รายงานวิจัยฉบับสมบูรณ์

โครงการสนับสนุนกลุ่มวิจัยระบาดวิทยา

โดย วีระศักดิ์ จงสู่วิวัฒน์วงศ์ และ คณะ

กันยายน ๒๕๔๒

สัญญาเลขที่ RTA/13/2539

รายงานวิจัยฉบับสมบูรณ์

โครงการเมธีวิจัยอาวุโส (โครงการส่งเสริมกลุ่มระบาดวิทยา)

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สนับสนุนโดยสำนักงานกองทุนสนับสนุนการวิจัย

ชุดโครงการเมธีวิจัยอาวุโส

กิตติกรรมประกาศ

โครงการสนับสนุนกลุ่มวิจัยระบาดวิทยา (โครงการเมธีวิจัยอาวุโส วีระศักดิ์ จงสู่วิวัฒน์วงศ์) ได้รับการสนับสนุนทางการเงินจากสำนักงานกองทุนสนับสนุนการวิจัย (สกว.) และทางด้านการบริหารจัดการจากคณะแพทยศาสตร์และคณะต่าง ๆ ในมหาวิทยาลัยสงขลานครินทร์

งานวิจัยในโครงการนี้ ส่วนใหญ่เป็นการใช้ทรัพยากรร่วมกับแหล่งทุนอื่น ๆ ทั้งในและต่างประเทศ เช่น องค์การอนามัยโลกซึ่งหน่วยระบาดวิทยาเป็นสถาบันฝึกอบรมให้กับผู้ได้รับทุน รวมทั้งเป็นผู้รับทุนวิจัยบางโครงการ, DANIDA แห่งประเทศเดนมาร์ค, มหาวิทยาลัย Newcastle ประเทศออสเตรเลีย และสถาบันวิจัยระบบสาธารณสุข

Abstract

Project Code: RTA/13/2539

Project title: Enhancement of Epidemiological Research Group, Prince of Songkla University

Investigators: (All are from Faculty of Medicine, Prince of Songkla University)

Virasakdi Chongsuvivatwong	Alan Geater	Than Winn
Pitchaya Tuntiseranee	Sawitri Assanangkornchai	Korpchoot Tayakkanonta
Silom Jamulitrat	Ladda Mo-suwan	Hatcha Sriplung
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Project Period: 20 September 1996 – 19 September 1999

Objectives:

1. To produce high quality epidemiological research for the purposes of planning and evaluation of health care.
2. To increase the number of high quality epidemiological researchers

Methodology: various methods e.g. survey, case-control study, cohort study, randomized control trial and diagnostic test.

Results:

Twenty-six publications in international journals were supported by this Senior Research Scholar Program during the funded period. Eight are presented in this report. Eight Thai and five international Ph.D. students are enrolled in the program

Discussion and conclusion

This program has contributed remarkably to scientific development in Thailand and Asia.

Suggestion:

The program needs further funding to ensure continuation of success in the development.

Keywords

Health systems research, international training program, Epidemiology.

บทคัดย่อ

รหัสโครงการ: RTA/13/2539

ชื่อโครงการ: โครงการส่งเสริมกลุ่มวิจัยระบาดวิทยา มหาวิทยาลัยสงขลานครินทร์

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ระยะเวลา: 20 กันยายน 2539 – 19 กันยายน 2542

วัตถุประสงค์:

1. ผลิตผลงานการวิจัยทางระบาดวิทยาที่ช่วยการวางแผนและประเมินผลการให้บริการสาธารณสุข
2. ผลิตนักวิจัยทางระบาดวิทยาที่มีคุณภาพสูง

วิธีการ ใช้ระเบียบวิธีวิจัยต่าง ๆ เช่น survey, case-control study, cohort study, randomized control trial and diagnostic test.

ผลลัพธ์:

โครงการได้มีส่วนสนับสนุนงานตีพิมพ์ในวารสารนานาชาติรวม 26 รายการ ส่วนที่อยู่ในรายงานนี้ซึ่งระบุชื่อ สกว. ในกิตติกรรมประกาศ มี 8 รายการ (ทั้ง 8 รายการเป็นผลงานตีพิมพ์ที่ล่าสุดโดยก่อนหน้านี้ที่ไม่ได้ระบุไว้ในกิตติกรรมประกาศภายในวารสารว่าได้รับการสนับสนุนจาก สกว. เนื่องจากรู้เท่าไม่ถึงการณ์)

มีนักศึกษาระดับปริญญาเอกไทย 8 คน ต่างประเทศ 5 คน

อภิปราย

โครงการนี้ได้พัฒนาศักยภาพทางด้านการวิจัยของประเทศไทยและของเอเชีย

ข้อเสนอแนะ:

ควรสนับสนุนการพัฒนาแบบนี้ต่อไป

Executive Summary

This program is based at the Epidemiology Unit, Faculty of Medicine, Prince of Songkla University, in order to strengthen research capabilities of the epidemiological research group. Several research projects were initiated. Eighteen oral presentations were given in international meetings and 4 books were published. Thirteen Ph.D. students enrolled in the program and were involved in the research.

Twenty-six articles were published or accepted for publication in international journals under this support. However, only the most recent eight are presented in this report. The other articles are omitted because they failed to acknowledge support from Thailand Research Fund due to inexperience of the grantee. The following paragraphs summarize the nine publications. Details of each article are in the annexed reprints and manuscripts.

Masrul M, Chongsuvivatwong V, Geater AF. (1999) Factors associated with coverage of iodine deficiency disorders (IDD) control programs in an endemic area in West Sumatra Indonesia. *Asia Pacific J Clin Nutr.* 8(1): 13-18.

This is study was carried out in West Sumatra, the endemic area for iodine deficiency of Asia. The program contributed in designing, analysis and preparation of the report. 495 school children aged 6-15 years in one subdistrict were examined and the guardians interviewed. The coverage of iodine capsule distribution was 27% and 48% of the households used iodized salt with an appropriate concentration (>= 40 ppm). Mothers' lack of knowledge was associated with poor iodine capsule coverage whereas the rich and middle income families tended to miss the idodized salt. Thus education program should be fine-tuned to these poorly covered subgroups.

Tuntiseranee P, Chongsuvivatwong V. (1999) A survey into process and worker's characteristics in the furniture industry in Songkhla Province southern region of Thailand. *Southeast Asia J Trop Med Pub Hlth.* 92(4): 814-819.

This study was carried out to examine the manufacturing process and working conditions of this kind of industry in southern Thailand. Altogether 69 managers and 1,000 workers participated in the study. There are two main types of wood industry, rubberwood and hard wood. The rubberwood industry is semi-automated with advanced technology, has a female-dominated workforce of 200-300 workers per factory and overseas-market orientation. The hardwood industry is based in small–scale workplaces ranging from 20 to 60 workers,

domestic-market oriented and has a male-dominated workforce. Most of the workers were young, single, and of low education and the labor force undertaking arduous work with long working hours per week and a high turnover rate. Solvent was the most frequent chemical exposure. The person-year incidence of chemical exposure in female workers was higher than in male workers for every group of chemicals. The standardized fertility ratio of female wood workers was only 51.6% of that of the Thai female population. There was a high abortion rate among women who became pregnant inside the wood industry. Wood industry workers were exposed to occupational hazards and accident prone work conditions.

Chongsuvivatwong V, Ritsmithchai R, Suiyawongpaisal P, Chariyaleertsak S, Kosuwan W, Punyaratabandhu P, Sutiwipakorn W. (1999) High prevalence of drink-driving in Thailand. *Drug and Alcohol Review* 18: 293-298.

This study was conducted to measure the prevalence of drivers with a blood alcohol concentration (BAC) over 50 mg/dl and to identify predictors for such an outcome. A cross-sectional survey was conducted in 8 provinces in Thailand. In each province, with the collaboration of the police, one checkpoint in a suburban area and one on a highway were used to collect data on drivers of 29 motorcycles, 20 4-wheel and 20 6+ wheel motor vehicles, during 1300-1500h, 1700-1900h and 2200-2400h. For each subject, a breath test for alcohol was undertaken using standard breath testing instruments. 4,675 male drivers were tested. The crude prevalence of high BAC was 12.6% (range 5.4-23.7%). The differences in prevalence between the suburban area (8.7%) and the highway (8.4%) and between drivers tested on weekdays (9.8%) and on holidays (7.5%) were not statistically significant. The crude prevalence were 3.4-3.8% and 3.8-3.9% at 1300-1500h and 1700-1900h, respectively. During 2200-2400h the prevalence rose to 19.2% 16.0% and 11.9% among the motorcylists, the 4-wheel vehicle drivers and the 6+ -wheel vehicle drivers, respectively. High BAC among Thai drivers in the study period was very common, especially at night. Efforts should be focussed on these high-risk groups and this time period.

Chongsuvivatwong V, Nagnaen W, Uga S. (1999) Soil contamination and infection by soil-transmitted helminths in an endemic village in Southern Thailand. Accepted for publication in *Southeast Asian J Trop Med Pub Hlth.* 13 May 1999.

