่ กำลังพล และครอบครัวทหารราบที่ 11 ในจังหวัดฉะเชิงเทรา อายุตั้งแต่ 20 ปีขึ้นไปทุกเพศ ระยะเวลาการศึกษา 1 ปี 6 เดือน ตั้งแต่เดือน มกราคม 2541 ถึง มิถุนายน 2542 โดยแบ่งการศึกษาเป็น 2 ส่วน คือ การตรวจกรองในภาคสนาม (Screening method) คืองานในภาคสนามเป็นการให้ความรู้เกี่ยวกับโรค การตรวจกรองและการป้องกันโรคโลหิตจางธาลัสซีเมีย ประชากรที่ได้รับข้อมูลเกี่ยวกับโรคและมีความประสงค์จะเข้าร่วมโครงการจะได้รับการซักประวัติ ตรวจร่างกาย และเจาะเลือด และการตรวจพาหะโดยวิธีมาตรฐาน (standard method) คือการเจาะเลือดจากภาคสนามจะนำมาทำการทดสอบยืนยันทางห้องปฏิบัติการที่หน่วยโลหิตวิทยา กองกุมารเวชกรรม การตรวจหาดัชนีเม็ดเลือดแดง ตรวจหาปริมาณ Hb E และ Hb A2 ตรวจหาชนิดของฮีโมโกบิล ตรวจหาภาวะเลือดจางจากการขาดธาตุเหล็ก และการตรวจหาพาหะของอัลฟาธาลัสซีเมีย

ประโยชน์ที่ได้จากการศึกษา

1. สามารถนำวิธีการตรวจกรองหาพาหะของธาลัสซีเมียและฮีโมโกบิลผิดปกติเป็นต้นแบบนำไปในการตรวจกรองระดับประเทศ
2. ใช้ประกอบกับแผนการควบคุมและป้องกันระดับประเทศได้อย่างมีประสิทธิภาพ

การนำไปใช้ประโยชน์และการเผยแพร่

ผลงานได้รับการเผยแพร่ในหน่วยงาน

ชื่อโครงการ ไทย 3 ประสิทธิภาพของการดูแลร่วมกันสำหรับผู้ป่วยโรคลมชักในจังหวัดนครราชสีมา

ชื่อโครงการอังกฤษ The effectiveness of shared care for patients with epilepsy in Nakhonratchasima province

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หลักการและเหตุผล

วัตถุประสงค์ของการศึกษา เพื่อที่จะประเมินประสิทธิภาพของระบบการดูแลร่วมกัน (Shared Care) สำหรับผู้ป่วยโรคลมชักในแง่ของการติดตามการรักษา การควบคุมอาการชัก คุณภาพชีวิต ความพึงพอใจของผู้ป่วย และการลดการดูแลรักษาที่ไม่เหมาะสม

วิธีการวิจัย การศึกษานี้เป็นการศึกษาเปรียบเทียบแบบสุ่มตัวอย่าง โดยสุ่มตัวอย่างโรงพยาบาลชุมชน การศึกษานี้ใช้เวลา 1 ปี โดยโรงพยาบาลชุมชนที่มีคุณสมบัติตามที่กำหนดจะถูกเชิญให้เข้าร่วมโครงการ โรงพยาบาลที่ยินดีเข้าร่วมโครงการจะถูกแบ่งกลุ่มออกเป็น 3 กลุ่ม จากนั้นในแต่ละกลุ่ม โรงพยาบาลจะถูกสุ่มให้เป็นโรงพยาบาลควบคุมและโรงพยาบาลที่มีการสอดแทรก จากนั้นผู้ป่วยในแต่ละโรงพยาบาลจะถูกเชิญให้เข้าร่วมโครงการ ผู้ป่วยที่มีคุณสมบัติตามที่กำหนด จะได้เข้าร่วมโครงการศึกษา

ผลการศึกษา โรงพยาบาลที่เข้าร่วมโครงการมีทั้งหมด 12 โรงพยาบาล และมีผู้ป่วยที่เข้าร่วมโครงการทั้งสิ้น 401 ราย ลักษณะพื้นฐานทางคลินิกของผู้ป่วยทั้งสองกลุ่มไม่มีความแตกต่างกันยกเว้นจำนวนผู้ป่วยที่รับประทานยากันชักหนึ่งตัวกับรับประทานยาอื่นร่วมด้วย แต่หลังจากแยกกลุ่มวิเคราะห์ตามความแตกต่างของลักษณะพื้นฐาน พบว่า ผู้ป่วยที่รับประทานยากันชักตัวเดียวในกลุ่มสอดแทรกมีอัตราการติดตามการรักษาได้สม่ำเสมอกว่าผู้ป่วยในกลุ่มควบคุม แต่การควบคุมอาการชัก คุณภาพชีวิต และความพึงพอใจไม่มีความแตกต่างกันระหว่าง 2 กลุ่ม

สำหรับสิ่งสอดแทรก พบว่าผู้ป่วยประเมินว่า การให้ความรู้จากพยาบาลมีประโยชน์และสามารถนำไปใช้ในชีวิตประจำวันได้ และแพทย์ก็มีความรู้ในเรื่องการดูแลรักษาเพิ่มขึ้นและเป็นประโยชน์ต่อการปฏิบัติ การดูแลรักษาที่ไม่เหมาะสมก็ลดน้อยลงอย่างมีนัยสำคัญด้วย

สรุป การดูแลร่วมกัน (Shared Care) มีประสิทธิภาพในการทำให้ผู้ป่วยติดตามการรักษาสม่ำเสมอขึ้น โดยเฉพาะผู้ป่วยที่มีอาการชักไม่รุนแรง และสิ่งสอดแทรกก็เป็นประโยชน์อย่างมากสำหรับผู้ป่วยและแพทย์ในการดูแลรักษาผู้ป่วยโรคลมชัก ถ้าการศึกษานี้นานขึ้นเป็นประมาณ 2-5 ปีก็คิดว่า การควบคุมอาการชัก คุณภาพชีวิตและความพึงพอใจของผู้ป่วย น่าจะดีขึ้น

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ชื่อโครงการ ไทย 4 การศึกษาเพื่อหาปัจจัยเสี่ยงของผู้ป่วยกล้ามเนื้อหัวใจตายเฉียบพลันกับกลุ่มควบคุม

ชื่อโครงการอังกฤษ INTER-HEART: a global study of risk factors in Acute Myocardial Infraction

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นพ.ปิยะ เกษมสุวรรณ	ศูนย์โรคหัวใจ วชิรพยาบาล
นพ.โสภณ กฤษณะรังสรรค์	ศูนย์โรคหัวใจ โรงพยาบาลตำรวจ
นพ.ประสาท เหล่าถาวร	ศูนย์โรคหัวใจ โรงพยาบาลพระมงกุฎเกล้า
นพ.บุญจง แซ่จึง	ศูนย์โรคหัวใจ โรงพยาบาลโรคทรวงอก
นพ.อภิชาต สุคนธสรรพ์	ศูนย์โรคหัวใจ มหาวิทยาลัยเชียงใหม่

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร, ศ.นพ.ศุภชัย ไชยธีรพันธ์, ศ.นพ.ธาดา ยิบอินซอย

หลักการและเหตุผล

โครงการวิจัยนี้เกิดจากความร่วมมือของนักวิจัยของ 47 ประเทศทั่วโลก โดยมีวัตถุประสงค์เพื่อหาความสัมพันธ์ของการเกิดโรคหัวใจขาดเลือดเฉียบพลัน (Acute Myocardial Infarction) กับปัจจัยเสี่ยงที่ทราบกันอยู่แล้ว และที่กำลังเป็นที่สนใจใหม่ ที่จะมีผลต่อการพัฒนาความรู้และกระบวนการที่จะนำไปสู่การควบคุมป้องกันโรคหัวใจอย่างมีประสิทธิภาพต่อไป

สำหรับประเทศไทยได้เข้าร่วมโครงการในฐานะเป็นหน่วยเก็บข้อมูล ซึ่งมีทั้งหมด 12 หน่วยได้แก่ โรงพยาบาลศิริราช โรงพยาบาลจุฬาลงกรณ์ โรงพยาบาลรามาธิบดี มหาวิทยาลัยขอนแก่น โรงพยาบาลราชวิถี โรงพยาบาลภูมิพลอดุลยเดช วชิรพยาบาล โรงพยาบาลตำรวจ โรงพยาบาลพระมงกุฎเกล้า สถาบันโรคทรวงอก

วัตถุประสงค์

เพื่อหาขนาดและความสัมพันธ์ระหว่างปัจจัยเสี่ยงที่ทราบกันแล้ว และปัจจัยเสี่ยงที่เพิ่งค้นพบใหม่ของการเกิดโรคกล้ามเนื้อหัวใจขาดเลือด และความแตกต่างของความสำคัญของปัจจัยเสี่ยงภายในประชากรกลุ่มต่างๆ

วิธีการวิจัย

กลุ่มตัวอย่างเป็นผู้ป่วย nonfatal MI ทั้งชายและหญิง ที่ได้รับการรักษาในหน่วย Coronary Care Unit หรือ Cardiology Ward ภายใน 24 ชม.แรกของอาการของ MI โดย กำหนด Criteria ของการวินิจฉัย ประกอบด้วยอาการและการเปลี่ยนแปลงทางคลื่นไฟฟ้าหัวใจซึ่งประกอบด้วย New Pathologic Q wave 1mm ST elevation lead ที่ติดต่อกันเท่ากับหรือมากกว่า 2 leads New left bundle branch block new persistent ST-T wave change ซึ่งเป็นลักษณะของ non-Q wave MI โดยที่การวินิฉัยจะได้รับการยืนยันด้วยการตรวจ Cardiac enzyme (สูงมากกว่า 2 เท่าของค่าปกติ) หรือมีการเปลี่ยนแปลงทางคลื่นไฟฟ้าหัวใจที่เข้ากับการวินิฉัยของ MI (Evolution of ECG change)

สำหรับกลุ่มควบคุมเป็น Hospital control (Match for +/- 5 years and sex) โดยการศึกษาจากผู้ป่วยจำนวน 500 ราย เปรียบเทียบกับ Control 500 ราย กลุ่มตัวอย่างจะได้รับการซักประวัติ ตรวจร่างกาย วัดความดันโลหิต การสอบถามเกี่ยวกับวิถีชีวิต การออกกำลังกาย การรับประทานอาหาร การรับประทานยา และเจาะเลือด เพื่อส่งไปวิเคราะห์ในห้องปฏิบัติการกลางที่ Hamilton Sciences Corporation, Ontario, Canada

ผลการวิเคราะห์กลุ่มตัวอย่างในประเทศไทย

ในกลุ่มตัวอย่างที่เก็บได้ในประเทศไทย มีผู้ป่วยโรคกล้ามเนื้อหัวใจตายเฉียบพลันจำนวน 181 คน และคนปกติที่ไม่เป็นโรคหัวใจจำนวน 216 คน ส่วนใหญ่ได้รับการศึกษาระหว่าง 1-8 ปี ปัจจัยที่ได้นำมาวิเคราะห์เพื่อหาความเสี่ยงในการเกิดโรคหัวใจขาดเลือด ได้แก่ การเป็นโรคความดันโลหิตสูง โรคเบาหวาน ค่าดัชนีมวลกาย สัดส่วนระหว่างเอวและสะโพก การออกกำลังกาย การดื่มเครื่องดื่มที่มี Alcohol ผสม พบว่าการเป็นโรคความดันโลหิตสูง โรคเบาหวาน และการมีสัดส่วนระหว่างเอวกับสะโพกมากกว่า 0.97 ในเพศชาย และมากกว่า 0.98 ในเพศหญิง เป็นปัจจัยเสี่ยงก่อให้เกิดโรคหัวใจขาดเลือดเฉียบพลัน ส่วนปัจจัยด้านระดับการศึกษา รายได้ ความเครียด และการออกกำลังกาย พบว่าไม่ได้เป็นปัจจัยเสี่ยงในการเกิดโรคหัวใจขาดเลือดเฉียบพลัน ส่วนการดื่มเครื่องดื่มที่มี Alcohol ปริมาณเล็กน้อย (1 ครั้ง/สัปดาห์) เป็นปัจจัยป้องกันการเกิดโรคหัวใจขาดเลือด

การเผยแพร่ผลการวิจัย

Rosengren, A., Hawken, S., Ounpuu, S., Sliwa, K., Zubaid, M., Almahmeed, W. A., et al. (2004). Association of psychosocial risk factors with risk of acute myocardial infarction in 11119 cases and 13648 controls from 52 countries (the INTERHEART study): case-control study. *Lancet, 364*(9438), 953-962.

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ชื่อโครงการไทย 5 การศึกษาครอบครัวโรคไหลตาย

นักวิจัยหลัก นพ.สมเกียรติ แสงวัฒนาโรจน์

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล

โรคไหลตาย (Sudden Unexplained Death Syndrome or SUDS) เป็นปัญหาที่สำคัญทางการแพทย์ การสาธารณสุข เศรษฐกิจ และสังคม ของประเทศไทย สามเหตุการเกิดไหลตายยังไม่เป็นที่ทราบแน่ โรคใหลตาย และ กลุ่มอาการ Brugada มีข้อเหมือนและแตกต่างกันหลายประการ คือ ทั้ง 2 กลุ่มอาการพบในผู้ชายมากกว่าผู้หญิง พบในคนอายุน้อย มีประวัติครอบครัว เกิด sudden death จาก VF โดยไม่พบความผิดปกติของหัวใจ (structure heart defect) ได้เหมือนกับ ECG พบลักษณะ RBBB และ ST elevation ใน lead V1 ถึง V3 ได้ทั้งคู่ ในกลุ่มอาการ Brugada จะตรวจพบในสมาชิกครอบครัวส่วนใหญ่ได้ หรือ ถ้าไม่พบ ก็สามารถกระตุ้นให้เกิด โดยการฉีด Ajmaline หรือ Procainamide ส่วนไหลตายจะตรวจพบได้ในบางรายที่รอดชีวิตมา และไม่แน่นอน บางครั้งตรวจพบ บางครั้งไม่พบ ถ้าตรวจพบ จะทำให้ ECG กลับมาปกติได้โดยการฉีด isoproterenal และ เมื่อฉีด Lidocaine ECG จะกลับผิดปกติอีก

วัตถุประสงค์

ตรวจหา mutation ของ ion channel gene ในครอบครัวของผู้เสียชีวิตหรือนอดชีวิตจากไหลตาย ที่มี ECG แบบ RBBB และ ST elevation ใน lead V1 – 3 ด้วยวิธี DNA sequencing

To determine the mutation on ion channel gene in Thai SUDS or SUDS survivor families with RBBB and ST elevation in V1 – 3 pattern by direct DNA sequencing

วิธีการดำเนินการวิจัย และการวิเคราะห์ข้อมูล

1. ผู้เสียชีวิตจากไหลตาย คือ ชาวอีสานที่แข็งแรงดี ไม่มีโรคประจำตัว เสียชีวิตกระทันหันโดยไม่คาดคิดขณะนอนหลับหรือ พักผ่อน และการตรวจชันสูตรศพไม่พบสาเหตุการตาย
2. ผู้รอดชีวิตจากไหลตาย คือ ชาวไทยที่เดิมแข็งแรงดี ไม่มีโรคประจำตัว เกิด cardiac arrest หรือ polymorphic ventricular tachycardia/ventricular fibrillation และได้ทำ cardiopulmonary resuscitation สำเร็จ ไม่มีประวัติการใช้ยาที่ทำให้เกิด polymorphic VT/VF ตรวจร่างกายปกติ และตรวจ ECG ไม่พบ long QT interval, blood chemistry, chest x-ray, echocardiography, exercise stress test และ coronary angiography อยู่ในเกณฑ์ปกติ
3. ครอบครัวผู้เสียชีวิตหรือ ผู้รอดชีวิตจากไหลตายที่มี ECG แบบ RBBB และ ST elevation ใน lead V1 – 3 คือ ญาติพี่น้องของผู้เสียชีวิตหรือรอดชีวิตจากใหลตาย ที่ตรวจคลื่นหัวใจ พบ RBBB และ ST segment (ส่วนของ ST segment ที่ห่างจาก J point 0.08 second) ยกสูงขึ้นมากกว่า 0.01 mV จาก baseline ใน lead V1 – 3 อย่างน้อย 2 ใน 3 leads ไม่ว่าจะเกิดขึ้นเอง หรือ ทำให้เกิด โดยใช้ยา ajmaline, procainamide เป็นต้น โดยการฉีดยาเข้าทางหลอดเลือดดำ ญาติพี่น้องที่ไม่มี ECG ดังกล่าว ถือว่าปกติ
4. คนปกติ หรือ กลุ่มเปรียบเทียบ คือ ชาวไทยอายุมากกว่า 50 ปีภูมิลำเนาเป็นคนอีสาน อาศัยอยู่ในหมู่บ้านเดียวกับผู้เสียชีวิตหรือรอดชีวิตจากไหลตาย ไม่มีประวัติการตายเฉียบพลันในครอบครัวอย่างน้อย 3 ชั่วอายุคน และไม่มี ECG แบบ RBBB และ ST elevation ใน lead V1 – 3 จำนวน 50 ราย

สถานที่ในการทำวิจัย

โรงพยาบาล ในจังหวัดนครพนม จังหวัดสกลนคร จังหวัดอำนาจเจริญ จังหวัดขอนแก่น และโรงพยาบาลในภาคตะวันออกเฉียงเหนือที่ใกล้กับที่อยู่ของครอบครัวใหลตาย โดยคณะวิจัยจะออกไปตรวจประมาณเดือนละครั้งจำนวน 9 ครั้งๆ ละ 1-3 วัน ส่วนญาติพี่น้องของครอบครัวใหลตายที่มาทำงานในกรุงเทพฯ จะนัดมาตรวจที่สาขาวิชาโรคหัวใจและหลอดเลือด ภาควิชาอายุรศาสตร์ คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

ผลการวิจัยได้เผยแพร่ในหน่วยงาน

ชื่อโครงการไทย 6 แนวโน้มการช่วยคืนชีพในผู้ป่วยระยะสุดท้าย และประสิทธิผลของการทำพินัยกรรมชีวิตเรื่องการช่วยคืนชีพในผู้ป่วยระยะสุดท้ายในโรงพยาบาลมหาวิทยาลัยเชียงใหม่

ชื่อโครงการอังกฤษ Trend of Cardiopulmonary resuscitation performed in Patients with Terminal Illness and the effectiveness of advance directive for terminal care in Chiang Mai University Hospital

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หลักการและเหตุผล The key hypothesis behind advance directives (ADs) proposes that, if an intervention enhances a person's right to choose, a dying person will not opt for expensive, life-prolonging medical care and an ethically acceptable saving of resources will result.

วัตถุประสงค์ To assess the acceptability and effectiveness of ADs in reducing cardiopulmonary resuscitation (CPR) attempts and in-hospital death among terminally ill patients in a tertiary care hospital in northern Thailand

ระเบียบวิธีวิจัย Non-randomized controlled study

ผลสรุป The majority of the terminal ill patients and the surrogates preferred to employ ADs in expressing their preferences on CPR and there was a high level of agreement between the subjects and surrogates on the decision. The use of ADs appeared to be effective in reducing futile CPR attempts and the in-hospital mortality rate among subjects during the index hospitalization. Advance directives were accepted well in this study setting.

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

Sittisombut, S., Love, E. J., & Sitthi-Amorn, C. (2001). Cardiopulmonary resuscitation performed in patients with terminal illness in Chiang Mai University Hospital, Thailand. *Int J Epidemiol, 30*(4), 896-898.

Sittisombut, S., Maxwell, C., Love, E. J., & Sitthi-Amorn, C. (2008). Effectiveness of advance directives for the care of terminally ill patients in Chiang Mai University Hospital, Thailand. *Nurs Health Sci, 10*(1), 37-42.

ชื่อโครงการไทย 7 ทัศนคติต่อการทำพินัยกรรมชีวิตและการให้ข้อมูลเรื่องผลของการช่วยคืนชีพในผู้ป่วยอายุรกรรม โรงพยาบาลมหาวิทยาลัยเชียงใหม่

ชื่อโครงการอังกฤษ Attitude towards advance directives and the impact of prognostic information on the preference for cardiopulmonary resuscitation on medical inpatients in CMU Hospital, Thailand

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นักวิจัยในทีม -

หลักการและเหตุผล Our previous study revealed that cardiopulmonary resuscitation (CPR) was performed in 65.7% of 411 terminally ill patients who died in a tertiary-care university hospital in northern Thailand. Advance directives (ADs) are needed to ensure that life-sustaining therapies are used more appropriately.

วัตถุประสงค์ To investigate inpatients' attitudes regarding ADs for CPR and the impact of providing prognostic information on treatment preferences for CPR

ระเบียบวิธีวิจัย Descriptive study

ผลสรุป Most patients had a positive attitude towards ADs for CPR. The majority preferred to have CPR when no information was provided on the chance of survival. However, this proportion decreased depending on the prognostic scenarios. Our investigation suggested that the preference of patients for CPR should be assessed individually and gradually, with adequate information given on the chance of survival.

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

Sittisombut, S., Love, E. J., & Sitthi-Amorn, C. (2005). Attitudes toward advance directives and the impact of prognostic information on the preference for cardiopulmonary resuscitation in medical inpatients in Chiang Mai University Hospital, Thailand. *Nurs Health Sci, 7*(4), 243-250.

Sittisombut, S., Maxwell, C., Love, E. J., & Sitthi-Amorn, C. (2009). Physicians' attitudes and practices regarding advanced end-of-life care planning for terminally ill patients at Chiang Mai University Hospital, Thailand. *Nurs Health Sci, 11*(1), 23-28.

ชื่อโครงการ ไทย 8 การตรวจสุขภาพประจำปีของผู้สูงอายุในเขตชนบทของจังหวัดขอนแก่น

ชื่อโครงการอังกฤษ Annual Health Examination among Elderly in Rural Areas of Khon Kaen Province

นักวิจัยหลัก ผศ.ดร.จิราพร เขียวอยู่

นักวิจัยในทีม ศิริพร คำสะอาด

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล การวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาการไปตรวจสุขภาพประจำปีของผู้สูงอายุในเขตชนบทของจังหวัดขอนแก่น ตัวอย่างเป็นผู้ที่มีอายุ 60 ปีขึ้นไปจำนวน 576 ราย สุ่มตัวอย่างแบบหลายขั้นตอน เก็บข้อมูลโดยการสัมภาษณ์โดยตรงตามแบบสอบถามซึ่งสร้างขึ้นด้วยวิธีมาตรฐาน

รูปแบบการวิจัย เป็นการวิจัยเชิงพรรณนา

ผลสรุป ที่ผ่านมามีผู้สูงอายุร้อยละ 79.9 ได้รับตรวจสุขภาพอย่างใดอย่างหนึ่งต่อไปนี้ การซักประวัติการสูบบุหรี่ การซักประวัติการดื่มสุรา การซักประวัติการบริโภคอาหาร การชั่งน้ำหนัก วัดส่วนสูง การวัดความดันโลหิต การวัดชีพจร การตรวจเลือด การตรวจปัสสาวะ การตรวจสายตา และ การตรวจฟัน เมื่อพิจารณาแต่ละประเภทของการตรวจสุขภาพดังกล่าวข้างต้น พบ ร้อยละของผู้สูงอายุที่ไปตรวจสุขภาพเท่ากับ 23.0,21.0, 36.4, 71.7, 32.5, 75.7, 55.4, 43.0, 41.6, 18.8, และ 13.3 ตามลำดับ ในกลุ่มผู้สูงอายุสตรี 391 ราย มีผู้ไปรับการตรวจเต้านม และมะเร็งปากมดลูก ร้อยละ 9.0 และ 11.5 ตามลำดับ

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

ได้เผยแพร่ผลงานในหน่วยงาน

ชื่อโครงการไทย 9 การศึกษาความเข้าใจ ความน่าเชื่อถือ ความสมบูรณ์ และความไวต่อการเปลี่ยนแปลงของแบบสอบถาม ฉบับภาษาไทย Health Assessment Questionnaire สำหรับผู้ป่วยโรคข้ออักเสบ
ชื่อโครงการอังกฤษ Comprehensibility, reliability, validity, and responsiveness of the Thai version of the Health Assessment Questionnaire in Thai patients with rheumatoid arthritis
นักวิจัยหลัก พญ.มนาธิป โอศิริ

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล The Health Assessment Questionnaire Disability Index (HAQ-DI) is a commonly used instrument to assess functional status of patients with rheumatoid arthritis (RA). Translations and adaptations of the HAQ-DI have been carried out for use with RA patients in several countries. The objective is to evaluate the psychometric properties of the Thai version of the HAQ-DI (Thai HAQ) in Thai patients with RA.

รูปแบบการวิจัย Comprehensibility of the Thai HAQ was assessed by126 patients with RA from 6 medical centers in Thailand. Another group of 115 patients with active RA was enrolled to test the reliability (internal reliability and 1-week test-retest reliability), construct validity (correlations with other measures of RA disease activity), floor and ceiling effects, and sensitivity to change of the Thai HAQ at 3 months of treatment with diseasemodifying
antirheumatic drugs.

ผลสรุป The Thai HAQ is comprehensible, reliable, valid and sensitive to change in the evaluation of functional status of Thai patients with RA. The Thai HAQ is an essential tool to measure treatment effects and progression of disability in RA patients and should be applied in both clinical trials and routine clinical care settings.

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

Osiri, M., Wongchinsri, J., Ukritchon, S., Hanvivadhanakul, P., Kasitanon, N., & Siripaitoon, B. (2009). Comprehensibility, reliability, validity, and responsiveness of the Thai version of the Health Assessment Questionnaire in Thai patients with rheumatoid arthritis. *Arthritis Res Ther, 11*(4), R129.

ชื่อโครงการไทย 10 การศึกษาภาวะความชุก ความรุนแรง ปัจจัย และผลที่เกิดขึ้นจากการเกิดเนื้อตายในผู้ป่วยที่ถูกงูเห่า และการศึกษาการป้องกันภาวะเนื้อตายที่เกิดขึ้นในสัตว์ทดลอง

ชื่อโครงการอังกฤษ Prevalence, severity, determinants and consequences of tissue necrosis among victims envenomed by Naja kaouthia (Thai Cobra) and Calloselasma rhodostoma (Malayan Pit Viper) and its prevention in an experimental model

นักวิจัยหลัก ดร.นวลน้อง วงศ์ทองคำ

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล

การถูกงูพิษกัดในประเทศไทย ยังคงเป็นปัญหาที่สำคัญทางการแพทย์โดยเฉพาะงูเห่า และงูกะปะ ซึ่งพิษสามารถก่อให้เกิดผลทั่วร่างกายและผลเฉพาะที่ ในผู้ป่วยที่มีอาการรุนแรงอาจเสียชีวิตหรืออาจเสียอวัยวะที่ถูกกัดอย่างถาวร หรืออาจต้องตัดอวัยวะส่วนนั้นทิ้งและก่อให้เกิดความพิการพยาธิสภาพบริเวณที่ถูกกัด เกิดจากการทำงานร่วมกันของเอนไซม์ phospholipase A_2 (PLA_2) ซึ่งสามารถทำลายกล้ามเนื้อ เอนไซม์ metalloproteinase ซึ่งทำให้เกิดภาวะเลือดออก และเอนไซม์ hyaluronidase ซึ่งช่วยทำให้พิษงูแพร่กระจาย รวมทั้งสารพิษอื่นๆ ในพิษงู

วัตถุประสงค์

1. การศึกษาด้านระบาดวิทยา ทั้งส่วนการศึกษาไปข้างหน้า และการศึกษาย้อนหลัง ในผู้ป่วยที่ถูกงูเห่าหรืองูกะปะกัด
2. การทดลองเพื่อดูประสิทธิภาพของตัวยับยั้งเอนไซม์ metalloproteinase และ PLA_2 โดยมีจุดมุ่งหมายเพื่อหาวิธีลดภาวะเกิดเนื้อตายบริเวณที่ถูกกัด และลดการเกิดพิษทั่วร่างกาย

ผลสรุป

ผลการศึกษาทางด้านระบาดวิทยาพบว่า อุบัติการณ์ของการเกิดเนื้อตายบริเวณที่ถูกงูกะปะและงูเห่ากัดสูงถึง 94.50% และ 91.10% ตามลำดับ โดยส่วนใหญ่จะพบภาวะเนื้อตายที่ไม่รุนแรงและจะแสดงออกในช่วง 12 ชั่วโมงแรกของการเข้ารับการรักษา การรักษาผู้ป่วยส่วนใหญ่เป็นการทำแผลเพื่อป้องกันและลดการติดเชื้อ มีผู้ป่วยที่ถูกงูเห่ากัดเพียง 1 รายที่ต้องถูกตัดนิ้ว

ผลการศึกษาในการทดลอง พบว่า 2 mM Na_2EDTA หรือ 20 mM N-Phenylglycine สามารถยับยั้งผลของเอนไซม์ metalloproteinase และ PLA_2 ตามลำดับได้อย่างสมบูรณ์ ทั้งในพิษงูเห่าและงูกะปะ การทดลองในสัตว์ทดลองพบว่า Na_2EDTA (93.05 ไมโครกรัม/หนู) หรือ N-Phenylglycine (37.80 ไมโครกรัม/หนู) เมื่อทำการ preincubate กับงูก่อนที่จะฉีดในหนูพบว่าสามารถลดการเกิดภาวการณ์บวม และการเกิดเนื้อตายอันเกิดจากพิษงูได้อย่างมีนัยสำคัญทางสถิติ ส่วน “Inhibitor mixture” ที่ประกอบด้วย N-Phenylglycine (37.80 ไมโครกรัม/หนู) Na_2EDTA (93.05 ไมโครกรัม/หนู) และตัวยับยั้งเอนไซม์ hyaluronidase คือ sodium aurothiomalate (195 ไมโครกรัม/หนู) พบว่าสารผสมนี้สามารถลดการเกิดเนื้อ

ตายเฉพาะที่เมื่อฉีดภายในเวลา 1, 3 และ 10 นาที หลังจากฉีดพิษงู และยังพบว่าผลของตัวยับยั้งเอนไซม์ metalloproteinase และ PLA_2 สามารถยืดระยะเวลาตายของหนูที่ฉีดพิษงูเห่าและงูกะปะ ในขนาดที่ทำให้หนูตาย ผลการทดลองนี้บ่งชี้ว่าสารผสม Inhibitor mixture มีประสิทธิภาพดีในการลดภาวะการเกิดเนื้อตาย ถ้าฉีดทันทีที่บริเวณที่ถูกงูกัด และลดความเป็นพิษที่ออกฤทธิ์ทั่วร่างกายของพิษงูเห่าและงูกะปะ

การนำผลไปใช้ประโยชน์

ผลการศึกษาทำให้ได้ข้อมูลที่เป็นประโยชน์ในการรักษาผู้ป่วยที่มีแผลถูกงูกัด โดยผลการทดลองบ่งชี้ว่าสารผสม Inhibitor mixture มีประสิทธิภาพดีในการลดภาวะการเกิดเนื้อตาย ถ้าฉีดทันทีที่บริเวณที่ถูกงูกัด และลดความเป็นพิษที่ออกฤทธิ์ทั่วร่างกายของพิษงูเห่าและงูกะปะ

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

Wongtongkam, N., Wilde, H., Sitthi-Amorn, C., & Ratanabanangkoon, K. (2005a). A study of 225 Malayan pit viper bites in Thailand. *Mil Med, 170*(4), 342-348.

Wongtongkam, N., Wilde, H., Sitthi-Amorn, C., & Ratanabanangkoon, K. (2005b). A study of Thai cobra (Naja kaouthia) bites in Thailand. *Mil Med, 170*(4), 336-341.

โครงการสหสาขาวิชาเพื่อแก้ปัญหาสาธารณสุขที่สำคัญของประเทศ 7 โครงการ

ชื่อโครงการไทย 1 ผลของการปรับเปลี่ยนการบริโภคมาเป็นข้าวกล้อง งา ผัก ผลไม้ ตามฤดูกาลของประชาชนในเขตเทศบาลในเขตเทศบาลในจังหวัดสุโขทัย
นักวิจัยหลัก สมนึก สุชัยธนาวนิช

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล

ปัจจุบันเทคโนโลยีเจริญก้าวหน้าอย่างรวดเร็ว โดยเฉพาะอย่างยิ่งการแปรรูปผลิตภัณฑ์ด้านอาหารและการกระตุ้นความอยากด้วยอิทธิพลสื่อโฆษณา ทำให้แบบแผนการบริโภคของคนไทยเปลี่ยนแปลงไปจากอดีต สถานการณ์การเจ็บป่วยของประชาชนที่เปลี่ยนแปลงจากโรคติดต่อมาเป็นโรคที่ไม่ติดต่อ การเจ็บป่วยด้วยโรคเหล่านี้ถูกเชื่อมโยงให้ประชาชนหันมาให้ความสนใจต่อการบริโภคมากขึ้น พฤติกรรมการบริโภคอาหารที่ถูกปนเปื้อนสารเคมีต่างๆ โดยที่ผู้บริโภคไม่มีโอกาสเลือกมากนักถูกมองว่าเป็นสาเหตุหนึ่งที่ทำให้เกิดโรคที่รักษาไม่หายเหล่านี้ หลายองค์กรให้ความสนใจในการบริโภคแบบย้อนยุค สุขภาพแบบองค์รวม เช่น อาหารมังสวิรัติ แมคโครไบโอติค หรืออาหารชีวจิต การปรับแบบแผนการบริโภคของคนไทยเพื่อเอื้อต่อสุขภาพดี มีชีวิตที่ยั่งยืนโดยไม่เคร่งครัดกับหลักการบริโภคแบบบังคับมากนัก น่าจะเป็นทางเลือกที่เหมาะสมให้สอดคล้องกับสภาวะเศรษฐกิจของประชาชนและของประเทศ

วัตถุประสงค์

1. เพื่อประเมินรูปแบบการรณรงค์การบริโคข้างกล้อง งา ผัก ผลไม้ตามฤดูกาลสามารถทำให้ประชาชนเปล่ยนมาบริโภคอาหารดังกล่าวมากกว่าพื้นที่ที่ไม่ได้รณรงค์
2. เพื่อศึกษาประสิทธิผลของการบริโภคข้างกล้อง งา ผัก ผลไม้ตามฤดูกาล ที่มีผลต่อสุขภาพของประชาชน
3. เพื่อเปรียบเทียบค่า fasting blood sugar อัตราการใช้ยา และค่าใช้จ่ายด้านสุขภาพของผู้ป่วยเบาหวานประเภท NIDDM ที่ปรับเปลี่ยนมาบริโภคข้าวกล้อง งา ผัก ผลไม้ตามฤดูกาล

ขอบเขตการวิจัย พื้นที่ทดลอง คือ เขตเทศบาลเมืองสวรรคโลก พื้นที่ควบคุม คือ เขตเทศบาลเมืองสุโขทัย

การเก็บรวบรวมข้อมูล

- ประเมินรูปแบบการรณรงค์และประสิทธิผลของการปรับเปลี่ยนการบริโภค
- พัฒนารูปแบบการรณรงค์เพื่อให้ความรู้ในพื้นที่

ประโยชน์ที่คาดว่าจะได้รับ

1. เพื่อประเมินรูปแบบการรณรงค์การบริโภคข้าวกล้อง งา ผัก ผลไม้ตามฤดูกาลสามารถทำให้ประชาชนเปล่ยนมาบริโภคอาหารดังกล่าวมากกว่าพื้นที่ที่ไม่ได้รณรงค์
2. เพื่อศึกษาประสิทธิผลของการบริโภคข้างกล้อง งา ผัก ผลไม้ตามฤดูกาล ที่มีผลต่อสุขภาพของประชาชน

3. เพื่อเปรียบเทียบค่า fasting blood sugar อัตราการใช้ยา และค่าใช้จ่ายด้านสุขภาพของผู้ป่วยเบาหวานประเภท NIDDM ที่ปรับเปลี่ยนมาบริโภคข้าวกล้อง งา ผัก ผลไม้ตามฤดูกาล

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

เผยแพร่ผลการศึกษาในหน่วยงาน

ชื่อโครงการไทย 2 ความต้องการและปัญหาด้านสุขภาพ การเข้าถึงบริการ และคุณภาพชีวิตของวัยรุ่น กับการสร้างภาคีความร่วมมือ
ชื่อโครงการอังกฤษ Adolescent Health Needs, Accessibility of Services and Quality of Life by Assisting in the Development of Community Partnerships.
นักวิจัยหลัก ดร.รัตนา สำโรงทอง

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล

วัยรุ่นคือวัยแรกเจริญพันธุ์จนถึงวัยเริ่มต้นของการเติบโตเป็นผู้ใหญ่ เป็นวัยที่ต้องการการดูแลเป็นพิเศษต่างไปจากวัยอื่นๆ เนื่องจากธรรมชาติของวัยรุ่นเป็นสิ่งที่ซับซ้อนยากที่จะเข้าใจการค้นหาสาเหตุของปัญหาและดำเนินการแก้ไขจึงเป็นเรื่องละเอียดอ่อน การดูแลจำเป็นจะต้องครอบคลุมไปทุกๆ ด้าน ซึ่งวัตถุประสงค์ของการดูแลนั้น ไม่ได้เฉพาะเจาะจงในเรื่องสุขภาพอย่างเดียว แต่ยังรวมถึงการพัฒนาการทางด้านกาย จิต สังคมของแต่ละบุคคลด้วย ดังนั้น นอกเหนือจากตัววัยรุ่นเองแล้ว การดูแลและแสวงหาทางแก้ไข จึงจำเป็นต้องรวมถึงครอบครัว ชุมชน สังคมและสิ่งแวดล้อมของวัยรุ่นด้วย

วัตถุประสงค์ ศึกษาลักษณะของการให้บริการด้านสุขภาพวัยรุ่นของหน่วยงานต่างๆ ในชุมชน

1. ศึกษาถึงความต้องการและปัญหาด้านสุขภาพ การเข้าถึงบริการของวัยรุ่นชาย-หญิง และในแต่ละกลุ่มอายุ
2. เปรียบเทียบความต้องการบริการด้านสุขภาพกับการไปใช้บริการของวัยรุ่นชาย-หญิง และในแต่ละกลุ่มอายุ
3. ศึกษาถึงการให้ความหมาย “คุณภาพชีวิต” ของวัยรุ่น
4. ประเมินคุณภาพชีวิตโดยใช้ แบบวัด WHO-BREF
5. สร้างภาคีความร่วมมือเพื่อพัฒนาการให้บริการด้านสุขภาพที่วัยรุ่นสามารถเข้าถึง อันนำไปสู่การลดปัญหาทางสุขภาพ ความซึมเศร้า อันนำไปสู่การมีคุณภาพชีวิตที่ดี

การเก็บข้อมูลเชิงคุณภาพใช้แบบแนวสัมภาษณ์เจาะลึก และแนวสนทนากลุ่ม การเก็บข้อมูลเชิงปริมาณใช้แบบสอบถามกับ กลุ่มตัวอย่างเป็นวัยรุ่นอายุ 12-22 ปี ที่อาศัยอยู่ในสลัมแห่งหนึ่งในกรุงเทพฯ การวิเคราะห์สถิติใช้ Chi-square และ Regression

ผลการศึกษา

พบว่ากลุ่มตัวอย่างเป็นเพศหญิงมากกว่าชาย (57.2% , 42.8%) แบ่งเป็นวัยรุ่นตอนต้น (อายุ 12-13 ปี 23.3%) วัยรุ่นตอนกลาง (14-17 ปี 48.2%) และวัยรุ่นตอนปลาย (18-22 ปี 28.5%) ส่วนใหญ่ (78.3%) อยู่ในสถานศึกษา มีเพียง 5.9% เจ็บป่วยเรื้อรัง วัยรุ่นเกือบ 1 ใน 5 คน เคยมีประสบการณ์ทางเพศ และส่วนใหญ่มีเพศสัมพันธ์กับคู่รัก โดยมีเพียงร้อยละ 12.6 ใช้ถุงยางอนามัยทุกครั้ง วัยรุ่นให้ความหมายเรื่อง “คุณภาพชีวิต” ใกล้เคียงกับคำจำกัดความขององค์การอนามัยโลก หากแต่วัยรุ่นไม่ได้กล่าวถึงเรื่องเพศและ

การเข้าถึงบริการ วัยรุ่นส่วนใหญ่ (71.8%) มีคุณภาพชีวิตในระดับกลาง สิบอันดับแรกของปัญหาสุขภาพวัยรุ่น ได้แก่ 1) สิว 2) ตั้งครรภ์ไม่พึงประสงค์ 3) ยาบ้า 4) เฮโรอีน 5) ทำแท้ง 6) เครียด 7) ต่อสู้/ชกตี 8) บุหรี่ 9) สุรา และ 10) ข่มขืน ซึ่งพบความแตกต่างอย่างมีนัยสำคัญทางสถิติในระหว่างเพศ กับปัญหาสุขภาพที่กล่าวมาแล้ว 8 จาก 10 เรื่อง (ยกเว้นเรื่องบุหรี่กับแอลกอฮอล์) และพบความแตกต่างอย่างมีนัยสำคัญทางสถิติในระหว่างกลุ่มอายุกับปัญหาสูบบุหรี่

การศึกษาเชิงคุณภาพพบว่ายังมีช่องว่าง การแบ่งแยก และความซ้ำซ้อนของการบริการด้านสุขภาพ ปัจจัยการเข้าถึงบริการด้านสุขภาพของวัยรุ่น ได้แก่ “อาชีพของผู้ปกครอง” และ “โอกาสได้พบแพทย์ที่สถานบริการสุขภาพ” การวิเคราะห์ความแตกต่างในระหว่างเพศและกลุ่มอายุของวัยรุ่น สำหรับปัจจัยเหล่านี้ พบว่า (1) ความแตกต่างในระหว่างเพศ อาชีพของผู้ปกครองมีความสำคัญสำหรับเพศชาย ในขณะที่โอกาสการได้พบแพทย์ที่สถานบริการสุขภาพกลับมีความสำคัญสำหรับเพศหญิง (2) ความแตกต่างในระหว่างกลุ่มอายุ พบว่าปัจจัยที่มีความสำคัญที่สุดถึงการเข้าถึงบริการในวัยรุ่นตอนต้น ได้แก่ “ช่วงเวลาที่สะดวกในการไปสถานบริการสุขภาพ” “ระดับการศึกษาในปัจจุบัน” และ “การรู้จักสถานบริการสุขภาพในชุมชน” สำหรับวัยรุ่นตอนกลาง ได้แก่ “รู้เกี่ยวกับค่าใช้จ่ายในบ้าน” และสำหรับวัยรุ่นตอนปลาย ได้แก่ “อาชีพของผู้ปกครอง” “รู้จักสถานบริการสุขภาพในชุมชน” และ “อายุ”

การไปใช้บริการด้านสุขภาพ พบว่าในสิบอันดับแรกของปัญหาวัยรุ่นนั้น กลุ่มวัยรุ่นไปใช้บริการน้อยกว่าร้อยละ 60 เพศชายไปใช้บริการน้อยกว่าเพศหญิง โดยเพศชายไปใช้บริการเนื่องจากบาดเจ็บจากการชกตี/ต่อสู้ การสูบบุหรี่ การดื่มแอลกอฮอล์ และความเครียด สำหรับเพศหญิงไปใช้บริการเนื่องจากความเครียดและภาวะความซึมเศร้า

จากการศึกษาพบว่า ผู้ที่ทำงานเรื่องวัยรุ่นในชุมชนตกลงที่จะร่วมกันเป็นภาคีเพื่อทำให้วัยรุ่นเข้าถึงบริการสุขภาพ และพัฒนาคุณภาพชีวิตวัยรุ่น โดยร่วมกันวางวัตถุประสงค์หลัก และนำผลการศึกษาของงานวิจัยครั้งนี้จะเป็นข้อมูลสำคัญ ในการวางแผนการดำเนินสำหรับจัดทำกิจกรรม/โครงการในชุมชน ในการพัฒนาการเข้าถึงสุขภาพของวัยรุ่น โดยเน้นด้านระบบสืบพันธุ์/เพศสัมพันธ์ สุขภาพจิต และสารเสพติด สำหรับการวิจัยในอนาคตนั้นควรพิจารณาในเรื่องของการเข้าถึงบริการด้านสังคมและปัจจัยทางด้านสังคมอื่นๆ ภาคีความร่วมมือและการวิจัยเชิงปฏิบัติการจะนำมาสู่ความร่วมมือและใช้ทรัพยากรร่วมกัน โดยควรมีการเลือกผู้นำเพื่อเป็นกลไกที่สำคัญในการทำงานร่วมกัน

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ชื่อโครงการ ไทย 3 การศึกษาผลกระทบของฝุ่นละอองขนาดเล็กต่อสุขภาพประชาชน จังหวัดเชียงใหม่
นักวิจัยหลัก ดร.นันทวรรณ วิจิตรวาทการ

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล

ประเทศไทยเป็นประเทศกำลังพัฒนา มีการนำวิทยาการและเทคโนโลยีใหม่ ๆ เข้ามาใช้อย่าง มากมาย ส่งผลให้เกิดการเจริญเติบโตทางเศรษฐกิจที่รวดเร็ว โดยเฉพาะในช่วงปี พ.ศ. 2538 – 2539 ทำให้เกิดกิจกรรมการก่อสร้างอาคาร ถนน สาธารณูปโภค รวมทั้งปริมาณยานพาหนะที่เพิ่มมากขึ้น และส่งผลกระทบต่อสิ่งแวดล้อมคือ ปริมาณฝุ่นละอองที่สูงขึ้นจนอยู่ในระดับที่เป็นปัญหา และมีผลกระทบต่อสุขภาพ ซึ่งปัญหานี้ไม่เพียงแต่เฉพาะในเขตกรุงเทพมหานครเท่านั้น ในพื้นที่ต่างจังหวัดก็เกิดผลกระทบเช่นกัน ในภาคเหนือที่จังหวัดลำปาง เชียงใหม่ นครสวรรค์ พบว่าสารมลพิษที่มีปริมาณเกินมาตรฐาน ได้แก่ ฝุ่นขนาดเล็กกว่า 10 ไมครอน (PM_{10}) ก๊าซโอโซน (O_3) และก๊าซซัลเฟอร์ไดออกไซด์ (SO_2) ส่วนในภาคตะวันออกเฉียงเหนือพบว่ามีปัญหาจากฝุ่นละอองเพียงชนิดเดียว จากการตรวจวัดที่จังหวัดขอนแก่นและนครราชสีมา ในภาคกลาง ภาคตะวันออกและภาคใต้ พบว่าฝุ่นละอองเป็นปัญหาหลักและก๊าซโอโซนเป็นปัญหารองลงมา

ฝุ่นละอองเป็นปัญหาอยู่ในทุกภาคของประเทศไทย แต่ในการศึกษาผลกระทบของฝุ่นละอองต่อสุขภาพ ส่วนใหญ่เป็นการศึกษาในกรุงเทพมหานคร เพื่อเป็นการขยายผลการศึกษาให้มีภาพกว้างขึ้น เห็นผลกระทบต่อสุขภาพที่ชัดเจนขึ้นจึงน่าที่จะมีการศึกษาในจังหวัดอื่น ๆ ที่นอกเหนือจากกรุงเทพมหานคร จากการพิจารณาถึงปริมาณฝุ่นละอองขนาดเล็ก (PM_{10}) และลักษณะของชุมชนที่ศึกษา พบว่าในจังหวัดเชียงใหม่มีลักษณะของชุมชนใกล้เคียงกับพื้นที่วงเวียนโอเดียนในกรุงเทพมหานคร ซึ่งทำการศึกษาในปี พ.ศ.2538 – 2539 ในแง่ของผลกระทบของฝุ่นละอองต่อสุขภาพทางระบบหายใจ ถึงแม้ว่าปริมาณ PM_{10} ที่ตรวจวัดได้ในจังหวัดเชียงใหม่จะมีค่าไม่สูงมากนัก คือมีค่าเฉลี่ยต่อปีเท่ากับ 75.3 และ 85.2 ไมโครกรัมต่อลูกบาศก์เมตร ($\mu g/m^3$) ในปี พ.ศ.2539 และ พ.ศ.2540 ตามลำดับ แต่จากการตรวจวัดปริมาณ $PM_{2.5}$ โดยใช้เครื่องมือของ US-EPA ที่จังหวัดเชียงใหม่ในช่วงฤดูแล้ง พบว่ามีค่าเฉลี่ย 24 ชั่วโมง อยู่ในช่วง 200–300 $\mu g/m^3$ ซึ่งเกินค่ามาตรฐานของสหรัฐอเมริกาที่ตั้งไว้ที่ 65 $\mu g/m^3$ และจากผลการศึกษาในต่างประเทศทั่วโลก พบว่าปริมาณฝุ่นละอองขนาดเล็ก (PM_{10} และ $PM_{2.5}$) มีความสัมพันธ์กับอัตราป่วยและอัตราตายเนื่องจากโรคระบบหายใจและโรคระบบหัวใจ แต่เนื่องจากสภาพภูมิประเทศและภูมิอากาศที่แตกต่างกัน อาจส่งผลถึงองค์ประกอบของฝุ่นละอองที่แตกต่างกัน และก่อให้เกิดผลกระทบต่อสุขภาพในระดับที่แตกต่างกันด้วย

ดังนั้นจากการที่ตรวจพบว่าปริมาณ $PM_{2.5}$ ในจังหวัดเชียงใหม่ มีค่าที่สูงเกินกว่ามาตรฐานมากจึงเป็นจุดที่น่าสนใจว่าในปัญหาฝุ่นละอองก่อให้เกิดผลกระทบต่อสุขภาพของคนในภาคเหนืออย่างไร และแตกต่างจากที่พบในกรุงเทพมหานครหรือในประเทศต่างๆ หรือไม่ และก่อให้เกิดความสูญเสียทางเศรษฐกิจมากน้อยเพียงใด

วัตถุประสงค์ของโครงการ

วัตถุประสงค์หลัก เพื่อศึกษาผลของฝุ่นละอองขนาดเล็ก (PM_{10} และ $PM_{2.5}$) ที่มีผลต่อสุขภาพของประชาชนในภาคเหนือของไทย

วัตถุประสงค์เฉพาะ

1. เพื่อศึกษาความสัมพันธ์ระหว่างปริมาณฝุ่นละอองกับการเจ็บป่วยด้วยอาการระบบหายใจในเด็กนักเรียนในจังหวัดเชียงใหม่
2. เพื่อศึกษาความสัมพันธ์ระหว่างปริมาณฝุ่นละอองกับการเจ็บป่วยด้วยอาการระบบหายใจในกลุ่มผู้ใหญ่ ในจังหวัดเชียงใหม่
3. เพื่อศึกษาความสัมพันธ์ระหว่างปริมาณฝุ่นละอองกับสมรรถภาพปอด
4. เพื่อประเมินถึงความสูญเสียทางเศรษฐกิจอันเกิดจากโรคระบบหายใจเนื่องจากฝุ่นละออง

รูปแบบการศึกษา การศึกษาครั้งนี้ได้วางรูปแบบการศึกษา โดยแบ่งเป็น 2 การศึกษาย่อย คือ

การศึกษาแบบ panel study เพื่อศึกษาผลกระทบต่ออัตราป่วยของระบบหายใจในแต่ละระดับของการสัมผัสกับอนุภาคมลสาร ซึ่งครอบคลุมถึง PM_{10}, และ $PM_{2.5}$ โดยการวิเคราะห์ข้อมูลที่ได้จากการติดตามการเจ็บป่วยของกลุ่มตัวอย่างเด็กและผู้ใหญ่จำนวนกลุ่มละประมาณ 100 คน เป็นเวลา 100 วัน และการสัมผัสอนุภาคมลสารของกลุ่มตัวอย่างเหล่านี้

การประเมินผลกระทบทางเศรษฐศาสตร์ โดยการออกแบบสำรวจเพื่อรวบรวม ข้อมูลเชิงเศรษฐศาสตร์ในกลุ่มตัวอย่างเดียวกับการศึกษาแบบ panel study เพื่อประเมินผล กระทบทางเศรษฐศาสตร์ที่เกิดขึ้นเนื่องจากปริมาณอนุภาคมลสารในจังหวัดเชียงใหม่

ผลการศึกษา Panel study ของอาการป่วยทางระบบหายใจ

การศึกษา Panel Study เป็นการศึกษาอาการป่วยทางระบบหายใจของกลุ่มตัวอย่างแต่ละคนที่ได้บันทึกอาการทางระบบหายใจในช่วง 24 ชั่วโมงที่ผ่านมาของตนในแต่ละวันตามแบบบันทึกอาการที่ใช้ในการศึกษา ทำการบันทึกทุกวันติดต่อกันเป็นระยะเวลา ประมาณ 100 วัน ในขณะเดียวกันก็มีการเก็บข้อมูลอนุภาคมลสารในพื้นที่ใกล้เคียงกับที่กลุ่มตัวอย่างอาศัยอยู่ กลุ่มตัวอย่างของการศึกษาครั้งนี้ประกอบด้วย 2 กลุ่ม คือ 1) กลุ่มผู้ใหญ่ ที่มีบ้านพักอาศัยอยู่ริมถนน 2) กลุ่มเด็กนักเรียนชั้นประถมปีที่ 3-6 จากการเก็บข้อมูลได้กลุ่มตัวอย่างผู้ใหญ่ 108 คน อายุเฉลี่ย 46 ปี ได้กลุ่มตัวอย่างเด็ก 101 คน อายุเฉลี่ย 11 ปี ทำการเก็บข้อมูลเป็นระยะเวลา 105 วัน ในแต่ละวันเฉลี่ยกลุ่มตัวอย่างให้ความร่วมมือในการเก็บข้อมูล (Response rate) ร้อยละ 92 ในกลุ่มเด็ก และร้อยละ 95 ในกลุ่มผู้ใหญ่

ในการวิเคราะห์ข้อมูลได้แบ่งกลุ่มตัวอย่างทั้งเด็กและผู้ใหญ่เป็น 2 กลุ่ม คือ กลุ่มปกติ และกลุ่มที่มีภาวะไวต่อมลภาวะ โดยในกลุ่มเด็กคือกลุ่มที่เคยมีประวัติเกี่ยวกับโรคปอดหรือโรคหัวใจ ส่วนในกลุ่มผู้ใหญ่คือผู้ที่เคยมีประวัติโรคหอบหืด โรคถุงลมโป่งพอง หรือโรคหัวใจ หรืออายุมากกว่า 65 ปี และทำการวิเคราะห์

เปรียบเทียบอัตราเสี่ยงต่อการเกิดอาการทางระบบหายใจระหว่างกลุ่มปกติและกลุ่มที่มีภาวะไวต่อมลภาวะ และวิเคราะห์หาความสัมพันธ์กับปริมาณมลพิษที่ตรวจวัดได้ในช่วงที่ทำการศึกษา

ระดับของมลพิษอากาศในช่วงที่ศึกษา ระดับฝุ่นละอองขนาดเล็ก (PM_{10}) ณ จุดตรวจวัดที่โรงเรียนเทศบาลวัดพวกช้าง เฉลี่ย 146.71 $\mu g/m^3$ $PM_{2.5}$เฉลี่ย 105.47 $\mu g/m^3$ และระดับฝุ่น PM_{10} ณ จุดตรวจวัดที่เทศบาลเชียงใหม่ เฉลี่ย 128.32 $\mu g/m^3$ $PM_{2.5}$ เฉลี่ย 90.21 $\mu g/m^3$

ผลการวิเคราะห์ในกลุ่มเด็กนักเรียน พบว่า กลุ่มเด็กที่มีความไวต่อมลภาวะมีความเสี่ยงต่อการสัมผัส $PM_{2.5}$มากกว่าเด็กปกติอย่างมีนัยสำคัญทางสถิติ เช่นอาการหายใจไม่สะดวก แน่นหน้าอก (OR = 4.6 ,95%CI 1.92, 10.93) หายใจไม่อิ่ม (OR = 4.5 95%CI 1.43, 5.65) หายใจมีเสียงวี้ด (OR =2.3 95% CI 0.98, 5.53) และเด็กผู้หญิงมีความเสี่ยงสูงกว่าเด็กผู้ชาย แต่ไม่พบความสัมพันธ์ระหว่างปริมาณ $PM_{2.5}$และ PM_{10} ต่อค่าความจุปอด (PEFR) แต่พบว่า ค่าทัศนวิสัย(Visibility)มีความสัมพันธ์กับค่าความจุปอด อย่างมีนัยสำคัญทางสถิติ คือเมื่อค่า Visibility เพิ่มขึ้น 10 หน่วย จะทำให้ค่า PEFR ลดลง 2.8 มิลลิลิตร

ในกลุ่มผู้ใหญ่ พบว่ากลุ่มที่มีความไวต่อมลภาวะมีความเสี่ยงต่อการสัมผัสมลพิษ ทั้ง PM_{10} และ $PM_{2.5}$ มากกว่ากลุ่มผู้ใหญ่ปกติอย่างมีนัยสำคัญทางสถิติ เช่นอาการหายใจไม่อิ่ม (OR = 23) อาการหายใจไม่สะดวกแน่นหน้าอก (OR =13.04-12.28) และอาการระคายคอ (OR = 1.94) และพบว่าเพศหญิงมีความเสี่ยงต่อการเกิดอาการต่าง ๆสูงกว่าเพศชาย

ในการวิเคราะห์ความสัมพันธ์ระหว่างค่าความจุปอด พบว่า $PM_{2.5}$ มีความสัมพันธ์ต่อค่าความจุปอด คือ เมื่อ $PM_{2.5}$ เพิ่มขึ้น จะมีผลทำให้ค่าความจุปอดลดลงอย่างมีนัยสำคัญทางสถิติ ส่วน PM_{10} ไม่พบว่ามีผลกระทบต่อค่าความจุปอด

การศึกษานี้แสดงให้เห็นว่าฝุ่นละอองขนาดเล็กทั้ง PM_{10} และ $PM_{2.5}$ มีความสัมพันธ์กับอาการทางระบบหายใจทั้งในผู้ใหญ่และในเด็กโดยเฉพาะกลุ่มที่มีความไวต่อการสัมผัสมลพิษ โดยเฉพาะ $PM_{2.5}$ ที่สะสมมีผลกระทบต่อค่าความจุปอดของผู้ใหญ่

ผลการประเมินผลกระทบทางเศรษฐศาสตร์

การศึกษาค่าความพึงพอใจที่จะจ่าย(Willingness to Pay, WTP) ได้ถูกออกแบบเพื่อใช้ควบคู่ไปกับการวิจัยการบันทึกอาการทางระบบหายใจประจำวันเพื่อให้ได้ข้อมูลว่ากลุ่มตัวอย่างจะให้ค่าในการหลีกเลี่ยงการมีอาการทางระบบหายใจเป็นเวลา 1 วัน มากเพียงใด ความท้าทายของการออกแบบสำรวจ WTP สำหรับอาการทางสุขภาพคือ การสร้างคำถามในทางที่จะช่วยให้กลุ่มตัวอย่างคิดในสภาพความเป็นจริงเกี่ยวกับการแลกเปลี่ยน (tradeoffs) ระหว่างรายได้หรือค่าใช้จ่ายกับการเจ็บป่วย ความคิดในการใช้จ่ายเพื่อหลีกเลี่ยงหรือลดการเจ็บป่วย ซึ่งผลจากการศึกษานี้สามารถหาค่าของผลกระทบต่อสุขภาพที่สัมพันธ์กับความเข้มข้นของมลภาวะทางอากาศในกรุงเทพมหานคร ซึ่งจะนำไปสู่การคำนึงถึงประโยชน์ของการควบคุมมลภาวะทางอากาศในกรุงเทพมหานคร

ในการประเมินผลกระทบทางด้านเศรษฐศาสตร์ในการศึกษานี้ ได้ประเมินค่าใช้จ่ายจริงที่เกิดขึ้นเมื่อเกิดอาการทางระบบหายใจในช่วง 3 เดือนที่ผ่านมา และความเต็มใจที่จะจ่าย เพื่อป้องกันไม่ให้เกิดอาการทางระบบหายใจ ค่าใช้จ่ายจริงในกลุ่มผู้ใหญ่สูงกว่าในกลุ่มเด็กทั้งในอาการเล็กน้อย อาการปานกลางและอาการ

มาก และจำนวนเงินที่ยินดีที่จะจ่ายเพื่อป้องกันอาการป่วยทางระบบหายใจน้อยกว่าค่าเฉลี่ยของค่าใช้จ่ายจริงทุกระดับอาการทั้งในเด็กและผู้ใหญ่ ยกเว้นในกลุ่มเด็กสำหรับกรณีอาการมากที่พ่อแม่ยินดีจะจ่ายเงินมากกว่าค่าใช้จ่ายจริง

การศึกษาจากตัวอย่างผู้ใหญ่ 101 คน มีจำนวนครั้งที่ป่วยด้วยอาการทางระบบหายใจรวม 135 ครั้ง ในช่วง 3 เดือน เท่ากับ 540 ครั้งใน 1 ปี หรือประมาณ 5 ครั้ง ต่อคนต่อปี และในแต่ละครั้งที่ป่วยสูญเสียค่าใช้จ่ายในการรักษาพยาบาลประมาณ 186 บาท ดังนั้น ใน 1 คนที่ป่วยจะสูญเสียค่าใช้จ่ายในการรักษาพยาบาลประมาณ 930 บาทต่อปี และถ้าหากประชากรในเชียงใหม่ที่อายุตั้งแต่ 15 ปีขึ้นไป มีอาการป่วยทางระบบหายใจทุกคน ในระยะเวลา 1 ปี คิดเป็นความสูญเสียทางเศรษฐกิจทั้งหมดประมาณ 2,630.5 ล้านบาท

โดยสรุปฝุ่นละอองขนาดเล็กทั้ง PM_{10} และ $PM_{2.5}$ มีผลกระทบต่อสุขภาพทั้งในประชากรเด็กและประชากรผู้ใหญ่ที่อาศัยอยู่ในจังหวัดเชียงใหม่และค่าใช้จ่ายที่สูญเสียเนื่องจากการรักษาอาการป่วยทางระบบหายใจที่เกิดขึ้นมีมูลค่ามหาศาล ทั้งนี้ยังไม่ได้รวมถึงมูลค่าความสูญเสียทางสุขภาพของประชาชนเข้าไปด้วย ถ้าหากสามารถดำเนินนโยบายต่าง ๆเพื่อการป้องกันและลดปริมาณฝุ่นละออง โดยเฉพาะฝุ่นละอองขนาดเล็กในจังหวัดเชียงใหม่ ก็น่าจะเป็นผลดีอย่างมากต่อสุขภาพของประชาชน

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

เผยแพร่ผลการศึกษาในหน่วยงาน

ชื่อโครงการไทย 4 สื่อสร้างสรรค์จากเพื่อนสู่เพื่อนเพื่อส่งเสริมพฤติกรรมป้องกันการเสพยาบ้าของวัยรุ่นในชุมชนแออัด

นักวิจัยหลัก นางสาวภัทรพรรณ เล้านิรมัย

นักวิจัยในทีม นางสาวอรพินท์ ไชยพยอม

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล

จากการเพิ่มของปัญหาที่มาจากครอบครัว เช่น การแยกทางกันของพ่อแม่ การเลี้ยงดูลูก สภาพคล่องทางการเงินของครอบครัว และปัญหาในชุมชน เช่นการเสพสิ่งเสพติด การพนัน ล้วนเป็นปัญหาใหญ่ที่กำลังทวีความรุนแรงมากขึ้น ปัญหาเหล่านี้มีผลกระทบโดยตรงกับวัยรุ่น ที่ส่วนใหญ่ใช้เวลากับเพื่อน ทำให้มีโอกาสพึ่งยาเสพติดจากเพื่อน ด้วยความซับซ้อนของปัญหาดังกล่าว จำเป็นต้องให้วัยรุ่นตระหนักถึงความเข้าใจในตนเอง โครงการนี้เป็นจุดเริ่มต้นในการกระตุ้นให้วัยรุ่นเห็นถึงศักยภาพของตนเองผ่านกลุ่มเพื่อนในการแก้ไขปัญหาได้อย่างถูกต้อง

วัตถุประสงค์

เพื่อสร้างและทดลองใช้กิจกรรมสื่อสร้างสรรในการส่งเสริมความรู้เกี่ยวกับยาบ้า ความตระหนักถึงความรุนแรงของยาบ้า และทักษะชีวิตที่ส่งเสริมพฤติกรรมป้องกันการเสพยาบ้า ให้แก่วัยรุ่นในชุมชนแออัดแห่งหนึ่งในกรุงเทพฯ

วิธีการวิจัย

ผู้ที่เข้ามามีส่วนร่วมประกอบด้วย ตัวแทนวัยรุ่นในชุมชน เจ้าหน้าที่องค์กรพัฒนาเอกชนในชุมชน และคณะผู้วิจัย โดยมุ่งเน้นให้วัยรุ่นได้มีส่วนร่วมในการจัดกิจกรรมต่างๆ เพื่อให้ได้กิจกรรมที่เหมาะสมกับสภาพชุมชน และตรงตามความต้องการของวัยรุ่นในชุมชนที่เลือกเป็นกรณีศึกษา โดยใช้เวลาในการทดลองดำเนินกิจกรรมประมาณ 1 ปี โครงการฯได้จัดกิจกรรมต่างๆ ประกอบด้วย การจัดตั้งมุมเพื่อนใจวัยรุ่น การเปิดให้บริการโทรศัพท์สายด่วนเพื่อนใจวัยรุ่น การจัดค่ายเยาวชน การฝึกอบรมการจัดทำสื่อ การจัดทำจดหมายข่าว และกิจกรรมย่อยอื่นๆ และติดตามประเมินผลการจัดกิจกรรมโดยใช้การสังเกตการณ์แบบมีส่วนร่วม การสัมภาษณ์โดยใช้แบบสอบถาม การสัมภาษณ์แบบเจาะลึก และการสนทนากลุ่ม

ผลการวิจัย

กิจกรรมในรูปแบบค่ายเยาวชนหรือค่ายอบรมที่จัดขึ้นภายนอกชุมชนเป็นรูปแบบกิจกรรมที่วัยรุ่นส่วนใหญ่ในชุมชนอยากจะเข้าร่วมมากที่สุด แต่มีข้อจำกัดบางประการ เช่น ใช้งบประมาณสูง และวัยรุ่นในชุมชนไม่สามารถเข้าร่วมได้อย่างทั่วถึง ส่วนการจัดตั้งมุมเพื่อนใจวัยรุ่น และการเปิดให้บริการโทรศัพท์สายด่วน ได้รับการตอบรับจากวัยรุ่นในระดับปานกลาง และยังจำกัดกลุ่มผู้ใช้บริการอยู่เพียงบางกลุ่ม แต่เป็นประโยชน์อย่างยิ่งในการใช้เป็นช่องทางในการประชาสัมพันธ์กิจกรรม สำหรับสื่อสิ่งพิมพ์ที่เหมาะสมกับวัยรุ่น

ในชุมชน ควรให้ความสำคัญกับรูปแบบของสื่อที่ดึงดูดความสนใจ ทั้งสีสัน การตกแต่ง รูปภาพ และศิลปกรรม นอกจากนั้น ควรคำนึงถึงความสม่ำเสมอในการเผยแพร่ ความทั่วถึงในการเผยแพร่ และประโยชน์ใช้สอยของสื่อด้วย เพื่อให้วัยรุ่นได้รับทั้งความรู้ และความเพลิดเพลินในการอ่านในเวลาเดียวกัน แต่สิ่งที่สำคัญของการจัดกิจกรรม คือ การเปิดโอกาสให้วัยรุ่นในชุมชนได้มีทางเลือกในการใช้เวลาว่างให้เกิดประโยชน์ แทนที่จะนำเวลาว่างไปใช้ในทางที่ผิด ส่วนประโยชน์อื่นๆ เช่น ความรู้ ความตระหนัก และทักษะชีวิต ถือเป็นผลที่ได้จากการเข้าร่วมกิจกรรมซึ่งจะมองเห็นผลในระยะยาวต่อไป

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

Laoniramai, P., Laosee, O. C., Somrongthong, R., Wongchalee, S., & Sitthi-Amorn, C. (2005). Factors affecting the experiences of drug use by adolescents in a Bangkok slum. *Southeast Asian J Trop Med Public Health, 36*(4), 1014-1019.

ชื่อโครงการไทย 5 การมีส่วนร่วมของประชาสังคมในกลยุทธเพื่อส่งเสริมการใช้ยาอย่างเหมาะสมเพื่อรักษาโรคติดต่อที่ทางเดินหายใจส่วนบน ของผู้ใหญ่ในระดับครัวเรือนและชุมชน: กรณีศึกษาชุมชนแออัดในกรุงเทพมหานคร

ชื่อโครงการอังกฤษ Partnership of civil society in a strategy to reduce the use of antibiotics in the treatment of adults with Upper Respiratory Infection (URIs) from viral origins at the household and community levels: A comparison study in congested community, Bangkok Thailand

นักวิจัยหลัก ดร.ศิริตรี สุทธจิตต์

ที่ปรึกษา ศ.นพ.จิตร สิทธีอมร

หลักการและเหตุผล

โรคติดเชื้อในระบบทางเดินหายใจเป็นโรคที่เกิดขึ้นได้บ่อย ในประเทศไทยพบว่าโรคติดเชื้อในระบบทางเดินหายใจส่วนบนเป็นโรคที่พบได้มากที่สุดในสถานพยาบาล และยาปฏิชีวนะที่มีส่วนใหญ่ใช้รักษาโรคที่เกิดจากการติดเชื้อในระบบทางเดินหายใจส่วนบน จากการใช้ยาปฏิชีวนะในการรักษาโรคทางเดินหายใจเพิ่มขึ้นทุกปี ผู้ใช้ยาเองบางคนซื้อยามารับประทานเอง รับประทานไม่ต่อเนื่อง และเกิดความเข้าใจผิดๆ เกี่ยวกับการรักษาโรคทางเดินหายใจ โดยเฉพาะหวัด ก่อให้เกิดปัญหาการใช้ยาที่ไม่เหมาะสม

วัตถุประสงค์

เพื่อประเมินประสิทธิภาพของกลยุทธในการลดการใช้ยาปฏิชีวนะที่ไม่เหมาะสมในการรักษาโรคติดเชื้อทางเดินหายใจส่วนบน สำหรับผู้ใหญ่ ในระดับครัวเรือนและชุมชน โดยผ่านการมีส่วนร่วมของประชาสังคม

วิธีการวิจัย

Pre-post study intervention study with a comparison group ดำเนินการศึกษาในชุมชนแออัดสองแห่งในกรุงเทพฯ โดยครอบคลุมการปรับเปลี่ยนพฤติกรรมของกลุ่มเป้าหมายทั้งสามกลุ่มที่เกี่ยวข้องกับการใช้ยาปฏิชีวนะ คือ ประชาชน ร้านยา และแพทย์ในสถานบริการสาธารณสุขกทม. Intervention คือการสนับสนุนให้เกิดประชาสังคมในกลุ่มเป้าหมาย ประกอบกับ educational และ managerial strategies ประเมินผลด้วยการสัมภาษณ์ครัวเรือน ล่อซื้อและสัมภาษณ์ร้านยา และการติดตามการสั่งใช้ยาในสถานบริการสาธารณสุข

ผลการวิจัย

ความพยายามในการสนับสนุนให้เกิดประชาสังคมด้านยาและสุขภาพในชุมชนแออัด โดยให้ประกอบด้วย 3 ภาคีทั้งผู้สั่งใช้ ผู้จ่าย และผู้ใช้ยา ยังไม่สามารถดำเนินการได้จริง ด้วยการขาดความพร้อมขององค์ประกอบในการประชาสังคมหลายด้าน เช่น มี knowledge gap ระหว่างกลุ่ม ขาดจิตสำนึกประชาสังคม และขาดพื้นที่สำหรับการแลกเปลี่ยนเสวนา เป็นต้น อย่างไรก็ตาม โครงการได้สนับสนุนให้เกิดคู่มือการรักษาโรคติดเชื้อทางเดินหายใจส่วนบนและให้มีการใช้ในแต่ละกลุ่มเป้าหมาย มีกิจกรรมในแต่ละกลุ่มเป้าหมาย เกิดคู่มือและสื่อสำหรับการให้ความรู้ ปรับทัศนคติต่อยาปฏิชีวนะและพฤติกรรมการใช้ยาอย่าง

เหมาะสม ทั้งนี้พบการลดลงในการจ่ายยาปฏิชีวนะของแพทย์ในศูนย์บริการสาธารณสุขกทม. แต่ยังไม่พบการปรับพฤติกรรมการใช้ยาในกลุ่มประชาชนและร้านยาที่ชัดเจน จึงควรต้องศึกษาเพิ่มเติมถึงการประยุกต์ใช้แนวคิดเรื่องประชาสังคมกับสุขภาพ และการใช้ยา โดยเฉพาะกับการประยุกต์ในกลุ่มธุรกิจเช่นร้านยา

การนำผลไปใช้ประโยชน์/การเผยแพร่ผลงาน

Suttajit, S., Wagner, A. K., Tantipidoke, R., Ross-Degnan, D., & Sitthi-amorn, C. (2005). Patterns, appropriateness, and predictors of antimicrobial prescribing for adults with upper respiratory infections in urban slum communities of Bangkok. *Southeast Asian J Trop Med Public Health, 36*(2), 489-497.

ชื่อโครงการไทย 6 การวิเคราะห์ความเสี่ยงในการเกิดโรคหัวใจ ชักและการเสียชีวิตจากการศึกษาระยะยาวในชุมชนแออัดคลองเตย

ชื่อโครงการอังกฤษ An Analysis of Population Cohort: Risk of Hypertension, Stroke, and Death of Residence in Klong Toey Slum

นักวิจัยหลัก นางสาวอรพินท์ ไชยพยอม

ที่ปรึกษา ศ.นพ. จิตร สิทธีอมร

หลักการและเหตุผล

จากสถิติโรงพยาบาลระดับศูนย์ในกรุงเทพมหานครพบว่า เกือบครึ่งของผู้ป่วยที่มีเลือดออกในสมองเกิดจากภาวะชัก ผู้ป่วยจำนวนมากมาจากชุมชนแออัดคลองเตย และจากสถิติสาธารณสุขในปีพ.ศ. 2539 พบว่าจำนวนผู้เข้ามารับการรักษาเพิ่มขึ้น โดยเฉพาะผู้ป่วยโรคความดันโลหิตสูงเพิ่มขึ้นอย่างต่อเนื่อง ทำให้รัฐต้องปรับคุณภาพการรักษาให้มีประสิทธิภาพมากขึ้น เพื่อลดการป่วยรุนแรงและการเสียชีวิตอันเป็นผลมาจากภาวะแทรกซ้อนของโรคความดันโลหิตสูงนี้

การศึกษานี้เก็บข้อมูลระยะยาวจากผู้ป่วยในชุมชนแออัดคลองเตยและแฟลตคลองเตยจำนวน 1885 คน ในปี พ.ศ. 2531 และมีการติดตามกลุ่มตัวอย่างดังกล่าวในปี พ.ศ. 2536, 2541 โดยการวัดความดันโลหิต ชั่งน้ำหนัก ประเมินภาวะชัก และการเสียชีวิต อย่างไรก็ตามโครงการนี้ยังขาดการวิเคราะห์เพื่อหาปัจจัยเสี่ยงต่างๆ เหล่านั้น

วัตถุประสงค์

เพื่อวิเคราะห์ปัจจัยเสี่ยงที่ทำให้เกิดการเสียชีวิตด้วยโรคหัวใจ ปัจจัยที่ทำให้เกิดการเกิดภาวะชัก และปัจจัยเสี่ยงที่ทำให้เกิดการเสียชีวิต ในกลุ่มประชาชนที่อาศัยในชุมชนแออัดคลองเตยและแฟลตคลองเตย

ผลการวิเคราะห์

จากกลุ่มตัวอย่างจำนวน 1,876 คน เพศชาย 867 คน (46%) หญิง 1,009 คน (54%) ความชุกของการเกิดโรคความดันโลหิตสูงมีแนวโน้มเพิ่มขึ้น จาก 20% ในปี พ.ศ.2531 และ 26% ในปีพ.ศ. 2536 ตัวแปรที่มีผลอย่างมีนัยสำคัญทางสถิติ ต่อการเสียชีวิตด้วยโรคหัวใจ คือ เพศ, อายุ, ระยะเวลาที่ดื่ม alcohol ตัวแปรที่มีผลอย่างมีนัยสำคัญทางสถิติ ต่ออาการชัก คือ อายุ กล่าวคือ เมื่อมีอายุเพิ่มขึ้น 1 ปี จะมีโอกาสเกิดชักเพิ่มขึ้น 1.3 เท่า และตัวแปรที่มีอิทธิพลต่อการเสียชีวิตอย่างมีนัยสำคัญทางสถิติ ($P<0.05$) ต่อการเสียชีวิตโดยรวม คือ อายุ, ระยะเวลาที่ดื่ม alcohol, HDL, Triglyceride

การนำผลไปใช้ประโยชน์/ การเผยแพร่

เผยแพร่ผลการศึกษาในหน่วยงาน

ชื่อโครงการ ไทย 7 การติดต่อของเชื้อหวัดสายพันธุ์ A ระหว่างคนและสัตว์ในประเทศไทย
ชื่อโครงการอังกฤษ Influenza A Infections at the Human Animal Interface
นักวิจัยหลัก ผศ. ดร.รัตนา สำโรงทอง

ที่ปรึกษา ศ.นพ. จิตร สิทธีอมร

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หลักการและเหตุผล

ในระหว่างปี 2003-2004 พบการระบาดครั้งใหญ่ของเชื้อดังกล่าวในสัตว์ปีกเป็นจำนวนมาก และมีการทำลายสัตว์ปีกในประเทศไทยมากกว่า 60 ล้านตัว ปัญหาดังกล่าวเกิดติดต่อกันมาเรื่อยๆจนถึงปี 2008 ตั้งแต่ปี 2003 จนถึงปัจจุบันพบว่า มีผู้ติดเชื้อทั่วโลก 359 คน และ เสียชีวิต 226 คน (www.who.int-accessed February 5, 2008) มีรายงานการระบาดของเชื้อโรคไข้หวัดนกมากถึง 48 ประเทศ (www.oie.int-accessed February 6, 2008) เช่น ประเทศ กัมพูชา จีน โครเอเชีย ฮ่องกง อินโดนีเซีย ญี่ปุ่น คาสัสถาน เกาหลี ลาว มาเลเซีย มองโกเลีย รัสเซีย ไทย ตุรกี เวียดนาม เป็นต้น

การระบาดของไข้หวัดนกในประเทศไทย มีการระบาดเป็นระลอก (wave) จำนวน 6 ระลอกแม้ว่าทุกฝ่ายได้ร่วมมือกันแก้ไขปัญหา แต่ยังไม่สามารถรับมือกับการระบาดของโรคได้ ถ้ามีการระบาดของหวัดนกขนาดใหญ่ (pandemic) เข้าสู่คน และแพร่กระจายจากคนสู่คนในภูมิภาคเอเชียจะทำให้มีผู้เสียชีวิตจำนวนมาก นับล้านคน ผู้เสียชีวิตส่วนใหญ่จะเป็นผู้ที่ยังไม่เคยมี ภูมิคุ้มกันของโรคมาก่อน โดยเฉพาะในเด็กหรือวัยรุ่นหากไวรัสดังกล่าวยังคงระบาดในสัตว์ปีก ก็จะทำให้มีโอกาสที่จะเกิดการติดเชื้อในคนและสัตว์อื่นเพิ่มขึ้น ซึ่งอาจก่อให้เกิดการระบาดที่รุนแรงมากขึ้นได้

การศึกษาครั้งนี้เป็นส่วนหนึ่งในการพัฒนาศักยภาพของบุคลากร ที่ทำการศึกษาที่เกี่ยวข้องกับการระบาดของไข้หวัดนก โดยจะมีการเชื่อมโยงข้อมูลที่ได้จากห้องปฏิบัติการ (ตัวอย่าง specimen ในคนและสัตว์) กับพฤติกรรมของประชาชนในชุมชนที่มีการระบาดซ้ำซาก เพื่อค้นหาสาเหตุทั้งทางระบาดวิทยา สังคม วัฒนธรรม เพื่อตอบโจทย์การระบาดซ้ำซาก โดยจะนำไปสู่การเกิดความร่วมมือกับภาครัฐ (เช่น มหาวิทยาลัย กระทรวงสาธารณสุข กรมปศุสัตว์ ฯลฯ) ภาคเอกชน (เช่น เจ้าของฟาร์มสัตว์ปีก ผู้ที่ทำธุรกิจเกี่ยวข้องกับสัตว์ปีก ฯลฯ) ส่วนท้องถิ่น (เช่น องค์กรปกครองส่วนท้องถิ่น) และชุมชน (เช่น เกษตรกรผู้เลี้ยงไก่บ้าน, ไก่ชน, เป็ด และสัตว์ปีกอื่นๆ) เพื่อให้ได้แนวทางและคำตอบในการเฝ้าระวัง ดูแล แก้ไขปัญหา และการรับมือไข้หวัดใหญ่สายพันธุ์ A และไข้หวัดนก โดยความร่วมมือจากทุกภาคส่วน ทั้งภาครัฐ สถาบันการศึกษา ท้องถิ่น และชุมชน รวมถึงการพัฒนาศักยภาพบุคลากรทางด้านการแพทย์ การสาธารณสุข สัตวแพทย์ และ

นักวิทยาศาสตร์ห้องปฏิบัติการให้มีประสิทธิภาพในการดำเนินโครงการวิจัยให้ได้รับการยอมรับในระดับสากล เกิดทักษะในการพัฒนาโครงการเพื่อแสวงหาทุนวิจัยจากแหล่งทุนภายนอกทั้งในและต่างประเทศ เพื่อศึกษาค้นคว้า และแก้ปัญหาการระบาดของเชื้อหวัดใหญ่สายพันธุ์ A และไข้หวัดนกต่อไป

วัตถุประสงค์

1. เพื่อหาข้อสรุปสถานการณ์ของการติดต่อของโรค โดยวิเคราะห์ข้อมูลที่มีอยู่ เพื่อแสดงข้อเท็จจริงตามหลักวิชาการเกี่ยวกับไข้หวัดนก ในประเด็นต่างๆ ในพื้นที่ที่มีไก่ตายซ้ำซากในจังหวัดสุพรรณบุรี
2. เพื่อค้นหาพฤติกรรมและปัจจัยเสี่ยงที่มีผลต่อการระบาดของโรคไข้หวัดใหญ่และไข้หวัดนกในพื้นที่ที่กำหนด

ประโยชน์ที่คาดว่าจะได้รับ

1. ทราบถึงสถานการณ์เกี่ยวกับไข้หวัดนก ในประเด็นต่างๆ จากข้อมูลที่มีอยู่
2. ทราบเกี่ยวกับการติดต่อในไก่พื้นบ้าน ไก่ชน และเป็ดไล่ทุ่ง รวมทั้งไก่ฟาร์ม การติดต่อจากสัตว์ปีกสู่คน โดยเน้นเฉพาะพื้นที่ในอำเภอเมือง และ/หรืออำเภออู่ทอง จังหวัดสุพรรณบุรี
3. โครงการวิจัยเพื่อป้องกันการระบาดของโรคไข้หวัดนก โดยร่วมมือกันของ กรมปศุสัตว์ สำนักงานสาธารณสุขจังหวัด มหาวิทยาลัย องค์กรต่างๆ ทั้งในและต่างประเทศ

ขอบเขตการดำเนินงาน ดำเนินโครงการวิจัยใน 2 อำเภอ ได้แก่ อ.เมือง และ อ.อู่ทอง จังหวัดสุพรรณบุรี

วิธีการวิจัย นักวิจัยได้พื้นที่วิจัยนำร่อง 2 แห่งโดยมีข้อกำหนดในการเลือกพื้นที่ คือ

1. พื้นที่ที่มีอัตราการตายของสัตว์ปีกสูง
2. มีความร่วมมือของปศุสัตว์และสาธารณสุขจังหวัด
3. ประชาชน ชุมชนและ NGO ให้ความร่วมมือ
4. หมู่บ้านที่มีการระบาดของหวัดนกซ้ำซาก

รูปแบบการวิจัยใช้วิธีการวิจัยแบบมีส่วนร่วมเพื่อตั้งคำถาม และใช้ระเบียบวิธีการวิจัยในการหาคำตอบ ความร่วมมือดังกล่าวจะมาจากส่วนท้องที่ NGO ในพื้นที่ หน่วยงานทางวิชาการ เพื่อที่จะวางแผนดำเนินการ ประเมินผล

การนำประโยชน์ไปใช้/การเผยแพร่ผลงาน

Somrongthong, R., Beaudomin, A.L., Pakinsee, S., & Sitthi-amorn, C. (2010). Folk Knowledge about Avian Influenza and the Use of Personal Protective Equipment: A Qualitative Study. *J Health Res*, *24*(Suppl 1), 27-32.

สรุปผลลัพท์ (Output) ที่ได้จากโครงการ

1. โครงการย่อย 17 โครงการ   1) ผลงานตีพิมพ์ ทั้งหมด 17 บทความ
        - ระดับนานาชาติ จำนวน 16 บทความ
        - ระดับชาติ จำนวน 1 บทความ
    2) นำเสนอในผลงานวิจัยในที่ประชุม
        - ระดับนานาชาติ 7 ครั้ง
        - ระดับชาติ 5 ครั้ง

2. ผลงานตีพิมพ์เพิ่มเติม จำนวน 7 บทความ

3. การบรรยายพิเศษในที่ประชุมระดับนานาชาติ จำนวน 3 ครั้ง

1. โครงการย่อย

ลำดับ	ชื่อโครงการย่อย	ผู้วิจัยหลักโครงการย่อย	การเผยแพร่ผลงาน				
			ชื่อผลงาน	การตีพิมพ์		การนำเสนอผลงานวิจัยในที่ประชุม	
				ระดับนานาชาติ	ระดับชาติ	ระดับนานาชาติ	ระดับชาติ
1.	The cost effectiveness of early detection of bancroftion filarasis in Myanmar Migrants using antigen-capsule ELISA, IgG4 antibody assays and PCR technique	ศ.พญ.สุรางค์ ไตรธีระประภาพ					
2.	รูปแบบการตรวจพาหะธาลัสซีเมียลัฮีโมโกลบินผิดปกติ	นพ.กิตติ ต่อจรัส					
3.	The effectiveness of Shared Care for patients with Epilepsy in Nakornratchasima	นพ.ธนินทร์ อัศวิเชียรจินดา	1) Prevalence of epilepsy in rural Thailand: a population-based study	√		√	√
			2) Compliance with treatment of adult epileptics in a rural district of Thailand	√			
4.	การศึกษาเพื่อหาปัจจัยเสี่ยงของผู้ป่วยกล้ามเนื้อหัวใจวายตายเฉียบพลันกับกลุ่มควบคุม - INTERHEART	ศ.นพ.จิตร สิทธีอมร	1) Association of psychosocial risk factors with risk of acute myocardial infarction in 11,119 cases and 13,648 controls from 52 countries: case-control study	√		√	
			2) Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study	√			
5.	การศึกษาครอบครัวไหลตาย	นพ.สมเกียรติ แสงวัฒนาโรจน์	The Right Ventricular Electrocardiographic leads for detections of Brugada Syndrome in Sudden Unexplained Death Syndrome survivors and their relatives	√			
6.	Trend of Cardiopulmonary Resusciation Patients with Terminal Illness in Chiang Mai	ผศ.ดร.สุดารัตน์ สิทธิสมบัติ	1)Cardiopulmonary resuscitation performed in patients with terminal illness in Chiang Mai University Hospital, Thailand	√		√	√
			2)Effectiveness of advance directives for the care of terminally ill patients in Chiang Mai Hospital, Thailand	√			

ลำดับ	ชื่อโครงการย่อย	ผู้วิจัยหลักโครงการย่อย	การเผยแพร่ผลงาน				
			ชื่อผลงาน	การตีพิมพ์		การนำเสนอผลงานวิจัยในที่ประชุม	
				ระดับนานาชาติ	ระดับชาติ	ระดับนานาชาติ	ระดับชาติ
7.	Attitudes towards advance directives and the impact of prognostic information on the preference for cardiopulmonary resuscitation on medical inpatients in CMU Hospital, Thailand	ผศ.ดร.สุดารัตน์ สิทธิสมบัติ	1)Attitudes toward advance directives and the impact of prognostic information on the preference for cardiopulmonary resuscitation in medical inpatients in Chiang Mai University Hospital, Thailand 2) Physicians' attitudes and practices regarding advanced end-of-life care planning for terminally ill patients at Chiang Mai University Hospital, Thailand	√ √			
8.	โครงการการตรวจสุขภาพประจำปี และปัจจัยที่เกี่ยวข้องของผู้สูงอายุในเขตชนบทของจ.ขอนแก่น	ผศ.จิราพร เขียวอยู่					
9.	การศึกษาความเข้าใจ ความน่าเชื่อถือ ความสมบูรณ์ และความไวต่อการเปลี่ยนแปลงของแบบสอบถาม Health Assessment Questionnaire ฉบับภาษาไทย สำหรับผู้ป่วยโรคข้ออักเสบ	รศ.พญ.มนาธิป โอศิริ	Comprehensibility, reliability, validity and responsiveness of the Thai version of the Health Assessment Questionnaire in Thai patients with rheumatoid arthritis	√			
10.	การศึกษาความชุก ภาวะความรุนแรง ปัจจัยและผลที่เกิดขึ้นจากเนื้อตายในผู้ป่วยถูกงูเห่าและงูกะปะกัด	ดร.นวลน้อง วงศ์ทองคำ	1) A study of 225 Malayan pit viper bites in Thailand. 2) A study of Thai cobra (Naja kaouthia) bites in Thailand.	√ √		√	√

ลำดับ	ชื่อโครงการย่อย	ผู้วิจัยหลักโครงการย่อย	การเผยแพร่ผลงาน				
			ชื่อผลงาน	การตีพิมพ์		การนำเสนอผลงานวิจัยในที่ประชุม	
				ระดับนานาชาติ	ระดับชาติ	ระดับนานาชาติ	ระดับชาติ
1.	ผลของการปรับเปลี่ยนการบริโภคมาเป็นข้าวกล้อง งา ผัก ผลไม้ ตามฤดูกาลของประชาชนในเขตเทศบาลในเขตเทศบาลในจังหวัดสุโขทัย	ภก.สมนึก สุชัยธนาวนิช					
2.	ความต้องการและปัญหาด้านสุขภาพ การเข้าถึงบริการ และคุณภาพชีวิตของวัยรุ่นกับการสร้างภาคีความร่วมมือ	ผศ.ดร.รัตนา สำโรงทอง	1) Sexual behaviors and opinions on sexuality of adolescents in a slum community in Bangkok 2) Factors affecting the experiences of drug use by adolescents in a Bangkok slum	√ √		√	√
3.	การศึกษาผลกระทบของฝุ่นละอองขนาดเล็กต่อสุขภาพของประชาชนใน จ.เชียงใหม่	รศ.ดร.นันทวรรณ วิจิตรวาทการ					
4.	สื่อสร้างสรรค์จากเพื่อนสู่เพื่อนเพื่อส่งเสริมพฤติกรรมป้องกันการเสพยาบ้าของวัยรุ่นในชุมชนแออัด	นส.ภัทรพรรณ เล้านิรามัย	Factors affecting the experiences of drug use by adolescents in a Bangkok slum	√			
5.	การมีส่วนร่วมของประชาสังคมในกลยุทธ์เพื่อส่งเสริมการใช้ยาอย่างเหมาะสมสำหรับการรักษาโรคติดต่อที่ทางเดินหายใจส่วนบนของผู้ใหญ่ในระดับครัวเรือนและชุมชน: กรณีศึกษาชุมชนแออัดในกรุงเทพมหานคร	ดร.ศิริตรี สุทธจิตต์	Patterns, appropriateness, and predictors of antimicrobial prescribing for adults with upper respiratory infections in urban slum communities of Bangkok	√		√	√
6.	การวิเคราะห์ความเสี่ยงในการเกิดโรคหัวใจ ชัก และการเสียชีวิตจากการศึกษาระยะยาวในชุมชนแออัดคลองเตย	นางสาวอรพินท์ ไชยพยอม					
7.	Influenza A Infections at the Human Animal Interface	ผศ.ดร.รัตนา สำโรงทอง	Folk Knowledge about Avian Influenza and the Use of Personal Protective Equipment: A Qualitative Study		√	√	

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3. Globalization and health viewed from three parts of the world. Bulletin of the World Health Organization 2001; 79 (9); 889-890.

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Prevalence of Epilepsy in Rural Thailand : A Population-Based Study

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Abstract

Background : A study of the community-based burden of illness based upon prevalence is needed to plan intervention strategy.

Purpose : To determine the prevalence of epilepsy in a rural population in Thailand.

Method : From January to June, 2000, all of the people in Talardkav sub-district were invited to be interviewed and examined by a neurologist who visited their village.

Results : Of the 2,069 people in 553 households who gave information (72.2% of the total households), 43 had a history of seizure and of the 43, 15 were epileptics. The prevalence of epilepsy was estimated at 7.2 per 1,000 population. The highest two peaks were in the age groups of 5-9 and 25-34 years (17.0, 17.4/1,000, respectively).

Conclusion : The prevalence of epilepsy in rural Thailand is low, although probably underestimated, but it is the best to date for rural Thailand.

Key word : Epilepsy, Epidemiology, Population-Based Study, Prevalence, Thailand

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Epilepsy is a disorder with significant social and economic consequences(1). In Thailand, it is the third commonest neurological disease after cerebrovascular disease and headache(2).

Prevalence, as a measure of the disease burden in the community, should be considered when planning the health needs at local, regional and national levels(3). The only previous study of the prevalence of epilepsy in Thailand reported a very low prevalence rate (2.8/1,000 population in those aged 15 years or more)(4).

The objective of this study was to determine the prevalence of epilepsy in a rural community in Thailand.

MATERIAL AND METHOD

This study was conducted in Nakhon Ratchasima province, the second largest of the 76 provinces in Thailand, located 254 km northeast of the capital, Bangkok. The province has an area of 20,494 km^2, divided into 26 districts, 287 sub-districts and has a total population of 1.77 million. The sub-district Talardkav, an average rural area, was chosen to survey people with a history of epilepsy because of its proximity (within 40 kilometers) to the Provincial Hospital. This sub-district has a population of 3,258, residing in 766 households in 11 villages in an area of 25 km^2. This population estimate is based upon a survey done by health volunteers and sub-district health officers every six months.

In this study, EPILEPSY was defined as two or more clinical afebrile seizures

- Unrelated to acute metabolic derangement or to withdrawal from alcohol or drugs(5).
- Excluding those which occur within a 24-hour period(5).
- Excluding those in which the diagnosis of epilepsy was questionable.

Each village in Talardkav sub-district was visited between January and June, 2000. In preparation, the authors met with all sub-district health officials, health volunteers and teachers in each village to discuss the objective and rationale of the survey. For seven days before the study, the sub-district health officers announced the date of study by the village intercom and the health volunteers went from door to door to tell all of the people whether they had or did not have a health problem, the date that the neurologist would visit their village to examine the people health, providing free common drugs and education related to their health problems and to invite them to have an examination on that date.

On the study day, a team consisting of sub-district health officials, health volunteers conducted general examinations (body weight and blood pressure) of all of the people and then the neurologist administered the screening questionnaire (Placentia et al)(6) in groups, consisting of six to eight persons from two to three families. They provided information about themselves and their children, and about those who were mentally retarded, demented or psychotic or who were not present. If the screening was suggestive of epilepsy, the neurologist conducted an in-depth interview with the individual; for those retarded, demented, psychotic or absent and for young children, with the parents or caregivers; for school aged children with both their parents and teachers. All of them were examined by the neurologist and provided with common drugs and education related to their health problems.

RESULTS

Population and sample characteristics

During the survey, 2,069 (69.5%) in 553 households of the total 3,258 people in 766 households gave the information. The remaining 1,189 did not because nobody in the household came and it was not possible to determine why they did not.

The gender and age specific response rates of receiving the information are shown in Table 1. Overall and in all but the age group 25-34 years, the response rates were higher among the females; significantly so only for the overall response rate and for the response rates in the age groups 10-14 and 55-64 years. There was a reversal of this observation in the age group 25-34 years, where the response rate was higher but not significantly so among the males. The response rates were lowest among those aged 15-44 years, (56.9%), with higher rates in the children (74.5%) and in the older adults (65.9%); p-value <0.001.

Seizure and epilepsy distribution

Among the 2,069 subjects who gave information, there were 43 (20.8/1000) with a history of seizure (Table 2). Of these 43, only 15 were diagnosed as epileptics. More of the 28 non-epileptics were male (52.9%) and most (82.1%) had had a febrile convulsion. Seizures related to withdrawal from alcohol were only found in the males.

Table 1. Gender and age specific response rates.

Age group (year)	Males		Females		Both genders		P-value (age specific)
	n/N	%	n/N	%	n/N	%	
0-4	83/110	75.5	96/115	83.5	179/225	79.6	ns
5-9	82/120	68.3	94/129	72.9	176/249	70.7	ns
10-14	94/137	68.6	97/122	79.5	191/259	73.7	<0.05
15-24	159/278	57.2	164/272	60.3	323/550	58.7	ns
25-34	148/250	59.2	140/267	52.4	288/517	55.7	ns
35-44	128/234	54.7	150/262	57.3	278/496	56.0	ns
45-54	100/163	61.3	123/179	68.7	223/342	65.2	ns
55-64	76/126	60.3	105/141	74.5	181/267	67.8	<0.05
65+	89/149	59.7	141/204	69.1	230/353	65.2	ns
All age groups	959/1,567	61.2	1,110/1,691	65.6	2,069/3,258	63.5	<0.01

n = Respondents
N = Population
ns = not significant

Table 2. Distribution by gender in those with seizures and epilepsy.

Seizure classification	Male		Female		Total	
	N	%	N	%	N	%
A. Total Epileptics	**5**	**100.0**	**10**	**100.0**	**15**	**100.0**
I. Generalized type	3	60.0	3	30.0	6	40.0
- Generalized tonic clonic	3	60.0	1	10.0	4	26.6
- Absence	0	0	1	10.0	1	6.7
- Generalized tonic	0	0	1	10.0	1	6.7
II. Localization related type	1	20.0	6	60.0	7	46.7
- Simple partial	0	0	1	10.0	1	6.7
- Complex partial	0	0	1	10.0	1	6.7
- Partial with secondarily generalized	1	20.0	4	40.0	5	33.3
III. Unclassified	1	20.0	1	10.0	2	13.3
B. Total Non-epileptics	**17**	**100.0**	**11**	**100.0**	**28**	**100.0**
I. Febrile convulsion	14	82.4	9	81.8	23	82.1
II. Single seizure	0	0	1	9.1	1	3.6
III. Seizure related to						
a) Acute Metabolic condition	2	11.8	1	9.1	3	10.7
b) Withdrawal from alcohol	1	5.9	0	0	1	3.6

In contrast, most of the 15 epileptics were female (66.7%). Slightly more of the epileptics were classified as having a localization related type of epilepsy (46.7%).

Prevalence rates

Of the 2,069 who gave information, only 15 were considered to be epileptics. This would yield a crude prevalence rate of epilepsy of 7.2 per 1,000 population (15/2,069) or a rate of 4.6/1,000 (15/3,258) if all the non-givers were assumed to have no history of epilepsy.

As shown in Table 3, the prevalence in females (9.0/1,000) was nearly twice that of the males (5.2/1,000); with the difference greatest in three age groups: 5-9 years (21.3 *vs* 12.2/1,000); 25-34 years (28.6 *vs* 6.8/1,000) and 45-54 years (16.3 *vs* 0/1,000).

DISCUSSION

Although examination was offered to all residents of Talardkav Sub-District, the response rate of receiving information was only 69.5 per cent. Most Thai people in a rural area are likely to visit a mobile medical service to obtain medication even if they

Table 3. **Gender and age specific prevalence of epilepsy.**

Age group (year)	Males		Females		Total		P-value
	n_1/n	$n_1/1{,}000$	n_1/n	$n_1/1{,}000$	n_1/n	$n_1/1{,}000$	
0-4	0/83	0	0/96	0	0/179	0	-
5-9	1/82	12.2	2/94	21.3	3/176	17.0	ns
10-14	0/94	0	1/97	10.3	1/191	5.2	ns
15-24	1/159	6.3	0/164	0	1/323	3.1	ns
25-34	1/148	6.8	4/140	28.6	5/288	17.4	ns
35-44	1/128	7.8	0/150	0	1/278	3.6	ns
45-54	0/100	0	2/123	16.3	2/223	9.0	ns
55-64	1/76	13.2	1/105	9.5	2/181	11.0	ns
65+	0/89	0	0/141	0	0/230	0	-
Total	5/959	5.2	10/1,110	9.0	15/2,069	7.2	ns

n = Respondents
n_1 = Epileptics
ns = not significant

have no definite medical complaint. They would only miss this opportunity when they thought their health was good and had something more important to do. It is possible that those not attending were concerned that their history of epilepsy would become known to either health officers or the community and, as a result, they or their family may become stigmatized. The same may be true for those who attended because the questionnaire was administered in a group setting. Epilepsy is a clinical diagnosis. Patient and eyewitness's information, therefore, is the key to making the diagnosis. However, most types of epilepsy involved loss of consciousness and then amnesia. Most of the time, the diagnosis, hence, can be made from only eyewitness's information.

There were 43 people with a history of seizures but only 15 were considered to be epileptic. In the non-epileptics, there was no marked difference between the males and females in the percentage of febrile convulsion and of seizure related to an acute metabolic condition.

Localization-related type of epilepsy was more common (46.7%) than the generalized type of epilepsy (40.0%). Neurocysticercosis, birth and accident related to head trauma might contribute to this high prevalence of partial epilepsy(3). Generalized epilepsy has been the most common type reported in most community-based surveys(3,7-18). This variation may be related to a lower level of case ascertainment of partial epilepsy, misclassification of a proportion of seizure(3,9), the time(3) and the method of diagnosis(13).

The crude prevalence rate of epilepsy in this study ranged from 4.6 to 7.2 per 1,000 population, which was quite low. However, similar prevalence rates have been reported by all community-based studies in Asia(3,4,7,19) (APPENDIX 1). Most studies in developing countries excluding Asia have found prevalence rates ranging from 8.5-57/1,000(8-13,20-23). In developed countries, prevalence rates range from 7.5-10.4/1,000(14,24,25). The exceptions are the studies done in Igbo-Ora, Nigeria (5.3/1,000)(20) and Riposto, Italy (2.7/1,000)(15). Moreover, the difference in prevalence rates between developing and developed countries as shown in APPENDIX 1, are not marked. In the hospital-based studies, the prevalence rates showed wide variations ranging from 2.0-20.3/1,000(16-18,26,27).

In a previous study in Thailand, the prevalence of diagnosed epilepsy in the population aged $\geq$ fifteen years was 2.8/1,000(4), which is considerably lower than that found in the present study (4.6-7.2/1,000). The reason might be that the previous study was done by asking people whether they had been diagnosed as epileptic and that different definitions and criteria for making the diagnosis of epilepsy were used by the physicians who examined the patients(4).

The reasons for the low prevalence ratio of epilepsy in the present study might be the method of questionnaire administration and of receiving information. Epileptics with no obvious convulsion might be missed. Recall bias is possible; maybe intentional, possibly due to the fear of stigmatization or unintentional because of the forgetfulness or ignorance of people to recall their previous symptoms. Incomplete information for making the diagnosis and the diagnostic method [e.g. no access to electroencephalography (EEG)] may also be responsible.

Most studies(3,7,11,13,15,19,20,24) have reported a higher prevalence of epilepsy in men, probably due to a higher frequency of head injury(13). In the present study, gender-specific prevalence in women was nearly twice as high as in men (9.0/1,000 *versus* 5.2/1,000) without statistical difference. One of the reasons for the difference from many reported studies is the lower response rates among the males, possibly because even if they have epilepsy they need to work to support their household. The other maybe men do not admit the occurrence of seizures as frequently as women in community surveys(13).

The age-specific prevalence of epilepsy in this study classified in accordance with some other studies demonstrated that the prevalence of epilepsy was highest in two peaks, 5-9 and 25-34 age groups (17.0 and 17.4/1,000, respectively), which was similar to the data from the community of Riposto, Italy(15). A possible cause of the highest two peaks' prevalence rate is the common onset of epilepsy in childhood and in young adult life(7). In developing countries, most peaked in the second decade(3,9-11,13, 14,19-21). However, in developed countries, it has been shown to be higher with increasing age(14,16-18,27). The lower prevalence rate of epilepsy in the elderly in developing countries may be related to multiple factors such as lower life expectancy(3), higher seizure-related mortality(3), and under-ascertainment of seizure disorders in this population(3).

The prevalence of epilepsy in rural Thailand was quite low compared to studies in developing countries(8,10,12,13,21-23). Although this figure is the best to date, it is likely an underestimate of the true prevalence.

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APPENDIX 1

Summary of studies on the prevalence of epilepsy by type of study and country.

A. Community-based studies

Country	Year of study	Prevalence rates/1,000			Authors	Reference number
		Male	Female	Total		
I. In developing countries						
Africa						
- Igbo-Ora, Nigeria	1982	5.1	5.6	5.3	Osuntokun BO, et al	20
- Aiyete, Nigeria	*	28.0	44.0	37.0	Osuntokun BO, et al	21
- Rural area, Tanzania	1989	9.2	11.1	10.2	Rwiza HT, et al	11
- Zinvie, Africa	1997	*	*	33.5-35.1	Debrock C, et al	22
- Nakuru, Kenya	1985-86	*	*	18.2	Kaamugisha J, et al	23
Latin America						
- Republic of Panama	1988	*	*	57.0	Gracia F, et al	8
- Guatemala	*	*	*	8.5	Mendizabal JE, etal	9
- Bogota, Columbia	1974	15.5	22.9	19.5	Gomez JG, et al	10
- Ecuador	1986-87	*	*	12.2-19.5	Placencia M, et al	12
- Cordillera Province, Bolivia	1996	11.4	13.1	12.3	Nicoleeti A, et al	13
Asia						
- Republic of China	1983	5.0	4.1	4.6	Li SC, et al	7
- Kerala, South India	1996	5.2	4.6	4.9	Radhakrishnan K, et al	3
- Thailand, Nationwide	1991-92	*	*	2.8	Chuprapawan C	4
- Haryana, North India	1992-94	4.9	3.3	4.2	Singh A, et al	19
II. In developed countries						
- Sydney, Australia	1980	*	*	7.5	Beran RG, et al	25
- Copiah County, Mississippi	1978	12.4	8.6	10.4	Haerer AF, et al	14
- Silivri, Turkey	1994	10.4	10.0	10.2	Keraagac N, et al	24
- Riposto, Italy	1987	2.6	2.8	2.7	Reggio A, et al	15

B. Hospital-based studies

Country	Year of study	Prevalence rates/1,000			Authors	Reference number
		Male	Female	Total		
Bradford, England	1996-98	*	*	7.3	Wright J, et al	18
South Glamorgan, UK	1996	*	*	2.0-13.4	Morgan CLI	26
Rural Iceland	1993	4.6	9.4	7.3	Olafsson E, et al	17
Tonbridge, UK	1983	15.4	26.5	20.3	Cockerell OC, et al	16
England and Wales	1995	*	*	5.15	Wallace H, et al	27

* = Not mentioned

ความชุกของโรคลมชักในชนบทของประเทศไทย : การศึกษาบนพื้นฐานของชุมชน

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การศึกษาโรคที่เป็นปัญหาในชุมชนจำเป็นที่จะต้องทราบถึงความชุกของโรคนั้นเพื่อที่จะวางแผนในการหามาตรการในการควบคุม

วัตถุประสงค์ : เพื่อหาความชุกของโรคลมชักในชนบทในประเทศไทย

ผู้ป่วยและวิธีการ : การศึกษาเริ่มตั้งแต่เดือนมกราคมถึงมิถุนายน 2543 โดยชาวบ้านทั้งหมดที่อาศัยอยู่ในตำบลท่าลาดขาว อำเภอโชคชัย จังหวัดนครราชสีมาได้รับเชิญให้เข้ารับการตรวจโดยประสาทแพทย์ที่หมู่บ้าน

ผล : ชาวบ้าน 2069 ราย ใน 533 ครัวเรือน (คิดเป็นร้อยละ 72.2 ของครัวเรือนทั้งหมด) ถูกสัมภาษณ์และตรวจโดยประสาทแพทย์ 43 รายมีประวัติเคยชักมาก่อน มีเพียง 15 รายที่เป็นโรคลมชักซึ่งได้ค่าความชุกประมาณ 7.2/1,000 ประชากร ความชุกสูงสุด อยู่ในช่วงอายุ 5–9 ปี (17/1,000 ประชากร) และ 25–34 ปี (17.4/1,000 ประชากร)

สรุป : ความชุกของโรคลมชักในชนบทค่อนข้างต่ำกว่าความเป็นจริง แต่ก็เป็นข้อมูลที่มีอยู่ในปัจจุบันนี้เท่านั้น

คำสำคัญ : โรคลมชัก, ระบาดวิทยา, การศึกษาบนพื้นฐานของชุมชน, ความชุก, ประเทศไทย

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Compliance with Treatment of Adult Epileptics in a Rural District of Thailand

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Abstract

Background : Epilepsy, a disease when seizures can occur from antiepileptic drug withdrawal, requires regular drug taking. Non-compliance, therefore, is a major factor contributing to suboptimal control of the seizures.

Purpose : To determine the factors associated with noncompliance in epileptics in rural Thailand.

Method : All epileptics, registered in the Pak Thong Chai District and their caregivers were invited to be interviewed and examined by a neurologist in their village.

Results : Of a total of 93 epileptics registered, 83 with their caregivers were interviewed and examined by the neurologist (T.A.) and of those 72 were adults. Of the 72 adult epileptics, 41 (56.9%) were 100 per cent compliant and factors found to be significantly associated with compliance were gender, household income and patient's health insurance (p-value < 0.05). The major reasons for non-compliance were misunderstanding (48.4%), forgetfulness (16.1%) and economic problem (12.9%).

Conclusion : To improve patient-compliance, the real factors for non-compliance, which are unique to patients in a specific area, need to be identified.

Key word : Epilepsy, Compliance, Adult, Reason for Non-Compliance, Thailand

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Epilepsy is one of the commonest problems encountered in neurological clinics in developing countries(1) and needs long-term treatment(2). Compliance, including attendance at appointments and adherence to antiepileptic drug regimens (AED) is very important in the management of epilepsy(3). The reason being that neglect of medical treatment may cause epileptic seizures(4), which, in turn, may result in increased direct medical costs(5), physical injury to self and others(5) and a decrease in the quality of life(6). The frequency of noncompliance with treatment in epileptics has been reported ranging from 19 per cent to 75 per cent(7-9).

The problem of compliance with treatment in chronic diseases is not selective but rather is pervasive and affects a broad range of illnesses(10). However, compliance in epilepsy has not been studied extensively(4).

The objectives of this study were to determine the frequency of non-compliance and the factors associated with non-compliance in epileptics in a rural district of Thailand.

MATERIAL AND METHOD

The study was conducted in Pak Thong Chai, one of the 26 districts of Nakhon Ratchasima Province, the principal province of Northeastern Thailand. The district is around 32 kilometers Southwest of the provincial capital and 286 kilometers from Bangkok. It covers 1,352 square kilometers with a population (in 1997) of 74,177 and is divided into 16 sub-districts with a total of 20 Sub-District Health Care Offices (SDHCO) and one Community Hospital.

In the district, like all districts in Nakhon Ratchasima Province, there is a Registry of Epileptics who have visited either the SDHCO or the Community Hospital; the Registry is updated yearly by sub-district health care officials. In 1997, 93 epileptics were registered in the district. All of the patients with their caregivers were informed of the study and invited, after informed consent, for an interview and examination by sub-district health care officials and a neurologist (T.A) from January-May 1998.

The data collected included: age; gender; socio-economic data; whether the patient had health care insurance which would entitle them to free health care including AEDs.

The data related to epilepsy included: age at first onset of epilepsy; duration of epilepsy and of treatment; frequency of seizures; the AED regimens; alcoholic intake and the need to be escorted for treatment.

The outcome variable measured was whether the level of compliance with AED regimens over the past year was 100 per cent (defined as taking the AED on time, without fail and without manipulating their dosage)(5), as determined during an in-depth interview of the patient and their caregiver. During the same interview, the major reason for non-compliance was determined.

The authors defined Epilepsy as two or more clinical afebrile seizures unrelated to acute metabolic derangements or to withdrawal from alcohol or drugs (11). Seizures, which occur within a 24-hour period, were excluded(11).

In the data analysis, the sample based upon the interview of the epileptic and of their caregivers, each group was further stratified into those considered compliance and non-compliance. The differences were, then, analyzed by univariate and multivariate analysis.

RESULTS

Of the 93 epileptics registered in Pak Thong Chai District, only 83 (89.2%) and their caregivers were interviewed and examined. The gender and age response rate is shown in Table 1. The non-respondents of ten epileptics, although it could not be verified, were presumably less affected by their epilepsy.

Of the 83 epileptics examined, only 11 were children (age 0-14 years); so, further analyses was restricted to the adults. Of the 72 adult epileptics, the average age was 36.3 years (SD = 14.0; median = 36; range: 16-75 years) and 59.7 per cent were female. The patient's characteristics and clinical characteristics are shown in Table 2.

The patient-compliance (100%) over the past one-year was 56.9 per cent. The differences between those considered to be compliant or non-compliant by each of the demographic, socio-economic and clinical variables are shown in Table 2.

By univariate analysis, none of the analyzed variables were significantly associated with compliance. However, by multivariate analysis, gender, household income and patient's health insurance had a significant association with compliance (shown in Table 2).

The major reasons for non-compliance were misunderstanding of the need for long-term treatment (48.4%); forgetfulness (16.1%) and economic problem (12.8%). The other reasons were continuity of seizures despite treatment (9.7%); misbeliefs (6.5%) and not having a caregiver to escort them to hospital (6.5%).

DISCUSSION

In this study, compliance with AED regimens over the past one year was measured by self-report of the patients or their caregivers. The data collection method and the cross-sectional design employed precluded the possibility of any pill counting procedures or blood level testing. Although, it was quite difficult for them to recall the degree of compliance with their physician's prescriptions, the authors used 100 per cent compliance rates; even though compliance of 80 per cent is sufficient for optimal treatment in patients with epilepsy(12). The frequency of the patients with 100 per cent compliance in the present study was only 56.9 per cent, which is similar to reports from other studies(6,13).

On multivariate analysis, gender, household income and patient's health insurance had a statistically significant relationship to compliance. The possible reasons for this finding is that, in Thailand any patient who holds any kind of health insurance card can get medical service including drugs free of charge at any level of government health care offices. In addition, most poor patients trust their physicians and strictly follow the physicians' suggestions. Economic status is still a major factor for patient compliance(10). Male gender is another variable because male patients usually work outside.

Other factors can affect compliance. However, the relationship of these factors to compliance has not been consistent. Age and number of AED taken had a statistically significant relationship with compliance in Buck's study(14) but were not in Gopinath's study(5). Seizure frequency and duration of epilepsy were related to compliance in three studies (Kyngas(4), Gopinath(5) and Loiseau(15)) but were not in Buck's study(14). However, gender and seizure type have consistently been shown to have no relationship with compliance(5,14,15). The patient's education in Gopinath's study(5) and of age at first onset of epilepsy in Loiseau's study(15) showed no significant relationship to compliance. Alcoholic intake in Kyngas 's study(4) and of higher income in Shope's study(16) revealed a significant association with compliance.

Not only the factors mentioned earlier but also several personal reasons may contribute to non-compliance including: patient's life style(14,17); patient's feeling of stigma(14); denial of their illness (18); individual's perception of causality(5); relationship between patient and health care staff(4,5,14); misconceptions regarding the goal of the treatment and the consequences of missing a prescribed drug dose(4); misunderstanding the doctor's instructions (18), fear of addiction(19) ; general dissatisfaction with treatment(5,19); trouble with remembering(18) and forgetfulness(18). Some studies have found that the following altered drug taking behavior: adverse side effects(4,18,19); patient's personal experience (14); family relationships(3); the support of parents(4).

Finally, no single measure represents a completely valid indicator of the risk of non-compliance. Mitchell et al stated in their paper that dealing with compliance in children that "It is multidimensional and includes related but somewhat distinct facets of socio-cultural, medical, behavioral, environmental

Table 1. Gender and age specific response rates.

Age group (year)	Males		Females		Both genders	
	n/N	%	n/N	%	n/N	%
0-4	1/1	100.0	0/0	-	1/1	100.0
5-9	2/2	100.0	2/2	100.0	4/4	100.0
10-14	3/3	100.0	3/3	100.0	6/6	100.0
15-24	9/11	81.8	7/7	100.0	16/18	88.9
25-34	7/10	70.0	10/11	90.9	17/21	80.9
35-44	6/10	60.0	18/18	100.0	24/28	85.7
45-54	5/5	100.0	2/2	100.0	7/7	100.0
55-64	1/1	100.0	4/4	100.0	5/5	100.0
65+	1/1	100.0	2/2	100.0	3/3	100.0
All age groups	35/44	79.5	48/49	97.9	83/93	89.2

n = Respondents, N = Registered epileptics

Table 2. Factors and their relationship with patient-compliance in adult epileptics.

Factors	C	NC	Total		P-value	P-value
	(41)	(31)	n	%	(Univariate)	(Multivariate)
Gender						
Male	16	13	29	40.3	0.99	< 0.05
Female	25	18	43	59.7		
Patient's education						
≤ 6 yrs	36	28	64	88.9	1.00	0.68
> 6 yrs	5	3	8	11.1		
Caregiver's education						
≤ 6 yrs	39	31	70	97.2	0.50	0.89
> 6 yrs	2	0	2	2.8		
Patient's employment						
Unemployed	19	13	32	44.4	0.89	0.91
Employed	22	18	40	55.6		
Household income (monthly) in Baht						
$\leq 2,800$	28	15	43	59.7	0.14	< 0.05
$> 2,800$	13	16	29	40.3		
Alcohol intake						
Regular or occasional	8	10	18	25.0	0.34	0.49
Not at all or quit	33	21	54	75.0		
Need to be escorted						
Yes	16	14	30	41.7	0.78	0.23
No	25	17	42	58.3		
AED regimens						
Monotherapy	28	24	52	72.2	0.55	0.45
Multiple AED regimens	13	7	20	27.8		
Patient's health insurance						
Yes (one or more cards)	36	21	57	79.2	0.07	< 0.05
No	5	10	15	20.8		
Age at first onset of epilepsy						
< 20 yrs	25	18	43	59.7	0.99	0.66
≥ 20 yrs	16	13	29	40.3		
Durtion of epilepsy						
≤ 6 yrs	5	2	7	9.7	0.69	0.77
> 6 yrs	36	29	65	90.3		
Duration of treatment						
≤ 6 yrs	5	7	12	16.7	0.39	0.79
> 6 yrs	36	24	60	83.3		
Seizure frequency						
$<$ once a week	36	24	60	83.3	0.39	0.06
$\geq$ once a week	5	7	12	16.7		

C = Compliance, NC = Non-compliance

(i.e. family), and individual characteristics"(10). In the present study, the reasons for non-compliance with AED regimens; misunderstanding, forgetfulness and economic problem were compatible with the results reported by other studies(15,16,18). This suggests how patient-compliance can be improved.

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การรับประทานยาตามแพทย์สั่งของผู้ป่วยโรคลมชักในชุมชน

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โรคลมชักเป็นโรคชนิดหนึ่งที่อาการชักจะเกิดขึ้นได้จากการลืมรับประทานยาป้องกันชัก การรับประทานยาตามแพทย์สั่งจึงมีความจำเป็น

วัตถุประสงค์ : เพื่อหาปัจจัยที่มีส่วนเกี่ยวข้องกับการไม่รับประทานยาตามแพทย์สั่งของผู้ป่วยโรคลมชักในชุมชน

ผู้ป่วยและวิธีการ : โดยการเชิญญาติและผู้ป่วยโรคลมชักที่ได้ขึ้นทะเบียนที่อำเภอปักธงชัย จังหวัดนครราชสีมาเพื่อที่จะสัมภาษณ์และตรวจโดยประสาทแพทย์ที่หมู่บ้านของผู้ป่วย

ผล : ผู้ป่วย 83 รายจากทั้งหมด 93 รายที่ได้ขึ้นทะเบียนที่อำเภอปักธงชัยและญาติได้รับการสัมภาษณ์และตรวจโดยประสาทแพทย์ ในจำนวน 83 รายนี้ 72 รายเป็นผู้ป่วยที่มีอายุตั้งแต่ 15 ปีขึ้นไป และมีเพียง 41 ราย (ร้อยละ 56.9) ที่รับประทานยาตามแพทย์สั่ง ปัจจัยที่มีส่วนเกี่ยวข้องกับการรับประทานยาของผู้ป่วยได้แก่ เพศ รายได้ของครอบครัว และการมีบัตรสุขภาพ ส่วนเหตุผลหลักที่ผู้ป่วยไม่รับประทานยาได้แก่ การขาดความรู้ความเข้าใจในเรื่องการรักษา (48.4%) การลืมรับประทานยา (16.1%) และปัญหาทางการเงิน (12.9%)

สรุป : การที่จะทำให้ผู้ป่วยรับประทานยาตามแพทย์สั่งเพื่อผลการรักษา จำเป็นที่จะต้องทราบถึงเหตุผลที่แท้จริงของผู้ป่วยซึ่งจะแตกต่างกันไปตามพื้นที่

คำสำคัญ : โรคลมชัก, การรับประทานยาตามแพทย์สั่ง,ผู้ป่วยที่อายุตั้งแต่ 15 ปีขึ้นไป, เหตุผลของการไม่รับประทานยา, ประเทศไทย

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Association of psychosocial risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648 controls from 52 countries (the INTERHEART study): case-control study

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See **Comment** page 912

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Summary

Background Psychosocial factors have been reported to be independently associated with coronary heart disease. However, previous studies have been in mainly North American or European populations. The aim of the present analysis was to investigate the relation of psychosocial factors to risk of myocardial infarction in 24 767 people from 52 countries.

Methods We used a case-control design with 11 119 patients with a first myocardial infarction and 13 648 age-matched (up to 5 years older or younger) and sex-matched controls from 262 centres in Asia, Europe, the Middle East, Africa, Australia, and North and South America. Data for demographic factors, education, income, and cardiovascular risk factors were obtained by standardised approaches. Psychosocial stress was assessed by four simple questions about stress at work and at home, financial stress, and major life events in the past year. Additional questions assessed locus of control and presence of depression.

Findings People with myocardial infarction (cases) reported higher prevalence of all four stress factors (p<0·0001). Of those cases still working, 23·0% (n=1249) experienced several periods of work stress compared with 17·9% (1324) of controls, and 10·0% (540) experienced permanent work stress during the previous year versus 5·0% (372) of controls. Odds ratios were 1·38 (99% CI 1·19–1·61) for several periods of work stress and 2·14 (1·73–2·64) for permanent stress at work, adjusted for age, sex, geographic region, and smoking. 11·6% (1288) of cases had several periods of stress at home compared with 8·6% (1179) of controls (odds ratio 1·52 [99% CI 1·34–1·72]), and 3·5% (384) of cases reported permanent stress at home versus 1·9% (253) of controls (2·12 [1·68–2·65]). General stress (work, home, or both) was associated with an odds ratio of 1·45 (99% CI 1·30–1·61) for several periods and 2·17 (1·84–2·55) for permanent stress. Severe financial stress was more typical in cases than controls (14·6% [1622] *vs* 12·2% [1659]; odds ratio 1·33 [99% CI 1·19–1·48]). Stressful life events in the past year were also more frequent in cases than controls (16·1% [1790] *vs* 13·0% [1771]; 1·48 [1·33–1·64]), as was depression (24·0% [2673] *vs* 17·6% [2404]; odds ratio 1·55 [1·42–1·69]). These differences were consistent across regions, in different ethnic groups, and in men and women.

Interpretation Presence of psychosocial stressors is associated with increased risk of acute myocardial infarction, suggesting that approaches aimed at modifying these factors should be developed.

Introduction

Popular opinion holds that stress is an important risk factor for coronary heart disease. However, compared with other major risk factors, psychosocial variables such as stress are difficult to define objectively, and stress consists of several different (and inter-related) elements. Therefore, measurement of stress is complex and difficult. Despite this drawback, several constructs within the broad conceptual framework of stress are increasingly regarded as being causally related to coronary heart disease.[1–15]

The concept of stress encompasses several factors, from external stressors such as job stress,[5,8,10,13] adverse life events[7] and financial problems, to potential reactions to stress such as depression,[1–3] vital exhaustion,[15] anxiety,[12,14] psychological distress,[11] and sleeping difficulties. The same construct might not be applicable in different countries and ethnic groups, because cultural influences can vary. Perceived mental stress, measured by response to a single-item question, was associated with increased mortality from coronary disease in a large study of Japanese men and women.[9] Apart from this study,[9] previous investigations have been done in mainly North American or European populations. Thus, limited data are available about psychological variables and coronary heart disease in other countries and ethnic groups. The aim of the INTERHEART study, undertaken in a large number of patients with a first acute myocardial infarction and controls matched for age and sex, was to investigate the associations of several psychosocial stressors with the risk of acute myocardial infarction globally, and in different populations characterised by age, sex, geographic region, and ethnic origin.

Patients and methods

Study population

12 461 incident cases of acute myocardial infarction from 262 centres in 52 countries representing all geographic regions, and 14 637 age-matched, sex-matched, and site-matched controls free of clinical heart disease, took part in the study.[16,17] Centres attempted to recruit consecutive patients. Recruitment was from February, 1999, until March, 2003. Patients admitted to the coronary care unit or equivalent cardiology ward of participating centres were screened to identify incident cases of acute myocardial infarction and enrolled within 24 h. Details of criteria used for the definition of acute myocardial infarction are described in the accompanying paper.[16] At least one control was recruited and matched to every case of acute myocardial infarction by age (up to 5 years older or younger) and sex. Eligible control sources were community-based (visitor or relative of a patient from a non-cardiac ward, or an unrelated visitor of a cardiac patient) or hospital-based.[16]

See **Articles** page 937

INTERHEART was approved by appropriate regulatory and ethics committees in all participating countries and centres. All participants provided informed consent before taking part in the study.

Procedures

We obtained data for demographic factors (country of origin, first language), socioeconomic status (education, occupation, income), lifestyle (tobacco use, physical activity, dietary patterns), personal and family patterns of cardiovascular disease, and risk factors.[16] Staff were trained in study procedures with standard manuals, videotapes, and instructions at meetings or at site visits. Trained staff administered the questionnaire before patients left the hospital. A standard yet simple set of questions that inquired about psychosocial conditions during the previous 12 months was included in the interview. Complete data on psychosocial variables were available for 11 119 cases and 13 648 controls.

We assessed psychological stress with two single-item questions relating to stress at work and home. Stress was defined as feeling irritable, filled with anxiety, or as having sleeping difficulties as a result of conditions at work or at home. Patients were specifically asked to respond about their condition before their acute myocardial infarction. For every question, we asked participants to report how often they had felt stress, using the following response options: 1) never; 2) some periods; 3) several periods; or 4) permanent stress. These two questions are an adaptation of a single question that has been used in multiple studies in Göteborg, Sweden since 1970. For example, in a prospective study of Swedish men,[14] permanent stress, according to this question, was associated with an increased risk of acute myocardial infarction, stroke, and death. Because stress at work and at home were highly intercorrelated, and because only 48·8% (5426) of cases and 54·1% (7387) of controls were currently working, we created a general stress scale that combined stress at work, home, or both and was graded as follows: 1) never experienced stress; 2) experienced some periods at home or at work; 3) experienced several periods at home or at work; 4) experienced permanent stress at home or at work.

See **Articles** page 937

We defined level of financial stress as: 1) little or none; 2) moderate; or 3) high or severe. Occurrence of major adverse life events was documented by asking participants whether they had experienced any specified life events in the past year—marital separation or divorce, loss of job or retirement, loss of crop or business failure, violence, major intrafamily conflict, major personal injury or illness, death or major illness of a close family member, death of a spouse, or other major stress.

Generalised locus of control—that is, the perceived ability to control life circumstances—was determined by responses to a questionnaire containing six scale items that have been used extensively in studies in eastern Europe.[18] Responses from controls were used to provide a summary score that was divided into quartiles, of which the first quartile represented the lowest and the fourth quartile the highest score.

We assessed depression by asking whether, during the past 12 months, the participant had felt sad, blue, or depressed for 2 weeks or more in a row, and if yes, graded by a set of seven no-yes questions—lose interest in things, feel tired or low on energy, gain or lose weight, trouble falling asleep, trouble concentrating, think of death, feeling worthless—of which five or more positive responses were defined as clinical depression. This questionnaire is an adaptation of the short form DSM-IV CIDI questionnaire for depression.[19]

Standard physical measurements were done in duplicate, by the same examiner, on every participant: height, weight, and waist and hip circumference. Waist and hip circumferences were measured with a non-stretchable standard tape measure. We recorded relevant items, including history of tobacco use, diabetes, family history, physical activity, and patterns of alcohol and food consumption. In 292 controls, we readministered the questionnaire after a median interval of 409 days. The weighted κ statistic was 0·53 for global stress, 0·66 for financial stress, 0·43 for life events, 0·60 for locus of control, and 0·44 for depression.

Statistical analysis

Details of statistical analysis are provided in the accompanying paper.[16] Briefly, we accounted for the potential differences in age structure of the populations (subdivided by region or ethnic origin) by direct standardisation of the frequencies to the overall INTERHEART age distribution, using a five-level age stratification factor (<45, 45–55, 56–65, 66–70, >70).[20] We calculated means and medians to summarise continuous effects and compared them with *t* tests, or

Region	Number	Case (%)	Control (%)	Odds ratio (99% CI)
Overall	24 767	27·3	20·1	1·55 (1·42–1·68)
Western Europe	1375	39·7	29·5	1·70 (1·23–2·34)
Central and eastern Europe	3473	26·6	23·7	1·11 (0·89–1·37)
Middle East	2892	30·2	23·0	1·27 (1·01–1·58)
Africa	1259	29·5	21·7	1·51 (1·07–2·12)
South Asia	3300	25·9	17·4	1·59 (1·28–1·98)
China and Hong Kong	5894	15·6	7·7	2·10 (1·66–2·67)
Southeast Asia	1921	29·8	24·2	1·27 (0·96–1·67)
Australia and New Zealand	1255	42·9	31·3	1·82 (1·32–2·51)
South America and Mexico	2783	40·2	24·6	2·01 (1·6–2·52)
North America	615	43·8	35·3	1·65 (1·05–2·59)

Ethnic group				
Overall	24767	27·3	20·1	1·55 (1·42–1·68)
European	6737	34·1	27·3	1·37 (1·18–1·59)
Chinese	6034	15·7	7·9	2·08 (1·64–2·62)
South Asian	3825	25·3	17·5	1·51 (1·23–1·85)
Other Asian	1770	30·6	25·5	1·25 (0·94–1·66)
Arab	2538	31·5	23·4	1·31 (1·03–1·66)
Latin American	2652	39·7	24·7	2·03 (1·60–2·56)
Black African	471	33·8	23·9	1·64 (0·91–2·95)
Coloured African	601	29·5	16·6	2·09 (1·25–3·50)

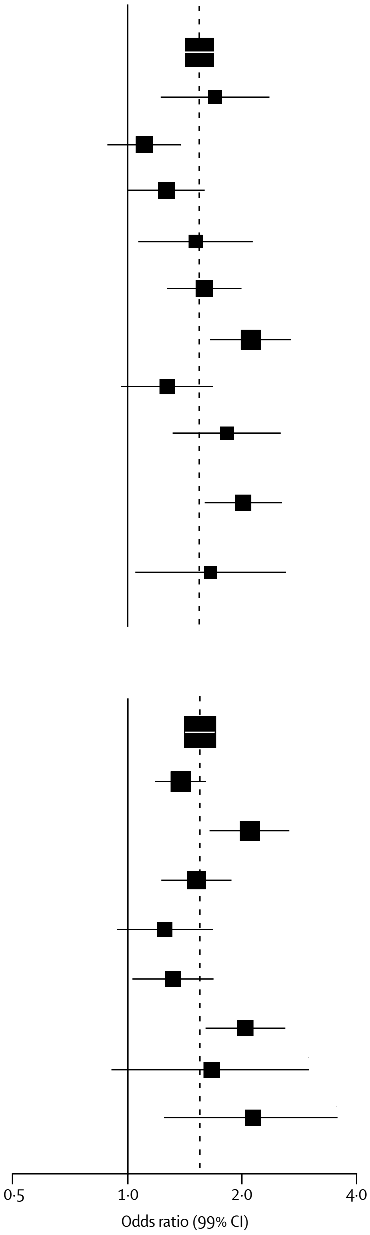

Figure 1: **Moderate or severe general stress in cases and controls by geographic region and ethnic origin**
Percentages and controls are age adjusted. Odds ratios are adjusted for geographic region, age, sex, and smoking.

appropriate non-parametric tests when distributional assumptions were in doubt. When testing for associations between stress subgroups, linear regression was used for continuous variables and the Cochran-Armitage trend test for frequencies. The findings presented are for models fitted with unconditional logistic regression, adjusted for age, sex, geographic region, and potential confounders.

Relative risk estimates are reported as odds ratios and accompanying 99% CIs. We produced statistical analyses and graphics with SAS version 8.2 (SAS, Cary, NC, USA) and S-Plus version 6 (Insightful, Seattle, WA, USA). All statistical tests of hypotheses are two-sided. Population attributable risks (PARs)—ie, the proportion of all cases attributable to the relevant factor if causality were proven—and 99% CIs were calculated for various risk factors in the study, using the methods of Benichou and Gail.[21] The PARs presented are adjusted for confounders in a similar fashion to the corresponding logistic regression models for odds ratio estimates. PAR estimates

Region	Number	Case (%)	Control (%)	Odds ratio (99% CI)
Overall	24767	24·1	17·6	1·55 (1·42–1·69)
Western Europe	1375	28·4	22·9	1·20 (0·87–1·66)
Central and eastern Europe	3473	17·3	15·7	1·04 (0·82–1·33)
Middle East	2892	24·5	15·2	1·95 (1·51–2·52)
Africa	1259	30·3	19·7	1·69 (1·20– 2·39)
South Asia	3300	30·0	19·0	1·62 (1·3–2·02)
China and Hong Kong	5894	20·4	9·7	2·38 (1·94–2·92)
Asia	1921	19·4	12·3	1·70 (1·21–2·39)
Australia and New Zealand	1255	25·6	22·1	1·18 (0·82–1·69)
South America and Mexico	2783	34·9	30·2	1·20 (0·96–1·50)
North America	615	23·7	19·3	1·37 (0·80–2·35)

Ethnic group				
Overall	24767	24·1	17·6	1·55 (1·42–1·69)
European	6737	22·1	18·6	1·16 (0·98–1·36)
Chinese	6034	20·2	9·6	2·38 (1·95– 2·92)
South Asian	3825	29·5	18·4	1·64 (1·34–2·02)
Other Asian	1770	20·1	13·5	1·59 (1·13–2·25)
Arab	2538	25·5	15·7	2·03 (1·55–2·65)
Latin American	2652	34·5	29·8	1·21 (0·96–1·52)
Black African	471	35·2	21·9	1·63 (0·91–2·93)
Coloured African	601	26·9	17·8	1·72 (1·03–2·88)

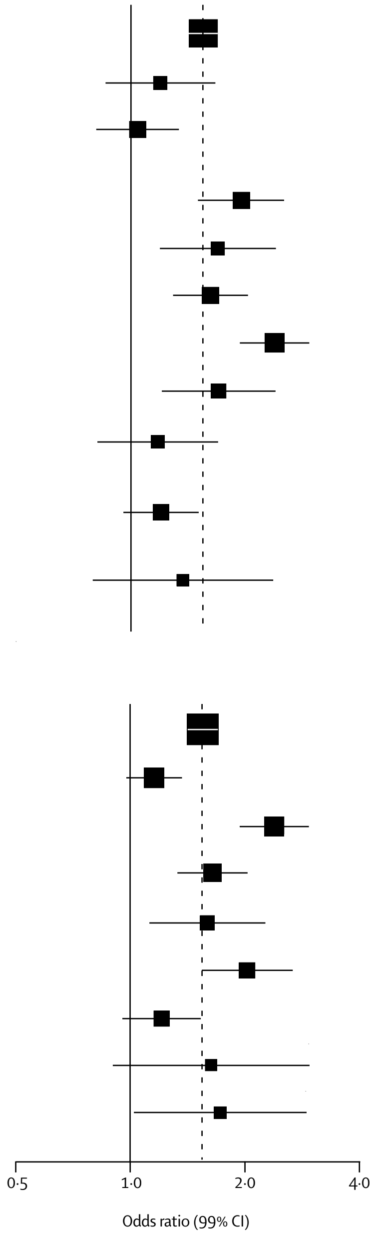

Figure 2: **Depression in cases and controls by geographic region and ethnic origin**
Percentages of cases and controls are age adjusted. Odds ratios are adjusted for geographic region, age, sex, and smoking.

were calculated with the Interactive Risk Attributable Program software (US National Cancer Institute, 2002).[22]

Role of the funding source

The sponsor of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all data and had final responsibility for the decision to submit for publication.

Results

The mean age of cases was 58·2 years (SD 12·2) and of controls 57·1 years (12·1); 24·2% (2686) of cases and 26·5% (3619) of controls were women. Figure 1 outlines the distribution of cases and controls by region and ethnic origin and provides the odds ratios associated with high general stress. We defined high general stress as several periods of or permanent stress, at work, home, or both. Figure 2 shows corresponding data for depressive mood, which we defined as feeling sad, blue, or depressed for 2 weeks or more in a row during the past 12 months.

Table 1 presents analyses among controls by general stress score. Individuals with high general stress were younger, heavier, and more usually smokers, had a slightly lower waist/hip ratio, and were less likely to have low income and low education. Strong associations were noted between perceived general stress and financial stress, having had two or more life events, depression, and low control. Inter-relations between the different psychosocial variables were very similar among cases and controls.

Half the study population (5426 cases [48·8%] and 7387 controls [54·1%]) were working outside the home. Higher ratings for work stress were more usual in cases than controls (table 2). For example, during the previous year, just over a third more cases experienced several periods of work stress compared with controls (odds ratio 1·38 [99% CI 1·19–1·61]), and permanent work stress was experienced by twice as many cases than controls (2·14 [1·73–2·64]), after adjustment for age, sex, geographic region, and smoking. The PAR among those working was 9% (99% CI 1–18). Further adjustment for education and income, hypertension, diabetes, level of physical activity, waist/hip ratio, dietary patterns, alcohol, or raised plasma lipids did not alter these results to a significant degree. Therefore, we report results from the most parsimonious model.

Compared with controls, cases also reported more frequent periods of stress at home during the previous 12 months (table 2). For example, more cases than controls experienced several periods of stress (odds ratio 1·52 [1·34–1·72]), whereas twice as many cases reported permanent stress at home compared with controls (2·12 [1·68–2·65]). The PAR for stress at home was 8% (4–12). Reports of severe financial stress were also more typical in cases than controls (adjusted odds ratio 1·33 [1·19–1·48]; table 2). The PAR for financial stress was 11% (7–14). Two or more stressful life events were reported by about a half more cases compared with controls (odds ratio 1·48 [1·33–1·64]; PAR 10% [8–13]; table 2). Of these events, business failure (1·60 [1·42–1·80]) and major intra-family conflict (1·55 [1·41–1·70]) had the highest risks, whereas job loss (1·36 [1·22–1·52]), death of spouse (1·37 [1·11–1·69]) and violence (1·31 [1·13–1·53]), although still significant, were associated with lower risk. Divorce, injury, and death of other family members were similar among cases and controls.

High locus of control was a significant protective factor. After adjustment for age, sex, geographic region and smoking, the odds ratio was 0·72 (99% CI 0·65–0·79) for the second highest quartile of the population relative to those in the lowest quartile for locus of control, and 0·68 (0·61–0·76) for the highest relative to the lowest quartile (table 2). However, after full adjustment for all risk factors, the apparent effect was substantially attenuated, with an estimated odds ratio of 0·75 (0·65–0·86) in the fourth quartile relative to the first. The PAR for low locus of control was 16% (10–22).

More cases than controls reported feeling sad, blue, or depressed for more than 2 weeks or more in a row (odds ratio 1·55 [1·42–1·69]; table 2), and this difference did not change substantially after adjustment for other factors. No relation was reported between number of items with positive responses for the depression question and risk of acute myocardial infarction. The PAR associated with sadness and depression was 9% (7–10).

The general stress measure—combining work and home stress—was associated with an odds ratio of 1·45 (1·30–1·61) for several periods and 2·17 (1·84–2·55) for permanent stress (table 2). Adding financial stress, locus of control, life events, and reports of feeling sad, either as single elements or in combination with this scale, did not improve its discriminatory power. For general stress, the PAR was 12% (7–17); however, combining any exposure to general stress, financial stress, stressful life events, depression, and low locus of control, a PAR of 29% (22–35) was estimated after adjustment for age, sex, geographic region, and smoking. Further adjustment for all risk factors as above changed the PAR estimate to 33% (25–41).

	Never (n=3688)	Some (n=7193)	Several (n=2183)	Permanent (n=584)	p*
Risk factor					
Age (years)	60·7 (12·01)	56·7 (12·0)	53·6 (11·4)	52·5 (10·6)	<0·0001
Body-mass index (kg/m^2)	25·7 (4·0)	25·8 (4·1)	26·0 (4·3)	26·6 (4·5)	<0·0001
Waist/hip ratio	0·918 (0·082)	0·906 (0·084)	0·906 (0·082)	0·912 (0·085)	<0·0001
Systolic blood pressure (mm Hg)	131 (18)	129 (17)	128 (17)	128 (18)	<0·0001
Serum cholesterol (mmol/L)	5·03 (1·31)	5·04 (1·22)	5·22 (1·22)	5·32 (1·17)	<0·0001
Serum triglyceride (mmol/L)	1·90 (1·29)	1·96 (1·35)	2·05 (1·65)	2·03 (1·32)	0·0003
Serum HDL (mmol/L)	1·08 (0·38)	1·07 (0·38)	1·08 (0·41)	1·11 (0·40)	0·67
ApoB/ApoA1 ratio	0·790 (0·374)	0·791 (0·326)	0·806 (0·327)	0·800 (0·243)	0·16
Smoking	25·6% (943)	27·2% (1952)	30·2% (658)	34·0% (197)	<0·0001
Sedentary leisure time physical activity	52·3% (1927)	55·1% (3963)	51·8% (1131)	49·9% (291)	0·48
Diabetes	7·9% (291)	7·0% (503)	7·2% (157)	7·2% (42)	0·28
Hypertension	24·0% (885)	21·7% (1559)	20·1% (438)	23·1% (135)	0·006
Income					
Lowest two-fifths	52·3% (1901)	49·2% (3494)	46·7% (1001)	44·1% (254)	<0·0001
Education					
Fewer than 8 years	44·5% (1639)	37·5% (2693)	30·5% (666)	26·7% (156)	
College or university	29·6% (1093)	36·2% (2605)	48·2% (1052)	49·5% (289)	<0·0001
Other psychosocial variables					
High or severe financial stress	4·8% (177)	11·6% (832)	21·7% (473)	30·3% (177)	<0·0001
Two or more events	7·2% (266)	10·7% (771)	25·0% (546)	32·2% (188)	<0·0001
Depression	10·1% (374)	15·7% (1132)	29·4% (642)	43·8% (256)	<0·0001
Low locus of control	16·0% (590)	18·7% (1343)	22·7% (496)	32·5% (190)	<0·0001

Data are mean (SD) or percentage of controls (n). Missing data for smoking in 46 controls, diabetes in nine, hypertension in eight, physical activity in eight, income in 192, and education in five. Spearman correlation coefficients (cases/controls) between global stress and financial stress 30·0/25·7, two or more life events 26·2/22·2, depression 22·7/19·5, locus of control –12·1/–5·6. *Test for trend.

Table 1: **Cardiovascular risk factors, income, education, and other psychosocial variables in controls (both working and non-working) by general stress score**

	Number of cases (%)	Number of controls (%)	Odds ratio (99% CI)	PAR (99% CI)
Stress at work (n=12 813)				
Never	1138 (21·0%)	1768 (23·9%)	1	
Some of the time	2499 (46·1%)	3923 (53·1%)	0·95 (0·84–1·08)	
Several periods	1249 (23·0%)	1324 (17·9%)	1·38 (1·19–1·61)	
Permanent	540 (10·0%)	372 (5·0%)	2·14 (1·73–2·64)	9% (1–18)
Stress at home (n=24 767)				
Never	4086 (36·8%)	5343 (39·2%)	1	
Some of the time	5361 (48·2%)	6873 (50·4%)	1·05 (0·97–1·13)	
Several periods	1288 (11·6%)	1179 (8·6%)	1·52 (1·34–1·72)	
Permanent	384 (3·5%)	253 (1·9%)	2·12 (1·68–2·65)	8% (4–12)
General stress* (n=24 767)				
Never	2777 (25·0%)	3688 (27·0%)	1	
Some period, home or work	5352 (48·1%)	7193 (52·7%)	1·05 (0·96–1·14)	
Several periods, home or work	2139 (19·2%)	2183 (16·0%)	1·45 (1·30–1·61)	
Permanent, home or work	851 (7·7%)	584 (4·3%)	2·17 (1·84–2·55)	12% (7–17)
Financial stress (n=24 767)				
Little or none	4872 (43·8%)	6628 (48·6%)	1	
Moderate	4625 (41·6%)	5361 (39·3%)	1·19 (1·11–1·29)	
Severe	1622 (14·6%)	1659 (12·2%)	1·33 (1·19–1·48)	11% (7–14)
Stressful life events (n=24 767)				
None	6425 (57·8%)	8528 (62·5%)	1	
1	2904 (26·1%)	3349 (24·5%)	1·23 (1·13–1·34)	
2 or more	1790 (16·1%)	1771 (13·0%)	1·48 (1·33–1·64)	10% (8–13)
Locus of control (n=24 767)				
Q1	2620 (23·6%)	2619 (19·2%)	1	
Q2	2938 (26·4%)	3265 (23·9%)	0·89 (0·80–0·98)	
Q3	3614 (32·5%)	4839 (35·5%)	0·72 (0·65–0·79)	
Q4	1947 (17·5%)	2925 (21·4%)	0·68 (0·61–0·76)	16% (10–22)
Feeling depressed† (n=24 767)				
No	8446 (76·0%)	11244 (82·4%)	1	
Yes	2673 (24·0%)	2404 (17·6%)	1·55 (1·42–1·69)	9% (7–10)
Depression (n=24 767)				
Not depressed	8446 (76·0%)	11244 (82·4%)	1	
0–1 items	346 (3·1%)	298 (2·2%)	1·50 (1·21–1·86)	
2–4 items	1369 (12·3%)	1145 (8·4%)	1·65 (1·47–1·85)	
5 or more items	958 (8·6%)	961 (7·0%)	1·44 (1·27–1·65)	

All associations are significant at p<0·0001. Q=quartile, where Q1 is lowest locus. *Includes both working and non-working participants. †Felt sad, blue, or depressed for more than 2 consecutive weeks in past year.

Table 2: Psychosocial risk factors in cases and controls

Separate analyses in men and women showed that, by contrast to men, work stress did not seem to be associated with acute myocardial infarction in women (p=0·006, for interaction; table 3). However, this apparent interaction should be interpreted cautiously because several subgroup analyses were done. For all other factors, effects among women were similar to those seen among men, with no significant heterogeneity. A separate analysis in the 435 patients who died while still in hospital showed the same relation with stress as the total population of patients with acute myocardial infarction (not shown).

Table 4 presents results of the effect of general stress in various subgroups stratified by age, smoking, income, and education. The association with acute myocardial infarction did not differ greatly by any of these factors. Permanent stress was less prevalent in older versus younger participants, but no significant interaction was recorded between age and stress (p=0·13). The effect of general stress was similar across different strata defined by age, income, or education and among smokers and non-smokers. Table 5 describes the combined effects of general stress and depression, and of general stress and locus of control.

The prevalence of moderate or severe general stress ranged from 7·7% among controls in China to 35·3% in North America (figure 1). Despite this difference, stress was more common among cases than controls in all geographic regions, with odds ratios varying between 1·3 and 2·1, with the exception of central and eastern Europe, where the difference in rates of stress between cases and controls seemed to be only minor. Almost all ethnic groups were characterised by more general stress in cases than controls (figure 1). Although the prevalence of sadness and depression also varied between regions and various ethnic groups (figure 2), it was related to acute myocardial infarction in various subgroups examined.

Discussion

Our study shows that several elements reflecting psychosocial stress are associated with increased risk of acute myocardial infarction. These factors include those that are subjective and perceived by the patients, such as stress, defined as tension or anxiety due to external influences. Some of these measures—eg, locus of control or depression—are not generally perceived by lay people to be stressors. Further, discrete external events (eg, major life events), which are less subjective and less likely to be subject to any biases, were also more frequent in cases than controls. The effect of stress is independent of socioeconomic status and smoking, and is by and large consistent across geographic regions, in different age groups, and in men and women. The excess risk of acute myocardial infarction associated with high levels of stress was still significant after adjusting for other cardiovascular risk factors.

During the past two decades, considerable evidence has accumulated with respect to the association of markers of stress and other psychosocial factors with coronary disease.[4,23] However, compared with many other biological and lifestyle risk factors, stress is a more difficult construct in that no consensus exists with respect to either definition or measurement. Further, stress is inevitably a subjective measurement, and hence is potentially open to biases and confounding. Nevertheless, the strong relation between self-reported stress and other more objective markers, such as life events or depression, and constructs such as locus of control (which is not associated by lay people as being related to stress) suggests face validity for the measures used in the study.

To date, most studies have dealt with stress at work, with stress outside the workplace receiving less attention. Both cross-sectional and prospective studies have shown a positive association between level of work stress and disease.[8,10,13] Number of work stressors has been associated with increased cardiovascular mortality

	Men			Women			
	Cases (%)	Controls (%)	Odds ratio (99% CI)	Cases (%)	Controls (%)	Odds ratio (99% CI)	p*
Stress at work							
Never	993 (20·3)	1504 (24·1)	1	145 (26·7)	264 (23·3)	1	
Some of the time	2265 (46·4)	3315 (53·0)	1·00 (0·88–1·15)	234 (43·0)	608 (53·6)	0·68 (0·48–0·96)	
Several periods	1125 (23·0)	1117 (17·9)	1·45 (1·23–1·70)	124 (22·8)	207 (18·2)	1·02 (0·68–1· 54)	
Permanent	499 (10·2)	316 (5·1)	2·34 (1·86–2·93)	41 (7·5)	56 (4·9)	1·11 (0·60–2·06)	0·006
Stress at home							
Never	3314 (39·3)	4171 (41·6)	1	772 (28·7)	1172 (32·4)	1	
Some of the time	4008 (47·5)	5005 (49·9)	1·01 (0·93–1·10)	1353 (50·4)	1868 (51·6)	1·16 (0·99–1·35)	
Several periods	862 (10·2)	718 (7·2)	1·53 (1·32–1·78)	426 (15·9)	461 (12·7)	1·53 (1·23–1·90)	
Permanent	249 (3·0)	135 (1·4)	2·36 (1·75–3·17)	135 (5·0)	118 (3·3)	1·88 (1·31–2·69)	0·12
General stress†							
Never	2074 (24·6)	2682 (26·7)	1	703 (26·2)	1006 (27·8)	1	
Some period, home or work	4024 (47·7)	5322 (53·1)	1·02 (0·93–1·13)	1328 (49·4)	1871 (51·7)	1·10 (0·94–1·30)	
Several periods, home or work	1654 (19·6)	1601 (16·0)	1·46 (1·29–1·66)	485 (18·1)	582 (16·1)	1·40 (1·13–1·73)	
Permanent, home or work	681 (8·1)	424 (4·2)	2·32 (1·93–2·80)	170 (6·3)	160 (4·4)	1·74 (1·25–2·40)	0·091
Financial stress							
Little or none	3707 (44·0)	4921 (49·1)	1	1165 (43·4)	1707 (47·2)	1	
Moderate	3495 (41·4)	3918 (39·1)	1·19 (1·09–1·29)	1130 (42·1)	1443 (39·9)	1·22 (1·05–1·41)	
Severe	1231 (14·6)	1190 (11·9)	1·33 (1·17–1·50)	391 (14·6)	469 (13·0)	1·33 (1·08–1·64)	0·74
Stressful life events							
None	4857 (57·6)	6242 (62·2)	1	1568 (58·4)	2286 (63·2)	1	
1	2186 (25·9)	2483 (24·8)	1·21 (1·10–1·33)	718 (26·7)	866 (23·9)	1·30 (1·11–1·52)	
2 or more	1390 (16·5)	1304 (13·0)	1·51 (1·34–1·70)	400 (14·9)	467 (12·9)	1·37 (1·12–1·68)	0·17
Locus of control							
Q1	1843 (21·9)	1780 (17·8)	1	777 (28·9)	839 (23·2)	1	
Q2	2130 (25·3)	2304 (23·0)	0·89 (0·79–1·00)	808 (30·1)	961 (26·6)	0·89 (0·74–1·07)	
Q3	2835 (33·6)	3668 (36·6)	0·73 (0·65–0·81)	779 (29·0)	1171 (32·4)	0·71 (0·60–0·85)	
Q4	1625 (19·3)	2277 (22·7)	0·72 (0·63–0·82)	322 (12·0)	648 (17·9)	0·55 (0·44–0·69)	0·019
Feeling depressed in past 2 weeks							
No	6532 (77·5)	8387 (83·6)	1	1914 (71·3)	2857 (78·9)	1	
Yes	1901 (22·5)	1642 (16·4)	1·53 (1·38–1·69)	772 (28·7)	762 (21·1)	1·60 (1·37–1·88)	0·17

*Interaction with sex. †Includes both working and non-working participants.

Table 3: **Psychosocial risk factors in cases and controls by sex**

in the Multiple Risk Factor Intervention Trial.[8] During a 9-year follow-up period of 12 336 men, those with three or more work stressors had an increased risk of cardiovascular death (relative risk 1·26 [95% CI 1·07–1·48]), and the experience of divorce also increased risk (1·37 [1·09–1·72]) relative to those who remained married or single). In one prospective study of women with coronary heart disease,[24] level of marital stress, according to the Stockholm Marital Stress Scale, was associated with a higher risk of recurrent events. By contrast, data from a large North American study of nurses[25] showed no association between a measure of work strain and subsequent coronary heart disease. However, this study had low power (only 146 events) and in view of the homogeneity of the population studied (all nurses) there might have been little variation in the distribution of stress levels.

Other general measures of stress have also been used. In a prospective survey of middle-aged Swedish men,[14] self-reported permanent stress over a defined period in the recent past (as measured by a single-item question similar to that used in INTERHEART) was associated with an increased risk of incident coronary heart disease (odds ratio 1·5 [95% CI 1·2–1·9], after adjustment for conventional coronary risk factors) during the 12-year follow-up. Similar results were noted in a large prospective study involving 281 cases in 73 424 Japanese men and women,[9] which reported an association between perceived mental stress and coronary heart disease mortality. The consistency of results that has been reported across multiple studies using different study designs and approaches provide a body of evidence that supports an association between various types of stress and coronary disease. In view of the large number of cases in the study, INTERHEART provides robust results, even in subgroups. Furthermore, the effect of stress on acute myocardial infarction in the present study was by and large consistent across different geographic regions, in different ethnic groups, in men and women, and at all ages.

Depression has been associated with an increased risk of coronary heart disease in both men and women.[1–3] In the present study, we showed that feeling sad, blue, or depressed for 2 weeks or more in a row was associated with acute myocardial infarction across different populations and across groups of people with different ethnic origins. A meta-analysis of 11 studies concluded that depression predicts the development of coronary heart disease in initially healthy people (odds ratio 1·64 [95% CI 1·29–2·08]).[26] Sensitivity analysis showed that

	Cases (%)	Controls (%)	Odds ratio (99% CI)	Cases (%)	Controls (%)	Odds ratio (99% CI)	Cases	Controls (%)	Odds ratio (%) (99% CI)
Age (years)	**<56**			**56–64**			**>64**		
General stress									
Never	782 (16·2)	1179 (18·7)	1	794 (26·5)	1106 (29·7)	1	1201 (36·4)	1403 (38·8)	1
Some period, home or work	2224 (46·2)	3436 (54·5)	0·98 (0·85–1·13)	1502 (50·0)	1956 (52·6)	1·11 (0·95–1·30)	1626 (49·3)	1801 (49·8)	1·07 (0·94–1·23)
Several periods, home or work	1263 (26·2)	1301 (20·6)	1·49 (1·26–1·76)	500 (16·7)	537 (14·4)	1·37 (1·11–1·69)	376 (11·4)	345 (9·5)	1·37 (1·10–1·71)
Permanent, home or work	548 (11·4)	391 (6·2)	2·10 (1·69–2·62)	206 (6·9)	122 (3·3)	2·50 (1·80–3·47)	97 (2·9)	71 (2·0)	1·82 (1·19–2·78)
Smoking	**Never**			**Former**			**Current**		
General stress									
Never	1062 (28·0)	1919 (27·5)	1	641 (28·9)	816 (28·4)	1	1047 (21·0)	897 (24·9)	1
Some period, home or work	1909 (50·3)	3789 (54·3)	1·01 (0·89–1·14)	1017 (45·9)	1429 (49·7)	1·01 (0·84–1·20)	2369 (47·6)	1888 (52·4)	1·12 (0·97–1·30)
Several periods, home or work	618 (16·3)	1017 (14·6)	1·41 (1·19–1·67)	391 (17·6)	499 (17·4)	1·25 (0·99–1·57)	1099 (22·1)	629 (17·5)	1·65 (1·37–1·98)
Permanent, home or work	208 (5·5)	251 (3·6)	2·07 (1·59–2·71)	169 (7·6)	132 (4·6)	2·17 (1·54–3·04)	465 (9·3)	189 (5·3)	2·33 (1·79–3·02)
Income	**1–2 (low)**			**3**			**4–5 (high)**		
General stress									
Never	1424 (25·0)	1901 (28·6)	1	541 (22·7)	729 (26·3)	1	779 (27·0)	1007 (25·0)	1
Some period, home or work	2802 (49·1)	3494 (52·5)	1·13 (1·00–1·27)	1248 (52·3)	1562 (56·4)	1·09 (0·91–1·31)	1248 (43·2)	2043 (50·6)	0·88 (0·75–1·04)
Several periods, home or work	1071 (18·8)	1001 (15·1)	1·52 (1·30–1·77)	444 (18·6)	384 (13·9)	1·74 (1·36–2·21)	586 (20·3)	759 (18·8)	1·21 (1·00–1·48)
Permanent, home or work	410 (7·2)	254 (3·8)	2·40 (1·90–3·04)	154 (6·5)	97 (3·5)	2·23 (1·52–3·28)	274 (9·5)	225 (5·6)	1·91 (1·45–2·52)
Education	**<8 years**			**9–12 years**			**Trade/college/university**		
General stress									
Never	1387 (28·1)	1639 (31·8)	1	711 (24·2)	955 (27·7)	1	679 (20·9)	1093 (21·7)	1
Some period homework	2483 (50·4)	2693 (52·3)	1·11 (1·01–1·22)	1435 (48·9)	1891 (54·8)	1·07 (0·94–1·21)	1432 (44·0)	2605 (51·7)	0·94 (0·83–1·06)
Several periods	798 (16·2)	666 (12·9)	1.53 (1·34–1·75	548 (18·7)	465 (13·5)	1·72 (1·46–2·03)	793 (24·4)	1052 (20·9)	1·28 (1·11–1·47)
Perrnanent home or work	262 (5·3)	156 (3·0)	2.23 (1·79–2·79)	240 (8·2)	139 (4·0)	2·53 (1·99–3·22)	348 (10·7)	289 (5·7)	2·02 (1·67–2·45)

Table 4: **General stress by age, smoking, income, and education in cases and controls**

clinical depression was a stronger predictor than depressive mood. Contrary to the findings in this meta-analysis, we did not find a so-called dose-response relation, because the risk of a myocardial infarction was similarly increased irrespective of the number of items in the depression scale that were positive. The prevalence of clinical depression among the controls in our study (7·0%) was comparable with estimates of mood disorders worldwide,[27] but lower than that for depressive mood (17·6%). This difference between studies suggests that those who were classified as being depressed in our study include some individuals with true clinical depression and some with a less specific reaction to stressors, which could account for the similarity of findings for depressive mood and stress.

Few studies have investigated the effect of external influences like financial stress or life events on risk of coronary disease. Findings of a case-control study[13] showed that experience of one life event or more during the year preceding an acute myocardial infarction, and dissatisfaction with one's financial situation, was twice as common in cases than controls among men, but no significant relation was found among women. However, the lack of effect in women in the above study[13] might have been because it contained few women. Our study, which includes 2686 female cases and 3619 female controls, shows consistent relations in both men and women. In a Danish registry-based study,[7] an extreme external stressor, such as the death of a child, was shown to be associated with increased risk of future acute myocardial infarction; this finding is consistent with the present study, in which business failure, major intrafamily conflict, job loss, death of spouse, and violence were associated with increased risk.

Our questionnaires were derived from items that were previously shown in longitudinal studies to predict

	General stress category											
	Never			**Some periods, at home or work**			**Several periods, at home or work**			**Permanent, at home or work**		
	Cases	Controls	Odds ratio (99% CI)	Cases	Controls	Odds ratio (99% CI)	Cases	Controls	Odds ratio (99% CI)	Cases	Controls	Odds ratio (99% CI)
Depression												
No	2359	3314	1·0	4319	6061	0·95 (0·80–1·14)	1333	1541	1·19 (0·97–1·45)	435	328	1·71 (1·32–2·21)
Yes	418	374	1.41 (1·21–1·64)	1033	1132	1·34 (1·07–1·68)	806	642	1·67 (1.33–2·11)	416	256	2·40 (1·83–3·15)
Locus of control												
Q4	619	917	1·0	867	1481	0·96 (0·80–1·15)	327	427	1·22 (1·00–1·49)	134	100	1·78 (1·38–2·30)
Q3	900	1186	1·03 (0·87–1·21)	1896	2693	0·99 (0·78–1·25)	605	780	1·26 (0·98–1·61)	213	180	1·84 (1·36–2·47)
Q2	781	995	1·34 (1·12–1·62)	1434	1676	1·29 (1·00–1·66)	535	480	1·64 (1·26–2·13)	188	114	2·40 (1·76–3·26)
Q1	477	590	1·55 (1·28–1·89)	1155	1343	1·49 (1·15–1·93)	672	496	1·90 (1·46–2·47)	316	190	2·77 (2·05–3·75)

Odds ratios adjusted for age, sex, smoking status, and geographic region.

Table 5: **Odds ratios for combined effect of general stress and depression or locus of control on risk of acute myocardial infarction**

cardiovascular events.[14] Because INTERHEART intended to recruit a large number of cases and controls from 52 countries, our questionnaires had to be simple and brief. The fact that such simple questions are informative across such diverse settings is a particular strength of our study.

Levels of stress, depression, and locus of control reported by INTERHEART controls varied substantially across regions. The differences in rates of these factors could be attributable to variations in interpretation of the questions in different cultures and the extent of social desirability with respect to responses, but this difference would not be expected to affect the comparisons between cases and controls, because both groups of participants were recruited within the same centre in every country. The validity of our conclusions is supported by the excess risk associated with most of the measures we used, and it is consistent in various regions. The odds ratios in various subgroups are essentially in the same direction, and the CIs generally overlap the overall odds ratio for every construct examined. Although we cannot exclude that self-reported stress might be subject to biases by cases spuriously reporting stress more often than controls, this is less likely to be a problem with measures such as low locus of control, life events, or perhaps depression, which are not typically judged to be associated with stress by lay individuals. The coherence of the results across both types of questions increases the plausibility of our findings, and the consistency across various geographic regions adds robustness and internal replication. Although quantification of any potential biases is difficult because of the case-control design we used, the similarity of our overall findings with those from several cohort studies is reassuring.

The present study has two additional potential limitations. First, we did not enrol patients who died before they could be interviewed. However, a separate analysis of the 435 patients who died in INTERHEART showed the same relation with stress as the total population of patients with acute myocardial infarction. Second, the experience of the acute myocardial infarction could theoretically alter a patient's perceptions about recent stress and mood. Even so, previous studies have shown that although perception of risk factor status may change, confirmatory search after the discovery of disease only moderately influences the recollection of symptoms in the month preceding disease.[28] A retrospective design has the advantage of assessing stress during the recent past, whereas longitudinal studies can underestimate the effects of a past period of intense stress owing to the long interval between an interview and the occurrence of an event, nor can they explore the relation of stress in the period just before the myocardial infarction. Also, true levels of stress might vary over time in the same individual. In 292 individuals, repeat measures obtained at an interval of greater than a year indicated a moderate correlation of 0·5 (compared with, for example, 0·7 for apolipoprotein B and 0·9 for smoking). This finding suggests that the effect of an analysis adjusting for variability (eg, regression-dilution bias) could indicate an even stronger relation than that described in the present article. However, adjustment for regression-dilution bias simultaneously across multiple variables is complex, and we are not aware of any study that has done that.

Not all prospective studies have reported a significant relation between psychological stress and ischaemic heart disease.[29–31] The lack of an association could be attributable to low power because of few events[29] in several studies and potential waning of an effect when events arise after measurement of stress.[29–31] Residual confounding of low socioeconomic status has been proposed as a potential explanation.[30] However, in INTERHEART, all associations recorded between psychosocial stress factors and myocardial infarction were unchanged after adjustment for income and education.

The mechanism by which psychosocial factors increase the risk of myocardial infarction is complex. In experimental studies, worsened coronary atherosclerosis[32] and endothelial dysfunction[33] happen in response to social disruption. Several studies have shown links between psychosocial variables and vascular function,[34,35] inflammation,[36] increased blood clotting, and decreased fibrinolysis.[37,38] The exact pathophysiological nature of the influence of psychosocial factors remains to be determined, as does the temporal sequence of events.

In conclusion, our study indicates that psychosocial stressors are related to increased risk of acute myocardial infarction. For severe global stress, the size of the effect was less than that for smoking but comparable with hypertension and abdominal obesity.[16] Our study is unique in having evaluated simultaneously multiple elements of stress, in inclusion of perception of stress and life events, and in objective constructs such as locus of control. In view of the large number of participants and inclusion of multiple populations and ethnic groups, we have shown that the effects of stress on acute myocardial infarction are similar in men and women, in people of various ages, and in all geographic regions of the world that we studied. The PAR for each of the measures ranged from 8% to 16%, and collectively adds up to 33% for all variables. If this effect is truly causal, the importance of psychosocial factors is much more important than commonly recognised, and might contribute to a substantial proportion of acute myocardial infarction.

Contributors

S Yusuf initiated the INTERHEART study and supervised the project, data analysis, and writing of the report. A Rosengren had main responsibility for writing the report. S Hawken did statistical analyses. S Ôunpuu coordinated the project. All other investigators facilitated and supervised the study in their own country and commented on drafts of the report.

Conflict of interest statement

We declare that we have no conflict of interest.

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Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study

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See Comment page 912

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Summary

Background Although more than 80% of the global burden of cardiovascular disease occurs in low-income and middle-income countries, knowledge of the importance of risk factors is largely derived from developed countries. Therefore, the effect of such factors on risk of coronary heart disease in most regions of the world is unknown.

Methods We established a standardised case-control study of acute myocardial infarction in 52 countries, representing every inhabited continent. 15 152 cases and 14 820 controls were enrolled. The relation of smoking, history of hypertension or diabetes, waist/hip ratio, dietary patterns, physical activity, consumption of alcohol, blood apolipoproteins (Apo), and psychosocial factors to myocardial infarction are reported here. Odds ratios and their 99% CIs for the association of risk factors to myocardial infarction and their population attributable risks (PAR) were calculated.

Findings Smoking (odds ratio 2·87 for current *vs* never, PAR 35·7% for current and former *vs* never), raised ApoB/ApoA1 ratio (3·25 for top *vs* lowest quintile, PAR 49·2% for top four quintiles *vs* lowest quintile), history of hypertension (1·91, PAR 17·9%), diabetes (2·37, PAR 9·9%), abdominal obesity (1·12 for top *vs* lowest tertile and 1·62 for middle *vs* lowest tertile, PAR 20·1% for top two tertiles *vs* lowest tertile), psychosocial factors (2·67, PAR 32·5%), daily consumption of fruits and vegetables (0·70, PAR 13·7% for lack of daily consumption), regular alcohol consumption (0·91, PAR 6·7%), and regular physical activity (0·86, PAR 12·2%), were all significantly related to acute myocardial infarction (p<0·0001 for all risk factors and p=0·03 for alcohol). These associations were noted in men and women, old and young, and in all regions of the world. Collectively, these nine risk factors accounted for 90% of the PAR in men and 94% in women.

Interpretation Abnormal lipids, smoking, hypertension, diabetes, abdominal obesity, psychosocial factors, consumption of fruits, vegetables, and alcohol, and regular physical activity account for most of the risk of myocardial infarction worldwide in both sexes and at all ages in all regions. This finding suggests that approaches to prevention can be based on similar principles worldwide and have the potential to prevent most premature cases of myocardial infarction.

Introduction

Worldwide, cardiovascular disease is estimated to be the leading cause of death and loss of disability-adjusted life years.[1] Although age-adjusted cardiovascular death rates have declined in several developed countries in past decades, rates of cardiovascular disease have risen greatly in low-income and middle-income countries,[1,2] with about 80% of the burden now occurring in these countries. Effective prevention needs a global strategy based on knowledge of the importance of risk factors for cardiovascular disease in different geographic regions and among various ethnic groups.

Current knowledge about prevention of coronary heart disease and cardiovascular disease is mainly derived from studies done in populations of European origin.[2] Researchers are unsure to what extent these findings apply worldwide. Some data suggest that risk factors for coronary heart disease vary between populations—eg, lipids are not associated with this disorder in south Asians,[3] and increases in blood pressure might be more important in Chinese people.[4] Even if the association of a risk factor with coronary heart disease is similar across populations, prevalence of this factor might vary, resulting in different population attributable risks (PAR)—eg, serum cholesterol might be lower in Chinese populations.[4] On the other hand, these apparent variations between ethnic populations could be attributable to differences between studies in their design and analysis, information obtained, and small sample sizes.

To clarify whether the effects of risk factors vary in different countries or ethnic groups, a large study undertaken in many countries—representing different regions and ethnic groups and using standardised methods—is needed, with the aim to investigate the relation between risk factors and coronary heart disease. Such a study could also estimate the importance of known risk factors on the PAR for acute myocardial infarction. This aim, however, needs either very large cohort trials or case-control studies with many events—eg, several thousands of cases of myocardial infarction in whom all (or most) currently known risk factors are measured. We judged the latter most practical.

INTERHEART is a large, international, standardised, case-control study, designed as an initial step to assess the importance of risk factors for coronary heart disease worldwide (slides available at http://www.phri.ca/interheart).[5] We aimed to include about 15 000 cases and a similar number of controls from 52 countries, representing all inhabited continents. Specific objectives are to determine the strength of association between various risk factors and acute myocardial infarction in the overall study population and to ascertain if this association varies by geographic region, ethnic origin, sex, or age. A key secondary objective is to estimate the PAR for risk factors and their combinations in the overall population and in various subgroups. This report focuses on the association of nine easily measured protective or risk factors (smoking, lipids, self-reported hypertension or diabetes, obesity, diet, physical activity, alcohol consumption, and psychosocial factors) to first myocardial infarction.