The aim of this study was to test the association between soil contamination and infection of the household members by soil-transmitted helminths in dry and rainy seasons. A lake-side community in southern Thailand with a population of 2340 was studied twice, in the dry season and rainy season. Fifty households were randomly selected. Soil samples near the

latrine, in the yard, at the foot-washing area and under the trees were taken and analysed for presence of helminthic eggs. All members of the selected household were interviewed and stool samples obtained. Age-adjusted odds ratios of presence of Ascaris and Trichuris eggs in the household soil for ascariasis and trichuriasis were 10.5 (95% CI 1.5-77.1) and 5.5 (95% CI 2.4-12.7) in dry season and 10.4 (95% CI 2.5-43.8) and 8.3 (95% CI 3.4-20.0) in rainy season. The levels of hookworm eggs detected in the soil were too low to test the association. Soil analysis for eggs of Ascaris and Trichuris may be used to predict infections among the household members but not that for hookworm.

Sangthong RC, Mo-suwan L, Chongsuvivatwong V, Junjana C. (1999) Secular increases in weight, height and body mass index among school children of Hat Yai: a 5-years follow-up study. Accepted for publication in *Southeast Asia J Trop Med Pub Hlth* on 25 June 1999.

Upward trends of growth and overweight have been reported from developed countries. As Thailand has been undergoing rapid economic transitions over the previous decades, we conducted the analysis to demonstrate the secular changes of growth over the five years follow-up. Subjects were a cohort of 2253 primary school children recruited in 1992 for Hat Yai Childhood Obesity Study. Baseline demographic and family data were collected by a questionnaire completed by parents. To quantify the cohort effect, a generalized estimating equations analysis was undertaken. Graphs of median weight, height, BMI and overweight prevalence of each birth cohort against age clearly show secular increases of growth and overweight and age effect. Children who were born one year later weighed 1.22 kg heavier, were 1.25 cm taller, and had a BMI of 0.23 kg/m^2 greater than those being born earlier.

Thongsuksai P, Chongsuvivatwong V, Sriplung H. (1999) Delay in breast cancer care: a study in Thai women. Accepted for publication in *Medical Care* September 1999

Breast cancer is the second most common cause of cancer death in Thai women. Cancer registry data reveal a high prevalence of late stage disease at diagnosis. Factors resulting delay in Thailand have not been investigated. The objective of this study was to determine the extent of, and the factors contributing to, delay in breast cancer care.

Women with breast cancer who were first treated at Songklanagarind Hospital between Jun 1994 and June 1996 were interviewed with retrospective chart audits of care. Dependent variables included patient delay (symptom recognition to first care) and system delay (first

care to treatment). Independent variables tested included demographic factors, help-seeking behavior and cancer knowledge. Non-parametric rank sum tests were used for univariate analysis and Cox regression was used for multivariate analysis. Hazard ratio (HR) from this type of regression reflects the relative risk for delay.

94 cases were included in the study. The median patient and system delay were 4 weeks. 26.6% and 24.4% of patient and system delay were longer than 12 weeks, respectively. Only marital status (unmarried compared to married women) was significantly associated with patient delay (HR 2.78, 95%CI 1.23-6.25). Contacting a provincial hospital instead of a university hospital as first medical care (HR 2.50, 1.23-5.26), being given a diagnosis rather than being told nothing (HR 2.04, 1.15-3.57) and being given treatment rather than being immediately referred (HR 4.55, 2.22-9.09) were associated with system delay.

Patient delay and system delay in breast cancer care are important weaknesses of disease control in Thailand. Educational program should target unmarried women who are at higher risk of delay. System delay in hospitals outside the university needs to be improved by a good referral system.

Tran TS, Jamulitrat S, Chongsuvivatwong V, Geater A. (1999) Risk factors for surgical site infections and febrile morbidity following cesarean section: a prospective study. Accepted for publication in *Obstetric & Gynecology* October 1999.

Cesarean section is one of the most common obstetric life-saving procedures. However, the operation often leads to infection and burden to the woman and the family. The objectives of this study were to determine post-cesarean infection complications and to identify the independent risk factors for surgical site infections.

A cohort of 969 cesarean sections from May to August 1997 was prospectively studied. Infections were identified by ward round, review of laboratory results and patient follow-up until 30 days after hospital discharge. Risk factors were identified via unconditional multiple logistic regression.

Surgical complications were rare. Febrile morbidity and infection complications were documented in 16.2% and 12.4% of subjects, respectively. Eighty-five subjects developed 95 surgical site infections (9.8%). Eight risk factors are independently associated with post-cesarean surgical site infections. Identified here are preoperative remote infections (adjusted OR = 16.1, 95% CI = 2.1-125.2); chorioamnionitis (aOR = 9.1, 95%CI = 1.8-45.2);

preoperative condition of patients (aOR = 5.1 for ASA score ≥ 3 95%CI=1.1-23.1); rupture of membrane (aOR = 2.5 for ROM ≥ 24 hours, 95%CI = 1.1-3.1); pre-eclampsia (aOR=2.2 95%CI = 1.03-4.7); higher body mass index (aOR = 2.0 for every 5-unit increment, 95%CI = 1.2-3.0); nulliparity (aOR = 1.8, 95%CI = 1.1-3.2); and increased volume of surgical blood loss (aOR = 1.3 for every 100 ml increment, 95% CI =1.1=1.5). Five factors were documented as independent predictors of febrile morbidity following cesarean section. They are chorioamnionitis (aOR = 16.0, 95%IC =3.1-83.3); preoperative condition of patient (aOR = 13.6 for ASA ≥ 3, 95%CI== 2.8-65.7), preoperative fever (aOR = 9.5, 95%CI = 3.8-23.7); pre-eclampsia (aOR = 2.4, 95%CI =1.2-4.6); and blood loss (aOR = 1.3 for every 100 ml increment, 95%CI = 1.1-1.5).

Teanpaisan R, Nittayananta W, Chongsuvivatwong V. (1999) Biotypes of Candida albicans isolated from HIV and HIV-free patients. Accepted for publication in *Journal Oral Medicine Pathology* October 1999.

This study was conducted to examine biotypes and antifungal susceptibility patterns of oral Candida albicans isolated from HIV-infected patients, HIV-free patients with candidiasis and healthy subjects. All isolates were biotyped using a typing system based on enzyme profiles, carbohydrate assimilation patterns and boric acid resistance. A total of 38 biotypes were found amongst 218 oral C. albicans isolates. The major biotype found was A1S, which accounted for 32.6% of all isolates and this biotype was the most common in all groups. There were more different biotypes of C.albicans in HIV-infected groups than the in others; however, there was no statistically significant difference between the groups. The minimum inhibitory concentrations (MICs) of a total of 118 isolates were determined for amphotericin B, and ketoconazole using the National Committee for Clinical Laboratory Standards (NCCLS) broth macrodilution method and the E-test. When the antifungal susceptibility pattern among the groups were compared, a statistically significant difference was found only with amphotericin B. The median MIC of amphotericin B in the HIV-infected group was higher than in the healthy group ($p = 0.013$, NCCLS's method; $p = 0.002$, E-test). However, this difference in sensitivity was not restricted to any sub-type investigated. Our results showed that the biotype patterns of C.albicans isolates that colonize HIV-infected patients are similar to those of HIV-free subjects, and there is no relation between antifungal susceptibility patterns and the biotypes.

เนื้อหางานวิจัย

Masrul M, Chongsuvivatwong V, Geater AF. (1999) Factors associated with coverage of iodine deficiency disorders (IDD) control programs in an endemic area in West Sumatra Indonesia. *Asia Pacific J Clin Nutr.* 8(1): 13-18.