See **Articles** page 953

Methods

Participants

Study participants were recruited from 262 centres from 52 countries in Asia, Europe, the Middle East, Africa, Australia, North America, and South America (webtable 1; http://image.thelancet.com/extras/04art8001webtable1.pdf). The national coordinator selected centres within every country on the basis of feasibility. To identify first cases of acute myocardial infarction, all patients (irrespective of age) admitted to the coronary care unit or equivalent cardiology ward, presenting within 24 h of symptom onset, were screened. Cases were eligible if they had characteristic symptoms plus electrocardiogram changes indicative of a new myocardial infarction (webappendix 1; http://image.thelancet.com/extras/04art8001webappendix1.pdf).

At least one age-matched (up to 5 years older or younger) and sex-matched control was recruited per case, using specific criteria. Exclusion criteria for controls were identical to those described for cases, with the additional criterion that controls had no previous diagnosis of heart disease or history of exertional chest pain. The overall median interval from recruitment of cases to inclusion of controls was 1·5 months. Hospital-based controls (58%) were individuals who had a wide range of disorders unrelated to known or potential risk factors for acute myocardial infarction and were admitted to the same hospital as the matching case. Community-based controls (36%) were attendants or relatives of a patient from a non-cardiac ward or an unrelated (not first-degree relative) attendant of a cardiac patient. In the remaining controls, 3% were from an undocumented source and 3% were recruited through the WHO MONICA study.[6]

Procedures

Structured questionnaires were administered and physical examinations were undertaken in the same manner in cases and controls. Information about demographic factors, socioeconomic status (education, income), lifestyle (smoking, leisure time, physical activity, and dietary patterns), personal and family history of cardiovascular disease, and risk factors (hypertension, diabetes mellitus) was obtained. Psychosocial factors (depression, locus of control, perceived stress, and life events) were systematically recorded and integrated into one score: details are provided in the accompanying paper.[7] Height, weight, waist and hip circumferences, and heart rate were determined by a standardised protocol. Waist and hip circumferences were measured with a non-stretchable standard tape measure: waist measurements were obtained over the unclothed abdomen at the narrowest point between the costal margin and iliac crest, and hip circumferences over light clothing at the level of the widest diameter around the buttocks. Although blood pressure at the time of examination was recorded in both cases and controls, the levels in cases would be systematically affected by the myocardial infarction and treatments—eg, β blockers, nitrates, and angiotensin-converting-enzyme inhibitors—that could lower blood pressure. Therefore, only self-reported history of hypertension is used in the analysis.

Non-fasting blood samples (20 mL) were drawn from every individual and centrifuged within 2 h of admission, separated into six equal volumes, and frozen immediately at –20°C or –70°C after processing. Centres were instructed to draw blood from cases within 24 h of symptom onset. However, because of delays in patient presentation, especially in some low-income countries, blood samples could only be obtained within 24 h in two-thirds of cases. Samples were shipped in nitrogen vapour tanks by courier from every site to a blood storage site, where they were stored at –160°C in liquid nitrogen (Hamilton, Canada) or at –70°C (India and China). Blood samples from all countries other than China were analysed in Hamilton for total cholesterol, HDL cholesterol, and apolipoproteins B (ApoB) and A1 (ApoA1).

Immunoturbidimetric assays were used to measure apolipoprotein concentrations (Roche/Hitachi 917 analyser with Tina-quant ApoB version 2 and ApoA1 version 2 kits; Roche Diagnostics, Mannheim, Germany). The ApoB method was standardised against the IFCC SP3–07 reference standard[8] and the ApoA1 method against the IFCC SP1–01 reference preparation.[9] The same measurement kits and a Roche/Hitachi 911 analyser were used in Beijing, China. Both laboratories measured the same lot numbers of Precinorm and Precipath controls (Roche Diagnostics) in every run, and in every patient sample analysis run in China, two study patients and two serum reference pool samples (pool A and B) were measured that had previously been analysed in the central core laboratory in Canada. Because apolipoprotein concentrations are not affected by the fasting status of the individual (unlike calculated LDL), we used the ApoB/ApoA1 ratio as an index of abnormal lipids in the current analysis.[10] Moreover, this ratio was predictive of myocardial infarction in subsets of patients (<12 h, 12–24 h, and >24 h after symptoms) in the present study (data not shown). Detailed information on lipoprotein fractions will be reported separately.

All data were transferred to the Population Health Research Institute, McMaster University, and Hamilton Health Sciences, Canada, where quality-control checks and statistical analyses were done. Data on smoking were missing in 1·1% of participants, hypertension in 0·6%, diabetes in 0·7%, psychosocial variables in 11%, physical activity in 1·1%, diet in 2·1%, and waist and hip measurements in 3·5%. Blood samples were available in 21 508 (79%) of 27 098 cases and controls.

INTERHEART was approved by appropriate regulatory and ethics committees in all participating countries and centres. All participants provided informed consent before taking part in the study.

We defined current smokers as individuals who smoked any tobacco in the previous 12 months and included those who had quit within the past year. Former smokers were defined as those who had quit more than a year earlier. For waist/hip ratio, tertiles were calculated separately for men and women based on the overall control data. The cutoffs used were 0·90 and 0·95 in men and 0·83 and 0·90 in women, to divide participants into thirds. Cutoffs for ApoB/ApoA1 ratios (deciles and quintiles) were derived from all controls (men and women). Region-specific cutoffs did not alter the results. Individuals were judged to be physically active if they were regularly involved in moderate (walking, cycling, or gardening) or strenuous exercise (jogging, football, and vigorous swimming) for 4 h or more a week. Regular alcohol use was defined as consumption three or more times a week. The combined psychosocial index was devised with a combination of the parameter estimates from the completely adjusted multivariate logistic regression model. The score was based on a combination of depression versus none, stress at work or at home (general stress variable) versus none, moderate or severe financial stress versus minimal or none, one or more life events versus none, and a locus of control score in the lower three quartiles versus the top quartile of the distribution.

Statistical analysis

Simple associations were assessed with frequency tables and Pearson's χ^2 tests for two independent proportions. For comparison of prevalence across distinct subgroups—eg, by region, country, or ethnic group—potential differences in age structure of the populations were accounted for by direct standardisation of the frequencies to the overall INTERHEART age distribution with a five-level age-stratification factor (<45, 46–55, 56–65, 66–70, >70).[11] Means and medians were calculated to summarise continuous effects and were compared by *t* tests or appropriate non-parametric tests when distributional assumptions were in doubt. When data have been categorised by tertiles, quintiles, or deciles, these were based on the overall control data. For waist/hip ratio, sex-specific cutoffs were used. For protective factors (exercise, diet, and alcohol), the PAR is calculated for the group without the exposure.

The findings presented are for models fitted with unconditional logistic regression, adjusted for the matching criteria, for two reasons. First, unmatched analyses were used because for 14% (1763/12461) of cases of myocardial infarction and 5% (738/14637) of controls, perfect matching was not possible. Undertaking a strict matched analysis would mean relevant loss of information because of the exclusion of these participants. Moreover, when data on a risk factor were missing in a case or control, the entire pair would be excluded from all analyses. Therefore, we widened the age-matching criteria and used frequency matching of cases and controls, using age and sex strata. Second, there was general agreement for key results among the many methods compared (conditional logistic regression, mixed models, and unconditional logistic regression, with adjustment for matching criteria). Estimated odds ratios and CIs calculated with the different methods were within 5% of each other, with a slight attenuation of effect estimates in the unconditional versus conditional models (webtable 2; http://image.thelancet.com/extras/04art8001webtable2.pdf).[11] Hence, findings presented are adjusted for age, sex, geographic region, and potential confounders, and should be interpreted as providing a slight underestimation of effect sizes for most comparisons.

Adjusted odds ratios for combinations of risk factors can be derived from their respective model coefficients in the multivariate logistic model. By summation of model coefficients and taking the antilog (panel) the combined effect of combinations of exposures can be estimated. Estimates of odds ratios and accompanying 99% CIs are presented for every risk factor and their combinations. Statistical analyses and graphics were produced with SAS version 8.2 (SAS, Cary, NC, USA) and S-Plus version 6 (Insightful, Seattle, WA, USA). All statistical tests of hypotheses are two-sided. PARs and 99% CIs were calculated for various risk factors in the study by a method based on unconditional logistic regression.[12] The PARs presented are adjusted for confounders in a similar manner to the corresponding logistic regression models for odds ratio estimates and, where indicated, are stratified by subgroups of interest. PAR estimates were calculated by the interactive risk attributable program software (US National Cancer Institute, 2002).[13]

For a simple dichotomous exposure and disease, and no adjustment for confounding, the usual formula for PAR was used (panel).[12] PAR adjusted for confounding

Panel: Formulae

Antilog $e^{\beta(i)}$

PAR $\dfrac{\Pr(E)(R-1)}{\Pr(E)(R-1)+1}$

where Pr(*E*) is probability of exposure to the risk factor and *R* is the relative risk of the disease in exposed versus unexposed individuals.

PAR adjusted for confounding

$$1-\sum_{i=0}^{I}\sum_{j=1}^{J}\rho_{ij}R_{ij}^{-1}$$

where

$$R_{ij}=\frac{\Pr(D=1|X=x_i,C=c_j)}{\Pr(D=1|X=x_0,C=c_j)}$$

and

$$\rho_{ij}=\Pr(X=x_i,C=c_j|D=1)$$

X is the exposure level, C is the confounder level, and D is disease status (D=0, disease is absent; D=1, disease is present).

	Cases (n=12 461)	Controls (n=14 637)
Geographic region		
Western Europe	664	767
Central and eastern Europe	1727	1927
Middle East	1639	1786
Africa	578	789
South Asia	1732	2204
China and Hong Kong	3030	3056
Southeast Asia and Japan	969	1199
Australia and New Zealand	589	681
South America and Mexico	1237	1888
North America	296	340
Ethnic origin		
European	3314	3710
Chinese	3130	3167
South Asian	2171	2573
Other Asian	871	1073
Arab	1306	1479
Latin American	1141	1834
Black African	157	369
Coloured African	311	339
Other	60	93

Table 1: Distribution of study population

is also shown in the panel. For variance estimates, the reader is referred to Benichou and Gail[15] since the derivations and formulae are complex. CI calculations were based on this method using a logit transformation approach, apart from when PAR estimates were negative, in which case conventional Wald type CIs were used.

Role of the funding source

The sponsors of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Between February, 1999, and March, 2003, 15 152 cases and 14 820 controls were enrolled. 1531 cases were diagnosed as having unstable angina, 260 had insufficient data, 205 did not have coronary artery disease, and 695 had a previous myocardial infarction. For 74 controls data were missing and 109 had previous coronary heart disease. Therefore, 12 461 cases and 14 637 controls are included in the analysis. Table 1 shows the distribution of participants by region and ethnic origin. 9459 cases (76%) and 10 851 controls (74%) were male.

Table 2 shows the median age of presentation of cases. The overall median age of cases with first acute myocardial infarction is about 9 years lower in men than in women in all regions of the world. However, the proportion of male cases was highest in countries with a younger age of presentation of acute myocardial infarction—eg, 85% of cases in south Asia and 86% in the Middle East were male compared with 74% in western Europe, 68% in central and eastern Europe, and 70% in China. Among regions, striking variations were noted in the age of first presentation of acute myocardial infarction, with the youngest patients in south Asia (median age 53 years) and the Middle East (51 years), and the oldest patients in western Europe, China, and Hong Kong (63 years). The highest proportion of cases with first acute myocardial infarction at age 40 years or younger was in men from the Middle East (12·6%), Africa (10·9%), and south Asia (9·7%) and the lowest proportion was in women from China and Hong Kong (1·2%), South America (1·0%), and central and eastern Europe (0·9%).

Overall effect of risk factors

Table 3 provides the overall odds ratios for individual risk factors adjusted for age, sex, smoking status, and region and by multivariate adjustment for all risk factors. All risk factors were significantly ($p<0·0001$) related to acute myocardial infarction, except alcohol, which had a weaker association ($p=0·03$). After multivariate analysis, current smoking and raised ApoB/ApoA1 ratio (top *vs* lowest quintile) were the two strongest risk factors, followed by history of diabetes, hypertension, and psychosocial factors (table 3). Body-mass index was related to risk of myocardial infarction, but this relation was weaker than that of abdominal obesity (waist/hip ratio), with body-mass index becoming non-significant with the inclusion of waist/hip ratio in the multivariate model (data not shown). Before multivariate adjustment, abdominal obesity (top *vs* lowest tertile) doubled the risk of acute myocardial infarction, but the effects were substantially diminished after adjustment for other risk factors, especially apolipoproteins. Daily consumption of fruits or vegetables, moderate or strenuous physical exercise, and consumption of alcohol three or more times per week, were protective (table 3).

	Overall			Men			Women		
	Number	Median age (IQR)	% <40 years (n)	Number	Median age (IQR)	% <40 years (n)	Number	Median age (IQR)	% <40 years (n)
Geographic region									
Western Europe	664	63 (54–72)	2·7 (18)	493	61 (53–70)	2·8 (14)	171	68 (59–76)	2·3 (4)
Central and eastern Europe	1727	62 (52–70)	2·9 (51)	1173	59 (50–68)	3·9 (46)	554	68 (59–74)	0·9 (5)
North America	296	59 (50–71)	4·0 (12)	210	58 (49–68)	3·3 (7)	86	64 (52–75)	5·8 (5)
South America and Mexico	1237	60 (51–70)	3·4 (42)	926	59 (50–68)	4·2 (39)	311	65 (56–73)	1·0 (3)
Australia and New Zealand	589	60 (51–69)	5·3 (31)	464	58 (50–67)	5·6 (26)	125	66 (59–74)	4·0 (5)
Middle East	1639	51 (45–59)	11·2 (184)	1410	50 (44–57)	12·6 (177)	229	57 (50–65)	3·1 (7)
Africa	578	54 (47–62)	9·7 (56)	385	52 (46–61)	10·9 (42)	193	56 (49–65)	7·3 (14)
South Asia	1732	53 (46–61)	8·9 (54)	1480	52 (45–60)	9·7 (143)	252	60 (50–66)	4·4 (11)
China and Hong Kong	3030	63 (53–70)	4·5 (135)	2131	60 (50–68)	5·8 (124)	899	67 (62–72)	1·2 (11)
Southeast Asia and Japan	969	57 (49–65)	7·0 (68)	787	55 (47–64)	8·3 (65)	182	63 (56–68)	1·7 (3)
Ethnic origin									
European	3314	62 (52–71)	3·2 (107)	2371	59 (51–69)	3·8 (89)	943	68 (58–75)	1·9 (18)
Chinese	3130	63 (53–70)	4·4 (139)	2217	60 (50–68)	5·8 (128)	913	67 (61–72)	1·2 (11)
South Asian	2171	52 (45–60)	10·6 (231)	1889	50 (45–60)	11·7 (220)	282	60 (51–66)	3·9 (11)
Other Asian	871	57 (48–65)	7·0 (61)	705	55 (47–64)	8·2 (58)	166	63 (56–68)	1·8 (3)
Arab	1306	53 (46–60)	9·0 (118)	1083	52 (45–59)	10·3 (111)	223	57 (50–65)	3·1 (7)
Latin American	1141	60 (51–69)	3·7 (42)	854	58 (50–67)	4·5 (38)	287	64 (55–72)	1·4 (4)
Black African	157	52 (46–61)	14·0 (22)	98	52 (46–59)	17·4 (17)	59	54 (48–67)	8·5 (5)
Coloured African	311	54 (47–63)	8·7 (27)	196	52 (46–62)	9·7 (19)	115	58 (49–65)	7·0 (8)
Other	60	57 (48–64)	6·7 (4)	46	53 (48–62)	6·5 (3)	14	63 (59–73)	7·1 (1)
Overall	12 461	58 (49–67)	6·0 (751)	9459	56 (48–65)	7·2 (683)	3002	65 (56–72)	2·3 (68)

Table 2: **Median age (years) of presentation of cases**

A strong and graded relation was noted between numbers smoked and risk of myocardial infarction, with the risk increasing at every increment, so that individuals smoking greater than 40 cigarettes per day had an odds ratio of 9·16 (99% CI 6·18–13·58; figure 1). The ApoB/ApoA1 ratio also showed a graded relation with myocardial infarction risk, with no evidence of a threshold, with an odds ratio of 4·73 (99% CI 3·93–5·69) for the top versus the lowest decile of ApoB/ApoA1 ratio (figure 1).

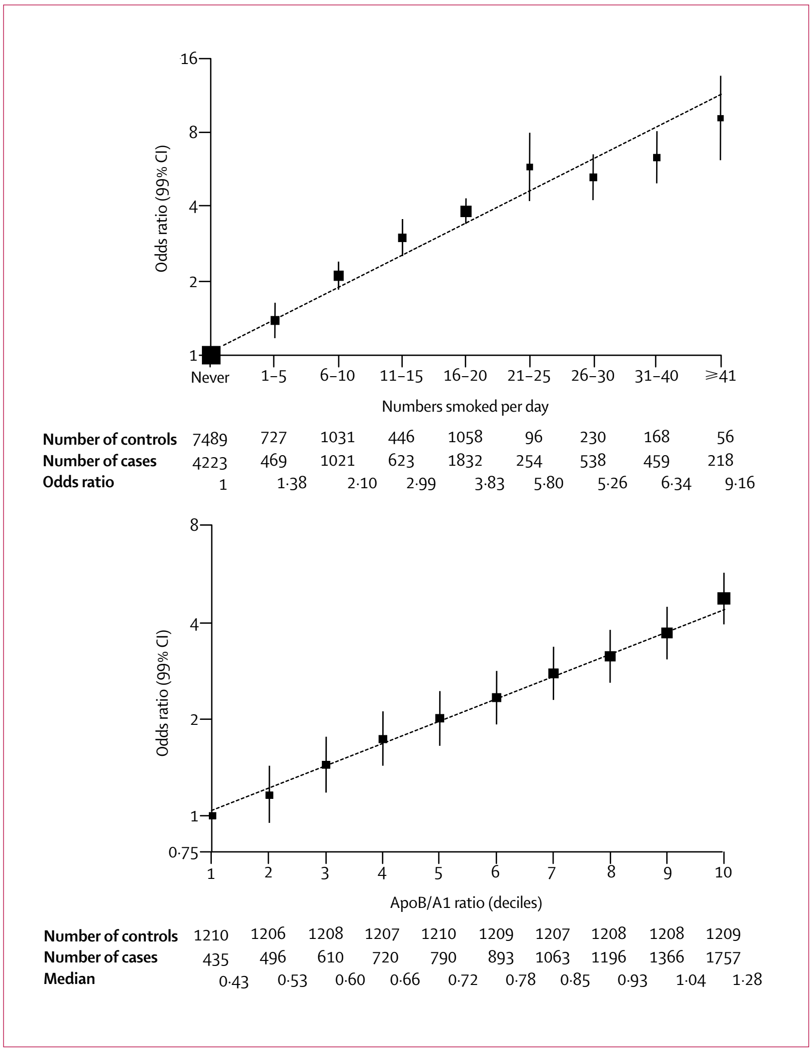
Cumulative effect of risk factors

Figure 2 shows the effect of multiple risk factors on increased risk of myocardial infarction. Together, current smoking, hypertension, and diabetes increased the odds ratio for acute myocardial infarction to 13·01 (99% CI 10·69–15·83) compared to those without these risk factors, and they accounted for 53% of the PAR of acute myocardial infarction. Addition of ApoB/ApoA1 ratio (top *vs* lowest quintile) increased the odds ratio to

	Prevalence		Odds ratio (99% CI) adjusted for age, sex, and smoking (OR 1)	PAR (99% CI)	Odds ratio (99% CI) adjusted additionally for all other risk factors (OR 2)	PAR 2 (99% CI)
	Controls (%)	Cases (%)				
Risk factor						
Current smoking*	26·76	45·17	2·95 (2·72–3·20)	–	2·87 (2·58–3·19)	–
Current and former smoking*	48·12	65·19	2·27 (2·11–2·44)	36·4% (33·9–39·0)	2·04 (1·86–2·25)	35·7% (32·5–39·1)
Diabetes	7·52	18·45	3·08 (2·77–3·42)	12·3% (11·2–13·5)	2·37 (2·07–2·71)	9·9% (8·5–11·5)
Hypertension	21·91	39·02	2·48 (2·30–2·68)	23·4% (21·7–25·1)	1·91 (1·74–2·10)	17·9% (15·7–20·4)
Abdominal obesity (2 *vs* 1)†	33·40	30·21	1·36 (1·24–1·48)	–	1·12 (1·01–1·25)	–
Abdominal obesity (3 *vs* 1)†	33·32	46·31	2·24 (2·06–2·45)	33·7% (30·2–37·4)	1·62 (1·45–1·80)	20·1% (15·3–26·0)
All psychosocial‡	–	–	2·51 (2·15–2·93)	28·8% (22·6–35·8)	2·67 (2·21–3·22)	32·5% (25·1–40·8)
Vegetables and fruit daily*	42·36	35·79	0·70 (0·64–0·77)	12·9% (10·0–16·6)	0·70 (0·62–0·79)	13·7% (9·9–18·6)
Exercise*	19·28	14·27	0·72 (0·65–0·79)	25·5% (20·1–31·8)	0·86 (0·76–0·97)	12·2% (5·5–25·1)
Alcohol intake*	24·45	24·01	0·79 (0·73–0·86)	13·9% (9·3–20·2)	0·91 (0·82–1·02)	6·7% (2·0–20·2)
ApoB/ApoA1 ratio (2 *vs* 1)§	19·99	14·26	1·47 (1·28–1·68)	–	1·42 (1·22–1·65)	–
ApoB/ApoA1 ratio (3 *vs* 1)§	20·02	18·05	2·00 (1·74–2·29)	–	1·84 (1·58–2·13)	–
ApoB/ApoA1 ratio (4 *vs* 1)§	19·99	24·22	2·72 (2·38–3·10)	–	2·41 (2·09–2·79)	–
ApoB/ApoA1 ratio (5 *vs* 1)§	20·00	33·49	3·87 (3·39–4·42)	54·1% (49·6–58·6)	3·25 (2·81–3·76)	49·2% (43·8–54·5)
All above risk factors combined¶	–	–	129·20 (90·24–184·99)	90·4% (88·1–92·4)	129·20 (90·24–184·99)	90·4% (88·1–92·4)

The median waist /hip ratio was 0·93 in cases and 0·91 in controls (p<0·0001), and the median ApoB/ApoA1 ratio was 0·85 in cases and 0·80 in controls (p<0·0001). Percentage of controls with four or five factors positive is 22·2% compared with 29·2% in cases. *PARs for smoking, abdominal obesity, and ApoB/ApoA1 ratio are based on a comparison of all smokers *vs* never, top two tertiles *vs* lowest tertile, and top four quintiles *vs* lowest quintile. For protective factors (diet, exercise, and alcohol), PARs are provided for the group without these factors. †Top two tertiles *vs* lowest tertile. ‡A model-dependent index combining positive exposure to depression, perceived stress at home or work (general stress), low locus of control, and major life events, all referenced against non-exposure for all five factors. §Second, third, fourth, or fifth quintiles *vs* lowest quintile. ¶The model is saturated, so adjusted and unadjusted estimates are identical for all risk factors. The odds ratio of 129·20 is derived from combining all risk factors together, including current and former smoking *vs* never smoking, top two tertiles *vs* lowest tertile of abdominal obesity, and top four quintiles *vs* lowest quintile of ApoB/ApoA1. If, however, the model includes only current smoking *vs* never smoking, the top *vs* lowest tertile for abdominal obesity, and the top *vs* lowest quintile for ApoB/ApoA1, the odds ratio for the combined risk factors increases to 333·7 (99% CI 230·2–483·9).

Table 3: **Risk of acute myocardial infarction associated with risk factors in the overall population**



	Never	1–5	6–10	11–15	16–20	21–25	26–30	31–40	≥41
Number of controls	7489	727	1031	446	1058	96	230	168	56
Number of cases	4223	469	1021	623	1832	254	538	459	218
Odds ratio	1	1·38	2·10	2·99	3·83	5·80	5·26	6·34	9·16

	1	2	3	4	5	6	7	8	9	10
Number of controls	1210	1206	1208	1207	1210	1209	1207	1208	1208	1209
Number of cases	435	496	610	720	790	893	1063	1196	1366	1757
Median	0·43	0·53	0·60	0·66	0·72	0·78	0·85	0·93	1·04	1·28

Figure 1: **Odds of myocardial infarction according to number of cigarettes smoked and ApoB/ApoA1 ratio**
Note the doubling scale on the y axis for both figures.

42·3 (33·2–54·0), and the PAR for these four risk factors together (top four quintiles of ApoB/ApoA1 ratio *vs* lowest quintile) was 75·8% (99% CI 72·7–78·6). Addition of abdominal obesity (top two tertiles *vs* lowest tertile) further increased the PAR to 80·2% (77·5–82·7).

Figure 3 shows the effects of multiple risk factors on reduced risk of acute myocardial infarction associated with healthy lifestyles. Daily consumption of fruit and vegetables and regular physical activity conferred an odds ratio of 0·60 (99% CI 0·51–0·71). Further, if an individual avoided smoking, the odds ratio would be 0·21 (0·17–0·25; figure 3), suggesting that modification of these aspects of lifestyle could potentially reduce the risk of an acute myocardial infarction by more than three-quarters compared with a smoker with a poor lifestyle.

Incorporation of all nine independent risk factors (current or former smoking, history of diabetes or hypertension, abdominal obesity, combined psychosocial stressors, irregular consumption of fruits and vegetables, no alcohol intake, avoidance of any regular exercise, and raised plasma lipids) indicates an odds ratio of 129·20 (99% CI 90·24–184·99; table 3), compared with not having any of these risk factors. Substituting the odds ratios for current smoking, the extremes of abdominal obesity (top *vs* lowest tertile) and ApoB/ApoA1 ratio (top *vs* lowest quintile) increases the combined effect of all nine risk factors to 333·7 (99% CI 230·2–483·9; figure 2). This represents a PAR of 90·4% (99% CI 88·1–92·4), suggesting that these risk factors account for most of the risk of acute myocardial infarction in our study population. In view of the overlap in the effect of the nine risk factors, most of the PAR could be accounted for by a combination of various risk factors, as long as they included smoking and the ApoB/ApoA1 ratio (PAR for their combination is 66·8% [99% CI 62·8–70·6]). The estimate of the combined effect of all nine risk factors is derived from a model, since very few individuals had zero risk factors or all nine risk factors. However, confidence that the majority of risk is indeed accounted for by these risk factors is lent support by the fact that of the 18 708 individuals with complete data on all risk factors, 43 controls and 24 cases had no risk factors and 49 cases and 11 controls had eight or more. Also, just five risk factors (smoking, lipids, hypertension, diabetes, and obesity), which a large proportion of individuals had, accounted for about 80% of the PAR.

Risk in men and women

Figure 4 presents odds ratios and PARs for risk of acute myocardial infarction in men and women. Similar odds ratios were recorded in women and men for the association of acute myocardial infarction with smoking, raised lipids, abdominal obesity, composite of psychosocial variables, and vegetable and fruit consumption. However, the increased risk associated with hypertension and diabetes, and the protective effect of exercise and alcohol, seemed to be greater in women then in men (figure 4).

Table 4 also shows PARs by sex for the various risk factors, adjusted for age and region only and the fully adjusted model. In men, smoking was associated with 42·7% of the PAR for acute myocardial infarction compared with 14·8% in women in the fully adjusted model. Abnormal lipids had the highest PAR in both men (49·5%) and women (47·1%), with high contributions from psychosocial risk factors (28·8% *vs* 45·2%) and abdominal obesity (19·7% *vs* 18·7%). Hypertension contributed to PAR in women to a greater extent (29·0%) compared with men (14·9%), partly because of a higher prevalence of hypertension in women who were about a decade older. Collectively, all nine risk factors accounted for 90% of the PAR in men and 94% in women (table 4).

Risk by age

Smoking, adverse lipid profile, hypertension, and diabetes had a greater relative effect on risk of acute myocardial infarction in younger than older individuals (table 5). Overall, abnormal lipids was the most important risk factor with respect to PAR in both young and old individuals (table 5). Collectively, the nine risk factors accounted for a significantly greater ($p<0·0001$) PAR in younger than older individuals; these patterns were consistent in males and females.

Regional and ethnic variations in importance of risk factors

When the odds ratio (adjusted for age, sex, smoking, and geographic region) for association of acute myocardial infarction with a risk factor is around 2 or more, eg, for smoking, lipids, hypertension, diabetes, abdominal obesity, and the combined psychosocial index, subgroup analyses are likely to be fairly robust. We recorded a clear, significant, and consistent excess risk of acute myocardial infarction associated with these risk factors in most regions of the world and in every ethnic group (figures 5–10). By contrast, when odds ratios were weaker (0·70–1·50; alcohol consumption, exercise, or diet), greater variability was noted across regions (data not shown). This apparent variability could be attributable to chance, because subgroup analyses are likely to be less reliable when smaller overall differences are subdivided across multiple subsets of the populations. Similar results were noted for analyses across various subgroups defined by ethnic origin, with consistent and clear excess risks being reported for tobacco use, abnormal lipids, history of hypertension, diabetes, and abdominal obesity (data not shown).

Population attributable risk by geographic region

Table 4 also presents overall PARs and values by sex across different geographic regions. In all regions, the nine risk factors account for between three-quarters and virtually all the PAR for acute myocardial infarction. The relative importance of every risk factor varied, and was largely related to its prevalence. However, raised lipids, smoking, and psychosocial factors were the most important risk factors in all regions in the world. It is noteworthy that in western Europe, North America, and Australia and New Zealand (representing high-income countries) and southeast Asia (mostly middle-income countries), abdominal obesity was associated with a PAR greater than that associated with smoking. A similar pattern was seen for Africa, but most of our data are drawn from South Africa, which is a middle-income country. However, obesity was less important in other parts of the world, where it is less prevalent. For example, obesity accounted for only 5·5% of the PAR in China compared with 35·8% for smoking (where 41% of male and 4% of female controls smoked). Subdividing the population by ethnic origin, these nine risk factors accounted for a very high proportion of the PAR in every ethnic group (Europeans, 86%; Chinese, 90%; south Asians, 92%; black Africans, 92%; Arabs, 93%; and Latin Americans, 90%).

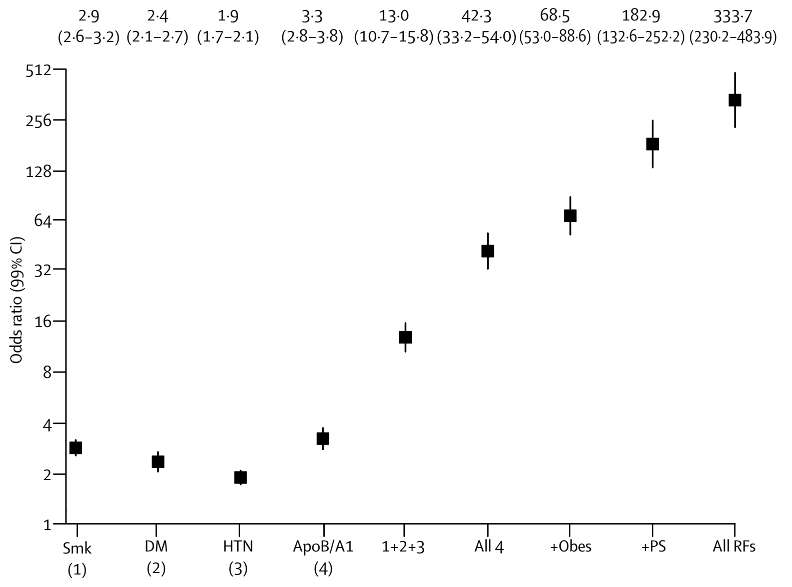


Figure 2: **Risk of acute myocardial infarction associated with exposure to multiple risk factors**

Smk=smoking. DM=diabetes mellitus. HTN=hypertension. Obes=abdominal obesity. PS=psychosocial. RF=risk factors. Note the doubling scale on the y axis. The odds ratios are based on current *vs* never smoking, top *vs* lowest tertile for abdominal obesity, and top *vs* lowest quintile for ApoB/ApoA1. If these three are substituted by current and former smoking, top two tertiles for abdominal obesity and top four quintiles for ApoB/ApoA1, then the odds ratio for the combined risk factor is 129·20 (99% CI 90·24–184·99).

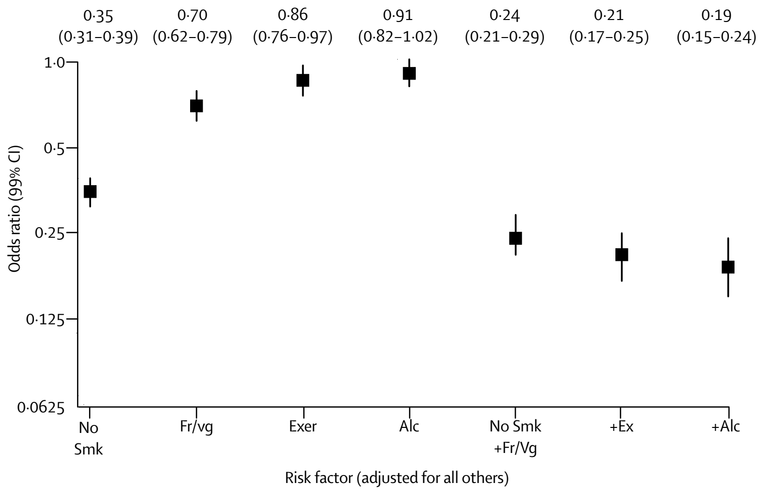


Figure 3: **Reduced risk of acute myocardial infarction associated with various risk factors**

Smk=smoking. Fr/vg=fruits and vegetables. Exer=exercise. Alc=alcohol. Note the doubling scale on the y axis. Odds ratios are adjusted for all risk factors.

Risk factor	Sex	Control (%)	Case (%)	Odds ratio (99% CI)	PAR (99% CI)
Current smoking	F	9·3	20·1	2·86 (2·36–3·48)	15·8% (12·9–19·3)
	M	33·0	53·1	3·05 (2·78–3·33)	44·0% (40·9–47·2)
Diabetes	F	7·9	25·5	4·26 (3·51–5·18)	19·1% (16·8–21·7)
	M	7·4	16·2	2·67 (2·36–3·02)	10·1% (8·9–11·4)
Hypertension	F	28·3	53·0	2·95 (2·57–3·39)	35·8% (32·1–39·6)
	M	19·7	34·6	2·32 (2·12–2·53)	19·5% (17·7–21·5)
Abdominal obesity	F	33·3	45·6	2·26 (1·90–2·68)	35·9% (28·9–43·6)
	M	33·3	46·5	2·24 (2·03–2·47)	32·1% (28·0–36·5)
Psychosocial index	F	–	–	3·49 (2·41–5·04)	40·0% (28·6–52·6)
	M	–	–	2·58 (2·11–3·14)	25·3% (18·2–34·0)
Fruits/veg	F	50·3	39·4	0·58 (0·48–0·71)	17·8% (12·9–24·1)
	M	39·6	34·7	0·74 (0·66–0·83)	10·3% (6·9–15·2)
Exercise	F	16·5	9·3	0·48 (0·39–0·59)	37·3% (26·1–50·0)
	M	20·3	15·8	0·77 (0·69–0·85)	22·9% (16·9–30·2)
Alcohol	F	11·2	6·3	0·41 (0·32–0·53)	46·9% (34·3–60·0)
	M	29·1	29·6	0·88 (0·81–0·96)	10·5% (6·1–17·5)
ApoB/ApoA1 ratio	F	14·1	27·0	4·42 (3·43–5·70)	52·1% (44·0–60·2)
	M	21·9	35·5	3·76 (3·23–4·38)	53·8% (48·3–59·2)

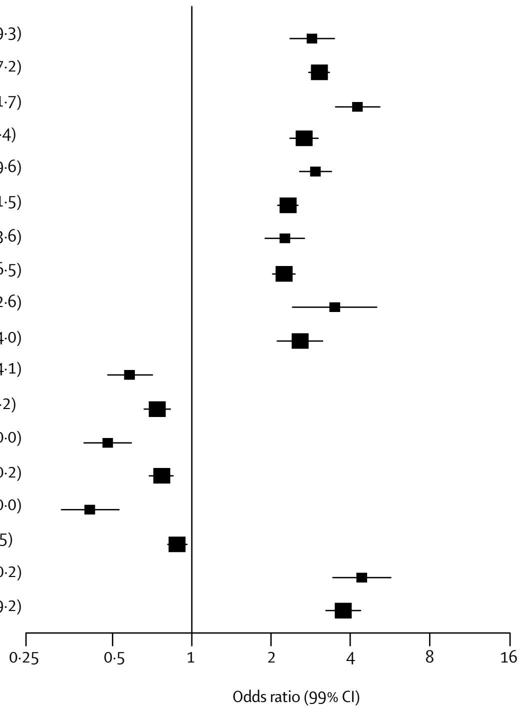


Figure 4: **Association of risk factors with acute myocardial infarction in men and women after adjustment for age, sex, and geographic region**
For this and subsequent figures, the odds ratios are plotted on a doubling scale. Prevalence cannot be calculated for psychosocial factors because it is derived from a model.

Consistency of results

Subgroup analyses with both types of controls (hospital-based and community-based) showed consistent odds ratios for current smoking (hospital-based 3·1 *vs* community-based 2·8), for the top quintile versus lowest quintile of lipids (4·2 *vs* 3·9), for diabetes (2·7 *vs* 3·4), for hypertension (2·1 *vs* 3·0), for abdominal obesity (1·7 *vs* 1·9), for psychosocial factors (1·6 *vs* 1·5), for consumption of fruits (0·78 *vs* 0·93) and vegetables (0·78 *vs* 0·83), for regular physical activity (0·79 *vs* 0·79), and for alcohol use (0·79 *vs* 0·86).

583 cases of acute myocardial infarction subsequently died in hospital. Odds ratios for fatal myocardial infarction associated with various risk factors were similar to those overall—smoking (2·1 for fatal myocardial infarction *vs* 3·0 overall), diabetes (4·0 *vs* 3·1), hypertension (2·4 *vs* 2·5), abdominal obesity (1·5 *vs* 2·2), and lipids (2·6 *vs* 3·9).

Family history

Family history of coronary heart disease was associated with an odds ratio of 1·55 (99% CI 1·44–1·67), adjusted for age, sex, smoking, and geographic region. Adjustments for the nine previously described risk factors slightly reduced the odds ratio to 1·45 (1·31–1·60). The PAR was 12·0% (99% CI 9·2%–15·1%), which fell to 9·8% (7·6–12·5) after full adjustment. However, when family history is added to the information from other nine risk factors, the overall PAR rose from 90·4% to only 91·4%, indicating that although family history is an independent risk factor for myocardial infarction, most of the associated risk burden can be accounted for through the other risk factors studied. Family history seemed to be slightly more important in young (PAR 14·8% [11·7–18·5]) compared with old individuals (10·4% [8·3–13·0]).

Repeat measures

Repeat measures of risk factors were made in 279 controls at a median interval of 409 days. The agreement rates for smoking (Cohen's kappa[16] κ=0·94), history of diabetes (κ=0·90), ApoB/ApoA1 (intraclass correlation=0·74), hypertension (κ=0·82), depression (κ=0·44), abdominal obesity (intraclass correlation=0·68), regular physical activity (κ=0·56), and consumption of fruits (κ=0·66), vegetables (κ=0·52), and alcohol (κ=0·52) were high to moderate. These data suggest that the association of myocardial infarction with smoking and diabetes is closer to the real effect, whereas the association of other risk factors measured with greater variability are probably underestimates due to regression-dilution bias.[17]

Region	Lifestyle factors					Other risk factors					
	Smoking (%)	Fruits and vegetables (%)	Exercise (%)	Alcohol (%)	All lifestyles (%)	Hypertension (%)	Diabetes (%)	Abdominal obesity (%)	All psychosocial (%)	Lipids (%)	All nine risk factors (%)
Men											
Western Europe	39·0	13·3	37·7	14·1	69·6	20·5	12·8	68·6	23·7	36·7	92·0
Central and eastern Europe	40·4	7·6	−0·4	10·4	48·9	15·9	5·8	31·7	−0·9	38·7	71·9
Middle East	51·4	5·8	1·9	−2·7	50·7	5·8	13·1	23·9	37·2	72·7	94·8
Africa	45·2	−4·4	15·9	24·1	63·7	26·8	11·6	60·4	33·8	73·7	97·9
South Asia	42·0	16·0	25·5	−5·7	58·1	17·8	10·5	36·0	13·9	60·2	88·4
China	45·3	15·1	16·6	4·2	63·7	19·9	7·9	4·9	32·0	41·3	88·8
Southeast Asia and Japan	39·2	8·5	31·4	24·6	69·6	34·3	19·1	57·9	26·9	68·7	93·7
Australia and New Zealand	46·1	8·0	20·6	11·2	61·0	18·3	5·6	49·5	31·6	48·7	87·5
South America	42·4	7·1	27·6	−7·4	57·7	28·1	9·7	35·2	36·1	41·6	86·1
North America	30·9	22·4	24·7	6·6	53·9	13·9	6·1	64·7	63·7	60·0	100
Overall 1	44·0	10·3	22·9	10·5	63·8	19·5	10·1	32·1	25·3	53·8	89·8*
Overall 2	42·7	11·7	9·3	5·1	56·5	14·9	8·0	19·7	28·8	49·5	89·8*
Women											
West Europe	11·1	8·4	38·3	34·2	65·2	25·9	21·0	50·6	67·1	47·9	97·1
Central and eastern Europe	13·1	12·8	42·7	29·9	65·4	42·7	15·7	20·0	15·0	26·8	86·1
Middle East	8·1	15·9	39·1	59·0	80·3	30·1	30·3	38·9	77·4	63·3	99·4
Africa	27·6	21·0	−37·9	28·8	61·2	35·1	27·5	54·6	54·9	74·6	93·3
South Asia	7·1	30·6	45·0	26·0	59·8	28·9	20·5	48·7	29·2	52·1	99·3
China	12·5	23·6	33·5	35·8	78·6	27·6	15·0	6·3	43·2	48·3	93·6
Southeast Asia and Japan	14·8	19·9	32·8	69·5	84·5	56·3	29·2	58·0	27·0	64·5	96·5
Australia and New Zealand	40·7	15·8	33·6	47·4	80·0	37·0	11·7	67·2	17·2	14·9	†
South America	25·8	5·9	27·4	44·1	71·8	47·9	22·2	63·0	37·8	59·3	96·1
North America	25·3	12·8	27·2	73·3	86·9	30·2	12·4	44·5	32·7	32·2	†
Overall 1	15·8	17·8	37·3	46·9	75·0	35·8	19·1	35·9	40·0	52·1	94·1*
Overall 2	14·8	19·1	27·1	22·1	60·6	29·0	16·1	18·7	45·2	47·1	94·1*
Men and women											
West Europe	29·3	12·4	38·4	18·7	67·6	21·9	15·0	63·4	38·9	44·6	93·9
Central and eastern Europe	30·2	10·2	11·3	12·9	49·6	24·5	9·1	28·0	4·9	35·0	72·5
Middle East	45·5	7·3	4·2	−1·0	47·6	9·2	15·5	25·9	41·6	70·5	95·0
Africa	38·9	4·8	10·1	26·6	63·4	29·6	16·7	58·4	40·0	74·1	97·4
South Asia	37·4	18·3	27·1	−5·5	56·6	19·3	11·8	37·7	15·9	58·7	89·4
China	35·9	18·0	20·3	5·7	62·3	22·1	10·0	5·5	35·4	43·8	89·9
Southeast Asia and Japan	36·2	11·2	31·4	27·9	69·9	38·4	21·0	58·0	26·7	67·7	93·7
Australia and New Zealand	44·8	11·1	23·8	18·6	66·0	22·6	7·2	61·3	28·9	43·4	89·5
South America	38·3	6·6	27·6	−3·7	56·6	32·7	12·7	45·5	35·6	47·6	89·4
North America	26·1	19·8	25·6	25·5	59·9	19·0	8·0	59·5	51·4	50·5	98·7
Overall 1	36·4	12·9	25·5	13·9	62·9	23·4	12·3	33·7	28·8	54·1	90·4*
Overall 2	35·7	13·7	12·2	6·7	54·6	17·9	9·9	20·1	32·5	49·2	90·4*

PAR estimates in women in some countries are based on small numbers and so they are less reliable . Overall 1= adjusted for age, sex, and smoking, Overall 2=adjusted for all risk factors. An extended version of this table with 99% CIs is shown in webtable 3 (http://image.thelancet.com/extras/04art8001webtable3.pdf). *Saturated model, no difference between adjusted and unadjusted models. †Non-estimatable.

Table 4: **PARs associated with nine risk factors in men and women by geographic region**

Discussion

Our study shows that nine easily measured and potentially modifiable risk factors account for an overwhelmingly large (over 90%) proportion of the risk of an initial acute myocardial infarction. The effect of these risk factors is consistent in men and women, across different geographic regions, and by ethnic group, making the study applicable worldwide. The effect of the risk factors is particularly striking in young men (PAR about 93%) and women (about 96%), indicating that most premature myocardial infarction is preventable. Worldwide, the two most important risk factors are smoking and abnormal lipids. Together they account for about two-thirds of the PAR of an acute myocardial infarction. Psychosocial factors, abdominal obesity, diabetes, and hypertension were the next most important risk factors in men and women, but their relative effect varied in different regions of the world. The usual measure of obesity (body-mass index) showed a modest relation with acute myocardial infarction but was not significant when abdominal obesity was included in the analysis.

Both smoking and apolipoproteins showed a graded relation with the odds of a myocardial infarction, without either a threshold or a plateau in the dose response. In particular, smoking even five cigarettes per day increased risk. This finding suggests that there is no safe level of smoking and that if quitting is not possible, the risk of myocardial infarction associated with smoking could be significantly reduced by a reduction in the numbers smoked. The graded relation between ApoB/ApoA1 ratio across the deciles is consistent with findings of a Swedish study[10] and shows that most populations in the world (at least

	Both sexes		Men		Women	
	Young	Old	≤55 years	>55 years	≤65 years	> 65 years
Odds ratios for relative effect of risk factors (99% CI)						
Lifestyle factors						
Smoking	3·33 (2·86–3·87)	2·44* (2·10–2·84)	3·33 (2·80–3·95)	2·52 (2·15–2·96)	4·49 (3·11–6·47)	2·14 (1·35–3·39)
Fruit and vegetables	0·69 (0·58–0·81)	0·72 (0·61–0·85)	0·72 (0·59–0.88)	0·77 (0·64–0·93)	0·62 (0·44–0·87)	0·55 (0·38–0·80)
Exercise	0·95 (0·79–1·14)	0·79 (0·66–0·94)	1·02 (0·83–1·25)	0·79 (0·66–0·96)	0·74 (0·49–1·10)	0·75 (0·46–1·22)
Alcohol	1·00 (0·85–1·17)	0·85 (0·73–1·00)	1·03 (0·87–1·23)	0·86 (0·73–1.01)	0·74 (0·41–1·31)	0·83 (0·49–1·42)
All four lifestyle factors	0·20 (0·14–0·27)	0·20† (0·15–0·27)	0·23 (0·16–0·33)	0·21 (0·15–0.29)	0·07 (0·03–0·18)	0·16 (0·06–0·41)
Hypertension	2·24 (1·93–2·60)	1·72 (1·52–1·95)	1·99 (1·66–2·39)	1·72 (1·49–1·98)	2·94 (2·25–3·85)	1·82 (1·39–2·38)
Diabetes	2·96 (2·40–3·64)	2·05* (1·71–2·45)	2·66 (2·04–3·46)	1·93 (1·58–2·37)	3·53 (2·49–5·01)	2·59 (1·78–3·78)
Abdominal obesity	1·79 (1·52–2·09)	1·50 (1·29–1·74)	1·83 (1·52–2·20)	1·54 (1·30–1·83)	1·58 (1·14–2·20)	1·22 (0·88–1·70)
Psychosocial	2·87 (2·19–3·77)	2·43 (1·86–3·18)	2·62 (1·91–3·60)	2·45 (1·82–3·29)	3·92 (2·26–6·79)	2·31 (1·22–4·39)
High ApoB/ApoA1 ratio	4·35 (3·49–5·42)	2·50* (2·05–3·05)	4·16 (3·19–5·42)	2·51 (2·00–3·15)	4·83 (3·19–7·32)	2·48 (1·60–3·83)
All risk factors other than smoking	101·86 (61·22–169·46)	43·24* (26·96–69·37)	59·06 (32·25–108·14)	38·88 (22·95–65·86)	473·43 (158·34–1415·5)	67·49 (21·39–212·90)
All nine risk factors including smoking‡	216·47 (126·67–369·94)	81·99* (50·02–134·40)	129·19 (68·60–243·28)	76·25 (44·07–131·93)	1100·6§ (342·72–3534·2)	111·45 (32·59–381·12)
Population attributable risks (99% CI)						
Lifestyle factors						
Smoking	40·7% (35·9 to 45·7)	33·1% (28·9 to 37·6)	52·0% (44·9 to 59·0)	39·0% (34·0 to 44·1)	20·8% (15·7 to 26·9)	8·2% (4·1 to 15·7)
Fruit and vegetables	16·9% (10·8 to 25·3)	11·9% (7·4 to 18·4)	15·7% (8·3 to 27·8)	10·1% (5·3 to 18·2)	18·4% (10·0 to 31·5)	18·7% (10·0 to 32·1)
Exercise	7·5% (0·7·to 46·9)	13·4% (5·4 to 29·7)	0·1% (0·0 to 100·0)	12·5% (4·4 to 30·6)	24·6% (6·8 to 59·2)	23·6% (4·3 to 67·8)
Alcohol	–4·1% (–19·8 to 11·6)	11·1% (4·7 to 23·9)	–9·1% (–25·1 to 6·9)	10·5% (4·3 to 23·6)	24·9% (3·3 to 76·3)	14·6% (0·5 to 84·6)
All four lifestyle factors	52.1% (39·5 to 64·4)	54·8% (46·2 to 63·1)	55·8% (42·1 to 68·7)	57·1% (48·4 to 65·4)	63·3% (36·8 to 83·6)	51·5% (21·7 to 80·3)
Hypertension	19·2% (16·0 to 22·8)	17·0% (14·0 to 20·5)	12·8% (9·4 to 17·1)	15·7% (12·7 to 19·4)	31·9% (25·7 to 38·6)	25·4% (17·1 to 35·8)
Diabetes	12·4% (10·3 to 14·9)	8·6% (6·9 to 10·7)	8·7% (6·6 to 11·5)	7·8% (6·0 to 10·1)	19·3% (15·1 to 24·5)	13·0% (8·9 to 18·5)
Abdominal obesity	24·8% (17·2 to 34·5)	18·1% (12·2 to 26·0)	23·4% (14·4 to 35·7)	18·3% (11·9 to 27·0)	24·9% (12·4 to 43·7)	11·8% (2·1 to 46·1)
Psychosocial	43·5% (32·2 to 55·6)	25·2% (16·0 to 37·2)	39·7% (25·4 to 56·0)	23·7% (13·9 to 37·4)	53·0% (35·4 to 69·9)	30·6% (10·6 to 62·1)
High ApoB/ApoA·1 ratio	58·9% (50·9 to 66·5)	43·6% (36·6 to 50·8)	59·7% (48·6 to 70·0)	45·3% (37·5 to 53·3)	56·1% (43·7 to 67·7)	36·3% (21·8 to 53·8)
All risk factors other than smoking	89·4% (84·7 to 92·7)	81·7% (76·4 to 86·1)	85·6% (77·7 to 91·0)	80·8% (74·8 to 85·7)	95·5% (90·0 to 98·0)	86·4% (70·8 to 94·3)
All nine risk factors including smoking	93·8% (90·9 to 95·8)	87·9% (84·1 to 90·8)	93·1% (88·9 to 95·8)	88·3% (84·4 to 91·4)	96·5% (92·0 to 98·5)	87·7% (73·1 to 94·9)

*p<0·001 are only provided for the overall comparison. †These values differ slightly but appear similar because of rounding. ‡Based on combining current and former smokers *vs* never smokers, top two tertiles *vs* lowest tertile for abdominal obesity, and top four quintiles *vs* lowest quintile for ApoB/ApoA1 ratio. If, however, extreme exposures (current *vs* never, top *vs* lowest tertile for abdominal obesity, and top *vs* lowest quintile for ApoB/ApoA1 ratio) were included, the odds ratios for all risk factors for the young group increases to 756·0 and in the old group to 160·8. §Unstable estimate, should be interpreted cautiously.

***Table 5:* Importance of risk factors in young and old individuals**

urban) have lipid abnormalities, which increase the risk of myocardial infarction. Since ApoB/ApoA1 ratio was the most important risk factor in all geographic regions in our study, a substantial modification of its population distribution is important for worldwide reduction of myocardial infarction. This act will probably need a concerted effort, including both population-based strategies to shift the distribution and treatments targeted at people with the greatest abnormalities.

Region	n	Control (%)	Case (%)	Odds ratio (99% CI)	PAR (99% CI)
Overall	26 527	47·9	65·6	2·27 (2·11–2·44)	36·4% (33·9–39·0)
W Eur	1403	55·0	73·3	1·96 (1·47–2·62)	29·3% (17·8–44·1)
CE Eur	3624	54·2	69·8	1·92 (1·60–2·30)	30·2% (23·0–38·6)
MEC	3301	45·4	64·5	2·64 (2·19–3·19)	45·5% (39·3–51·9)
Afr	1339	53·8	70·1	2·18 (1·60–2·96)	38·9% (27·1–52·2)
S Asia	3706	41·0	60·3	2·43 (2·03–2·89)	37·4% (31·6–43·6)
China/HK	6062	42·7	62·2	2·30 (2·00–2·65)	35·9% (31·5–40·5)
SE Asia	2131	57·1	70·5	1·96 (1·54–2·49)	36·0% (25·9–47·5)
ANZ	1267	54·2	77·4	2·80 (2·03–3·86)	44·8% (33·0–57·2)
S Am	3068	48·9	69·4	2·35 (1·92–2·87)	38·3% (31·0–46·1)
N Am	626	64·6	76·8	1·82 (1·14–2·88)	26·1% (8·8–56·5)

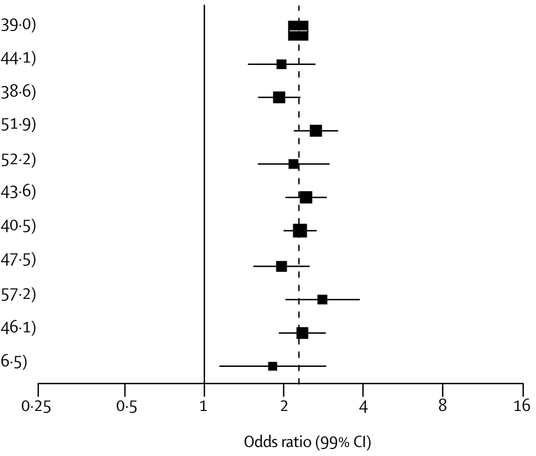


***Figure 5:* Risk of acute myocardial infarction associated with current or former smoking, overall and by region after adjustment for age and sex**
W Eur=western Europe. CE Eur=central and eastern Europe. MEC=Middle East Crescent. Afr=Africa. S=South. HK=Hong Kong. SE=southeast. ANZ=Australia and New Zealand. N=North. Am=America.

Region	n	Control (%)	Case (%)	Odds ratio (99% CI)	PAR (99% CI)
Overall	21 408	20·0	33·5	3·87 (3·39–4·42)	54·1% (49·6–58·6)
W Eur	1047	13·8	29·4	3·76 (2·10–6·74)	44·6% (23·5–67·8)
CE Eur	2618	20·3	29·4	2·20 (1·52–3·18)	35·0% (19·2–54·9)
MEC	3291	29·9	49·6	5·33 (3·48–8·18)	70·5% (57·8–80·7)
Afr	1037	18·0	39·0	7·93 (4·32–14·58)	74·1% (59·7–84·6)
S Asia	2820	27·7	42·7	3·81 (2·49–5·83)	58·7% (42·7–73·1)
China/HK	5400	7·3	14·3	3·43 (2·61–4·51)	43·8% (36·7–51·2)
SE Asia	1858	22·7	48·0	6·22 (3·71–10·41)	67·7% (52·0–80·2)
ANZ	487	13·8	26·8	3·97 (1·71–9·22)	43·4% (16·0–75·6)
S Am	2644	27·1	40·6	2·79 (1·85–4·23)	47·6% (29·6–66·2)
N Am	206	12·4	28·8	4·75 (1·34–16·86)	50·5% (18·2–82·4)

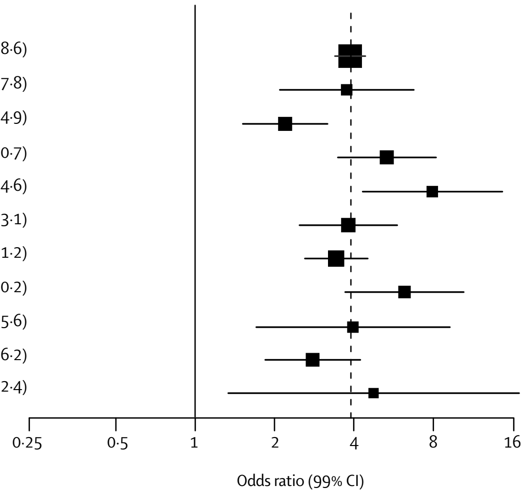


Figure 6: **Risk of acute myocardial infarction associated with ApoB/ApoA1 ratio (top *vs* lowest quintile), overall and by region after adjustment for age, sex, and smoking**
PAR is for the top four quintiles versus the lowest quintile.

Our data show that risks associated with the major risk factors (odds ratio of about 2 or greater on univariate analyses, such as smoking, abnormal lipids, psychosocial factors, hypertension, diabetes, and abdominal obesity) were consistently adverse in all regions of the world and in all ethnic groups. In particular, the odds ratios for these risk factors were qualitatively similar (although some quantitative differences were apparent), despite variations in prevalence for every risk factor in controls derived from different subpopulations. However, as expected, the PAR is affected both by the prevalence of the risk factor and the odds ratio. We are unaware of any other large study that has assessed whether risk factors have a similar or differing effect in many ethnic groups.

Our finding that most risk factors have directionally similar odds ratios in ethnic groups and countries differs from inferences reached by comparison of results of different studies, which used other methods.[3,4] Some of these researchers suggested that the effects of the major risk factors could vary qualitatively in different regions and ethnic groups, possibly because of inconsistent methodologies, differences in criteria used to recruit participants, variations in information obtained, and a fairly modest number of events in each study, thereby leading to imprecise estimates of risk that could have been exaggerated or diluted by the play of chance. Since we had more than 800 cases of acute myocardial infarction within every major ethnic group (other than black or coloured Africans), our results within most

Region	n	Control (%)	Case (%)	Odds ratio (99% CI)	PAR (99% CI)
Overall	26 916	22·3	38·6	2·48 (2·30–2·68)	23·4% (21·7–25·1)
W Eur	1425	16·4	33·0	2·22 (1·62–3·05)	21·9% (15·6–30·0)
CE Eur	3636	32·7	46·0	2·11 (1·76–2·53)	24·5% (19·2–30·6)
MEC	3404	20·2	25·9	1·84 (1·45–2·33)	9·2% (5·7–14·4)
Afr	1355	21·6	43·4	3·34 (2·40–4·65)	29·6% (22·8–37·3)
S Asia	3881	13·8	31·1	2·89 (2·31–3·60)	19·3% (15·7–23·4)
China/HK	6075	21·1	37·3	2·41 (2·06–2·80)	22·1% (18·7–26·0)
SE Asia	2141	15·3	46·8	5·63 (4·26–7·45)	38·4% (33·3–43·6)
ANZ	1269	22·0	37·8	1·94 (1·40–2·68)	22·6% (15·6–31·6)
S Am	3100	27·7	49·3	2·48 (2·03–3·04)	32·7% (27·2–38·8)
N Am	630	28·6	38·8	1·58(1·01–2·47)	19·0% (9·2–35·2)

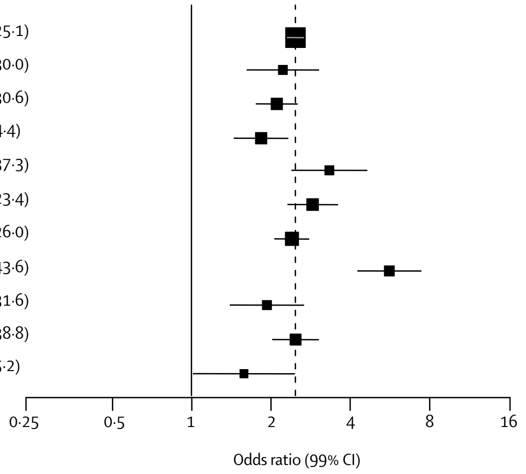


Figure 7: **Risk of acute myocardial infarction associated with self-reported hypertension, overall and by region after adjustment for age, sex, and smoking**

Region	n	Control (%)	Case (%)	Odds ratio (99% CI)	PAR (99% CI)
Overall	26903	7·6	18·3	3·08 (2·77–3·42)	12·3% (11·2–13·5)
W Eur	1422	4·2	17·7	4·29 (2·61–7·05)	15·0% (11·0–20·1)
CE Eur	3636	6·8	13·8	2·61 (1·95–3·49)	9·1% (6·6–12·4)
MEC	3401	11·6	25·1	2·92 (2·26–3·79)	15·5% (12·2–19·4)
Afr	1355	8·0	25·0	3·69 (2·38–5·73)	16·7% (11·8–23·1)
S Asia	3882	10·6	21·4	2·48 (1·93–3·18)	11·8% (8·9–15·5)
China/HK	6075	2·9	11·6	5·07 (3·72–6·90)	10·0% (8·3–11·9)
SE Asia	2140	9·2	27·4	4·19 (3·01–5·83)	21·0% (16·8–25·9)
ANZ	1269	4·8	11·8	2·37 (1·34–4·19)	7·2% (3·9–12·8)
S Am	3093	9·0	20·2	2·45 (1·86–3·24)	12·7% (9·4–17·0)
N Am	630	9·7	16·6	1·75 (0·94–3·29)	8·0% (2·9–20·1)

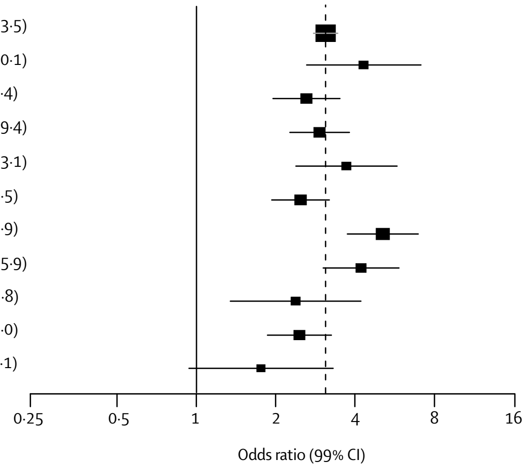


Figure 8: **Risk of acute myocardial infarction associated with self-reported diabetes, overall and by region after adjusting for age, sex, and smoking**

ethnic groups are statistically robust. The number of cases of myocardial infarction in this study within every region or ethnic group is larger than in most previous studies, especially in those of non-European origin.

The prevalence of several risk factors varied substantially, especially when subdivided by sex. For example, smoking in female controls worldwide has a prevalence of only 9·25% compared with 33% in male controls. As a result, despite similar odds ratios in women and men, the PAR attributable to smoking varied greatly (16% in women and 44% in men). These data suggest that the overall approach to prevention of coronary heart disease could be similar worldwide, but with varying emphasis in different subgroups (eg, sex and geographic region) on the basis of the prevalence of individual risk factors and economic and cultural factors. The above data also suggest that smoking cessation is very important in most male populations worldwide and in women in North and South America, western Europe, and Australia and New Zealand. By contrast, quitting smoking is currently less important for reducing acute myocardial infarction in women in most other geographic regions. However, if women in these countries start smoking they are likely to have a

Region	n	Control (%)	Case(%)	Odds ratio (99% CI)	PAR (99% CI)
Overall	26136	34·2	47·2	2·24 (2·06–2·45)	33·7% (30·2–37·4)
W Eur	1306	34·1	62·5	4·50 (2·98–6·78)	63·4% (51·3–74·1)
CE Eur	3538	41·0	49·3	1·74 (1·39–2·17)	28·0% (18·3–40·3)
MEC	3309	45·1	58·2	1·85 (1·43–2·41)	25·9% (13·7–43·5)
Afr	1265	38·8	61·1	3·75 (2·44–5·74)	58·4% (44·1–71·3)
S Asia	3821	31·2	44·2	2·43 (1·93–3·06)	37·7% (28·8–47·4)
China/HK	6018	21·1	25·3	1·32 (1·11–1·58)	5·5% (1·4–19·4)
SE Asia	2101	21·1	44·4	5·71 (4·13–7·89)	57·9% (49·1–66·2)
ANZ	1224	39·2	63·8	4·40 (2·82–6·88)	61·3% (45·6–74·9)
S Am	2959	48·6	64·8	2·41 (1·79–3·25)	45·5% (32·3–59·2)
N Am	595	31·3	63·7	4·68 (2·57–8·50)	59·5% (40·3–76·2)

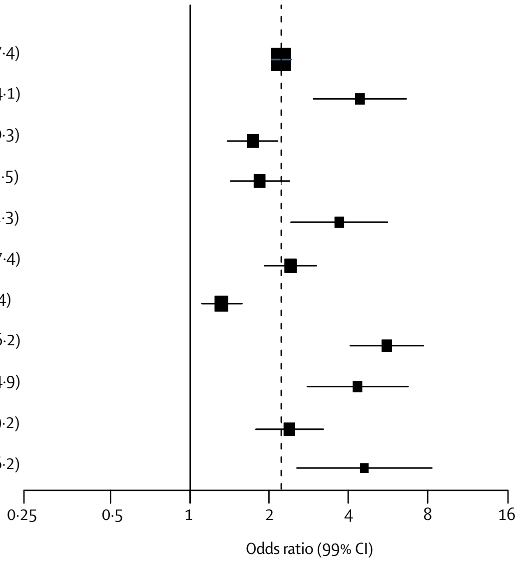


Figure 9: **Risk of acute myocardial infarction associated with abdominal obesity measured as waist/hip ratio (upper tertile *vs* lowest tertile), overall and by region after adjusting for age, sex, and smoking**
PARs are for top two tertiles *vs* lowest tertile.

Region	n	Odds ratio (99%CI)	PAR (99% CI)
Overall	24767	2·51 (2·15–2·93)	28·8% (22·6–35·8)
W Eur	1375	3·92 (1·95–7·91)	38·9% (20·2–61·5)
CE Eur	3473	1·14 (0·73–1·78)	4·9% (0·0–96·0)
MEC	2892	2·77 (1·78–4·29)	41·6% (25·2–60·1)
Africa	1259	3·17 (1·59–6·33)	40·0% (17·3–67·9)
S Asia	3300	2·15 (1·45–3·17)	15·9% (4·0–46·3)
China/HK	5894	6·00 (4·05–8·89)	35·4% (24·6–47·9)
SE Asia	1921	1·85 (1·02–3·37)	26·7% (17·8–38·1)
ANZ	1255	1·99 (1·02–3·87)	28·9% (10·0–59·7)
S Am	2783	2·08 (1·29–3·36)	35·6% (17·2–59·5)
N Am	615	4·16 (1·50–11·53)	51·4% (24·0–78·0)

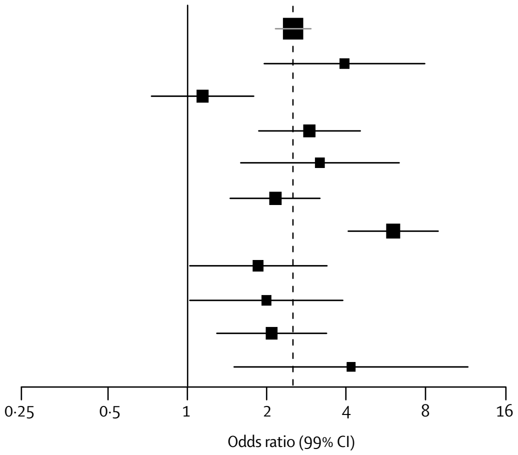


Figure 10: **Risk of acute myocardial infarction associated with the composite psychosocial index, overall and by region**

substantial increase in rates of acute myocardial infarction attributable to smoking.

Hypertension and diabetes were associated with a greater odds ratio and PAR in women compared with men, but women with these factors were about a decade older than men. Further, the protective effects of exercise and alcohol consumption also seemed greater in women than in men. While the amplified effect of diabetes in women has been reported before,[18] we are not aware of similar data about the other three factors. Thus, even though significant interactions were noted between these risk factors and sex for the odds of myocardial infarction, it would be prudent to seek independent confirmation.

Known risk factors (generally smoking, hypertension, raised lipids, and diabetes) have sometimes been claimed to account for only about half the risk of a myocardial infarction. The origins of this claim are unclear.[19] Our analysis, which is based on traditional and some newly described risk factors, suggests that more than 90% of the risk of an acute myocardial infarction in a population can be predicted by the risk factors included in our study. Findings of several previous studies—in which fewer risk factors were measured (most large studies have not included apolipoproteins, psychosocial factors or abdominal obesity)—lend support to our observations. Stamler and colleagues[20] studied five US cohorts and categorised individuals on the basis of the presence of five factors (abnormal electrocardiogram, diabetes, smoking, cholesterol, and blood pressure). Those without any of these risk factors were judged to be in the low-risk category and had an 80–90% lower risk of coronary heart disease in every cohort compared with the rest of the population. Similar results were also reported in an analysis of the Göteborg population, in which individuals with low blood pressure and a low amount of cholesterol, who were also non-smokers, had an age-adjusted relative risk of 0·09, which was much lower that for than the average population (relative risk 1·0) in the study.[21]

The importance of modifying risk factors is lent support by data from randomised trials—eg, blood-pressure lowering,[22] lipid lowering,[23] dietary modification[24]—or persuasive evidence of causality from observational studies[25] (eg, smoking cessation).[26] Some investigators have suggested that a pill that combines a statin, antihypertensive drugs, and aspirin, together with avoidance of smoking, could potentially reduce the risk of myocardial infarction by more than 80% to 90%.[27] These studies, along with INTERHEART, suggest that one of the major emphases in research should be to understand why currently known risk factors develop in some individuals and populations, and to identify approaches to prevent their development or reduce them. For example, understanding the mechanisms by which societal factors affect development of risk factors (urbanisation, food and tobacco policies, shifts in occupation from energy expending jobs to sedentary ones, and urban structure, etc) could lead to new approaches to prevent development of risk factors (primordial prevention),[4] which in turn could reduce coronary heart disease substantially.

Although the odds ratio for an acute myocardial infarction in people with a family history was about 1·5, the PAR rose from 90% with the nine potentially modifiable risk factors to 91% with the addition of family history. This finding suggests that a large part of the effect of family history might be mediated through known risk factors, which could be affected by both shared lifestyles and genetic factors rather than through independent pathways. Therefore, the main challenge in the next few decades will be a combination of discovering more effective strategies to substantially alter or prevent development of known risk factors by understanding the societal, environmental, and biological causes of the development of these factors.

One of the most important risk factors for acute myocardial infarction in our study was smoking, which accounts for about 36% of the PAR of acute myocardial infarction worldwide (and about 44% in men). Regular consumption of fruits and vegetables was associated with a 30% relative risk reduction. Thus, eating fruit and vegetables, taking exercise, and avoiding smoking could lead to about 80% lower relative risk for myocardial infarction. Our results are similar to the findings of the US Nurses Health Study,[28] which also indicated that lifestyle modification could potentially avoid more than three-quarters of the risks of coronary heart disease and strokes in women. These conclusions are also lent support by the results of the Lyon Heart Study,[24] which suggested that dietary modification by itself reduced the risk of coronary heart disease by about half in patients with coronary disease. Our data suggest that lifestyle modification is of substantial importance in both men and women, at all ages, in individuals from all geographic regions of the world, and in those belonging to all major ethnic groups. Therefore, smoking avoidance, increased consumption of fruits and vegetables, and moderate activity (along with lipid lowering) should be the cornerstone of prevention of coronary heart disease in all populations worldwide.

We also recorded an additional protective effect of moderate alcohol consumption (PAR 7%). The effect seemed to be surprisingly large in women, in whom absence of regular alcohol consumption accounted for about 22% of PAR, but with wide confidence limits (–4·9 to 60·8). This finding suggests that the best estimate of PAR attributable to alcohol consumption in women is probably closer to the overall estimate of 7%. Promotion of the consumption of moderate alcohol to prevent myocardial infarction might also not be acceptable to many populations, for cultural or religious reasons, and might increase the proportion of heavy drinkers and thereby enhance the risk of other diseases such as strokes, some cancers, cirrhosis of the liver, or injuries. The overall PAR without alcohol included in the model is 89·7%; adding alcohol increases it by less than 1% because of the substantial overlap in contributions of other risk factors. Therefore, advice about alcohol use could be best customised to individuals depending on their social, cultural, and religious backgrounds and the overall effect on their health.

Our study has several potential limitations. First, a case-control design is potentially open to confounding if there is differential ascertainment of risk factors between cases and controls. We minimised this factor by using standardised methods for data collection in both cases and controls. The inclusion of incident (first) acute myocardial infarction cases reduces the possibility that individuals with previous cardiovascular disease might have substantially altered lifestyles or risk factor levels before this event. Further, the odds ratios associated with all major risk factors—eg, smoking, lipids, diabetes, and hypertension—in INTERHEART is similar to that reported in other cohort studies in western populations. We attempted to minimise biases in the selection of controls by excluding individuals in whom the risk factors that we were interested in studying were implicated as being protective or harmful. Reanalysis of our data by the two types of controls—hospital-based and community-based—did not alter our results. Our results are qualitatively similar for most risk factors in all regions of the world, providing internal replication. Any selection biases are unlikely to have been similarly prevalent across a large number of centres in 52 countries. Therefore, we think that there is little material bias in our results because of the use of a case-control study design.

Second, whereas some of the risk factors were ascertained or measured with high accuracy (eg, smoking), others (eg, history of diabetes or hypertension) were based on history and therefore ascertained with some error. The actual blood pressure value after a myocardial infarction is potentially confounded because it might have fallen in some patients because of the infarction itself or as a result of the drugs used in the management of the acute phase. Similarly, glucose concentrations rise with acute myocardial infarction (stress hyperglycaemia) and are therefore not an indication of earlier levels. We obtained blood samples for HbA1c but these are yet to be analysed. Therefore, our approach to diagnosis of hypertension or diabetes might have led to misclassification in some individuals with respect to their risk-factor status. These misclassifications would tend to underestimate the real relation between these risk factors and outcomes. Analysis of our control group data indicates a relation between the reported prevalence of hypertension in every centre and measured blood pressure in controls (data not shown), suggesting that there is some validity in using self-reports of hypertension as a surrogate for measured blood pressure. However, the absence of available blood pressure and glucose values could have underestimated their importance.

Third, the correlations between repeated measures of several variables (eg, diet or physical activity) many months apart is only moderate. Methods to correct for measurement error and regression dilution bias for one risk factor have been described;[17] however, we are not aware of methods that adjust for several risk factors simultaneously. However, if correction for regression-dilution bias could have been made it could further increase the odds ratios for most risk factors, which in turn would increase the overall PAR accounted for by the nine risk factors that we measured. This outcome means that the nine risk factors measured in this study probably account for virtually all the PAR for myocardial infarction in the population included in this study.

Fourth, our data are based on hospital-based patients with acute myocardial infarction and matched controls (mainly from urban areas) and are therefore unlikely to reflect the population prevalence of risk factors in an entire country or region. This fact could potentially have an effect on our estimates of PAR. However, the key to ensuring internal validity of the study is to recruit cases and controls from the same population, which has been our emphasis. Therefore, our estimates of PAR should be regarded as providing reliable information about the specific population enrolled into our study. Nevertheless, when data are available from several countries (eg, for smoking), the rates in controls in INTERHEART closely match published reports for similar age-groups and sexes. As a result, our overall conclusions that the risk factors measured in this study account for most of the risk of acute myocardial infarction is probably broadly applicable. In view of the consistency of our data, the odds ratios from the present study could be applied to other populations and their PAR can then be derived by using population-specific prevalence rates of specific risk factors.

Fifth, although the effects of individual risk factors and combinations of four or five of them are reasonably robust, our estimates of the effect of all nine is model-dependent because very few individuals have eight or nine risk factors or, conversely, none. However, crude examination of the extremes of risk-factor distribution, and the fact that just five risk factors (smoking, lipids, hypertension, diabetes, and obesity) for which we have a sizeable number of individuals predicts about 80% of the PAR, suggests that our model-based estimates are reasonably valid.

Our study has several strengths. First, the case-control study has several advantages over other designs, especially a cohort study. It allows efficient enrolment of large numbers of cases and hence greater statistical power, rapid and cost-effective study conduct, and enhances the ability to recruit a large number of cases occurring at young ages, in whom disease association might be stronger. Second, our study included several risk factors that have previously not been assessed with conventional risk factors, including apolipoproteins (ApoB/A1 ratio), which might be the best marker of the balance of atherogenic and antiatherogenic particles,[10] psychosocial factors,[7] and measures of abdominal obesity, all of which have added substantial information to the other commonly studied risk factors. Third, the large size of the study provides high power and precision in estimates both overall and in subgroups. Fourth, the inclusion of large numbers of individuals from all regions of the world and multiple ethnic groups makes our study results broadly applicable.

In conclusion, our study has shown that nine easily measured risk factors are associated with more than 90% of the risk of an acute myocardial infarction in this large global case-control study. These results are consistent across all geographic regions and ethnic groups of the world, men and women, and young and old. Although priorities can differ between geographic regions because of variations in prevalence of risk factors and disease and economic circumstances, our results suggest that approaches to prevention of coronary artery disease can be based on similar principles throughout the world. Therefore, modification of currently known risk factors has the potential to prevent most premature cases of myocardial infarction worldwide.

Contributors

S Yusuf initiated the INTERHEART study, supervised its conduct and data analysis and had primary responsibility for writing this paper. S Ôunpuu coordinated the worldwide study and reviewed and commented on drafts. S Hawken did all data analyses and reviewed and commented on drafts. All other authors coordinated the study in their respective countries and provided comments on drafts of the manuscript.

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Conflict of interest statement

We declare that we have no conflict of interest.

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Research Article

Effectiveness of advance directives for the care of terminally ill patients in Chiang Mai University Hospital, Thailand

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Abstract The key hypothesis behind advance directives (ADs) proposes that, if an intervention enhances a person's right to choose, a dying person will not opt for expensive, life-prolonging medical care and an ethically acceptable saving of resources will result. In order to assess the acceptability and effectiveness of ADs in reducing cardiopulmonary resuscitation (CPR) attempts and in-hospital death among terminally ill patients in a tertiary care hospital in northern Thailand, a non-randomized, controlled intervention study using an after-only unequivalent control group design was conducted. The majority of the subjects and the surrogates preferred to employ ADs in expressing their preferences on CPR and there was a high level of agreement between the subjects and surrogates on the decision. The use of ADs appeared to be effective in reducing futile CPR attempts and the in-hospital mortality rate among subjects during the index hospitalization. Advance directives were accepted well in this study setting.

Key words advance directives, cardiopulmonary resuscitation, terminal care, terminally ill patients.

INTRODUCTION

Cardiopulmonary resuscitation (CPR) is one of the most frequently performed medical interventions. This technique was originally developed to revive victims of sudden cardiac or respiratory arrest (Kowenhoven *et al.*, 1960). In many hospitals, it has been attempted on any patient who has cardiopulmonary arrest regardless of the underlying disease. Such routine application of CPR has contributed to several problems, including high mortality rates after CPR attempts (DeBard, 1981; Bedell *et al.*, 1983; McGrath, 1987; Rozenbaum & Shenkman, 1988; Peberdy *et al.*, 2003), continued physical suffering and worsening of clinical status (Bedell *et al.*, 1983), a vegetative state (Rozenbaum & Shenkman, 1988; FitzGerald *et al.*, 1997), high cost (Detsky *et al.*, 1981), and financial burden (FitzGerald *et al.*, 1997; Desbiens & Wu, 2000; Levenson *et al.*, 2000; Lynn *et al.*, 2000; Somogyi-Zalud *et al.*, 2000; Whitcomb & Blackman, 2007). The high death rate following CPR might reflect the fact that CPR is commonly performed on patients with terminal illnesses who often experience a poor outcome following CPR (Bedell *et al.*, 1983; Rozenbaum & Shenkman, 1988).

Terminally ill patients usually suffer from the deterioration of their disease processes, such as severe pain (Lynn *et al.*, 2000; Roth *et al.*, 2000; Somogyi-Zalud *et al.*, 2000), dyspnea (Desbiens & Wu, 2000; Levenson *et al.*, 2000; Lynn *et al.*, 2000), depression (Block, 2000; Levenson *et al.*, 2000; Lynn *et al.*, 2000), and confusion (Lynn *et al.*, 2000; Somogyi-Zalud *et al.*, 2000). Following successful CPR, they might go on living, but their lives could be marred by severe and sometimes intolerable suffering. The inappropriate resuscitation of patients can result in an increased cost of care with little tangible medical benefits.

Our previous study of hospital deaths in a tertiary care hospital reveals that 65.7% of terminally ill patients received CPR prior to death (Sittisombut *et al.*, 2001). The decision to perform CPR in this setting was based mainly on the physicians in charge, with minimal input obtained from patients or their relatives. Several studies indicate that most terminally ill patients prefer CPR to be limited in the face of unfavorable outcomes (Steinbrook *et al.*, 1986; Covinsky *et al.*, 2000) and an increased familiarity with CPR usually leads to a decreased desire for this maneuver (Murphy *et al.*, 1994; Desbiens & Wu, 2000; Sittisombut *et al.*, 2005). The excessive use of CPR could be reduced if terminally ill patients

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are informed well in advance and their preferences regarding the use of CPR are taken into consideration.

By providing a means for competent persons to guide their medical care after they have become incompetent, advance directives (ADs) are regarded as an effective mechanism to ensure that patients' wishes about medical treatment at the end of their life are respected (Crane *et al*., 2005). However, although ADs are widely advocated in Western countries, only a few studies dealing with the use of ADs in Asian countries have been reported (Low *et al*., 2000; Miura *et al*., 2001; Akabayashi *et al*., 2003) and ADs have not yet achieved legal recognition in this region.

Whether it is possible to engage terminally ill patients in discussing and making decisions on such profound issues as CPR and terminal care planning remains unknown in Thailand. This study was intended to determine whether ADs were acceptable to terminally ill inpatients in a tertiary care hospital in northern Thailand and to examine the effectiveness of ADs in reducing the use of CPR, as well as the associated in-hospital deaths among these patients.

METHODS

This study employed a quasi-experimental design comparing the patients allotted to the intervention group with those in the non-randomized control group. It was conducted after the research proposal received approval from the institutional review board of the Faculty of Medicine, Chiang Mai University (CMU).

Patients who were admitted to the medical wards in the CMU Hospital with at least one of the following five diagnoses, as determined by the physicians in charge, were eligible for the study: non-small cell lung cancer, stages III or IV (NSCLC), multi-organ system failure with sepsis, untraumatic and non-diabetic coma with Glasgow coma score of 3, carcinoma of the colon with liver metastasis, and end-stage liver disease (ESLD). A surrogate, a person who was most qualified to make decisions on behalf of each patient, also was recruited. Inclusion was limited to patients and/or surrogates who were at least 40 years of age, alert, oriented, able to speak Thai, and who provided written informed consent for participation in the study.

During the period from 1 April to 30 November 2001, 217 patients who were eligible to participate in the study were assigned as potential control subjects. In a subsequent period, 1 December 2001 to 31 May 2002, an additional 231 eligible patients were recruited into the intervention group. Among all the eligible patients, only 376 met the inclusion criteria. The final study sample consisted of 188 subjects in each group. Comparisons revealed no significant differences in the number of exclusions from the control group (13.4%, [95% CI: 8.8–17.9]) and the intervention group (18.6%, [95% CI: 13.6–23.6]) with respect to discharge or transfer before the interview was possible, clinical deterioration or death.

During the first of the two chronologically separated phases, the enrollment of and observations on the control group were performed. To identify potentially eligible study subjects, the investigator, two nurses, and a research assistant made rounds and reviewed all hospital admissions in each of the medical wards from Monday to Friday of the business week. For admissions during the weekend and holidays, the patient records were searched in the same manner on the following business day. For those considered eligible, the team introduced themselves to the patient and/or surrogate, explained the objective of the study, and invited them to participate in the study. The demographic and clinical data were gathered from the medical records and at the initial interview for the consenting subjects. The three outcomes (CPR/do not resuscitate [DNR] event, hospital discharge, and death in hospital) were observed and recorded on a daily basis.

In the second phase, the patients eligible for the study were identified and enrolled as subjects in the intervention group in the same manner as in the first phase. The only difference between the control group and the intervention group was the administration of the AD intervention prior to the observation in the latter. A tool for the AD intervention was developed, based on the relevant literature that reflected the objectives of the study, and it was validated by six experts. To adapt the tool to the culture and beliefs of the subjects, input from 10 terminally ill patients was sought by face-to-face discussion with the patients. Following the appropriate adaptation, the same six experts were invited to review, comment, and provide additional suggestions. Their comments and suggestions were used in the final adjustment of the tool. The inter-rater reliability of the tool after improvement was 8.5, as assessed by using Cohen's kappa method.