บทนำ

ภาวะขาดสารไอโอดีน (iodine deficiency disorder – IDD) เป็นภาวะที่พบบ่อยในประเทศกำลังพัฒนา โครงการเมธีวิจัยอาวุโสได้ช่วยเหลือสถาบันวิจัยในประเทศอินโดนีเซียออกแบบการศึกษา วิเคราะห์ข้อมูลและตีพิมพ์รายงานฉบับนี้ในวารสาร

จังหวัด West Sumatra เป็นจังหวัดที่มีรายงานว่ามีปัญหา IDD สูงที่สุดของประเทศนั้น การวิจัยนี้มีวัตถุประสงค์ในการหาว่าการครอบคลุมของโครงการควบคุม IDD บกพร่อง ณ จุดใด เพื่อจะได้ปรับปรุงแก้ไขให้ดีขึ้นต่อไป

วิธีการ

สำรวจนักเรียนชั้นประถม 495 คน จาก 51 โรงเรียนในเขตอำเภอที่รายงานว่าระดับ IDD สูงที่สุด เก็บข้อมูลโดยใช้แบบสอบถามผู้ปกครองและเยี่ยมบ้านเพื่อตรวจตัวอย่างเกลือภายในครัวโดยใช้ชุดตรวจสอบมาตรฐาน

ผลการศึกษา

นักเรียน 133 คนหรือเพียงร้อยละ 27 ของตัวอย่างเท่านั้นที่ได้รับ iodine capsule ภายในหกเดือนที่ผ่านมา และครัวเรือนเพียง 235 หลังหรือร้อยละ 48 ของตัวอย่างที่มีเกลือซึ่งมีความเข้มข้นของไอโอดีนตั้งแต่ 40 ppm. ขึ้นไป เด็กที่ได้รับ iodine capsule มีแนวโน้มที่จะมีเกลือไอโอดีนที่บ้านด้วย

ครัวเรือนที่มาฐานะยากจนมีแนวโน้มที่จะมีเกลือไอโอดีนดีกว่าครัวเรือนที่มีฐานะปานกลางและฐานะดีตามลำดับ ในขณะเดียวกันนักเรียนที่ผู้ปกครองมีความรู้เรื่อง IDD ดีมีแนวโน้มที่จะได้รับ iodine capsule มากกว่านักเรียนที่ผู้ปกครองมีความรู้ในเรื่องนี้น้อย ระดับการศึกษาทั่วไปไม่มีผลต่อการรับ ioddine capsule จากโครงการนี้

อภิปราย

การศึกษานี้แสดงให้เห็นจุดอ่อนของโครงการควบคุม IDD ของประเทศอินโดนีเซียที่เน้นเฉพาะกลุ่มยากจนและละเลยกลุ่มฐานะดีและฐานะปานกลาง โครงการควบคุมนี้สมควรได้รับการแก้ไขให้ดีขึ้น

Tuntiseranee P, Chongsuvivatwong V. (1999) A survey into process and worker's characteristics in the furniture industry in Songkhla Province southern region of Thailand. *Southeast Asia J Trop Med Pub Hlth*. 92(4): 814-819.

บทนำ

อุตสาหกรรมไม้เป็นอุตสาหกรรมที่สำคัญในภาคใต้ เมื่อเศรษฐกิจและสังคมพัฒนามากขึ้น ความต้องการใช้ไม้มีมากขึ้น และมีคนงานเข้าสู่อุตสาหกรรมนี้มากขึ้นด้วย จำเป็นต้องมีการศึกษารายละเอียดเพื่อประกอบการวางแผนการควบคุมทางอาชีวอนามัย

วัตถุประสงค์ของการวิจัยครั้งนี้คือเพื่อศึกษากระบวนการผลิต (manufacturing process) ของอุตสาหกรรมไม้ในภาคใต้ โดยใช้จังหวัดสงขลาเป็นจุดศึกษาเนื่องจากเป็นจังหวัดที่มีความหนาแน่นของอุตสาหกรรมด้านนี้มากที่สุด

วิธีการ

ใช้ฐานข้อมูลโรงงานจากอุตสาหกรรมจังหวัดเป็นจุดเริ่มในการคัดเลือกและสุ่มตัวอย่างโรงงาน เกณฑ์การคัดเลือกคือ ต้องอยู่ในอำเภอหาดใหญ่ หรือ อยู่นอกหาดใหญ่แต่มีกระบวนการปรับปรุงเนื้อไม้ ทั้งนี้เพื่อจะได้ศึกษาขั้นตอนที่สำคัญในการปรับเนื้อไม้ซึ่งยังขาดความรู้ด้านนี้อยู่

ในขั้นสุดท้าย ได้คัดเลือกโรงงานทั้งสิ้น 69 แห่ง เก็บข้อมูลขั้นตอนการผลิตโดยวิธีสังเกตระหว่างการเดินผ่าน (walk through survey technique) หลังจากนั้นได้สัมภาษณ์กลุ่มคนงานตัวอย่างรวม 1,000 คน

ผลการศึกษา

พบการผลิตใหญ่ ๆ สองรูปแบบ คืออุตสาหกรรมไม้ยางพาราซึ่งเน้นการผลิตเพื่อส่งออก ใช้คนงานหญิงเป็นหลักประมาณ 200-300 คนต่อแห่ง และ ใช้เทคโนโลยีค่อนข้างสูง กับอุตสาหกรรมไม้เนื้อแข็งซึ่งเน้นการผลิตเพื่อขายภายในประเทศ มีแรงงานชายเป็นหลักประมาณ 20-60 คนต่อแห่ง และ ใช้เทคโนโลยีค่อนข้างต่ำ

ในอุตสาหกรรมไม้ยางพารา ผู้ชายจะควบคุมเลื่อยไฟฟ้าตัดให้ไม้ซุงเล็กลงและให้ผู้หญิงจุ่มไม้ที่เลื่อยแล้วลงไปในสารละลาย borax และ pentachhorophenol (ทุกคนไม่ได้สวมถุงมือ) เพื่อทำให้ไม้ยางแข็งและปลอดภัยจากแมลง จากนั้นจึงนำไม้ที่ได้ไปตัดให้เป็นชิ้นเล็กลงไปอีก เข้ารูปทรง อัดและทากาวภายใต้ความร้อนและแรงดันสูงแล้วจึงขัดให้เรียบและชักเงา

อุตสาหกรรมไม้แข็งรับไม้มาจากประเทศมาเลเซียมีการแช่ไม้ลงใน pentachlorophenol และ formaldehyde แล้วใช้ช่างไม้ชายประกอบให้เป็นกรอบหน้าต่าง บานประตูและเฟอร์นิเจอร์ต่าง ๆ

คนงานส่วนใหญ่มีการเข้าออกงานบ่อย (high turnover) ระยะเวลาการทำงานเพียง 0.4 ถึง 2 ปี ทำงานสัปดาห์ละ 6 วันและร้อยละ 61 ทำงานนอกเวลาด้วย อัตราการเกิดอุบัติเหตุสูงถึงร้อยละ 10.8 ต่อปี มีเพียงครึ่งเดียวเท่านั้นที่รายงานต่อกรมแรงงาน

คนงานส่วนใหญ่เป็นโสด ผู้หญิงที่แต่งงานแล้วส่วนใหญ่ใช้วิธีคุมกำเนิดวิธีใดวิธีหนึ่ง อัตราการแท้งค่อนข้างสูงคือประมาณร้อยละ 19 ของการตั้งครรภ์

อภิปราย

อุตสาหกรรมไม้ในภาคใต้เป็นอุตสาหกรรมขนาดใหญ่ที่มีความเสี่ยงสูงทั้งจากสารเคมีและจากอุบัติเหตุ นอกจากนี้ยังมีแนวโน้มว่าอาจจะมีผลไม่พึงประสงค์ต่อการตั้งครรภ์เนื่องจากอัตราการแท้งค่อนข้างสูง อุตสาหกรรมชนิดนี้จึงควรได้รับการดูแลควบคุมด้านอาชีวอนามัยเป็นพิเศษ

Chongsuvivatwong V, Ritsmithchai R, Suiyawongpaisal P, Chariyaleertsak S, Kosuwan W, Punyaratabandhu P, Sutiwipakorn W. (1999) High prevalence of drink-driving in Thailand. *Drug and Alcohol Review* 18: 293-298.

บทนำ

การขับรถโดยหลังการดื่มสุราเป็นสาเหตุที่สำคัญของอุบัติเหตุการจราจร ระดับแอลกอฮอล์ในเลือด (blood alcohol concentration หรือ BAC) ตั้งแต่ 0.05 mg/dl ขึ้นไปถือว่าเป็นระดับที่เป็นอันตราย

การศึกษาครั้งนี้เป็นการศึกษาสหสถาบันโดยความร่วมมือของห้ามหาวิทยาลัย ครอบคลุมพื้นที่ 8 จังหวัด เพื่อหาความชุกของผู้ขับขี่ยานพาหนะที่มี BAC ตั้งแต่ 0.05 mg/dl ขึ้นไป

วิธีการศึกษา

เลือกจังหวัดทั้ง 8 แห่งที่เคยศึกษาไว้แล้วได้แก่ กรุงเทพมหานคร, อยุธยา, เชียงใหม่, ตาก, นครราชสีมา, ขอนแก่น, สงขลา และภูเก็ต เก็บข้อมูลส่วนตัว (เพศ และ อายุและประวัติการขับขี่) โดยใช้แบบสอบถาม และวัดระดับ BAC โดยเครื่องตรวจวัดระดับแอลกอฮอล์ในลมหายใจ Lio Alcometer SL-400 และ PBA 3000

ในแต่ละจังหวัดมีจุดตรวจสองชนิดคือในเมืองและนอกเมือง อาศัยตำรวจจราจรช่วยหยุดรถ โดยมีช่วงเวลาการศึกษาคือ ในวันราชการและวันหยุด และแต่ละวันเก็บข้อมูลเวลา 13.00-15.00 น, 17.00-19.00น และ 22.00-24.00น โดยแต่ละครั้งให้ได้รถ 4 ล้อ, 6 ล้อขึ้นไป และจักรยานยนต์ อย่างละ 20 คัน