In the implementation of ADs, nurses interacted with patients and their surrogates in a step-by-step manner. They: (i) provided assurance to patients regarding their authority and autonomy; (ii) encouraged patients and their surrogates to seek information on diagnosis and prognosis from the attending physicians; (iii) provided information on CPR and its associated outcomes; (iv) assessed the patients' perception of authority and autonomy, diseases, prognosis, and CPR and its outcomes for their specific illnesses; (v) provided psychological support to patients and their families during the entire study period; and (vi) assessed the patients' preference for CPR. The surrogates also were asked whether they wished to have CPR performed on the respective patients and their choices on behalf of the patients were recorded. In order to obtain independent data from the patients and their surrogates, the interviews were performed separately for each patient and surrogate. In every step of the implementation of ADs, adequate time was allowed for discussion, clarification, and questions. Otherwise, an appointment for a return visit was made. The nature and timing of the visits depended on the wishes of the patients.

Ethical considerations

The implementation of ADs was a sensitive issue as psychological trauma might occur in terminally patients in the intervention group. This problem was alleviated by providing a comprehensive approach and psychological support to the subjects and their families prior to enrollment. Participation was entirely voluntary and was sought only after patients and/or surrogates were given relevant information in at least one session. Each potential subject and/or surrogate was approached and the research assistant explained the purpose of the study and obtained written consent. Only research assistants with adequate basic knowledge in research, counseling skills, and experience in caring for patients with terminal illness were selected for the study. They were trained in the implementation of ADs at the beginning of the study and then regularly supervised throughout the study. In addition, the study was approved by the institutional review board of the study hospital.

Statistical analysis

The baseline demographic and clinical characteristics of the patient groups were determined using descriptive statistics. The differences between the control group and the intervention group were tested by using *t*-tests for the continuous variables and χ^2 tests for the categorical variables. The Mantel-Haenszel (MH) χ^2 or covariate analyses were performed to test the homogeneity for any significant difference observed.

RESULTS

Baseline demographic and clinical characteristics

The majority of the subjects were married males who lived in a rural area with limited formal education and irregular income, while NSCLC and ESLD represented the two most common diagnoses, accounting for 93.3% of these patients. Comparisons of the demographic characteristics and selected clinical parameters revealed that, with two exceptions, there were no significant differences between the intervention group and the control group (Tables 1,2). The clinical parameters that differentiated between the two groups were the proportions of patients with ESLD and high cerebral performance categories (CPC) scores (Table 2). The proportion of patients admitted with ESLD was greater in the control group than in the intervention group (35.1% *vs* 19.1%). Similarly, the proportion of the control subjects with CPC scores of 3 and 4, representing patients with dependency regarding their daily activities, was almost double that in the intervention group (57.4%, [95% CI: 50.4–64.5] *vs* 31.4% [95% CI: 24.7–38.0]). Apparently, the control subjects were in relatively poorer clinical conditions than the intervention subjects. However, when the MH χ^2 test was employed to assess the distribution of patients based on the proportion of patients with ESLD and high CPC scores, the result showed that there was homogeneity of the study subjects.

Outcomes of the advance directives implementation

When the ADs were implemented for 188 subjects allocated to the intervention group, it was possible to identify only 132 (70.2%) surrogates willing to participate in the study. Among these subject–surrogate pairs, 80 (60.6%) chose to employ ADs, whereas 17 (12.9%) did not (Table 3). There was an agreement between the patients and their surrogates on the decision concerning the use of ADs in 73.5% of the pairs (Table 3). Notably, the patients and their surrogates were generally hesitant to sign an AD document, preferring instead to have their directives communicated orally to one another.

Table 1 Demographic characteristics

Parameter	Total (*n* = 376) N (%)	Control group (*n* = 188) N (%)	Intervention group (*n* = 188) N (%)
Gender			
Male	243 (64.6)	123 (65.4)	120 (63.8)
Female	133 (35.4)	65 (34.6)	68 (36.2)
Age (years)			
Mean (SD)	57.5 (11)	57.0 (10)	58.0 (12)
Range	40–96	40–85	40–96
40–49	103 (27.4)	52 (27.7)	51 (27.1)
50–59	103 (27.4)	55 (29.3)	48 (25.5)
≥ 60	170 (45.2)	81 (43.0)	89 (47.4)
Marital status			
Married	312 (83.0)	156 (83.0)	156 (83.0)
Single	15 (4.0)	9 (4.8)	6 (3.2)
Widowed	49 (13.0)	23 (12.2)	26 (13.8)
Education			
≥ Grade 9	107 (28.5)	64 (34.0)	43 (22.9)
≤ Grades 4–6	254 (67.5)	124 (66.0)	130 (69.1)
No formal education	15 (4.0)	–	15 (8.0)
Income			
Regular income	79 (21.0)	46 (24.5)	33 (17.6)
Irregular income	179 (47.6)	84 (44.7)	95 (50.5)
No income	118 (31.4)	58 (30.9)	60 (31.9)
Residence			
Urban	99 (26.3)	53 (28.2)	46 (24.5)
Rural	277 (73.7)	135 (71.8)	142 (75.5)
Religion			
Buddhist	370 (98.4)	185 (98.4)	185 (98.4)
Others	6 (1.6)	3 (1.6)	3 (1.6)

During the index hospitalization, 33 subjects (8.8%) underwent CPR attempts, whereas 342 subjects (90.9%) were hospitalized without CPR. Only one subject gave a DNR order (Table 4). Of the 33 subjects who received CPR, 24 (12.8% [95% CI: 8.0–17.5]) were in the control group and nine (4.8% [95% CI: 1.7–7.9]) were in the intervention group (Table 4).

Of the 376 subjects, 315 (83.8%) left the study hospital alive and 61 (16.2%) died in the hospital (Table 5). Among the latter, 44 (23.4% [95% CI: 17.4–29.5]) were in the control group and 17 (9.0% [95% CI: 4.9–13.1]) were in the intervention group.

DISCUSSION

This study was designed to assess the acceptability and effectiveness of ADs for terminally ill patients in a tertiary care, teaching hospital in northern Thailand. The patients in the control group and the intervention group were separately enrolled in two phases of different duration. The disparity reflects a major organizational change in the Thai public

Table 2 Clinical characteristics

Parameter	Total (*n* = 376) N (%)	Control group (*n* = 188) N (%)	Intervention group (*n* = 188) N (%)
Diagnosis			
NSCLC	249 (66.2)	118 (62.8)	131 (69.7)
ESLD	102 (27.1)	66 (35.1)	36 (19.1)
Others	25 (6.7)	4 (2.1)	21 (11.2)
MOSFS	7 (1.9)	–	7 (3.7)
Coma	10 (2.7)	1 (0.5)	9 (4.8)
Ca colon	8 (2.1)	3 (1.6)	5 (2.7)
Presence of comorbidity	121 (32.2)	63 (33.5)	58 (30.9)
CPC score: independent	209 (55.6)	80 (42.6)	129 (68.6)
CPC 1	113 (30.1)	41 (21.8)	72 (38.3)
CPC 2	96 (25.5)	39 (20.8)	57 (30.3)
CPC score: dependent	167 (44.4)	108 (57.4)	59 (31.4)
CPC 3	150 (39.9)	104 (55.3)	46 (24.5)
CPC 4	17 (4.5)	4 (2.1)	13 (6.9)
Mental status			
Oriented	342 (91.0)	171 (91.0)	171 (91.0)
Not oriented	34 (9.0)	17 (9.0)	17 (9.0)
Confused	17 (4.5)	13 (6.9)	4 (2.1)
Coma	17 (4.5)	4 (2.1)	13 (6.9)

CA colon, cancer of the colon with metastases to the liver; CPC, cerebral performance categories; ESLD, end-stage liver disease; MOSFS, multiple organ system failure with sepsis; NSCLC, stages III and IV non-small cell lung cancer.

Table 3 Agreement on the employment of advance directives (ADs) between patients and surrogates

	Surrogate Yes AD N (%)	No AD N (%)	Total N (%)
Patient			
Yes AD	80 (60.6)	13 (9.8)	93 (70.5)
No AD	22 (16.7)	17 (12.9)	39 (29.5)
Total	102 (77.3)	30 (22.7)	132 (100.0)

Table 4 Cardiopulmonary resuscitation (CPR) attempts

Event	Total (*n* = 376) N (%)	Control group (*n* = 188) N (%)	Intervention group (*n* = 188) N (%)
CPR performed	33 (8.8)	24 (12.8)	9 (4.8)
CPR not performed	342 (90.9)	164 (87.2)	178 (94.7)
DNR order	1 (0.3)	–	1 (0.5)

DNR, do not resuscitate.

Table 5 In-hospital mortality and outcome

Outcome	Total (*n* = 376) N (%)	Control group (*n* = 188) N (%)	Intervention group (*n* = 188) N (%)
Dead	61 (16.2)	44 (23.4)	17 (9.0)
Alive	315 (83.8)	144 (76.6)	171 (91.0)
Discharge	256 (68.1)	109 (58.0)	147 (78.2)
Self-discharge	51 (13.5)	32 (17.0)	19 (10.1)
Transfer	8 (2.2)	3 (1.6)	5 (2.7)

health system, which occurred during the first phase of the study. Patients had to pay all costs of medical care before and at the beginning of this study. However, starting in June 2001, the Ministry of Public Health stipulated that patients had to pay only 30 Bahts per hospital visit (Health System Reform Office, 2000). This benefit applied only when patients were treated in specifically designated, primary health care facilities. Based on the size of the registered population, the primary health care facility was allocated a fixed budget to cover expenses for the care of patients in their setting and for all costs after referral. This policy adversely affected recruitment in that, during the early period of this policy, the primary facility was reluctant to refer patients, especially those with terminal illnesses, as it could consume large amounts of the budget. During the first 3 months of the implementation of the policy, the number of admissions of terminally ill patients in the study hospital, mostly from referral, decreased from about 25–30 subjects per month to = 20 per month. There was, however, a "rebound" in the subsequent period. The fluctuation in the admission of potential subjects necessitated the adjustment of the recruitment time, especially in the first phase, so that an adequate number of patients could be enrolled.

When the subjects in the intervention group in this study were provided with relevant information and the choice of using ADs to express their wishes, the majority of them decided in favor of using ADs to express their preference on CPR. This finding contrasts with the observation that higher education and socioeconomic status are associated with higher rates of AD completion in the USA (Braun *et al.*, 2001), as most of our subjects had relatively low socioeconomic status and minimal formal education. The high level of acceptability of ADs detected in this study might reflect the method of implementation of ADs and a high regard for the health profession, especially the personnel who provide services in the tertiary care facilities, by people of northern Thai culture, or both. In a previous study, 20 housebound elderly people with restricted formal education were resistant to planning in advance for the hypothetical future when they were interviewed in only one session that took up to 2 h to complete (Carrese *et al.*, 2002). An element in the successful implementation of ADs in our study might lie in the method of intervention, in which empathetic nurses conducted multiple interviews that were paced according to the perception and emotional status of the patients.

An important finding in this study is the observation that patients and their surrogates were only willing to express their preference on CPR by engaging in verbal discussion, not by signing a document. Our finding is similar to that of Gamble *et al.* (1991), who found that no elder person had signed the living will document. Other studies reported only 4–47% of patients with a completed living will document (Sugarman *et al.*, 1992; Miles *et al.*, 1996; Kerridge *et al.*, 1998; Heiman *et al.*, 2004). It has been suggested that a possible explanation for the low rates of AD use by older people is that they trust their families to make decisions for them (Puchalski *et al.*, 2000). In the absence of a written document, an informal expression of a person's need might help reduce the difficulties when the family decides to make a substitute judgment. Proper management of this issue will be crucial in the large-scale implementation of ADs in the future.

The lower CPR and in-hospital mortality rates detected in the intervention group in this study might not entirely reflect the effectiveness of AD implementation. Other factors, including the discrepancy of the CPC score and the proportion of ESLD between the two groups, might have contributed to the differences. It is likely that the discrepancy between the physician's decision and the patient's preference could modify the outcomes that we measured, especially on the CPR attempts. Although most patients who died in a previous study did not want aggressive care, 63% still received life-sustaining treatment (Somogyi-Zalud *et al.*, 2002). However, it should be noted that, despite the major changes in the Thai public health system, the policy toward CPR in terminally ill medical patients remained unchanged in the study hospital throughout the two phases of the study. As a result of this consistency in the hospital policy, the possible influence of the variations in timing and interval of the two enrollment periods on the outcomes would be minimal.

Limitations

The study was performed in two chronologically separated phases without randomization. Only terminally ill patients in a tertiary care, teaching hospital were studied. The preference for AD use in other groups might be different and it would be important to extend the study to unhospitalized subjects of other age groups. Also, it would be necessary to examine whether the implementation of ADs is possible and effective in other settings.

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Research Article

Attitudes toward advance directives and the impact of prognostic information on the preference for cardiopulmonary resuscitation in medical inpatients in Chiang Mai University Hospital, Thailand

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Abstract Our previous study revealed that cardiopulmonary resuscitation (CPR) was performed in 65.7% of 411 terminally ill patients who died in a tertiary-care university hospital in northern Thailand. Advance directives (ADs) are needed to ensure that life-sustaining therapies are used more appropriately. To investigate inpatients' attitudes regarding ADs for CPR and the impact of providing prognostic information on treatment preferences for CPR, we interviewed a randomly selected group of 200 ambulatory medical inpatients in multiple sessions. The results showed that most subjects had a positive attitude towards ADs for CPR. The majority preferred to have CPR when no information was provided on the chance of survival. However, this proportion decreased depending on the prognostic scenarios. Our investigation suggested that the preference of patients for CPR should be assessed individually and gradually, with adequate information given on the chance of survival.

Key words advance directives, ambulatory patients, cardiopulmonary resuscitation.

INTRODUCTION

Cardiopulmonary resuscitation (CPR) is common in hospitals in Thailand, but there have been only a few reports on the use of CPR in English-language journals (Suraseranivongse *et al*., 1998; Sittisombut *et al*., 2001) and none in Thai journals. Our previous study revealed that, of 411 terminally ill patients who died in Chiang Mai University Hospital, 65.7% received CPR prior to death, and that most patients receiving CPR had a cerebral performance category score of 3 or 4, indicating that they were in a very poor condition (Sittisombut *et al*., 2001). In order to reduce the inappropriate use of CPR, counter-balancing measures are needed to ensure that life-sustaining therapies are used more appropriately. Advance directives (ADs) are widely regarded as the best available mechanism to ensure that patients' wishes about medical treatment at the end of life are respected (Walker *et al*., 1995; Roter *et al*., 2000). The ADs provide a means for competent persons to guide their medical care after they have become incompetent (Emanuel & Emanuel, 1989; Daly & Sobal, 1992). Although ADs has been widely advocated in western countries (Danis *et al*., 1991; Emanuel *et al*., 1991; Molloy & Guyatt, 1991; Schneiderman *et al*., 1992b), only two studies dealing with ADs were reported from Asian countries, including Singapore and Japan (Low *et al*., 2000; Miura *et al*., 2001), and none from Thailand, as ADs have not yet achieved legal recognition in these Asian countries.

Previous studies indicated that most patients with ADs prefer to limit care (Schneiderman *et al*., 1992a; Weeks *et al*., 1994; Covinsky *et al*., 2000). However, High (1987) noted that discussions of the end-of-life care frequently occurred too late, after the person has

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been incapacitated. Therefore, it might be useful if patients could be counseled to plan and express their preferences in advance during a regular admission. By so doing, patient autonomy could be better assured and unnecessary care might be limited. However, such a study has not been tried in Thailand and, specifically, in the northern Thai culture. Whether it would be socially and culturally acceptable to ask patients to discuss so profound an issue as CPR and terminal care-planning remains unknown.

A wide variation in survival following in-hospital CPR episodes has been observed (Cummins *et al.*, 1997). Despite advances in CPR technology, the percentage of patients who are successfully resuscitated in the hospital setting has remained low (7–24%) during the past 30 years in Western countries (DeBard, 1981; Bedell *et al.*, 1983; McGrath, 1987; Woog & Torzillo, 1987; Rozenbaum & Shenkman, 1988; George *et al.*, 1989; Roberts *et al.*, 1990; Berger & Kelley, 1994). For some patient groups, survival can be < 5% or close to zero, depending on the type and severity of their diseases (Bedell *et al.*, 1983; Rozenbaum & Shenkman, 1988; Taffet *et al.*, 1988; George *et al.*, 1989; Moss, 1989; Peterson *et al.*, 1991). Pre-arrest clinical conditions, advanced age (McGrath, 1987; Taffet *et al.*, 1988; George *et al.*, 1989), and CPR that was performed in general hospital wards (Hershey & Fisher, 1982; George *et al.*, 1989) are associated with a poor prognosis. Moreover, the time delay before resuscitation, the quality of CPR efforts, and the duration of the CPR episode all contribute to the initial survival and the discharge survival (Bedell *et al.*, 1983; Woog & Torzillo, 1987; Rozenbaum & Shenkman, 1988).

Among several outcomes of CPR attempts, failure resulting in death is, by necessity, an acceptable risk. Other outcomes include a permanent vegetative state (Rozenbaum & Shenkman, 1988; FitzGerald *et al.*, 1997), and the worsening of clinical status (Detsky *et al.*, 1981; Bedell *et al.*, 1983; FitzGerald *et al.*, 1997). In a study by FitzGerald *et al.* (1997), it was found that almost half (44% of 162 cases) of patients who survived CPR were actually living with a worse level of functioning and were profoundly disabled. Many of the resuscitation efforts are followed by the use of mechanical ventilation and/or admission into an intensive care facility, both of which are quite costly (Detsky *et al.*, 1981).

Our goal was to assess the attitudes of Thai ambulatory patients in general medical wards toward ADs for CPR. We also studied the preferences of this population regarding CPR after providing information on different prognostic scenarios. The results of this study will guide our next step in ADs intervention in terminally ill patients.

METHODS

After the proposal was approved by the Institutional Review Board of the Faculty of Medicine, Chiang Mai University, an acceptability study of ADs for CPR was conducted. This study was a part of the research project on the use of ADs for the care of terminally ill patients in Chiang Mai University Hospital in northern Thailand. The hospital is a government teaching facility, serving as the tertiary-care hospital for the northern provinces of Thailand. Routine admission is allowed from Monday to Friday (08.00 hours–04.00 hours); only emergency and/or seriously ill patients are admitted during unofficial times (16.00 hours–08.00 hours) and on weekends.

Patients who were admitted to all adult medical wards (three female and four male wards) from 1 November 2000 – 31 December 2000 and who met the inclusion criteria were randomly selected (generally 4–6 cases/day, depending on the number of admissions). Those who were ≥ 18 years of age, alert, orientated, able to communicate in Thai, and who agreed to participate by giving informed consent were eligible for the study. When a selected patient's consent could not be obtained, another eligible patient in the same ward was randomly selected. Patients with one or more of the following diagnoses were excluded: non-small cell lung cancer (stages III or IV), non-traumatic and non-diabetic coma, multi-organ system failure with sepsis, carcinoma of the colon with metastasis to the liver, end-stage liver disease, exacerbation of congestive heart failure, exacerbation of chronic obstructive pulmonary disease, and acute respiratory failure. This was because they might need a more specific approach. Similarly, patients with HIV infection or AIDS were excluded. Two-hundred patients were invited to participate in the study. Consent could not be obtained from three patients and replacements were selected accordingly. All subjects were interviewed in person by trained interviewers using a structured questionnaire.

The questionnaire was developed based on related literature that reflected the objective of the study. The questionnaire was then validated by five experts and pretested with 10 patients who had similar characteristics to our study subjects. The questionnaire inquired about the participants' gender, age, marital status, religion, education, personal income, and usual place of residence (rural/urban). After explaining the CPR procedure, the patients were asked about their preferences with respect to CPR in different prognostic scenarios associated with varied post-CPR survival. The scenarios for assessing CPR preferences were as follows: (i) without any information regarding the chance of survival; (ii) with the chance of discharge of 7–24% (as in acute-onset diseases); (iii) with the chance of survival of 0–5% (as in some specific diseases); and (iv) CPR followed by living permanently on mechanical ventilation and/or coma. The responses to these questions were either "yes CPR", "no CPR", "up to physician", or "up to relative". Finally, patients were asked to express their feelings regarding the discussion of ADs for CPR.

During the reliability testing, it was found that the questionnaire should not be administered in a single interview as the patients appeared to be tense. The interviews were subsequently performed in multiple sessions. The inter-rater and intra-rater reliability, assessed using Cohen's Kappa statistic (Munro & Page, 1993), were 0.80 and 0.85, respectively. No adjustment was made in the final questions or in their sequences, other than those previously suggested by the experts.

During the data collection phase, the interviews were conducted in person by the primary investigator and three nurses who had previous research experience, were trained in the use of the structured questionnaire, and who were supervised by the primary investigator. The questionnaire was administered over at least two sessions by empathetic nurse-researchers who "paced" the interview according to when the subject seemed ready for the next group of questions.

In the first interview, the interviewers introduced themselves, explained the objective, the process of the study, and the method of selection of the subjects. After receiving signed consent, the balance of the initial interview focused on general information, including the demographic data. The next interview started again with the general topic and, then, moved forward to the participants' CPR preferences and their attitude toward advanced planning for CPR. All patients were assured that the confidentiality of their information would be respected.

In the analysis, the demographic characteristics of the patients and the responses of the interviewees were computed using descriptive statistics. Chi-squared statistics were used to test the difference (Polit & Hungler, 1999) in the demographic characteristics by gender. Patients' preference for CPR ("no CPR" vs "yes CPR" in different survival scenarios) by gender, age, marital status, income level, residential place, and type of illness were assessed using the multiple logistic regression method (Munro, 2001). The odds ratio (OR) for each variable was adjusted for possible confounding by all other variables in the table. The statistically significant level was set at $P < 0.05$.

RESULTS

Of the first 200 patients who fulfilled the inclusion criteria, 197 (98.5%) agreed to participate and only three were additionally recruited. Among the participants, 129 (64.5%) were male (which was comparable to the gender distribution in the medical inpatients of Chiang Mai University Hospital), 52.0% were ≥ 45 years, 71.0% were married, 77.5% were residents of rural areas, and 62.0% were admitted with chronic illnesses. The majority (80.0%) was poor (without regular income, with unstable income, or with yearly personal income of 33 600 Baht, equivalent to ≤ $US840), with more than half (57.5%) having no regular income (Table 1). All were Buddhists. Seventy-five percent had primary education (grades 4–6). When the demographic data were compared between male and female participants, the only statistically significant difference was that more females were in the lower income category than males (93.0% *vs* 72.9%).

Attitudes toward advance directives

Nearly all of the subjects (97.0%) thought that it was a good idea to discuss advanced planning for CPR on a routine basis for all admitted patients. All were interested in knowing the outcomes. However, our subjects expressed a distrust of formal documents and they preferred to provide oral instructions to surrogate(s) for their CPR planning.

Preferences for cardiopulmonary resuscitation

After receiving the information only on the CPR procedures, most of the subjects (87.5%) preferred to have CPR. When the chances of survival were also provided, the proportion of patients with preference for CPR decreased to 68.5% when the chance of discharge was 7–24%, and to 45.5% when the chance of survival was 0–5%. Only 27.5% of the subjects still preferred to have CPR if it was followed by living permanently on mechanical ventilation and/or in a coma.

Factors affecting preferences

Subjects' preferences for or against CPR were affected by the level of prognostic information (Table 2). Gender, age, marital status, personal income, and the type of illness also affected the preferences.

Females were more likely to prefer no CPR, as compared with males, when the prognostic information was not provided (OR = 5.37, 95% confidence interval (CI) = 1.47–19.58), when the survival chance was 0–5% with CPR (OR = 3.10, 95% CI = 1.47–6.54), and when CPR might be followed by mechanical ventilation and/or coma (OR = 7.58, 95% CI = 2.91–19.76). Gender did not affect the preference only when there was a high chance of survival.

Table 1. Demographic characteristics

Characteristic	Male ($n = 129$) N (%)	Female ($n = 71$) N (%)	Total ($n = 200$) N (%)	P*
Age (years)				0.246
< 45	58 (45.0)	38 (53.5)	96 (48.0)	
< 30	17 (13.2)	13 (18.3)	30 (15.0)	
30–44	41 (31.8)	25 (35.2)	66 (33.0)	
> 45	71 (55.0)	33 (46.5)	104 (52.0)	
≥ 60	30 (23.2)	15 (21.1)	45 (22.5)	
Marital status				0.646
Married	93 (72.1)	49 (69.0)	142 (71.0)	
Not married	36 (27.9)	22 (31.0)	58 (29.0)	
Single	24 (18.6)	13 (18.3)	37 (18.5)	
Widowed	8 (6.2)	8 (11.3)	16 (8.0)	
Divorced	4 (3.1)	1 (1.4)	5 (2.5)	
Personal income (Baht/year)				0.001**
≤ 33 600	94 (72.9)	66 (93.0)	160 (80.0)	
No regular income	62 (48.1)	53 (74.7)	115 (57.5)	
Unstable income	31 (24.0)	11 (15.5)	42 (21.0)	
≤ 33 600	1 (0.8)	2 (2.8)	3 (1.5)	
> 33 600	35 (27.1)	5 (7.0)	40 (20.0)	
33 601–60 000	17 (13.2)	2 (2.8)	19 (9.5)	
> 60 000	18 (13.9)	3 (4.2)	21 (10.5)	
Place of residence				0.730
Rural	99 (76.7)	56 (78.9)	155 (77.5)	
Urban	30 (23.3)	15 (21.1)	45 (22.5)	
Type of illness				0.756
Acute	48 (37.2)	28 (39.4)	76 (38.0)	
Chronic	81 (62.8)	43 (60.6)	124 (62.0)	

*P-value by chi-squared test with 1 degree of freedom; **$P < 0.01$.

Similar results also were observed in different age groups. Subjects who were ≥ 45 years (older adults) who were presented with the scenario in which the survival chance with CPR was 7–24% preferred no CPR four times more than the subjects who were < 45 years (younger adults) (OR = 3.96, 95% CI = 1.28–12.26). Meanwhile, when the scenario indicated that the survival chance with CPR was 0–5%, or when the scenario was that CPR might be followed by mechanical ventilation, coma, or both, older adults said they would prefer no CPR approximately two to three times more than younger adults (OR = 2.85, 95% CI = 1.33–6.12 and OR = 2.37, 95% CI = 1.02–5.50, respectively).

Subjects who were not married were more likely to decide in favor of no CPR compared to those who were married. However, the OR of preferences varied between 3.87, 3.40, and 2.34, depending on which of the following scenarios were presented: no prognostic information, a survival chance of 7–24% with CPR, and a survival chance of 0–5% with CPR, respectively.

Subjects who had a low income (≤ 33 600 Baht/year) were more likely to decide that no CPR would be their preference as compared to those who had a higher income. Increased ORs for the preference of no CPR associated with low income had been observed in two scenarios: when the survival chance was 0–5% with CPR (OR = 3.26, 95% CI = 1.01–10.56), and if CPR might be followed by mechanical ventilation, coma, or both (OR = 7.88, 95% CI = 2.65–23.47).

Finally, the OR of preferring no CPR differed between patients admitted for chronic illness and patients admitted for acute illness. A significant OR was observed only in the scenario in which CPR might be followed by mechanical ventilation, coma, or both. Subjects with a chronic illness were more likely to express a preference for no CPR as compared to those with acute illness (OR = 3.12, 95% CI = 1.40–6.98).

Deferral of decision

When the information regarding the prognosis was not provided, up to 7.7% of the male subjects decided to defer the decision, compared to none of the female subjects (Table 3). With the three prognostic circumstances, the proportion of the male subjects who deferred the decision increased to 22.5–34.1%,

Table 2. Preference for no cardiopulmonary resuscitation (CPR) by demographic variables when scenarios with different prognostic probabilities were provided

	Scenario							
	No information		Survival of 7–24%		Survival of 0–5%		CPR followed by mechanical ventilation and/or coma	
Variable	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*
Gender	5.37 (1.47–19.58)	0.011	2.11 (0.70–6.33)	0.183	3 10 (1.47–6.54)	0.003	7.58 (2.91–19.76)	< 0.001
Age	1.85 (0.57–6.05)	0.306	3.96 (1.28–12.26)	0.017	2.85 (1.33–6.12)	0.007	2.37 (1.02–5.50)	0.045
Marital status (not married/married)	3.87 (1.21–12.37)	0.022	3.40 (1.13–10.22)	0.029	2.34 (1.03–5.28)	0.042	0.75 (0.31–1.77)	0.508
Personal income	0.37 (0.08–1.80)	0.217	0.90 (0.17–4.80)	0.904	3.26 (1.01–10.56)	0.049	7 88 (2.65–23.47)	< 0.001
Place of residence (urban/rural)	1.01 (0.25–4.05)	0.988	1.05 (0.31–3.64)	0.933	1.92 (0.83–4.46)	0.129	1.21 (0.46–3.21)	0.701
Type of illness (chronic/acute)	3.44 (0.87–13.52)	0.077	1.29 (0.43–3.86)	0.652	1.49 (0.70–3.19)	0.304	3.12 (1.40–6.98)	0.006

whereas this proportion remained low in the female subjects. All male subjects chose to defer their decision to the physicians but the female subjects preferred the relatives.

DISCUSSION

This study was designed to survey ambulatory individuals who were admitted to general medical wards of a tertiary-care hospital in northern Thailand to assess their attitude toward ADS, their preferences for or against CPR, and to identify any issue(s) which needed improvement prior to the intervention study. Our results might be different from previous studies performed in more developed countries (Emanuel & Emanuel, 1989; Danis *et al.*, 1991; Emanuel *et al.*, 1991; Molloy & Guyatt, 1991; Daly & Sobal, 1992; Walker *et al.*, 1995). One of the distinguishing features of this study is the low socioeconomic status of the subjects. These patients were generally very poor; the proportion of subjects who were living in poverty was higher than the general Thai population (Tangcharoensathien *et al.*, 2000). The majority of subjects lived in rural areas and were undereducated. (Table 1)

High response rate

A very high response rate (98.5%) was obtained from patients who were approached to enrol in this study and it was quite unexpected. Previous studies reported lower rates (77%) in other group of subjects (Murphy *et al.*, 1994). Such a high response might reflect the cultural norms of rural residents of northern Thailand and the way they think about health-care workers. However, we feel that our interviewing method, in which the interviewers employed an empathetic manner and took time to ensure that the patients were comfortable with the pace of the interviews, might also have increased the confidence of the interviewees in agreeing to participate and expressing their attitude and preferences. This approach should be useful in studying similar groups of subjects in the future.

The majority of our northern Thai subjects welcomed the discussion on CPR issues. Most agreed that planning for CPR should be discussed in advance. This is in contrast to a previous study in Singapore where only 37.2% of 43 elderly Chinese agreed that making an AD would be necessary (Low *et al.*, 2000). Although our subjects expressed distrust in signing formal documents and preferred to provide only oral instructions to their surrogates, this attitude is not uncommon. In other studies in the USA, Emanuel *et al.* (1993) and Campbell and Frank (1997; p. 200) found that the pro-

Table 3. Deferral of decision regarding cardiopulmonary resuscitation (CPR) by gender

Information provided before expression of preference	Decision deferred to physicians Male N (%)	Decision deferred to physicians Female N (%)	Decision deferred to relatives Male N (%)	Decision deferred to relatives Female N (%)
None	10 (7.7)	0	0	0
Survival of 7–24%	43 (33.3)	0	0	2 (2.8)
Survival of 0–5%	44 (34.1)	0	0	2 (2.8)
CPR might be followed by the need for permanent mechanical ventilation and/or coma	29 (22.5)	0	0	3 (4.2)

Total males = 129; total females = 71.

portion of patients who had advanced care planning "in a written document" was low. Similarly, Hanson *et al*. (1994) found that only 41% of the decisions to withhold CPR from 311 incompetent patients was guided by the patients' preference. Although this practice is more acceptable to the patients, the lack of written ADs might pose practical problems for health-care workers when the actual decision for CPR has to be made in the absence of surrogates.

The proper use of ADs requires that patients have access to the necessary information and are allowed an adequate period of time to consider the alternatives. Our patients agreed that the assessment of preference concerning CPR should take place on a routine visit for every admitted patient. Another study has revealed that many ambulatory medical inpatients want to be involved in the decision-making on CPR (Gamble *et al.*, 1991). To this end, clinicians and/or other health-care workers should be encouraged to take a more active role in promoting discussions of the patient's wishes regarding end-of-life care by informing patients and their families of the patient's autonomy regarding advance medical planning. As we have found in this study, medical inpatients in our hospital settings are quite receptive to such discussion well before they become unable to participate in the decision process. The high rate of CPR performed on terminally ill patients reported earlier (Sittisombut *et al.*, 2001) indicates that the discussion on end-of-life care and/or ADs did not take place or received low priority. Further studies are needed to determine who among various health-care workers would be best responsible for this valuable work and how to motivate such personnel to initiate discussion with patients and their families.

In the absence of information regarding CPR outcomes, the majority of our subjects favored resuscitation; however, many, especially those who were poor, refused resuscitation when it would be accompanied by mechanical ventilation and/or coma. This change in preference reinforces the role of information in preference previously documented in many studies (or confirms that prognostic information had resulted in more patients' refusal of CPR). Walker *et al*. (1995) reported that only a small percentage of retired elderly desired CPR in the scenarios of terminal illness, functional impairment, and cognitive impairment. Other surveys showed that most persons opposed aggressive treatment in the persistent vegetative state (Emanuel *et al*., 1991), dementia, and terminal situations (Emanuel *et al*., 1991; Miura *et al*., 2001). Molloy and Guyatt (1991) found that 88% of 119 elderly persons in Canada requested not to even have CPR performed. The high proportion of patients with preference for CPR in the absence of prognostic scenarios in this study strongly suggests that patients have had limited access to information on the end-of-life care and the possible choices that they can make.

It is intriguing that gender strongly affects the decision and the expressed preference in our subjects. Male subjects chose to defer the decision more than their female counterparts. Moreover, all of the male subjects who decided to defer the decision after receiving each of the four prognostic scenarios preferred that their physician(s) should make the decision. In contrast, all of the females who choose to defer the CPR decision selected their family members as the decision-maker; none chose their physician(s). These results are quite contradictory to the role of the male. Generally, the man is the leader of the family in Asian societies (H. Sethabouppha, unpubl. data, 2002). For a serious medical topic, the man probably believes that if he could not make a decision, no one else in his family could do so. This may explain, in the case of non-deciding males, why the decision on CPR was delegated to the physician. The role of gender in preference was also evident in the finding that female subjects preferred the "no-CPR" decision more commonly than the male counterparts. This might reflect the role of females as the care provider in the family and the thinking that they should not expect help from other family members. It is notable that the OR between the two genders was highest in the scenario where CPR would be accompanied by mechanical ventilation and/or coma.

There were some limitations in this study. This report concerns only ambulatory subjects at a tertiary-care regional hospital. As the study was conducted at a single site and targeted only northern Thai people with their unique culture, the study was clearly limited in terms of generalizability. The mental status of the subjects was not formally assessed; however, all patients were able to participate in the interview without difficulty.

CONCLUSIONS

Our findings are different from previous studies in many aspects. We obtained a very high response rate and gender-specific differences that might indicate cultural differences. Most of our subjects were poor, had only primary education and were from rural areas. They were unfamiliar with the questions and specific information on the end-of-life care; therefore, the method of interview had been adjusted accordingly. This technique should be repeated to test its reliability in a similar group of subjects, as well as others. Importantly, our patients distrusted AD documents. These feelings were respected but further investigation is needed to identify the most effective strategy to address the patient's needs in this society.

We confirmed previous findings that the survival chance after CPR and the worst condition postCPR can dramatically change the preference for CPR. However, the preferences of other groups of subjects or patients with various other conditions might be quite different. For future study, it would be of interest to extend the study to non-hospitalized subjects (young adults < 40 years, middle-aged adults aged 40–59 years, and older adults ≥ 60 years), and hospitalized patients with a chronic and/or terminal illness. Also, it would be important to test whether the ADs are effective in reducing unnecessary CPR episodes in terminally ill patients in our health-care settings.

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Research Article

Physicians' attitudes and practices regarding advanced end-of-life care planning for terminally ill patients at Chiang Mai University Hospital, Thailand

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Abstract This study examined physicians' attitudes toward advanced directives and practices for the end-of-life care at Chiang Mai University Hospital, Thailand. The data were collected from 55 physicians (24 instructors and 31 residents) using self-reported questionnaires. The majority of the participants affirmed the usefulness of the advance directive (AD) for cardiopulmonary resuscitation and respected the patients' wish for this directive, although advanced end-of-life care and resuscitation planning with the patients was limited. Mostly, the relatives were consulted regarding ADs. This study suggests that, in traditional Thai culture, physicians and families are more inclined to make decisions for the patient when they feel that it is in the patient's best interest. Further research is needed to investigate how and to what extent such attitudes can affect medical practice for end-of-life care in the context of the rapid development and consequent changes taking place in Thailand.

Key words advanced directive, physician's attitude, terminal care, terminally ill patient.

INTRODUCTION

Advances in medical technology have contributed to extraordinary cures and recovery in patients around the world (Greenwald, 2007). In some circumstances, however, these advances have created problems, particularly for terminally ill patients (Levenson *et al.*, 2000; Whitcomb & Blackman, 2007). Aggressive and costly technology is often used to extend life (Somogyi-Zalud *et al.*, 2002; Grossman, 2005) and, in many cases, prolong the suffering of terminally ill patients (Reynolds *et al.*, 2005). Caring for dying patients appears to be one of the most difficult challenges of modern medicine. Decisions to limit treatment are an increasingly common feature in the clinical management of patients towards the end of life (Holzapfel *et al.*, 2002; Braun *et al.*, 2007; Szalados, 2007).

By providing a means for competent persons to guide their medical care after they have become incompetent, advanced directives (ADs) allow patients to influence treatment decisions by expressing a personal view on the balance between the quality and duration of life. Advanced directives are documents that enable people to decide what will happen to them or who will make decisions on their behalf if the time comes when they are no longer able to participate in discussions or decisions about their own health care (Ramsey & Mitty, 2003). In the USA, the Patient Self-determination Act of 1991 requires hospitals and nursing homes to inform patients of their right to refuse medical treatment (La Puma *et al.*, 1991). In this circumstance, ADs serve as a legal document that allow competent people to give instructions regarding the health care they would like to receive during a time of crisis when they will not be competent to make their own decisions (Fisher, 2008). The use of ADs constitutes a part of the whole process of assisting patients to understand their condition, options for medical treatment, and the potential complications. It also involves discussing the available choices with patients and their family and reflecting on those choices in light of personal values, goals, and religious or cultural beliefs. Such advance planning is helpful for patients who might lose the ability to speak for themselves because of a progressive and/or serious illness.

The initiation of the discussion on end-of-life care planning is especially important for patients with a terminal illness. These patients seem to be precisely those expected to benefit from earlier discussions of the merits of their terminal care. Unfortunately, these means have been underutilized (Quill, 2000; Gallo *et al.*, 2003; Booth *et al.*, 2004; Dougherty *et al.*, 2007). A recent report in Thailand showed that the use of

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ADs appears to be effective in reducing futile cardiopulmonary resuscitation (CPR) attempts and the in-hospital mortality rate among terminally ill patients (Sittisombut *et al.*, 2008).

Although ADs are widely advocated in Western countries, such as the USA, Canada, UK, the Netherlands, and Switzerland, only a few studies dealing with ADs in Asian countries have been reported (Low *et al.*, 2000; Miura *et al.*, 2001; Akabayashi *et al.*, 2003; Sittisombut *et al.*, 2005). Most of these studies focused on the attitudes of patients towards ADs; thus, little is known concerning the attitudes of Asian physicians (Tee *et al.*, 1997; Asai *et al.*, 1998). The purpose of this study was to examine the attitudes and practices of Thai physicians regarding the end-of-life care planning for terminally ill patients in an acute care medical center in northern Thailand.

METHODS

This was a descriptive study utilizing questionnaires that were developed from the literature that reflected the objectives of the study. The questions were focused on the provision of information about terminal illness, the attitudes towards ADs for CPR, and the experiences of physicians in using ADs in clinical practice. After the content validity of the questionnaires was approved by five local experts, the questionnaires were tested in a pilot study with 10 physicians who had similar characteristics to the study's sample. The inter-rater reliability, as assessed by using Cohen's Kappa statistics, was 0.85.

Ethical considerations

This study was a part of a larger research project on the use of ADs in the care of terminally ill patients at Chiang Mai University Hospital, Thailand (Sittisombut *et al.*, 2008). The research was approved by the institutional review board of the Faculty of Medicine, Chiang Mai University. Participation in the study was voluntary and anonymous, and all the participants signed an informed consent form before the commencement of the study. The data were adequately protected by utilizing a code system: no names were used and the data were stored in a secure locker, which could be accessed only by the research team.

Recruitment of the participants

Physicians who were working and caring for terminally ill patients in the Medical Department, Chiang Mai University Hospital, at the time of the study and who agreed to participate by giving informed consent were eligible for the study. There was a total of 106 physicians working in the Medical Department during the study period. Forty-four of these physicians were faculty members (instructors) and 62 were in the residential training program. Eleven faculty members were out of the country during the study period, leaving a total of 95 physicians eligible for participation in the study. The physicians were informed of the objectives and methods and then invited to participate in the study. The questionnaires were distributed by the investigator. The completed questionnaires were returned by the physicians at their convenience.

Statistical analysis

The demographic characteristics of the participants and the responses to the questionnaires were analyzed using descriptive statistics. Chi-squared statistics were used to test the differences in the demographic characteristics according to the employment position.

RESULTS

Response rate

Of the 95 potential participants, one declined to participate, three had not been involved recently in terminal care, and 36 did not return the questionnaires. Among 55 (57.9%) of the eligible physicians who participated in the study, there were 24 instructors and 31 residents. The difference in the response rate between the instructors and residents was significant at $P = 0.03$.

Demographic characteristics

The participants were predominantly male (61.8%) and in the age range of 23–57 years (Table 1). More than half of the participants were $\leq$ 30 years of age. The majority (67.3%) were single. The participants' educational backgrounds include a Doctor of Medicine (MD) degree (56.4%), and a MD degree with the completion of a Board of Internal Medicine training program (40%). Two of the participants held a PhD degree in addition to a MD degree and the completion of the Board of Internal Medicine training program. Approximately half (54.5%) of the participants had $\geq$ 3 years of clinical experience. Significant differences were noted between the faculty members and the residents in all the demographic variables, including age, gender, marital status, education, and working experience (Table 1).

Provision of information on terminal illness

In the study hospital, information about terminal illness was normally provided by the physicians to the patients' immediate family members when the patients were incapacitated and unable to communicate. In cases where the patients remained capable of communicating, 41.8% of the participating physicians indicated that they still preferred to inform a relative about the patients' condition (Table 2). The instructors were more likely to prefer telling a relative than the residents (45.8% *vs* 38.7%). Only 20% of the participants preferred to inform the patients only, whereas 36.4% preferred to inform both the patients and their relatives.

On their care of patients with a terminal illness in the past, 21 participants (38.2%) stated that they had informed the "majority" of their patients about their illness (Table 2). Only 11 participants (20.0%) had told all of their patients about their illness, while six participants (10.9%) stated that they had provided this information in "some cases". In contrast, 45

Table 1. Demographic characteristics stratified by the employment position

Characteristic	Total (*n* = 55) N (%)	Instructor (*n* = 24) N (%)	Resident (*n* = 31) N (%)	*P*-value
Gender				0.020
Male	34 (61.8)	19 (79.2)	15 (48.4)	
Female	21 (38.2)	5 (20.8)	16 (51.6)	
Age (years)				0.001
23–30	31 (56.4)	3 (12.5)	28 (90.3)	
> 30	14 (25.5)	14 (58.3)	–	
Missing data	10 (18.1)	7 (29.2)	3 (9.7)	
Marital status				0.001
Single	37 (67.3)	7 (29.2)	30 (96.8)	
Married	18 (32.7)	17 (70.8)	1 (3.2)	
Education				0.001
MD degree	31 (56.4)	– (0.0)	31 (100.0)	
Higher than MD degree	24 (43.6)	24 (100.0)	– (0.0)	
Work experience				0.001
≤ 3 years	25 (45.5)	3 (12.5)	22 (71.0)	
> 3 years	30 (54.5)	21 (87.5)	9 (29.0)	

MD, Doctor of Medicine.

Table 2. Participants' responses to questions informing the patient and/or relative about the diagnosis and prognosis in cases where the patient was capable

Question/response	Total (*n* = 55) N (%)	Instructor total (*n* = 24) N (%)	Resident total (*n* = 31) N (%)	*P*-value
1. Which person would you prefer to inform about the diagnosis and prognosis?				0.873
(a) Patient	11 (20.0)	5 (20.8)	6 (19.4)	
(b) Relative	23 (41.8)	11 (45.8)	12 (38.7)	
(c) Both the patient and relative	20 (36.4)	8 (33.4)	12 (38.7)	
(d) No answer	1 (1.8)	–	1 (3.2)	
2. How often have you informed the patient about the terminal diagnosis and prognosis?				0.921
(a) Every patient	11 (20.0)	3 (12.5)	8 (25.8)	
(b) The majority of the patients	21 (38.2)	8 (33.4)	13 (41.9)	
(c) Some patients	6 (10.9)	3 (12.5)	3 (9.7)	
(d) None of the patients	4 (7.3)	3 (12.5)	1 (3.2)	
(e) Other	2 (3.6)	2 (8.3)	–	
(f) No answer	11 (20.0)	5 (20.8)	6 (19.4)	
3. How often have you informed the relative about the terminal diagnosis and prognosis of the patient				0.190
(a) Every case	45 (81.8)	18 (75.0)	27 (87.1)	
(b) The majority of the cases	7 (12.8)	4 (16.7)	3 (9.7)	
(c) Some cases	2 (3.6)	2 (8.3)	–	
(d) No answer	1 (1.8)	–	1 (3.2)	

participants (81.8%) responded that they informed the immediate relatives in every case. There was no significant difference between the faculty members and the residents with regard to providing information about the patients' illness (Table 2).

Attitudes toward advanced directives for cardiopulmonary resuscitation

Only one-half of the participating physicians (50.9%) thought that it was appropriate to inform all terminally ill patients about CPR and to allow them to make decisions in advance (Table 3). Fourteen participants (25.5%) preferred to decide on a case-by-case basis by considering the physical and psychological conditions, religion, and the cultural background of each individual. One-fifth (20.0%) did not agree that information on CPR should be discussed with terminally ill patients. No statistically significant difference was observed between the instructors and the residents in the responses to this question.

In their responses to the question, "Within the Thai cultural environment, is it a good idea to provide CPR

Table 3. Participants' responses to questions regarding providing patients information about cardiopulmonary resuscitation (CPR)

Question/response	Total (*n* = 55) N (%)	Instructor total (*n* = 24) N (%)	Resident total (*n* = 31) N (%)	*P*-value
1. Is it appropriate to inform all terminally ill patients about CPR and allow them to decide in advance?				0.215
(a) Yes	28 (50.9)	9 (37.5)	19 (61.3)	
(b) No	11 (20.0)	6 (25.0)	5 (16.2)	
(c) Other	14 (25.5)	8 (33.4)	6 (19.3)	
(d) No answer	2 (3.6)	1 (4.1)	1 (3.2)	
2. In Thai culture, is it a good idea to provide CPR information to all admitted patients and allow them to decide about CPR in advance?				0.005
(a) Yes	19 (34.5)	3 (12.5)	16 (51.6)	
(b) No	17 (31.0)	6 (25.0)	11 (35.5)	
(c) Other	19 (34.5)	15 (62.5)	4 (12.9)	

Table 4. Participants' responses to questions regarding their behavior in relation to cardiopulmonary resuscitation (CPR)

Question/response	Total (*n* = 55) N (%)	Instructor total (*n* = 24) N (%)	Resident total (*n* = 31) N (%)	*P*-value
1. Have you ever asked patients who were terminally ill whether or not they wanted to have CPR performed?				0.292
(a) Yes	19 (34.5)	10 (41.7)	9 (29.0)	
(b) No	34 (61.8)	14 (58.3)	20 (64.5)	
(c) Other	2 (3.6)	–	2 (6.5)	
2. Have you ever asked the relatives of a terminally ill patient whether or not they wanted to have CPR performed for the patient?				0.183
(a) Yes	52 (94.6)	22 (91.7)	30 (96.8)	
(b) No	2 (3.6)	2 (8.3)	–	
(c) Other	1 (1.8)	–	1 (3.2)	
3. If the patients with terminal illnesses request that they do not want to have CPR, would you prefer to follow their wishes?				0.063
(a) Yes	50 (90.9)	24 (100.0)	26 (83.9)	
(b) Other	4 (7.3)	–	4 (12.9)	
(c) No answer	1 (1.8)	–	1 (3.2)	

information to all admitted patients and allow them to decide about CPR in advance?", about one-third (34.5%) of the participants thought it was appropriate to inform all admitted patients regarding CPR and to allow them to make advance decisions (Table 3). Although another one-third (31.0%) responded that it was not appropriate, the remainder (34.5%) stated that their responses to this question depended on the individual patient. The residents (51.6%) were more likely to respond positively to this question than the instructors (12.5%) and there was a statistically significant difference between the two groups ($P = 0.005$).

Use of advanced directives in medical practice

More than one-half (61.8%) of the participating physicians had never asked their terminally ill patients whether they wanted to have CPR performed or not (Table 4). However, the majority (94.5%) had discussed this issue with the patients' relative(s). If the patients with a terminal illness were to specify that they did not want to have CPR, the majority of the participants (90.9%) stated that they would follow their wishes. There was no significant difference between the instructors and the residents on this response (Table 4).

DISCUSSION

Although most physicians accept the ethical proposition that patients are entitled to know their prognosis (Hancock *et al.*, 2007), the provision of such important information appears to be different among physicians in various social and cultural backgrounds. A small proportion of Thai physicians participating in this study preferred to inform the terminally ill patients about their diagnosis and prognosis. Our findings were in accordance with previous studies conducted in Asian countries on physicians' attitudes. Only 13% (Tinada, 1994) and 31% of Japanese physicians (Mizushima *et al.*, 1990) and no Chinese physicians (Feldman *et al.*, 1999) would inform their patients with cancer of their diagnosis. Similarly, Jiang *et al.* (2006) reported that only 40.5% of Chinese oncologists believe that patients with a terminal illness should know the truth about their diagnosis. A high rate of non-disclosure of a cancer diagnosis appears to be common among physicians in Asia (Back & Huak, 2005). However, this might reflect a general attitude prevalent in their communities. Families are known to play a significant role in ethical decision-making for patients in India (Chattopadhyay & Simon, 2008). There is evidence to indicate that families are strongly resistant to informing patients about their diagnosis (Wang *et al.*, 2004). A study in Japan found that only 4.3% of families consent to the physician notifying patients about their diagnosis (Tazawa *et al.*, 1990). Some studies revealed that Asian patients themselves do not wish to be told the truth (Seo *et al.*, 2000; Elwyn *et al.*, 2002).

Similar to previous reports from the USA (La Puma *et al.*, 1991), the majority of Thai physicians in this study expressed a positive attitude towards ADs and respect for the patient's wishes regarding CPR. Yet, only one-third of them agreed with discussing advanced CPR planning with all admitted patients and one-half supported the offering of an AD for CPR to terminally ill patients. This attitude of Thai physicians does not reflect those of the patients. In the same health-care setting, the majority of ambulatory patients thought that it was a good idea to discuss advance planning for CPR on a routine basis with all admitted patients (Sittisombut *et al.*, 2005). Although they were still able to communicate, terminally ill patients were also in favor of using an AD to determine their preference for CPR (Sittisombut *et al.*, 2008). These studies suggest that, in contrast to the physicians' attitude, Thai patients are receptive to such discussions well before they become unable to participate in the decision-making process.

An interesting finding from this study indicates that, when it comes to ADs, Thai physicians tend to give greater weight to the decisions of family members than to those of the patients. While one-third of the participants reported asking terminally ill patients whether or not they wanted to have CPR performed, almost all of them raised this question with the patients' relatives. Most of the participating physicians felt that discussing this sensitive issue with the patients was time-consuming and might be harmful to certain patients. These findings are similar to those from previous studies of physicians in Japan (Asai *et al.*, 1998) and Singapore (Tee *et al.*, 1997), but they differ from similar studies in the USA and Canada, where physicians are more likely to give patients a greater voice in their own decisions (Bruera *et al.*, 2000; Ruhnke *et al.*, 2000). In a study by Bruera *et al.* (2000), the physicians surveyed in Europe, South America, and Canada agreed that "do not resuscitate" orders should be discussed with the terminally ill patient in all cases. A survey in the USA found that the residents discussed the patient's preferences for CPR with most patients on the day of admission (Smith *et al.*, 2006).

It is not clear yet whether the physicians' preference actually contributes to the high rate of CPR in Chiang Mai University Hospital (Sittisombut *et al.*, 2001). Currently, when terminally ill patients are provided with the information concerning their prognosis and the possibility of CPR during their hospitalization, many of the northern Thai patients do wish to make an advanced decision and the use of the AD appears to be effective in reducing futile CPR attempts (Sittisombut *et al.*, 2008).

CONCLUSIONS

The data from this study suggest that cultural differences shape physicians' opinions and practices concerning ADs with terminally ill patients. Greater emphasis on individual autonomy might result in more collaboration between the physicians and the patients with respect to ADs and end-of-life decisions, but traditional Thai culture appears to permit the physicians and the families to make decisions on behalf of the patients when they feel it is in the patient's best interest. However, recent reports suggest that Thai patients are willing to participate in the end-of-life decisions. Further research is needed to clarify the effects of culture on end-of-life care, particularly in the context of the rapid development and consequent changes taking place in Thailand.

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Research article

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Comprehensibility, reliability, validity, and responsiveness of the Thai version of the Health Assessment Questionnaire in Thai patients with rheumatoid arthritis

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Abstract

Introduction The Health Assessment Questionnaire Disability Index (HAQ-DI) is a commonly used instrument to assess functional status of patients with rheumatoid arthritis (RA). Translations and adaptations of the HAQ-DI have been carried out for use with RA patients in several countries. The objective of this study was to evaluate the psychometric properties of the Thai version of the HAQ-DI (Thai HAQ) in Thai patients with RA.

Methods Comprehensibility of the Thai HAQ was assessed by 126 patients with RA from 6 medical centers in Thailand. Another group of 115 patients with active RA was enrolled to test the reliability (internal reliability and 1-week test-retest reliability), construct validity (correlations with other measures of RA disease activity), floor and ceiling effects, and sensitivity to change of the Thai HAQ at 3 months of treatment with disease-modifying antirheumatic drugs.

Results More than 98% of the patients regarded the Thai HAQ as comprehensible. The internal consistency of the Thai HAQ was satisfactory with the overall Cronbach alpha of 0.91. The test-retest reliability of the Thai HAQ was acceptable with the intraclass correlation coefficient of 0.89. Moderate correlations between the Thai HAQ and other outcomes of RA disease activity were observed, except erythrocyte sedimentation rate, with the Spearman correlation coefficients ranging from 0.42 to 0.57. The responsiveness of the Thai HAQ was moderate, with a standardized response mean of 0.75 (95% confidence interval 0.56 to 0.94).

Conclusions The Thai HAQ is comprehensible, reliable, valid and sensitive to change in the evaluation of functional status of Thai patients with RA. The Thai HAQ is an essential tool to measure treatment effects and progression of disability in RA patients and should be applied in both clinical trials and routine clinical care settings.

ACR: American College of Rheumatology; CI: confidence interval; DMARD: disease-modifying antirheumatic drug; ESR: erythrocyte sedimentation rate; HAQ: Health Assessment Questionnaire; HAQ-DI: Health Assessment Questionnaire Disability Index; ICC: intraclass correlation coefficient; OMERACT: Outcome Measures in Rheumatology Clinical Trials; RA: rheumatoid arthritis; SD: standard deviation; SRM: standardized response mean; Thai HAQ: Thai version of the Health Assessment Questionnaire Disability Index.

Introduction

The Stanford Health Assessment Questionnaire (HAQ) was originally developed to measure five important health outcomes in patients with chronic diseases [1,2]. These dimensions include premature death, functional disability, pain and discomfort, adverse effects of treatment, and costs. The HAQ Disability Index (HAQ-DI), the HAQ section to evaluate functional capacity, is the most commonly used instrument for assessing disability in patients with rheumatoid arthritis (RA). The HAQ-DI is a predictive factor of future disability and joint damage in patients with RA [3-5]. Because it demonstrated sensitivity to change, the HAQ-DI was chosen by the Outcome Measures in Rheumatology Clinical Trials (OMERACT) and the American College of Rheumatology (ACR) to be incorporated into the core set of outcome measures of RA disease activity [6-8]. The HAQ-DI not only is considered an essential measure of disability in patients with RA in clinical trials, but also is used in clinical practice.

The HAQ-DI has been translated and adapted to suit the activities and cultures in diverse populations from more than 50 countries [9,10]. As with the original HAQ-DI, a number of translations of the HAQ-DI into other languages have been proven to be reliable, valid, and sensitive to change. For the Thai version of the HAQ-DI (Thai HAQ), three items were adapted and two activities were added to the existing items to tailor the questionnaire to the lifestyle and culture of Thai people. The Thai HAQ was back-translated and tested for its validity and responsiveness in a pilot study at a tertiary care hospital in Thailand [11]. However, psychometric validation of the Thai HAQ is still important if it is to be recommended as a standard instrument to measure long-term disability in Thai patients with RA. It is also needed for demonstrating the effectiveness of disease-modifying antirheumatic drug (DMARD) therapy, especially with the expensive biologics, and for use in guidelines to follow the patients over time. Thus, the objective of this study was to evaluate the comprehensiveness, reliability, validity, and responsiveness of the Thai HAQ in Thai-speaking patients with RA from different parts of the country.

Materials and methods

Comprehensibility

One hundred twenty-six adult patients who met the ACR 1987 revised criteria for the classification of RA [12] were included in the comprehensibility assessment of the Thai HAQ. These patients were enrolled from six medical centers in Thailand from January to April 2006 regardless of their disease activity. The comprehensibility questionnaire was self-reported by the patients. For older patients and those with poor eyesight, the responses were performed with the assistance of relatives who accompanied them and of rheumatology nurses at the clinics. The patients were asked whether they understood the 20 items from the eight domains of the Thai HAQ. The levels of comprehensibility for each item were categorized on a 4-point scale (0, not comprehensible; 1, slightly comprehensible; 2, moderately comprehensible; and 3, highly comprehensible). Scores of 2 or more for each item were regarded as comprehensible.

Reliability, validity, and responsiveness

From the same six institutes, 115 more patients with RA were consecutively selected between January 2006 and July 2007 to be included in this part of study. Each patient had to fulfill all of the following criteria: (a) met the ACR 1987 revised criteria for the classification of RA [12], (b) was at least 18 years of age, and (c) had active disease characterized by (i) at least six tender joints, (ii) at least six swollen joints, (iii) a Westergren erythrocyte sedimentation rate (ESR) of at least 28 mm/hour, and (iv) at study entry, just starting a non-biologic DMARD, an increase in the dose of a non-biologic DMARD, or the addition of another non-biologic DMARD. The patients were excluded if they were pregnant or breastfeeding, receiving prednisolone at a dose of more than 10 mg per day, or did not give informed consent. The mode of Thai HAQ administration was similar to that of the comprehensibility assessment. The assessments of reliability, validity, and responsiveness of the Thai HAQ were conducted in accordance with the OMERACT filter for outcome measures in RA [8]. Both parts of the study protocols were approved by the ethics committees of each institute. This study was conducted in accordance with the Declaration of Helsinki. All patients were required to give written informed consent before entering this study.

The Thai HAQ

The Thai HAQ included 20 items from eight domains adapted from the original HAQ-DI to suit Thai culture and activities. The ability to perform an activity for each item is rated on a 4-level scale, in which the score ranges from 0 (no difficulty in performing that activity) to 3 (inability to perform that activity). The requirement of a device or physical assistance in any item increases the lower score to 2. To calculate the HAQ-DI score, the maximum scores from each domain were summed and divided by 8 to yield a score that ranged from 0 to 3. The higher score indicated greater disability.

Statistical analysis

Baseline characteristics of the studied patients were presented as number and percentage for discrete parameters and as mean and standard deviation (SD) for continuous parameters. Comprehensibility assessment of the Thai HAQ was presented as percentage of patients with moderate or high comprehensibility in the Thai HAQ.

Reliability

Reliability was assessed by test-retest reliability and internal consistency. The test-retest reliability was performed with a 1-week interval. This interval was used because the patients would not be able to remember the first test and the effects of DMARDs added were not expected at 1 week of treatment.

The patients completed the first Thai HAQ at their clinic visits. The second was sent to them by mail. Test-retest reliability of the Thai HAQ was analyzed using intraclass correlation coefficients (ICCs). The ICCs and their 95% confidence intervals (CIs) were calculated using a two-way random-effects model. An ICC value of 0.85 or higher was considered acceptable [13]. Internal consistency among each domain of the Thai HAQ was evaluated by Cronbach alpha using the results from the first administration. The overall Cronbach alpha was calculated from all eight domains of the Thai HAQ. For each domain, Cronbach alpha was obtained by deleting that domain from the questionnaire [14].

Validity

Construct validity of the Thai HAQ was performed by correlating the baseline eight domains and total scores of the Thai HAQ with the following outcome measures of RA disease activity: number of tender joints (total 68 joints), number of swollen joints (66 joints), patient's assessment of pain, patient global assessment of disease activity, physician global assessment of disease activity, and ESR. Pain score and patient and physician global assessments of disease activity were measured on a 5-level categorical scale, in which the higher score indicated greater pain and worse disease status. The correlation coefficients used in this study were Spearman correlation coefficients. Correlation coefficients of greater than 0.6, of 0.6 to 0.3, and of less than 0.3 were considered strong, moderate, and weak correlations, respectively [15]. The Thai HAQ was also evaluated for floor and ceiling effects. Floor and ceiling effects were considered to be present if at least 15% of the patients scored 0 (the lowest possible score) or 3 (the highest possible score), respectively, on the Thai HAQ [16].

Responsiveness

Responsiveness of the Thai HAQ and other measures of RA disease activity was calculated from the baseline values and the values at month 3. To assess the responsiveness of the Thai HAQ and other parameters, the differences between baseline and month 3 scores were used for calculating the standardized response mean (SRM) from the formula:

$$\text{SRM} = \text{mean change of the score} / \text{SD change of the score}.$$

The SRM value between 0.6 and 0.8 is considered moderate effect and clinically significant. The value of greater than 0.8 represents large effect [17,18]. The statistical software used in this study was SPSS for Windows, version 11.0 (SPSS Inc., Chicago, IL, USA). The statistically significant level was determined as a *P* value of less than 0.05.

Results

Demographic data of both groups of studied patients are shown in Table 1. The comprehensibility of the Thai HAQ was assessed by 126 patients, whose domiciles were distributed in all parts of the country. Twenty-six patients (20.6%) were from Bangkok. Among the others, 35 (27.8%) resided in Central Thailand, 23 (18.3%) in the North, 11 (8.7%) in the Northeast or East, and 31 (24.6%) in the Southern part of Thailand. The mean (SD) age of the studied patients was 50.5 (13.0) years. One hundred fourteen patients (90.5%) were women. Although 68.3% of the patients (86 patients) completed only primary education (that is, 6 years of formal education), more than 90% of the 126 patients scored each item of the Thai HAQ as moderately or highly comprehensible, as shown in Table 2.

Of the 115 patients with RA enrolled to test the reliability, validity, and responsiveness of the Thai HAQ, 99 (86.1%) were women. The mean (SD) age was 48.9 (11.9) years, and

Table 1

Demographic characteristics of studied patients

Demographic characteristics	Comprehensibility assessment	Reliability, validity, responsiveness assessment
Number of patients	126	115
Females/males, number (percentage)	114/12 (90.5%/9.5%)	99/16 (86.1%/13.9%)
Age in years, mean ± SD	50.5 ± 13.0	48.9 ± 11.9
Disease duration in months, mean ± SD	ND	68.9 ± 71.8
Rheumatoid factor-positive patients, number (percentage)	ND	88 (76.5%)
Formal education, number (percentage) of patients		
≤6 years	92 (73.0%)	81 (70.4%)
>6 to ≤12 years	26 (20.6%)	24 (20.9%)
>12 years	8 (6.4%)	10 (8.7%)

ND, no data; SD, standard deviation.

Table 2

Comprehensibility of each item of the Thai HAQ assessed by 126 Thai patients with rheumatoid arthritis

Thai HAQ domain	Thai HAQ item	Percentage comprehensibility
	Are you able to:	
Dressing and grooming	1. Put on clothes, including buttoning up?	100
	2. Wash your hair?	100
Arising	3. Get up from a chair without armrests?	98.4
	4. Lie down and get up from the bed, or sit in floor-sitting or kneeling position?	100
Eating	5. Slice food with a knife?	99.2
	6. Lift up a glass (filled with water) for drinking?	99.2
	7. Open up food or beverage cans?	99.2
Walking	8. Walk outdoors on level ground?	100
	9. Climb up five steps of stairs?	99.2
Hygiene	10. Apply soap over the body and towel up?	100
	11. Lift up a water bowl to wash yourself?	100
	12. Sit down and get up from a toilet seat?	100
Reach	13. Reach for a 2-kg object from an overhanging cupboard?	98.4
	14. Bend down to pick up an article from the floor?	100
Grip	15. Open a car door?	100
	16. Open containers (such as conserve or Ovaltine jar)?	99.2
	17. Turn on and off a faucet, or wring clothes after washing?	99.2
Activities	18. Go marketing?	99.2
	19. Get on and off a car or a bus?	99.2
	20. Sweep and mop?	98.4

Thai HAQ, Thai version of the Health Assessment Questionnaire Disability Index.

the mean (SD) disease duration was 68.9 (71.8) months. Rheumatoid factor was positive in 77%. The mean (SD) Thai HAQ score at baseline was 1.56 (0.75).

Internal consistency of the Thai HAQ was satisfactory, with the Cronbach alpha of 0.910 among all eight domains. Removal of each domain of the Thai HAQ did not produce a significant change in the Cronbach alpha. The highest alpha was 0.899 when the dressing domain was deleted and the lowest alpha was 0.886 when the reach or activity domain was excluded from the Thai HAQ.

Test-retest reliability of each domain and total Thai HAQ scores was acceptable. The average measure ICC of the Thai HAQ was 0.89 (95% CI 0.84 to 0.92). For each domain of the Thai HAQ, the estimates of ICC ranged from 0.77 to 0.87. The mean and SD of each domain of the Thai HAQ at baseline and day 7 as well as the ICCs and 95% CIs are shown in Table 3.

The Spearman correlation coefficients for construct validity of each domain of the Thai HAQ and total Thai HAQ scores are shown in Table 4. Moderate correlation was observed between the majority of Thai HAQ domains as well as the Thai HAQ and outcomes of RA disease activity. These correlation coefficients ranged from 0.30 to 0.57. The highest correlation coefficient was observed between the Thai HAQ and ACR functional class (correlation coefficient 0.57), whereas the lowest was seen between the Thai HAQ and ESR (correlation coefficient 0.37). ESR correlated weakly with four domains of the Thai HAQ (dressing and grooming, walking, grip, and activity domains). The grip and walking domains of the Thai HAQ also had weak correlations with the number of swollen joints, number of tender joints, and pain level.

Floor and ceiling effects of the Thai HAQ were not observed in the studied patients. At baseline, none (0%) scored 0 or 3

Table 3

Test-retest reliability of eight domains of the Thai HAQ

Thai HAQ domain	Mean ± SD score on day 1	Mean ± SD score on day 7	ICC (95% CI)[a]
Dressing and grooming	0.90 ± 0.83	0.82 ± 0.83	0.83 (0.75-0.88)
Arising	2.05 ± 1.67	1.85 ± 0.99	0.84 (0.77-0.89)
Eating	1.60 ± 1.02	1.47 ± 1.02	0.82 (0.75-0.88)
Walking	1.27 ± 0.98	1.12 ± 1.01	0.87 (0.81-0.91)
Hygiene	1.34 ± 0.80	1.22 ± 0.96	0.77 (0.66-0.84)
Reach	1.80 ± 1.07	1.61 ± 1.07	0.77 (0.67-0.84)
Grip	1.91 ± 0.97	1.62 ± 1.00	0.78 (0.69-0.85)
Activities	1.59 ± 1.01	1.33 ± 1.00	0.80 (0.70-0.86)
Thai HAQ	1.56 ± 0.75	1.38 ± 0.80	0.89 (0.84-0.92)

[a] Two-way random-effects average measure intraclass correlation coefficient (ICC). CI, confidence interval; SD, standard deviation; Thai HAQ, Thai version of the Health Assessment Questionnaire Disability Index.

on the Thai HAQ. At 3 months of treatment, 6 patients (5.2%) scored 0 and 1 patient (0.9%) scored 3.

Responsiveness of the Thai HAQ and other measures of RA disease activity was moderate as the SRMs were 0.6 or higher, except for ESR. The SRM for the patient global assessment of disease activity was the highest (0.94), whereas that for the Thai HAQ was 0.75. The SRMs for the Thai HAQ compared with the other measures of RA disease activity are shown in Table 5.

Discussion

Approximately 90% of the patients enrolled in this study were women. The high proportion of female patients with RA was observed across all six institutes (range 73.3% to 96.8%). This finding was because more women than men are affected by RA and because women with chronic rheumatic diseases in Thailand generally comply with long-term treatment better than men do.

Our study has shown that the Thai HAQ is comprehensible among Thai patients with RA recruited from different parts of Thailand. Despite the finding that more than 70% of the

Table 4

Spearman correlation coefficients between each domain and the Thai HAQ and outcomes of rheumatoid arthritis disease activity

Thai HAQ domain	Tender joint count	Swollen joint count	Patient global assessment	Physician global assessment	Pain	ESR	ACR functional class
Dressing	0.31	0.32	0.40	0.34	0.34	0.23[a]	0.47
Arising	0.42	0.39	0.45	0.42	0.35	0.43	0.35
Eating	0.32	0.33	0.35	0.30	0.31	0.35	0.44
Walking	0.37	0.27[a]	0.43	0.39	0.35	0.28[a]	0.53
Hygiene	0.39	0.39	0.44	0.37	0.33	0.40	0.42
Reach	0.39	0.39	0.39	0.35	0.32	0.31	0.42
Grip	0.29[a]	0.29[a]	0.35	0.33	0.22[a]	0.28[a]	0.38
Activity	0.30	0.35	0.44	0.42	0.41	0.23[a]	0.51
Thai HAQ	0.46	0.43	0.52	0.48	0.42	0.37	0.57

[a] Correlation coefficient of less than 0.3 represents weak correlation and 0.3 to 0.6 represents moderate correlation between the Thai HAQ (Thai version of the Health Assessment Questionnaire Disability Index) domain and rheumatoid arthritis disease activity. $P < 0.05$ for all correlation coefficients. ACR, American College of Rheumatology; ESR, erythrocyte sedimentation rate.

Table 5

Differences of treatment effect and standardized response means of rheumatoid arthritis disease activity and function outcomes between baseline and month 3 of treatment

Rheumatoid arthritis outcome	Mean difference of treatment (95% CI)	SRM (95% CI)
Tender joint count	-3.58 (-2.42 to -4.74)	0.59 (0.40 to 0.78)
Swollen joint count	-2.72 (-1.90 to -3.53)	0.64 (0.45 to 0.83)
Patient global assessment	-0.79 (-0.63 to -0.96)	0.94 (0.74 to 1.13)
Physician global assessment	-0.77 (-0.61 to -0.94)	0.89 (0.70 to 1.09)
Pain level	-0.75 (-0.58 to -0.93)	0.82 (0.62 to 1.01)
ESR	-13.93 (-7.01 to -20.84)	0.41 (0.21 to 0.61)
Thai HAQ	-0.50 (-0.38 to -0.63)	0.75 (0.56 to 0.94)
ACR functional class	-0.44 (-0.29 to -0.60)	0.59 (0.38 to 0.80)

ACR, American College of Rheumatology; CI, confidence interval; ESR, erythrocyte sedimentation rate; SRM, standardized response mean; Thai HAQ, Thai version of the Health Assessment Questionnaire Disability Index.

patients had a limited educational level, there was no significant variation in the comprehensibility of each item of the Thai HAQ. All 126 patients regarded nine items as comprehensible. Only one and two patients, respectively, rated eight and three items of the Thai HAQ as slightly comprehensible. Among the three items with the least comprehensibility, two of these ('get up from a chair without armrests' and 'reach a 2-kg object from an overhanging cupboard') are common activities in many urbanized populations. However, neither of these activities is considered common by older Thai people who get used to living in the traditional Thai style. The other item, sweep and mop, a common activity for Thai people, was rated as slightly comprehensible by two older patients with RA who no longer performed this activity. The comprehensibility of the Thai HAQ was higher than that of the Korean HAQ, which ranged from 76% to 98% [19].

The Thai HAQ scores that included and excluded the use of aids/devices or assistance varied between 0 and 0.25 (data not shown). Use of aids/devices or other people's assistance may enhance the HAQ-DI scores [20]. In this study, most patients who required aids/devices or assistance scored that item 3, instead of 2, as they were unable to do that activity by themselves.

The Thai HAQ has been demonstrated to have satisfactory internal consistency with the Cronbach alpha of 0.910. The Cronbach alpha for each item of the Thai HAQ was also high and varied insignificantly. Our findings were comparable to the results from the HAQ-DI in other Asian countries, including South Korea [19], China [21], Kuwait [22], and Japan [23]. The Cronbach alpha in these studies ranged from 0.86 to 0.95. Test-retest reliability of the Thai HAQ has been shown to be acceptable with the ICC of 0.89. The test-retest reliability of the Thai HAQ was less than those of the Korean and Japanese HAQs but was higher than the Chinese and Arabic HAQs. For each domain of the Thai HAQ, only the walking domain had an ICC of greater than 0.85. The mean scores of each domain of the Thai HAQ and total scores in the second administration were lower than those in the first visit. This finding was not explained by the effects of DMARDs added but might be caused by the advice from the physicians to rest the inflamed joints or the adjustment of nonsteroidal anti-inflammatory drugs and/or analgesics, which should take effect within 1 week.

The method of assessing test-retest reliability of the Thai HAQ by self-administration on the first visit and mailed response 1 week later was similar to those of the Korean and Japanese HAQ studies. Potential biases incurred from a mailed response, such as the incompleteness of filling out the questionnaire and failure to return the response, were avoided.

The Thai HAQ has been demonstrated to correlate moderately with the other measures of RA disease activity. The correlation coefficients between the Thai HAQ and patient global assessment of disease activity and ACR functional class were higher than those between the Thai HAQ and number of tender joints, number of swollen joints, physician global assessment of disease activity, and pain level. Weak correlations were found between the walking domain and number of swollen joints and between the grip domain and number of tender joints, number of swollen joints, and pain level. Newly designed devices (that is, car doors, faucets, and containers) and footwear and improvement of fabric quality (for the wring cloth item) may help improve the patient's ability to perform the activities in the grip and walking domains.

The lowest correlation coefficient was observed between the Thai HAQ and ESR. This finding corroborated with the results from the Arabic, Chinese, and Korean HAQs as ESR correlates better with RA disease duration, radiographic changes, and joint deformity than with functional disability [20]. Three measures of RA disease activity, including patient and physician global assessments of disease activity and ACR functional class, had moderate correlation with all domains of the Thai HAQ. These correlations emphasized the importance of function on the overall health status of patients with RA.

Floor and ceiling effects of the Thai HAQ were not detected at either baseline or month 3 of treatment in this study. These effects were not investigated in the Arabic, Chinese, Japanese, or Korean HAQs. At month 3 of DMARD treatment, very few patients reported the lowest and highest possible scores. Six patients who reported the Thai HAQ score of 0 had significant improvement in their function after DMARD treatment. The only patient who scored 3 was an older patient who already had severe disability at baseline and did not respond to the increment of methotrexate dosage.

Responsiveness of the Thai HAQ measured as SRM was regarded as moderate effect and clinically significant. Large response means (SRM >0.8) were observed for the patient and physician global assessments of disease activity and for pain level. Moderate response means were found for the Thai HAQ (0.75) and number of swollen joints (0.64), whereas the number of tender joints and ACR functional class had the SRM closed to moderate effect (0.59). Our study has shown that patient-reported outcomes, including the Thai HAQ, were more efficient than physician-related outcomes, such as the numbers of tender and swollen joints, in detecting treatment effect. As expected, a small response mean was observed for the ESR (0.41).

Conclusions

This study, together with our previous work, demonstrates that the Thai HAQ has been shown to be comprehensible, reliable, valid, and sensitive to change in detecting disability in Thai patients with RA. Our findings have confirmed the validity of using the Thai HAQ as an instrument to measure functional status of RA patients after treatment with DMARDs or biologic agents or both in clinical trials and daily practice.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

MO initiated the concept and design of the study and collected, analyzed, and interpreted the data and prepared the manuscript and finalized it in accordance with the recommendations. JW, SU, PH, NK, and BS collected the data. All authors read and approved the final manuscript.

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A Study of 225 Malayan Pit Viper Bites in Thailand
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A Study of 225 Malayan Pit Viper Bites in Thailand

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This study evaluated factors affecting the severity of bite site necrosis and systemic symptoms resulting from envenomation among patients bitten by Malayan pit vipers (*Calloselasma rhodostoma*) in Thailand. We studied 145 victims prospectively. An additional 80 medical records were obtained for a retrospective study. Collected data included gender of the victims, anatomic locations of bites, where attacks took place, and predisposing factors and how they might have affected the clinical course. Most patients presented with minimal to moderate symptoms. Only eight patients required surgical wound debridement. None required amputation. However, 27 subjects developed permanently swollen limbs, presumably because of lymphatic or vascular injury. Significant coagulopathies were common (52.48%), and the only two deaths were attributable to intracranial hemorrhage. The improved clinical outcomes in the prospective and retrospective groups, compared with older series, might have been attributable to better public education, improved road infrastructure, and more health care facilities. Less reliance on nonprofessional healers and fewer applications of tourniquets also might have influenced clinical outcomes. Malayan pit viper antivenin, manufactured in Thailand, appears to be effective in reversing dangerous coagulopathies.

Introduction

Snake envenomation from Malayan pit viper (MPV) (*Calloselasma rhodostoma*, formerly known as *Angkistrodon rhodostoma*) (Fig. 1) bites can result in serious disability and death. Previous studies reported mortality rates of 1 to 2%.[1,2] Clinical manifestations of MPV bites may be local, systemic, or both. Hemorrhagic effects attributable to coagulopathy are often seen with MPV bites. The MPV is a dangerous and abundant species in southeast Asia and is known to bite without warning. It has been reported in Thailand, Cambodia, Java, Peninsular, Malaysia, Myanmar, Sumatra, and Vietnam. Snakes of the Crotalinae subfamily, which includes the MPV, are responsible for the majority of reported snakebites in Thailand.[3-5] Clinical manifestations resulting from coagulopathy include petechiae, epistaxis, hematuria, hemoptysis, uterine, gastrointestinal, and central nervous system hemorrhage, disseminated intravascular coagulation, and shock. In MPV venom, as with other viperid venoms, hemorrhagic metalloproteinases are responsible for local hemorrhage, as a result of degradation of collagen of the vascular basement membrane, followed by total disintegration of the vascular structure.[6,7] The major hemorrhagin of this venom is a glycoprotein termed rhodostoxin. It is reported to be responsible for local necrosis through activation of tissue tumor necrosis factor-α.[8] However, the role of hemorrhagic metalloproteinases in systemic complications remains unclear. The MPV venom contains proteins that affect platelet aggregation. Aggretin is a heterodimeric C-type lectin that activates platelets by binding to the platelet glycoproteins GP1b and $\alpha_2\beta_1$.[9] It may induce thrombocytopenia in envenomed patients.[10] A protein with similar structure, called rhodocetin, was shown to inhibit collagen-induced platelet aggregation.[11] The venom also contains coagulation factor II and factor X activators and thrombin-like enzymes (ancrod), which are responsible for consumption coagulopathy and organ failure. Although consumption coagulopathy and thrombocytopenia are considered to be the major causes of systemic bleeding, hemorrhagic metalloproteinases could damage vascular endothelial cells, destroying vascular integrity, provoking platelet aggregation, and activating the coagulation cascade. This may terminate in disseminated intravascular coagulation. Almost all of the systemic effects of MPV venom can be successfully treated with supportive measures and species-specific antivenin. However, local toxicity from venoms, such as edema and myonecrosis, are not prevented or reversed by antivenin therapy. The MPV venom first causes pain, swelling, and ecchymoses, which appear within minutes after the bite (Fig. 2). The MPV, unlike cobras, has large fangs that can inject venom deep into tissues. Necrosis may therefore involve the skin, subcutaneous tissues, and muscle, which can progress slowly to end in dry gangrene. These effects prolong hospitalization and increase morbidity, which may result in loss of a digit or limb.[12] Factors contributing to clinical outcomes are related to the snake's size and the amount of venom injected. The geographic origin of the snake and the quality of medical care rendered may also influence outcomes. It is important, at the time of presentation, to make a rapid estimate of the degree of envenomation and to determine whether there is progression of symptoms. A recently published clinical tool is the snakebite severity score (SSS), shown in Table I. The SSS helps workers assess vital signs serially, search for evidence of progression of local tenderness, edema, and induration, and prepare a flow chart of systemic symptoms. It also allows scoring of the clinical severity and improves record keeping.[13] This study evaluated various factors that had effects on the severity of tissue necrosis and the systemic envenomation syndromes of patients bitten by a MPV.

Methods

One hundred forty-five patients were collected prospectively, between April 2002 and June 2003, from 10 provincial hospitals throughout the country and from districts known to have many snakebite victims. Eighty hospital charts for snakebite patients

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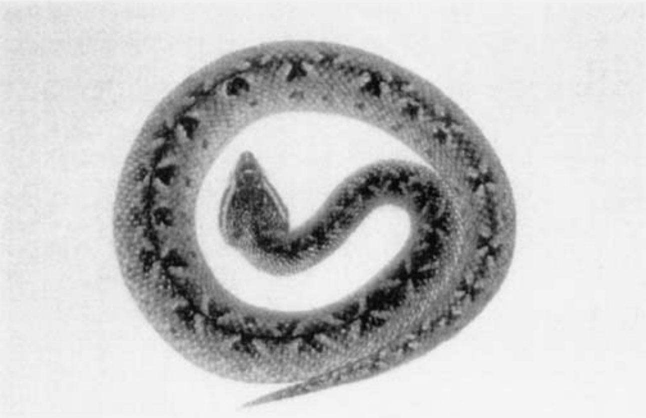

Fig. 1. MPV (*C. rhodostoma*).

Fig. 2. Severe necrotic reaction for a Thai child bitten by a MPV. The necrosis involves deep and superficial tissues.

in Prachuap Khiri Khan province from the year 2001 were also reviewed retrospectively. Eligibility criteria for patient selection included a bite from a MPV for which the species of the snake was confirmed. Patients were included if the snake was not captured but the patient presented with a good description and clinical and laboratory features consistent with MPV envenomation. These features included a venous clotting time (VCT) of >30 minutes and multiple hemorrhagic blisters at the bite site that evolved rapidly.[14,15] Informed consent to participate in the prospective study was obtained from patients or their relatives.

Data from hospital records in the prospective and retrospective series were summarized by two nurses and reviewed by the principal investigator. The SSS was modified from the report by Dart et al.[13] as indicated in Table I. The following information was tabulated and analyzed: clinical signs and symptoms, pulse, temperature and blood pressure, urinalysis results, complete blood counts, and VCT. Electrolyte levels and renal function parameters were evaluated where indicated. Data were collected at admission, 2 and 12 hours later, and daily thereafter. This information was compiled with the SSS level.[13] Statistical analyses used the χ^2 test or Student's t test.

Results

The prospective study collected a total of 145 MPV bite victims from six provinces (Fig. 3). The victims came from the southern region, which included Trang (33.79%), Nakhon Si Thammarat (22.07%), Prachuap Khiri Khan (17.93%), Surat Thani (15.06%), and Songkhla (7.50%) provinces. Surprisingly, we found that Lampang, a northern Thai province, provided 2.76% of the cases (4 of 145 cases; Fig. 4). We found no MPV bite victims in Nakhon Ratchasima (northeast), Lop Buri (central), Ratchaburi (western), and Nakhon Sawan (northern) provinces. The peak snakebite season was in May, early in the monsoon season (19.31%; Fig. 5). All snakebite victims were Thai residents. There were no foreigners or tourists in this group.

Snakebites occurred throughout the day (from 8:00 a.m. to 4:00 p.m.), representing the time that victims worked in fields or rubber plantations, but some bites occurred at night (21.25%) and then mostly near the victims' homes. The size of snakes, as reflected by the distance between fang marks, was recorded only in the prospective study. Sizes ranged between 1.6 and 1.70 cm. We searched the literature in an effort to determine the relationship of the space between fang marks and snake size but found no published study. Local Thai herpetologists assured the authors that more space between fangs is related to larger snake size (L. Chanhome, personal communication). The number of snakes brought to the hospital for identification was higher in the prospective study (Table II).

More male patients experienced snakebites (age range, 27–50 years). However, there were five children (3.5%) < 15 years of age in the prospective group and eight (10%) in the retrospective group. Most bites occurred in rural areas, outdoors, and in dark or dusky places. Bites on the lower limbs, especially legs, represented 40 to 60% of cases. Bites on fingers or toes represented 30% (Table II).

The mean time between snakebite and arrival at a hospital was 175 minutes in the prospective study, and times did not differ significantly between patients who did or did not have severe tissue necrosis. The time was significantly longer (110–690 minutes) in the retrospective study. Most patients (60% in the prospective study and 100% in the retrospective study) had not applied tourniquets. The volume of antivenin administered was four to nine vials (i.e., 40–90 mL). Approximately 95% of the MPV antivenin used came from the Queen Saovabha Memorial Institute of the Thai Red Cross Society (Bangkok, Thailand), which is now the only antivenin manufacturer in Thailand.