ผลการศึกษา

จากการหยุดรถ 4,778 คัน มีคนขับที่ปฏิเสธไม่ยอมให้วัด BAC น้อยกว่าร้อยละ 1 เป็นหญิงร้อยละ 2 จึงวิเคราะห์เฉพาะผู้ชาย

ต่อไปนี้จะใช้คำว่า"ภาวะเมาขับ" สำหรับสื่อความหมายถึงสภาวะที่ผู้ขับขี่ยานพาหนะมีระดับ BAC ตั้งแต่ 0.05 mg/dl ขึ้นไป ความชุกของภาวะเมาขับอยู่เป็นร้อยละ 8.7 ถึง 8.4 ในเขตนอกเมืองและในเมือง และร้อยละ 9.8 และ 7.5 ในวันธรรมดาและวันหยุดตามลำดับ ภาวะเมาขับสูงขึ้นอย่างชัดเจนในเวลากลางคืน ในช่วงเวลาใกล้เที่ยงคืนประมาณ 1 ใน 5 ของผู้ขับรถจักรยานยนต์อยู่ในภาวะเมาขับ เมื่อใช้สมการถดถอย logistic ในการวิเคราะห์ พบว่าความเสี่ยงในเมืองกับนอกเมืองไม่ต่างกัน วันหยุดกับวันธรรมดาไม่ต่างกัน รถยิ่งเล็กมากคนขับยิ่งเมาขับมากขึ้น ในตอนเย็น ความชุกของภาวะเมาขับเพิ่มขึ้นร้อยละ 45 ส่วนตอนเที่ยงคืนเพิ่มเป็น 5.8 เท่าของตอนกลางวัน

อภิปราย

คนขับรถในประเทศไทย "เมาขับ" บ่อยมากโดยเฉพาะในตอนกลางคืน ความเชื่อที่ว่าพฤติกรรมของผู้ขับขี่รถขนาดใหญ่มีอันตรายมากกว่ารถขนาดเล็กไม่ได้รับการยืนยันในการศึกษานี้ ความจริงแล้ว ผู้ขับ

รถขนาดเล็กมีแนวโน้มที่จะเมาขับมากกว่า ประเทศไทยควรรีบเร่งบังคับใช้กฎหมายป้องกันเมาขับ เพื่อลดความสูญเสียอันไม่จำเป็นนี้แต่โดยเร็ว

Chongsuvivatwong V, Nagnaen W, Uga S. (1999) Soil contamination and infection by soil-transmitted helminths in an endemic village in Southern Thailand. Accepted for publication in *Southeast Asian J Trop Med Pub Hlth*. 13 May 1999.

บทนำ

การตรวจไข่พยาธิจากอุจจาระเป็นวิธีมาตรฐานในการสำรวจความชุกและความรุนแรงของปัญหาหนอนพยาธิในชุมชน อย่างไรก็ตาม ในปัจจุบันประชากรมีการเคลื่อนย้ายสูงและการออกนอกบ้านไปทำงานตั้งแต่เช้าตลอดจนการไม่ร่วมมือในการให้ตรวจอุจจาระมักจะเป็นปัญหาในการสำรวจเสมอ การศึกษานี้จึงมีวัตถุประสงค์ที่จะเปรียบเทียบหาความสัมพันธ์ระหว่างการพบไข่หนอนพยาธิต่าง ๆ ในดินเทียบกับการตรวจจากตัวอย่างอุจจาระ หากพบว่ามีความสัมพันธ์สูงก็น่าจะใช้วิธีการตรวจในดินเสริมหรือทดแทนการเก็บตัวอย่างอุจจาระตรวจต่อไป

วิธีการศึกษา

เก็บข้อมูลจากหมู่บ้านที่ศึกษาอยู่ซึ่งอยู่ริมทะเลสาบสงขลาสองครั้งโดยใช้ครัวเรือนตัวอย่าง 50 ครัวเรือน เก็บดินบริเวณข้างส้วม, ลานบ้าน, ใกล้ที่ล้างเท้า และใต้ร่มไม้ในบริเวณแต่ละบ้านเพื่อตรวจหาไข่หนอนพยาธิโดยวิธีของ Uga ในช่วงเดียวกันได้เก็บตัวอย่างอุจจาระของสมาชิกในบ้านไปตรวจหาไข่หนอนพยาธิด้วยโดยวิธี Modified Kato

ผลการศึกษา

การพบไข่พยาธิไส้เดือนและไข่พยาธิแส้ม้าในตัวอย่างดินมีความสัมพันธ์กับการพบไข่พยาธิดังกล่าวแต่ละชนิดในตัวอย่างอุจจาระของสมาชิกในครัวเรือนอย่างมีนัยสำคัญยิ่งโดยมี odds ratio 10.5 และ 5.5 สำหรับพยาธิทั้งสองในแล้งและ 10.5 และ 8.3 ในฤดูฝนตามลำดับ อย่างไรก็ตาม พบไข่พยาธิปากขอได้น้อยมากในตัวอย่างดินทั้ง ๆ พบค่อนข้างมากในตัวอย่างอุจจาระโดยที่ไม่พบว่ามีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ

อภิปราย

การตรวจตัวอย่างดินมีประโยชน์ในการสะท้อนปัญหาพยาธิไส้เดือนและพยาธิแส้ม้า แต่ไม่มีประโยชน์ในการสะท้อนปัญหาพยาธิปากขอในชุมชน วิธีการตรวจตัวอย่างดินน่าจะนำไปใช้เสริมการประเมินความรุนแรงของปัญหาหนอนพยาธิผ่านดินได้ในท้องที่ซึ่งความร่วมมือในการตรวจอุจจาระต่ำ

Sangthong RC, Mo-suwan L, Chongsuvivatwong V, Junjana C. (1999) Secular increases in weight, height and body mass index among school children of Hat Yai: a 5-years follow-up study. Accepted for publication in *Southeast Asia J Trop Med Pub Hlth* on 25 June 1999.

มีแนวโน้มว่าเด็กในประเทศกำลังพัฒนาที่มีการเติบโตทางเศรษฐกิจจะมีการเติบโตที่รวดเร็วกว่าเดิม การศึกษาครั้งนี้จึงมีวัตถุประสงค์เพื่อตรวจสอบว่ากรณีดังกล่าวเกิดขึ้นกับภาคใต้ของประเทศไทยมากน้อยเพียงไร

วิธีการศึกษา

ได้นำข้อมูลการติดตาม cohort เด็กนักเรียนในอำเภอหาดใหญ่ 2253 คนเป็นเวลาต่อเนื่อง 5 ปี ตั้งแต่ปี 2535 มาวิเคราะห์หา cohort effect โดยวิธีสร้างกราฟของ cohort และใช้สถิติ generalized estimating equations

ผลการศึกษา

กราฟที่ได้แสดงให้เห็นชัดว่าค่ามัธยฐานของน้ำหนัก ส่วนสูง และ BMI (body mass index) ตลอดจนความชุกของการมีภาวะน้ำหนักเกินมีแนวโน้มสูงขึ้นในเด็กรุ่นใหม่ โดยที่แต่ละรุ่นจะมีน้ำหนักมากกว่ารุ่นเดิมเมื่ออายุเดียวกันถึง 1.22 กิโลกรัม สูงกว่าเด็กรุ่นเดิมเมื่ออายุเท่ากันถึง 1.25 ซม. และ BMI สูงขึ้นกว่ารุ่นเดิมในอายุเดียวกัน 0.23 หน่วย

อภิปราย

การศึกษานี้แสดงว่าเด็กไทยรุ่นใหม่มีสภาพร่างกายที่เติบโตมากกว่าในรุ่นก่อนหน้านั้นอย่างรวดเร็ว ด้านที่ดีก็คือภาวะทุพโภชนาการจากการขาดโปรตีนและพลังงานจะน้อยลงหรือหายไป ด้านที่ไม่ดีก็คือจะมีเด็กน้ำหนักตัวเกินและอ้วนมากขึ้น อันจะนำมาซึ่งการเกิดโรคอ้วน ความดันโลหิตสูงและเบาหวานในอายุที่น้อยลง

Thongsuksai P, Chongsuvivatwong V, Sriplung H. (1999) Delay in breast cancer care: a study in Thai women. Accepted for publication in *Medical Care* September 1999

บทนำ

มะเร็งเต้านมเป็นมะเร็งที่คร่าชีวิตหญิงไทยเป็นอันดับสองรองจากมะเร็งปากมดลูก ทะเบียนมะเร็งในโรงพยาบาลสงขลานครินทร์ระบุว่าผู้ป่วยมะเร็งเต้านมส่วนใหญ่รับการรักษาในระยะท้าย ๆ วัตถุประสงค์ของการศึกษาครั้งนี้จึงต้องการหาปัจจัยที่ทำให้ผู้ป่วยได้รับการรักษาช้า