The incidence of tissue necrosis at the MPV bite site was 95% in the prospective study and 94% in the retrospective study. The most common SSS levels were minimal (score of 1 for 78.6% and 86.25% of the prospective and retrospective groups, respectively) (Fig. 6). These patients had local pain and mildly inflamed wounds. They required only wound care to prevent or control infection. Patients with severe local necrosis (scores of 2–3) represented 23 (15.9%) of 145 prospectively studied patients. Six (26%) of 23 patients had moderate to severe local tissue

TABLE I

MODIFIED SSS

Criteria	Level
Pulmonary system	
No symptom/sign	0
Minimal dyspnea, chest tightness, mild or vague systemic discomfort, or respirations of 20–25 breaths/minute	1
Moderate dyspnea (tachypnea, 26–40 breaths/minute; use of accessory muscle)	2
Cyanosis, air hunger, extreme tachypnea, or respiratory insufficiency/failure	3
Cardiovascular system	
No symptom/sign	0
Tachycardia (100–125 beats/minute), palpitations, generalized weakness, benign dysrhythmia, or hypertension	1
Tachycardia (126–175 beats/minute) or hypotension, with systolic blood pressure of <100 mm Hg	2
Extreme tachycardia (>175 beats/minute) or hypotension, with systolic blood pressure of <100 mm Hg, malignant dysrhythmia, or cardiac arrest	3
Local wound	
No symptom/sign	0
Pain, swelling, or ecchymosis within 5–7.5 cm of bite site	1
Pain, swelling, or ecchymosis involving less than one-half of the extremity (7.5 cm from bite site)	2
Pain, swelling, or ecchymosis extending beyond affected extremity (>100 cm from bite site)	3
Gastrointestinal system	
No symptom/sign	0
Abdominal pain, tenesmus, or nausea	1
Vomiting or diarrhea	2
Repeated vomiting, diarrhea, hematemesis, or hematochezia	3
Hematologic system	
No symptom/sign	0
Coagulation parameters slightly abnormal: PT, <20 seconds; PTT, <50 seconds; platelets, 100,000–150,000/mL; fibrinogen, 100–150 μg/mL; VCT, 10–20 minutes	1
Coagulation parameters abnormal: PT, <20 to 50 seconds; PTT, <50 to 75 seconds; platelets, 50,000–100,000/mL; fibrinogen, 50–100 μg/mL; VCT, 21–30 minutes	2
Coagulation parameters abnormal: PT, <50 to 100 seconds; PTT, <75 to 100 seconds; platelets, 20,000–50,000/mL; fibrinogen, <50 μg/mL; VCT, >30 minutes	3
Coagulation parameters markly abnormal, with serious bleeding or the threat of spontaneous bleeding: unmeasurable PT or PTT; platelets, <20,00/mL; undetectable fibrinogen, and severe abnormalities of other laboratory values, including VCT, also fall into this category	4
Central nervous system	
No symptom/sign	0
Minimal apprehension, headache, weakness, dizziness, chills, or paresthesias	1
Moderate apprehension, headache, weakness, dizziness, chills, paresthesia, confusion, or fasciculation in area of bite site	2
Severe confusion, lethargy, seizures, coma, psychosis, or generalized fasciculation	3

PT, prothrombin time; PTT, partial thromboplastin time.

necrosis (scores of 2–3) that required surgical debridement. There was no need for amputation in either group. The severity of tissue necrosis was significantly influenced by the quality and timing of treatment rendered ($p < 0.05$). However, two victims required surgical decompression because of swelling and circulatory impairment; bite sites were a finger or toe, locations without abundant soft tissue space, causing the compartment syndrome (scores of 2–3).

Systemic manifestations involved the central nervous, cardiovascular, pulmonary, gastrointestinal, and hematologic systems. An overall analysis of SSS values revealed 0.80 to 1.00 involving the central nervous system, 0.40 to 0.90 the pulmonary system, 0.03 to 0.17 the gastrointestinal system, 0.45 to 0.83 the cardiovascular system, 1.69 to 1.84 the hematologic system, and 1.01 to 1.17 bite site reactions. The highest scores appeared 12 hours after hospitalization (Fig. 7). No patients developed septicemia but two subjects had the disseminated intravascular coagulation syndrome and died as a result of intracranial hemorrhage. The first patient, a 60-year-old man, came to the hospital comatose and with severe coagulopathy (VCT of >30 minutes and hematuria). He had been bitten by a MPV 3 days previously and had been treated by a traditional healer with herbal remedies and local potions. He was moribund and had moderately severe tissue necrosis (score of 2) at the bite site. The patient was intubated and given 30 mL of antivenin, and his VCT returned to normal after 6 hours. However, he had developed intracranial hemorrhage and never regained consciousness. The second fatality was a 72-year-old man. He was admitted to the hospital 1 hour after having been bitten by a MPV. On the first day of admission, he had pain at the bite site and was very apprehensive but had no abnormal systemic symptoms and no coagulopathy (VCT of 10 minutes). On the morning of his second hospital day, the patient developed bleeding from his gums and had a VCT of >30 minutes. There was no antivenin available at that time. In the afternoon, the patient went into shock, lost consciousness, and developed hematuria, hematemesis, and thrombocytopenia. He remained deeply unconscious and required vasopressors. During the afternoon of

Fig. 3. Map of Thailand, showing the 10 provincial locations.

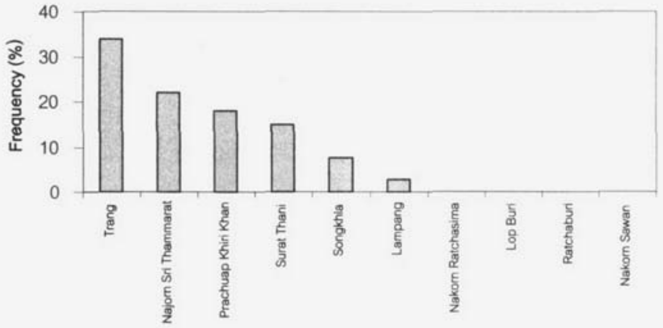

Fig. 4. Distribution of snakebite victims among the 10 provincial hospitals, in the prospective study.

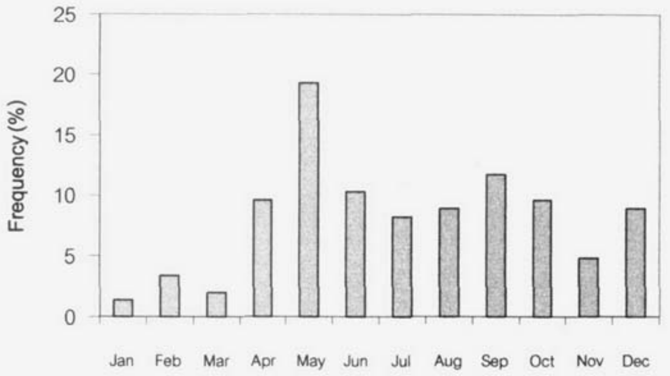

Fig. 5. Seasonal frequency of snakebites by *C. rhodostoma* during April 2002 to June 2003.

the second day, after it was decided that his case was hopeless, the patient was taken home to die.

Among victims with coagulopathy, 52.48% and 35.44% in the prospective and retrospective groups, respectively, had severe abnormal coagulopathy (VCT of >30 minutes). The mean VCT was >21 minutes on the first day and gradually decreased to normal by day 5 after treatment with antivenin. Most patients who had VCTs of >30 minutes and who received antivenin (three to five vials) showed improvement in the VCT 6 to 12 hours later, with return to normal 2 days later. In the prospective study, 25 of 145 victims did receive antivenin but their VCTs were still >30 minutes 12 hours later. The patients were given an additional three to five vials, which rapidly normalized the VCT in all cases.

Discussion

Our prospective and retrospective studies revealed some degree of bite site tissue injury for almost all victims. None of the patients required amputations, which indicates that even severe tissue necrosis of level 3 (by SSS) usually resolves in 2 to 3 weeks. Resolution can occasionally take 2 to 3 months, and for some victims the limb may remain permanently swollen because of vascular and/or lymphatic damage.[16]

Species-specific antivenin neutralizes circulating venom and reverses systemic symptoms. Local bite site necrosis, however, responds poorly (if at all) to antivenin administration.[17] This is partly attributable to the fact that tissue injury occurs rapidly and may be well established by the time the patient arrives at a hospital. Severe tissue necrosis was found in 2 (1.4%) of 145 cases in our prospective study and required surgical debridement. Both subjects appeared with a delay of 4 to 5 hours. They did receive 15 vials (150 mL) of antivenin after arrival at the hospital, but there was still progression of local necrosis. An additional four patients with tissue necrosis, who did not receive antivenin, had first been treated by traditional healers. The patients required surgical wound debridement. There were no cases of severe tissue necrosis in the retrospectively studied group. This finding is surprising and needs an explanation. Prachuap Khiri Khan provincial hospital, the site of the retrospective study, is located in a relatively prosperous region with good road infrastructure, a higher level of education, and good access to medical centers. It is likely that patients in this region reported more rapidly for medical care, rather than visiting traditional healers. This may be one explanation for less tissue injury and better outcomes. Only 61 (25%) patients in this group received antivenin.

Traditionally, patients bitten by venomous snakes in Thailand applied tourniquets to the bite site in an attempt to delay absorption of venom into the circulation. This is no longer recommended, because it was found to be dangerous.[12] A previous study of patients bitten by MPVs in Thailand showed that tourniquets applied by patients failed to inhibit the spread of venom into the general circulation.[12,18,19] Another study reported gangrene after tourniquet application.[14] Data concerning bite vic-

TABLE II

VARIOUS FACTORS AFFECTING TISSUE NECROSIS

Variables	Prospective Study		Retrospective Study	
	No Tissue Necrosis	Tissue Necrosis	No Tissue Necrosis	Tissue Necrosis
Gender (no.)				
Male	64	9	44	6
Female	58	14	30	0
Location (no.)				
Urban	22	3	25	1
Rural	100	20	49	5
Place of bite (no.)				
Indoor	12	2	1	0
Outdoor	110	21	71	6
Predisposing factors (no.)				
Barefoot	92	19	23	1
Dusk	30	4	48	5
Site of bite (no.)				
Lower	85	16	61	3
Upper	37	7	13	3
First aid treatment (no.)				
Tourniquet	47	10	0	0
No tourniquet	75	13	68	5
Treatment (no.)				
Dressing	120	17	74	5
Debridement	2	6	0	1
First seen by traditional healers (no.)	7	6		
Age (years)[a]	48.61 ± 1.71	46.60 ± 4.26	39.95 ± 2.21	26.85 ± 8.05
Time of bite[a]	00:50 p.m. ± 30 minutes	2:18 p.m. ± 59 minutes	1:54 p.m. ± 45 minutes	12:50 p.m. ± 60 minutes
Duration of hospitalization (days)[a]	3.02 ± 1.73	4.35 ± 0.65[b]	2.15 ± 0.13	4.33 ± 1.11
Time between bite and seeking medical advice (minutes)[a]	175.20 ± 44.16	187.17 ± 67.04	111.35 ± 26.20	690.00 ± 580.29
VCT (minutes)[a]				
First day	>21.58 ± 0.84	>25.91 ± 1.97[b]	>19.97 ± 0.90	>24.00 ± 3.82
Third day	>11.26 ± 0.97	>14.71 ± 0.87[b]	>18.00 ± 4.24	>20.93 ± 1.51

[a] Mean ± SE.

[b] Statistically significant, $p < 0.05$.

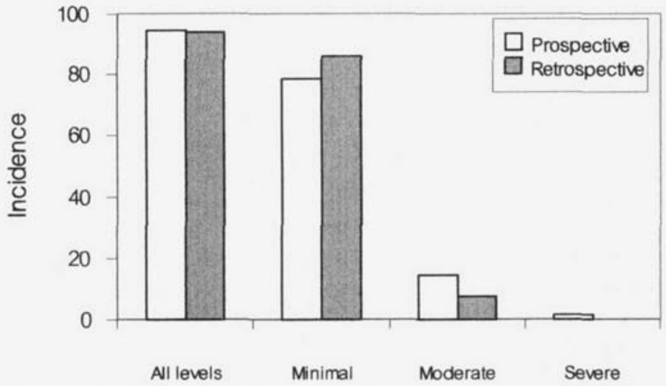

Fig. 6. Incidence of tissue necrosis after *C. rhodostoma* bites in the prospective and retrospective studies.

tims, circumstances, and sites of bites, as well as anatomic locations, were similar to those reported by Mitrakul.[20] Ismail and Memish,[21] and Da Silva et al.[20-22] The distance between fang marks is thought to be related to the size of the snake and possibly the amount of venom injected. Where this was recorded, bites had a mean space of 1.6 to 1.7 cm between fang marks. This may indicate that they came from female adult or young male snakes (L. Chanhome, personal communication).

When the SSS values involving the central nervous, cardiovascular, pulmonary, gastrointestinal, and hematologic systems were analyzed, it appeared that the score usually was severe only on the first day and there was rapid subsequent improvement. One study[14] noted nonclotting blood 1.5 to 72 hours (mean, 27.5 hours) after admission. Coagulopathies appeared within the first 24 hours in our study as well. Abnormal VCTs were significantly more common among patients who also had severe bite site tissue necrosis by the first and third days of hospitalization. Recurrences of coagulopathy after an initial response to antivenin were not uncommon and occurred more frequently among subjects with initial severe clotting abnormalities. Previous studies suggested that such recurrences of coagulopathy are related to decreases in circulating antivenin levels and/or reversible binding of antivenin to venom protein. There may also be a depot of non-neutralized venom at the bite site that is released slowly.[12,23,24]

Most patients presenting with MPV bites remained in stable condition after admission and received no antivenin. They were discharged after a period of observation in the emergency ward (30–40%). The mean duration of hospitalization for all patients was 3 to 5 days. All patients in this study who had a VCT of >30 minutes at admission received MPV antivenin. The average dose

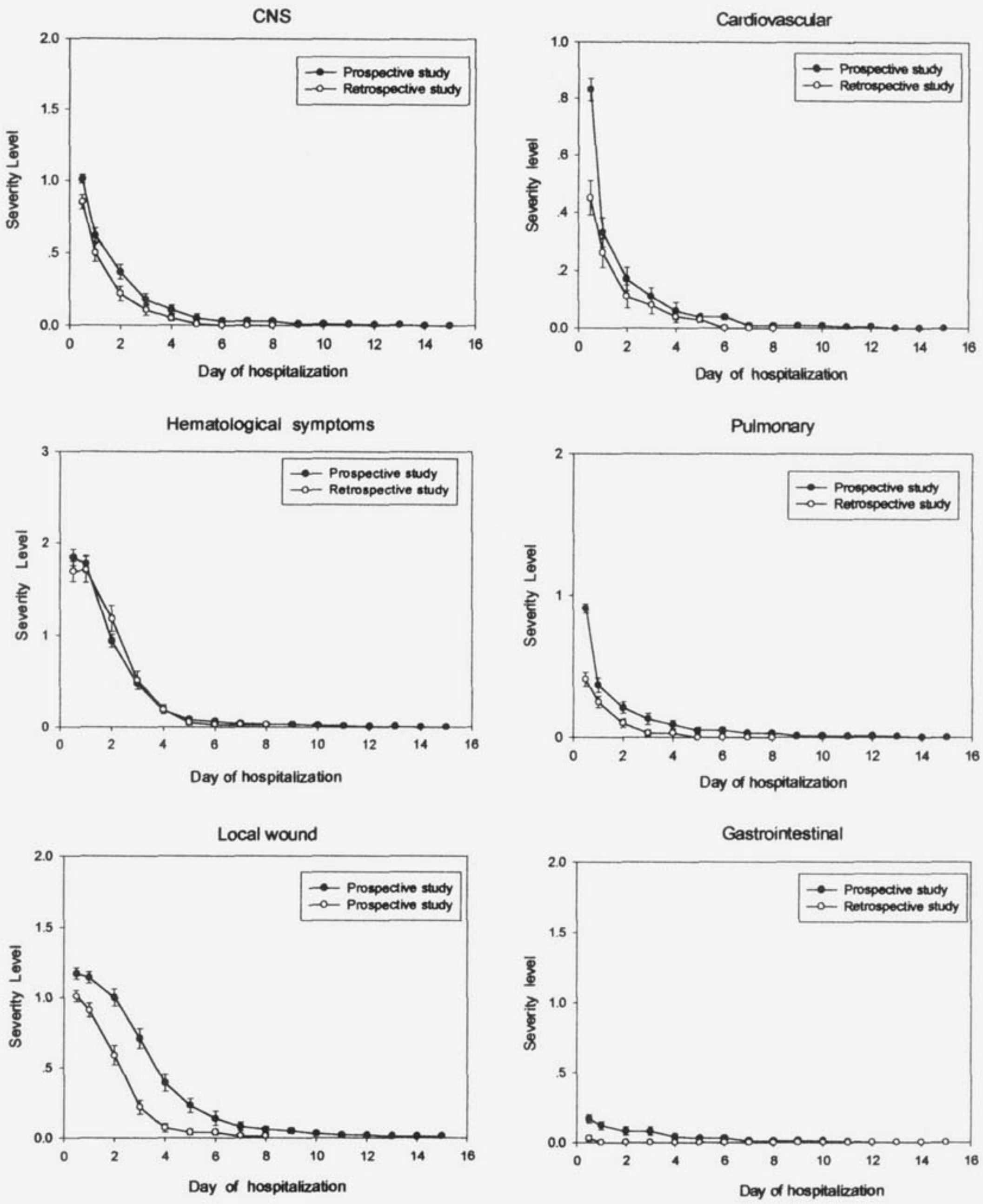

Fig. 7. Severity of envenomation, as evaluated with the modified SSS.

was five vials, which is in accordance with the manufacturer's recommendations. We identified only two patients who received antivenin and developed mild to moderate serum sickness (1.8%). There were no cases of anaphylaxis among a total of 111 subjects who received purified, pepsin-digested antivenin of equine origin, demonstrating again the relative safety of purified, pepsin-digested, snake antivenin.

The severity of tissue necrosis in our two groups was decreased compared with previous studies reported more than a decade ago. Those studies found significant necrosis requiring surgical debridement and even amputation in 10.9% of cases (5 of 46 victims).[14] We identified only 8 cases (5.5%) among 145 patients in the prospective group and one case (1.25%) among 80 patients in the retrospective study. There were no amputations among our patients, compared with 2.2% reported by Warrell et al.[14] However, 27 (18.6%) of 145 subjects had permanently swollen limbs because of vascular and/or lymphatic damage. The improved outcomes in our two groups are most likely attributable to better public education and road infrastructure and expanded health care facilities in rural areas. There was also considerable improvement in the quality of the antivenin used. Warrell et al.[14] demonstrated that at least one batch of *C. rhodostoma* antivenin, manufactured in Thailand before 1986, was of poor efficacy. Traditional healers, who may cause delays in treatment and increase the risk of wound infection, appear to play a lesser role in caring for snakebite victims today.

The MPV (*C. rhodostoma*) is prevalent through most of southeast Asia. It is a dangerous snake, because its coloration makes it difficult to spot in its natural environment. It often bites without warning and is an occupational hazard for rubber plantation workers and the military operating in the field. This snake is both tissue toxic and hematotoxic, and deaths resulting from coagulopathy and disseminated intravascular consumption have been reported. Purified, pepsin-digested, species-specific antivenin is manufactured in Thailand. It is active against coagulopathy and systemic symptoms but appears to do little to counteract local tissue necrosis, which is usually well established by the time victims present for treatment.

Acknowledgments

This study would not have been possible without the help of the directors and staffs of the 10 provincial hospitals. Photographs and critical review were provided by Dr. Lawan Chanhome from the Thai Red Cross Snake Farm. This study was supported by grants from the Thailand Research Fund and is being submitted to the School of Graduate Studies of Chulalongkorn University, as part of the requirements for a doctoral degree, by the senior author. None of the authors has a financial interest in the production of antivenin.

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Dr. Perlin presents the John D. Chase Award for Physician Executive Excellence to Dr. Michael J. Kussman-VA (BG, MC, USA (Ret.))

A Study of Thai Cobra (Naja kaouthia) Bites in Thailand
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Military Medicine; Apr 2005; 170, 4; ProQuest Medical Library
pg. 336

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A Study of Thai Cobra (*Naja kaouthia*) Bites in Thailand

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This study evaluated factors affecting the severity of bite site necrosis and systemic symptoms resulting from envenomation among patients bitten by Thai cobras (*Naja kaouthia*) in Thailand. We studied 45 victims prospectively. An additional 40 medical records were obtained for a retrospective study. Collected data included gender of the victims, anatomic locations of bites, where attacks took place, and predisposing factors and how they might have affected the clinical course. Most patients were asymptomatic or mildly symptomatic. Neurotoxic symptoms and respiratory failure developed in 31.11% and 12.50% in the prospective and retrospective groups, respectively. Only one patient died, from the effects of prolonged respiratory failure. There was some degree of tissue necrosis at the bite site for almost all victims. One victim required amputation of a digit in the retrospective study, and 33.60% of the prospective group and 20% of the retrospective group required minor surgical debridement. Snakebites in Thailand are still a public health problem, although rapid urbanization has decreased the number of victims because of degradation of the snake's habitat.

Introduction

The Thai cobra (*Naja kaouthia*) (Fig. 1) is the most well-known venomous snake in Thailand. It is widely distributed throughout the country and is also found in northeastern India, the Andaman Islands, Nepal, Bangladesh, Myanmar, Malaysia, Laos, Cambodia, southern Vietnam, and southern China.[1] It is not the only *Naja* species found in Thailand. *Naja sumatrana*, also known as the golden spitting cobra, is found in southern Thailand and *Naja siamensis* is the most common spitting cobra seen in the western and central regions, especially in the provinces of Ang Thong, Suphan Buri, Kanchanaburi, and Tak. The king cobra (*Ophiophagus hannah*) is found in more remote regions of Thailand. It belongs to a different genus than *Naja*, but there are great similarities in the action of the venom. The lethal toxins of the genera *Naja* and *Bungarus* show a high degree of amino acid sequence homology.[2] The bite of *N. kaouthia* is dangerous, with a mortality rate that appears to be higher than that for other venomous snakes.[3] The main lethal component of the venom is a postsynaptic neurotoxin that binds to the nicotinic cholinergic receptor sites at the neuromuscular junction. It produces an effect similar to that seen with curare poisoning.[4] The neurotoxicity results in ptosis, ophthalmoplegia with blurred vision or diplopia, dysphagia with increased salivation, dysarthria, flaccid paralysis, loss of deep tendon reflexes, coma, and respiratory failure.[5] In addition to the neurotoxicity, local tissue swelling and inflammation, followed by tissue necrosis, are common manifestations[6-8] (Fig. 2). Cardiotoxin (also known as cytotoxin), direct lytic factors, and myotoxin are present in cobra venom and are almost certainly responsible for myonecrosis. However, tissue necrosis usually involves only skin and subcutaneous tissue (unlike with bites from most vipers, which have larger fangs) (Fig. 2). Once tissue damage has occurred, antivenin of high potency and in large quantity fails to prevent further tissue necrosis. Bite site injury prolongs hospitalization and may increase morbidity, particularly if complicated by secondary infection.[7,9] The severity of local tissue necrosis and respiratory failure are related to the timing, dose, and potency of venom injected and the quality of supportive care rendered.

It is important, at the time of presentation, to make a rapid estimate of the degree of envenomation and to determine whether there is progression of symptoms (i.e., worsening of clinical signs and symptoms over time). A recently published, useful, clinical tool is the snakebite severity score (SSS), shown in Table 1.[10] It helps workers assess vital signs serially, search for evidence of progression of local tenderness, edema, and induration, and prepare a flow chart of systemic symptoms. The SSS thus provides a method for scoring clinical severity and improves record keeping.

Respiratory failure and local tissue necrosis have been well recognized as major causes of death and morbidity. Therefore, this study evaluated various factors that had effects on the severity of tissue necrosis and on the systemic envenomation syndrome of patients bitten by Thai cobras.

Methods

Forty-five patients were collected prospectively, between April 2000 and June 2003, from 10 provincial hospitals throughout the country that were known to treat a significant number of snakebite victims. Forty hospital charts of snakebite patients in Nakhon Sawan, a province north of Bangkok, from the years 1997–2000 were also reviewed retrospectively.

Eligibility criteria for patient selection included a bite from *Naja kaouthia* for which the species of the snake was confirmed. Patients were also included if the snake was not captured but the patient presented with a good description and clinical features of *N. kaouthia* envenomation, such as ptosis or dysphagia with increased salivation.[5] Informed consent to participate in the study was obtained from patients or their relatives.

Data from hospital records in the prospective and retrospective series were summarized by two nurses and reviewed by the principle investigator. The SSS, as modified from the report by Dart et al.,[10] was used to compile data (Table I). The following information was tabulated and analyzed: clinical signs and symptoms, pulse rate, and temperature. Data were collected at

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Fig. 1. Defensive position of *N. kaouthia*.

admission, 2 and 12 hours later, and daily thereafter. Statistical analyses used the χ^2 test or Student's *t* test.

Fig. 2. Cobra bite 1 week later. The tissue necrosis is superficial and does not involve muscle.

Results

The prospective study collected a total of 45 *N. kaouthia* snakebite victims from 10 provinces (Fig. 3). Most victims came from Nakhon Si Thammarat (southern) and Nakhon Sawan (northern) provinces, i.e., 13 (28.89%) and 11 (24.44%), respectively (Fig. 4). The peak prevalence was in May (13 of 45 cases; 28.89%), which is in the early part of the rainy season (Fig. 5).

Snakebites by *N. kaouthia* were distributed throughout the

TABLE I

MODIFIED SSS

Criteria	Level
Pulmonary system	
No symptom/sign	0
Dyspnea, minimal chest tightness, mild or vague discomfort, or respirations of 20–25 breaths/minute	1
Moderate respiratory distress (tachypnea, 26–40 breaths/minute; accessory muscle use)	2
Cyanosis, air hunger, extreme tachypnea, or respiratory insufficiency/failure	3
Cardiovascular system	
No symptom/sign	0
Tachycardia (100–125 beats/minute), palpitations, generalized weakness, benign dysrhythmia, or hypertension	1
Tachycardia (126–175 beats/minute) or hypotension, with systolic blood pressure of <100 mm Hg	2
Extreme tachycardia (>175 beats/minute) or hypotension, with systolic blood pressure of <100 mm Hg, malignant dysrhythmia, or cardiac arrest	3
Local wound	
No symptom/sign	0
Pain, swelling, or ecchymosis within 5–7.5 cm of bite site	1
Pain, swelling, or ecchymosis involving less than one-half the extremity (7.5 cm from bite site)	2
Pain, swelling, or ecchymosis extending beyond affected extremity (>100 cm from bite site)	3
Gastrointestinal system	
No symptom/sign	0
Pain, tenesmus, or nausea	1
Vomiting or diarrhea	2
Repeated vomiting, diarrhea, hematemesis, or hematochezia	3
Hematologic system	
No symptom/sign	0
Coagulation parameters slightly abnormal: PT, <20 seconds; PTT, <50 seconds; platelets, 100,000–150,000/mL; fibrinogen, 100–150 μg/mL	1
Coagulation parameters abnormal: PT, <20 to 50 seconds; PTT, <50 to 75 seconds; platelets, 50,000–100,000/mL; fibrinogen, 50–100 μg/mL	2
Coagulation parameters abnormal: PT, <50 to 100 seconds; PTT, <75 to 100 seconds; platelets, 20,000–50,000/mL; fibrinogen, <50 μg/mL	3
Coagulation parameters markly abnormal, with serious bleeding or the threat of spontaneous bleeding: unmeasurable PT or PTT; platelets, <20,000/mL; undetectable fibrinogen and severe abnormalities of other laboratory values, including venous clotting time, also fall into this category	4
Central nervous system	
No symptom/sign	0
Minimal apprehension, headache, weakness, dizziness, chills, or paresthesia	1
Moderate apprehension, headache, weakness, dizziness, chills, paresthesia, confusion, or fasciculation in area of bite site, ptosis, and dysphagia	2
Severe confusion, lethargy, seizure, coma, psychosis, or generalized fasciculation	3

PT, prothrombin time; PTT, partial thromboplastin time.

Fig. 3. Map of Thailand, showing the 10 provincial locations.

day and were most common between 11:00 a.m. and 4:00 p.m. (48.9% and 37.5% in the prospective and retrospective studies, respectively). Some victims were bitten at night (15%). The size of the snakes, as reflected by the distance between fang marks, was recorded only in the prospective study. Distances ranged between 1.45 and 1.50 cm. The number of snakes presented for identification was larger (27 of 45 cases, 60%) in the prospective study (Table II).

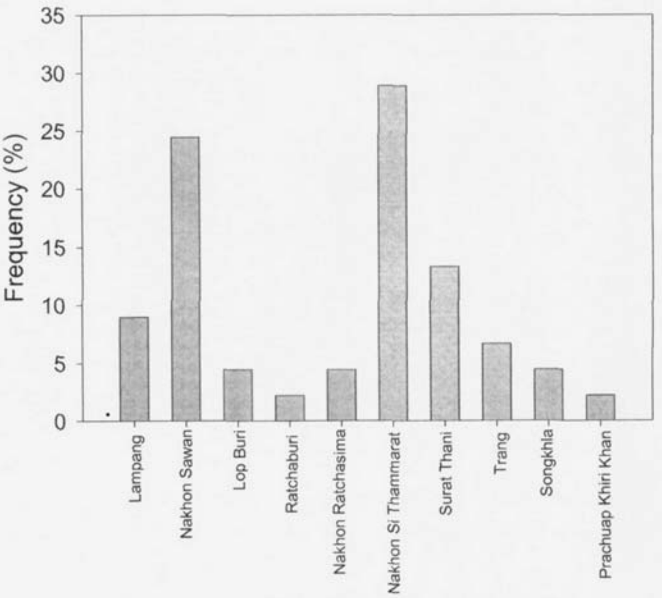

Fig. 4. Distribution of snakebite victims among the 10 provincial hospitals, in the prospective study.

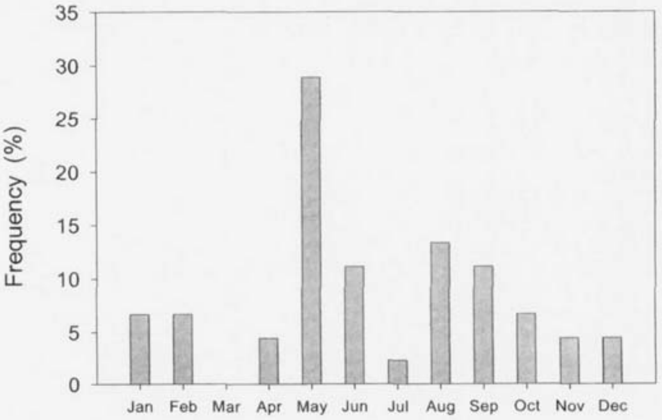

Fig. 5. Seasonal frequency of snakebites by *N. kaouthia* during April 2002 to June 2003. The monsoon season is May to October.

More male patients experienced snakebites, with a mean age range of 37 to 50 years. However, there were two children (4.5%) <15 years of age in the prospective study and five (12.5%) in the retrospective study. Most bites were on toes and fingers (40%). Bites of the lower limbs, especially feet, represented 25 to 35% (Table II). Most bites occurred in rural areas, outdoors, and in dusky or dark places. Times between the bite and arrival at a hospital or health center ranged between 65 and 120 minutes (1–2 hours) and did not differ significantly between patients who did or did not have severe tissue necrosis, in both groups. Twenty-seven (60%) of 45 victims applied tourniquets in the prospective study, and 7 (17.50%) of 40 victims did so in the retrospective study. Only two patients in the prospective group and none in the retrospective group were first treated by traditional healers. Antivenin therapy ranged from 1 to 20 vials (mean of 2–6 vials, 20–60 mL, in both groups). The antivenin used for all groups was from the Queen Saovabha Memorial Institute of the Thai Red Cross Society (Bangkok, Thailand). The range of hospitalization was 2 to 6 days, with a maximum of 29 and 20 days in the prospective and retrospective studies, respectively (Table II). The severity of tissue necrosis was related to the length of hospitalization only in the retrospective study ($p < 0.05$).

Tissue necrosis at the bite site was seen for 91.11% (41 of 45 cases) and 65% (26 of 40 cases) of cases in the prospective and retrospective studies, respectively. The most common SSS level was minimal tissue necrosis (score of 1 for 84.5% and 60% in the prospective and retrospective groups, respectively). There was no case of severe tissue necrosis in either group (Fig. 6). Twenty-nine of 45 victims (64.5%) in the prospective group and 77.5% in the retrospective group required some surgical wound care to prevent or control infection, but the wounds were of moderate local severity (score of 2 for 33.6% and 20% in the prospective and retrospective groups, respectively). Only one patient required amputation of the thumb, in the retrospective group. Lack of abundant soft tissue to allow expansion with swelling (the compartment syndrome) was the cause.[11]

TABLE II

VARIOUS FACTORS AFFECTING TISSUE NECROSIS

Variables	Prospective Study		Retrospective Study	
	No Tissue Necrosis	Tissue Necrosis	No Tissue Necrosis	Tissue Necrosis
Gender (no.)				
Male	4	21	11	15
Female	0	20	3	11
Location (no.)				
Urban	1	4	1	14
Rural	3	37	13	22
Place of bite (no.)				
Indoor	1	12	3	8
Outdoor	3	29	11	18
Predisposing factors (no.)				
Barefoot	3	32	3	6
Darkness	1	9	11	20
Site of bite (no.)				
Lower	2	25	6	18
Upper	2	16	8	8
First aid (no.)				
Tourniquet	3	24	1	6
No tourniquet	1	17	13	20
Treatment (no.)				
Dressing	3	26	13	18
Debridement	1	15	1	7
Amputation			0	1
Age (years)[a]	46.25 ± 7.77	41.92 ± 2.50	43.26 ± 4.12	37.30 ± 4.06
Time of bite[a]	11:25 a.m. ± 51 minutes	00:30 p.m. ± 49 minutes	4:01 p.m. ± 49 minutes	2:50 p.m. ± 42 minutes
Time between bite and seeking medical advice (minutes)[a]	68.75 ± 38.42	83.65 ± 11.73	120.00 ± 18.50	95.19 ± 19.09
Distance between fang marks (cm)[a]	1.50 ± 0.28	1.45 ± 0.10		
No. of antivenin vials used[a]	6.25 ± 3.42	4.37 ± 0.84	4.07 ± 2.19	2.15 ± 1.01
Duration of hospitalization (days)[a]	5.50 ± 3.17	5.65 ± 0.88	2.87 ± 0.51	5.34 ± 0.89[b]

[a] Mean ± SE.

[b] Statistically significant, $p < 0.05$.

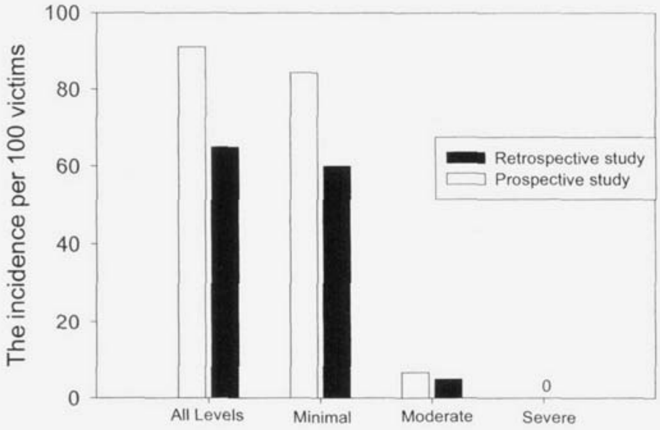

Fig. 6. Tissue necrosis after N. kaouthia bites in the prospective and retrospective studies.

Clinical manifestations involved the central nervous, cardiovascular, pulmonary, gastrointestinal, and hematologic systems and injury at the bite site (Fig. 7). An overall analysis of SSS values revealed 1.05 to 1.62 involving the central nervous system, 1.07 to 1.42 the pulmonary system, 0.13 to 0.27 the gastrointestinal system, 0.55 to 0.89 the cardiovascular system, 0 the hematologic system, and 0.70 to 0.98 bite site injury. The highest scores were observed 12 hours after hospitalization; most patients presented with no or only mild symptoms, which gradually decreased to level 0 (no symptoms) after 5 days of hospitalization, in both the prospective and retrospective studies. On the first day of hospitalization, 14 (31.11%) of 45 victims in the prospective group and 5 (12.50%) of 40 victims in the retrospective group had dysphagia, flaccid paralysis, and respiratory failure. The patients were intubated. Only one patient, in the prospective study, died as a result of respiratory failure. He was 66 years of age and came to the hospital deeply comatose, in advanced respiratory failure. He was intubated, given 50 mL of antivenin for the first dose, and given the same antivenin dose 2 hours later. He never regained consciousness in >4 days of hospitalization and was taken home to die at the request of his family.

Discussion

Our two studies revealed some degree of tissue necrosis and progression of systemic symptoms for almost all victims. The

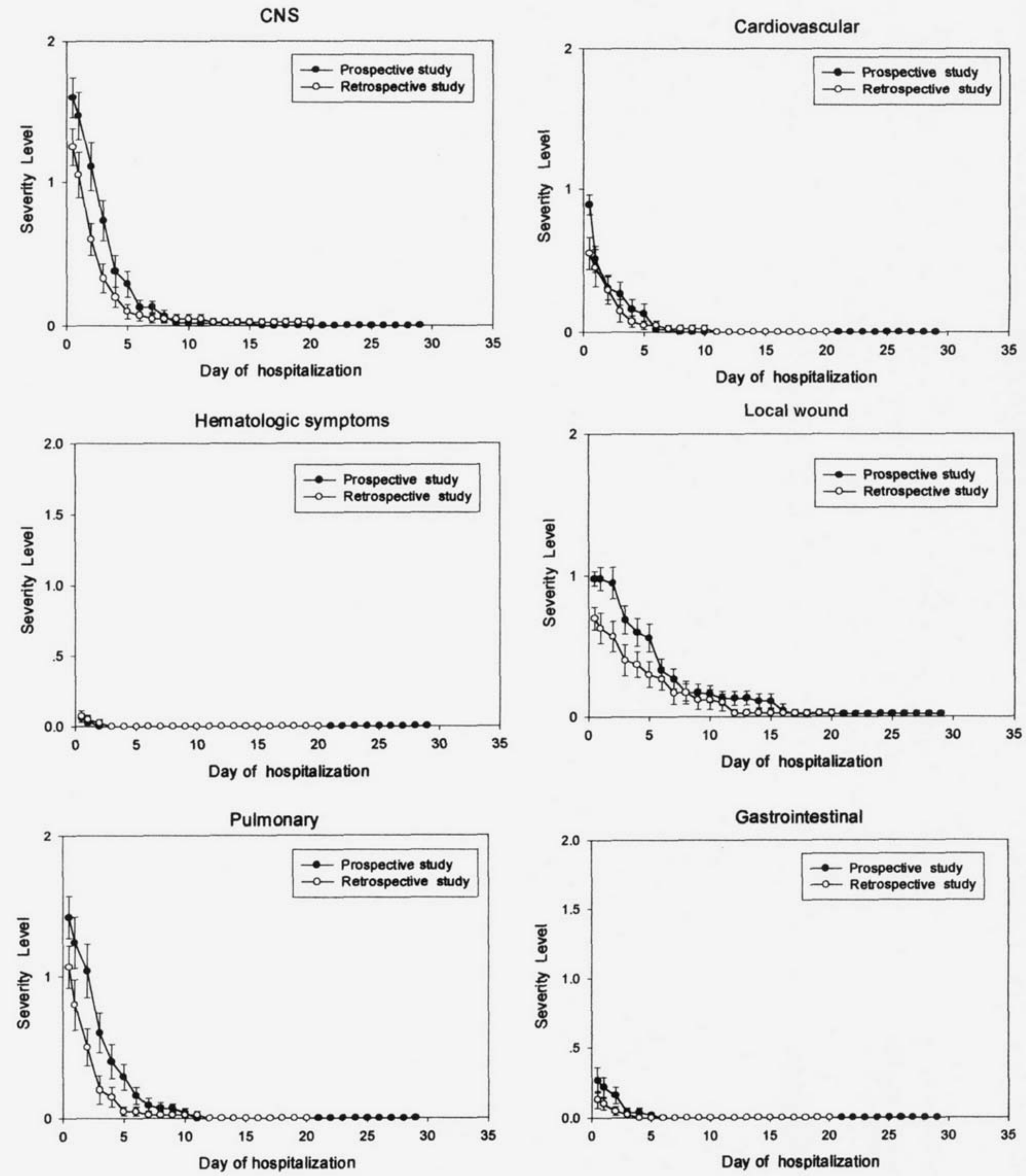

Fig. 7. Severity of envenomation, as evaluated with the modified SSS.

incidence of tissue necrosis was 91.11% (41 of 45 cases) in the prospective group and 65% (26 of 40 cases) in the retrospective group. Most patients had minimal tissue necrosis and no patients had severe tissue necrosis. However, one victim required amputation of the thumb and almost one-third required minor surgical debridement. Patients presented to medical facilities quickly, with times between bite and admission ranging from 60 to 120 minutes. It is noteworthy that evidence of tissue necrosis was already present at arrival. There was no difference in the severity of tissue necrosis among patients who arrived more rapidly after being bitten and those who arrived with significant delay. A previous study showed that antivenin administration within 30 minutes after the bite did not prevent local tissue damage.[12] Histopathologic findings suggested that local reactions at the bite sites result from vasculitis and thrombosis of superficial and deep dermal vessels and may extend to subcutaneous tissues.[9] Neurotoxic symptoms and respiratory failure developed in 31.11% and 12.5% of cases in the prospective and retrospective groups, respectively. They required intubation and assisted respiration, and one patient died as a result of respiratory failure, because of a delay in treatment and irreversible central nervous system damage.

Species-specific antivenin neutralizes circulating venom and reverses systemic symptoms. It does not immediately release venom bound to binding sites at neuromuscular junctions. Our data indicated that 9 of 10 victims who required intubation regained spontaneous respiratory function, with reversal of dysphagia, dysarthria, and flaccid paralysis, within 2 to 3 days after receiving *Naja* antivenin (mean of 11 vials, 110 mL). A previous study showed that 100 mL is adequate for recovery of respiratory paralysis and has the same beneficial effect as 200 mL.[7] Antivenin administered early and in adequate doses shortens the duration of paralysis and the time of respiratory assistance.[13,14] Pochanugool et al.[7] showed that, even if species-specific antivenin is administered in a timely manner, severely envenomed patients still require intubation and respiratory assistance.

Traditionally, patients bitten by venomous snakes in Thailand applied tourniquets to the bite site, in an attempt to delay absorption of venom into the systemic circulation. In our study, 27 (60%) of 45 victims used a tourniquet in the prospective study and 7 (25.92%) of 27 patients required intubation and assisted respiration. Among patients who did not apply tourniquets, 38.89% (7 of 18 patients) developed respiratory failure. Previous reports showed that tourniquets applied by patients failed to inhibit the spread of venom into the general circulation.[15-17] There was no relationship between the use of restriction bandages and the kinetics of serum venom levels among patients after *N. kaouthia* bites.[18] Our data concerning bite victims, circumstances, and sites of bites, as well as anatomic locations, were similar to those reported by others.[9,18,19]

Most patients who presented with *N. kaouthia* bites remained asymptomatic or mildly symptomatic. They received no antivenin (45–75%) and were discharged after periods of observation ranging from 3 to 4 days. Cases with moderate to severe symptoms (SSS of 5), with involvement of the central nervous, cardiovascular, pulmonary, gastrointestinal, and/or hematologic systems, showed that these symptoms were severe only during the first day and improved rapidly thereafter. The mean amounts of antivenin used were two to six vials (20–60 mL). The beneficial effects on neurotoxic and systemic symptoms of the administration of specific antivenin were shown by Pochanugool et al.[7] We identified only one patient who had a positive skin test result with equine cobra antivenin; this patient was not given antivenin and received only prolonged supportive treatment. No patients developed serum sickness (0 of 45 cases).

Hospitalization was prolonged significantly for patients with tissue necrosis. The range of hospitalization times was 20 to 29 days. Most patients were rural farm workers with a high risk of secondary infection if discharged home.

In 1988, Pongprasit et al.[9] showed that 51% of cobra bite victims presented with severe tissue necrosis and 27.66% required full-thickness skin grafts. More recently, Chulalongkorn University Hospital found that 60.3% of patients bitten by cobras presented with tissue necrosis.[18] Many (if not most) of those patients represented a selected population referred to Chulalongkorn University Hospital from other medical facilities. Rural medical care has been significantly expanded and improved in the past decades, and fewer patients are referred to secondary and tertiary care facilities. Also, the number of snakebites throughout the country has decreased, because of reduction of the snake population as a result of snakes being hunted for their hides and flesh[7] and degradation of their habitat.

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SEXUAL BEHAVIORS AND OPINIONS ON SEXUALITY OF ADOLESCENTS IN A SLUM COMMUNITY IN BANGKOK

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Abstract. This study was a survey research aiming to investigate sexual behaviors and opinions on sexuality of adolescents in a slum community. The study group comprised of 377 adolescents aged 12-22 years in a slum community in Bangkok randomly selected, and data were collected using self-administered questionnaires. Results indicated that 18.8% of the adolescents were sexually experienced with the average age of 15 years old at first intercourse. 63.1% of the adolescents had unprotected sexual intercourse with lovers or friends. Almost one-third of the population believed that premarital sexual activity was acceptable. One-sixth of the adolescents agreed that having sexual intercourse with a lover is safe, assuming that they had trustworthy partners and that having sexual intercourse was the best way to prevent their lover from having sexual activities with other partners. In addition, gender and age range were found to be the factors that significantly related to the adolescents' opinions that premarital sexual activity was acceptable and having sexual intercourse with a lover was safe ($p<0.05$), whereas the relationship between the opinions and education level was statistically insignificant. It is recommended that familial, academic, community and public health support are necessary in educating the adolescents on reproductive health and family planning in order to reduce high risk behaviors associated with acquiring HIV and other STDs.

INTRODUCTION

Presently, adolescents are categorized as a risk group for acquiring sexually transmitted diseases (STDs) (Anonymous, 1994) due to the curious and experimental nature and as they begin to develop sexual desires (Steinberge, 1993). Sexual activity among adolescents was found to increase in developing countries (Hedberg *et al*, 1998). This was endorsed by the World Health Organization report, which found that 50% of new HIV infected patients globally were in the 10-24 year old age range (WHO, 1989). These adolescents included those who were outside education systems, those with inferior social opportunity, and youth laborers, all of whom were at greater risk for acquiring STDs, especially HIV/AIDS, than subjects in other groups (Cates and Pheeters, 1997, unpublished paper).

This study was, therefore, a survey research to investigate opinions about sexuality and sexual behaviors of adolescents with inferior social opportunities. Klong Toey community was selected for this survey because it is a slum community with the majority of its population being low-income and facing problems of poverty, employment insecurity and a lack of land ownership because the Port Authority of Thailand has rights on the land (Office of the Prime Minister, 1994). This study aimed to survey risky sexual behaviors and opinions on sexuality of adolescents in Klong Toey to reduce high-risk behaviors among disadvantaged youths.

MATERIALS AND METHODS

The study group was randomly recruited from 14,800 teenagers in Bangkok's Klong Toey community. A study group of 375 was determined by using Taro Yamane Table. The researcher, however, conducted additional surveys giving a sample size of 377. The error of the

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study group was determined to be 0.05.

Sampling method

A cluster stage random sampling technique was utilized. Randomly selected subjects from 25 communities in Klong Toey district obtaining a total of 23 communities. In sampling of community populations, systematic random sampling was adopted to determine the ratio of the populations in the communities. Sampling of household subjects was done by determining the ratio and sample size of the subjects by systematic random sampling obtaining the ratio of 1:9.

Instruments

Questionnaires on demographical data and on sexual behaviors and opinions about sexuality of adolescents were employed in this study.

Data analysis

The data were analyzed using the SPSS PC program by dividing the analysis as follow: frequency distribution, percentage, mean, and standard deviation were obtained in analysis of demographical data and sexual behaviors of the study groups. Chi-square test was employed in analysis of opinions on sexuality.

RESULTS

General characteristics of the study group

As shown in Table 1, the ratio of female to male subjects is 1.5: 1. The average age was 16 years old with 19.1 % of the subjects in the 14-17 years old range and 37.7 % of the subjects in the 18-22 years old range. The ratio of adolescents inside education systems to those outside education systems was 2.5:1.

Sexual experiences of adolescents

The result indicates that 81.2% of the study group never had sexual experiences, while 18.8% of that had sexual experiences with the average age of 15 years old at first intercourse.

Sexual partners and uses of condom during sexual activities

Sexual partners of the sexually active adolescents mainly comprised of their lovers (70.5%). When having sexual intercourse with their lovers, 63.1% of the subjects did not use condoms, while only 12.3% always used condoms. When having sexual intercourse with friends, 42.8% of the subjects did not wear condoms, 28.6% always used condoms. However, when having sexual intercourse with pros-

Table 1
Demographical data.

Variables	Number	%
Gender		
Male	166	44.0
Female	211	56.0
Age		
12-13 years old (Early teenage)	72	19.1
14-17 years old (Mid teenage)	163	43.2
18-22 years old (Late teenage)	142	37.7
Mean ($\overline{x}$) = 16.0	377	100.0
Standard deviation = 3.02		
Education background		
Studying both inside and outside conventional education systems	272	72.1
Not studying	105	27.9

Table 2
Percentage of partners whom the adolescents had sexual activities which classified by percentages of frequency of condom uses.

Sexual partners of the adolescents (No. of subjects)	Frequency of condom uses during sexual activities		
	Always used (%)	Occasionally used (%)	Never used (%)
Lovers (50)	12.3	24.6	63.1
Friends (14)	28.6	28.6	42.8
Female/male prostitutes (7)	71.4	14.3	14.3

titutes, the majority of the subjects always used condoms, while only 14.3% of those never used condoms during sexual intercourse as shown in Table 2.

Opinions on sexuality of adolescents

70.6 % of the study population believed that having premarital sex was unacceptable. 84.9% of the adolescents disagreed that having sexual intercourse with a lover is safe, reasoning that they did not trust their lovers or that they did not know if their partners had STDs. Only 15.1% of the adolescents agreed with the opinion, reasoning that their partners were trustworthy or that it was the best prevention from their partners having multiple sexual partners.

Opinions on the risk for acquiring sexually transmitted diseases

74.8 % of the population believed that they were not at risk for STDs because they never had sexual experiences. 7.4 % believed that they were at risk for STDs because they had unprotected sexual intercourse with their lovers or friends until present time and their lovers or friends also had unprotected sexual intercourse with other partners. However, 17.8% of the subjects were unsure of such risk even though they had unprotected sexual experiences.

Factors relating to the opinions on sexuality of the adolescents

The factors that significantly related to the opinions of the adolescents that 'having sexual intercourse with a lover is safe' included gender (p=0.000) and age range (p=0.0002) (Table 3).

The factors that significantly related to the opinions of the adolescents that 'having premarital sexual activities are acceptable' included gender (p=0.0002) and age range (p=0.0002) (Table 4).

DISCUSSION

The study results found that one-fourth of teenagers were sexually experienced with the average age of 15 years at first sexual intercourse. This corresponds to a study, which found that the majority of adolescents in slum communities became sexually experienced between the ages of 14-16 years of age (Kanungsukaseam, personal communication). Interestingly, adolescents who had sexual intercourse with lovers or friends did not wear condoms, believing that their partners were trustworthy and that it was the way to prevent their partners from having sexual activities with other people. Consequently, the adolescents in this slum community were at a high risk for acquiring and spreading HIV and other STDs, which corresponds with the WHO report that found that teenagers under the age of 20 years old in developing countries are a risk group for acquiring STDs, especially HIV/AIDS (Reid, 1994).

Almost one-third of the adolescents believed that premarital sexual activity is acceptable. These opinions reflect the tendency of the adolescents in the slum community to have liberal sexual attitudes. Furthermore, teenagers typi-

Table 3
Factors relating to the opinion that having sexual intercourse with lovers is safe.

Variables	Opinion that having sexual intercourse with lovers is safe		p-value of χ^2
	Agree (%)	Disagree (%)	
Gender			
Male	11.4	32.6	
Female	3.7	52.3	0.000
Age			
12-13 years old (Early teenage)	4.0	14.9	
14-17 years old (Mid teenage)	8.7	34.3	
18-22 years old (Late teenage)	2.4	35.7	0.0002

Table 4
Factors relating to the opinion that having premarital sexual activities are acceptable.

Variables	Opinion that having premarital sexual activities are acceptable		p-value of χ^2
	Agree (%)	Disagree (%)	
Gender			
Male	17.5	12.0	
Female	11.9	58.6	0.0002
Age			
12-13 years old (Early teenage)	4.0	14.8	
14-17 years old (Mid teenage)	8.8	34.5	
18-22 years old (Late teenage)	16.6	21.3	0.0002

cally imitate the behaviors of their peer group, which can increase risky behavior (Brown, 1990). Such sexual attitudes might be used to predict incidence of illness among adolescents with high-risk sexual practices. These facts emphasize that teenagers in this community are potentially at high risk for acquiring AIDS and other STDS. Furthermore in Thai societies, discussion about sexuality is taboo, especially among young women. Because of the culturally sensitive nature of sexual health, Thai adolescents face limited information and knowledge of reproductive health and health service provisions.

For these reasons, the pattern of health care service provision should be promptly improved by increasing services to support education on reproductive health, reproductive system diseases, proper sexual practices, prevention of STDs, and family planning. Health facilities and community organizations need to be coordinated in preparing and integrating such courses into school teaching to suit the actual problems of the adolescents in the slum community. Health care providers need to be trained for the specific needs of adolescents in terms of health service provisions and information on safe sex practices and family planning. Moreover, health professional should provide familial support and communication should be promoted among the parents of these adolescents to reduce the sex taboo associated with Thai culture.

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Existing health needs and related health services for adolescents in a slum community in Thailand

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ABSTRACT

The health problems of youth have dramatically shifted in the last 30 years from biological to social causes of morbidity and mortality. In this population, major health problems that are becoming increasingly important for preventive intervention include substance abuse, teenage pregnancy and AIDS. Presently, there is limited research on the health status and health care needs of adolescents, particularly those who are difficult to track and quantify. The objective is to carry out a situation analysis of the health needs of adolescents, including the availability of existing services for them. The study setting is Klong Toey, the biggest slum community in Bangkok, where 38 adolescents were selected for focus group discussion, including in-depth interviews of youth leaders, government and non-government officers and schoolteachers, who work with adolescents. The result showed that adolescents in Thailand are older than traditionally defined. The culture and life-style of Thai society influence adolescents to stay with their families longer. Most adolescents do not have adequate and appropriate knowledge about sex and sexual relationships. The most important health problems are drug dependency and unwanted pregnancy among schoolgirls, which have commonly led to illegal abortions, and subsequent termination of schooling due to regulations and social norms. For general illness, such as pain associated with menstruation, headache and common cold, most have resorted to

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self-medication with drugs obtained from the local drugstore. Males tend to acquire injuries from violence, accidents and drug abuse. The need for female adolescents is a clinic with female staff who will be able to provide both consultative and curative care, while the need for males is qualified staff for consultation, especially regarding drug abuse. Adolescents under-utilize existing government health services due to their unavailability and adolescents' dissatisfaction with their services. This study was conducted in only one community, however, the findings are important for the planning and delivery of appropriate and effective health services for young people living in urban slums.

BACKGROUND

Although adolescents are often considered to possess good physical health, it is a period of physical, social and psychological change. The socio-cultural, political, religious environments and the economic conditions in which adolescents develop, have a strong influence on their development and health in later life. Due to development and rapid social change, the health problems of youth have dramatically shifted in the last 30 years from biological to social causes of morbidity and mortality. In fact, the literature and experience have indicated that adolescents' health problems have become serious, particularly in the developing countries, and require prompt action. This has resulted in an increasing volume of literature relating to the development of adolescent health services that meet the needs of their target group. However, a lack of understanding and a lack of emphasis on adolescent needs in policy and programming continues, especially in Asia. The outcome is that many still have limited access to health care, information concerning their growth and development, or counseling services. Even when health services do exist, they may be culturally inappropriate, insensitive to adolescent health needs, or delivered by staff with insufficient training in adolescent health. Thus, adolescents are unlikely to use them. This is alarming in a time of increased sexual activity among unmarried adolescents, a younger age at first intercourse, and evidence of an increasing incidence of STDs and HIV/AIDS in this group. Risk behaviors are also heavily concentrated in youth, leading to more unprotected sex, teenage pregnancies, substance abuse, and their consequent negative health effects.

In Thailand, many studies have shown that adolescents experience similar risks to the ones outlined above. For example, of the 22,064 drug addicts treated at rehabilitation clinics in Thailand, 24% of them were adolescents. This study also states that only 35.7% of adolescent males' first intercourse is protected, while only 25.9% of females' is protected. In addition, 41.2% of all AIDS patients in Thailand are 15-29 years old and 50.4% of all HIV+ people fall into this category. There is resistance to sex education by many Thai adults, as they still consider that it will probably lead to increased sexual activity among adolescents. These studies, among others, point to the need for appropriate adolescent health programs, especially in a time of economic crisis where less money is being spent in the public sector. It is often adolescents and young people who suffer from budget and service cuts. Such programs should be able to learn and reflect the needs of adolescents, acquire their help in planning and delivery, have the support of local leaders and parents and be trusted by the adolescents themselves. They must be culturally appropriate and institutionalized to ensure support and cost-effectiveness. Most studies focus on youth and adolescents in general and very few studies have targeted disadvantaged adolescents, particularly those living in slum communities. As so little is known about the specific problems and strengths unique to this group, this project was initiated. It is hoped that it will result in a better understanding of adolescents' health needs and behavior so that appropriate and accessible health services can be provided to this often overlooked group.

Our study was conducted in Klong Toey slum, the biggest slum community in Bangkok, the capital of Thailand. The area is about 3 square km., encompassing 25 different slum communities with a population of more than 70,000. There are around 17,000 inhabitants who are aged between 12-22 years. The community was first established in 1952 as a dwelling place for port workers and other laborers. Although many residents have lived there all their lives, the majority of them have no rights to the land they occupy, which creates a feeling of instability among the populace. Most people are laborers or unskilled workers. The biggest problems are poverty, lack of job security, limited education, and debt. In terms of health, the community suffers from overcrowding, unhygienic conditions, widespread drug and alcohol abuse, lack of clean drinking water, and broken families. There is a private doctor's clinic within the slum and a health center run by the Bangkok Metropolitan Authority.

OBJECTIVES

To carry out a situation analysis of the health needs of adolescents, including the availability of existing services for adolescents in an under-privileged community of Bangkok. The information is needed to develop actions and further research to increase access to health care for adolescents, formulate the role of local and the central government in adolescent health, as well as to propose ways to improve adolescents' social environment, to promote healthy adolescent lifestyles.

METHODOLOGY

A group of adolescents was assembled for focus group discussions, to understand their needs (health and non-health), their knowledge of, and access to, existing services, as well as their perception of the adequacy and quality of those services. Thirty-eight adolescents, aged between 12-23 years, were gathered for focus group discussions. Two groups were male and two groups were female. Each group consisted of 8-10 participants. They were selected by purposive sampling, i.e., with the help of the youth leaders in each of the 18 sections within the slum community. Two adolescents represented each section. The discussion followed a pre-prepared interview guideline plus observation of the behaviors of the adolescents, including their interaction and physical characteristics, during the discussion sessions. The product of the discussion was to be the variables that were to be used to construct an interview guideline.

In-depth interviews with 10 youth leaders, 4 health providers of the health center in the community and 4 non-government organization staff who were working with adolescents, were conducted in the community. The objective of the in-depth interviews was to understand the perception of each individual group, related to adolescents' health problems, actual utilization of the health services by adolescents, and the needs for health services.

Organizing the meeting among stakeholders and relevant agencies; a group of 21 individuals from various agencies in Thailand was gathered at the Health System Research Institute to discuss potential research activities pertaining to adolescent health. These included the Health System Research Institute, Mahidol University, the Department of Mental Health, the Division of Family Health and Population, the Division of Health Promotion, the Institute of Health Research, the Bangkok Metropolitan Administration, the Department of Obstetrics and Gynecology at Chulalongkorn Hospital, the Division of School and Youth Health, private sector organizations dealing with youth, adolescents and AIDS, and the College of Public Health, Chulalongkorn University. The experiences and the activities of these agencies related to the adolescents' health were summarized. It was agreed that the College of Public Health, Chulalongkorn University, would serve as an information center for adolescent health. It was also agreed that periodic meetings should be organized to exchange resource persons, research results and other information about adolescent health.

RESEARCH FINDINGS

Focus Group Discussions among the Adolescents

The main objectives of focus group discussions were: 1) to understand the perceptions of the health problems of adolescents in the slum community, and 2) to understand their perceived needs for health services. The discussions followed a pre-prepared interview guideline plus observation of the behaviors of adolescents, including their interactions and physical characteristics during the discussion sessions.

Findings:

Most of the female adolescents were well-behaved, well-dressed, clean, pleasant and appeared to be happy. One member of the female group was a little reserved and silent (It was later reported by an officer from a private organization that she might be an addict and her household had been involved in illegal drug trafficking.) All females in the groups were unmarried. Three members came from broken families (the parents were separated).

Most of the male adolescents in the discussions were happy and appeared to be healthy. They were not as well-dressed as the females and used the language of their peers. One of the members was a heroin addict who said that he had already given up the habit. He appeared to be sick and unhealthy. Most of the males had had some sexual experiences. One of the members had already had a family and was divorced.

The major health problems of the female adolescents were:

1. Pain associated with menstruation. Most had taken care of this problem themselves by using a rubber hot-water bottle and common analgesics.
2. General illness, such as headache and common cold. Most had resorted to self-medication with drugs obtained from local drugstores.
3. More than half of the female adolescents had used cleaning agents to clean their sex organs. Information about these products had been obtained from advertisements in the mass media and from various direct sales. Friends and close relatives had been important sources of information as well. Various cleaning agents had been used, particularly during menstruation.
4. Most had taken care of their external physical appearance, especially weight control. However, it had been difficult to control their eating habits.
5. Most had taken particular care of their skin complexion and the avoidance and treatment of acne.
6. Some had had boyfriends and all denied having ever had pre-marital sex.
7. Friends had been the main source of consultation about sex and sex organs. Some had had bad experiences consulting mothers who had tended to suspect an association between the questions about sex and sex organs with hidden sexual relationships with men.
8. Some of the adolescents had become metamphetamines addicts because their households had been involved in drug pushing (methyl amphetamines). Some had been selling the drugs to friends in their schools.
9. About one-third of the females in the focus groups knew about the use of "Postinal" for the prevention of pregnancy. The information had been obtained from friends with experiences and from married neighbors. Most had not had any sexual experiences.
10. Some had used "Dian" to increase the size of their breasts. The information about the drug came from friends.
11. Some had taken "Frimelude" to delay their menstruation for special occasions, such as if they planned to go for a picnic up-country.

12. Most had not dared to experiment with illegal drugs. Only two smoked occasionally.
13. Most of the stressful problems included problems with boyfriends, girlfriends and performance at school. Most had spent time thinking about the problems during their walks at shopping centers.
14. Everyone knew about AIDS but thought that it was not a problem since most did not indulge in drugs and extra-marital sexual relationships.
15. Mothers had been the most frequent consultants for general illnesses, friends or elder sisters for sexual organs and sexual relationships, and classmates for problems with performance in school.
16. Most would wait for minor illnesses to disappear and would buy their own drugs if the symptoms did not disappear.

The major services used by the female adolescents were:

1. Private clinic services, which were preferred due to their efficiency.
2. BMA Health Stations, which had not provided satisfactory services and could consume a lot of time.

The major perceived health service needs for female adolescents were:

1. A clinic with female service providers who could give consultation about various female health problems.
2. A consultation services for family and other problems, in addition to health problems.
3. A fitness club for physical exercise and weight control.

The major health problems for male adolescents were:

1. Most minor ailments were not problems since males should be perceived as being strong and should not worry about minor illnesses. If the illnesses persisted, most had resorted to self-medication.
2. Most of the problems had been due to accidents and injuries at the workplace.
3. Most male adolescents had had some involvement in community activities, such as being volunteers for the prevention of fire and arson.
4. Most had not had any opportunity for formal education. Most had enrolled in schools for adults and thus had had ample time during the

day. Most had lived with their parents. Only one lived on his own. Most had sought occasional work at a private organization in the community and received daily wages.

5. Questions about sex and sex organs had been discussed among friends, peers and close relatives, more than with parents or other household members.
6. Most had had some experiences with cigarettes, alcohol, and some illicit drugs. Some had been addicted to heroin but reported having quit the habit already. The opportunity to work in a private non-government organization was cited as the main reason for quitting drugs. Their work had kept them from the drug environment in the community.
7. Masturbation was cited as a way to reduce sexual desire and most considered masturbation as a natural activity, which did not incur any feeling of guilt.
8. Some had had accidents and injuries, including motorcycle accidents.

The major uses of health services among the male adolescents were

1. Most had not used BMA Health Services because of unfriendly attitudes towards the officers of the health station. The health officers had been perceived as being stern and not willing to spend adequate time to care for their problems. Most had preferred self-treatment.
2. Health services in schools had had limited capacity for only minor ailments. Most had not used school health services.
3. Most male adolescents had had experiences with females, such as their sweethearts, girlfriends, prostitutes and others. Most had not used condoms, especially with sweethearts and friends. As for prostitutes, they had chosen only those who "looked clean" and often had requested their partners to clean up before intercourse.

The major perceived health service needs for male adolescents included:

1. Community health services capable of giving advice about drug addiction, including treatment. The services should be appropriately distributed at various sites.
2. Periodic focus group discussions about the problems and experiences of male adolescents.

3. Adequate time for health providers to give adequate consultation.
4. A comprehensive set of services including consultation, referral and treatment.

In-Depth Interviews

In-depth interview of staff of the private organization working with adolescents:

Findings: It was perceived that most adolescents did not have adequate appropriate knowledge about sex and sexual relationships. They did not quite understand the physiological changes associated with adolescence. They had little idea about appropriate health promotion and care for their sex organs, due mainly to natural socialization among their peers. Most of the adolescents' problems related to their family, individual problems, problems with friends, problems with boyfriends and girlfriends. Some had problems with their studies. Many experienced mental and emotional stresses.

It was perceived that the health problems of the adolescents were not significant. This might be due to the nature of the services given by the private organization in question, which dealt mainly with giving consultations, rather than health services in general. Many of the adolescents preferred to seek consultations from someone they did not know, rather than their parents.

The executive of the organization thought that care for adolescents was important and that the efforts in Thailand had been hampered by discontinuity, due to a lack of a steady flow of funds, and competent human resources who had adequate experience working with adolescents. It is possible that the lack of concern for adolescent health may stop the flow of future funds.

In-depth interview of officers in an organization in the slum community:

The **objectives** of the interviews were: 1) to understand the social and environmental situations and other problems in the community; 2) to get access to the organizations within the community who had worked with adolescents; and 3) to document the perceptions of these officers about the needs for health services for adolescents in the community.

Findings: It was found that of all the 18 communities in Klong Toey, drug dependence was perceived as the most important health problem. Some communities had been active in the promotion of illicit drugs. Many adolescents in the slum had not had an opportunity to continue their formal education due to poverty. Many had been striving to study in adult informal education and thus had had ample time to be idle and become involved with drugs.

Besides drug dependency, pregnancy among schoolgirls had been common, leading to illegal abortions and subsequent termination of schooling. These girls had confided with their mothers about the unwanted pregnancies. Most of the unwanted pregnancies had ended up in separation of the girls and their sexual partners.

AIDS and HIV had been common due mainly to needle sharing. However, asymptomatic HIV subjects had had frequent sex with changing partners. Most of the adolescents who had sex with HIV subjects had thought that they had little likelihood of being infected with the virus. This erroneous perception among adolescents is a cause for concern, and must be changed.

In-depth interviews of youth leaders in the community:

The **objectives** of the interviews of community youth leaders were: 1) to understand the perceptions of the leaders about the health problems of adolescents; 2) to understand their needs for health services; and 3) to understand the actual utilization of health services by the adolescents.
Findings: The nature and extent of health problems among the adolescents in the slum community depend on the sex of the adolescents. Males tended to acquire injuries from violence and accidents, while females had been affected by general illnesses. Drug dependence had been a major problem among the males. Many of the addicts had come from families with drug dealers in the household. Some had had too much idle time, because they had been too poor to go to school. For women, teenage pregnancies had been common, leading to illegal abortion, premature marriage and eventual termination of formal education.

Health services are needed in the community. Consultation and advice about adolescents' health problems are most needed. Health services should be available 24 hours a day, since the problems associated with violence and injuries among males occur on a constant basis.

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Most adolescents do not use the services provided by the Bangkok Metropolitan Administration Health Center. The main reasons include different personalities between the providers and the adolescents, inadequate staff and inadequate time given to satisfactorily address the health problems of the adolescents.

In-depth interview of staff of the Bangkok Metropolitan Administration (BMA) Health Station:

The **objectives** of the interviews were: 1) to understand the services available at the health center for the general public and the adolescents; 2) the utilization of health services by the adolescents, and 3) the perceived problems and barriers in providing services for the adolescents.

Findings: The BMA Health Station had given comprehensive care to the general public such as disease prevention, health promotion, treatment and rehabilitation. The most common types of care sought by people were mother and child health services, treatment for general illnesses, care for the elderly and care for chronic diseases such as hypertension and diabetes. Care provided to the adolescents had been minimal. The BMA Health Station had 10 beds for admission. This was to be expanded in the future. At that time, there were no consultation services for the adolescents. Most of the care given to adolescents had been in the area of accidents, violence and general illnesses. The main barrier to the BMA Health Station in performing its tasks had been insufficient human resources.

CONCLUSION

This study was conducted through situation analysis of the providers' and clients' perspectives of adolescents' health care needs and their accessibility, and these factors were ascertained through surveys of facilities, including community, school-based and hospital services currently available to adolescents. From qualitative data, conclusions have been drawn about the general adolescent health situation in the Klong Toey slum, the biggest slum community in Bangkok. It was perceived that the Thai adolescents in this study were older than the traditional definition, as a result of unique Thai cultural and lifestyle factors, which increase the period of adolescence. It was felt that most of the adolescents did not have adequate or appropriate knowledge about their sex and sexual relationships. The most important health problems, as suggested by both health workers and adolescents, were drug dependency, unwanted pregnancy among schoolgirls (leading to subsequent termination of schooling), general illnesses such as pain associated with menstruation, headache, and the common cold. Most individuals tended to self-medicate at the local drugstore. Males reported their main health concerns were related to injuries acquired from violence, accidents and drug abuse. Needs for female adolescents were stated to be for a clinic with female staff who could provide both consultative and curative services, while males felt a need for qualified staff for consultations, especially regarding drug abuse. Health and fitness equipment was requested. The adolescents stated the reason for not frequenting existing government health services was that they felt the services provided were either inappropriate or irrelevant and they often felt dissatisfied with the treatment they received.

This study was undertaken in only one community, and these adolescents' problems may not be common to all in Thailand. However, the findings are important inputs to the planning and delivery of appropriate and effective health services to young people living in urban slums. Action research in the service sector is needed to develop and test prototypes for adolescent health services.

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BITS 'N PIECES

Association between postnatal catch-up growth and obesity in childhood: Prospective cohort study

The objective of this study was to identify predictors of postnatal catch-up growth from birth to two years and its relation to size and obesity at five years. 848 full term singtons from a 10% random sample of the Avon longitudinal study of pregnancy and childhood were studied.

Overall, 30.7% (260 o 848) of infants showed a gain in SD score for weight greater than 0.67 SD scores between zero and two years, indicating clinically significant catch-up growth. These children had lower weight, length and ponderal index at birth than other children and were more often from primoparous pregnancies. They also had taller fathers than other children and their mothers had lower birth weights and were more likely to smoke during pregnancy. Children who showed catch-up growth between zero and two years were heavier, taller and fatter at five years than other children.

Mechanisms that signal and regulate early catxh-up growth in the postnatal period may influence associations between small size at birth and risks for disease in adulthood.

Ong KKL, Ahmed ML, Emmett PM, Preece MA, Dunger DB. BMJ 2000;320:967-71.

FACTORS AFFECTING THE EXPERIENCES OF DRUG USE BY ADOLESCENTS IN A BANGKOK SLUM

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Abstract. The purpose of this research was to study the demography, financial status, social status, knowledge of amphetamines, perceived harmfulness of amphetamines, and life skills in the prevention of drug abuse in adolescents. The factors leading to drug use among young people were also studied. The study group was composed of 354 subjects aged 12 to 22 years, living in 2 slums in Bangkok. The research showed that about 7% of the sample group had used drugs before. Four percent had never used drugs, but someone had tried to talk them into using them. Almost 20% had friends who had used drugs, and 11% had friends who were still using drugs. About 13% of the adolescents in the study group had family members who used drugs and another 9% had family members who were still using drugs. In our study, we found that the most common drug group was amphetamines. On average, the participants had a low level of understanding about drug abuse, especially of the symptoms, side effects, and legal penalties. Most of the adolescents realized how harmful amphetamines and other drugs were and had a high degree life skills. Factors influencing adolescent drug use were (1) personal factors, such as monthly income/allowance and life skills; (2) family environment, such as drug abuse history in the family; and (3) social environment, such as a drug abuse history among friends. When studying the life skill factors of the adolescents, which is an independent factor capable of influencing the experience with drugs, the researchers found that the time spent with other members of the family and the family members' drug experiences were the only factors leading to life skills in the prevention of drug abuse in adolescents. In addition to letting children learn on their own, training them to acquire life skills is beneficial when faced with problematic situations. Creating relationships between adolescents and other members of the family, friends, and society can increase their life skills, diminishing the risk of drug abuse.

INTRODUCTION

Many researchers have sought the cause of drug abuse/addiction, so that effective treatments and preventive methods can be implemented. Research has found that the problem arises from many aspects: family sources, such as mother-father relationships, the way parents raise their children, the financial situation of the family, and the community, such as illicit gathering places, wrong or bad values, and neglect (Pisuttiwongse, 1996). The people adolescents spend time with also affect his/her habits. Adolescents who have friends using drugs are more prone to become addicts themselves. Friends tend to introduce others to drug use (Adger, 1992). Another factor affecting drug abuse is the lack of knowledge of the drug's effects.

Because of the complexity of the problem, collaboration between several groups must be implemented to increase adolescents' understanding amphetamines and themselves, to enable them to develop self-worth and to prepare them to face drug temptations, learning to say "No" to drugs. Society should support these adolescents in preparing them for such situations. Friends, family, teachers and other members of the community should give support to adolescents so that they are emotionally and mentally ready to fight against drugs.

This research is part of a project called "Creative communication between friends to support drug (amphetamine) prevention habits among

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adolescents: a case study of a Bangkok slum". The research investigated basic information about adolescents in Bangkok's slums as a basis for implementing activities supporting the prevention of drug abuse among young people.

MATERIALS AND METHODS

This research was based on a survey. The sample group was composed of adolescents ranging in age from 12-22 years, living in Bangkok slums. A purposive sampling method was used to select 2 slums with different characteristics. Simple random sampling was used to select the 354 participants from the 2 communities. Data were collected by questionnaires filled out by the adolescents. A staff member was present to give assistance to the participants, such as explaining the meaning of the questions or how to fill out the questionnaire, and answer any concerns raised by the participants. Descriptive statistics were used to analyze the data collected. Frequencies, averages and standard deviations were calculated. Logistic regression analysis was used to study the factors influencing drug use habits.

RESULTS

Demographic, economic, and social characteristics

The sample group was comprised of more women than men, aged 15-19. Thirty percent of the participants' parents were separated. The parents were mostly employees or salespersons in street. They were mostly primary-school educated. Most of the subjects had finished middle school. The average family income was about 10,000 baht per month, providing for 5 family members. The adolescents received, on average, a 2,400-baht monthly allowance from their parents. The main problem the participants faced was financial. When any problems occurred, the participants turned to their parents first, then to their friends. The adolescents spent most of their time listening to music, watching television, and hanging out with friends in order to relax.

The drug habits of adolescents and their close ones

The research shows that about 7% of the sample group had used drugs before. Four percent had never used drugs but someone had tried to talk them into using them. Almost 20% had friends who had used drugs, and 11% had friends who were still using drugs. About 13% of the adolescents in the study group had family members who had used drugs and another 9% had family members who were still using drugs. In this study, the most common drug group used was amphetamines.

Knowledge, perceived harmfulness, and promoting of life skills to prevent amphetamine addictive behavior

The adolescents had a low level of understanding regarding amphetamines, especially regarding their symptoms and side effects. Their main sources of knowledge were educators or schools. Nevertheless, these adolescents had high levels of perceived harmfulness of amphetamines, and had high score levels for life skills (Tables 1-3).

Factors influencing adolescent drug use behavior

The personal factors influencing the drug habits of adolescents were the amount of money the adolescent received per month, and the life skills promoting amphetamine-prevention attitudes. Adolescents with no financial problems were less likely to use drugs. Adolescents with skills to prevent drug abuse were at lower risk for drug use. The family environmental factor that influenced adolescent drug habits was the experience of drug use in a family member. An adolescent who had a family member who used drugs was 1.4 times more likely to have used them than an adolescent who had no family member using drugs. Previous drug use by friends, being a social factor, also increased the risk of adolescent drug habits. In other words, an adolescent who had a friend using drugs was about 1.5 times more likely to use drugs than someone who did not have a friend using drugs (Table 4).

Factors influencing adolescent life skills

On additional analysis, an independent factor, namely life skills, also influenced the drug experience of adolescents. The research found that the family environment, which included

Table 1
Percentage of adolescents classified by score level of knowledge of amphetamines, and their experience using drugs.

Score level for knowledge of amphetamines	Experience using drugs		Total
	Never	Experienced	
Low level of knowledge	43.0	33.3	42.4
Moderate level of knowledge	45.5	62.5	46.6
High level of knowledge	11.5	4.2	11.0
Total	100.0	100.0	100.0
(Number)	(330)	(24)	(354)
Average score	3.99	3.96	4.02

Table 2
Percentage of adolescents classified by score level for perceived harmfulness of amphetamines, and their experience using drugs.

Score level for perceived harmfulness of amphetamines	Experience using drugs		Total
	Never	Experienced	
High level	69.7	45.8	68.4
Rather high level	22.7	41.7	23.8
Moderate level	5.8	8.3	5.8
Rather low level	1.8	4.2	2.0
Total	100.0	100.0	100.0
(Number)	(330)	(24)	(354)
Average score	4.21	4.01	4.20

Table 3
Percentage of adolescents classified by score level for life skills promoting amphetamine-prevention attitudes, and their experience using drugs.

Score level for life skill	Experience using drugs		Total
	Never	Experienced	
Low level of life skills	2.8	8.7	3.2
Moderate level of life skills	37.4	60.9	39.0
High level of life skills	59.7	39.0	57.9
Total	100.0	100.0	100.0
(Number)	(318)	(23)	(341)
Average score	25.53	23.65	25.19

spending time with family members and the drug experiences of family members, was the only factor influencing adolescent life skills: the more time spent with their family, the higher the level of life skills. Someone who had a family member with a drug history would have a higher level of life skills than someone who did not (Table 5).

DISCUSSION

Even though most of the participants had never used drugs before, some of them were still at great risk for drug use due to a family drug history. The most dangerous was when a friend in the group was using drugs, because adoles-

Table 4
Logistic regression analysis results of factors influencing adolescent drug use experiences.

Factors	B	SE	p-value	Exp(B)
Personal factors				
Gender (female [a])	1.205	0.693	0.082	3.335
Age	0.124	0.143	0.389	1.131
Income	-0.001	0.000	0.019 [b]	0.999
Knowledge	-0.013	0.185	0.944	0.987
Perception	0.033	0.031	0.291	1.034
Skill	-0.228	0.097	0.018 [b]	0.796
Family environment factors				
Number of family members	-0.113	0.136	0.408	0.894
Marital status of parents (separated [a])	1.319	0.785	0.093	3.740
Warmth	0.098	0.471	0.674	1.219
Restriction	-0.209	0.345	0.544	0.811
Quarreling	0.287	0.357	0.421	1.332
Conflicts	-0.003	0.425	0.994	0.997
Concern	-0.726	0.412	0.078	0.484
Spending time	0.140	0.325	0.666	1.151
Drug use experience in a family member (No family member experienced drug use [a])	-1.486	0.662	0.025 [b]	0.226
Socio-environmental factors				
Community (participation [a])	-1.086	0.851	0.202	0.338
Education (Vacation [a])	0.495	0.939	0.598	1.641
Participation in drug activity in the community (never [a])	0.912	0.793	0.250	2.489
Drug use experience among friends (never [a])	-1.534	0.754	0.042 [b]	0.216

[a]Control group; [b]$p<0.05$
B = Unstandardized regression coefficient; Exp(B) = Exponential of B; SE = Standard error of B

cents bestow a great deal of importance upon friends, putting the subject at increased risk for adolescent drug abuse. Suphap (1997) stated that adolescent behavior was greatly influenced by the behavior of members of the group or the group leader. Analysis of the factors influencing adolescent drug habits (mostly amphetamine addiction) showed that family or friends' drug habits do influence adolescent risk of drug use. This is consistent with the results of the research by Sussman *et al* (2000), which found that the drug use habits of friends were a predictive factor for adolescent drugs habits. Adolescents were more likely to be influenced if a member of the family, especially a parent, had a history of drug use. Adger (1992) found that the family factor influences the probability of alcohol and drug abuse by an individual. For instance, if a father drank alcohol, his son was more likely to drink alcohol. An adolescent who had a drug-addicted friend was more likely to use drugs than someone with no friends who use drugs.

Adolescent culture revolves around friends. They are easily influenced by friends because of the need for peer recognition. Being shunned and isolated from the group is considered humiliating and the worst punishment. Curiosity increases the risk of drug abuse. To prevent the occurrence of such problems, a new referral group needs to be established and friends need to draw adolescents away from drugs.

Having a family member or friend who has used drugs does not mean that all adolescents will follow in his/her footsteps. Adolescent life skills also play an important role here. The research indicates that the higher the life skill level,

Table 5
Multiple regression analysis results of factors influencing adolescent life skills promoting drug-prevention behavior.

Factors	B	SE	Beta	t	p-value
Constant	22.794	2.356		9.675	0.000 [b]
Personal factors					
Gender (female [a])	-0.056	0.379	-0.010	-0.150	0.881
Age	-0.089	0.069	-0.100	-1.312	0.191
Income	-0.000	0.000	-0.003	-0.043	0.966
Knowledge	0.029	0.090	0.022	0.332	0.740
Perception	0.016	0.016	0.069	1.060	0.290
Family environment factors					
Number of family members	-0.011	0.063	-0.011	-0.173	0.863
Marital status of parents (separated [a])	-0.464	0.392	-0.008	-0.118	0.906
Warmth	0.176	0.257	0.056	0.685	0.494
Restriction	0.079	0.211	0.025	0.376	0.707
Quarreling	0.093	0.194	0.034	0.477	0.634
Conflicts	0.037	0.218	0.012	0.169	0.866
Concern	0.117	0.248	0.039	0.471	0.638
Spending time	0.412	0.178	0.159	2.311	0.022[b]
Drug use experience in a family member (No family member experienced drug use [a])	0.918	0.421	0.140	2.179	0.030[b]
Socio-environmental factors					
Community (participation [a])	-0.057	0.379	-0.010	-0.150	0.881
Education (Vacation [a])	-0.793	0.467	-0.111	-1.697	0.091
Participation in drug activity in the community (never [a])	0.379	0.358	0.068	1.057	0.292
Drug use experience among friends (never [a])	-0.496	0.399	-0.081	-1.243	0.215

$R^2 = 0.112$; F = 1.800[b]
[a]control group; [b]$p<0.05$
B = Unstandardized regression coefficient; SE = Standard error of B
Beta = Standardized regression coefficient; t = t value for B
R = Correlation coefficient; R^2 = Coefficient of determination; F = F value for regression model

the lower the risk of drug abuse. These skills include life adaptations, problem solving, communication, negotiation, analysis, reasoning, and coping with stress, especially when faced with peer pressure. Adolescents acquiring the latter skills can prevent drug abuse (Lapsirianankul, 2000).

To acquire such skills, adolescents need to learn from life experiences, and from their interactions with other members of society. Our study shows that monthly allowance also influences adolescent drug habits. Participants with no financial worries were less likely to use drugs. This does not mean that parents or guardians must increase their children's allowances. Teaching financial values to adolescents can minimize financial problems.

Forty-two percent of participants had a low level of understanding regarding amphetamines, while 46.6% had a moderate level. Schools were the primary source of information regarding amphetamines and other drugs. The results of the study reflect those by Varalaksna (1995), which indicated that educators were the ones who really understood the threat of drugs and who communicated these risks to the students. One problem is that the age range of students influenced by drugs now starts in primary school.

Thus, drug awareness programs to prevent drug abuse need to be implemented in primary school age children. Even though adolescents had a low level of understanding of amphetamines and their side effects, the majority of them (68.4%) did comprehend the power of drugs over people. This can be considered a first step in preventing most young people from using drugs.

The study also shows that an important factor influencing life skill levels is the family environment. This means that the family is the source of life skills acquisition among adolescents, from spending time with members of the family. The more time spent with the family, the greater the learning process from parental experience and human interaction. These activities shape the values and behavior of adolescents. However, this can also be harmful to adolescents, since a family drug history can negatively influence children. This is consistent with a study by Low *et al* (1996), which found that being beyond the concern of the family can lead to drug use in adolescents. Nevertheless, family drug experience increases the life skills of those who have experienced them, compared with those who have not. This may be because they have faced drug problems before, and learned to say “No” to drugs, developing the necessary life skills.

This does not mean that people with no family drug experience have fewer life skills, since these skills can be acquired by one’s own experience, and through interaction with other members of society in many different situations. Drug awareness activities can also be a method of teaching adolescents to understand the harm of using drugs and how to prevent such situations. Although a one-day, two-day, or one-week drug awareness activity cannot develop immediate skills for drug prevention, it can be combined with other life experiences to prevent the influence of drugs. Ko (1997) found that youth camps can be used to inform and educate adolescents about drugs and how to prevent drug use. Thus, a shield against amphetamines and other drugs can be achieved with close collaboration between the adolescent, parents, friends, educators, the community, and society.

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PATTERNS, APPROPRIATENESS, AND PREDICTORS OF ANTIMICROBIAL PRESCRIBING FOR ADULTS WITH UPPER RESPIRATORY INFECTIONS IN URBAN SLUM COMMUNITIES OF BANGKOK

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Abstract. Upper respiratory tract infections (URIs) are the most common infections worldwide. Their frequent inappropriate treatment with antibiotics is likely to increase antibiotic resistance, contribute to morbidity and mortality, and waste scarce resources. Using data from registration books and prescriptions, we measured patterns and assessed appropriateness and predictors of antibiotic prescribing for viral and bacterial URIs treated in health centers located in two slum communities in Bangkok, Thailand. Based on recorded diagnoses and symptoms, 91% of the patients probably had viral URIs; 60% of viral and 89% of bacterial URI patients were prescribed an antibiotic. Compliance with the national treatment guideline was 36.4% for treatment of viral URIs and only 1.7% for treatment of bacterial URIs. Amoxicillin was the most frequently prescribed antibiotic regardless of diagnosis. Among viral URI patients, those who were young, male, and self-paying were more likely to receive antibiotics; part-time physicians were more likely to prescribe antibiotics for these patients. Among patients with bacterial URIs, those who paid for drugs by themselves were more likely to receive antibiotics compared to patients covered by the national health insurance plan. We used these formative results as input to the design of health center and community interventions to encourage more appropriate prescribing for URI among adults.

INTRODUCTION

Upper respiratory tract infections (URIs) are the most common infections worldwide (Bamberger and Jackson, 1995). In Thailand, acute URIs are an important health problem. Nearly half of respondents to the 2000 National Health and Welfare Survey (NSO, 2000) reported having had a respiratory disease during the two preceding weeks, the most frequently reported acute health problem.

Although viruses cause most URIs (Therapeutic Guidelines, 1998), antimicrobial agents are still among the most frequently prescribed drugs for URI. Unnecessary antimicrobial use for URI, both at health facilities and in the community, is one of the most common drug use problems (Grand *et al,* 1999). Adverse consequences of antimicrobial use for viral URIs are particularly unfortunate in developing countries (Kunin, 1993). Since most patients pay out-of-pocket for their medicines, they waste scarce household resources on unnecessary care. Moreover, inappropriate antimicrobial use increases drug resistance in the community, requiring use of more expensive and potentially more toxic alternative drugs when antimicrobial treatment is needed. These more expensive antimicrobials are less likely to be affordable in resource-poor settings. In Thailand, data from the Drug Control Division (2003) showed that antimicrobials are the most frequently used drugs and their use increases every year.

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According to the WHO Strategy for the Containment of Antimicrobial Resistance (WHO, 2001), developing countries play an important role in the emergence of antimicrobial resistance. In developing countries, bacterial resistance to antimicrobial agents is common in isolates from healthy persons (Okeke *et al,* 1999). In urban slum communities with poor sanitation, high incidences of HIV/AIDS, multi-drug resistant tuberculosis (MDRTB), and drug addiction, resistance is likely to spread easily.

Studies in developed countries suggest that both clinical and socio-cultural factors contribute to inappropriate antimicrobial prescribing (Avorn and Solomon, 2000; Murray *et al,* 2000; Pechere, 2001). A recent review by Radyowijati and Haak (2003) highlighted the lack of data to characterize the importance of different determinants of antibiotic use in developing countries. There are few studies of antimicrobial use for URIs in these settings and most report on treatment of URIs in children. Patterns of antimicrobial use in low-income countries differ from those in industrialized countries, and complex relationships exist between antibiotic use and local culture, socioeconomic characteristics, and poor health care infrastructure (Radyowijati and Haak, 2003).

To provide formative data to guide the design of interventions to improve treatment of URI in adults, we assessed patterns of antimicrobial and other drug treatment for adults with URIs treated in health centers in two slum communities in Thailand.

MATERIALS AND METHODS

Setting

We conducted the present study in two of the 61 health centers run by the Bangkok Metropolitan Administration (BMA), which provide care in under-served slum communities in Bangkok, Thailand. More than 125,000 individuals live in 22,063 households in a two square kilometer slum area covered by the two health centers. People in these communities face problems of substandard housing, poor sanitation, unemployment, low income, high incidence of HIV/AIDS, MDRTB, sexually transmitted diseases, and drug addiction.

Data sources

We retrospectively identified in registration books of the two health centers all patients over 18 years of age who were treated for URI in 2001. We included cases with diagnoses of URI, cough and cold symptoms, pharyngitis, tonsillitis, otitis media, or sinusitis. We abstracted the prescriptions these patients had received, which were written by a total of 19 physicians.

Information about patients collected from registration books included age, gender, and diagnoses. Type, amount, and cost of prescribed drugs, type of payment for drugs, and physician name were collected from copies of the prescriptions maintained in the clinic pharmacies. Additional information about physician characteristics (age, gender, full-time or part-time employment status, specialty, and number of years practicing) was gathered directly from the physicians and from health center administrators.

The study was approved by the Human Research Ethical Committee at the Faculty of Medicine of Chulalongkorn University; the Ethical Review Committee for Research in Human Subjects, Ministry of Public Health, Thailand; and the Boston University Medical Center Institutional Review Board.

Definition of ‘likely viral’ and ‘likely bacterial’ URIs

We classified patients diagnosed with URI or common cold, unspecified URI, or symptoms like cough, rhinitis or headache as having ‘likely viral’ URIs. Patients diagnosed with pharyngitis, sore throat, tonsillitis, acute otitis media, or sinusitis were classified as having ‘likely bacterial’ URIs. Patients with more than one URI diagnosis were classified according to the most severe diagnosis.

Definition of appropriate treatment

We classified treatments according to the National Standard Treatment Guideline for Respiratory Tract Infections (MoPH, 1996). For viral URIs, such as nonspecific URI, acute bronchitis, rhinitis, or influenza, the Guideline emphasizes that antibiotics should not be given unless patients have high fever, severe cough, or abscesses. For bacterial URIs, the Guideline recommends penicillin V, penicillin G, or erythromycin for 7-10 days for pharyngitis and tonsillitis;

amoxycillin (or ampicillin, coamoxycillin), cotrimoxazole or erythromycin for 14 days for otitis media; and the same antimicrobials or doxycycline for 14-21 days for sinusitis.

Analysis

We first assessed drug treatment patterns for URIs, cough and cold, pharyngitis/tonsillitis, otitis media, and sinusitis. We calculated the percentage of patients receiving an antimicrobial prescription; percentage of prescribed treatments consistent with the standard treatment guideline; and cost associated with inappropriate antimicrobial use. We evaluated differences in antimicrobial prescribing by patient and physician characteristics using chi-square tests or Fisher's exact tests for categorical variables and Student's *t*-tests for continuous variables. A difference with a two-sided p-value <0.05 was considered statistically significant. Numerical variables were recoded to categorical variables for univariate and logistic regression analyses.

To examine predictors of antimicrobial prescribing, we developed generalized linear mixed models (Guo and Zhao, 2000) that adjust for clustering of cases by provider. We looked for factors associated with appropriate treatment using separate logistic regression models for viral and for bacterial URI cases. Variables that were associated with antimicrobial prescribing in univariate analyses (p-value < 0.10) were included in the initial logistic regression model; variables were removed sequentially if they were non-significant and their removal did not change the odds ratios of remaining predictors by at least 20%. Odds ratios and 95% confidence intervals were calculated from the final models.

We replaced missing age values (n=6, 0.13%) with median age; seven cases (0.16%) with missing payment status were excluded from the logistic regression analyses. Data were managed and analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows 12.0.0 (SPSS Inc, 2004) and Statistical Analysis Software (SAS) 8.02 (SAS Institute Inc, 1999).

RESULTS

Between January and December 2001, 4,608 adult URI patients visited the study health centers. They accounted for 10.6% of all health center patients, 15.8% of adult patients, and 35.2% of all URI patients. There was no seasonal pattern of cases presenting with URI. Almost all (97.9%) adult URI patients received a prescription, resulting in 4,512 prescriptions for analysis. Patients without a prescription may not have received one or may have filled it at a drug store outside the health center.

Characteristics of patients

Most patients were women and nearly half of the patients were between 18 and 40 years old (Table 1a). More than half of the patients (57.6%) paid for their prescription at the point of service, while the rest received free care or paid a small copay (30 baht, about US$ 0.80) under the national health insurance plan. Nearly all (91.0%) adult URI patients were classified by their diagnoses and symptoms as likely to have viral URIs. Among patients likely to have bacterial URIs, more than three-fourths were diagnosed with pharyngitis. Most (87%) patients did not have other diagnoses at the time of their visit. Those with co-diagnoses mostly had chronic diseases, such as hypertension, heart disease, diabetes, arthritis, gout, and gastrointestinal disease.

Characteristics of physicians

Physicians had an average age of 53 years, half were women, and most had practiced for more than 10 years (Table 1b). Most physicians were general practitioners or trained in public health or family medicine. Only 4 (21%) physicians worked full-time at the health centers.

Pattern of drug prescribing for viral and bacterial URIs

All patients with bacterial URIs received at least one drug, and only 13 (0.3%) patients with viral URI did not receive a drug. As shown in Table 2, physicians treated viral and bacterial URIs differently. For viral URI patients, analgesics/antipyretics and antihistamines were the most frequent symptomatic treatments prescribed, followed by antimicrobial agents. Physicians prescribed antihistamines and vitamins significantly more frequently for viral URI patients. Bacterial URI patients received significantly greater numbers of drugs, injections, antimicro-

Table 1a
Characteristics of patients receiving prescriptions (n=4,512).

Characteristic	No. (%)
Female	3,173 (70.3)
Age: Year, mean±SD	44.91±17.00
18-40	2,060 (45.7)
41-60	1,352 (29.9)
> 61	1,100 (24.4)
Payment	
Self payment	2,595 (57.6)
Free of charge	1,910 (42.4)
Diagnosis	
Viral URIs	4,107 (91.0)
Bacterial URIs	
Pharyngitis/ Tonsillitis	309 (6.8)
Otitis media	89 (2.0)
Sinusitis	7 (0.2)
Co-morbid illness	586 (13.0)

Table 1b
Characteristics of physicians (n=19).

Characteristic	No. (%)
Female	9 (47.4)
Age: Years, mean±SD	53.0±15.5
Full-time practice	4 (21.1)
General practice	13 (68.4)
Years in practice	
>10	15 (78.9)
≤10	4 (21.1)
URI cases treated/ year	
<100	7 (36.8)
101-500	9 (47.4)
>500	3 (15.8)

bials, analgesics/antipyretics, and cough suppressants than patients with viral illness.

Overall, 62.9% of all URI patients received a prescription for an antimicrobial, 60.3% of viral URI patients and 89.4% of bacterial URI patients (91.6% of patients with pharyngotonsillitis, 83.1% with otitis media, and 71.4% with sinusitis). Antimicrobials made prescriptions more costly. Prescriptions for viral URI patients with an antimicrobial cost 43 baht (about US$1.20) more than those without an antimicrobial.

Appropriateness of antimicrobial prescribing

To assess appropriateness of antimicrobial prescribing, we evaluated the type and duration of antimicrobial treatment among patients with common cold, pharyngitis/tonsillitis, and otitis media, who had no other diagnoses and who received an antimicrobial drug. These patients received 16 different antimicrobials, all of which were on the 1999 National Essential Drugs List. Regardless of diagnosis, amoxicillin was the most frequently prescribed antimicrobial. Macrolides (erythromycin, roxithromycin), chloramphenicol, and lincomycin injection were more frequently prescribed for bacterial than for viral URIs.

Only a small proportion of URI patients were treated according to the National Standard Treatment Guideline for Respiratory Diseases (1996). Shaded boxes in Table 3 show appropriate prescribing based on diagnosis. Only 36.4% (1,287) of viral URI patients were treated correctly without antimicrobials. Among URI patients with likely bacterial diagnoses, 14.2% (52) received appropriate oral antimicrobials, 4.0% (11) of those with pharyngitis/tonsillitis and 54.3% (38) of those with otitis media.

The average duration of prescribed oral antimicrobial treatment was 6.3 days for viral URIs and 6.7 for bacterial URIs. When considering appropriateness of indication and duration of antimicrobial prescribing simultaneously, only 1.7% of bacterial URI patients were treated appropriately, 5 (1.8%) patients with pharyngitis/ tonsillitis and 1 (1.4%) patients with otitis media.

Factors associated with antimicrobial prescribing

Adjusted for potential physician clustering and potential confounders, several patient and physician characteristics were associated with greater rates of antimicrobial prescribing in viral URIs (Table 4). Male patients and younger patients (under age 60) were significantly more likely to receive antimicrobials for viral URIs than their respective comparison groups (Table 4). Patients who payed for their medicines out-of pocket or were insured under non-national health plans were somewhat more likely to receive antimicrobials than those insured under the national health

Table 2
Drugs prescribed for URI patients.

Drugs prescribed	No. of prescriptions (%)	
	Viral URIs (n=4,107)	Bacterial URIs (n=405)
Antimicrobial	2,477 (60.3)	362 (89.4)[b]
Analgesic/antipyretic	2,983 (72.6)	328 (81.0)[b]
Antihistamine	2,805 (68.3)	135 (33.3)[b]
Mucolytic	1,842 (44.9)	198 (48.9)
Cough suppressant	1,350 (32.9)	175 (43.2)[b]
Vitamin	836 (20.4)	46 (11.4)[b]
Other symptomatic drug[a]	454 (11.1)	70 (17.3)
Mean no. of drugs per prescription	3.20±1.07	3.67±1.26[b]
Injection	63 (1.5)	27 (9.0)[b]
Median cost per prescription (baht)	44.0	76.0
With antimicrobial	59.0	78.0
With no antimicrobial	16.0	16.0

[a] bronchodilators, anti-inflammatory enzymes, (antiseptic) mouth preparations, topical antiseptics.

[b] p-value <0.05

Table 3
Antimicrobials prescribed among antimicrobial recipients[a].

Antimicrobials prescribed	No. of prescriptions (%)[b]		
	Common cold (n=2,247)	Pharyngitis/ tonsillitis (n=275)	Otitis media (n=70)
Penicillin V	54 (2.4)	8 (2.9)	3 (4.3)
Erythromycin	67 (3.0)	3 (1.1)	2 (2.9)
Amoxicillin±clavulanic acid[c]	1,581 (70.4)	196 (71.3)	31 (44.3)
Ampicillin	6 (0.3)	- -	- -
Co-trimoxazole	70 (3.1)	9 (3.3)	5 (7.1)
Dicloxacillin/ Cloxacillin[c]	217 (9.7)	14 (5.1)	23 (32.9)
Roxithromycin[c]	141 (6.3)	37 (13.5)	4 (5.7)
Chloramphenicol ear drop[c]	10 (0.4)	2 (0.7)	25 (35.7)
Doxycycline	17 (0.8)	2 (0.7)	- -
Tetracycline	87 (3.9)	5 (1.8)	- -
Cephalexin	5 (0.2)	1 (0.4)	- -

[a] patients with co-morbid diagnosis excluded.

[b] totals may sum to more than 100% because some patients received >1 antimicrobial.

[c] p-value <0.05 for differences in prescribing across disease categories.

Note: shading indicates guideline-recommended therapy.

plan. Part-time physicians tended to prescribe more antimicrobials but this association was also not statistically significant.

There was little variability in antimicrobial prescribing for bacterial URI patients. Only payment status was a significant predictor of antimicrobial prescribing for bacterial URIs, after adjusting for the health center. Patients paying out of pocket or insured under non-national health plans were more likely to receive antimicrobials than those insured under the national health plan (OR, 2.17, 95% CI, 1.15 – 4.09).

Cost of URI treatment

The average cost of treating bacterial URI

Table 4
Factors associated with antimicrobial prescribing for viral URI patients (n=4,107).

Characteristics	Antimicrobial prescribed (%)	Crude OR (95% CI)	Adjusted OR [a] (95% CI)
Gender			
Male	779 (64.9)	1.41 (1.20 - 1.64)	1.47 (1.26 - 1.72)
Female	1,698 (58.4)	Referent	Referent
Age			
18-40 yr	1,255 (68.9)	3.95 (3.28 - 4.77)	3.62 (2.92 - 4.50)
41-60 yr	734 (59.4)	2.29 (1.89 - 2.78)	2.17 (1.76 - 2.68)
>60 yr	488 (46.5)	Referent	Referent
Payment type[b]			
Self-payment	1,518 (65.5)	1.96 (1.70 - 2.27)	1.19 (1.00 - 1.40)
Free of charge	954 (53.5)	Referent	Referent
Physician employment status			
Part-time	2,041 (62.8)	2.32 (0.84 - 6.41)	2.58 (0.85 - 7.85)
Full-time	436 (51.0)	Referent	Referent

[a] adjusted for gender, age, payment type, and physician employment status; OR denotes odds ratio, CI denotes confidence interval.

[b] patients paying out-of-pocket or patients insured under health plans other than the national health plan are classified as self-pay patients; patients insured under the national health plan are classified as free-of-charge.

was greater than the cost of treating viral URI (80 baht *versus* 46 baht per case, a difference of approximately US$0.85). Patients who received antimicrobials paid 44-53 baht more per prescription than patients who did not receive antimicrobial treatment.

DISCUSSION

Pattern of prescribing for URIs

The vast majority (90%) of URI patients who visited health centers in these two slum areas in Bangkok in 2001 most likely had viral URIs. High rates of prescribing of symptomatic drugs, such as antipyretics/analgesics and antihistamines, for these viral URI patients would be appropriate according to the National Standard Treatment Guideline (1996). However, 60.3% of patients with viral URIs received antimicrobials. In bacterial URIs, antimicrobials were prescribed more frequently than symptomatic drugs to 89% of patients. Antimicrobial prescribing rates for bacterial URIs in these slum communities were similar to those reported from developed countries (Dosh *et al,* 2000; Linder and Singer, 2003). For viral URIs, however, antimicrobial prescribing rates were much higher than those observed in developed countries (9 - 46%) (Dosh *et al,* 2000; Linder and Singer, 2003; Steinman *et al,* 2003).

Appropriateness of antimicrobial prescribing

Based on estimates from the National Standard Treatment Guideline (1999), about 0.5-2.0% of viral URI patients who had high fever, severe cough, and/or abscesses would need antimicrobials. High-risk patients, such as those with HIV/AIDS and intravenous drug users, may also need empirical antimicrobial treatment. Proportions of these high-risk patients may have been underestimated in this study due to underreporting of these co-morbidities. Nevertheless, 60.3% of patients with likely viral URI received antimicrobials, a proportion far higher than expected, implying substantial overuse of antimicrobials for most URI patients treated at these health centers.

Among patients with bacterial URIs who received antimicrobials, selection and duration of antimicrobial treatment were problematic. Antimicrobials that were not recommended by the treatment guideline (amoxycillin-clavulanic acid, cefalexin, ciprofloxacin, chloramphenicol, tetracycline) were prescribed for 85.1% of these patients. About 4% of URI patients received tetracycline or ciprofloxacin, antibiotics which should be very carefully prescribed in women of childbearing age.

The average duration of antimicrobial treatment among bacterial URI patients was 6.7 days and only 18% of patients received antimicrobial treatment for 7-14 days. We cannot assess the appropriateness of failing to prescribe an antimicrobial for 42 patients (10.7%) with bacterial URIs.

Predictors of antimicrobials prescribing

We found different predictors of antimicrobial prescribing for viral and bacterial URI patients. Younger, male patients with viral URIs were more likely to receive antimicrobials than others with viral URIs. This finding agrees with results from some (Linder and Stafford 2001) but not all previous studies (Dosh, 2000; De Sutter *et al,* 2001; Steinman *et al,* 2003). Younger patients are more likely to be infected with Group A β-hemolytic streptococci (GABHS), and some treatment algorithms recommend antimicrobial treatment for younger patients with sore throat (McIsaac *et al,* 1998). It may also be possible that physicians tend to prescribe antimicrobials more frequently because of concern about effects of illness on work loss in this population (Linder and Singer, 2003). Physician age and gender did not influence prescribing patterns, but employment status possibly did. Part-time physicians at the health centers include retired physicians and young medical doctors from other health settings. Because they practice in the community only half a day, 1-3 days per week, they may perceive different prescribing needs than full-time physicians.

Ability to pay may contribute to the decision to prescribe antimicrobials for viral and bacteria URI patients. The recent health system reform in Thailand introduced capitated payment for patients in the national health plan. Physicians may tend to prescribe more drugs for patients who pay out of pocket or are insured in the fee-for-service civil servant medical benefit scheme in order to to compensate for lost health center revenue due to care for patients under the national health plan. This may also represent greater willingness to conform to patient demand for antibiotics when cost is not an issue. Dong and colleagues (1999) also showed that patients with URI in China who paid out-of-pocket received antimicrobials more frequently, although they hypothesized that this might be due to these patients presenting later at health facilities with more advanced illness.

Cost of unnecessary antimicrobial use

Unnecessary prescribing of antimicrobials for viral URIs is a serious and costly problem. It may increase antimicrobial resistance in the community, rendering common antimicrobials ineffective and causing a need for more expensive new antimicrobials. For individuals with viral URIs, the added cost of unnecessary antimicrobial treatment was 43 baht per case. Based on average monthly total income and expenditures per household in the year 2001 from the National Statistical Office (2003), this accounted for 10.8% of daily household income or 13.2% of total daily household expenditures and a total of 106,511 baht expended per year for unnecessary antimicrobial treatment of viral URI patients at the two study health centers.

Study limitations

We need to acknowledge the following limitations of the study. Some cases may be misclassified as viral or bacterial. Physicians note only broad diagnoses in health center registration books, and detailed information such as clinical signs, duration of symptoms, and other clinical information, such as HIV infection and pregnancy, is limited. We may have overestimated the prevalence of viral URI and thus of inappropriate antimicrobial use. Nevertheless, viral URIs are estimated to account for 65-90% of URIs in adults (MoPH, 1996; Therapeutic Guidelines 1998; Dolin 1998; Heikkinen and Jarvinen, 2003), which is consistent with the 91% estimate of viral cases presenting for treatment in our setting.

Our ability to generalize the present findings from health centers in slum areas to other settings in Thailand or elsewhere may be limited. Patterns of prescribing and the factors that influence prescribing in private health care settings or public hospitals may be quite different, due to institutional policies, pharmaceutical company marketing, and access to laboratory facilities. In addition, the high risk nature of our population may influence the propensity to prescribe antibiotics as preventive therapies.

Future research should explore other possible determinants of antimicrobial use, including patients' expectations (Britten and Ukoumunne, 1997), their attitudes towards antimicrobials (Walker *et al,* 2003), and the impact of existing health care policies and regulations.

Conclusion

Patients with viral URIs treated in health centers in these slum communities frequently receive unnecessary antimicrobials and patients with bacterial URIs frequently receive inappropriate antimicrobial treatments. These patterns are likely to accelerate rates of growth of antimicrobial resistance to commonly used antibiotics. From the perspective of patients, this means wasting money for unnecessary and potentially harmful medicines and from the perspective of society this means risking loss of potent antimicrobials through misuse. Interventions to promote more rational use of antimicrobials in these settings are urgently needed. Incorporating findings from the present study, we are currently developing multi-sectoral interventions to improve treatment of URI among adults in these slum communities (Suttajit *et al,* 2003).

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FOLK KNOWLEDGE ABOUT AVIAN INFLUENZA AND THE USE OF PERSONAL PROTECTIVE EQUIPMENT: A QUALITATIVE STUDY

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ABSTRACT: Avian influenza (Al) outbreaks in Thailand from January 2004 to December 2005 resulted in 22 human cases, and 14 deaths. Three confirmed cases were reported in Suphanburi Province in 2004, one of whom died. Based on experiences if AI in Suphanburi, this study aimed to assess and describe the nature of local residents' knowledge about AI and identify their perceived benefits and barriers to the use of personal protective equipments (PPE). Four focus group discussions (FGD) with 38 participants in high and low infectivity areas were organized. In addition, ten in-depth interviews in high and low infectivity areas were conducted. Most of these cases were correlated with raising poultry or direct contact with dying poultry. The findings revealed that almost all of the participants perceived the cause of AI to be from wild birds and/or migratory birds. There are differences in local knowledge and beliefs between participants in high and low infectivity areas. The participants in high infectivity areas have more knowledge than the participants in low infectivity areas. Some of the participants in low infectivity areas believed that AI is caused by mosquitoes, wind, air and water. The use of PPE (gloves) is low among participants of all ages and types of poultry owned. Most use plastic bags instead of gloves to handle dying poultry. The benefits of using PPE (gloves, including plastic bags) related more to protection from odors rather than protection from AI transmission. The potential barriers to PPE use were related to cultural factors, lack of knowledge, comfort, availability and cost. This study suggested that public health professionals should promote the use of PPE and hand washing by raising their awareness.

Keywords: Folk knowledge, Avian Influenza, Use of personal protective equipments, Qualitative study

INTRODUCTION: Avian influenza (AI) outbreaks in Thailand from January 2004 to December 2005 resulted in 22 human cases and 14 deaths1). Chulalongkorn University, comprising the College of Public Health Sciences, Faculty of Veterinary Sciences and Faculty of Medicine in collaboration with the University of Minnesota, USA, has conducted a research project entitled Influenza A Infections at the Human Animal Interface. The project aims to gain better understanding of the epidemiology and transmission of infection in provinces where there have been repeated epidemics, and to achieve more effective disease prevention and control. The project adopted multidisciplinary approaches for data collection, including qualitative, quantitative and laboratory investigation. Suphanburi Province was purposively selected for the study because it was the location of the first human case of H5N1 confirmed by the Ministry of Public Health. Three confirmed cases were reported in 20042), one of whom died. Based on experiences of AI in Suphanburi, this study aimed to assess and describe the nature of local residents' knowledge about AI and identify the perceived benefits and barriers to the use of personal protective equipments (PPE). The World Health Organization recommends the use of Personal Protective Equipment (PPE) and hand washing as effective measures for infection prevention and to control the spread of disease). PPE items include gloves, masks,

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boots and protective clothing. To gain a more in-depth understanding of the folk knowledge and the perceived benefits and barriers to the use of PPE, a qualitative study was conducted. This qualitative study, comprised of focus group discussions (FGD) and in-depth interviews (IDI), is supplementary to a larger study survey and is conducted to improve the understanding of the underlying reasons for reported behaviors and practices related to the use of PPE for avian influenza prevention and control.

MATERIALS AND METHODS: The district and subdistrict selection described here reflects that which was conducted for the larger overhead study. Within Suphanburi Province, participating districts were chosen based upon their outbreak experience during the third wave of highly pathogenic avian influenza A (HPAI) from July through November 20054). Of the six districts that were affected, the two most affected districts (Muang and U Thong) were specifically selected for this study. In each district, one sub-district was identified which had experienced three or more waves of poultry outbreaks (or high infectivity areas) and had the most reported chicken deaths. Within each of these two high infectivity districts, one sub-district was chosen based upon having the greatest number of chicken deaths , as well as the willingness of local health officers to cooperate. Matching on population size and density, number of villages, and agricultural occupations, we selected one more sub-district in each district that had experienced less than two waves of AI poultry outbreaks (or low infectivity areas). For this FGD and IDI sub-study, one high infectivity sub-district (in U Thong District) and one low-infectivity subdistrict (in Muang District) was selected.

Data collection for this study took place in focus group discussion (FGD) and in-depth interviews (IDI). Within the subdistricts, the FGD and IDI participants were recruited using a snowball sampling technique. This technique utilizes referral chains to identify study participants. In this study, participants were identified by local health officers, village health volunteers and village leaders. The criteria for participation in the FGD was currently owning poultry of any kind (July, 2008) or having owned poultry at the time of the H5N1 outbreaks during the third wave of HPAI (July-November 2005).

The question guides for FGDs and IDI were developed based on the Health Belief Model5), as the Health Belief Model has been very influential in the area of health education in Thailand6). The FGD guides were written to explore perceptions of the causes of AI in poultry, the perceived severity of AI, and perceived benefits/ barriers to PPE use. After securing permission from the participants, all conversation during FGDs and IDIs was audio recorded. Transcripts were created from the audio recordings, and the transcriptions were coded to identify emergent themes by the researchers.

RESULTS: Two FGDs in high-infectivity areas and two FGDs in low-infectivity areas were organized. A total of 32 poultry owners participated in FGDs. Eighteen participants (56.3%) were from high-infectivity areas and were between the ages of 37-79 years. Fourteen participants (43.7%) were from low-infectivity areas with and age range of 25-81. Most of them are rice farmers (75.0%). During the study period, almost all of them were raising the poultry. The majority raised backyard chickens. A few of them raised both backyard chickens and ducks. Two of them raised fighting cocks and one raised grazing ducks. Some of the participants stated that they raised backyard chickens for food and for the ritual. The rituals usually related to paying respects or make offerings to god/ghost/spirit for their crop products. For example, informing ghost/spirit for growing rice, for harvest, asking for rain, and so on. These mentioned rituals require that the chicken be steamed with liquor. Therefore the backyard chickens are needed 2-3 times per year. Most of them stated that they refuse to buy chicken from the market as it not fresh enough for the ritual. Most participants' activity related to poultry is feeding. During the AI outbreak, eleven of the participants in the high-infectivity areas and eleven participants in the low-infectivity areas were faced with poultry death.

FGD participants' characteristics

	FGDs		
Sex	High-infectivity area	Low – infectivity area	Total
Male	*8*	*10*	*18*
Female	*10*	*4*	*14*
Total	**18**	**14**	**32**
Age range	37-79 yrs.	25-81yrs.	

Ten IDIs were conducted. Five participants resided in the high AI infectivity areas and were aged between 36 - 59. Another five participants resided in the low AI infectivity areas and were aged between 41-68 years. The participants included six villagers, two village health volunteers and two community leaders. Almost all of them raised backyard chickens. Two of them raised grazing ducks. Most participants' activity related to poultry was feeding. During the AI outbreak, all of them were faced with poultry death.

IDI participants' characteristics

	IDIs		
Sex	**High-infectivity area**	**Low-infectivity area**	**Total**
Male	*3*	*4*	*7*
Female	*2*	*1*	*3*
Total	**5**	**5**	**10**
Age range	*36-59*	*41-68*	

Perceived Causes of AI in Poultry

All of the participants both high and low infectivity areas defined the Avian Influenza (AI) or 'Kai Wad Nok' in Thai, meaning 'Bird Influenza'. Most of them perceived that migratory birds and wild birds were cause of AI in poultry.

> *Male, aged 37 (FGD, high infectivity areas) "Migratory birds fly from place to place, they bring AI, but our chickens, they are at home, therefore the AI cause from the wild bird and migratory bird"*

> *Male, aged 58 (IDI, high infectivity areas): "Bird Flu is the disease that the Asian open bill stork carry the avian flu viruses. These viruses were blown away in the air and our poultries got affected.*

However few of them had no idea about the relation of transmission between a bird and their poultries.

> *Female, aged 53 (FGD, low infectivity areas): ".... I am, sometimes afraid getting infected with AI, however, I have no idea about what are the mode of transmission"*

Interestingly, the participants in the low AI infectivity areas had different perceptions regarding the causation of AI in poultry when compare with the high infectivity areas. For example, they perceived that AI was caused by air, wind, water, mosquitoes and grazing ducks.

> *Male, aged 45 (FGD, low infectivity areas): "AI by wind, when it happen all chicken died with black face. I don't know how it is happen. I just wonder on this disease (AI), it is called 'bird flu' but mostly chicken died.... not birds."*

> *Male, aged 25 (FGD, low infectivity areas): "....migratory birds migrate for food and water around our community. Our chickens in the community were contaminated with the water and secretion of those migratory birds."*

> *Male, aged 70 (FGD, low infectivity areas): "....chicken died due to mosquitoes bite, as I observe most of chickens live in the mosquitoes net safer than the chicken live outside mosquitoes net".*

Perceived Severity of AI

Some participants in the high infectivity areas perceived that AI is a severe disease as it causes massive poultry death. In addition, it leads to death of human beings. However, few believed that AI can be prevented with vaccine.

> *Male, aged50 (FGD, high infectivity areas): "AI is very severe because of massive numbers of bird deaths if it occurs"*

> *Female, aged 47 (FGD, high infectivity areas): "...I am afraid of AI if someone infected, he/she will die"*

> *Male, aged 56 (FGD, high infectivity areas): "...I think AI can be prevented with vaccine"*

In contrast, the participants in the low infectivity areas have less concern about the severity of AI

> *Male, aged 70 (FGD, low infectivity areas): "...I have been raising the chicken for many years so I do not think that I can get infected with AI by contacting the chicken."*

> *Male, aged 58 (IDI, high infectivity areas): "...I am afraid of AI because this disease can kill a flock of chicken or duck so it might kill human as well.*

Few of the participants in the low infectivity areas belief that AI can be prevented with vaccine or "germ killer medicines" (antibiotics)

> *Female, aged 40 (FGD, high infectivity areas): ".... I think AI can be prevented with vaccine or germ killer medicines"*

Use of the Personal Protective Equipments (PPE)

Most of the participants both in high and low infectivity areas did not use gloves with their poultry during the study period in 2008. They also had low awareness of the AI outbreak.

> *Female, aged 48 (FGD, low infectivity areas): "Using gloves is unnecessary for people in upcountry. We live in rural area, we have simple life."*
>
> *Male, aged 70 years (FGD, low infectivity areas): "I didn't use gloves as I think it is not necessary, I didn't touch much the poultry"*
>
> *Male, aged 65 (IDI, low infectivity areas): "I have never used any gloves or mask because I do not touch or contact the chicken directly. I just throw the steamed rice to them (feeding).*

However, the participants in the high infectivity areas mentioned that during the AI outbreak in 2005 some of them used gloves or plastic bags especially for culling and carrying the dead chickens/ducks. Some of them used plastic bags only for their own dying birds, but they did not use for neighbors'. The participants in the low infectivity areas mentioned that they usually used plastic bags instead of gloves. It was used because of smell rather than protection of the AI transmission. Moreover the quality of bags was not assessed, some bags were leaking or torn.

As mentioned earlier, some participants raised backyard chickens for rituals. Those rituals related to paying respects or making offerings to god/ghost/spirit for their crop products. They usually culled their backyard chickens 2-3 times per years. Most of them stated that they did not use gloves or plastic bags. The reasons for not using gloves or plastic bags were that they were unnecessary or that participants perceived that their chickens were free from diseases.

> *Male, aged 62 (IDI, low infectivity areas): "culling my chickens, it is not necessary to use gloves. My chickens are free from disease."*

The benefits and barrier to PPE used

The benefits of using PPE

The majority of participants realized the benefits of the use of PPE. They learnt how to use PPE from the village health volunteers (VHVs), health personal. Interestingly, we found that a few participants used PPE regularly. In addition, a few perceived the benefit of use PPE (gloves or plastic bags) to relate to smell rather than protection of the AI transmission. Participants realized the benefits of using PPE (*gloves or mask)*as it can protect them from AI, however, they did not use it.

> *Male aged 56 (FGD, high infectivity areas): "I covered my hands with plastic bags when I had to carry the dead birds and buried them because I was afraid of the smell."*
>
> *Male aged 45 (FGD, low infectivity areas): "It is good that other people protected themselves by using gloves or mask when they contact their poultries. However, I do not wear any gloves or mask."*

The barriers to use of PPE

The reasons for not using PPE, especially gloves, in both low and high AI infectivity areas related to availability, cost, and complications with use, comfort and not being a normal part of life. Moreover, in the low AI infectivity areas mentioned, participants did not use gloves because of forgetfulness, laziness, unfamiliarity, not being necessary, weather too hot to wear gloves, and not appropriate to the rural culture.

> *Male aged 60 (FGD, low infectivity areas): "Using PPE is complicated. It is not simple way of life for rural people."*
>
> *Male aged 51(FGD, low infectivity areas): "I saw my neighbors wore the gloves when they feed their chicken. They seem worried too much about their hygiene."*
>
> *Male, aged 56 (FGD, low infectivity areas): "I used to wear the gloves whole carrying ducks but it was uncomfortable. Bare hands are more convenient."*
>
> *Female, aged 41 (IDI, low infectivity areas):"It's complicated. We just fed the chicken without touching them. We wanted to use the rubber gloves are difficult to find and costly. However, if we get them for free, we will use them during the outbreak or the campaigns only"*
>
> *Male, aged 45 (FGD, low infectivity areas): "I do not like wearing the gloves or a plastic bag when carrying the chicken because it is too hot but I always wash the chicken blood from my hands after slaughtering…not because of AI awareness."*

Sources of AI information

Most of the participants from both high and low infectivity areas have received AI information from various sources including village health volunteers (VHV), television, newspaper, health office, people talking in the village. However they prefer to get information from VHV or village headmen. In addition, they would like to get more information as they currently have poultry at home and the participants were afraid of the approaching winter. They believed that flu and AI occur during winter.

Limitations

A limitation of this qualitative study is the findings are unable to generalize about a broader population. Therefore, the researchers acknowledge that the findings pertain to our targeted subjects. It means that the experiences of these subjects may not adequately describe the experience of all villagers who raise poultry.

DISCUSSION: AI outbreaks are considered to be threats to national economic growth and, as such, require policy attention and research funds. The Thai Government has made a considerable effort in promoting prevention and control of AI transmission, including health education for poultry owners7). In order to create and implement effective interventions to combat AI transmission, an understanding of local perspectives and responses to AI is needed8). This study employed qualitative interview and focus group methods to gather and describe rural villagers' knowledge of AI and use of PPE. The findings reveal that all participants both high and low infectivity areas defined the Avian Influenza (AI) as 'Kai Wad Nok' in Thai, meaning 'bird influenza'. Most of them perceived that migratory birds and wild birds were cause of AI in poultry. However, a few of them had no understanding of the potential of transmission between wild birds and their poultry. Interestingly, the participants in the low AI infectivity areas had different perceptions regarding the causation of AI in poultry when compared with those in high infectivity areas. For example, they perceived that AI is caused by air, wind, water, mosquitoes and grazing ducks.

Moreover, there are differences in local knowledge and beliefs between participants in high and low infectivity areas. The participants in high infectivity areas have more knowledge than the participants in low infectivity areas. It might be that the participants in the high infectivity areas were often exposed to researchers and health personals during the AI outbreak. This finding is similar to a study in Israel which found that the sense of knowledge was significantly higher in the affected AI areas compared to the nation as a whole9). The participants in the high infectivity areas perceived that AI is a severe disease as it is a cause of massive poultry death and its leads to the death of human beings. In contrast, the participants in the low infectivity areas were less concerned about the severity of AI.

While a few participants used PPE regularly, the use of PPE is low among participants of all ages and types of poultry owned. This is despite the finding that the majority of the participants recognized the benefits of PPE. Knowledge regarding the use of PPE was obtained most frequently from VHVs and health personnel, a finding consistent with several other studies10,11,12). The reported barriers to PPE-use focused around cultural, informational and socio-economic factors. The reasons given for not using PPE, especially gloves, in both low and high AI infectivity areas are that PPE is costly, largely unavailable, complicated to use, uncomfortable and is not a normal part of daily life. Some participants also mentioned they did not use gloves because of forgetfulness or laziness. In some cases, a less costly and more available substitute, such as a plastic bag, was used instead of more traditional form of PPE.

The findings of this study suggest that public health professionals should promote the use of PPE by raising awareness of their uses and benefits. in addition, to improve present health education regarding AI prevention and control, consideration should be extended beyond the health belief model to find innovative approaches to developing education messages for specific local situations. For example, the participants indicated that gloves were not readily available and were costly, so they used plastic bags instead. They also stated that they tried to avoid direct contact with their poultry because they were afraid of AI transmission, however, they never mentioned regular hand washing after contact with poultry. Based upon these findings, a campaign promoting regular hand washing after poultry-related activities, as well as assessment of the integrity of plastic bags (to make sure that there are no holes) could be very effective among some rural Thai people.

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Right Ventricular Electrocardiographic Leads for Detection of Brugada Syndrome in Sudden Unexplained Death Syndrome Survivors and Their Relatives

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Summary

Background: Sudden unexplained death syndrome (SUDS) is a sudden death syndrome in previously healthy Southeast Asian young adults without any structural causes of death. Many SUDS survivors show electrocardiographic (ECG) evidence of RSR' and ST elevation in leads V_1 to V_3, which is similar to the ECG pattern in Brugada syndrome. However, in many cases transient normalization of the ECG does not make diagnosis with standard 12-lead ECG possible.

Hypothesis: To overcome this problem, we utilized the new right ventricular ECG leads to detect the Brugada syndrome in SUDS survivors.

Methods: The subject was a Thai male patient who presented with a SUDS-like syncopal attack. He had cardiac arrest due to idiopathic ventricular fibrillation.

Results: Post-resuscitation standard 12-lead ECG showed no diagnostic features of Brugada syndrome. However, ECG patterns of RSR' and ST elevations typical for Brugada syndrome could be detected at the higher intercostal space leads V_1 to V_3. We observed similar findings in 2 of the other 10 SUDS survivors and 4 of 23 healthy family members.

Conclusions: Our data suggest that these new right ventricular leads ECG may be helpful in detecting Brugada syndrome in SUDS survivors and their relatives.

Key words: Brugada syndrome, sudden unexplained death syndrome, electrocardiography, right ventricle

Introduction

Sudden unexplained death syndrome (SUDS) is characterized by sudden death in previously healthy Southeast Asian young adults during sleep or at rest, without any structural causes of death as ascertained in postmortem study. This syndrome among young male Southeast Asian refugees in the United States has been reported by the Center of Disease Control and Prevention in the last decade.[1] The native people who resided in the northeastern region of Thailand have long recognized the same pattern of death known as "Lai Tai," or dying during sleep. The survivors of SUDS are defined as patients who were apparently healthy before developing sudden cardiac arrest due to idiopathic ventricular fibrillation (VF) but were successfully resuscitated. Presumptive survivors of SUDS are patients who experienced symptoms that reflect the clinical presentation of SUDS: agonal respiration, unresponsiveness after labored respiration during sleep, transient symptoms of distress (e.g., moaning, thrashing, grimacing), and syncope or seizure-like symptoms, but did not have documented cardiac arrest or VF previously.[2]

Previous study in Southeast Asian refugees[3] and a recent study in Thai men[2] showed that VF was the possible cause of cardiac arrest and death in survivors of SUDS. The electrocardiographic (ECG) patterns of RSR' and ST segment elevation in leads V_1 to V_3 are quite common in these survivors[2] and are similar to those found in Brugada syndrome. In 1992, Pedro and Josep Brugada described clinical characteristics of Brugada syndrome in eight otherwise healthy patients who developed sudden and aborted cardiac death due to idiopathic

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VF, and all patients had the ECG markers of RSR' and ST-segment elevation in leads V_1 to V_3.[4] Two ST-segment elevation patterns in Brugada syndrome have been described: "coved" and "saddle-back" types.[5] The ECG manifestations in patients with Brugada syndrome could be transiently normal; thus, a diagnosis detected by standard 12-lead ECG could be missed.[6] These dynamic ECG changes of RSR' and ST-segment elevation (Brugada sign) in leads V_1 to V_3 have also been reported in survivors of SUDS.[7] It was proposed that the heterogeneity of repolarization across the right ventricular outflow tract (RVOT) might contribute to the pathogenesis of these ECG patterns and polymorphic ventricular arrhythmia in Brugada syndrome.[8] We hypothesize that the RVOT repolarization heterogeneity might accordingly occur in survivors of SUDS and might lead to sudden VF. Thus, if the ECG leads for the right ventricle, especially the RVOT region, were utilized, it would be more likely that Brugada syndrome-like ECG patterns would be detected in survivors of SUDS who had transient normalization of ECG in standard ECG leads V_1 to V_3.

Methods and Results

Case Report

A 29-year-old Thai male, a carpenter, was apparently healthy until he suddenly and unexpectedly lost consciousness while reading a newspaper. He was successfully aroused by his wife and brought to King Chulalongkorn Memorial Hospital, Bangkok. During an interview at the emergency room, he became unconscious again and was found pulseless. The ECG monitoring showed VF. He was successfully resuscitated and was transferred to the medical intensive care unit where he was determined to be clinically normal. Blood pressure was 158/72 mmHg, heart rate 76/min, and temperature 36.6°C. Physical examination was normal. The ECG showed a normal sinus rhythm, normal P waves and PR intervals, J point and ST-segment up-sloping elevation in leads V_2 and V_3; the corrected QT interval (QTc) was normal (408 ms) (Fig. 1). To obtain the ECG of the right ventricle and RVOT, we recorded the leads V_1 to V_3 at the intercostal spaces (ICS) higher than standard position: the "$-V_1$, $-V_2$, $-V_3$" represented the leads analogous to V_1, V_2, V_3 at the third ICS; the "$-2V_1$, $-2V_2$, $-2V_3$" represented V_1 to V_3 at the second ICS; at the lower ICS, the "$+V_1$, $+V_2$, $+V_3$" represented the leads analogous to V_1 to V_3 at the fifth ICS; and V_{3R}, V_{4R}, V_{5R} represented standard right precordial leads (Fig. 2). We arbitrarily defined the coved type of Brugada syndrome as an ECG pattern of >0.1 mV downsloping ST-segment elevation with inverted T wave and saddle-back type as a "fat" R' wave (>40 ms), a >0.1 mV of ST-segment elevation and R'/T amplitude ratio >0.75. The RSR' and significant downsloping ST-segment elevation with negative T waves (coved type), which were not present in the initial standard ECG, were revealed in leads $-V_1$, $-V_2$, and $-2V_1$ to $-2V_3$ (Fig. 3). A standard 12-lead ECG taken on the next day showed saddle-back type Brugada syndrome in lead V_2.

The laboratory test, including complete blood count, urinary analysis, blood chemistry, and electrolytes, was normal. Serum potassium was 4.0 mEq/l and magnesium 0.73 mmol/l (normal values = 0.5–1.1 mmol/l). Chest x-ray and echocardiography were normal. All pressure and oxymetry parameters during left and right-sided cardiac catheterization were within normal limits. Coronary angiography revealed normal coronary arteries. Right and left ventriculograms were normal with a ventricular ejection fraction of 68 and 61%, respectively. The electrophysiologic study showed a normal sinus node, a normal atrioventricular (AV) node, and His-Purkinje function without evidence of any accessory pathway. The Brugada sign in leads V_1 to V_3 were provoked by procainamide 10 mg/kg intravenous infusion (data not shown). No arrhythmia was induced with programmed stimulation at the right ventricular (RV) apex and RVOT at 3 cycle lengths (600, 500, 400 ms) with and without isoproterenol. Arrhythmia monitoring was negative. Because the patient refused implantation of an implantable cardioverter-defibrillator (ICD), he was discharged and treated with low-dose metoprolol. The Brugada signs in standard and new right ventricular lead ECGs (after beta

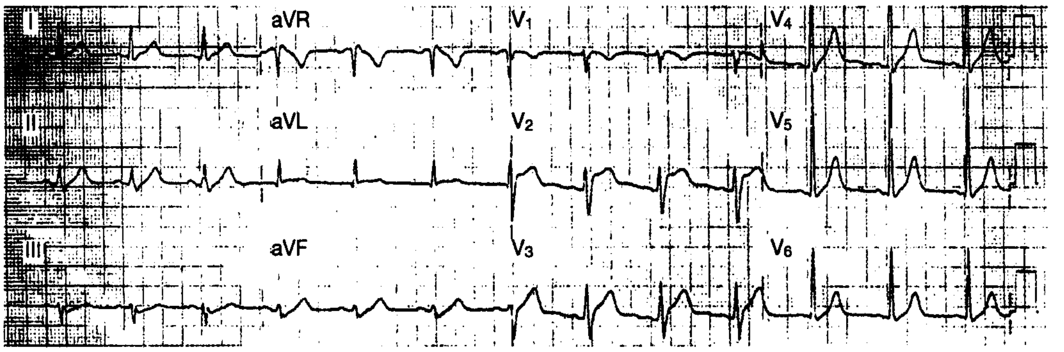

FIG. 1 Initial standard 12-lead electrocardiogram (ECG) of a Thai patient (the case report), post resuscitation from ventricular fibrillation, shows normal sinus rhythm, left ventricular hypertrophy by voltage criteria, normal QTc interval, and J point elevation with upsloping ST elevation in leads V_2 and V_3. No "coved" or "saddle-back" type ECG of Brugada syndrome was observed.

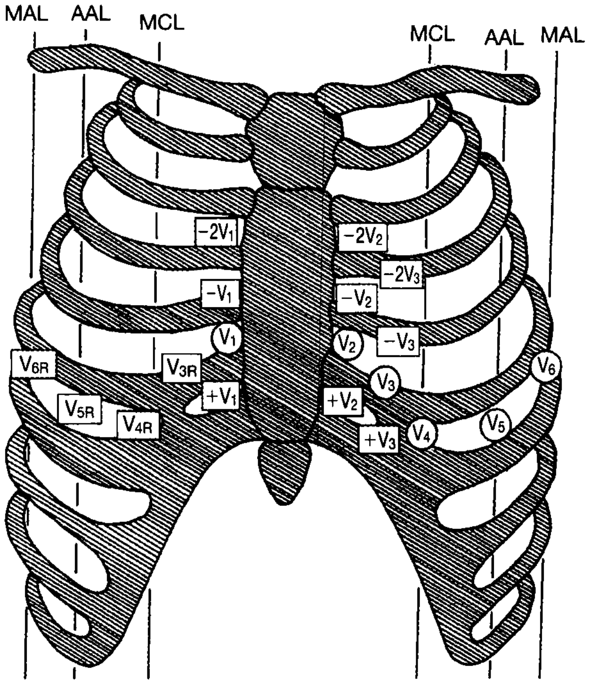

FIG. 2 Standard precordial positions of conventional chest leads V_1 to V_6 (open circles) and the right ventricular electrocardiographic leads: $-V_1$ to $-V_3$, $+V_1$ to $+V_3$, $-2V_1$ to $-2V_3$, and V_{3R} to V_{6R} (open squares) are shown. The lead $-V_1$ is just to the right of the sternum in the third intercostal space; the lead $-V_2$ to the left of the sternum in the third intercostal space; the lead $-V_3$ is one intercostal space higher than standard lead V_3; the leads $+V_1$ and $+V_2$ are just to the right and left, respectively, of the sternum in the fifth intercostal space; the lead $+V_3$ is one intercostal space lower than the standard lead V_3; the leads $-2V_1$ and $-2V_2$ are just to the right and left, respectively, of the sternum in the second intercostal space; the lead $-2V_3$ is two intercostal spaces higher than standard lead V_3; the lead V_{4R} lies in the right midclavicular line (MCL) in the fifth intercostal space; lead V_{3R} is halfway between leads V_1 and V_{4R}; the lead V_{5R} lies in the right anterior axillary line (AAL) in the fifth intercostal space; the lead V_{6R} lies in the mid-axillary line (MAL) in the fifth intercostal space.

blocker) were not more prominent than the predischarge ECG (without beta blocker) during 1- and 3-month follow-up.

Extended Study in Other Survivors of Sudden Unexplained Death Syndrome and Their Family Members

We employed these new 12 right ventricular ECG leads ($-V_1$ to $-V_3$, $-2V_1$ to $-2V_3$, $+V_1$ to $+V_3$, and V_{3R} to V_{5R}) and standard 12-lead ECG in cases of the other three survivors of SUDS and seven presumptive survivors of SUDS (41.5 ± 8.2 years). All but one were male. They had been apparently healthy before the syncopal attack. The three survivors of SUDS had cardiac arrest due to idiopathic VF and the other seven patients had clinical symptoms typically found in SUDS.[9, 10] Two patients (one survivor and one presumptive survivor of SUDS) had coved and/or saddle-back type of Brugada syndrome in leads V_1 to V_3 as well as in leads $-V_1$ to $-V_3$ and $-2V_1$ to $-2V_3$. The other two survivors of SUDS did not have these typical ECG markers in standard leads V_1 to V_3, but did have when placing the recorder at the higher ICS leads (Fig. 4). We also employed these new right ventricular ECG leads together with standard 12-lead ECG to study 23 healthy family members of survivors of SUDS and 40 healthy controls. None had a history of structural heart disease and all showed normal results on physical examination. According to standard 12-lead ECG, as well as right ventricular ECG leads, two family members showed typical coved or saddle-back patterns for Brugada syndrome, and four showed them only by utilizing the higher ICS V_1 to V_3 ($-V_1$ to $-V_3$ and $-2V_1$ to $-2V_3$) ECG leads (Fig. 5), not by standard lead V_1 to V_3 (Table I). We followed up all six asymptomatic family members and did not treat them with any medication or ICD. None of the controls had typical ECG patterns of Brugada syndrome by either method. The coved or saddle-back ECG types could not be detected in lower ICS V_1 to V_3 right precordial leads ($+V_1$ to $+V_3$ and V_{3R} to V_{5R}) in either survivors of SUDS or their relatives.

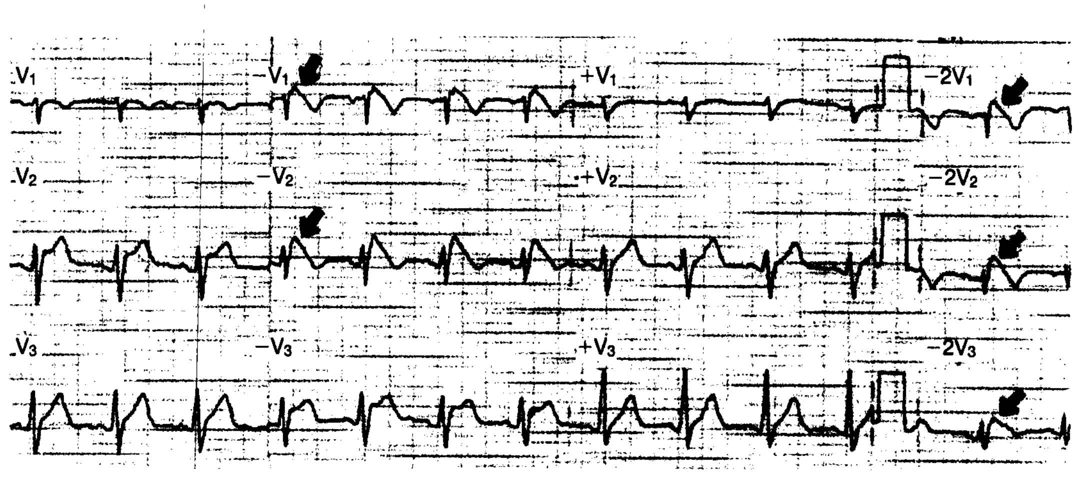

FIG. 3 The initial standard leads V_1 to V_3 of the electrocardiogram (ECG) of the case report did not show the typical RSR' and ST elevation of Brugada syndrome, but when the new right ventricular ECG leads ($-V_1$ to $-V_3$, $+V_1$ to $+V_3$, $-2V_1$ to $-2V_3$, and V_{3R} to V_{5R}) were employed (see Fig. 2), the "coved" types of Brugada syndrome were revealed in leads $-V_1$, $-V_2$, and $-2V_1$ to $-2V_3$ (closed arrow).

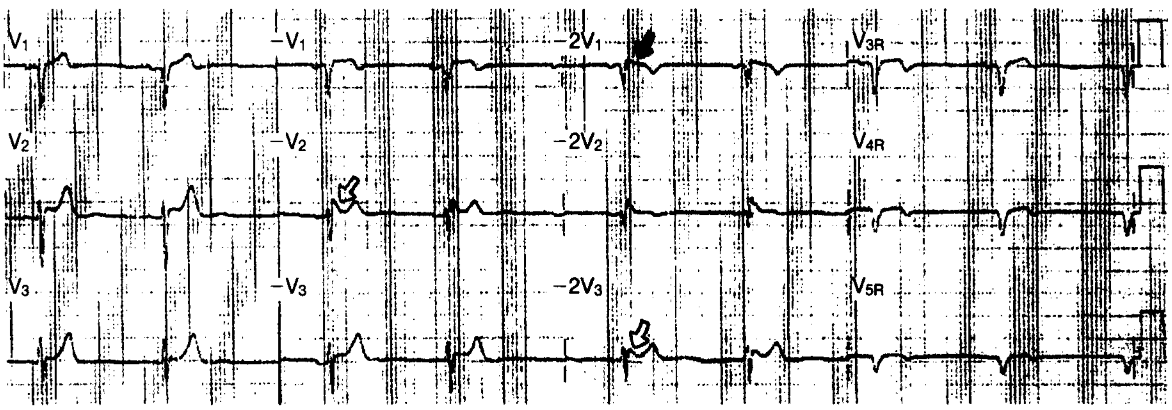

FIG. 4 The electrocardiogram (ECG) of the survivor of sudden unexplained death syndrome (SUDS) exhibits no ECG pattern of Brugada syndrome in leads V_1 to V_3, but reveals the "saddle-back" type in leads $-V_2$ and $-2V_3$ (open arrows) and "coved" type in lead $-2V_1$ (closed arrow).

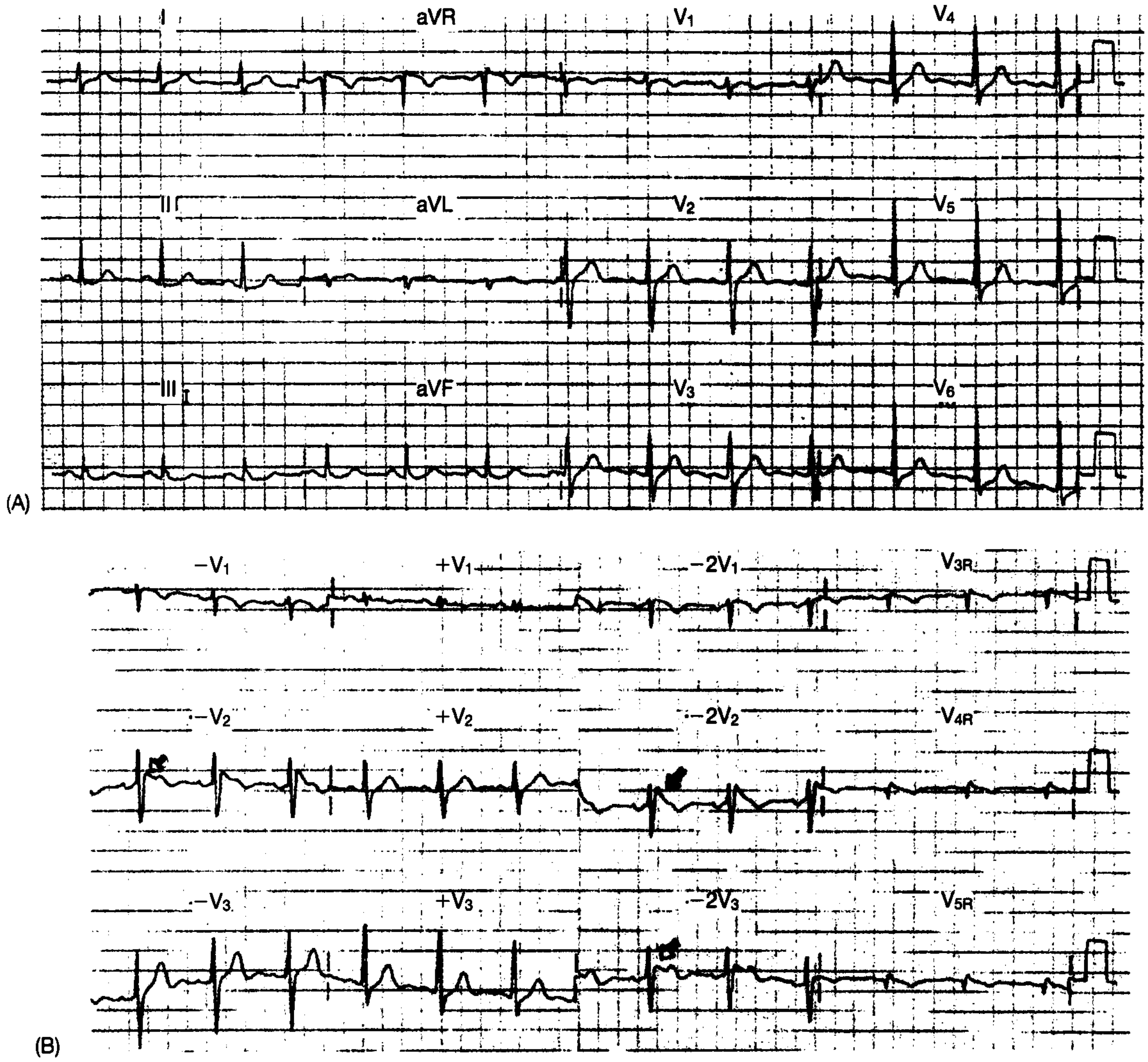

FIG. 5 The electrocardiogram (ECG) of the father of a survivor of sudden unexplained death syndrome (SUDS). (A) Standard 12-lead ECG shows no RSR' and ST elevation of Brugada syndrome in leads V_1 to V_3. (B) Right ventricular ECG leads (detail in text and Fig. 2) exhibit "saddle-back" type in leads $-V_2$ and $-2V_3$ (open arrow) and "coved" type in lead $-2V_2$ (closed arrow).

TABLE I Positive Brugada sign (RSR' and ST-segment elevation) in different sets of electrocardiographic leads

ECG leads	NSUDS & PNSUDS (n = 11)	Family members (n = 23)	Controls (n = 40)
Standard V_1 to V_3, no. (%)	2 (18.2)	2 (8.7)	0 (0)
Higher ICS V_1 to V_3, no. (%)	5 (45.5)	6 (26.1)	0 (0)
Lower ICS V_1 to V_3, no. (%)	0 (0)	0 (0)	0 (0)
Standard V_{3R} to V_{5R}, no. (%)	0 (0)	0 (0)	0 (0)

Abbreviations: ECG = electrocardiographic, NSUDS = near sudden unexplained death syndrome or sudden unexplained death syndrome survivors, PNSUDS = presumptive sudden unexplained death syndrome survivors, Higher ICS V_1 to V_3 = higher intercostal space leads V_1 to V_3 or leads $-V_1$ to $-V_3$ and $-2V_1$ to $-2V_3$ (see Fig. 2), Lower ICS V_1 to V_3 = lower intercostal space leads V_1 to V_3 or leads $+V_1$ to $+V_3$ (see Fig. 2).

Discussion

The ECG pattern of RSR' with ST-segment elevation and inversion of the T wave in leads V_1 to V_3, with or without right bundle-branch block, is a diagnostic hallmark of Brugada syndrome in idiopathic patients with VF.[4] However, this ECG pattern can be transiently normalized; thus Brugada syndrome possibly could be underdiagnosed with the standard ECG.[6] To overcome this problem, a serial standard 12-lead ECG should be performed[2] because of the hourly or daily dynamic changes of this ECG manifestation,[11] or sodium channel-blocking agents such as procainamide can be administered intravenously to unmask the ST-segment elevation in leads V_1 to V_3.[11] The RSR' and ST-segment elevation in Brugada syndrome has been proposed to be a reflection of conduction delay localized in the RV anterior wall and RVOT by isochrone mapping;[12] the ECG recorder position should be extended to cover the sites where abnormal electrical impulse prevails. The more ECG leads we placed for RV and RVOT, the greater was the chance of detecting Brugada syndrome. Therefore, we selected the leads V_1 to V_3 at higher ICS ($-V_1$ to $-V_3$ and $-2V_1$ to $-2V_3$), lower ICS ($+V_1$ to $+V_3$), and right precordial leads (V_{3R} to V_{5R}) for our study.

We report the case of a survivor of SUDS with Brugada sign only in higher ICS leads V_1 to V_3 ($-V_1$ to $-V_3$ and $-2V_1$ to $-2V_3$). The patient was treated with low-dose beta blocker therapy because there is some evidence that sudden unexplained deaths among Thai workers in Singapore were related to stress and emotional problems,[13] and beta blockers may reduce stress and the ventricular arrhythmia threshold. Beta blockers may also provoke the Brugada sign by slowing the heart rate, but this manifestation was not observed in our patient, perhaps because of the smaller dosage.

Our data have shown that the new right ventricular ECG leads could identify Brugada syndrome in 5 of 11 survivors of SUDS and 6 out of 23 of their healthy relatives, whereas the standard 12-lead ECG could do so in only 2 of 11 and 2 of 23, respectively. Thus, these right ventricular ECG leads are more sensitive than the standard 12-lead ECG for detection of Brugada syndrome.

Previous studies[2, 6, 7] have suggested that the dynamic changes of RSR' and ST-segment elevation in Brugada syndrome might relate to the electrical heterogeneity of the right ventricle at different times, and our data demonstrate that these changes might also relate to different sites detected by different ECG leads. These findings may support the hypothesis of electrical heterogeneity at different sites leading to phase 2 reentry as a trigger for idiopathic VF, proposed by Lukas and Antzelevitch.[14]

The secondary R waves (R') may normally be present or increase in amplitude in the higher ICS of leads V_1 and V_2 with an inverted T wave,[15] and can be differentiated from the ECG patterns of Brugada syndrome by ST-segment elevation which is absent in normal patients. The coved and saddle-back ECG patterns in Brugada syndrome look similar to right bundle-branch block and early repolarization patterns, respectively. We observed that the saddle-back type ECG in SUDS survivor had a "fat" R' wave (> 40 ms) which is different from the "tall peak" R' wave in the right bundle-branch block pattern in our healthy controls. The R' wave in the saddle-back type was also as tall as or a little shorter than the T-wave amplitude (R'/T ratio > 0.75), compared with the early repolarization pattern in normal controls. However, sensitivity and specificity of these criteria for Brugada syndrome need to be established in a large population study.

Conclusion

These findings have several clinical implications. First, the results demonstrate that a portion of the Thai population who suffered from acute syncopal attacks similar to SUDS probably are patients with Brugada syndrome. Second, we found that healthy family members of survivors of SUDS had an "occult" ECG pattern of Brugada syndrome as well; under certain conditions, they might develop idiopathic VF and, consequently, sudden death similar to that observed among SUDS victims. The results also support previous observations that about 30–40% of SUDS victims had a history of SUDS attacks in one or more of their family members.[9, 13, 16] Third, to increase sensitivity for detection of subjects at high risk of developing SUDS, especially those who are family members of SUDS victims, the right ventricular ECG leads should be utilized concomitantly with a standard 12-lead ECG. When used in conjunction with the standard 12-lead ECG, the new right ventricular ECG lead method might also enhance the sensitivity for detection of Brugada syndrome. It is conceivable that utilization of this method together with sodium-channel blocker test, as well as serial ECG, will further increase the sensitivity for detecting Brugada syndrome (our unpublished data).

Our new right ventricular ECG lead method is easy to perform, inexpensive, less operator dependent, and suitable for mass screening of patients at high risk of developing SUDS.

We also propose these new right ventricular ECG leads as a screening tool for Brugada syndrome in Thai sudden death survivors.

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Priority setting for health research: lessons from developing countries

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Research resources for addressing health problems of developing countries remain disproportionately low compared with the tremendous disease burdens borne by these countries. There is a need to focus these scarce resources on research that will optimize health benefits and lead to equity. This paper reviews processes and methods that have been used for setting research priorities. Past and current processes have focused on expert-driven research agenda, emphasizing scientific autonomy and global analyses. Methods for setting priorities have focused on the metrics of disease burdens, while less attention has been placed on who sets priorities and how choices are made.

The paper proposes a strategy of priority setting, based on lessons learned from essential national health research (ENHR) approaches attempted in several developing countries. With equity in health and development as its goal, the proposed model is demand-driven, and involves multi-dimensional inputs and multiple stakeholders. Various steps of the process are discussed: getting participants involved; gathering evidence and information; determining criteria for priority setting; and implementation and evaluation. The paper concludes with a discussion of the gap between national research priorities and the research agenda set at regional and global levels, an issue that needs to be satisfactorily addressed in the future.

Preface

This paper is a timely review of the issues around research priority setting, especially as they relate to health problems of developing countries. This is one of the major issues to be discussed at the International Conference on Health Research for Development, to be held on 10–13 October 2000 in Bangkok, Thailand. Ten years after the Commission on Health Research for Development reviewed the state of health research in the world, the forthcoming international conference is expected to lead to a new vision and a responsive health research agenda for the next decade. The conference participants will thoroughly review the many initiatives in health research over the last decade, examine possible scenarios and options for international health research cooperation, and discuss new tools and methodologies. In the conference session devoted to priority setting, participants will critically review experiences, gaps in methodology, and lessons learnt. This paper, from the perspective of developing countries, will be an important contribution to this session, and will flow into the overall declaration on the future of health research for the next decade.

The International Conference on Health Research for Development is spearheaded by an international organizing committee from the World Health Organization, the World Bank, the Global Forum for Health Research and the Council on Health Research for Development. Close to 30 other national and international organizations are collaborating on the steering process.

Introduction

Ten years ago, the Commission on Health Research for Development urged countries to undertake essential national health research (ENHR) in order to help correct imbalances in global health and development.[1] In 1992, estimated resources for research on health problems of developing countries amounted to only 4.4% of global research and development (R&D) investment,[2] a marked contrast to the fact that almost 90% of the global disease burden in 1990 was in developing countries.[3] Over the past decade, various strategies to increase the research resources for developing country problems have been attempted by international health bodies and agencies. Yet the latest estimates, according to the Global Forum for Health Research, still stand at an unhealthy '10/90' disequilibrium.[4] These constraints underscore the continuing need to focus on priorities in order to optimize health benefits and impact from scarce research resources.

Experiences in priority setting: processes and methods

Processes

The process of research agenda setting, until recently, has been limited, partly because the ideological emphasis has been on 'scientific autonomy'. Thus, resultant research agenda have tended to be expert-driven, largely detached from the public arena, and with insufficient operational emphasis. At the country level, there has been a heavy reliance on the inputs of prominent scientists, members of medical research councils (MRCs) or ministries of science and technology. It is notable, however, that while in the United States, the US National Institutes of Health primarily considers recommendations from leading science and technology experts, it also periodically makes use of user and patient panels to identify health care priorities.

The World Health Organization (WHO) Advisory Committee on Health Research, at both the global and regional levels, depends largely on scientific experts and directors of MRCs. Its special programmes, such as the Special Programme on Research and Training on Tropical Diseases (TDR) and the Special Programme on Research, Development & Research Training on Human Reproduction (HRP), have also made use of expert committees for setting priorities.

The process of health sector reform and WHO's efforts in health systems research, coupled with the World Bank's emphasis on user fees during the mid-1980s, led to a growing research interest on health systems development and cost-effectiveness analysis.[5,6] In 1996, the WHO *Ad Hoc* Committee on Health Research Relating to Future Intervention Options proposed a global research agenda based on a five-step process of priority setting. This involved a great deal of technical expertise and analytic work on burden of disease and cost-effectiveness of health interventions.[5] This has been taken a step further by the Global Forum on Health Research by drawing together various constituencies and networks at the global level in order to address identified research gaps.[4]

Methods

Many models have been used to set priorities for health resource allocation, some of which have been applied to research priority setting. These approaches range from qualitative methods of consensus building to the use of quantitative formulations and prioritisation matrices.[8–10] In recent years, composite indicators have gained prominence in the research priority-setting process because these single measures lend themselves to comparisons across a broad range of diseases and are particularly attractive for cost-benefit analyses of interventions. For example, the disability-adjusted life-year (DALY), a single measure of the disability, premature mortality and relative values of life at given ages, has been used to assess global and regional burden of disease.[11] More recently, another formulation, healthy life-years (HeaLYs), has been proposed to similarly reflect disability and premature mortality, but with improved valuations on the stream of life lost due to disability or death, based on the natural history of the disease, and with discounting calculated separately.[12]

Although useful in advancing methods for rational resource allocation, the extended discussions on burden of disease measures have sidelined other important issues in research priority setting. These include: Who sets priorities and how? What criteria are used to guide prioritization? These questions become all the more important in the light of the continuing observation that priorities for international health research have seldom been developed with the active participation of developing country research leaders and communities.[13]

Priority-setting exercises based on essential national health research (ENHR) approaches have been attempted in several developing countries, among them Benin, Commonwealth Caribbean countries, Guinea, Kenya, Nicaragua, The Philippines, South Africa, and Thailand.[14,15] Table 1 lists general research priority areas identified by some countries. Aside from priorities focusing on important diseases, it is worthwhile to note that all five countries identified the need for research on and for health policy. This may be due to the widespread emphasis on decentralization and health care financing since over a decade ago.

In this paper, we describe lessons learned from the experience of these countries. A framework for priority setting is presented to define the overall approach. We then suggest steps and methods that countries can use to bring stakeholders together and to set priorities for health research. We believe that these processes of self-determination pave the way for a stronger developing country voice in priority setting at the international level and for increasing the allocation of research resources to developing country problems.

Using the ENHR strategy

ENHR, a strategy first espoused by the Commission on Health Research for Development, is an integrated and systematic approach for organizing and managing country-specific and global health research in order to promote health and development on the basis of equity and social justice.[1,16] The framework that we propose for priority setting has the ENHR strategy as its basis and thus has equity in health and development as its goal.

As shown in Figure 1, priority setting in this model is demand-driven, focusing on an analysis of health needs, people's expectations and societal trends. The involvement of different stakeholders is multi-level (i.e. multiple inputs from communities, districts, sub-national and national levels) and multi-dimensional (i.e. quantitative and qualitative scientific inputs, as well as social, economic, political, ethical and management considerations). Consultative group processes, which are strongly featured in this approach, are inclusive, participatory, interactive and iterative.

Who sets priorities?

The participants are those who have a major stake in the goal of equity in health and development. Countries that have used ENHR strategies have identified four general categories of participants: researchers, decision-makers at different levels, health service providers, and communities. However, the country experiences also suggest the need for stronger representation from the private sector (e.g. professional health associations, the pharmaceutical industry), parliamentarians, and potential donors and international agencies.

Table 1. Examples of broad research priority areas identified in selected developing countries[a]

Country	Research priority areas
Caribbean	• Epidemiology of most common diseases • Access to health care facilities • Cost-benefit and outcome measurements of health policies and practices • Effects of environmental, ethnic, economic, social, and behavioural factors on incidence and prevalence of specific diseases
Guinea	• Research capacity strengthening • Malaria, diarrhoea and other priority health problems • Quality and financing of health care, human resources • Traditional health care: quality, collaboration, medicinal plants
Nicaragua	• Mother and child health • Communicable diseases • Drug addiction/alcoholism • Health care financing • Human resources development • Community involvement
Philippines	• Health care delivery • Product research and utilization • Health sector organization and management • Economics of health care
Uganda	• Maternal and child welfare and nutrition • Water and sanitation • Communicable diseases, including HIV/AIDS • Health systems and policy analysis

[a] It should be noted that some research priorities identified by the countries are not mutually exclusive. The above examples are indicative of the beginning process of priority setting, but more work needs to be done to refine and prioritize the research areas and questions.

The participation of a broadened spectrum of stakeholders helps to identify research needs, technical and financial capabilities, information gaps and distortions, the political environment, and the values and ethics of a given society (see Table 2). More importantly, involving major stakeholders in priority setting fosters ownership of both process and output, and facilitates shared responsibility and accountability in the implementation of the research agenda. In addition, when these stakeholders buy into the process, this could translate into cost sharing in research, not only by international agencies but also by the developing countries themselves.

The selection of participants from different groups and perspectives should be done carefully so that the research agenda has sufficient breadth to benefit a large number of stakeholders, but is narrow enough to have meaningful and manageable priorities. Thus an important initial step is to know the participants, who and where they are, their needs and interests, their expectations, and their strengths and weaknesses.

Getting participants involved

Experiences of countries in this review suggest some entry points in which national groups might involve stakeholders in research priority-setting from the outset, for example:

(1) a national ENHR convention or workshop, with participation from communities, researchers, health programme managers and policy-makers; followed by the formation of a task force with tripartite representation to refine the research agenda (e.g. Barbados, Jamaica, Kenya, Nepal, South Africa, Tobago, Trinidad, Uganda and Zimbabwe);
(2) formation of an inter-sectoral and multidisciplinary working group appointed by the Ministry of Health (e.g. The Philippines); or
(3) a research institute or university group which is tasked to develop and propose processes for priority setting; a larger group of participants is then involved in the actual priority-setting process (e.g. Thailand).

Based on experience, a small but representative working group can effectively facilitate the priority-setting process. This core group, in consultation with the larger group of participants, should moderate the extent and nature of participation of different groups or individuals. This may vary according to the nature of the ENHR activity, for example: the collection and analysis of health information, including community situation analysis through participatory action research; people's consultations through focus-group discussions or interviews; consensus building on specific thematic areas; decision-making for determining and applying criteria for priority setting; or translation of priority research areas into specific research programmes and projects.

Involving participants thus generally involves a sequential pattern of consultations, analyses and priority setting at the community and district levels, and aggregation and synthesis of these outputs at the provincial and national levels. Where conflicting priorities arise, several iterations as well as consensus-building processes may be necessary. However, priorities,

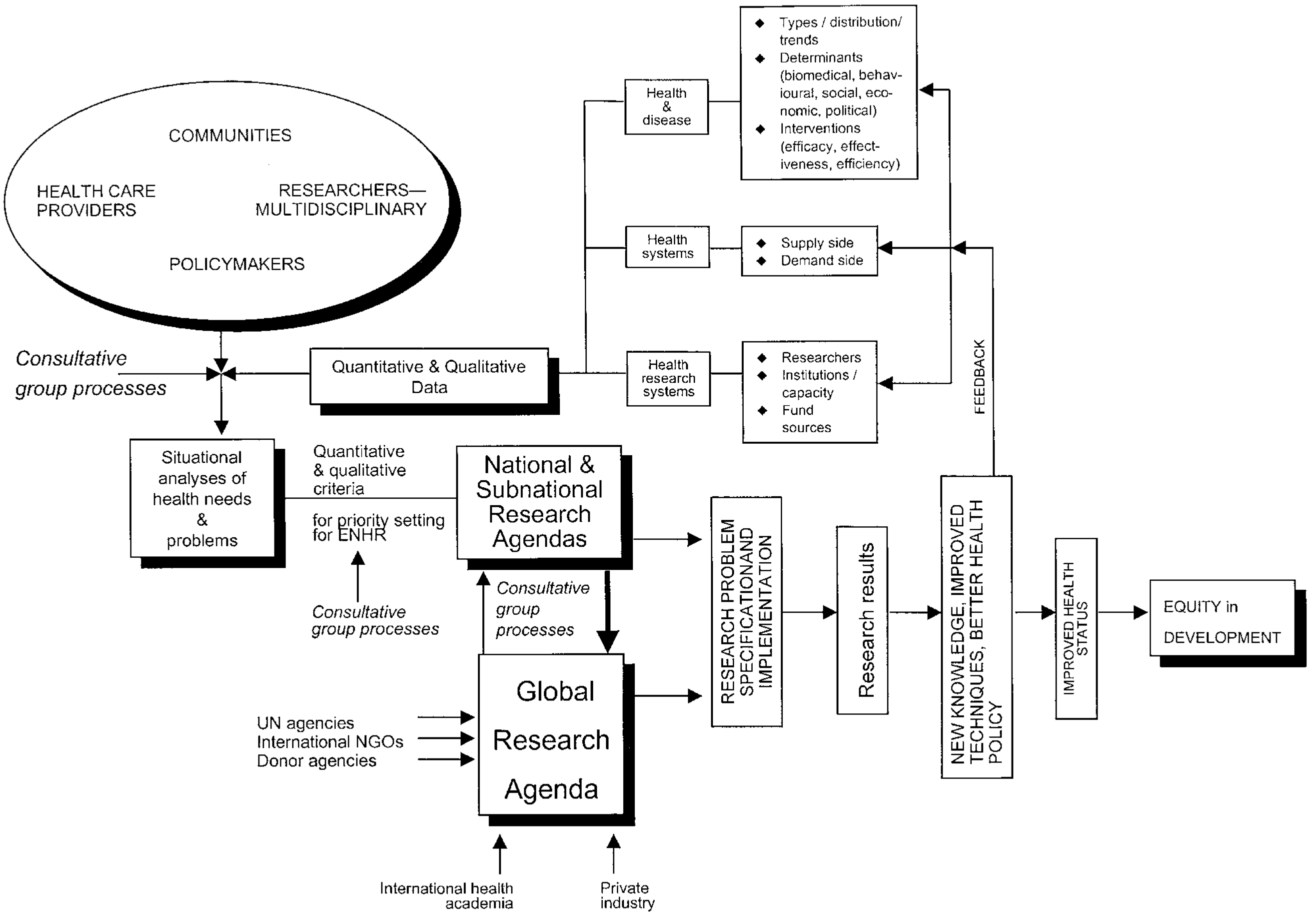

Figure 1. Framework for priority setting using the ENHR strategy

Table 2. Potential functions, roles and responsibilities of various stakeholders in priority setting for health research[a]

Core functions	Principal stakeholders	Roles and responsibilities
Payers	International/regional groups, e.g. multi-lateral organizations, NGOs National science and technology agencies	Mobilize funds in accordance with priority research area Provide international perspectives or technical inputs on health problems
Doers	Ministry/government agencies Academia/university Private sector NGOs	Clearinghouse function Set research policy/agenda Set standards, quality control Technical and ethical reviews Optimize use of resources Package findings for dissemination to various users
Users	Ministry of Health – planners, providers Local government NGOs and people's organizations Research communities – international, national, sub-national	Provide societal and ethical perspectives Arrange Forum to discuss research findings Make decisions balancing evidence and values

[a] All three groups have responsibilities to: (1) participate in priority setting; and (2) advocate for evidence-based policy and action.

especially at the local level, are largely context-sensitive and thus may not always be appropriate at different levels of aggregation.

In some cases, time constraints may necessitate parallel, rather than sequential, consultations for different groups and levels. This is also acceptable, as long as transparency and genuine involvement characterize the priority-setting processes. Acceptance, a sense of ownership, and implementation of the research agenda are perhaps the best indicators of involvement in the process.

Information for setting priorities

Decisions on priorities should be made based on the best available information. Evidence-based situation analysis at the outset can inform the priority-setting process. Three broad categories of information should be gathered and analyzed: the health status in a given setting, the health care system, and the health research system (see Figure 1, quantitative and qualitative data inputs). All three dimensions are important for assessing the main health problems, the supply- and demand-side of health care, and the research resources available to address priority research areas.

Sources of information can be varied; for example, vital registration systems, special surveys, patient records, focus group discussions or informed opinion. Statistical projections on demographic parameters, health determinants and diseases also provide useful information for determining the future impact of health research.

Despite the many sources, the 'lack of data' at the national and sub-national levels of many developing countries is often given as an excuse for arbitrary decisions on research priorities. Countries should begin with what is available, but should build on this to improve the quality of information and to fill important gaps. Because of the iterative nature of the priority-setting process, more and better information is progressively available in succeeding prioritization cycles.

In addressing issues of equity, the situation analysis should specifically cover the concerns of the vulnerable and the disadvantaged. Some countries' experiences (e.g. The Philippines, Benin) have demonstrated that the participation of non-governmental and people's organizations in the priority-setting process is more likely to draw attention to the situation and needs of neglected and marginalized groups.

The packaging and use of information gathered is another key issue. The heterogeneity of stakeholders means that the data will not always be understood in the same way. Thus, the working group coordinating the entire priority-setting process has to pay close attention to the interactions among participating groups. Steps need to be taken to ensure that the import of specialized information is within the grasp of all, including less technically skilled participants. In the same vein, it is important to balance the 'rigorous with the spontaneous'; i.e. to recognize that the information or perceptions or sensitivities expressed by various partners may influence the choice of priorities.

Criteria for setting priorities

A systematic and transparent process of priority setting is important in ensuring that the voice and will of the different stakeholders are heard and respected. Without openness and accountability, the voice of a 'moneyed' or inner circle may subvert the process of consensus building.

Research priorities will depend on a two-step process of, first, selecting criteria for priority setting and, second, selecting research topics from among identified priority problem areas. The countries in this review used one or more criteria from the following categories:

(1) magnitude and urgency of the problem, as suggested from quantitative and qualitative data in the requisite situation analysis;
(2) extent of previous research and the potential contribution of research in discovering, developing or evaluating new interventions;
(3) feasibility of carrying out the research in terms of the technical, economic, political, socio-cultural and ethical aspects;
(4) expected impact of the research, considering both direct and indirect effects, short- and long-term benefits, as well as its implications on issues of affordability, efficacy, equity and coverage.

The above categories could be broken down to as many as 12 distinct criteria. However, experiences at the country level and with a variety of participants show that a manageable core of criteria should be no more than six or seven. At the global level, for instance, the WHO *Ad Hoc* Committee proposed five steps for determining 'best buys' for global R&D, entailing an assessment of the following: the magnitude of the problem; the reasons for the persistence of the problem; the current knowledge base; the cost-effectiveness of potential interventions; and the current level of effort.[5]

The selection of the final criteria will depend on the purpose and level of action of the priority-setting exercise (i.e. global, national, sub-national, village levels, etc.), the availability of information related to the specific criterion, and the ability to define and measure the criteria in a common language or framework. The assignment of equal or differential weights to the criteria should be carefully deliberated upon by the participants until a consensus is reached on the selected criteria and the weights.

In assembling research areas to be considered, efforts should be made to cluster health problems into equivalent and meaningful levels so that priority areas are not chosen merely by the breadth and magnitude of the topics covered under a cluster. In addition, each research area should be specific and explicit enough to provide a common understanding among different stakeholders.