วิธีการ

เก็บข้อมูลจากผู้ป่วยที่มาโรงพยาบาลสงขลานครินทร์ในช่วงมิถุนายน 2537 ถึงมิถุนายน 2539โดยการสัมภาษณ์และตรวจสอบจากเวชระเบียน ตัวแปรตามที่สำคัญคือความล่าช้าเนื่องจากผู้ป่วยซึ่งวัดด้วยระยะเวลาที่ผู้ป่วยรู้สึกมีอาการจนถึงผู้ป่วยเริ่มพบแพทย์ และความล่าช้าเนื่องจากระบบโดยวัดจากการพบแพทย์ครั้งแรกจนถึงการได้รับการรักษา การวัดผลของตัวแปรอิสระใช้วิธี Cox regression ซึ่งมีหน่วยความเสี่ยงสัมพัทธ์เป็น hazard ratio (HR) ถ้ายิ่งสูงมากแสดงว่ายิ่งเสี่ยงมาก

ผลการศึกษา

เก็บข้อมูลผู้ป่วยได้ 94 ราย มัธยฐานของความล่าช้าเนื่องจากผู้ป่วยและความล่าช้าเนื่องจากระบบเท่ากันคือ 4 สัปดาห์ ปัจจัยที่เกี่ยวข้องกับความล่าช้าของผู้ป่วยมีเพียงอย่างเดียวคือภาวะสมรส ผู้ป่วยที่เป็นโสดมี (HR = 2.78) เมื่อเทียบกับผู้ป่วยที่เคยแต่งงานแล้ว ปัจจัยเกี่ยวกับความล่าช้าของระบบได้แก่การรับการรักษาครั้งแรกที่โรงพยาบาลชุมชนโดยมี (HR=2.5) การได้รับคำวินิจฉัยจากแพทย์คนแรกเมื่อเทียบกับการไม่ได้รับคำวินิจฉัย (HR=2.04) และได้รับการรักษาจากแพทย์คนแรกเมื่อเทียบกับกลุ่มที่แพทย์ผู้รักษาส่งต่อทันที (HR=5.5

อภิปราย

ความล่าช้าในการรับการรักษาทั้งที่เกิดจากผู้ป่วยและที่เกิดจากระบบเป็นจุดอ่อนที่สำคัญในระบบการควบคุมโรคมะเร็งเต้านมในประเทศไทย กลุ่มหญิงโสดควรได้รับคำแนะนำที่ถูกต้องมากขึ้นเพราะมีความเสี่ยงต่อการล่าช้ามากกว่า ในขณะเดียวกันแพทย์ที่ไม่ได้อยู่โรงพยาบาลมหาวิทยาลัยควรส่งต่อผู้ป่วยให้เร็วขึ้น เพื่อผู้ป่วยจะได้รับการรักษาอย่างทันท่วงที

Tran TS, Jamulitrat S, Chongsuvivatwong V, Geater A. (1999) Risk factors for surgical site infections and febrile morbidity following cesarean section: a prospective study. Accepted for publication in *Obstetric & Gynecology* October 1999.

บทนำ

งานวิจัยนี้เป็นส่วนหนึ่งของวิทยานิพนธ์ปริญญาเอกของนักศึกษาในโครงการระบาดวิทยานานาชาติ โครงการเมธีวิจัยอาวุโสมีส่วนในการสนับสนุนเวลาและความพยายามของอาจารย์ที่ปรึกษา จึงถือได้ว่าเป็นผลงานอย่างหนึ่งของ สกว.

การผ่าคลอด (cesarean section) เป็นหัตถการที่ทำบ่อยที่สุดอย่างหนึ่งในทางสูติศาสตร์ การติดเชื้อหลังการผ่าคลอดเป็นภาวะที่ไม่พึงประสงค์อย่างยิ่ง เพราะเป็นทำให้ผู้ป่วยได้รับความทุกข์ทรมานและโรงพยาบาลต้องสิ้นเปลืองงบประมาณในการรักษาพยาบาลโดยไม่จำเป็น การศึกษาครั้งนี้มีวัตถุประสงค์หาปัจจัยเสี่ยงที่ทำให้เกิดการติดเชื้อในโรงพยาบาล

วิธีการ

เป็นการติดตามผู้ป่วย (cohort study) จำนวน 969 คนที่รับการผ่าคลอดในโรงพยาบาล Hung Vuong ในประเทศเวียดนาม ระหว่างเดือนพฤษภาคมถึงสิงหาคม 2540 การเฝ้าระวังการติดเชื้อหลังการผ่าคลอดทำโดยการเยี่ยมผู้ป่วยในหอผู้ป่วย ติดตามผลทางห้องปฏิบัติการและติดตามผู้ป่วยหลังคลอดภายใน 30 วัน

ผลการศึกษา

พบผู้ป่วยมีไข้หลังการผ่าตัด (fibrile morbidity) ร้อยละ 16.2 และติดเชื้อทุกอวัยวะรวมร้อยละ 12.4 ส่วนการติดเชื้อบริเวณแผลผ่าตัดร้อยละ 9.8 ปัจจัยเสี่ยงที่สำคัญของภาวะแผลผ่าตัดติดเชื้อคือ การมีการติดเชื้ออยู่แล้วในอวัยวะอื่นรวมทั้งแผลติดเชื้อที่ผิวหนัง, การติดเชื้อของน้ำคร่ำ (chorioamnionitis) สภาพร่างกายของผู้ป่วยที่ไม่พร้อมคือมี ASA score (หน่วยวัดความเสี่ยงของสมาคมวิสัญญีแพทย์ประเทศสหรัฐอเมริกา) ตั้งแต่ 3 ขึ้นไป, ถุงน้ำคร่ำแตกก่อนกำหนด, ภาวะ pre-eclampsia, การมี body mass index สูง, การตั้งครรภ์ครั้งแรก และการเสียเลือดมากระหว่างการผ่าตัด

อภิปราย

การพบปัจจัยเสี่ยงเหล่านี้ทำให้ต้องเพิ่มความระมัดระวังในการผ่าคลอดผู้ป่วยที่มีภาวะดังกล่าวมากเป็นพิเศษ

Teanpaisan R, Nittayananta W, Chongsuvivatwong V. (1999) Biotypes of Candida albican isolated from HIV and HIV-free patients. Accepted for publication in *Journal Oral Medicine Pathology* October 1999

บทนำ

เชื้อรา *Candida albicans* เป็นเชื้อที่พบบ่อยในช่องปากของคนปรกติ คนที่เป็นเบาหวาน และคนที่เป็นโรคเอดส์ เชื้อราชนิดนี้สามารถจำแนกตาม biotypes และ การดื้อต่อยาปฏิชีวนะ ในประเทศไทยซึ่งมีโรคทั้งสามชนิดโดยเฉพาะโรคเอดส์ซึ่งพบมาก แต่ไม่เคยมีผู้ศึกษาว่า biotype และการดื้อยาในผู้ป่วยสามชนิดนี้ต่างกันมากน้อยเพียงไร การศึกษานี้จึงมีวัตถุประสงค์ที่จะตอบคำถามดังกล่าวเพื่อเป็นพื้นฐานในการศึกษาระบาดวิทยาของเชื้อ Candida ในประเทศไทยต่อไป โครงการส่งเสริมกลุ่มระบาดวิทยาได้มีส่วนในการวิเคราะห์ข้อมูลและร่วมจัดเตรียมรายงานการวิจัยตีพิมพ์ในวารสารนานาชาติครั้งนี้

วิธีการ

ได้แยกเชื้อ Candida albicans 82 isolates จากผู้ป่วยจากน้ำลายของผู้ป่วยโรคเอดส์ 15 ราย, 76 isolates จากผู้ป่วยเบาหวาน 15 ราย และ 60 isolates จากคนแข็งแรงดี 16 ราย นำ isolate ทั้งหมดไปแยก biotype ด้วยวิธีของ Williamson และคณะ จากนั้นนำไปวัดระดับการดื้อยา minimal inhibitory concentration (MIC) ต่อ amphotericine B, ketoconazole โดยวิธี NCLLS macrodilution

ผลการศึกษา

Biotype A1S พบได้ถึงร้อยละ 32.6 ของ isolates ทั้งหมดโดยสัดส่วนร้อยละของ isolates นี้ไม่สัมพันธ์กับอาการโรคของผู้ป่วย

ผู้ป่วยโรคเอดส์มีจำนวน biotype ต่อผู้ป่วยหนึ่งคนมากกว่าผู้ป่วยชนิดอื่น แต่ไม่มีนัยสำคัญทางสถิติ อย่างไรก็ตาม ระดับมัธยฐาน MIC ต่อ amphotericine B ของเชื้อที่แยกจากผู้ป่วยเอดส์สูงกว่าที่แยกจากผู้ป่วยกลุ่มอื่น ๆ อย่างมีนัยสำคัญทางสถิติ แต่ระดับ MIC ต่อ ketoconazole ไม่แตกต่างกัน