While it may not be necessary for all participants to be involved at every stage of the priority-setting process, the core group should document the processes and results at each stage. Methods for combining results range from addition of scores on simple scales to complex mathematical models or matrices.[9,10,17] The procedures for applying the criteria to the research areas are time consuming, but they enhance acceptance, ownership and implementation of the research agenda as a result of transparent and systematic procedures.

For most countries in this review, these crucial intervening steps leading to the selection of research priority areas and topics were not fully documented, leading to problems of reliability and credibility.

Implementation and evaluation

It remains to be seen whether, in the long term, priority-setting using the ENHR strategy will, in fact, improve the use of limited resources and generate more research funding for problems of the poor. There are intermediate but critical steps to ensure success: effective advocacy and dissemination of the agenda to all stakeholders, especially decision-makers who hold the key to health policy and research resources; implementation of the agenda by researchers, in partnership with other stakeholders; and periodic review and assessment of priorities.

Three important indicators are proposed for evaluation:

(1) Utilization of the research agenda: how extensive was the implementation of the research priorities? How much interest did the research agenda generate among stakeholders?
(2) Involvement of multiple stakeholders: how many groups or constituencies were involved and what were their contributions? Who were not involved?
(3) Do the research priorities address equity in health? For this, one could measure the proportion of researches that address health problems of the poor, the shift of resource flows towards equity-targeted programmes and the identified research priorities, and 'buy-in' from national and international sources.

The outcome and impact of these priority-setting exercises in the developing countries have yet to be fully evaluated. It is important to note, however, that competencies such as priority setting cannot be taken in isolation. Other important factors and competencies must be considered, for example, the country mechanism to support ENHR, advocacy, partnership development, resource mobilization, community participation, and translation of research results into policy and action.

The ENHR strategy and global health research priorities

ENHR includes research that may be country-specific or that may have international import. Individual countries should weigh the resources they direct at key national problems, but should also be well informed about the international health research effort. Common health problems shared with other developing countries may spell out opportunities for collaborative, multi-country research efforts, e.g. the growing problem of anti-microbial resistance, community-based evaluations of impregnated bednets in the control of malaria, behavioural interventions against smoking, or the development of innovative health care financing schemes. A number of middle-income developing countries, like Brazil, Malaysia, South Africa and Thailand, are also in a position to carry out basic research on developing country diseases, such as leishmaniasis, malaria, dengue and tuberculosis. The appropriate mix of country-specific and international health research is an important issue to address in the priority-setting exercise. This provides the national players with some leverage and basis for matching international donor interests with national and local concerns, or for negotiating research areas for assistance.

In addition, the systematic formulation, articulation and dissemination of national research agendas are important inputs to the global research agenda (see Figure 1). There should be efforts towards an upward synthesis of national priorities at the regional and global levels. This is to balance an oft-perceived 'one-sidedness' in global agenda setting. In the short term, hands-on participation of developing country representatives in global task forces devoted to specific initiatives could gradually improve the capabilities of these countries in the analysis, synthesis and articulation of their priorities. For the long term, the biggest challenge is to steadily increase the internal capacity of countries for analyzing their own health problems and needs, setting priorities, designing, implementing and evaluating research and health programmes. International efforts to strengthen countries' research capabilities will redound to the international good, as international databases and global health research priorities become more firmly grounded in country realities.

Endnote

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Notes on Corporate Authorship

The Working Group on Priority Setting was constituted in February 1997 by the Council on Health Research and Development, an international non-governmental organization devoted to the promotion and support of strategies for essential national health research (ENHR) in developing countries. The Working Group is one of four groups tasked to gather and analyze data derived from country experiences related to ENHR competencies. Members are from research institutes and councils, academic institutions, government agencies and NGOs, as well as from bilateral funding agencies.

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Strengthening health research capacity in developing countries: a critical element for achieving health equity

Chitr Sitthi-amorn, Ratana Somrongthong

Equity in health as the core value of health for all advocated by the Alma Ata declaration has not been achieved. Poverty is widening and inequity prevails.[1] New illnesses have burdened and strained health systems. Rapid growth of private medical services, medical technology, and uncontrolled insurance markets in many developing countries with relatively rapid private sector growth have resulted in unwanted consequences, highlighted by the economic crisis in Asia.[2] The rising number of international organisations and institutions involved in global health has eroded national sovereignty. The migration of health professionals from the public to the private sector and from developing to developed countries has diminished their ability undertake research and implement research findings.[3] It has also limited developing countries' ability to participate in the political debates and decisions on global health governance. Greater support of research for development is needed and health equity must be adopted as a core value.

Defining health research capacity

Health research capacity is the ability to define problems, set objectives and priorities, build sustainable institutions and organisations, and identify solutions to key national health problems.[4] This definition encompasses research capacity at the levels of individuals, research groups, institutions, and nations. Research capacity can broadly be divided into four domains: skills and competencies; scientific activities; outcomes; and impacts on policies and programmes.[5] Measures on process, outcome, and impact are necessary to capture a comprehensive picture of research capacity (fig 1).

The Commission on Health Research for Development identified four components as "essential health research."[7]

- Analysis of the burden of illnesses and their determinants to identify and set priorities among health problems
- Research to guide and accelerate the implementation of research findings to tackle key health problems (for example, the cost effectiveness of preventing death from malaria among poor rural populations[8])
- The development of new tools and methodologies to measure and promote equity (a project to promote trust between the government and rural poor in Brazil resulted in improved maternal and child health[7 9])
- Basic research to advance understanding of disease and disease mechanisms[7] and to develop "orphan" drugs and vaccines.

In addition to carefully targeted programmes and intelligently designed social security systems, participatory research is important to ensure that those who are involved in or affected by the research understand the rationale for the research and the potential benefit that may accrue.[1]

Summary points

Health inequity is widening between and within countries

Research capacity in developing countries is weak

As a result developing countries are unable to participate effectively in national and international health policy development

International and national cooperation and collaboration is needed to strengthen research capacity for health development

Health policy should be informed by a wide range of stakeholders and underpinned by sound evidence

Greater solidarity and commitment to tackling global health inequity is needed

Challenges for the research community in developing countries

The health research community in developing countries faces problems at several levels. At the global level there has been an increase in organisational and institutional players in international health[10] and a subtle but systematic erosion of national sovereignty. In some countries there is evidence that these players have been responsible for fragmentation of research and research capacity building.[11 12]

At the national level, political instability is a problem.[11] Where governments and health ministers are frequently changing, the translation of economic and social development plans to effective national and regional research initiatives is incoherent.[12] Gaps, duplication of effort, and fragmentation of research are common. Priority setting, resource mobilisation and allocation, quality control, and dissemination and utilisation of research findings are similarly impaired.[12]

At the institutional level research units have been over reliant on international funds, which have been diminishing in real terms over the past few years.[11] They have also failed to establish good links to national policymakers, non-governmental organisations, and the public. These two factors have resulted in much research that has not been well geared to addressing national health needs. In addition many research units are struggling to cope with a "brain drain" of basic scientists and clinical researchers to developed countries which offer more opportunities and greater political and financial security.

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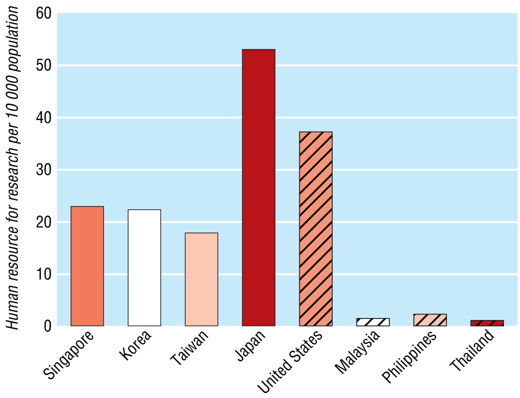

Fig 1 Number of researchers per 10 000 population in developing and developed countries[6]

Supporting research workers

Researchers in developing countries are poorly paid. Many have to work in private practice to make ends meet. Schemes to promote research as a viable career option by giving research awards and supplementing researchers' salaries have been tried but not yet systematically evaluated.[13 14] Intellectual isolation is another problem, although the increasing use of the internet is fostering more exchange between researchers in developed and developing countries. Encouraging researchers to join national, regional, and global networks is another way that isolation may be overcome and motivation increased.

International efforts to strengthen research capacity

Despite the problems outlined above, some international efforts have enhanced the research capacities and the research environment in many developing countries. Notable among these are the special programme of tropical disease research (TDR); the special research programme in human reproduction (HRP) of the World Health Organization; the International Clinical Epidemiology Network (INCLEN), initiated by the Rockefeller Foundation; and the Field Epidemiology Training Program (promoted by Centers for Disease Control).[10 11] The TDR and HRP programmes have been jointly sponsored by the WHO and other UN agencies and are governed by special boards, with the WHO acting as host and day to day manager. Their primary focus is on finding new knowledge and technologies for dealing with selected tropical diseases and with human reproduction (www.who.int/tdr, www.who.int/hrp). The TDR and HRP have contributed significantly to strategic and applied research in Africa, Asia, and Latin America, primarily by providing good training and support of local scientists, and help to promote the uptake of research results by end users (government, non-governmental organisations, private sector, and the public).[5 11]

Successful building of research capacity depends on national governments incorporating capacity building in their national plans. It also needs strong leadership from health professionals, transparent recruitment of research workers (who need to be given adequate support), and good exchange and partnership with reputable units in developed countries.[5] National research systems must also be accountable, operate transparently, and direct their efforts towards defined national health priorities.[5]

National initiatives

Developing countries have also invested in research and have achieved some successes. Before the economic crisis, South East Asian countries poured money into science to create a talent pool that can compete globally.[15] In Thailand, for example, the Thailand Research Fund has supported basic and interdisciplinary research in all branches of science, including basic medical sciences. The fund gives no-bonded research grants to students for PhD studies in Thai universities. Each grant covers not only the student's fees tuition and research allowance but also a budget to pursue elective studies and research and data analysis in any collaborating universities abroad. The efforts will help Thailand to improve its research capacity and university infrastructure (www.trf.org.th). The government also funds the Health System Research Institute.[14–16] These new programmes have highlighted the need for transparency and the importance of rigorous peer review. Other approaches to capacity strengthening include the award of non-bonded research grants to PhD students studies in local universities that have good links to reputable institutions in the North.[14]


PANOS PICTURES

Fig 2 Getting research into practice in rural Thailand

The way forward

In response to growing global health threats (including climate change, AIDS, tuberculosis, malaria, and epidemics of Nippah virus, which causes an encephalitis that is associated with a high mortality) and the transfer of health risk, developing countries and international donors need to invest in health research capacity building. Developing countries must be empowered to participate in debates and decisions about priority setting, regulatory frameworks, and codes of ethics for research collaboration. A good starting point for this is for countries in specific regions to start to cooperate to tackle common regional health problems. Representatives from the region can interact with other regions to reduce global health threats.[17] Mechanisms must be introduced to ensure that investment in research capacity building results in sound equable health governance. Politicians, professional groups, non-governmental organisations, and the public and private sectors must work together at all stages of research development and implementation.

The relative success of agricultural research under the direction of the Consultative Group on International Agricultural Research (CGIAR) may provide a lesson for the health sector.[18] CGIAR has successfully raised awareness of key issues, harnessed the expertise of independent scientific advisory committees, and created great donor solidarity.

Adopting a philosophy of *kalayanamitra* (friends-helping-friends) and intelligent solidarity will help promote a commitment to research to equity in health development.

We thank those who enabled us to participate in several key activities related to research capacity strengthening in developing countries, which form the basis of the argument in the paper; most notable are a special advisor to the Oslo study on the performance of the World Health Organization; the coordinator of the Asian dialogue to raise the Asian voice in health research; a consultant in the study on the cost benefit of the Government investment in health research by the Thailand Rating and Information Services. Special thanks to Drs Kelly Lee and Tessa Richards for making suggestions for revision of the document.

SEAN SPRAGUE/PANOS PICTURES

Fig 3 Vaccination in Bangkok: countries need to cooperate to tackle common regional health problems

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Commentary: Health research and human development in Papua New Guinea

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Because of the enormous health problems they face, less developed nations should give particular support to health related research, but regrettably this is rarely so. Sitthi-amorn and Somrongthong explore the global context of this inadequacy and discuss the elements required to develop research capacity. There are, however, a small number of health research institutes in developing countries that have already created national programmes of essential health research. The Papua New Guinea Institute of Medical Research is such an organisation.

The primary activity of the institute is conducting research into the health problems of the people of Papua New Guinea. Major programmes have been established in respiratory diseases, malaria, malnutrition, enteric diseases, sexual health and women's health, and the quality of this research is internationally recognised; it is raising global knowledge while informing local public health policy.[1]

One of the strengths of the Papua New Guinea Institute of Medical Research is that it has always taken a broader focus than the medical “problem.” The studies have brought clinicians, epidemiologists, and laboratory workers together with anthropologists and behavioural scientists and, most importantly, the participating community, to look at disease in context, rather than as a series of isolated “puzzles.” The interdisciplinary structuring of the institute is a rare model in medical research, but one which has undoubtedly made its work directly relevant to national health policy.

Building such an institution requires support, both financial and intellectual, and the form of this support is critical to maintaining independence and equity. The Papua New Guinea Institute of Medical Research receives substantial core funding from the national government, an act of foresight in a country that struggles to afford curative care. This is an important moral anchor, compelling the institute to deliver value, in terms of evidence to inform health policy. The use of this support to maintain a strong infrastructure means that the value of the research programme is multiplied through securement of external project funding. Much of this funding flows through collaboration with colleagues overseas, and a network extending through Australia, Europe, and North America allows the institute to benefit from project funding by such agencies as National Institutes of Health, the European Union, and the Wellcome Trust.

Significantly, many of these international colleagues have worked in Papua New Guinea for long periods and have made commitments not primarily based on self interest. Moreover, they have worked under the direction of the national system to help develop a national research institute, with up to date technical competence and with a strong research focus on health problems perceived as important by the community. These collaborations have also created many training opportunities for local scientists at all levels and prevented any feeling of intellectual isolation.

A unique aspect of the institute’s international collaborations is that the benefit of partnership extends beyond simple twinning arrangements. The many different groups with long term research interests in Papua New Guinea have formed a “buttressing coalition” that crosses the boundaries of national or scientific interests. These include the Walter and Eliza Hall Institute, the Wellcome Trust Centre for Epidemiology of Infectious Diseases and Case Western University. Under the coordination of the Papua New Guinea Institute of Medical Research, the members communicate with each other to provide collective support for the development of the institute’s general research infrastructure. It is certainly a refreshing experience to see scientists trying this alternate model of working, and benefiting as individuals from their contribution to a collective goal.

Government to government development aid funding, particularly from Australia, is an increasingly important source of support for health research in Papua New Guinea. Recognition of research as a critical element of health and human development is a satisfying victory for the committed lobbyists of the regional medical and scientific community. The Papua New Guinea Institute of Medical Research adheres to a simple formula in this respect: “no research without development; no development without research.”[2] It is critical, however, that foreign government assistance remains a partnership that supports the agenda of the institute, not a directive that subverts it.

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Commentary: Does strengthening research capacity improve health equity?

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Sitthi-amorn and Somrongthong make the assumption, as do most international experts in public health, that further strengthening the research capacity of scientists and institutions in developing countries is unequivocally worthwhile. It is often stated that this will improve health equity and generate more and better information for national policy makers than has been the case in the past.

Yet after 20 years of activity to strengthen research capacity and millions of dollars of investments, we still know so little about the impact of these efforts. Individual programmes and projects have gone through their usual donor-driven evaluation cycles, but there is little systematic information available to evaluate the investments or inform new initiatives. Many programs count the number of scientists trained, others count the number of studies funded.[1] Most capture the reports and publications that have emerged from the investments, though much of the knowledge is not readily accessible as it never reaches the peer-reviewed published literature. Some have tried to measure the impact of published work by counting the frequency that the work is cited in other literature.[2] The contribution of research capacity strengthening in improving health equity is completely unmeasured and has been little more than a rhetorical, though important, goal statement.

Efforts are under way to address these deficiencies. The research capacity strengthening unit of the World Health Organization’s tropical disease research programme and the applied research on child health project, at the Center for International Health at

Boston University, are working together to develop systematic criteria for the evaluating investments in strengthening health research capacity. Their activities have been driven by programme officers' desire to know if the research capacity strengthening investments make sense and spurred by the demands of donor agencies to document the results and impacts of the investments.

Three levels of impact are being measured: on individual researchers, national research insitutions, and the global health research system. Special attention is being paid to develop measurable indicators of the impact of these research investments on improvements in policies and programmes. Linking changes in population health status to specific investments in health research and capacity strengthening is extremely difficult. More progress has been made in developing a consensus on indicators of individual research skill development, research productivity, and individual career development. Measuring improvements in equity still has a long way to go. The Rockefeller Foundation has identified this as one of the subthemes of its health equity programme (www.rockfound.org/programs/healthequity/).

Those of us committed to strengthening health research capacity believe that an honest, systematic evaluation of the impacts of these efforts is becoming increasingly important as global scientific and political imperatives lead us into an era in which more funds will be invested in developing country scientists and institutions. Boosting the quantity and quality of scientific research carried out in developing countries is essential. But it is equally essential that the inevitably limited resources are well spent. This type of honest appraisal is a key element of *kalayanamitra,* or friends-helping-friends.

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Health technology transfer

Eva Harris, Marcel Tanner

Global health relies on biomedical scientists and public health workers to solve infectious disease and other health problems at a local level. Yet investigators in developing countries face tremendous obstacles; scientific isolation, insufficient technical training and research tools, a lack of up to date scientific information, and limited financial, material, and human resources. To build local scientific capacity to monitor and control disease and to promote health, research on locally relevant issues must be supported and sustainable partnerships built to facilitate these efforts. We discuss key elements for transfer of technologies in health research and present two case studies of such programmes.

Developing countries need up to date technologies

Though 93% of the world's burden of preventable mortality occurs in developing countries,[1] too little research funding is targeted to health problems of developing countries, creating a dangerous funding differential.[2] In addition, many modern laboratory technologies remain inaccessible in these nations. Both utilitarian and humanitarian arguments can be made for training scientists and health professionals in developing countries in the use of modern laboratory and epidemiological skills. It takes only a day or two for a pathogen to get from any one place on the planet to any other; thus, building capacity in developing countries is a necessary strategy for preventing the global spread of infectious agents.[3] Additionally, as a matter of principle, all countries, especially those with high burdens of disease, should have access to the most effective tools to control their infectious disease problems.

Summary points

More funding must be made available to scientists in developing countries and to organisations that support in-country training and research

Genuine partnership and mutual trust is a prerequisite for the sustainable transfer of technology from developed to developing countries

Building local scientific capacity and long term North-South and South-South partnerships are important in establishing effective health research programmes

Research topics should have local relevance and priority, and technology transfer should be participatory, equitable, and sustained

Autonomous research centres attract funding and reduce administrative burdens

Key elements in technology transfer

Through transferring biomedical technologies and conducting collaborative research in resource poor countries, we have identified key elements in the technology transfer process. In addition to technical issues, successfully implementing a new technology depends on economic support, political cooperation, functional infrastructure, good communication, and an understanding of sociocultural issues, and environmental concerns. Though likely to be beyond the direct control of the investigator, these factors can be

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Details of the case studies are available on the BMJ's website

Globalization and health viewed from three parts of the world

Some health implications of globalization in Thailand

Chitr Sitthi-amorn,[1] Ratana Somrongthong,[2] & Watana S. Janjaroen[3]

In recent years Thailand's economy has become increasingly dependent on international forces (*1*). With this exposure have come advances in health care technology and improvements in living standards, as well as increasing disparities between social groups (*2*) and exposure to health risks from other parts of the world (*3, 4*).

Prior to 1997, when the economy was strong, there was intense competition for a share of the health market. Resources were invested in speculative markets with potential for large expansion. Private hospital beds increased from 8066 in 1982 to 21 297 in 1992 and 34 973 in 1996. The number of specialized doctors in private hospitals increased, leading to shortages in the public sector (*5*). The culture of free enterprise brought with it an enlarged middle class, insurance coverage for hospitalization, tax incentives for private health care, heavy investment in advanced health technology for private sector use, and an internal "brain drain", at the expense of public health (*5, 6*). Aggressive promotion increased the demand for expensive imported medicines and procedures (*7, 8*). The cost of medical care for civil servants and state employees has quadrupled in the last seven years, reflecting the lack of adequate governance in the health care business sector (*5, 9*). Meanwhile the share of the underprivileged in the country's overall wealth was decreasing (*4*). The slump of 1997, followed by devaluation of the baht, and recession with its concomitant negative health impact, reflects the country's overdependence on cheap labour and foreign investment, and consequent inability to control and protect its own economy.

Direct health effects

Perhaps the most important direct effect of globalization on health in Thailand is unequal access to medical care by different social groups. The rise in imported sophisticated technologies has increased costs and necessitated new training. An analysis made in 1996 found that the average cost of medical care per admission was 1558 bahts for health cardholders (rural) and 9981 bahts for civil servants (privileged), a sixfold difference (*10*). If these facilities were treating similar diseases, explanations are needed for the huge variation. The economic gap might create demand unrelated to need and distort market competition. The organization of health service delivery was obscure, and there were no rules governing the payment of providers. Unequal access to care was reflected by unequal health status (*2*). Infant mortality in the poorest regions was twice as high as in the richest ones.

Second, there are increasing problems of environmental pollution. These include inadequate treatment of raw sewage (for instance, in tourist areas), and the notorious air pollution in Bangkok and other big cities (*11*). Environmental degradation and disruption of the ecosystem have led to frequent floods and changes in disease vector behaviour. The construction of a dam in the North-eastern region, financed by a loan from a development bank, has caused natural disasters affecting food production (*12*).

Third, concerns about new infections and the resurgence of old ones have been on the rise. International trade and travel are shaping the patterns of epidemics. The plague scare in India had worldwide reverberations. The nipah virus outbreak in Malaysia caused concerns in Thailand (*13*). Cholera epidemics can inflict enormous costs on a country and this results in attempts to hide them by calling the disease "severe diarrhoea". The costs associated with controlling HIV infection continue to rise. Fears of foot and mouth disease have affected meat consumption. The control of new dangers of this kind will require global cooperation but many aspects of control have to be country-specific.

Fourth, globalization has brought with it unhealthy lifestyles. Health has been damaged by the promotion of fashionable drugs, foods and other consumer products such as tobacco, alcohol, melatonin and Viagra. Fifth and finally, globalization brings with it many concerns about health ethics. For instance, the options for genetic manipulation and the patenting of the technologies will have direct and far-reaching effects on health and social well-being.

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Indirect effects

These direct effects are complemented by indirect ones, which include the economic crisis in Asia. Among many other things, it led to a rise in suicides, malnutrition, abandoned children, low birth weight, and a rise in deaths from preventable diseases such as acute respiratory infections, diphtheria and measles (*14, 15*). These adverse effects were partly due to decreased use of the health services (*14*). Increased poverty and unemployment also led to rising rates of crime, prostitution, migration and drug trafficking (*16*).

Response

These brief notes may be enough to indicate the need for an active response to globalization, rather than mere observation and speculation. In the first place, the world needs a clearly recognized moral authority to uphold the principle of equity in health and social justice (*17*). This authority has to be translated into norms and standards, accountability, measures for resolving conflicts and responding to emergencies, and a mandate to implement them. It needs to focus on key aspects of globalization which have implications for health. These include international capital volatility, drug trafficking, migration, protection of the environment, disease surveillance, and the indifference of market forces to marginalization, famine, suffering and oppression.

Next, the existing international institutions have to be reoriented. They have to re-examine their specific contributions to the overall well-being of the world. To do this they need to give full recognition to the changing context in which they are now working, and to the other actors involved. They must clearly define the roles of all concerned, and establish true partnerships for equitable cooperation, free from the domination of particular countries and companies.

Finally, national institutions have to be reoriented. They have to work out new partnerships between civil society, industry, government and other actors. An important goal here is to empower the public and specific groups in society to make rational choices and to demand accountability from those entrusted with implementing them. Thailand has been through a political transformation highlighted by the drafting of a new constitution. Its current health reform effort focuses on harmonization of living standards, rights, environmental protection, and equity between groups. ■

Acknowledgement

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Some health implications of globalization in the United Kingdom

John Wyn Owen[1]

The British Prime Minister in his introduction to a recent government White Paper said, “Globalization creates unprecedented new opportunities and risk” and the White Paper goes on to state that “making globalization work for the world's poor is a moral imperative and a first-order priority for the British Government” (*1*). At the highest level of government, then, globalization, including its impact on health, is seen as a policy imperative, albeit outward-focused, helping to eliminate world poverty.

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The Nuffield Trust, an independent charitable foundation established in 1940, was one of the organizations in the United Kingdom to ask at an early stage — in the context of its programme on "the changing role of the state and the machinery of government for health policy" — whether globalization was extending to health and health care. In 1997 the Secretary of the Trust addressed the Annual Meeting of the Association of Academic Health Centers in Palm Springs on this subject, and in 1998 the Trust supported a delegation drawn from the Royal Colleges, the National Health Service, universities, senior policy-makers, key opinion-leaders and mass media to attend a trilateral conference (UK, USA and Canada) in Washington DC. At the conclusion of the meeting the UK participants saw the need to stimulate UK and international action on globalization and health because of the moral and ethical imperatives for action rather than for primarily national or bilateral interests.

On returning to the UK, the group became the Steering Group for the "Global Health A Local Issue" policy review — an analysis with a view to action — which culminated in a national conference funded by the Trust and held jointly with the Royal College of Physicians on 31 January 2000. The framework adopted was based on the work of Dr Kelley Lee. It describes globalization as a process that is changing the nature of human interaction across many spheres, particularly those of politics and institutions, economics and trade, social and cultural life, and the environment and technology. It is changing the temporal, spatial and conceptual boundaries that separate individuals in society. During the programme 14 seminars and workshops were held and 18 papers were presented (*2*), covering: health and the environment; economy, trade and aid; social and cultural factors; institutional and political issues; uncertainty and global health risks; local perspectives of global health; working with industry for global health; and development of a framework, including a practical model for UK action on global health.

The conference endorsed the framework, following which a number of significant events have taken place: a UK Partnership for Global Health was established; a web site and network contact was established for those interested in the field to exchange contributions (*3*); members of the Partnership contributed to the UK Foresight Report, particularly on trade and health (*4*); members of the Partnership did the research for the UK White Paper on the implications of globalization for the health of the poor, women's health and the caring professions; and a Centre for Health, Environment and Climate Change was established at the London School of Hygiene and Tropical Medicine.

Further areas for policy analysis

Globalization and health is now a priority area for government in the UK. The Nuffield Trust, through its network of influence and its programme of grants, fellowships, seminars and conferences, has played a leading role in bringing this about. Alongside others, it has raised the awareness of senior ministers, policy officials, community leaders, researchers and the Royal Colleges about these issues. It will continue with further research and policy analysis in areas such as those listed in the box. The Nuffield Trust and the UK Partnership for Global Health are also keen to pursue the notion of an international award for responsible globality by international public and private sector organizations through responsibility auditing for health.

Areas for research and policy analysis

- The impact of globalization on the determinants of health in the UK.
- The impact of the UK (its trade, industries, academic and research resources) on global health.
- Health as a foreign policy imperative in the UK. The likely effect of the UK 2001 budget announcement of the government's intention to establish a Global Health Fund with WHO and to introduce a new and special tax credit to help companies contribute to the relief of disease around the world and provide an incentive to accelerate research on the killer diseases in the poorest countries. This was discussed at the G8 meeting in Genoa (July 2000) and incorporated in the communiqué (*5*), announcing the establishment of a new global fund to fight HIV, AIDS and tuberculosis.
- Further integration of domestic and development policy objectives for health. The formulation of a UK Global Health Strategy, building on the government's practice of "joined-up government".

Peter Hain, in his book *The end of foreign policy* (*6*) sketches out a vision for new diplomacy to reflect interconnectedness and the new global interests that have taken shape alongside more traditional national ones. "Perhaps foreign ministries will be named Departments of Global Affairs as the concept of 'foreign' becomes ever harder to define." The task requires the specialized skills of all government departments and the committed and innovative involvement of nongovernment actors in business and civil society. "In the process we will see an end to traditional foreign policy and the evolution of a new foreign policy based upon global linkages recognizing natural limits and embracing global responsibility: a foreign policy for a world in which there is no longer any such place as 'abroad'." ■

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Some health implications of globalization in Kerala, India

K. R. Thankappan[1]

The Indian State of Kerala with a per capita income of around 1% of that of the wealthiest countries, has achieved good health comparable to theirs. For example the infant mortality rate for Kerala in 2000 was 14/1000 live births (*1*) compared with 7/1000 for the USA (*2*). Life expectancy at birth was 76 years for women and 70 for men in Kerala; in the United States these figures were 80 and 74 respectively (*2*). However, Kerala's per capita expenditure on health was only US$ 28 whereas that of the USA was US$ 3925 (*3*). The most important reasons for this good health in Kerala are probably the following: its high level of female literacy (87%); access to health care (e.g. 97% institutional deliveries); a good public distribution system (PDS), which provides essential food items at subsidized rates (the system covers 96% of the population); political commitment (40% of the state budget went to the social sector till recently — 15% to health, and 25% to education); good communication and transport (newspapers, telephones, rural roads); land reforms (land distributed to the poorest and the landless) which helped reducing inequality in land and income; and Christian missionaries who started schools and hospitals, mostly in rural areas (*4*). Overall, the achievements of Kerala seem to result from a relatively fair distribution of wealth and resources across nearly the entire population of the state (*5*).

Globalization as promoted by the World Trade Organization (WTO), the World Bank, the International Monetary Fund and the transnational corporations has created a new world order. One of its major impacts is increasing inequality, which is detrimental to Kerala's health achievements. The Indian government initiated a major economic reform in June 1991 to increase economic growth. Social sector expenditure declined considerably during the first few years of this reform, resulting in stagnation in the development of public sector facilities.

In spite of the high demand for health care, the Kerala government could not increase its hospital beds substantially, for lack of resources for the health sector. During the 10 years from 1986 to 1996, public sector hospital beds in Kerala increased by only 5.5%, from 36 000 to 38 000, while in the private sector there was a 40% increase, from 49 000 to 67 500. Furthermore, the quality of the public health sector decreased because the financial restrictions affected supplies, including drugs, more than the salaries of the well-organized and militant employees (*6*). Taking advantage of this situation, the unregulated private sector in Kerala opened many hospitals with high-tech equipment, thereby increasing the cost of health care. For example, in 1995, 22 out of the 26 computerized tomography scan centres in the state were in the private sector (*6*) and even the small remainder in the public sector is decreasing now. The introduction of user charges in the public hospitals as part of the reform process increased the out-of-pocket expenses of those using public health facilities.

Household health expenditure in Kerala has increased over five times (517%) during a 10-year period of 1987–96. This increase was significantly higher (768%) among the poorest people than among the richest (254%). Even after adjusting for inflation the increase in health expenditure was about 4 times higher than the increase in consumer price index (*7*). The major reasons for this increase in health care costs are the increasing privatization of health care in the state, the increasing and often unnecessary use of technology, and a rise in drug prices. For example, Kerala has one of the highest rates of caesarean deliveries in the world now. Caesarean rates were reported to be 22% of all deliveries in rural areas and 34.5% in urban areas (*8*). The extra cost of caesarean deliveries in the state was estimated to be Rs 25 million (US$ 540 000) in the year 2000. Around 75% of the pregnant mothers had at least one ultrasonography test without any notable change in the management or outcome of pregnancy (*9*).

Another aspect of globalization is migration. Although there had been small-scale migration from Kerala to other Indian states and neighbouring countries since India's independence in 1947, large-scale migration started after the oil boom of the 1970s. The Kerala economy started to stagnate in the early 1970s owing to many factors, including high wage levels compared to those in other states, and well-organized and militant workers creating a less investor-friendly environment. The investors could easily start industries in other states, using cheap labour. Slow growth of the economy and the consequent high unemployment rate (3 times the Indian average) were the push factors for large-scale migration.

International migration has been increasing over the years. In 1998 there were 1.4 million Keralites residing in other countries and another 0.7 million in other states of India. In addition there were 1.65 million Keralites who came back to the state after residing in other countries or other states of India. There were an estimated 6.35 million households in Kerala in 1998, and 40% of them had at least one migrant (*10*). One of the major consequences of migration was the flow of remittances into Kerala, estimated at Rs 4717 million (US$ 876 million) or 10.7% of the domestic product of Kerala in 1998. The total amount of remittances was nearly 3 times the budget support to the state from the government of India (*10*). Better housing and commodities were some of the advantages the

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families of migrants enjoyed compared to those of non-migrants. For example 54% of migrant households had a television set compared with 34% of non-migrant households. The respective percentages for refrigerators were 40 and 13 (*10*). Migration also helped to reduce inequality in the state because a large proportion of migrants were from the poorer classes (*11*). Although the remittances could not be effectively used to promote industries in Kerala there is some evidence of revived growth in the Kerala economy since 1991, mainly in the service sector. The annual growth rate of net domestic product in Kerala for 1991–97 was reported to be 6.05% compared to 2.88% during 1971–90 (*12*).

Kerala has always been a food-deficit state. This deficit has been corrected by an efficient PDS through a widespread network of ration shops in the state. The ration shops, school lunches and agricultural labour pensions were reported to benefit female-supported households more than male-supported ones, reducing one aspect of gender inequality in the state (*5*). During 1986–87, 37% of the rural Keralites depended on PDS for their purchase of rice, the staple diet (*13*). The PDS also worked as a price check in the open market. From 1997, however, as a consequence of the change in the policy of the government of India, arising out of the process of economic reform, it was decided to limit the PDS subsidy to those below the poverty line. Moreover, the hike in prices for PDS announced by the Union Finance Minister of India in his budget speech in February 2000 was described as "a severe blow to the PDS in Kerala threatening its very survival" (*14*).

Since rice cultivation in Kerala was not profitable compared to cash crops like rubber and coconut, farmers converted paddy fields into coconut and rubber plantations. As a result of international trade agreements the importation of edible oil, coconut and rubber has been unrestricted since 1994. Although some import restrictions are still there, India's agreement to the WTO calls for the removal of all the remaining restrictions by 2005. Kerala is the state most affected by this liberalization because its major agricultural products are coconut and rubber. The price of 100 kg of rubber plummeted from Rs 5204 in 1995–96 to Rs 2994 (a 42.5% reduction) in 1998–99 (*15*). Rubber provides the livelihood of over 750 000 families in the state. The fall in prices of rubber and coconut has severely affected the economy of the state, which will have serious implications for the health of Keralites, especially that of farmers.

In conclusion, globalization challenges the foundations of the Kerala model of low cost health care, which is built on distributive justice**.** How can the people of the state face the challenges of globalization? The decentralization process, which the Kerala government started in 1996 by transferring power and money (40% of the state budget) to the local authorities presents a good opportunity to tackle at least some of the challenges of globalization. The potential for additional resource mobilization from the local community and from the migrants could be realized in the decentralized planning process. Transparency in programme implementation, together with the democratization of planning processes, will enhance people's participation.

There is enormous potential for further growth in the service sector in a well-educated society like that of Kerala. However there is a need to devise specific measures to make Kerala more investor-friendly and attract investment from within and outside the state including foreign investment for accelerated growth of income. This should be done without sacrificing the welfare gains of the past, and without a market takeover of health, education and welfare, which could price out the poor. ■

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Priority setting for health research: lessons from developing countries

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Research resources for addressing health problems of developing countries remain disproportionately low compared with the tremendous disease burdens borne by these countries. There is a need to focus these scarce resources on research that will optimize health benefits and lead to equity. This paper reviews processes and methods that have been used for setting research priorities. Past and current processes have focused on expert-driven research agenda, emphasizing scientific autonomy and global analyses. Methods for setting priorities have focused on the metrics of disease burdens, while less attention has been placed on who sets priorities and how choices are made.

The paper proposes a strategy of priority setting, based on lessons learned from essential national health research (ENHR) approaches attempted in several developing countries. With equity in health and development as its goal, the proposed model is demand-driven, and involves multi-dimensional inputs and multiple stakeholders. Various steps of the process are discussed: getting participants involved; gathering evidence and information; determining criteria for priority setting; and implementation and evaluation. The paper concludes with a discussion of the gap between national research priorities and the research agenda set at regional and global levels, an issue that needs to be satisfactorily addressed in the future.

Preface

This paper is a timely review of the issues around research priority setting, especially as they relate to health problems of developing countries. This is one of the major issues to be discussed at the International Conference on Health Research for Development, to be held on 10–13 October 2000 in Bangkok, Thailand. Ten years after the Commission on Health Research for Development reviewed the state of health research in the world, the forthcoming international conference is expected to lead to a new vision and a responsive health research agenda for the next decade. The conference participants will thoroughly review the many initiatives in health research over the last decade, examine possible scenarios and options for international health research cooperation, and discuss new tools and methodologies. In the conference session devoted to priority setting, participants will critically review experiences, gaps in methodology, and lessons learnt. This paper, from the perspective of developing countries, will be an important contribution to this session, and will flow into the overall declaration on the future of health research for the next decade.

The International Conference on Health Research for Development is spearheaded by an international organizing committee from the World Health Organization, the World Bank, the Global Forum for Health Research and the Council on Health Research for Development. Close to 30 other national and international organizations are collaborating on the steering process.

Introduction

Ten years ago, the Commission on Health Research for Development urged countries to undertake essential national health research (ENHR) in order to help correct imbalances in global health and development.[1] In 1992, estimated resources for research on health problems of developing countries amounted to only 4.4% of global research and development (R&D) investment,[2] a marked contrast to the fact that almost 90% of the global disease burden in 1990 was in developing countries.[3] Over the past decade, various strategies to increase the research resources for developing country problems have been attempted by international health bodies and agencies. Yet the latest estimates, according to the Global Forum for Health Research, still stand at an unhealthy '10/90' disequilibrium.[4] These constraints underscore the continuing need to focus on priorities in order to optimize health benefits and impact from scarce research resources.

Experiences in priority setting: processes and methods

Processes

The process of research agenda setting, until recently, has been limited, partly because the ideological emphasis has been on 'scientific autonomy'. Thus, resultant research agenda have tended to be expert-driven, largely detached from the public arena, and with insufficient operational emphasis. At the country level, there has been a heavy reliance on the inputs of prominent scientists, members of medical research councils (MRCs) or ministries of science and technology. It is notable, however, that while in the United States, the US National Institutes of Health primarily considers recommendations from leading science and technology experts, it also periodically makes use of user and patient panels to identify health care priorities.

The World Health Organization (WHO) Advisory Committee on Health Research, at both the global and regional levels, depends largely on scientific experts and directors of MRCs. Its special programmes, such as the Special Programme on Research and Training on Tropical Diseases (TDR) and the Special Programme on Research, Development & Research Training on Human Reproduction (HRP), have also made use of expert committees for setting priorities.

The process of health sector reform and WHO's efforts in health systems research, coupled with the World Bank's emphasis on user fees during the mid-1980s, led to a growing research interest on health systems development and cost-effectiveness analysis.[5,6] In 1996, the WHO *Ad Hoc* Committee on Health Research Relating to Future Intervention Options proposed a global research agenda based on a five-step process of priority setting. This involved a great deal of technical expertise and analytic work on burden of disease and cost-effectiveness of health interventions.[5] This has been taken a step further by the Global Forum on Health Research by drawing together various constituencies and networks at the global level in order to address identified research gaps.[4]

Methods

Many models have been used to set priorities for health resource allocation, some of which have been applied to research priority setting. These approaches range from qualitative methods of consensus building to the use of quantitative formulations and prioritisation matrices.[8–10] In recent years, composite indicators have gained prominence in the research priority-setting process because these single measures lend themselves to comparisons across a broad range of diseases and are particularly attractive for cost-benefit analyses of interventions. For example, the disability-adjusted life-year (DALY), a single measure of the disability, premature mortality and relative values of life at given ages, has been used to assess global and regional burden of disease.[11] More recently, another formulation, healthy life-years (HeaLYs), has been proposed to similarly reflect disability and premature mortality, but with improved valuations on the stream of life lost due to disability or death, based on the natural history of the disease, and with discounting calculated separately.[12]

Although useful in advancing methods for rational resource allocation, the extended discussions on burden of disease measures have sidelined other important issues in research priority setting. These include: Who sets priorities and how? What criteria are used to guide prioritization? These questions become all the more important in the light of the continuing observation that priorities for international health research have seldom been developed with the active participation of developing country research leaders and communities.[13]

Priority-setting exercises based on essential national health research (ENHR) approaches have been attempted in several developing countries, among them Benin, Commonwealth Caribbean countries, Guinea, Kenya, Nicaragua, The Philippines, South Africa, and Thailand.[14,15] Table 1 lists general research priority areas identified by some countries. Aside from priorities focusing on important diseases, it is worthwhile to note that all five countries identified the need for research on and for health policy. This may be due to the widespread emphasis on decentralization and health care financing since over a decade ago.

In this paper, we describe lessons learned from the experience of these countries. A framework for priority setting is presented to define the overall approach. We then suggest steps and methods that countries can use to bring stakeholders together and to set priorities for health research. We believe that these processes of self-determination pave the way for a stronger developing country voice in priority setting at the international level and for increasing the allocation of research resources to developing country problems.

Using the ENHR strategy

ENHR, a strategy first espoused by the Commission on Health Research for Development, is an integrated and systematic approach for organizing and managing country-specific and global health research in order to promote health and development on the basis of equity and social justice.[1,16] The framework that we propose for priority setting has the ENHR strategy as its basis and thus has equity in health and development as its goal.

As shown in Figure 1, priority setting in this model is demand-driven, focusing on an analysis of health needs, people's expectations and societal trends. The involvement of different stakeholders is multi-level (i.e. multiple inputs from communities, districts, sub-national and national levels) and multi-dimensional (i.e. quantitative and qualitative scientific inputs, as well as social, economic, political, ethical and management considerations). Consultative group processes, which are strongly featured in this approach, are inclusive, participatory, interactive and iterative.

Who sets priorities?

The participants are those who have a major stake in the goal of equity in health and development. Countries that have used ENHR strategies have identified four general categories of participants: researchers, decision-makers at different levels, health service providers, and communities. However, the country experiences also suggest the need for stronger representation from the private sector (e.g. professional health associations, the pharmaceutical industry), parliamentarians, and potential donors and international agencies.

Table 1. Examples of broad research priority areas identified in selected developing countries[a]

Country	Research priority areas
Caribbean	• Epidemiology of most common diseases • Access to health care facilities • Cost-benefit and outcome measurements of health policies and practices • Effects of environmental, ethnic, economic, social, and behavioural factors on incidence and prevalence of specific diseases
Guinea	• Research capacity strengthening • Malaria, diarrhoea and other priority health problems • Quality and financing of health care, human resources • Traditional health care: quality, collaboration, medicinal plants
Nicaragua	• Mother and child health • Communicable diseases • Drug addiction/alcoholism • Health care financing • Human resources development • Community involvement
Philippines	• Health care delivery • Product research and utilization • Health sector organization and management • Economics of health care
Uganda	• Maternal and child welfare and nutrition • Water and sanitation • Communicable diseases, including HIV/AIDS • Health systems and policy analysis

[a] It should be noted that some research priorities identified by the countries are not mutually exclusive. The above examples are indicative of the beginning process of priority setting, but more work needs to be done to refine and prioritize the research areas and questions.

The participation of a broadened spectrum of stakeholders helps to identify research needs, technical and financial capabilities, information gaps and distortions, the political environment, and the values and ethics of a given society (see Table 2). More importantly, involving major stakeholders in priority setting fosters ownership of both process and output, and facilitates shared responsibility and accountability in the implementation of the research agenda. In addition, when these stakeholders buy into the process, this could translate into cost sharing in research, not only by international agencies but also by the developing countries themselves.

The selection of participants from different groups and perspectives should be done carefully so that the research agenda has sufficient breadth to benefit a large number of stakeholders, but is narrow enough to have meaningful and manageable priorities. Thus an important initial step is to know the participants, who and where they are, their needs and interests, their expectations, and their strengths and weaknesses.

Getting participants involved

Experiences of countries in this review suggest some entry points in which national groups might involve stakeholders in research priority-setting from the outset, for example:

(1) a national ENHR convention or workshop, with participation from communities, researchers, health programme managers and policy-makers; followed by the formation of a task force with tripartite representation to refine the research agenda (e.g. Barbados, Jamaica, Kenya, Nepal, South Africa, Tobago, Trinidad, Uganda and Zimbabwe);
(2) formation of an inter-sectoral and multidisciplinary working group appointed by the Ministry of Health (e.g. The Philippines); or
(3) a research institute or university group which is tasked to develop and propose processes for priority setting; a larger group of participants is then involved in the actual priority-setting process (e.g. Thailand).

Based on experience, a small but representative working group can effectively facilitate the priority-setting process. This core group, in consultation with the larger group of participants, should moderate the extent and nature of participation of different groups or individuals. This may vary according to the nature of the ENHR activity, for example: the collection and analysis of health information, including community situation analysis through participatory action research; people's consultations through focus-group discussions or interviews; consensus building on specific thematic areas; decision-making for determining and applying criteria for priority setting; or translation of priority research areas into specific research programmes and projects.

Involving participants thus generally involves a sequential pattern of consultations, analyses and priority setting at the community and district levels, and aggregation and synthesis of these outputs at the provincial and national levels. Where conflicting priorities arise, several iterations as well as consensus-building processes may be necessary. However, priorities,

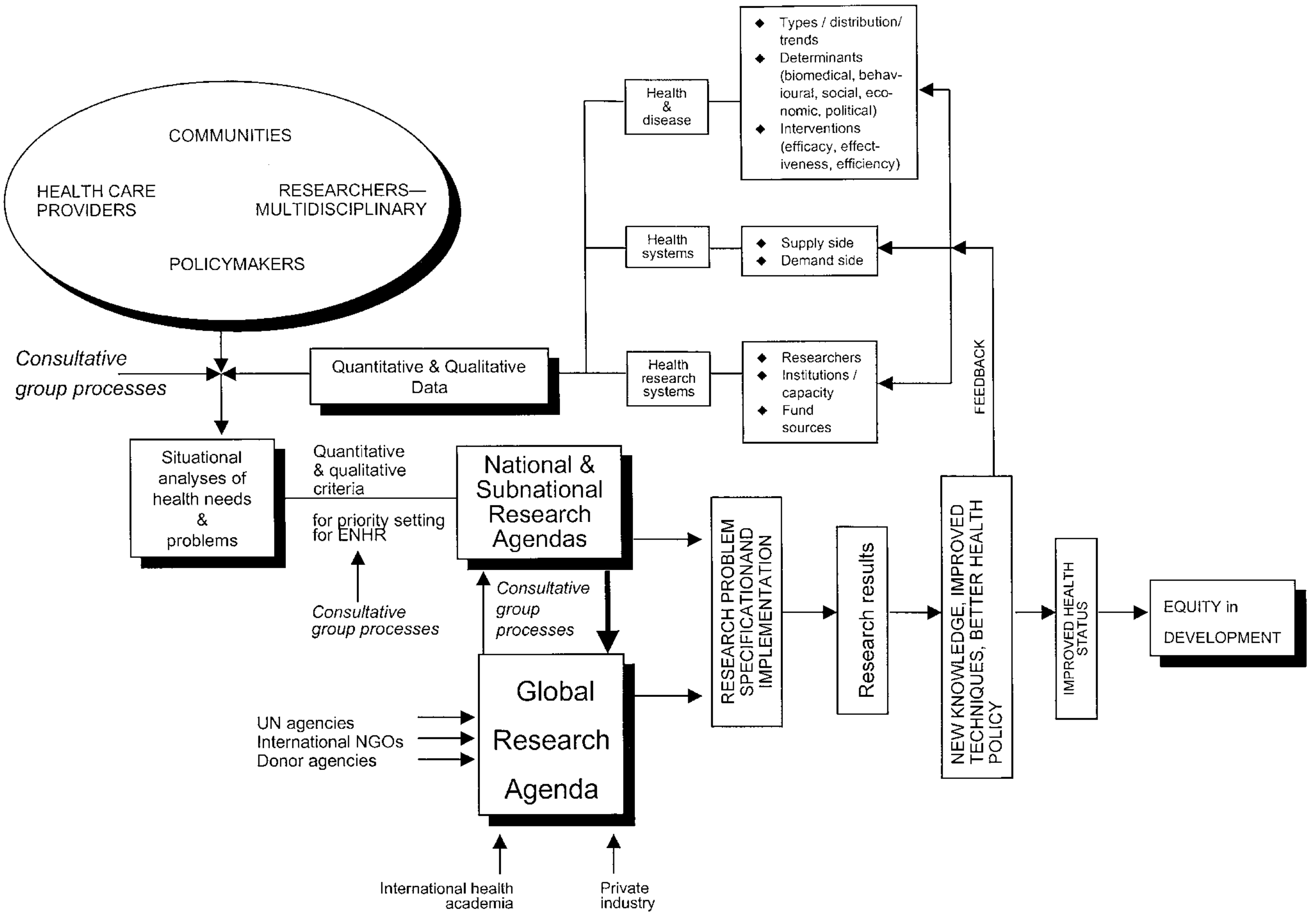

Figure 1. Framework for priority setting using the ENHR strategy

Table 2. Potential functions, roles and responsibilities of various stakeholders in priority setting for health research[a]

Core functions	Principal stakeholders	Roles and responsibilities
Payers	International/regional groups, e.g. multi-lateral organizations, NGOs National science and technology agencies	Mobilize funds in accordance with priority research area Provide international perspectives or technical inputs on health problems
Doers	Ministry/government agencies Academia/university Private sector NGOs	Clearinghouse function Set research policy/agenda Set standards, quality control Technical and ethical reviews Optimize use of resources Package findings for dissemination to various users
Users	Ministry of Health – planners, providers Local government NGOs and people's organizations Research communities – international, national, sub-national	Provide societal and ethical perspectives Arrange Forum to discuss research findings Make decisions balancing evidence and values

[a] All three groups have responsibilities to: (1) participate in priority setting; and (2) advocate for evidence-based policy and action.

especially at the local level, are largely context-sensitive and thus may not always be appropriate at different levels of aggregation.

In some cases, time constraints may necessitate parallel, rather than sequential, consultations for different groups and levels. This is also acceptable, as long as transparency and genuine involvement characterize the priority-setting processes. Acceptance, a sense of ownership, and implementation of the research agenda are perhaps the best indicators of involvement in the process.

Information for setting priorities

Decisions on priorities should be made based on the best available information. Evidence-based situation analysis at the outset can inform the priority-setting process. Three broad categories of information should be gathered and analyzed: the health status in a given setting, the health care system, and the health research system (see Figure 1, quantitative and qualitative data inputs). All three dimensions are important for assessing the main health problems, the supply- and demand-side of health care, and the research resources available to address priority research areas.

Sources of information can be varied; for example, vital registration systems, special surveys, patient records, focus group discussions or informed opinion. Statistical projections on demographic parameters, health determinants and diseases also provide useful information for determining the future impact of health research.

Despite the many sources, the 'lack of data' at the national and sub-national levels of many developing countries is often given as an excuse for arbitrary decisions on research priorities. Countries should begin with what is available, but should build on this to improve the quality of information and to fill important gaps. Because of the iterative nature of the priority-setting process, more and better information is progressively available in succeeding prioritization cycles.

In addressing issues of equity, the situation analysis should specifically cover the concerns of the vulnerable and the disadvantaged. Some countries' experiences (e.g. The Philippines, Benin) have demonstrated that the participation of non-governmental and people's organizations in the priority-setting process is more likely to draw attention to the situation and needs of neglected and marginalized groups.

The packaging and use of information gathered is another key issue. The heterogeneity of stakeholders means that the data will not always be understood in the same way. Thus, the working group coordinating the entire priority-setting process has to pay close attention to the interactions among participating groups. Steps need to be taken to ensure that the import of specialized information is within the grasp of all, including less technically skilled participants. In the same vein, it is important to balance the 'rigorous with the spontaneous'; i.e. to recognize that the information or perceptions or sensitivities expressed by various partners may influence the choice of priorities.

Criteria for setting priorities

A systematic and transparent process of priority setting is important in ensuring that the voice and will of the different stakeholders are heard and respected. Without openness and accountability, the voice of a 'moneyed' or inner circle may subvert the process of consensus building.

Research priorities will depend on a two-step process of, first, selecting criteria for priority setting and, second, selecting research topics from among identified priority problem areas. The countries in this review used one or more criteria from the following categories:

(1) magnitude and urgency of the problem, as suggested from quantitative and qualitative data in the requisite situation analysis;
(2) extent of previous research and the potential contribution of research in discovering, developing or evaluating new interventions;
(3) feasibility of carrying out the research in terms of the technical, economic, political, socio-cultural and ethical aspects;
(4) expected impact of the research, considering both direct and indirect effects, short- and long-term benefits, as well as its implications on issues of affordability, efficacy, equity and coverage.

The above categories could be broken down to as many as 12 distinct criteria. However, experiences at the country level and with a variety of participants show that a manageable core of criteria should be no more than six or seven. At the global level, for instance, the WHO *Ad Hoc* Committee proposed five steps for determining 'best buys' for global R&D, entailing an assessment of the following: the magnitude of the problem; the reasons for the persistence of the problem; the current knowledge base; the cost-effectiveness of potential interventions; and the current level of effort.[5]

The selection of the final criteria will depend on the purpose and level of action of the priority-setting exercise (i.e. global, national, sub-national, village levels, etc.), the availability of information related to the specific criterion, and the ability to define and measure the criteria in a common language or framework. The assignment of equal or differential weights to the criteria should be carefully deliberated upon by the participants until a consensus is reached on the selected criteria and the weights.

In assembling research areas to be considered, efforts should be made to cluster health problems into equivalent and meaningful levels so that priority areas are not chosen merely by the breadth and magnitude of the topics covered under a cluster. In addition, each research area should be specific and explicit enough to provide a common understanding among different stakeholders.

While it may not be necessary for all participants to be involved at every stage of the priority-setting process, the core group should document the processes and results at each stage. Methods for combining results range from addition of scores on simple scales to complex mathematical models or matrices.[9,10,17] The procedures for applying the criteria to the research areas are time consuming, but they enhance acceptance, ownership and implementation of the research agenda as a result of transparent and systematic procedures.

For most countries in this review, these crucial intervening steps leading to the selection of research priority areas and topics were not fully documented, leading to problems of reliability and credibility.

Implementation and evaluation

It remains to be seen whether, in the long term, priority-setting using the ENHR strategy will, in fact, improve the use of limited resources and generate more research funding for problems of the poor. There are intermediate but critical steps to ensure success: effective advocacy and dissemination of the agenda to all stakeholders, especially decision-makers who hold the key to health policy and research resources; implementation of the agenda by researchers, in partnership with other stakeholders; and periodic review and assessment of priorities.

Three important indicators are proposed for evaluation:

(1) Utilization of the research agenda: how extensive was the implementation of the research priorities? How much interest did the research agenda generate among stakeholders?
(2) Involvement of multiple stakeholders: how many groups or constituencies were involved and what were their contributions? Who were not involved?
(3) Do the research priorities address equity in health? For this, one could measure the proportion of researches that address health problems of the poor, the shift of resource flows towards equity-targeted programmes and the identified research priorities, and 'buy-in' from national and international sources.

The outcome and impact of these priority-setting exercises in the developing countries have yet to be fully evaluated. It is important to note, however, that competencies such as priority setting cannot be taken in isolation. Other important factors and competencies must be considered, for example, the country mechanism to support ENHR, advocacy, partnership development, resource mobilization, community participation, and translation of research results into policy and action.

The ENHR strategy and global health research priorities

ENHR includes research that may be country-specific or that may have international import. Individual countries should weigh the resources they direct at key national problems, but should also be well informed about the international health research effort. Common health problems shared with other developing countries may spell out opportunities for collaborative, multi-country research efforts, e.g. the growing problem of anti-microbial resistance, community-based evaluations of impregnated bednets in the control of malaria, behavioural interventions against smoking, or the development of innovative health care financing schemes. A number of middle-income developing countries, like Brazil, Malaysia, South Africa and Thailand, are also in a position to carry out basic research on developing country diseases, such as leishmaniasis, malaria, dengue and tuberculosis. The appropriate mix of country-specific and international health research is an important issue to address in the priority-setting exercise. This provides the national players with some leverage and basis for matching international donor interests with national and local concerns, or for negotiating research areas for assistance.

In addition, the systematic formulation, articulation and dissemination of national research agendas are important inputs to the global research agenda (see Figure 1). There should be efforts towards an upward synthesis of national priorities at the regional and global levels. This is to balance an oft-perceived 'one-sidedness' in global agenda setting. In the short term, hands-on participation of developing country representatives in global task forces devoted to specific initiatives could gradually improve the capabilities of these countries in the analysis, synthesis and articulation of their priorities. For the long term, the biggest challenge is to steadily increase the internal capacity of countries for analyzing their own health problems and needs, setting priorities, designing, implementing and evaluating research and health programmes. International efforts to strengthen countries' research capabilities will redound to the international good, as international databases and global health research priorities become more firmly grounded in country realities.

Endnote

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Notes on Corporate Authorship

The Working Group on Priority Setting was constituted in February 1997 by the Council on Health Research and Development, an international non-governmental organization devoted to the promotion and support of strategies for essential national health research (ENHR) in developing countries. The Working Group is one of four groups tasked to gather and analyze data derived from country experiences related to ENHR competencies. Members are from research institutes and councils, academic institutions, government agencies and NGOs, as well as from bilateral funding agencies.

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4

Rebuilding Health Systems towards Health Security: Some Essential Indicators

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Introduction

Health is a state of complete physical, mental and social well being and not merely the absence of disease. Despite the unprecedented progress in health technologies and economic growth in this century, unnecessary illnesses and early deaths persist in the developing world. Millions of poor children are dying yearly due to malnutrition, preventable illnesses and injuries. Economic benefits have occurred along side wider health disparities between the rich and the poor, the elite and the socially deprived groups, the industrialized and the developing societies.

The world has an unprecedented opportunity to secure health for all if nations put emphasis on strengthening their health systems and not only their health care systems. A strong health system can be represented by a healthy tree. A healthy tree has roots, a trunk, branches, and must survive in the changing atmosphere and environment.

The *root of a healthy tree* is represented by the societal values and principles in building the national health system. In recent years, several trends have emerged in values, health system, including health as the *right* of citizens, access to *quality* services (prevention, promotion, treatment, rehabilitation), development of *evidence-based standards, norms and guidelines*, expansion of the *definition of health to capture the notion of quality of life* and *holism, adequate finance to achieve and sustain universal access* and social justice. The trends and values must be firmly rooted within society and guide the evolution of a strong health system.

The stakeholders in society *form the trunk of the tree*. They include people, both rich and poor, the provider, the government, NGOs, professional organizations as well as the private sector and the health industry. The most important stakeholder is the public and society at large. At times, there can be conflicts between these stakeholder groups. The values of the health system must be debated by these groups and must become the basis of accepted methods of conflict resolution. The role of the government must change from a key provider of services to overseeing the healthy growth and function of the overall health system. Delegation of authority to regions and provinces while maintaining an effective oversight function centrally will be required.

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Professional organizations are expected to capture and assess the dynamics of technological advances and give advice to stakeholders for their adoption, dispersion and rational use. Many more public organizations have been established for special functions such as hospital accreditation, monitoring health professionals' education, and public health services, as well as presenting options for the public. These organizations are expected to have good governance, efficient management, and are expected to explain their decisions to the public and stakeholders. The NGOs have played active advocacy roles for the society.

The public have been better informed and have been entrusted with more responsibility for self care and have been encouraged to make appropriate decisions concerning their health. Public education, incentive packages and legal measures have been updated to facilitate more appropriate choices. Indeed, the actors in health will be diversified and the relationship between them must be nurtured to ensure a healthy trunk of a strong health system.

A health system includes a health building system, disease prevention and health care. Together, they form the **branches** of a healthy tree. A health building system forms the first branch of a healthy tree.

In addition to health promotion, a **health building system** must be based on healthy public policy, including health considerations in development policy. Development policies must take into account health concerns. Energy policy (dam for hydropower), agriculture (use of fertilizer and design of irrigation systems), industry policy (industrial wastes and environmental pollution), and urbanization among others can no longer be considered in isolation from health and the well-being of the public.

A **disease prevention system** forms the second branch of a healthy tree. In recent years, the world has experienced the need for more collaborative efforts to deal effectively by with emerging diseases. Outbreaks of ebola virus, plague, Nippah virus, multi-drug resistant TB and SARS have emphasized the need for nations to have the capacity to protect their people and work with others to protect national and global society.

Finally, an important branch of a healthy tree is the **health care system** which has to be efficient, equitable, of high quality, good self care, amenable to choices for alternative care with elements of consumer protection. With the rapid technological advances in the genomic era, the actors in health must work together and make a nation's health care reflective of the values (the root) of the society.

In this epoch of globalization, a nation's health system does not work in isolation. The healthy tree must not be rigid, but must strive and survive under rapid changes of the environment. The changes include globalization, global advances in sciences, health sector trends, privatization, trade, technology, including drugs (driving up the cost), genome discovery which brings advances and opportunities for mankind but also can have unwanted ethical, legal and social consequences and can create chaos if the knowledge from genome is misused. The global environment, which can benefit as well as threaten health systems is dynamic and moving fast beyond expectation.

The current trend of globalization and cooperation has emphasized economic growth. It is undeniable that economic growth can bring in resources needed to build an advanced health system for securing health. However, economic growth alone is inadequate to build a strong health system. The right understanding of the broad concept of health and the need for a healthy tree concept for building a responsive health system is fundamental to securing health.

Resources from economic growth must be redistributed to increase social opportunities for a nation's citizen, including education, health, and an equitable access to natural resources within the framework of the economy of the country. This will guard against inappropriate competition for the most advanced and expensive high technology and drugs among the public and private sectors. The role of the government and the management of the health system have to change. Good governance through involvement of the most important stakeholders has to be a critical element in defining the new roles as well as setting up good management system.

We propose that the current bias on economic growth through globalization be balanced with an emphasis on a fairer redistribution of economic benefit to increase social opportunities to people across income and household consumption per capital. Social opportunities include education, health, and fair access to natural resources. We argue that economic benefits must be channeled to tackle two specific areas: (1) *strengthening health systems* for health priorities focusing on inequality; and (2) develop *standards to protect health in development policies* including agriculture, industry, energy, and urbanization.

In *strengthening health systems*, economic benefits must be redistributed according to priorities based on relevance, financial and technical feasibility, the acceptability of stakeholders, the utility of results, timeliness, and ethical standards. As resources are scarce, priorities must aim at significant health needs. If resources to deal with the priorities come from the public sector, then the emphasis must be on a fair redistribution of economic benefits towards sector-specific equity objectives, such as equal services for equal needs. The underprivileged must be targeted since the poor can be most hard hit when economic crisis strikes, as demonstrated during the economic crisis in Asia and in many parts of the world.

The challenge is to make the targeting through public channels efficient, i.e., the underprivileged and the main intended beneficiaries are the main receivers of the benefit from the economic deliberations within the environment where there is an increasing pluralism of health care system including the unprecedented growth of private medical services; the use and abuse of increasingly sophisticated medical technology; the inequity of access to health care through the various payment and insurance mechanisms; as well as social changes associated with increased urbanization have led to higher prevalence of drug dependence, AIDS, problems of the elderly and child abuse.

In terms of protecting health while promoting development, *standards* must be developed when development policies are conceived. These include agriculture, industry, energy and urbanization or housing policies. The contemporary modes of industrialization, agricultural practices, energy consumption and urban planning are generating unprecedented occupational and environmental health problems. Development activities can change the ecology affecting the occurrence of emerging and re-emerging diseases. Development can also pollute the environment with toxic wastes. An effective surveillance system must be in place as a preventive measure to deal with unexpected outbreaks of infectious diseases and toxins even when standards are in place.

It is important to develop indicators and benchmarks to track and monitor progress towards the redistribution of economic benefits to secure health. Indicators have to reflect the components of health security within the framework of the changing paradigm at the national, regional and international levels.

Components of health security include health promotion, disease prevention and health care (treatment and rehabilitation) within the framework of rapidly changing technological possibilities and disease profiles at the local and global levels (Garrett L. 1994). **Health promotion** involves healthy environment, adequate nutrition, good lifestyles affected by globalization and international dependency. **Disease prevention** requires control of known infectious and non-infectious diseases, active and passive surveillance of emerging and re-emerging diseases as well as mounting appropriate control in concert with active and passive surveillance information. **Effective health care** refers to access to treatment and rehabilitation of acceptable quality across social classes. Therefore, treatment and rehabilitation involve the development and adaptability of health systems that can ensure access to quality services within the framework of technical possibilities according to current and emerging needs in a most efficient way. This means access to the right service, at the right time without undue delay, at the right level of facility by the right personnel to maximize health gain and minimize disability.

There are at least **four perspectives** to guide health actions for health security: (a) the perspective of the **beneficiaries** of health actions (patients, relatives and family), (b) **the providers** of health, (c) the perspective of **health facilities** and (d) that of the **society**. The beneficiaries of health action want the best services for individuals and their relatives (quality regardless of cost). Health providers seek the most technically desirable and cost effective services to their intended beneficiaries (technical efficiency).

Health facilities must make sure that the services provided are efficient, and the facilities are financially viable. The society must make sure that tax money collected from all is used to provide health to all sectors of the society, rich or poor, men and women. When resources are scarce and finance limited, choices have to be made to strike an appropriate balance between equity, efficiency, quality and social accountability of health actions.

The choice of health actions will depend on the perspectives to be adopted. When there is a conflict between perspectives, the decision must be based on ***the sources of funds and use of resources*** to provide health actions. When resources to deal with a fair redistribution of economic benefits come from the public sector, then the society perspective must be adopted, i.e., equal services for equal needs, healthy public policy, disease surveillance, environmental and food security.

On the assumptions discussed above, we propose some possible indicators to channel the redistribution of economic benefits towards health security using the society viewpoints as described below.

Indicators for health security

A. Health promotion:

(1) **Environmental pollution:** Global environment changes can threaten individual and global health security and harm sustainable development. Environmental changes can lead to emerging

and re-emerging infectious diseases and other health hazards due to ecological changes resulting from population increase, population migration as refugees or for job opportunities, traveling, trade and industrial growth and wastes, acid rain, deforestation, over use of natural resources and urbanization. When forests disappear, wild animals, insects and other living creatures migrate and can spread unfamiliar infections to human beings. In addition to infections, environmental pollution also lead to more asthma and respiratory infections and cancers. Individual nations cannot deal effectively with the environmental problems alone. Indicators include:

(a) Agreements among nations (international, regional, bilateral) to create concerted efforts and standards to reduce environmental pollution, undesirable ecology changes, and overuse of natural resources.

(b) Collective short, medium, and long term plans with milestones and time line to implement and monitor adherence to the agreements and standards among nations.

(c) Periodic forum where the results of the implementation and adherence to the agreements and standards are discussed and plans modified.

At the national level, people in many urban slums, rural areas and refugee camps are suffering from insufficient environmental sanitation essential to disease prevention and child development. This has added to environmental pollution resulting from development policies. Therefore, the indicators for a fair redistribution of economic benefits for health security at the local level include:

(a) The magnitude and trend of resource allocation to built up infrastructure, human capacity, and programmes to improve environmental sanitation and reduce environmental pollution harmful to human health.

(b) The existence of standards and effectiveness of campaigns, incentives, law and law enforcement to reduce environmental pollution resulting from agriculture, industry, energy and housing policies.

(c) The magnitude and trend of adherence to standards in urban and rural areas as well as refugee camps where health problems associated with poor environmental sanitation and pollution still prevail.

(2) Nutrition: Malnutrition remains a widespread problem in the developing countries. Malnutrition can adversely affect the growth and development of children. Pregnant mothers with inadequate nutrition deliver low-birth-weight babies. Unhealthy children and babies have less access to social opportunities needed for human security. Both over- and under-nutrition can make people unhealthy. Food security implies that people in each household have the physical and economic ability to access healthy food (total calories and trace elements) at all times (adequate production, procurement, or acquisition via welfare). It also requires that the country has the ability to have adequate food acquisition (production or procurement) as well as an efficient food storage and supply system. **Food security is therefore a critical element to prevent malnutrition and enhance health and human security.** The indicators for a fair redistribution of economic benefits towards food security include:

(a) The magnitude and trends of resources from economic benefits which are diverted to programmes to ensure adequate production, procurement or acquisition of food to all sectors of the population.

(b) The re-examination of tax barriers and trade agreements between countries can affect food security with implications on health and human security (Fouere T, et al. 2000).

(c) The involvement of countries in negotiating with the World Trade Organization (WTO), World Health Organization (WHO), as well as Food and Agricultural Organization (FAO) to review, amend, implement and monitor tax barriers and trade agreements to guarantee food security for all.

(d) The magnitude and trend of household quintiles (classified by household consumption per capita) that have the physical and economic ability to access healthy food in terms of total calories and trace elements.

(e) The magnitude and trend of anthropometric indicators including weight for height, height for age, weight for age, upper mid-arm circumference using quantitative technique for equity analysis (WB technical report #2).

(3) **Consumer protection** ensures efficacy and safety of consumer products including food, drugs and medical equipments as well as healthy selection of products for consumption. The proposed indicators for redistributing economic benefits for tracking consumer protections are:

(a) The magnitude and trends of resources from economic benefits that are allocated for effective consumer product surveillance systems, including the tracking of the nature and extent of use and abuse of products by various household consumption groups through unethical promotion strategies.

(b) The existence of standards and effectiveness of campaigns, incentives, law and law enforcement to reduce unethical promotion.

(c) The magnitude and trend of complaints and lawsuits for compensation due to poor products by various household consumption groups, urban and rural areas as well as refugee camps.

(4) **Indicators for general health:** Indicators for measurement of general health (as distinct from diseases) may be used to assess the impact of health promotion. These indicators are available such as WHO Quality of Life (QOL) (1995), the World Bank Measurement of Adult Health (WB technical Note #3, accessed 2003), and the "Concentration Curve" and "Concentration Index" (WB technical note #6, 7, 2003). Indicators include medical models, functional models, and self-perceived models. The methodology for comparison of health among different quintiles of wealth (poorest 20%; 2nd poorest; middle; 2nd richest, richest 20%) has been published and is available for use.

B. Disease prevention:

(1) **Surveillance for infectious diseases:** Surveillance is considered a tool for diagnosis of conditions, which can easily become an epidemic and affect many people in the community, a country and across countries. It is an important tool for health security. Surveillance has been traditionally applied to the control of infectious diseases. Now, surveillance will have to encompass the detection of toxins, such as hazardous chemicals, pesticides in human milk and lead in blood of children, as well as genetically modified products. Of particular importance are the diseases transmitted from animals to man such as the outbreak of chicken virus in Hong Kong, Nippah virus in Malaysia and recently the Severe Acute Respiratory Syndrome (SARS). Also, there is an increasing concern about intentional use of infectious agents to

achieve military and political objectives, commonly referred to as bio-terrorism (WHO Report of Executive Board 2000 & 2001).

Surveillance can be active, passive and targeted periodically towards special groups seeking treatment from sentinel sites. To be effective, a surveillance system must be integrated with other measures to orchestrate a control of the spread of diseases under surveillance. Therefore, the role of surveillance is: to monitor secular and long-term trends of diseases and public health issues affecting health security; to provide early warning for disease outbreaks, which threaten health security; to evaluate prevention and control programmes; and to monitor the effect of climate changes which affect emergence and re-emergence of infectious diseases. Effective surveillance of infectious disease has to be international in scope to share information on such diseases as Ebola, Dengue, SARS, outbreak of plague etc.

Three types of surveillance can be used to diagnose the nature and extent of a health problem in a community: active surveillance, passive surveillance and sentinel surveillance. Each has its own sensitivity of detection of health problems and will need different requirements. Most countries only have a passive surveillance system because to maintain an active system would entail sophisticated laboratories. Some infrastructure and human resource requirements will be needed to maintain a sentinel surveillance system.

(a) *Active surveillance: A case study from India:* Plague in India highlights the need for international cooperation and surveillance. In the first 25 years of the century, India lost about 12 million people to plague. The government launched an effective control programme and in the 1950s, plague was mostly under control. In 1959, plague was eliminated from India and in 1966, India declared the eradication of plague. Since then, very little efforts related to the control of plague were carried out. There was no research and laboratory work being done on plague. The lack of laboratory diagnosis during the outbreak in 1994 caused an epidemic of panic. There was a loss of 2 billion US dollars to the Indian economy and probably several billion dollars globally. What should have been a focal public health event turned into a worldwide emergency.

The goals of active surveillance are: a) to detect without delay the introduction of change in incidence of a specific disease agent (active surveillance has to be disease specific although there are also some exceptions); b) to alert pubic health officials early on in the course of the epidemic, i.e., the early warning system (emphasis on pre-epidemic period as opposed to epidemic period); c) to assess the extent of risk transmission of a particular disease; and d) to estimate and monitor the efficacy of control activities. Active surveillance has to be laboratory-based. The case definitions of an active system can vary. These case definitions can be non-specific in the pre-epidemic period and become more specific during the epidemic when the incidence increases. There must be standardized sample collection and reporting. The surveillance tool must be convenient and easily transportable (Cassol S, et al. 1996; Frerichs RR 1994).

When a clear disease definition is not available, syndromes can be used to cover multiple diseases. When a syndromic approach is used, the case definition is very non-specific but can be supplemented later with a more definite diagnostic technique.

Laboratories must be able to: (1) conduct routine surveillance for priority diseases important in the area; (2) focus on epidemic transmissions of priority diseases; (3) recognize new diseases, natural disasters, imported disease and bio-terrorism.

At least the laboratory should be able to conduct surveillance on priority diseases and if it is not capable of detecting the broad spectrum of new and other infections there must be some reference laboratory in the Region such as a WHO reference laboratory where samples can be sent for identification and confirmation. Ideally, every country should have a national laboratory with satellite laboratories at the district and local levels. However, this can be expensive for poor countries. A more efficient way of sharing existing resources is to map out existing laboratory facilities in a region, coordinate sharing and standardization among them and develop new facilities, which might be needed. The WHO reference laboratory should be capable of a wide array of diagnostic capability and WHO can link up with other sophisticated laboratories such as the Center for Disease Control.

Every national laboratory should have some well trained personnel, enough facilities, equipment and basic microbiology. The state-of-the-art technology such as PCR is important but not as important as basic microbiology. A mechanism should exist to ensure quality assurance so that people are confident of laboratory results.

Once an infection has been identified, the standard public health measures must be actively applied such as the identification of individuals, the quarantine, the sanitary regulation, the sacrifice of infection sources in animals, the measures to heighten precautions in individuals before vaccines and definitive treatment becomes available.

(b) *Passive surveillance:* Passive surveillance is most useful to monitor long-term secular trend but insensitive to track the epidemic activities. Most countries have a passive surveillance system. The key components of a passive surveillance system include the use of standardized case definition and a standardized reporting system. Passive surveillance relies on physicians and health officials to report disease from the peripheral and therefore very insensitive for predictability of epidemic activities. Constant communications, reference and referral, political and economic support are all crucial components of an active and passive surveillance systems.

Effective emergency response is a necessary complementary measure to prevent the spread of infectious diseases. Good coordination between epidemiology, laboratory diagnosis and people in the field doing control is critical. Effective control has to be disease-specific and the knowledge about the dynamics of transmission is essential. Further, strong community involvement is needed for sustainability. There has to be a real-time response and timely policy decisions. Therefore, laboratory capability must be credible so that rapid decisions can be taken to respond to the problems in real-time rather than wait until the epidemic spreads or peaks.

(2) Empowering the community to be integrated in surveillance and control: Outreach is an area where public health has often failed. Despite the availability of health education materials for all kinds of diseases and health problems, people usually ignore them. Social scientists and medical anthropologists who know how to communicate with the community should be encouraged to play a greater role in developing health education messages. The use of one

message for all recipients with diverse ethno-social backgrounds is unlikely to succeed. The public must know their responsibility about disease transmission and disease prevention. They cannot rely on the government to do everything. Governments must have an honest assessment of what the epidemiologists have to say and must not hear only what the government wants to hear.

An integrated community-based approach must be based on common ownership and relevant policy decisions and must capitalize on updated technology and instruments available to cope with epidemics and prevent disease. People must have some say in the programme and set the priority. Government officials must not simply go and tell people how to do things. Without community ownership there is no sustainability. Policy decisions have to support the community-based approach.

Therefore, possible indicators for a fair redistribution of economic benefits for health security based on disease prevention include:

(a) *Agreements among nations* (international, regional, bilateral) to create standards and concerted surveillance of infections and toxins as well as effective emergency response, including effective sharing of information, effective surveillance laboratory networks with various degrees of sophistication.

(b) *Collective short, medium, and long term plans* with milestones and time line to implement and monitor adherence to the agreements and standards among nations.

(c) *Periodic forums* where the results of the implementation and adherence to the agreements and standards are discussed and plans modified.

(d) *The magnitude and trend of resource allocation* to develop an effective surveillance system, emergency response and community empowerment to help control disease outbreak and spread of toxic substances.

(e) *The magnitude and trends of disease outbreaks and spread of toxic substances.*

C. Effective care (Treatment and rehabilitation):

When people get sick or become disabled, they must be able to access essential, cost effective and quality care, regardless of the ability or willingness to pay for it. In other words, people's health and their ability to function productively must not be a victim of market forces; and the universal coverage of essential care must be ensured for all. Several lessons have been learnt from the recent economic crisis in Asia. These lessons can be useful to prepare nations to deal with the opportunities and threat of agreements negotiated through the World Trade Organization so that nations can guard against the unwanted consequences on health.

Lessons learnt from the economic crisis

The effect of globalization on health has been affected by the corruption and poor governance in the health system. There have been many non-productive investments and wasteful practices in the health sector. Before the economic crisis in Asia, resources were invested in speculative markets. Since the 1980s and well before the economic crisis, South-East Asia invested in many private hospitals.

In Thailand, for example, private hospital beds increased dramatically over the years, i.e., from 8,066 in 1982 to 21,297 in 1992 and 34,973 in 1996. The number of doctors in private hospitals and the ratio of specialists increased, leading to a shortage in the public sector (Ministry of Public Health; Bureau of health policy and Plan 1997). The culture of free enterprise, the enlarged middle class, the inclusion of hospital insurance in salary packages, and tax incentives for the private health care industry, provided strong inducements for investment in private hospitals, advanced technology, migration of leading specialists from the public to the private sector at the expense of the public sector (Chaudhary V. 1992). Increases in the import of new expensive drugs and wastage due to treatment occurred in response to aggressive pharmaceutical industry promotion and consumers' demands for more expensive medicines and procedures (Ministry of Public Health, Bureau of health policy and Plan 1997; Barnett A. et al. 1980).

Medical care costs provided as "welfare" to government civil servants and those employed in medical enterprises increased sharply from 4,315 million bahts (US$ 108 million) to 16,500 million bahts (US$ 412 million) in 1995, a four-fold increase in seven years. Inadequate management, monitoring and evaluation necessary for good governance and lack of regulation of the corporate health care business sector have prevailed (Barraclough S. 1997).

Due to the crisis many direct health consequences such as an increase in suicides occurred as well as other adverse health effects such as malnutrition, abandoned children, low birth weight among the poor, mortality from acute respiratory tract infections and vaccine preventable diseases including diphtheria, measles and hepatitis (Prida Tae-Arruk 2001; Choprapawon C. 2000.). These adverse health effects were partly due to the lower rates of utilization of services especially by those who had no prepaid insurance (Prida Tae-Arruk 2001). The poor were disproportionately affected by adverse health consequences of the economic crisis. Ironically, such injustice was apparent despite the fact that the public hospitals in the Ministry of Public Health received increased budgets for their poor patients through the "Good Health at Low Cost" programme (Prida Tae-Arruk 2001).

Moreover, free health insurance received by poor people decreased from 19.7% in 1997 to 13.5% in1998 (Prida Tae-Arruk 2001), adding greater inequity in access to health care. The government has recently developed a universal coverage scheme to enhance the social safety net for effective access to treatment and rehabilitation.

The World Trade Organization (WTO) and health

The WTO was established in 1994 to facilitate negotiations leading to rules to liberalize international trade through multilateral trade agreements. Since its inception, more than 140 nations have joined the WTO. Indeed, countries have used the WTO to negotiate guidelines for a relationship leading to economic growth via foreign investment and opportunities to export to larger markets.

There are three key multilateral agreements: the General Agreement on Tariffs & Trade (GATT), the General Agreement on Trade in Services (GATS) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). The GATT can affect health by trade on health products such as genetically modified foods. The GATS liberalizes markets in service industries including health services and can promote consumers' choices particularly those who have the ability to pay for the services. The TRIPS agreement is relevant to intellectual property rights on drugs and medical equipment.

Therefore, these agreements can affect health in general as well as access to medicines and services in particular. Nations must develop measures to monitor access to services and medicines of people of different social classes as well as the barriers to medicines and services. Tools must be developed to monitor the various interrelated markets. Nations need tools to measure the performance of the finance market (various insurance schemes), the human resource market (human resource mobility in the light of GATS implementation), optimal facility and equipment planning, rational use of drugs and medical commodities, as well as the market for human resource training and education.

Information generated from the analysis of the various markets must be collated, integrated, and synthesized to guide the organization of optimal services as well as setting rules to pay providers and facilities to promote equity in health for development. The most important measure is to promote the "Robinhood Rules", in redistribution of resources to increase social opportunities and guard against the reversed Robinhood Rules, which channel public resources to support the for-profit sector.

Indicators for a fair redistribution of economic growth for equity of access in health care include:

(1) The availability and use of tools to analyze various markets: financing, human resource, facilities and equipment, commodities and pharmaceuticals, and education of human resource for health.

(2) The presence of documents which analyze the relationship between the inter-related markets: finance, human resource, facilities and equipment, drugs and commodities, as well as professional education.

(3) The use of evidence-based analysis of inter-related markets for organizing service delivery and setting rules for payment of providers and facilities both in the public and private sectors.

(4) The magnitude and trend of resource allocation for improvement of registration and de-registration of drugs and medical devices.

(5) The differential distribution of health care personnel and facilities between urban and rural areas, between private and public sectors.

(6) The magnitude and trend of resource allocation for development, revision, implementation, monitoring of evidence-based health care guidelines.

(7) The existence of a mechanism to monitor adherence of guidelines as well as the effectiveness of guidelines.

(8) The differential coverage and access to health care services across individuals or household quintiles ranked by their living standards based on individual income and household consumption per capita.

(9) The progressivity of health care payments as measured by out-of-pocket payment for health care services across individuals or household quintiles ranked by their living

standards based on individual income and household consumption per capita (World Bank technical note # 16, accessed June 2003).

(10) The magnitude and trend of resources to address important neglected areas; human resources; accountability; central government functioning; evidence for policy. This would depend on an adequate understanding of the relationship between culture, illnesses and care. (Kleinman, A. 1995).

(11) The "benefit incidence analysis" for assessing the target efficiency of public subsidy, across individuals or households ranked by their living standards based on household consumption per capita (World Bank Technical Note #12, accessed June 2003).

(12) The probability of contacting health system when needed across individuals ranked by their living standards (World Bank Technical Note #13, accessed June 2003)

(13) Mortality, morbidity, and disability rates across individuals ranked by their living standards.

(14) Periodic forums where the results of the above indicators can be discussed.

(15) Documents collated from the meeting between the Ministry of Finance and the Ministry of Health on potential threats from WTO agreements, such as regulations and deregulation by the government on health services as well as public sector subsidies for health services.

Strategies to ensure health security

Strategies at the national level

- *Uphold values of public health with focus on health security:* Equity, social justice, self-sufficiency, and sustainability have been suggested as the key values for public health, and should be upheld (Berlinguer, Giovanni. 2000). The fundamental role of the government in the provision of health security should be revitalized. For example, in Thailand, tax incentives for use of expensive equipment and 25% taxation on essential drugs should be dropped (Bennett S, Tangcharoensathien V. 1994). Guidelines and options are available to guide a wider application of the concept of sustainable development through involving more players in, for example, private sector contracts for primary health care (Palmer N. 2000).
- *Appropriate restructuring involving public health values, health security and new players.* Restructuring the health system requires involvement and commitment of all stakeholders if appropriate technology is to be delivered to desirable targets. Thus, even though effective medicines are available to treat AIDS, control of the disease will not be possible without a robust infrastructure to bring the medicine to those in greatest need: the poor and the underprivileged. The restructuring of health security systems by means of involving both the public and private sectors has been tarnished by inadequate governance which never considered impact in terms of adverse health impacts, but solely on cost containment (Barraclough S. 1997; Palmer N. 2000; Learthiendumrong, J & Tangcharoensathien, V. 1999).

  The key question is what kind of organizational change is optimal for a health system, which can uphold the key public health values focusing on health security and is still cost-effective and affordable by a country. Answering this question requires some hard decisions involving changes in the role of different government ministries, and changes in the roles of both the public and private sectors. Such changes are paralleled by the unsuccessful health system changes attempted in the USA during the first Clinton administration (Brock, DW & Daniels, N. 1994); and the new National Health Service plan now being attempted in England. (The NHS Plan, http://www.doh.gov.uk/nhsplan) One of the keys to effective organizational reform is to create a platform for evidence-based discussions among the main stakeholders. This may result in some degree of wider ownership of the reform agenda and a system of compensations or allowances to reward good performance (Israr SM, *et al.* 2000).