อภิปราย

การที่ผู้ป่วยโรคเอดส์มีแนวโน้มที่จะมีเชื้อ *Candida albicans* หลายหลาก biotype มากกว่าผู้ป่วยอื่นๆ แต่ไม่พบนัยสำคัญทางสถิติอาจจะเป็นเพราะจำนวนผู้ป่วยที่ศึกษาครั้งนี้มีน้อยเกินไป อย่างไรก็ตาม การพบว่าผู้ป่วยเอดส์มีเชื้อ *Candida albicans* ที่ดื้อยา amphotericine B มากกว่าผู้ป่วยอื่นๆ ทำให้ต้องระมัดระวังในการใช้ยาปฏิชีวนะชนิดนี้มากขึ้นโดยต้องคำนึงว่าในผู้ป่วยเอดส์เชื้อที่กำลังรักษาอยู่อาจจะดื้อยามากกว่าผู้ป่วยอื่น ๆ

Research Output ซึ่งได้รับการสนับสนุนจากทุนเมธีวิจัยอาวุโส (ส่วนมีดอกจันทน์ได้แสดงไว้ในภาคผนวกเป็นรายงานที่ได้ระบุ สกว. ไว้กิตติกรรมประกาศในวารสาร ยังมีอีกหลายรายการที่ไม่ได้ระบุไว้ทั้ง ๆ ที่ได้รับการสนับสนุน เนื่องจากความรู้เท่าไม่ถึงการณ์ของผู้รับทุน)

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หนังสือ

เพชรวรรณ พึ่งรัศมี และ วีระศักดิ์ จงสู่วิวัฒน์วงศ์ *รายงานการทบทวนเอกสารทางวิชาการชุดโครงการเรื่องวัณโรค* รวม 4 เล่ม:

1. *สถานการณ์และการควบคุมวัณโรคในประเทศไทย - ภาพสะท้อนของการคิดและการวางแผนร่วมกันระหว่างหน่วยงานของกระทรวงสาธารณสุข*

2. *การติดเชื้อและอัตราป่วยวัณโรคของประชากรบางกลุ่มในประเทศไทย- ผลการทบทวนรายงานการวิจัย 62 เรื่อง ระหว่าง พศ. 2502-2541*

3. *วัณโรคดื้อยาหลายขนาน (MDR-TB) คุกคามประเทศไทยจริงหรือ? – ผลการทดทวนรายงานวิจัย 55 เรื่อง ระหว่าง พศ. 2511-2541*

4. *พัฒนาการของการควบคุมวัณโรคโดยยุทธวิธี Directly Observed Therapy, Short-course (DOTS) ในประเทศไทยจนถึงกุมภาพันธ์ 2542*

การจดทะเบียนสิทธิบัตร

- ไม่มี

การนำเสนอผลงานในที่ประชุมวิชาการนานาชาติ

ที่ประชุม International Epidemiology Association Meeting ณ เมืองปีนังประเทศมาเลเซีย 18-24 กุมภาพันธ์ 2540

1. **Chongsuvivatwong V.** Nagnaen W, Uga J. Soil contamination and helminthic infection in an endemic village in Southern Thailand
2. **Geater AF, Chongsuvivatwong V, Chompikul C.** Lead contamination among primary school children living in Pattani River basin
3. **Assanangkornchai A.** Family history ot drinking problems and the risk for alcohol-use disorders
4. **Tongsuksai P, Chongsuvivatwong V** Delay in seeking care in cancer patients
5. **Tuntiseranee P, Koanathakul O.** Long working hours and sub-fecundity
6. **Rithsmithchai S.** Factors associated with short duration exclusive breastfeeding in a semi-rural community
7. **Jaravejsarn W. Chongsuvivatwong V, Geater AF.**Is parental smoking a risk factor for acute respiratory infection in 2-6 month old infants?

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Reprints and Manuscripts

Original Article

Factors associated with coverage of iodine deficiency disorders by control programs in an endemic area in West Sumatra, Indonesia

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In order to ascertain the coverage and to identify factors determining the success of an iodine deficiency disorders (IDD) control program in West Sumatra, Indonesia, a cross-sectional study among 495 school children aged 6–15 years in a subdistrict of an endemic goitre area was conducted. Coverage of iodine capsule distribution was 27%. Forty-eight percent of the households used iodized salt with an appropriate concentration (≥ 40 p.p.m.). Factors associated with not taking idodine capsules among children were: mother's lack of knowledge about the iodine capsule (OR 13.3, 95% CI 7.4–24.1) and mother's education level (OR 1.89, 95% CI 1.05–3.39). For unsatisfactory use of iodized salt in a household, the only predictor was family monthly income. Odds ratios and 95% CI for moderate and high family income were 2.42 (1.39–4.21) and 2.22 (1.4–3.54), respectively. We concluded that for coverage in an IDD control program, supplementation and fortification alone were not enough. Education had an impact on coverage of the supplementation. Furthermore, iodization of salt needs further improvement in relation to quality control. Finally, the program neglected high-income groups. These pitfalls should be corrected.

Key words: iodine deficiency disorders, iodine capsules, iodized salt, risk factors, West Sumatra, Indonesia.

Introduction

Nutritional deficiency is one of the main public health problems in many countries, including Indonesia.[1] Iodine deficiency disorders (IDD) are still highly prevalent throughout the entire country.[2] The effects of IDD constitute some of the most serious problems encountered during the human life cycle, including cretinism and mental retardation. Iodine deficiency disorders are not merely public health and nutrition issues, but also a major obstacle to human and economic development.[3,4]

According to a national report, the total goitre rate (TGR) in the endemic area in West Sumatra was 34% and the population at risk was 74%.[5] The main strategy in IDD control in this area has been to focus on supplementation with yearly iodine capsules in addition to fortification of kitchen salt, which commenced in 1977.[3,4] The reason for shifting from iodized injection to iodized oil capsules was mainly a lack of adequate personnel to cover the target group.[2]

There have been several studies examining the coverage of distribution of iodine capsules. These showed coverage among school children of 60 and 48.3%.[6] However, these studies did not include the coverage of iodized salt and did not identify risk factors for not being covered. The aims of this study were, therefore, to document in detail the coverage of both iodine capsules and iodized salt among school children. In addition, the study aimed to identify risk factors not addressed by the IDD control program in West Sumatra.

Materials and methods

A cross-sectional sample of 495 school children aged 6–15 years was drawn randomly from the list of pupils at the education office (51 schools) in one subdistrict of West Sumatra with high IDD prevalence (TGR > 30%), from June to September 1995. A questionnaire-based interview was undertaken by trained interviewers with the mother or guardian of each child to obtain information on socio-economic status, and availability of iodine supplementation and fortification. The questions assessing knowledge were of the yes-no type, and covered knowledge of the mother on causes of IDD (eight questions), prevention of IDD (five questions), effects of IDD (five questions), supplementation (two questions) and fortification (two questions).

A salt sample was taken from each household and assessed for iodate concentration with a rapid kit test (iodine kit, produced by Kimia Farma PLC, Jakarta, Indonesia).

Statistical analysis

The total number of correct answers for knowledge assessment was used as a knowledge score. Scores lower than four were classified as low and scores of four and above were classified as high.

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Data entry and validation were undertaken using Epi Info 5.[8] Statistical analysis was carried out with a Stata package (Stata Corporation, TX, USA).[9] Descriptive statistics and cross-tabulation were initially used. Taking school as the cluster variable, design effect and intracluster correlation were computed in estimating the level of coverage and its 95% confidence interval. The level of design effect and intracluster correlation reflects how the coverage was 'clustered' at the school level. Logistic regression[10] was then used to identify factors having an independent association with outcome. The modelling strategy followed a backward elimination procedure.

Results

Out of 495 subjects, 133 (27%) received iodine capsules within the past 6 months and 235 (48%) had appropriately iodized salt. There was a positive association between getting iodine capsules and having appropriately iodized salt (Table 1). Children having appropriate salt at home had a significantly higher rate of receiving iodine capsules in the past 6 months.

Among those who had received iodine capsules, 48% had received them at school, 19% at the Integrated Health Post Service in the village, 17% during a home visit of the cadre and the remainder at the health centre. The design effect of school on the coverage of iodine capsules was 7.7 with intracluster correlation within school of 0.331. However, as expected, iodized salt coverage was much less clustered (design effect = 1.8, intracluster correlation within school = 0.041).

Table 1. Association between coverage of iodine supplementation and fortification

Getting capsule in the past 6 months	Level of iodate in salt		
	≥ 40 p.p.m.	< 40 p.p.m.	Total
Yes	78 (33%)	55 (21%)	133 (27%)
No	157 (67%)	203 (79%)	360 (73%)
Total	235 (100%)	258 (100%)	493 (100%)

Pearson Chi^2 (1) = 8.8014, P = 0.003.