- *Focus on evidence-based decisions.* Several tools and methods are available for knowledge management to aid movement towards better decisions. These tools and methods are needed for estimating demand for health resources based on needs to ensure health security (Abel-Smith B. 1986; Mach EP & Abel-Smith B. 1983). Instruments that are capable of estimating needs, resources, utilization, costs and outcomes of care are essential if the full impact of decisions is to be understood, and public values for health security maintained. Research focusing beyond epidemiology and onto health security systems is needed when financing, incentives for providers, incentives for facilities, acquisition of technology, and the production of human resources are all integral parts of the decision process. Efforts are needed by countries to explore, collate, use and refine these tools and instruments to guide decisions, such as questions about the feasibility of national health insurance purchase cooperatives to foster equity, efficiency and quality of actions towards health security.
- *Empower the intended beneficiaries to participate in evidence-based policy decisions.* Social policies that focus on human development must be the main aim of the public sector, i.e., investment in human capital. To enhance equity, any human development policy should set as a target increasing the social opportunities of all members of society in their access to education, health security, and natural resources. According to Amartya Sen, re-vitalized intended beneficiaries with sufficient opportunities for access to social opportunities will not be content with reliance on welfare but would rather produce quality activities that can compete in any market or can bring in resources (Sen A. 1993; Sen A. 1999). Such users of services will have more freedom to choose and can make more informed decisions, which, in turn, can strengthen the market. Stronger members of the society will increase the efficiency of the market through more freedom of choice. Investing in human capital must involve cooperation of the social, economic and environmental sectors (Woodward A, Hales S, Litidamu N, Phillips D, Martin J. 2000). Improved social opportunities for the voices of the poor to be heard through democratic means are essential to deal with the unwanted consequences of economic or environmental crises, which disproportionately and unfairly affect the poor. Enhanced democracy will make the voice of the poor loud and clear, and it is likely that demands for appropriate "safety nets" and greater fairness in the society will result (Woodward A, Kawachi I. 2000).

A key to success in implementing these strategies and actions lies in a nation's capacities - which include epidemiology, public health focusing on health security – to manage knowledge for good governance. Each country may need to review the kind of expertise, information and management system required for knowledge generation and management to achieve good governance. Good governance is needed for both the health system and the health research system through building strong interactions between the two. Income per capita alone does not ensure health security of the people in a country despite demonstrated relationships between health and economic growth. Some poor countries appear to do things right and have better health at a low GNP than others that do not. This is not to deny the fact that the biggest killer in the developing world remains poverty. It is rather a challenge for nations to make plans using long term goals, intermediate goals and step-by-step measures. Appropriate infrastructure and information system will have to be inputs to logical decisions. The infrastructure and information system will have to focus on development of capacities for knowledge management to facilitate decision-making based on good governance through a check and balance mechanism participated by key stakeholders in a society.

Strategies for the international community

Globalization has moved the world from an era of national concerns to an era of global health. There is an increasing international transfer of health risk such as pollution and epidemics which increasingly threaten the health of countries. Nations are increasingly losing power and capacity to ensure their policies are securing the health of their people.

International development agencies and enterprises need to define clear moral authority and values on the acceptable norms and standards of accountability and compliance, fair conflict resolution as well as negotiated dispute resolution. These should be based on a "level playing field" rather than unilaterally imposed by sanctions. New global health contexts, architecture, rules and regulations are needed to define new ways of cooperation and setting priorities to balance the positive and adverse interactions between economic growth and disease, and between health and wealth.

- *One moral aspect is a concern for equity.* Efforts must be made to enable countries to participate in the opportunities for economic growth but through knowledge management for good governance. Price and profit control might not work as expected if not focused on economic evaluation and good governance (Bloor K, Freemantle N. 1996). Health must be considered a global public good particularly if a concern for equity is to be honoured. The World Health Organization has been exploring ways to partner with the private sector to enhance better equity and security in health (Buse K, Walt G. 2000a; Buse K, Walt G. 2000b).
- Basically, the world is looking for *new rules and new platforms for collective action* and these cannot emerge from nation states. We need global rules for global governance. The new global rules have to go beyond being concerned solely with economic phenomenon (i.e., growth) but have to link with cultural and political processes, which shape the ways people and nations live their daily lives. The use of new electronic media in addition to other means can serve as a platform to transfer information and to engage the attention of stakeholders. Trying to find and to work with a set of rules that satisfies all stakeholders and produce a global agreement is a challenge. But, transparency, accountability and consistency in managing knowledge to make balanced decisions respecting a concern for equity and health security will be fundamental to recast and sustain an effective global health governance infrastructure. The key requirement is for nations and stakeholders to find effective ways of working together, in alliance with public and private, north and south, so that the world can rise to the challenges of health security mankind is facing. Nations and stakeholders must demonstrate their achievements and overcome differences, mistrust, skepticism, and fragmented development efforts.

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Information systems and community diagnosis in developing countries[*]

Chitr Sitthi-Amorn

Outline

This chapter outlines the importance of information in the planning, monitoring, and evaluation of health problems, their determinants, intervention options, and evaluation of health intervention in a community. It argues for at least five objectives of the health actions, which determine what types of information are needed. A general framework for information and community diagnosis is given which includes defining the community, agreeing on the indicators, determining the sources and methods of obtaining the information, and using the information to predict the current situation as well as future trends. Each of the sources or methods used for information gathering (routine reports, surveillance, survey and special studies, rapid survey, contact tracing, and vital registration and census) has inherent strengths and weaknesses. Therefore a combination of approaches for collecting information for community diagnosis is necessary. Despite the availability of several approaches to developing an information system, some technological limitations for a community diagnosis exist and are also discussed. Finally, a comparison is made between information systems in developed and developing countries, which partly reflect the different emphasis in the operation of health-care systems as well as differences in available resources for community diagnosis.

Introduction

Information is the basis for planning for a rational allocation of resources to cope with public health problems. Information should shed light on health situations, help to set priorities, appraise options, develop and implement programmes, and monitor and evaluate actions to determine whether they adequately address the situations. Information is the essence of the planning process. Decision-makers balance evidence from information with their values and the imperatives to arrive at the best choices. Information includes what is measured, what is not measured, and what is inherently unmeasurable. Most information systems, which rely on information technology, collect measurable quantifiable information possibly at the expense of less explicit soft and qualitative information. Therefore, an appropriate mix of measurable and intangible information will be needed. Although the information is rarely perfectly accurate, its accuracy can be enhanced through the development of a clear operational definition, training and motivating the enumerators, and interaction with stakeholders to standardize interpretations.

The definition of a community can have many interpretations such as a neighbourhood or a collection of people in similar geographical circumstances. A community also refers to a group of people who share the same stakes and common interests such as trade unions, those who are mobilized around a given activity, or the users of health services. Some have even expanded the definition of a community to include those employed in a workplace, the population of a nation, or a civil society. In this chapter, a community can encompass several interpretations such as a village, subdistrict, district, province, or nation. A fundamental requirement of an information system is to enhance the ability of decision-makers to employ evidence-based actions and enhance their roles in solving problems of a community however defined. A community is not a static entity; therefore any meaningful information system for the diagnosis of community problems requires a dynamic interaction between the members of the community and the managers of information systems. It is important to make the best use of updated information and interpret information into meaningful strategic options that reflect the reality of health and health-care systems in a given community or society. Any information produced should then be fed back to the community to enhance their future involvement. This feedback can then be the driving force in linking information to actions because the community will press for the kind of information they can use.

Public health policy-makers and health-care managers need timely, useful, and balanced information (quantifiable and intangible) for the diagnosis of health needs, their determinants, and trends to achieve effective planning and monitoring of health-care interventions. New challenges to public health have highlighted the importance of community involvement in defining problems and in coping with them. These challenges include globalization and its impacts on environment, the relationship between trade and health, emerging diseases, the market orientation of health-care system, and changes in behaviour and lifestyles. There are several ways to obtain health information for the diagnosis of communities including routine health facility reporting, screening, surveillance, special large-scale surveys, rapid surveys, contact tracing, and census. These methods vary depending on the objectives, investment, and utilities available.

The objectives of public health actions

An overall objective of community diagnosis is to estimate the magnitude of the health problems and their determinants as well as to

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analyse trends and changing paradigms of these problems and determinants. Because the community consists of heterogeneous groups, the overall objective needs to be expanded to include many value-laden issues such as health needs and determinants, equity, responsiveness to expectation, efficiency, protection of individuals, and fairness. The results of community diagnosis can then be used as evidence for discussion among the stakeholders in the community, balancing the values of the various stakeholders in setting priorities and making decisions for resource allocation acceptable to the community. The priorities and decisions for control should take into account not only the current status of health but also the impact that controls may have on health of the future generation.

The priorities and decisions for control depend not only on the indicators used for the diagnosis but also on the expressed or unexpressed values of a health system. Recently, the World Health Organization (**WHO**) suggested some possible value-laden objectives of a health system. Indicators for these value-laden objectives are being developed for better measurements of how well a health system has achieved its objectives. The possible value-laden objectives of a health system include (a) improving average health status and reducing the burden of illnesses, (b) reducing health inequities, (c) responding to the legitimate expectations of individuals, (d) improving the efficiency of health system, and (e) protecting individuals and enhancing fairness (WHO 2000*a*).

Improving average health status and reducing the burden of illnesses

Improving average health status and reducing the burden of illnesses as measured by life expectancy, death rates by age groups, disease or morbidity rates, and the measurement of the burden of illness combining mortality and morbidity are important functions of public health professionals. Indicators for the measurement of risk factors to explain mortality and morbidity have also been developed.

There are changes occurring in the burden of illnesses resulting from population growth both in developing and developed countries. In addition, demographic and epidemiological transitions can influence trends of ill health in a nation or community. Lifestyle changes are associated with illnesses such as cardiovascular diseases and the epidemics of HIV infection and tobacco use. Owing to globalization, there are many things in the future that will change health and the burden of illnesses in a community. The current decline in communicable disease mortality in many areas of the world may reverse due to drug resistance and new pathogens. Therefore, the mortality and morbidity rates from various diseases will be the backbone of information needed for health planning.

Reducing health inequities

Equity is particularly important if planning involves allocation of resources for health from the government budget that comes mainly from taxation. The agencies implementing the plans can be the government or non-governmental organizations supported by the government. In contrast, the private health system does have more responsibility to satisfy individuals who pay for their services, rather than the responsibility for reducing inequities. Therefore, the reduction of health inequities as an indicator does not apply to the private as much as to the government system.

Health inequality is linked to the agenda of poverty and material deprivation. The WHO has developed a set of measures for health inequalities including social, household, and individual differences in health. For example, male life expectancy differs greatly among various regions of the United States. Health inequalities differ between various regions of the world with different stages of human development as exemplified by the health status in Mexico compared with that of the United States and Japan. The distribution of life expectancy at birth estimated from large numbers of small area studies showed that life expectancy is most equally distributed in Japan. In both Mexico and the United States, the distribution of life expectancy between areas was wider, indicating more inequity between population groups. The inequity is particularly significant for men (WHO 2000*a*) Measuring inequalities gives health a central theme in the development agenda.

In terms of investment in research, there is also a 10/90 disequilibrium between global health expenditures for research and the burden of illness (Commission on Health Research for Development 1990). This report found that less than 10 per cent of global health research funds were spent on 90 per cent of health problems in developing countries. Thus, information on these parameters will be needed to plan a more balanced allocation of resources according to needs.

Responding to the legitimate expectations of individuals

The legitimate expectations of individuals reflect an attempt to fulfil their right to health services because they are citizens of a country and community. Legitimate expectations do not include expectations based on self-interest at the expense of the public. Examples of legitimate expectations include the provision of emergency services and services with high public health values such as immunization, preventive and promotive services, and the treatment of infectious diseases.

One measure of the response to the legitimate expectations of individuals is satisfaction with services. Satisfaction has multiple dimensions including access, cost, and quality of care. There is a significant difference in the satisfaction with health systems between countries. Satisfaction with health services in the community can also be compared within regions in countries and between the public and private sectors.

Improving the efficiency of health system

The efficiency of a health system depends on the allocation of resources to services with high public health values (allocative efficiency) and the provision of technically efficient services (technical efficiency) including clinical services. Technical efficiency involves the use of cost-effective services and some form of competition and market mechanism, and therefore can apply readily to the private sector. Measures to improve the efficiency of a health system may be in conflict with measures to reduce inequities. Nevertheless, measures to reduce inequities using public resources must also be efficient. This gives rise to the notions of hierarchy of objectives in community diagnosis. It is difficult to prescribe the optimal mix between equity, efficiency, and satisfaction with services. The challenges are to use the available resources to best achieve health system goals agreed upon by the society.

There are variations in health-care expenditures with respect to the gross domestic product of countries. Thailand spends more on health as a percentage of gross domestic product than Malaysia but has a lower life expectancy and higher infant mortality than Malaysia. Theoretically, the private sector can enhance the efficiency of health care through the provision of good services at a competitive price. However, it is not known whether the changing proportion of the private sector correlates with efficiency (Newbrander 1997) because the public sectors of countries have monitored the pricing and quality of private services with differing levels of rigour. Some information for planning health care has to involve centralized efforts to monitor service standards and to protect the public. Information is needed to monitor financing, provide services at public and private facilities, and to enable the public to make appropriate choices.

Protecting individuals and enhancing fairness

Protecting individuals and enhancing fairness are two important goals of health. Citizens of a country have a right to a certain level of health regardless of whether they are rich or poor. Rights to health promotion services, disease prevention such as immunization, treatment of emergencies, and acute infections are some examples. Governments can involve the stakeholders to determine the level of health all citizens will have within the constraints of limited resources.

Each of the objectives can serve to indicate directions for the development of variables to measure the current health situation as well as to assess changes with time. A good variable has to be reliable, valid, sensitive to change, and credible to the stakeholders.

Although fulfilment of many of these objectives would lead to similar decisions, this may not be true for all cases. For example, coping with inequity by focusing on the health of the underprivileged groups to enhance social justice will require different decisions than improving the average health status of both the élites and the underprivileged groups of the society.

Without clear objectives of the health system, the demand for good information missing in the information system can be used as an excuse not to plan a programme. One important argument for not using information for planning is that information is not accurate and basing a decision on incomplete information can do more harm than good. Therefore, a clear objective will identify the minimum information needed to make decisions. A clear objective will help focus on the improvement of an information system to enhance its utility to meet the objective. A balance can then be struck to see whether a minimum level of useful information exists for the decision. In the case of inadequate information, efforts to collect additional information through a rapid survey or focus group discussions can fill an information gap in planning.

Components of information systems for planning health care

The major components of health care which will need systematic information for planning include information about (a) health situations and needs, (b) the availability of resources to deal with those needs including the various approaches to organizing and financing of the resources, (c) the organization and capacity to take those resources and convert them into services (that is, the performance of the system: efficacy, effectiveness, efficiency, quality, and decision analysis), (d) variation of use, and practice with their implication on equity to access and coverage, (e) the impact on health outcome, and (f) the consequences of health-care financing on politics, the economy, and society as well as on the welfare of the entire population.

The users and contributors of information for health planning can be policy analysts, health-care providers, epidemiologists, social scientists, and economists, among others. The gatherers and users of health information are often different people at different levels of the health-care system. For policy decisions, policy analysts will need information to facilitate policy recommendations. Those who provide health services and have the task of being accountable for the services they provide should also be involved in the development of an information system. The general areas outlined above differ among developed and developing countries, not with respect to the problems themselves but rather to the emphasis given to each of them.

The measurement of needs

With respect to the measurement of needs, it is important to understand current needs, trends, and types of services needed (promotive, preventive, curative, and rehabilitative), including both objective and subjective needs. The differentiation between need, demand, and utilization is also crucial (Box 1).

Health care need

- Current needs:
  - real need versus want
  - effective demand
  - use
  - prioritization

  Trends, for example in AIDS and related conditions, ageing, trade
- Types: promotive, preventive, treatment, rehabilitation
- Validity and objectives of data sources

Real needs are those that require appropriate fulfilment and they may be both felt or unfelt. Demand is generated by felt need, and needs and demands require effective provisions. Effective provisions represent the capacity of the health systems to satisfy the real needs within the technological and other resources of the society. Use is not the same as effective provision although it is easier to measure. This is fundamental to the author's approach to the problem. Utilization reflects the perception of health need, individual reaction to symptoms of ill health, resources that the individual must invest to acquire the service, ability of the facilities to provide the service, and benefits that the providers of service expect to generate. It does not tell us what volume of service is optimal. It is important to know what volume of health services should be consumed, not just how they are actually consumed, to decide upon the likely benefit of a particular investment. Without appropriate data, decision-makers might focus on ineffective provisions without meeting needs. A needs-based system is difficult to establish but is essential to allow people to be more responsible for what they do in terms of their own health.

Current needs only represent part of the picture in planning of health services. The health system has to be more aggressively involved in the trends of diseases such as HIV infection and AIDS, with the emphasis on finding more effective means of delivering educational and other preventive programmes which highlight high-risk activities. With the new industrialized trends of developing countries, occupational diseases will be increasingly important. The current trend of population demographics may require a greater emphasis on the needs of the elderly who may claim a greater share of the funds provided by the various health-care schemes.

In the analysis of the types of effective provision, it is necessary to understand the need to establish a balance between preventive and promotive strategies versus treatment and rehabilitation.

It is important to develop an information system in both developed and developing countries to measure incidence and prevalence of objective and subjective needs as well as the use of specific types of health services to fulfil those needs.

Fulfilment of non-health needs can also lead to health improvement. For example, the role of women in determining the health and life prospects of their children is crucial. It is therefore important to find ways to assure women's health through nutrition, education, gender equality, and health practices. How can social and other non-health interventions interrupt the vicious circle of poverty, health, and the lack of social development? This area will remain important for future research.

Information about the organization and financing of a health service

The organizational arrangements for health-care financing and delivery are also important components of an information system to ensure universal coverage and equity of access.

The organization

Ideally, the structure that should be involved in a health service system are the public health facilities, the private sector, other communities, the workplace, and families and individuals. Major activity is currently occurring in the public sector, particularly the ministries of public health. Information about other components of a health system must also be sought. So-called 'unqualified' personnel or 'minimally trained community-based health-care workers' for workplace communities, family support, and self-care, can be trained to become resources for health-care currently provided by higher level professionals (Box 2).

Appropriate personnel requirement is also an important issue. It is important to identify the appropriate proportion, type, qualifications, and distribution of personnel required to support the health-care financing schemes. How much should currently 'unqualified' personnel be trained to support the system? What is the role of informal care and self-care?

Privatization will not facilitate universal access to health care. It will, however, affect the financing and payment system. More active work and more cross-cultural comparisons are needed in this respect, particularly where more privatization is developing in many countries, including those in Eastern Europe. Information will be needed to monitor the extent to which these trends can alter the basic relationship between patients and health-care professionals resulting in an impact on health and the quality of services as well as on the livelihood of people.

The structure and the organization of a health system

- Structures
  public: ministries of public health, local government offices
  private sector
  workplace
  home
- Personnel requirement
  specialist/generalists
  nurses
  currently 'unqualified
  informal care
  self-care
- Population being served
  based on workplace
  based on residence
  other
- Co-ordination

Finally, although some resources are needed for mounting and co-ordinating an information system, it is important that the proportion of resources allocated to co-ordination not be so substantial as to jeopardize other activities. However, the information base to do such analyses may not exist and therefore may need to be constructed.

Information on financing

The framework for analysis of the financing of health services is depicted in Box 3.

The factors affecting the various sources of health-care financing mechanisms vary between countries. In this complex situation, it is important to resolve questions over who pays, who receives payment,

Financing of health systems

- Who pays?
  insurance scheme
  employers
  government (welfare)
- Pay for how much?
  total
  percentage of gross national product
  trends
- Pay for what?
  types of services
  levels of services
  specific activities
- Pay to whom?
- Basis of payment
  fees for services
  capitation
  co-payment

vhat is being paid for, who eventually benefits, and how to ensure haring and pooling of the risk of ill health to attain a certain degree of quity.

In order to monitor and determine the appropriate emphasis of the programme, the total amount of payment under the various health-are financing schemes, its trends, the relative proportions of the arious schemes, and the percentage of gross national product used for ach scheme need to be assessed.

The relative contribution of the various health-care financing chemes for preventive, promotive, curative, and rehabilitative care is lso important to guide the setting and monitoring of the appropriate proportion of these various services. Related to these issues is the elative contribution of health-care financing schemes to the various evels of services: primary health care, primary medical care, secondary nedical care, and tertiary medical care.

The basis for payment under the health-care financing schemes will be important for determining the rate and the appropriateness of utilization of services.

The alternative models

Each of the alternative models has their strengths and weaknesses. Each of them may be considered appropriate for meeting the needs of health services, depending on the situation. However, there are some common targets of all models of financing. These are equity, efficiency, stability, sustainability, administrative feasibility, health impact, as well as impacts on the socio-economic and political systems of a society. As there are numerous ways of organizing resources, alternative models have to be developed, tested, and compared.

Resource allocation and utilization of services

In allocating resources, it is important to define practice variations and use variations (including issues of acquisition, diffusion, use, and control of access to health technology). Practice variations result from the decisions of providers while use variations are the consequences of consumer behaviour (Box 4).

Variations of service provision can depend on which scheme is used to pay health-care providers (for example, fee-for-service scheme or capitation). The rate of certain procedures might be inappropriately increased if the fee-for-service scheme is adapted to the point that the financing system cannot be sustained because of a greater emphasis on treatment than prevention. In Australia, for example, the rates of obstetric intervention in private patients have been higher than for non-private patients (Roberts *et al.* 2000). The views of specialists differ on whether or not to perform cancer genetic testing and carry out prophylactic hysterectomies when patients prove positive (Matloff *et al.* 2000). If coverage refers to the degree to which effective provision is given to those who have real need, it is not always true that more services lead to more coverage. Conversely, hospitals may avoid providing standard services if they are costly, or may not join the health-care financing schemes programme if a capitation scheme is in place. If the hospitals fail to provide high-cost but already proven efficacious and standard care because the services are too expensive, certain ethical issues may arise. A good information system should be able to identify these issues.

Box 4 Resource allocation and use

- Practice variations among providers
  - special 'track'
  - over or under prescription of technologies
  - provider satisfaction
- Variations among users
  - underuse
  - overuse
  - user satisfaction
- Access, equity, coverage
  - among social insurance clients
  - among clients of other insurance schemes
- Allocative efficiency

On the one hand, people who are covered by private health-care financing schemes might overutilize health resources because they perceive that it is their right to obtain services. On the other hand, people might underutilize services under certain health-care financing schemes because they may perceive that they are receiving inferior care.

Services that are overutilized might lead to inequitable access to services of other low-income groups. If coverage refers to the degree to which effective provisions are given to those who have real needs for services, it is not always true that more services lead to more coverage.

An information system has to associate appropriate population denominators with the numerators, particularly where the people in a catchment area can use many different financing schemes for the same health condition. In this general area, the topics of national relevance are those of access, equity, and coverage as they relate to factors including income, age, sex, and occupation.

Health system performance

Measures of health system performance are becoming increasingly important as the financial demands of health care have put increasing pressures on national economies (Box 5). Although some of the most exciting work is taking place in developed countries, much is happening in developing countries as well. The field of epidemiology has made a great contribution to public health and health-care research. Epidemiology, political mapping, decision analysis, health system economics, and evidence-based practice have helped revolutionize the practices of medicine and public health. Epidemiology, however, supplements but does not replace basic sciences. The major problem for measuring health system performance is the availability of data. Information systems therefore need to be strengthened to be able to track the performance of public health interventions.

Health system performance

- Efficacy
- Effectiveness
- Operative efficiency
- Clinical decision analysis
- Outcome and epidemiology of medical care

It is not only the expensive technology of public health and clinical medicine that is subjected to the analysis of health system performance, but the very inexpensive and moderately priced everyday practices also need to be evaluated. Information systems are needed to track preventive activity such as immunization programmes, screening for chronic diseases, availability of early treatments, and risk factor counselling.

Decision-makers and health providers must have the skill to evaluate their own decisions and practices, and to be more accountable in their decisions. The design of a good information system should empower these practitioners to ask questions about public health interventions. Such an empowerment should lead not only to heightened expectation and demand for quality and accessibility at reasonable cost, but also create an environment in which the information system for public health decisions has reason to grow. A more systematic approach to information systems is needed. Information and technology gaps between developed and developing countries in this area need to be narrowed. Only then can the strategies to define an optimal health care for all be achieved.

It is important to make providers accountable for their services. This requires information support. Information should not be an exercise that can only be performed in university faculties. The task of the specialists in information systems is to make the methods as accessible as possible. The emphasis in much of information system research in the decade ahead will shift from a traditional study of inputs (for example, personnel, facilities, procedures, appliances, drugs, and so on) to the evaluation of health-care output and performances.

Information on health outcomes

Outcomes of care are usually measured using mortality and morbidity rates. While these are important indicators, they do not take into account the impact of illnesses and death on the individuals and their families as well as on the economic and social well being of the society. The death of a child in a family might have very different consequences from the death of the mother; in many societies, such as those in Africa, the death of a mother might lead to the death of other children and disintegration of the whole family. Deaths of young adults have more impact on the production of the society than deaths of the incapacitated elderly. Therefore the definition of outcome of care needs to take into consideration the lifetime consequences of illnesses, impact of illnesses and death on other family members, the well being of society, and productivity (Box 6).

Defining outcomes of care

An exciting feature of health-care analysis is the ability to access information to measure outcome, for example measures of functional health status and well being. This field has previously not received enough attention. More people are doing research on what it means to have certain physical limitations. Functional health status is complex and the study of it can provide important information. More research on quantitative measures of well being, including the quality-adjusted life year, is needed. It is hoped that methods will be developed to measure these not only in individuals but also in communities.

Health outcomes

- Definition
    functional status
    well being
- Health status measures
    single index from aggregates
    utilities
    preferences

Health status measurement

Far more attention needs to be spent than previously on health status measurements including (a) the aggregation of various health indicators into single indices, (b) deriving the utilities and preferences for various health states, (c) the measure of possible health states across the various health conditions, (d) the measure of health status in children and the elderly (most of the current measures of health status apply to adults), and (e) evaluation of clinical treatments and changes in health-care delivery.

Information of development policies affecting health

A public health system is very different from a health-care system. The public health system needs to provide information on development policies that can affect health. These include policies on the macroeconomy, agriculture, energy, and housing (Box 7).

Development policies affecting health

- Macroeconomic
- Agriculture
- Industrial
- Energy
- Housing

Planning a public health system requires information on the ecology and environment, schools, workforce, social care, housing, and alternative energy sources in addition to information about the performance and integration of various levels of health care as described above. Public expenditures and subsidies to stimulate macroeconomic growth may be done at the expense of support for essential drugs, employment programmes for the poor, and so on. Agricultural development can exploit land use, which can change biodiversity and thereby promote emerging diseases and resistant strains of micro-organisms. Agricultural development can also affect the short- and long-term health of migrants and local people through the use of pesticides and acute poisoning. Improvement in irrigation systems can change the lifecycle of vectors and complicate water-borne diseases. An information system to monitor work safety and pollution should go along with the development of industrial policy. To promote safe energy, information is needed on the sources of energy (for example, the effect of hydropower on deforestation and health), consumption of energy for cooking, household use, transport, and pollution standards by industries, and pricing policy related to the use of safe energy. Information on housing policy can cover issues such as health problems in slums and government housing, safety of ise buildings, availability of public services, cost of rent red to cost of food, and hygiene standards.

general framework for community gnosis

ing the community

irst task to define health and disease burden in a given unity is to define the target community. This can be a country, ice, district, or state, but might be a more defined geographical , such as an urban inner city, or a socially defined group, such as communities, women in the reproductive age range, pregnant ers, infants, young adults, or the elderly. The target population d be broad enough to cover all subgroups relevant for the ment of health situations outlined by the objectives such as of access to care. If the target population is not well defined at utset, there could be a tendency for the subgroups from whom re easily obtained to be over-represented. For example, disease ns from hospital data under-represent those who have limited to hospitals.

lth indicators

lefinition of indicators is a pre-requisite for the development of fective information system in community diagnosis. Indicators to reflect the kind of decisions which will be needed to estimate urden of illness and the strategies for control.

tive and negative health

ly, health indicators should reflect both the positive and negative ts of health status. The new definition of health by the WHO ides the physical, mental, social, and spiritual aspects of health. y attempts have been made to develop measures of quality of life proxy of positive health (e.g. the WHO quality of life instrument nymous 1995)). Positive health measures have not been widely in developing countries partly due to cultural influence on the ctations of people. Poor people in developing countries are more y to accept the limitation and be satisfied with poorer health than counterparts in wealthier countries.

ood health tends to be unnoticed until obvious symptoms from ases have occurred. The concept of the 'burden of risk' can be ght to the attention of public health officers if there is a method to lify the course of presymptomatic illness. Thus screening for ertension is an essential public health tool because of the sibility of modifying the course of hypertension and preventing ke. Screening for diseases can be a part of community diagnosis if a -effective intervention is available for modifying the course of the ase once identified at screening.

n most developing countries, health information systems are cipally oriented towards negative aspects of health because of the tive ease of their measurement. People will seek help from the lth-care system when they become ill. The main health indicators expressed in terms of crude age-adjusted or age-specific mortality s (such as infant mortality rates, mortality for children under 5, or ternal mortality rates), disease-specific morbidity rates, and life ectancy at birth. Mainly because diseases have different natural tories and impacts, other indicators have been developed. Examples include potential years of life lost, quality-adjusted life years gained, disability-adjusted life years, healthy life years lost, and disabilities and quality of life index (Murray and Lopez 1996; Hyder and Morrow 1998). Debate has continued over the assumptions that these measures make, such as the relative values of time lived at different ages and the application of discounting rates over time. Many maintain that the implications of age weighting and discounting are unacceptable. Those who disagree with allotting relative values to time find it difficult to trade healthy years by giving less weight to future generations in favour of the present generation. Those who agree with age weighting and discounting feel that such methods of weighting and discounting are consistent with the necessary allocation of resources, for reasons of cost-effectiveness, and with avoidance of giving less value to childhood death. In view of this debate, it is important for developing countries to focus on the development of information that can measure mortality and morbidity rates with some degree of certainty. These standard indicators can later be transformed to calculate other newer indicators after agreement has been reached over the various methods.

Sources of information and the methods that can be used for community diagnosis

Information for community diagnosis can come from many sources (Box 8). Examples include routine reporting from health facilities, surveillance, screening, special surveys, contact tracing, vital registration, and a combination of several methods including using qualitative information to define variables and continued surveys of the nature and extent of the problems once the variables are defined.

The details of these approaches are addressed in the next section.

Sources of information and methods for community diagnosis

- Routine reporting from health facilities
- Surveillance including active, passive, and sentinel surveillance
- Screening
- Special surveys
- Rapid surveys
- Contact tracing
- Vital registration
- A combination of several methods

Trend analysis

Information can be gathered and analysed for changes over time. Trends in the health status of a nation and a community involve demographic transition, urbanization, education expansion, changing status of women, economic transformation, politics, technological innovation, and global integration including the international transfer of risk (for example, pollution and global epidemics), trade liberalization, and shared learning leading to accelerated development and interdependencies. Assessing trends can be done in terms of health situations, burden of illnesses, and risk behaviours (Ungchusak *et al.* 1996; Kitsiripornchai *et al.* 1998; Mills *et al.* 1998), and can be used to assess the effectiveness of an intervention (Muller *et al.* 1995).

Characteristics of community diagnosis

The basis of community diagnosis is to learn whether the community has achieved the objectives proposed by the policy and programmes in use. There are several desirable characteristics for community diagnosis:

- ability to address important problems amenable to practical control
- ability to identify most of the target health events
- adequacy in reflecting changes in distribution of events over time, place, and person
- having a clearly defined population, data collection, data flow, analysis, interpretation, and feedback
- orientation towards appropriate action
- being participatory, uncomplicated, sensitive, timely, and inexpensive.

Sources of information and methods for community diagnosis

Routine reporting system

In developing countries, death registrations are incomplete and disease notification is unreliable. The information most readily available is from health facilities such as clinics and hospitals. The number or proportions of patients who seek care are commonly presented to indicate the burden of illness. This method has particular appeal because of its simplicity and low cost. Routine reporting from hospitals and health facilities can give useful information on the health status and burden of illness of a target catchment area to plan and monitor health services if survey information is not available or gives incomplete information. For example, the burden of illnesses and priority ranking of disease in Ghana has been based mainly on the routine information obtained from hospital facilities (Ghana Health Assessment Project Team 1981).

Information from routine reporting of the HIV seroprevalence among heroin users derived from different regions of a country can shed light on the rate of HIV infection at an early stage of infection (Table 1).

Information from the routine report of a key facility for the treatment of drug-dependent patients of Thanyarak Hospital (Thailand) indicated that the spread of HIV seroprevalence among drug users occurred first in the central region of Thailand including Bangkok, followed by the north, the south, and the northeast.

Routine reporting from health facilities has frequently been used to identify disease trends for health problems associated with stigmatization such as drug dependence and HIV/AIDS as shown in Fig. 1.

When the information obtained from male addicts in one facility (that is, among new cases, revisited cases, and non-heroin addicts) was analysed, the seroprevalence among the new cases showed a declining trend (Fig. 2). Conversely, the seroprevalence rates among the old cases and the non-heroin addicts (not injecting) were stable. These trends suggested a possible change in the behaviour of the new cases of heroin injectors, which may have been due to a successful campaign by the authorities.

Similarly, the routine reporting of the hill tribes people seeking treatment for drug dependence at the key Northern Drug Dependence Treatment Center (Thailand) showed a constant increase in the proportion of heroin users among this traditional people who used to smoke opium over the years as shown in Fig. 3. There was a rising trend of the percentage of injecting drug users among the hill tribespeople, indicating a shift in drug use pattern from opium smoking to heroin use first by smoking and later via injection. The higher percentage of injecting drug users compared with the percentage of heroin users since 1992 suggested that the hill tribespeople also injected other drugs.

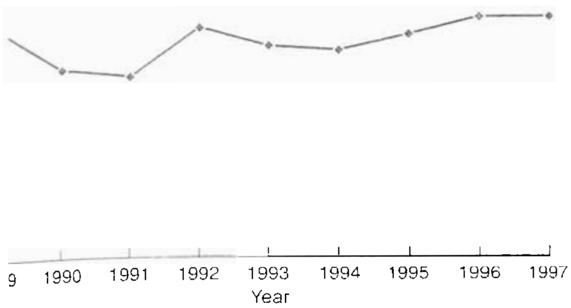
The increase in the percentage of heroin users seeking treatment has corresponded with an increase in HIV-positive prevalence among the hill tribe population up to 1994 as shown in Table 2. Despite the limitations discussed below, routine reporting can generate useful information for planning if analysed and interpreted with care.

Limitation of routine reporting: measuring utilization of services versus health needs

In developing countries, events reported depend on the use of facilities. This gives rise to a distorted picture of health problems in the community since many who need services do not have access to health facilities due to geographical, financial, cultural, and other barriers, or when the coverage of the population by such services is incomplete. It has been demonstrated that between one-third and two-thirds of diabetic and hypertensive people in a community either did not know that they had the diseases or did not seek hospital care (Wadsworth et

Table 1 Provinces with HIV seropositive drug users classified by region (Thanyarak Hospital: December 1987 to December 1988)

	Number of provinces with HIV+ addicts and total number of HIV+ addicts per region			
	Central region	**Northern region**	**Northeastern region**	**Southern region**
Oct–Dec 1987	8	1	–	–
Jan–Mar 1988	15	8	–	1
Apr–Jun 1988	21	10	4	2
Jul–Sep 1988	23	11	7	6
Oct–Dec 1988	25	13	8	8
HIV+ cases (*n*)	603	103	11	32



ercentage of HIV-positive people among injecting drug users
d from routine reporting data from drug dependence treatment
at the Thanyarak Hospital, July 1989 to December 1997. (Data
Poshyachinda 1997, personal communication.)

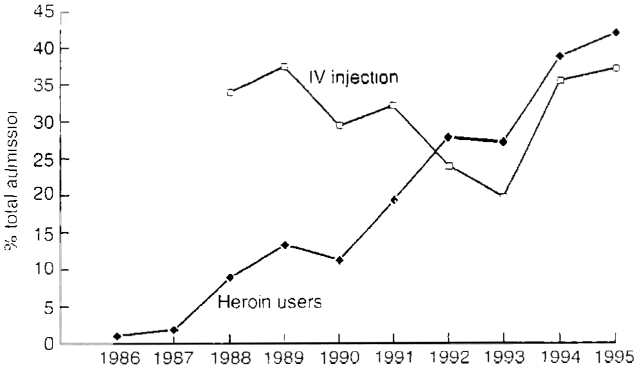


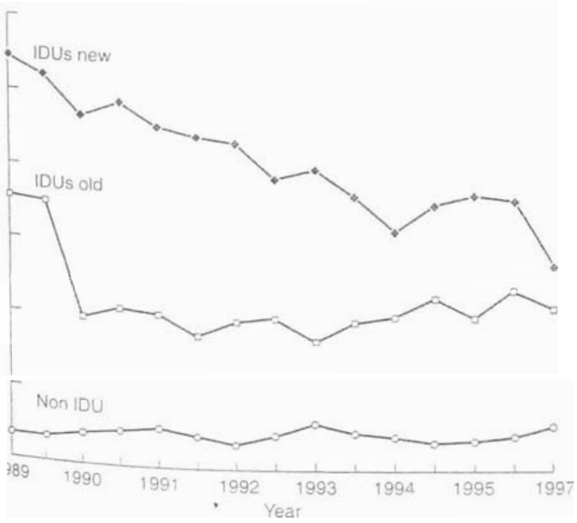
Fig. 3 The percentage of heroin users and the percentage of injecting drug users among the hill tribespeople seeking care at the Northern Drug Dependence Treatment Centre (Thailand): 1986 to 1995. (Data from V. Poshyachinda 1997, personal communication.)

l; Sitthi-Amorn *et al.* 1989). In addition, because the services ed by the various levels of health care are uncoordinated due to ferral systems, one patient could seek care from several places erefore be counted many times, leading to an overestimate of rden of illnesses. Many factors can affect why patients use or do services including the reputation of health facilities, difficulty ss to facilities, and client perception of the seriousness of their Thus, in using routine reporting, it must be remembered that formation available is not perfect and that the information l may not be obtainable. A review of the information system be done periodically to ensure that the information system es the information desired for planners to meet the defined ves of the health system.

ıtine reporting is most useful in capturing most cases if a ion produces severe symptoms, and if the natural history of the ion is long enough to permit seeking treatment. Thus, a on of routine hospital records can be used to produce cancer registries capturing most cancer cases in a community because most patients with cancer will have severe enough symptoms before death to seek treatment from health facilities. Conversely, a large proportion of myocardial infarction patients will die outside health facilities and therefore the records from health facilities alone will underestimate the true magnitude of the burden of illness from this condition. Likewise, reports from health facilities will underestimate cases of diarrhoea since many people only have mild symptoms and will not seek care.

The methods for detection of specific diseases between health facilities can create biased estimates in a routine reporting system. For example, differences in the incidence, prevalence, and mortality from coronary heart disease are observed between and within countries. In addition to the differing levels of risk factors between communities, these differences are also believed to be related to the different application of technology in health-care facilities. Medical care for acute myocardial infarction has changed significantly in the past decades, with the development of new methods for diagnosis and treatment. Although widely known, these technologies are not consistently applied for reasons of availability and cost, as well as local medical cultures and traditions (Luepker and Herlitz 1999).

To cope with the difference between utilization of major health facilities and the actual health need, an extended network of health



Percentage of HIV-positive people among new injecting drug users,
ssion cases of injecting drug users, and non-injecting drug users,
Thanyarak Hospital, July 1989 to December 1997. (Data from
yachinda 1997, personal communication.)

Table 2 HIV seropositive prevalence among hill tribe heroin and opium users (Northern Drug Dependence Treatment Centre, 1992 to 1995)

	HIV seroprevalence[a] (%)			
	1992	**1993**	**1994**	**1995**
Heroin				
Smoking	4.6 (388)	4.4 (387)	14.1 (199)	8.1 (346)
Injecting	20.6 (92)	24.3 (74)	55.3 (99)	37.3 (204)
Opium users				
Smoking	2.3 (1274)	3.2 (951)	7.1 (451)	2.5 (710)
Injecting	–	–	–	5.9 (51)

[a] Number in sample given in parentheses

facilities may be involved in community assessment of the nature and extent of a particular disease. Primary care doctors can play a major role in the identification of health problems, and the entry of patients into the health-care system. Patients with diseases such as acute low back pain usually recover within a short period of time, and in most cases major diagnostic studies are not required. The chances of these patients having significant pathology necessitating surgical or other forms of sophisticated intervention may be less than 1 per cent. Therefore, the patients may not seek treatment from major health centres. The involvement of primary health-care doctors can thus contribute to a better estimate of the burden of this illness (Rosomoff and Rosomoff 1999).

Outreach based on the samples defined in a health facility can also be used to determine the possible source of community infections. For example, in determining whether secondary cases of tuberculosis resulted from those dying in health facilities, a retrospective review of all cases of tuberculosis reported within a specified period was combined with a prospective evaluation of the molecular characteristics of new tuberculosis cases. The study revealed that cases of tuberculosis diagnosed after death did not appear to be significant sources of tuberculosis in the community (DeRiemer *et al.* 1999).

Efforts should be made to improve the quality of routine systems and to make use of innovative analyses of routine information because of the simplicity and potential usefulness of routine reporting systems (Kitayaporn *et al.* 1994, 1996*a*,*b*; Mastro and Kitayaporn 1998). Unfortunately, in many countries, significant progress in this direction is not expected. Therefore it is important to supplement routine reporting systems with other methods of estimating the burden of illnesses including screening, surveillance, special surveys, rapid surveys, and contact tracing.

Surveillance

Surveillance is considered a tool for community diagnosis of diseases which have the potential to become an epidemic, thus affecting many people in the community or internationally. Surveillance has been traditionally applied to the control of infectious diseases. The new paradigms of public health require that surveillance include the detection of toxins, hazardous chemicals, and genetically modified products. Of particular importance are the diseases transmitted from animals to humans, such as the outbreak of chicken influenza virus in Hong Kong and nipah virus in Malaysia. The influenza strains transmitted from birds to humans can cause widespread infection. Thus, surveillance has to be supplemented with strategies to detect the transmission of species-specific infections, which occur between humans and animals.

Depending on the nature of the diseases, surveillance can be active, passive, or targeted periodically towards special groups seeking treatment from sentinel sites. To be effective, a surveillance system must be integrated with other measures to take control of the spread of diseases under surveillance. The role of surveillance is:

- to monitor' secular and long-term trends of diseases and public health issues
- to provide early warning for disease outbreaks
- to evaluate prevention and control programmes
- to monitor the effect of climate changes

Effective surveillance of infectious disease has to be international in scope to monitor and share information on such diseases as Ebola, dengue, and plague.

Three types of surveillance can be used to diagnose the nature and extent of a health problem in a community: active surveillance, passive surveillance, and sentinel surveillance. Each of these types has its own sensitivity of detection of a health problem and has different requirements. Most countries have only passive surveillance systems because maintaining an active system is very costly and often requires some sophisticated laboratory support. Considerable infrastructure and human resources are required to maintain a sentinel surveillance system.

Traditionally, the main use of surveillance systems has been to monitor epidemics of infectious diseases. Recently, surveillance has been increasingly used to detect toxins, such as pesticides in human milk and lead in the blood of children, as well as deficiencies of trace elements such as vitamin A, zinc, folic acid, and iodine in adults.

The world has recently seen increases in diseases and epidemics in others that were once controlled. Since the middle of the twentieth century, antibiotics combined with improved sanitation, housing, nutrition, and vaccines have led to a dramatic drop in many infectious diseases that once killed millions (WHO 2000*b*). By the early 1960s, infectious diseases began to be controlled and these campaigns were so successful that many predicted their potential eradication. This created complacency among public health officials, policy-makers, and the public, which led to many policy and technical problems such as a decline in political and economic support for infectious disease programmes. This has led to the development of drug-resistant microbes, resistant vector strains, and the re-emergence of diseases once under control. There has been a decay of infrastructures and a shortage of trained personnel to deal with major infection control. One of the most important problems has resulted from the neglect of prevention in favour of using the 'magic bullet' or the 'high-technology/quick-fix' solution.

In addition to the relative neglect of comprehensive infectious disease control, other factors also contributed to the re-emergence of infection. These factors include an unprecedented world population growth since the Second World War, unplanned urbanization, uncontrolled deforestation, and agricultural practices such as reclaiming land which bring people closer to infective agents to which they have not previously been exposed. Changes in the pattern of biodiversity and environment may promote the transmission of emerging infections from animals to humans (zoonosis) such as Hong Kong chicken influenza virus and the recent outbreak of nipah virus in pigs. The emergence of new infectious diseases can also result from changes in irrigation systems, sexual practices, organic transplants (resulting in immunocompromised host), consumer goods (tin and plastic containers as breeding sites for mosquitoes), vehicles (tyres as breeding sites for mosquitoes and other vectors), commerce, and travel. These changes in practices and lifestyles are ideal mechanisms of constantly redistributing pathogens around the world.

Other factors include genetic changes in aetiological agents such as influenza (change in strains), development of antibiotic-resistant microbes and insecticide-resistant vectors, and an increase in vector-borne disease in general (through various hosts). These pos arios will need more research before scientists can fully under- d the influence of genetic factors of micro-organisms on trans- ion potential.

:limate changes are imputed to help spread infectious disease but ıg evidence to support this notion has yet to be found. The El ɔ phenomenon has been imputed to have caused the spread of gue in Indonesia and Thailand. Since dengue epidemics can be ed by many factors, the relative contribution of climate to the ad of diseases still needs to be clarified. Thus research is needed to whether the degree of efforts to strengthen surveillance systems is led in areas where more severe climate changes occur.

surveillance can give information for policy-makers to act on ch will help to reverse the trend of infectious diseases. Regulations controls should be targeted at population growth, urbanization, deforestation. Stronger emphasis must be placed on strengthen- public health policy and public health rules that have been egulated to give more rights to individuals but consequently, might m the public at large. A better balance between individual rights the good of the community must be established.

The public health infrastructure (including surveillance systems) many countries, particularly in the developing world, must be proved, including personnel and laboratory facilities to deal with major infectious diseases.

A key strategy is to rethink disease prevention from the public lth standpoint, emphasizing disease prevention that includes such itegies as general hygiene, vaccines, vector control, public outreach, l education.

Surveillance systems for effective infectious disease prevention ıst provide information to promote:

- ffective emergency responses to outbreaks of disease
- public and professional outreach to communicate important nformation effectively to key stakeholders such as the public, doctors, and government officials
- effective community-based preventive strategies.

tive surveillance: a case study from India

gue in India is a useful example to highlight the need for ernational co-operation and surveillance. In the first 25 years of the entieth century, India lost about 12 million people to plague. The vernment launched an effective control programme, and in the 50s plague was mostly brought under control. In 1959, plague had en eliminated from India, and in 1966, India was declared plague e. Subsequently, very little effort related to the control of plague was rried out. There was no laboratory doing diagnostic work for plague. August 1994, an outbreak of pneumonic plague began in aharashtra and moved into the city of Surat by September. The rveillance system did not pick it up. No one knew about it, not even e WHO. People started dying of pneumonic types of haemorrhagic seases in Surat, an industrialized city of several million people. Some octors consulted their old books and realized that it could be neumonic plague. They sent samples to the laboratory for diagnosis, ut the laboratory could not diagnose it. This created confusion, ncertainties, and a lack of confidence among medical communities. eople panicked and 500 000 people fled the city of Surat. The WHO ontacted the United States Centers for Disease Control (CDC) for ssistance in identifying the microbes because it had the only unctional plague diagnostic laboratory in the world. The CDC sent references and diagnostic kits to 15 countries in Southeast Asia and Europe. The WHO and the CDC were working blind and had to assume the worst. People from Surat fled to Madras, Bombay, and other cities worldwide, spreading the problem. There were reports about the spread in New Delhi and Pakistan, and the CDC worked with the WHO to intensify surveillance. Fortunately, rumours about the spread to other countries worldwide proved to be a false alarm and there were no cases identified from countries outside India. In retrospect, it was discovered that there was an outbreak of plague in Maharashtra and a few cases in Surat. There was no transmission to Bombay, New Delhi, Madras, and Calcutta. The lack of laboratory diagnosis capability had caused an epidemic of panic. There was a loss of 2 billion American dollars from the Indian economy and probably several billion dollars from the global economy. What should have been a focal public health event turned into a worldwide emergency. The WHO is not a policing organization and its actions are limited if countries do not want to co-operate.

The goals of active surveillance include:

- to detect without delay the introduction of change in incidence of a specific disease agent: active surveillance has to be disease specific although there are some exceptions
- to alert pubic health officials early about the epidemic—an early warning system (the emphasis is on the pre-epidemic period as opposed to the epidemic period)
- to assess the extent of the risk of transmission of a particular disease
- to estimate and monitor the effectiveness of control activities.

Active surveillance usually has to be laboratory based. The case definitions of an active system can vary. Case definitions can be non-specific in the pre-epidemic period but become more specific during the epidemic as the incidence increases. There must be standardized sample collection and reporting. The surveillance tool must be convenient and easily transportable (Frerichs *et al.* 1994; Cassol *et al.* 1996*a*,*b*).

When a clear disease definition is not available, syndromes can be used to cover multiple diseases. For example, although the basic diagnosis of dengue has to be laboratory based, a syndromic approach may also be used to increase case detection. The syndromic approach for dengue consists of three surveillance systems: clinic doctors, fever alert, and sentinel hospitals. When a syndromic approach is used, the case definition is very non-specific but should later be supplemented with more definite diagnostic techniques. In the case of dengue, the clinics and the hospital will be asked to submit to the laboratory information on a quarter of their viral syndromes every week. Fever alert allows blood to be taken for laboratory confirmation within 24 hours. Hospital deaths of all viral syndromes should similarly be laboratory confirmed and ideally autopsied (difficult in many countries). Individually, none of the three approaches is sensitive but collectively they become so. Clearly, the laboratory is critical to this type of effort.

The laboratory must be able to (a) conduct routine surveillance for priority diseases important in the area, (b) focus on epidemic transmissions of priority diseases, and (c) recognize new diseases, natural disasters, imported diseases, and bioterrorism.

At a minimum the laboratory should be able to conduct surveillance on priority diseases. If it is not capable of detecting the broad spectrum of new and other infections there must be some reference laboratory in the region such as a WHO reference laboratory where samples can be sent for identification and confirmation. Ideally, every country should have a national laboratory with satellite laboratories at the district and local levels. However, this can be beyond the means of poor countries. A more efficient way of sharing existing resources is to map out existing laboratory facilities in a region, co-ordinate sharing and standardization among them, and develop new facilities, which might be needed in the region. WHO reference laboratories should be capable of a wide array of diagnostic procedures. The WHO can also link up with other sophisticated laboratories such as the CDC in the United States.

Every national laboratory should have some well-trained personnel, enough facilities, equipment, and basic microbiology capacity. State-of-the-art technology such as the polymerase chain reaction assay is important but not as important as basic microbiology, which has frequently been ignored. The capacity to perform polymerase chain reactions at the expense of basic microbiology is a mistake because sophisticated equipment inappropriately used can create data that are misleading.

A mechanism should be in place to ensure quality assurance so that people have confidence in laboratory results.

Once an infection has been identified, the standard public health measures must be actively applied such as the identification of individuals, implementation of quarantine, implementation of sanitary regulations, the sacrifice of infectious sources such as animals, and measures to heighten precautions by individuals at risk. With acute emerging virus infections, there might not be time to develop vaccines and to find a treatment. In such cases, public health precautions will be the key coping measures. With bacterial infections, available antibiotics can be resorted to, some of which may be helpful.

Another example to highlight the importance of the laboratory is the concern for yellow fever. Yellow fever is a time bomb. An increase of yellow fever has occurred in Europe and the United States. This means that it can also be taken to Asia, and might remain there undetected because of insufficient laboratory capability. In the 1930s, there were major epidemics of yellow fever in Latin America. In 1947, the Pan American Health Organization implemented an *Aëdes aegypti* eradication programme to control the epidemics of yellow fever and dengue. By 1970, they had eradicated cases in much of Central and South America but they then abandoned the programme. *Aëdes aegypti* began to reinvade tropical America. There is the highest risk in 50 years for the occurrence of yellow fever in urban areas. If urban yellow fever begins to occur in Latin America with 300 million people, it will spread to other urban areas, particularly those with populations of over 1 million. This may also happen in Asia owing to ease of transport and travel. When this happens, the medical and public health communities might impute the illness to dengue, malaria, or leptospirosis. Therefore, the laboratory must be able to distinguish yellow fever from other diseases so health professional can react quickly and appropriately.

Passive surveillance

Passive surveillance is most useful for monitoring long-term secular trends but is relatively insensitive to tracking epidemics. Most countries have a passive surveillance system. The key components of a passive surveillance system include the use of standardized case definitions and a standardized reporting system.

Passive surveillance relies on doctors and health officials to report diseases and therefore is very insensitive for predicting epidemics. Constant communications, reference, and referral, together with political and economic support, are all crucial components of both active and passive surveillance systems.

Effective emergency response: a necessary complementary measu surveillance An effective emergency response is an important element necessary for the effective prevention of the spread of infectious diseases. Good co-ordination between epidemiologist, laboratory personnel, and professionals in the field is critical. Effective control has to be disease specific. Knowledge about the dynamics of transmission is essential. Furthermore, there must be strong community involvement for sustainability and a real-time response and timely policy decisions. Even when a surveillance system has predictive capability, many policy-makers do not believe the surveillance data and, as a result, do not respond to the data quickly enough. Therefore, laboratory capability must be credible and understandable so that rapid decisions are made in real time rather than after the epidemic spreads or peaks.

Outreach: empowering the community to be integrated in surveillance diagnosis and control Outreach is an area where public health has failed. Despite the availability of health education materials by public health specialists for all kinds of diseases and health problems, people usually ignore them. Social scientists and medical anthropologists who know how to communicate with the community should be encouraged to play a greater role in developing health education messages. The use of the 'scatter-gun' approach, having one message for all recipients with diverse ethnosocial background, is unlikely to succeed. Education messages should be targeted at different groups, particularly the medical community (epidemiologists and doctors who must be well versed in diagnosis, treatment, and disease prevention), who use them to reach the public. The public must accept their own responsibility and not rely on the government to do everything. Government officials must make an honest assessment of what the epidemiologists have to say and must not have 'selective hearing', for example questioning epidemiological data to protect local tourism.

An integrated community-based approach must have common ownership and an emphasis on disease prevention. The approach must take advantage of all the updated technology and instruments available to cope with the epidemic and prevent disease. People must have a role in the programme and in setting the priorities of the programme. Government officials must not simply tell people how to do things. Without community ownership there is no sustainability. Policy decisions have to support a community-based approach.

Sentinel surveillance

A sentinel surveillance system can help to identify rapidly changing health problems in a country or community (Box 9).

Selecting sentinel sites

- Not necessarily representative sites
- Likely to identify problems
- High enough case load
- Staff capacity and willingness
- Data reliable
- High-quality diagnostic capabilities

good example is surveillance for HIV/AIDS to monitor the iveness of intervention programmes in Thailand.

sentinel surveillance, the main objective is not to achieve sentativeness of a health problem or an epidemic of the entire lation. Rather, the objective is to track an approximate pattern or of the situation on which to base interventions. Sentinel illance allows monitoring of trends in specific groups within the nunity. Thus in Thailand, monitoring the year of first use of n can provide an estimate of when the next heroin epidemic may . Sentinel surveillance has been able to monitor the pattern of nfection among the people engaging in high-risk activity such as addicts, commercial sex workers, those infected with sexually nitted diseases, expectant mothers, and military conscripts kesorn *et al.* 1998).

ie results of sentinel surveillance must be interpreted with care. ritical factor is the issue of population change among different les to estimate the magnitude of health problems. A prevalence of r cent of HIV-positive people among drug addicts may give the ession that the situation of HIV spread has been stabilized. New of HIV-positive people among military recruits can give a better ate of the trend in HIV-related problems in a country or unity. However, the interpretation may be invalid if the rate of nfection equals the rate among the addicts who disappeared from etection of the sentinel surveillance system either through tion or death.

ning

bjective of a screening programme is to detect health problems at ly stage and link the problems with services which are effective in fying the natural history of the diseases or to prevent cases with ic diseases such as HIV infection from spreading infection to nfected contacts.

ie target for screening can be the general public as well as those ed in high-risk activity. Genital chlamydial infection is a ion sexually transmitted infection that is often asymptomatic, associated with long-term morbidity in many women. Early ion can be diagnosed reliably using non-invasive methods and d effectively with antibiotics. Screening for genital chlamydial ion in high-risk settings, such as genitourinary medicine and ion clinics, has already been documented (Stephenson 1998). ning in the wider community also needs to be evaluated since ydial infection is widely distributed among young sexually people who may have little contact with health services. Studies n progress to assess the acceptability of different screening aches for both women and men in the community, and to are the performance of newer diagnostic techniques. The ffectiveness of community-based screening for reducing mor- needs to be evaluated empirically in randomized trials to rage a coherent, evidence-based screening policy (Stephenson

vestments in national screening programmes should be based on its to the people who are found to be positive who can then be intervention treatment or monitoring. Ideally, the evidence of benefits should be strong such as evidence from a randomized ol trial. In the United Kingdom, a national programme to screen orn infants for phenylketonuria was introduced in 1969, ved in 1981 by a similar programme for congenital hypothyroid- Decisions to start these national programmes were informed by evidence from observational studies. Subsequent national registers of diseases were used to measure the impact of the screening programmes. Differences and changes in infrastructure and standard instruments for screening within and between screening facilities over time can result in inconsistent policies and inequitable access to effective screening services, as well as to problems in the comparability of information. More recent developments in tandem mass spectrometry have made it technically possible to screen for several inborn errors of metabolism in a single analytical step. However, the availability of the instrument should not prompt decisions for screening. In fact, for each of these conditions, evidence is required that the benefits of screening outweigh the harm, ideally informed by evidence from randomized controlled trials. Setting a priority on what conditions should be formally evaluated can be an important challenge to the public health, clinical, and scientific communities (Dezateux 1998). Screening programmes have the potential to reduce the burden from mortality, morbidity, and disability, and to improve quality of life and livelihood, but they also have the potential to cause harm. A set of criteria will be needed to identify worthwhile screening programmes, develop strategies, and mount effective implementation that is agreed upon by stakeholders. A much more critical approach to screening is now being adopted. Efforts are being made to ensure that new programmes of proven benefits that are acceptable to the public, are effectively and equitably implemented in the community particularly if the resources from such a screening programme come from taxation. This issue will stimulate further discussion and debate among important stakeholders (Peckham and Dezateux 1998).

In developing an expensive screening programme, one criterion is to redefine the unacceptable by the stakeholders particularly the community. For example, the community might decide that it is unacceptable to have children infected with HIV. If so, couples will be encouraged to be screened and counselled for HIV infection if they decide to have a child. It is imperative to strengthen the community-based programme. Unless healthy populations and healthy communities decide to be involved, screening programmes will not be very effective. The communities must be encouraged to help providers and decision-makers help themselves.

Survey and special studies

The objective of a special survey is to gain insight into the nature and extent of a problem in a defined community. The problems to be surveyed may be suggested by information from routine reporting and the surveillance system. Surveys and special studies can answer a particular question relevant to a community when routine systems cannot yield adequate information for action. Members of the community can be involved in such a survey not only as collectors of data or joint explorers of local conditions but also as partners in interpreting the data and in determining systematically how to manage a problem. The community can also shed light on the cultural meaning attached to a disease or a condition (MacQueen *et al.* 1996; Van Landingham *et al.* 1997). An understanding of the survey results as seen from the standpoint of the people will enhance an understanding of the problem and improve the dissemination of the results of surveys to the community and thus empower the community groups. Primary health care workers can be the most important group to engage in the dissemination of information to the individuals. In the Philippines, health-care workers learn to identify the mosquitoes responsible for the spread of malaria and help conduct and read blood smears.

One example of a survey is to assess whether universal condom use to reduce the spread of HIV infection was effective as suggested by routine surveillance (Mastro and Limpakarnjanarat 1995). A survey was conducted and showed that a low rate of condom use occurred in lower social class commercial sex workers, construction workers, and poor truck drivers. The seroconversion rates of HIV among these sex workers was shown to be on the rise (Sawanpanyalert *et al.* 1994; Mastro and Limpakarnjanarat 1995; Kilmarx *et al.* 1998). Many commercial sex workers did not use condoms if they were entertaining 'regular customers', if they drank, or if they believed that healthy people had no risk of HIV transmission (Vanichseni *et al.* 1993). The special survey was an important supplement to the information gathered from routine surveillance for designing effective control strategies.

A special survey was also conducted among housewives in Thailand to clarify the reasons for a rise in HIV infection in pregnant women. The survey showed that there was a significant difference in attitude between the Thai housewives who were HIV positive and those who were HIV negative. Those who were HIV positive were not confident at discussing HIV disease with their partners. They were also less likely to tell their partners first if they were infected (Suwanagool *et al.* 1995). Special surveys also helped to clarify the risk of perinatal transmission (Shaffer *et al.* 1999), and the rate of discordance of HIV status between pregnant women and their partners (Siriwasin *et al.* 1998). This special study helped to design a public health campaign aimed at addressing the increase in HIV prevalence among pregnant women discovered from the sentinel surveillance system.

Training of interviewers and enumerators for valid data collection is required for epidemiology studies. Qualitative data to identify variables meaningful to a community, reflecting their voices, and bringing in the human dimension of a problem can be a powerful complement to epidemiological surveys which highlight differences between groups. Therefore, public health surveys and special studies have embraced methods from the social sciences in the identification of variables for surveys as well as the interpretation, dissemination, and use of results.

Large-scale health surveys conducted by government agencies, which record information on a large number of health-related variables, are available for analysis. The information can be applied to estimate demographic profiles associated with possible lifestyles and biochemical determinants of diseases. It can also estimate the probability of receiving some clinical services and screening according to the type of health insurance, the probability of receiving a digital rectal examination, and the effectiveness of community intervention to encourage positive lifestyles such as smoking cessation (Graubard and Korn 1999). Special studies which follow cohorts can detect changes in epidemics and behavioural factors (Limpakarnjanarat *et al.* 1999).

Rapid surveys

The objective of a rapid survey is to collect information required to make decisions to cope with urgent health problems when the true nature and extent of the problem is unknown. Large surveys are usually expensive and cannot be done frequently or timely enough to assess or evaluate health problems in a specific area. Furthermore, it is unwise to infer the results of a large general population survey for local planning (Smith 1989). A rapid survey can be used to collect population-specific information on health situations, on possible determinants of disease, and on knowledge, perceptions, and cultural aspects of illnesses. A typical rapid survey can be carried out by sampling 30 clusters of seven to ten respondents (or households), each covering 200 to 300 household interviews (Henderson and Sunaresan 1982; Frerichs and Tar Tar 1989). These methods have been used to assess the status of immunization, family planning, and use of antenatal services.

Contact tracing

Contact tracing is particularly useful when information from routine systems and surveillance suggests the need for a clarification of the pattern of the spread of diseases (Box 10). It is also useful to estimate acute illness episodes and disease problems among illegal migrants and mobile ill-defined populations such as tourists and migrant workers. The purposes of contract tracing (community visiting team) are to confirm the diagnosis, determine the extent of secondary transmissions, and estimate the pattern of risk behaviours.

Purpose of contact tracing

Confirm diagnosis and find causes
- Behaviour risk estimates
- Estimate magnitude of problems
- Identify possible control measures
- Identify where/to whom to apply control measures
- Recommend control measures

Contact tracing can lead to more cases contacting the patients who failed to come to receive service from the health-care system and thus increases the validity of the estimates of the magnitude of problems. In addition, better targeting of control measures can be a desirable outcome, leading to increased efficiency of the health system.

Contact tracing was carried out for heroin users seeking treatment from Samutprakarn Hospital in Thailand (Table 3) to identify the magnitude of needle-sharing behaviours among the confirmed addicts.

Through contact tracing, drug use and needle sharing were identified as a mode of spread of HIV infection from the urban to rural

Table 3 Drug use and travel pattern of 731 injecting heroin users treated at Samutprakarn Hospital

Ever travel and stay over night in other province	38.9%
Reasons for travelling	
Holiday/sociocultural ceremonies	45.6%
Occupational/personal business	39.5%
Visiting friends/relatives	16.8%
Drug injection while travelling	59.5%
Needle sharing	24.7%
Borrowed from someone	6.3%
Lent to someone	10.6%
Borrowed from and lent to someone	7.8%

result gave rise to the design of a prevention programme ·educing needle sharing among addicts during travel. ıcing could also document the spread of HIV infection victs through needle sharing in prisons.

ional travel can be one of the major modes of transmission imates of contacts of tourists with sex workers, beach boys, ge parlour attendants through surveys and contact tracing arify the magnitude and pattern of disease transmission al. 1993). Migration also occurs across borders for jobs in n, factories, logging, and commercial sex work (Asian enter for Migration 1999).

tration and census

ration relies on the requirement by law to report health uding birth and death. These figures can be obtained from l statistical offices and relevant departments such as health, ucation, and the ministry of interior. Many countries also dic censuses every 10 years.

are examples in developing countries where events are orted due to the lack of quality assurance of the reporting en to document all deaths. For example, the accuracy of nd infant mortality rates in most developing countries is le. The perinatal and infant mortality rates in a rural district d as measured from surveys were compared with the official o assess accuracy. All stillbirths and 45 per cent of infant re unregistered (Lumbiganon *et al.* 1990).

tion, the inaccurate enumeration of deaths and inadequate ertification of deaths in developing countries limits the infer the cause of death, particularly in those occurring ospital or clinical settings. In Thailand, the causes of were defined only in about 40 per cent of all deaths. Verbal nd lay reporting have been used as methods for estimating of death (Snow and Marsh 1992; Kleinman 1978) through ered from relatives and friends. Verbal autopsy has been ed for the diagnosis of causes of child mortality. Standard ve been developed for the diagnosis of common causes of mortality to allow a comparison of the results of different ang and Bang 1992). Such standard criteria will be needed to lata on cause-specific mortality for evaluating disease e and for targeting, monitoring, and measuring the impact ntions.

ıation of several methods: an example

nic disciplines for community diagnosis have both strengths nesses. To solve a public health problem adequately requires om several disciplines and approaches either through g multidisciplinary teams or training public health rs to move beyond disciplinary boundaries.

bination of several methods has been used to understand the s of HIV infection in Thailand. An epidemic among drug predicted by routine reporting from various drug dependatment centres (Ministry of Public Health 1997). In addition, nformation from drug dependency treatment facilities a the spread of the epidemic from Bangkok to the pro the urban to rural areas. Different incidence rates emic s geographical areas at any point in time. The population c regional areas, such as the hill tribes drug discussed above, most likely occurred at different times from 1987 to at least 1995 if not after (Beyrer *et al.* 1997). HIV infection in non-injecting drug users consistently persisted due to sexual behaviour. Contact tracing showed that travelling, needle sharing, and imprisonment interfere with intervention efforts to stop the spread of HIV infection. Periodic special surveys showed that a reduction of risk behaviours such as needle sharing could be achieved in a relatively short time with timely implementation of appropriate interventions. They also documented the epidemiological evolution of HIV-1 subtypes B and E among heterosexuals and injecting drug users in Thailand (Limpakarnjanarat *et al.* 1998; Poshyachinda 1993*a,b*). Moreover, routine reporting and sentinel surveillance supported the notion that the prevalence among injecting drug users in the rural population and minority groups was still low when preventive interventions were introduced. Nonetheless, the prevalence in these populations increased to the level of Bangkok and the central region.

Sentinel surveillance has demonstrated the development of infective pools of HIV infection among intravenous drug users and commercial sex workers in Thailand. Special surveys and contact tracing among the clients of sexually transmitted disease clinics and among the migrant workers helped clarify the transmission among the high-risk and socially deprived groups. Also, through the sentinel surveillance of pregnant women visiting antenatal clinics, military conscripts, blood donors, and outpatient clinics, the epidemic was shown to have spread from the infective pool and high-risk populations to the general population, and subsequently demonstrated the reduction of the rate of the epidemic through effective control (Fig. 4). The story of an information system and various methods for community diagnosis of HIV infection has emphasized the need for a combination of approaches to understand the evolution of a public health problems as well as the effectiveness of control measures. It also showed the value of various types of information system in explaini aspects of epidemics leading to effective control.

Finally, the information system and attempt at co diagnosis will only be possible if done in concert w commitment and effective administration and plan ances the evidence and values collected from diff within the society (Phoolcharoen *et al.* 1998*a*,

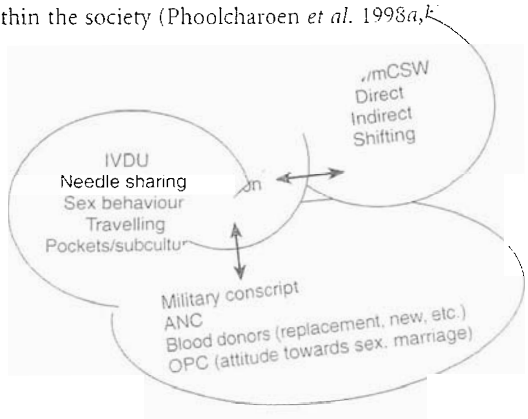


Fig. 4 Model of transmission of HIV infection in Thailand derived from various methods of community diagnosis. IVDU, intravenous drug user; STD sexually transmitted disease; CSW, commercial sex worker; ANC, antenatal clinics; OPC, outpatient clinics.

Technological limitations of information systems and community diagnosis

Even if the data for community diagnosis are valid, methodological advances are still needed to help set priorities for health needs.

Estimates of lifetime effects on individuals with particular health problems

Many health measures such as person years of life lost, healthy days of life lost, disability-adjusted life years, and quality-adjusted life years attempt to introduce time dimensions to the evaluation of health and diseases. These measures are not likely to correspond to social preferences and social investment in the individuals before death occurs. The social preferences probably vary between cultures and therefore an attempt to make global estimates using common measures might not be valid to compare burden of illness. Particular care must be used if these measures affect the allocation of resources across countries.

Effects of health problems of individuals on their relatives

The loss of the main source of income through death is not equivalent to the death of a dependent in a family. Therefore, deaths will not be equal among members of a household depending on many factors. These include the changes in social status caused by widowhood or orphanhood, changes in the dependency ratios of the household, and the reallocation of work responsibilities between household members. Other significant factors are the reallocation of domestic responsibilities, changes in major sources and the levels of income of the household in which deaths occur, changes in ownership and indebtedness, and expenditure due to medical bills or funeral costs.

Therefore, the community needs to be consulted to see whether the community diagnoses accurately reflect their perceptions of the values given to deaths and illnesses, particularly when decisions on the allocation of limited resources will be based on such a diagnosis.

Universities have a definite role in helping to overcome the technological limitations of information as well as to guide and direct the society with respect to appropriate community diagnosis and appropriate control measures. Academics should meet the challenge and accept responsibility not only by teaching and in-depth research but also by advocating the most appropriate methods for community diagnosis in the light of limited resources.

Information systems of developed and developing countries

In developed and developing countries, mortality reporting, registrations of some diseases (such as cancer), routine reporting, and census data have been the main sources of information used to estimate the burden of health problems. These generally have been supplemented by household surveys and periodic population-based survey such as the National Health Examination Survey, the National Health and Nutrition Examination Survey, the Health and Welfare Survey, contact tracing, and several population surveillance syst notifiable diseases.

However, the most significant difference between the informati systems of developed and developing countries is the accuracy routine statistics, particularly with respect to the cause of mor Thus, in Thailand, data collected for cause of death suffered fr under-reporting. In addition, nearly half of the reported deaths we classified under ill-defined causes (Samutharaks *et al.* 1997). Ev when deaths occur in hospitals, only a small percentage under autopsy (less than 10 per cent for large hospitals in Thailand). In so developed countries, linking records of repeat events occurring individuals has been used to reduce the errors in recording the caus deaths, dramatically reducing validity problems (Archeson 1966). to the validity of morbidity data, even Western countries have varia notification of infection, with poorer notification for milder infecti (Benjamin 1968). For diseases like cancer with a much longer natu history, most patients are likely to be registered.

The chief challenge of information systems in developed countri is how to ensure that the pressure of new but untested technology do not dictate the acquisition of high-technology equipment to track operation of managed care. Recently, large budgets have been allo to information systems in large health-care networks such as Kaiser-Permanente's Northern California Region ($1 billion o 7 years), Health Care Sacramento ($27.5 million over 5 years), Sutler Health ($150 million over the next 7 years) (Morrissey 19 How much the gain in health will mirror the extent of the increas the efficiency of service delivery remains to be investigated. Moreo there is a tendency for further investment in telemedicine and expansion of fibre-optic capacity. This trend will complicate information systems are used to track the allocation of resources appropriate reimbursement for patient care. Whether the increm increase in the investment in information systems will produ proportional gain in health of the community is a valid and unanswered question.

Developing countries must not be trapped into investing in h technology for sophisticated information systems beyond their n Some guidelines might be useful for decisions on the effe information system projects. Firstly, the involvement of the sy users from the beginning is desirable for establishing a clear realistic goal. Secondly, a complete review for existing solutions be in place before deciding on investing in high technology. Th some assurance of adequate support and continuity from the ve must be obtained since developing countries will be very depen on the support system. Finally, the reality of the organizat constraints on the systems must be taken into account, for exam the adequacy of human resources to operate the system. Therefo is important to 'think big' (holistic manner), 'start small' (adop evolutionary not a 'big bang' approach), and 'act rationally' accor to the need to advance the objectives of the health-care system (W 1994).

However, developing countries must invest in resources to ca essential information on health problems and trends (the reso used, utilization, costs, and outcomes of public health proble decide whether an investment in health care will yield the out described in the objectives of the health-care system. An inform system is not for gathering information via sophisticated techn It is for giving evidence to stakeholders to solve health problem an accepted method of conflict resolution.

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PRESCRIPTION PATTERN FOR TREATMENT OF HEMORRHOIDS UNDER THE UNIVERSAL COVERAGE POLICY OF THAILAND

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Abstract. The Universal Coverage Policy (UCP) or “30 Baht Scheme” was launched in Thailand in 2001. The policy caused a cutback in the budgets of all public hospitals and health service centers. Traditional medicine was then viewed as an alternative to save costs. This study examines whether this had any influence on hemorrhoid treatment prescription patterns, ratio of traditional/modern medicine, or the cost of hemorrhoid treatment after the UCP was implemented at a community hospital. The traditional medicine prescribed was Petch Sang Kart and the modern alternative was Proctosedyl. All hemorrhoid prescriptions at a community hospital from October 2000 to January 2003 were surveyed. Segmented Regression Analysis was applied to evaluate prescription trends, the ratios between the types of medicine, and the hemorrhoid treatment cost. A total of 256 prescriptions were analyzed. The average number of traditional medicine prescriptions per month were more than modern medicine (41 *versus* 16). During the study period, the trend of modern medicine use and the treatment cost was decreased ($p<0.01$). The ratio of traditional/modern medicine increased 0.2 times ($p=0.02$).

INTRODUCTION

Hemorrhoidal problems are common, affecting millions of men and women in the United States and elsewhere (Digestive Disease Statistics, 2003). A large database survey conducted in the United States and England found a prevalence of about 4%, with approximately 10 million people in the United States alone reporting symptoms associated with hemorrhoids. In general, the development of symptoms before age 20 was usual. About half of all people by age 50 have hemorrhoids to some extent (Faccini *et al*, 2001). Women may begin to have hemorrhoids during pregnancy. Johanson and Sonnenberg (1990) asserted that hemorrhoidal disease is most frequent in ages 45 to 65 in both genders, and declines thereafter. Hemorrhoids usually do not pose a danger to health, however, chronic bleeding from hemorrhoids may lead to anemia.

In Thailand, the perception is that hemorrhoid are a minor, temporary problem. In most cases, hemorrhoid symptoms resolve spontaneously within a few days. There is a lack of database information on the nature and extent of hemorrhoids in Thailand. Clinical data from Mae On Hospital (2002) suggests that it is a significant problem.

The Universal Coverage Policy (UCP) or “30 Baht Scheme” for each visit or admission was launched in Thailand in 2001(Towse and Mills, 2004). The policy has effected budget allocations to health service centers and public hospitals. The hospital has to reduce the cost of treatment, due to increasing demand and a constrained budget. Some hospitals have implemented this policy by prescribing traditional medicines to lower the cost of treatment under the UCP. Mae On Hospital is a 10-bed community hospital in Chiang Mai. It launched its policy of using traditional medicines in 1994. In 1995, a traditional medicine center at Mae On Hospi-

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tal was established for alternative treatment and cost-reduction. The traditional medicines used include Andrographis Paniculata, Cissus Gradrangularis Linn., (Petch Sang Kart), Curcuma Longa Linn. and Galic, produced by the local people at Mae On Hospital. In addition, well-trained traditional medicine specialists from the Ministry of Public Health supervise the local people from time to time to ensure the quality of the medicines.

This study aimed to assess the trends of hemorrhoid prescription writing, by comparing the number of traditional and modern medicines prescribed, and comparing the ratio of the medicines, and the cost of hemorrhoid treatment before and after the UCP implementation at Mae On Hospital. Petch Sang Kart and Proctosedyl are the traditional and modern medicines prescribed to patients with hemorrhoids. In order to explore the impact of the UCP on hemorrhoid treatment, the average number of prescriptions before and after policy implementation was observed monthly.

MATERIALS AND METHODS

Design

Interrupted time-series design with retrospective data collection.

Study site

Mae On Hospital was chosen to observe the trends of traditional and modern medicines, and the cost of treatment. Petch Sang Kart is a traditional medicine, and Proctosedyl is a modern medicine prescribed to patients with hemorrhoids. This study was carried out over 28 months, 12 months before and 16 months after implementation of the UCP.

Methods

All hemorrhoid prescriptions at Mae On Hospital during October 2000 to January 2003 were collected. The trends of prescriptions, cost of traditional and modern medicines were compared before and after the universal coverage scheme. The total number of hemorrhoid prescriptions during the study period was 256. Over 60 % of the prescriptions were female. The patients were between 10 and 81 years old, with an average age of 46 (SD= 15.21). Most of the patients received traditional medicine; half of them received both traditional and modern medicines. The number of drugs prescribed per visit per month was examined to observe the prescription pattern. Segmented Regression Analysis was applied to identify changes, including gradual changes over time due to the UCP.

The units analyzed were the monthly mean number of medicines, the ratio between the mean number for traditional/modern medicine, and the average monthly cost of treatment. The average number of medicines per visit per month was calculated from the total number of medicines prescribed during that month, and divided by the total number of hemorrhoid patients during that same month. The ratio of traditional to modern medicines was from the average number of Petch Sang Kart per visit per month divided by the average number of Proctosedyl per visit per month. The average cost of hemorrhoid treatment per visit per month was calculated from the total cost of hemorrhoid treatment per month divided by the total number of hemorrhoid patients per month.

RESULTS

Medicine prescription per visit per month

The average number of medicines per visit per month during the study period indicated changes in prescribing patterns (Fig 1). The trend lines for Proctosedyl and Petch Sang Kart had different patterns of change. The trend line for Proctosedyl, both pre-and post-policy, did not change much, and remained stable, while the line for Petch Sang Kart was unstable. The number of Petch Sang Kart prescriptions per visit per month was higher than Proctosedyl's.

Ratio of medicine prescriptions per visit per month

The prescription pattern ratio of the average number of traditional medicine/modern medicines prescribed per visit per month is shown in Fig 2. The trend line was unstable pre- and post-UCP, and the ratio was high for the 18th month and at the end of the study (8.1 times and 7.9 times, respectively).

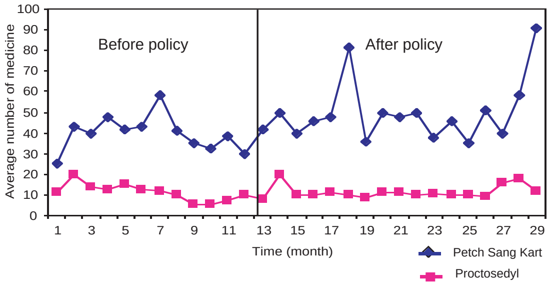

Fig 1–The average number of medicines per visit per month.

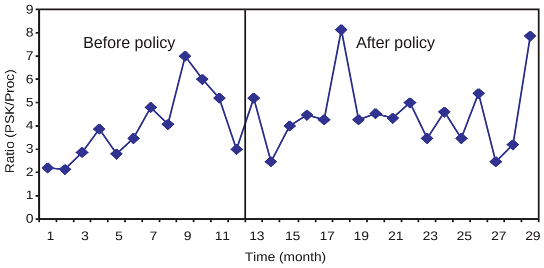

Fig 2–The ratio of medicine prescriptions per visit per month.

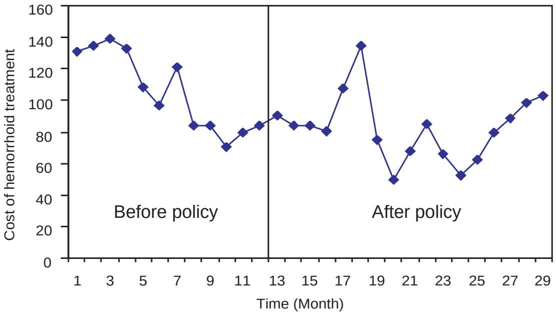

Fig 3–The average cost of hemorrhoid treatment per visit per month (baht).

Cost of hemorrhoid treatment

Fig 3 presents the average cost of hemorrhoid treatment per visit per month. The trend of the cost of treatment declined before UCP implementation. At the starting point of UCP implementation, the cost of hemorrhoid treatment was higher than at the end of the pre-policy period.

Segmented Regression Analysis

Segment Regression Analysis was applied to analyze the average number of medicines per visit per month, the ratio of the medicines, and the average cost of hemorrhoid treatment per visit per month (Table 1). At the beginning of the observation period, the average number of suppositories of Petch Sang Kart and Protosedyl per visit per month were 41.76 (95% CI: 25.43 to 58.09) and 16.77 (95% CI: 12.66 to 20.88), respectively. The average number of Proctosedyl suppositories decreased by 0.85 of a suppository ($p<0.01$). The ratio of traditional/modern medicine was 2.12 (95% CI: 0.26 to 3.97) and increased by 0.2 times ($p = 0.02$).The average cost of hemorrhoid treatment was 145.95 baht per visit per month (95% CI: 122.71 to 169.21). The cost significantly decreased by 6.11 baht during the observation time ($p<0.01$).

DISCUSSION

Segmented Regression Analysis is a tool to assess the prescription pattern and cost of the treatment. This analysis is appropriate to study effects of intervention conduced as part of a randomized trial as well as interventions that constitute a natural experiment. It also allows the researchers to control baseline levels and trends, and to assess how much the UCP changed the outcome of interest. Wegner *et al* (2002) asserted that Segmented Regression Analysis required data on continuous or counted outcome measures, summarized at regular, and evenly spaced intervals. Thus the prescription pattern of hemorrhoid treatment in the community hospital was observed before and after the UCP.

According to the recommendation of Wegner *et al* (2002), a number of time points before and after the policy and a number of observations at each point in the time series are sufficient to conduct segmented regression analysis. There was some missing data. The outliers were corrected by averaging the data. The Durbin-Watson statistical test for autocorrelation of the error term in the regression model showed no problems with autocorrelation (the value was 2.05), indicating an adjustment for autocorrelation was not required.

The results reveal that Petch Sang Kart was prescribed more than Proctosedyl during the study period. The trend of traditional medicine

Table 1
Segmented Regression Analysis of the average number of medicines per visit per month, ratio of medicine, and the average cost of hemorrhoid treatment per visit per month.

Medicine	b (slope)	95% CI	p-value
Traditional medicine (Petch Sang Kart; PSK)			
Constant	41.76	25.43 to 58.09	<0.01
Time points in months (1-29)	-0.32	-2.54 to 1.89	0.76
Implication of policy (0=before, 1=after)	4.92	-14.79 to 24.64	0.61
Time points in months after policy implementation	1.12	-1.46 to 3.70	0.38
R^2= 0.19			
Modern medicine (Proctosedyl)			
Constant	16.77	12.66 to 20.88	<0.01
Time points in months (1-29)	-0.85	-1.41 to -0.29	<0.01
Implication of policy (0=before, 1=after)	3.91	-1.06 to 8.87	0.12
Time points in months after policy implementation	0.97	0.32 to 1.62	<0.01
R^2=0.29			
Ratio of medicine (PSK/Proctosedyl)			
Constant	2.12	0.26 to 3.97	0.02
Time points in months (1-29)	0.29	0.04 to 0.54	0.02
Implication of policy (0=before, 1=after)	-1.16	-3.40 to 1.08	0.29
Time points in months after policy implementation	-0.27	-0.56 to 0.02	0.66
R^2= 0.21			
Cost of treatment			
Constant	145.95	122.71 to 169.21	<0.01
Time points in months (1-29)	-6.22	-9.37 to -3.06	<0.01
Implication of policy (0=before, 1=after)	15.66	-12.41 to 43.73	0.26
Time points in months after policy implementation	5.75	2.08 to 9.42	<0.01
R^2=0.52			

use was not different between the pre-policy and post-policy periods, while the level and trend of Proctosedyl use declined. Regarding the doctors' prescription, they prescribed 30 suppositories of Petch Sang Kart or 10 suppositories of Proctosedyl. Many factors were related to the prescription pattern, such as the number of doctors, treatment experience, and medical practice. The doctor was the most important factor influencing the prescription pattern. Some patients were prescribed Petch Sang Kart longer than the regular prescription due to the long distance between patient's house and the hospital. However, we found that there was only one doctor prescribing medicine in this manner at Mae On Hospital. Therefore, the main confounding was eliminated. Since the doctors tried to replace some modern medicine with traditional medicine, the ratio of medicine increased from the staring point through the end of the observation period (p=0.02). The cost of hemorrhoid treatment decreased from the staring point through the end of the observation period (p<0.01).

The average number of modern medicines, and the cost of hemorrhoid treatment has decreased. While the ratio of traditional/modern medicine has increased. This study demonstrates that modern medicine for treating hemorrhoids has had reduced use with an effect on the cost of treatment.

On initiation of the traditional medicine project at Mae On Hospital, traditional medicine for hemorrhoids was not known to the patients. However, most of the patients were satisfied with the traditional medicine after taking it because it is from the local wisdom. Traditional medicine is now requested to reduce the symptoms from hemorrhoids.

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