Breakdown of the coverage of the iodine capsule supplementation program is shown in Table 2 and that of appropriate salt in the kitchen is shown in Table 3. There was no difference in the coverage of supplementation between boys and girls nor among different age groups. The lower income group had the highest coverage whereas the middle income group had the lowest. Education of the parents was strongly associated with supplementation. Those with higher education had higher coverage. The association in the coverage of supplementation with family income was similar. The lower income group had the highest percentage of appropriate salt in the kitchen and the middle income group had the lowest. In contrast to the finding with supplementation, there was no association between education of the parent and availability of iodized salt in the kitchen.

Logistic regression analysis (Table 4) shows that knowledge regarding iodine capsules and mother's education were highly and significantly associated with children taking iodine capsules. Children whose mothers had low knowledge about iodine capsules were more likely not to have taken iodine capsules. In contrast, mothers' knowledge of the causes and effects of IDD had a significant negative association with child supplementation. Iodine deficiency disorder knowledge and socio-economic status did not show a statistically significant association with supplementation. Level of education of the mother was a significant determinant, even after adjustment for all groups of knowledge.

Regarding the coverage of appropriate salt, knowledge and education were not found to play a predictive role (Table 5). The only significant predictor was monthly income of the family. The lower income group was significantly better covered than the middle and high income groups.

Discussion

The enrolment rate of primary education in Sumatra has been higher than 80%. Thus, our sample was a fair representation of target children in this age group in the study area.

The coverage of the program reported in this study is not very different from that reported in previous years.[6,7] In general, the coverage has been low and needs improvement. The

Table 2. Coverage of iodine capsules by different socio-demographic variables

	Yes (%)	No (%)	Total	d.f.	Chi-squared test	P
Sex						
male	66 (25)	197 (75)	263	1	0.8984	0.343
female	67 (29)	165 (71)	232			
Age (years)						
< 9	33 (23)	110 (77)	143	2	1.6203	0.445
9– < 12	69 (28)	175 (72)	244			
≥ 12	30 (29)	72 (71)	102			
Family monthly income (1000 Rupiahs)						
≤ 100	54 (42)	76 (58)	130	2	22.0405	< 0.001
100–149	21 (16)	108 (84)	129			
≥ 150	57 (25)	173 (75)	230			
Mother's education						
Illiterate – primary	28 (15)	165 (85)	193	1	24.5984	< 0.001
Secondary school	105 (35)	197 (65)	302			
Father's education						
Illiterate – primary	22 (14)	137 (86)	159	1	21.3781	< 0.001
Secondary school	110 (34)	216 (66)	326			

d.f., degrees of freedom; P, probability.

Table 3. Coverage of appropriate iodized salt by different socio-demographic variables

	≥ 40 p.p.m. (%)	< 40 p.p.m. (%)	Total	d.f.	Chi-squared test	*P*
Family monthly income (1000 Rupiahs)						
≤ 100	81 (62)	49 (38)	130	2	14.4792	< 0.0001
100–149	54 (42)	74 (58)	128			
≥ 150	99 (48)	130 (52)	229			
Mother's education						
Illiterate – primary	91 (47)	101 (53)	192	1	0.0093	0.923
Secondary school	144 (48)	157 (52)	301			
Father's education						
Illiterate – primary	75 (47)	83 (53)	158	1	0.0300	0.862
Secondary school	157 (48)	168 (52)	325			

d.f., degrees of freedom; *P*, probability.

Table 4. Predictors for not taking iodine capsules from logistic regression

Factors	No. taking	No. not taking	Adjusted OR 95% CI[a]
Knowledge of IDD prevention			
High (≥ 4)	59	75	1
Low (< 4)	74	287	1.54 (0.76–3.14)
Knowledge of IDD causes			
High (≥ 4)	74	150	1
Low (< 4)	59	209	0.39 (0.19–0.80)**
Knowledge of IDD effect			
High (≥ 4)	5	16	1
Low (< 4)	127	346	0.27 (0.08–0.88)**
Knowledge of iodine capsules			
High (≥4)	88	56	1
Low (< 4)	43	304	13.3 (7.40–24.1) **
Mother's education			
High	105	197	1
Low	28	165	1.89 (1.05–3.39) *
Family monthly income			
Low	54	76	1
Moderate	21	108	1.76 (0.85–3.65)
High	57	173	1.02 (0.56–1.83)
Sex			
Male	66	197	1
Female	67	165	0.9 (0.5–1.5)

IDD, iodine deficiency disorder; [a]not taking vs taking; *$P < 0.05$; **$P < 0.01$. CI, confidence interval.

association between the two types of coverage may be due to their linkage with the level of activities of health personnel, which varied from one community to another. It is worrying to see that approximately 40% of the subjects were not covered by any preventive method.

Iodine capsule usage depends on the recall of the mother and the children. Iodine capsules are meant to be taken by the subject every 6 months, which is actually not a common event. Recall error might be expected to be minimal. If such an error took place at random, it would tend to bias the result toward no association.

The high design effect of iodine capsule distribution by school suggests that there are remarkable differences of coverage among schools. It is therefore necessary to focus the distribution process on the 'captive audience' at school, where quality control should be assured more easily.

The association between mother's knowledge of iodine capsules and coverage of this supplementation may be explained by recall of the mother. The independent association between education of the mother and coverage of supplementation may be explained by better access to written media by the literate mother. However, the negative association between knowledge about causes and effects of IDD with coverage of supplementation remains unexplained.

The second method of reducing IDD is to increase the availability of iodized salt in the kitchen. However, there are other sources of salt in the cooking process, such as fish sauce and soy sauce, which are not iodized. Kitchen salt is relatively cheap compared to these sauces and is likely to be more often consumed by the lower economic group. Measurement by kitchen salt sampling may underestimate fortification among the higher income groups to a greater extent than among the lower income group. Moreover, a high percentage of salt samples had low iodate content even though iodization of salt is a legal requirement in the country. The pitfalls may be in the production process, which is not fully controlled, and/or in the storage time, which may be too long to keep the iodate at the protective level.

Similar to coverage of supplementation, the lower income group had a higher percentage of having appropriate salt in

Table 5. Predictors for using non-iodized salt (<40 p.p.m.) from logistic regression

Factors	≥ 40 p.p.m.	< 40 p.p.m.	Adjusted OR 95% CI[a]
Knowledge of IDD prevention			
High (≥ 4)	69	65	1
Low (< 4)	166	193	1.10 (0.64–1.91)
Knowledge of IDD causes			
High (≥ 4)	106	117	1
Low (< 4)	128	139	0.83 (0.51–1.35)
Knowledge of IDD effect			
High (≥ 4)	11	10	1
Low (< 4)	223	248	1.03 (0.40–2.67)
Knowledge of iodine capsule			
High (≥ 4)	116	114	1
Low (< 4)	116	142	1.11 (0.73–1.68)
Mother's education			
High	144	157	1
Low	91	101	0.81 (0.53–1.25)
Monthly income			
Low	81	49	1
Moderate	54	74	2.42 (1.39–4.21)*
High	99	130	2.22 (1.40–3.54)**
Sex			
Male	122	139	1
Female	113	119	0.86 (0.61–1.25)

IDD, iodine deficiency disorder; [a],< 40 p.p.m. vs ≥ 40 p.p.m.; *$P < 0.01$; **$P < 0.001$. CI, confidence interval.

the kitchen. Combining this fact with the expectation that this group tends to use cooking salt more often than do the higher income groups, difference in the actual coverage may be greater than that calculated. This reverse relationship between income and use of iodized salt can also be explained by the lack of an economic barrier to obtain the appropriate salt and, perhaps, the tendency of the health system to focus its nutrition programs on the poor.

We recommend that the control program should be reviewed. Supplementation through school should be further improved. Quality control of iodization of salt and knowledge of the target population should be imposed. Although the coverage among the lower income group was higher than among other groups, it was still low and more effort should be put into obtaining universal coverage in this highly endemic area.

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Factors associated with coverage of iodine deficiency disorders by control programs in an endemic area in West Sumatra, Indonesia

M Masrul, V Chongsuvivatwong and AF Geater

Asia Pacific Journal of Clinical Nutrition (1999) Volume 8, Number 1: 13–18

FAKTOR-FAKTOR YANG BERKAITAN DENGAN CAKUPAN PROGRAM PENGENDALIAN GANGGUAN AKIBAT KURANG YODIUM (GAKY) PADA SEBUAH DAERAH ENDEMIK DI SUMATERA BARAT INDONESIA

Abstrak

Telah dilakukan sebuah study cross-sectional terhadap 495 murid sekolah dengan usia 6-15 tahun, pada sebuah daerah endemik goiter, untuk memastikan cakupan dan identifikasi terhadap faktor-faktor penentu dari program pengendalian GAKY di Sumatera Barat, Indonesia.

Cakupan distribusi kapsul yodium 27%. Empat puluh delapan persen rumah tangga menggunakan yodium dengan konsentrasi yang memadai ($\geq$ 40ppm). Faktor-faktor yang berkaitan dengan tidak memakai kapsul yodium pada anak-anak: rendahnya pengetahuan ibu mengenai kapsul yodium (OR 13.3, 95% CI 7.4 - 24.1) dan tingkat pendidikan ibu (OR 1.89, 95% CI 1.05 - 3.39). Ketidak puasan dalam memakai garam yodium di rumah tangga, sebagai satu-satunya prediktor adalah pendapatan bulanan keluarga. Odds rasio dan 95% CI terhadap pendapatan menengah dan tinggi adalah 2.42 (1.39-4.21) dan 2.22 (1.4-3.54).

Kami menyimpulkan bahwa untuk meningkatkan cakupan dalam program pengendalian GAKY, suplementasi dan fortifikasi saja tidak cukup. Pendidikan juga mempunyai dampak yang besar terhadap cakupan suplementasi. Juga, diperlukan pengendalian kualitas yodisasi garam dapur yang baik. Akhirnya diakui bahwa program mengabaikan kelompok dengan tingkat pendapatan yang tinggi. Kekurangan ini harus diperbaiki.

Factors associated with coverage of iodine deficiency disorders by control programs in an endemic area in West Sumatra, Indonesia

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在印度尼西亞的Sumatra 西部缺碘症流行地區控制碘缺乏症措施的普及率和有關的因素

摘要

爲了查明 Sumatra 西部控制缺碘症措施的普及率和促使控制缺碘症措施成功的有關因素，我們在甲狀腺腫大流行區 調查了495名學齡兒童(6-15歲).

碘膠囊的分發率是27%，有48%的家庭使用含有適當碘濃度(>=40ppm)的碘鹽. 兒童没能服用碘膠囊的原因是: 母親對碘膠囊的認識不足(OR=13.3, 95% CI: 7.4-24.1)和母親的受教育水平低(OR=1.89, 95% CI: 10.5-3.39). 家庭未能使用足夠的碘鹽的唯一指征是家庭的月收入. 中等和高家庭月收入的OR和95% CI 分別爲: 2.24(1.39-4.21) 和 2.22 (1.4-3.54).

我們認爲控制缺碘症措施的普及率，碘補充和强化的實施在 Sumatra 西部仍不足. 教育對控制缺碘症措施的普及率有很大的影響. 碘鹽化需要質量控制來改善. 控制缺碘症措施 忽視了高收入家庭，這一缺陷應給與糾正.

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A SURVEY INTO PROCESS AND WORKER'S CHARACTERISTICS IN THE WOOD FURNITURE INDUSTRY IN SONGKHLA PROVINCE, SOUTHERN REGION OF THAILAND

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Abstract. A cross-sectional survey of the wood furniture industry was conducted in southern Thailand in February 1993. The aim was to examine the manufacturing process, occupational hazards at the workplace, workers' demographic characteristics, period of employment, incidence rate of work related injury and some reproductive history of workers. Altogether 69 managers and 1,000 workers participated in the study. There are 2 main types of wood industry, rubberwood and hardwood. The rubberwood industry is semi-automated with advanced technology, has a female-dominated workforce of 200-300 workers per factory and overseas-market orientation. The hardwood industry is based in small-scale workplaces ranging from 20 to 60 workers, domestic-market orientation and has a male-dominated workforce. Most of the workers were young, single, of low education and were high turnover rate laborforce, with arduous work and long working hours per week. Solvent was the most frequent chemical exposure. The person-year incidence of chemical exposure in female workers was higher than in male workers for every group of chemicals. The incidence of accidents was twice as high as the official rate. The standardized fertility ratio of female wood workers was only 51.6% of that of the Thai female population. There was a high abortion rate among women who became pregnant inside the wood industry compared to that among pregnancies outside the wood factory. Wood industry workers were exposed to occupational hazards and accident-prone work conditions.

INTRODUCTION

Southeast Asia is well known for rubber plantation for several decades. Southern Thailand is a part of Southeast Asia where rubber plantations occupy approximately 15% of land. Rubberwood furniture industry was introduced in the late 1980s in addition to hardwood furniture industry which has existed for a long time (Academic Center of Economical Industry, Southern Thailand, 1992). The wood furniture industry is rapidly expanding since the demand for furniture both inside and outside Thailand is growing rapidly with the increasing living standard. This industry has also introduced new occupational health problems to the wood furniture workers. From previous literature, respiratory symptoms (Dykewicz *et al,* 1988; Shamssain, 1992), neurological symptoms (Baker *et al,* 1985), reproductive health effects (Lipscomb *et al,* 1991; Cordier *et al,* 1992) and possibly carcinogenic effects (Nylander *et al,* 1993) are expected to be important problems.

Songkhla province is the most industrialized province in Southern Thailand and is surrounded by rubber plantations. As a result, it is the main location of the rubberwood and hardwood furniture industry including other down-stream businesses. There was also no base-line information on health problems among the workers in the wood furniture industry in southern Thailand. Therefore, our study was performed to explore occupational health problems from the wood furniture industry in this province. The objective of the study was to obtain data on the manufacturing process, physical and chemical hazards in the workplace, demographic characteristics of the workers, injury and reproductive health problems. The last problem was of particular significance as the worker population were mostly young and in the reproductive age group so that they, as well as the coming generation, might be vulnerable to reproductive hazards in the workplace.

MATERIALS AND METHODS

One hundred and twenty-nine wood factories from a computerized registry at Provincial Industrial Works of Songkhla Province were identified.

Inclusion criteria for selection into the study were 1) factories located in Hat Yai district and 2) factories outside Hat Yai district which were engaged in wood impregnation and furniture production. Seventy-three factories were eligible according to these criteria. Ten were out of business, 6 could not be found and 1 refused to participate. Another thirteen factories, which were not registered but identified in the field trip were included. Altogether 69 factories were included in the study. The managers were interviewed using a questionnaire to obtain information on manufacturing procedures, factory age, membership of social security scheme and worker compensation fund, number and sex of workers. Worksites were observed using walk-through survey technic (Harrington *et al,* 1992).

Subsequently, the factories were stratified by the number of workers into 5 strata (<20 workers, 20-49 workers, 50-99 workers, 100-400 workers and ≥ 400 workers). The sample of 1,000 out of 4,545 workers was selected proportional to size of each strata. Face-to-face interview was conducted to obtain data on demographic characteristics, work history, chemical exposure at work, work-related injury and reproductive history. Eligible injury was defined as an accident leading to at least one day of sick leave. History of chemical exposure was obtained by asking subjects about exposure to specific agents in daily work (as suggested by walk through survey). Questions on reproductive health problems were confined to female workers.

Data were computerized using the CRS program and SPSS was used for statistical analysis.

RESULTS

There are 2 main categories of wood industry in the study area - rubberwood and hardwood. From interviewing the managers and the walk-through survey, the median age of the factory was 5 years (range 1 to 34 years). The factories were then grouped into type and potential occupational hazards as shown in Table 1.

In rubberwood industry, the production chain starts from the rubberwood *sawmill* which is a small-scale worksite of about 20-30 workers using 48-inch naked saw to cut logs into planks. Afterwards, female workers dip the planks into borax and pentachlorophenol solution barehanded to preserve rubberwood before sending it to the impregnation factories. The *wood impregnation factory* is semi-automated industry where the planks were put in a vacuum tank to impregnate with borax and pentachlorophenol for 3-6 hours. The *furniture production factories* then buy the impregnated planks, cut them into small pieces, and bind them using heated pressure and special glues. These are then shaped up into furniture part, polished both with machine and scrupulously by hands, painted and varnished with lacquer. Most rubberwood factories are semi-automated, have 200-300 workers, a female-dominated workforce, are overseas market-oriented and have daily wage workers except sawmill, wood bead factory and wood box factory. By contrast, *wood bead process* is small with about 35 workers and low-invested equipment. Chemical exposures and work participation are similar to those in the impregnation and furniture factory. *Wood box producing factory* is a very small domestic industry of around 5 workers using hammer and nail to make up boxes. No hazardous chemical is used in this process.

The raw material used in hardwood industry is mainly inferior wood and assorted lumber imported from Malaysia. The typical characteristics of hardwood factories are small scale ranging from 20 to 60 workers, have domestic-market orientation and have male dominated workforce as professional carpenters. The chemical exposures in *furniture production* are pentachlorophenol, formaldehyde from plywood, solvent and paint compounds whereas no chemicals are used in *window and door frame* process. In *wholesale and retail trade,* the main job is to transport the wood parts to the client's place.

In conclusion, chemical exposures in wood and furniture industry are as follows: fungicides and insecticides, *eg* borax, pentachlorophenol; solvents, *eg* methyl alcohol, aromatic hydrocarbons, *eg* toluene, xylene and ketone, kerosene, turpentine, aliphatic hydrocarbons including mixtures of solvent-urea adhesives; painting compounds, *eg* industrial paint, polyethylene paint and amino-paint. Workers were also exposed to physical hazards such as wood dust; heat from putting firewood into boiler; loud noise from sawing, cutting or automatic polishing machines; whole-body vibration among workers who drive forklift trucks, local vibration among workers using manual polishing tool and sawing machine including ergonomic prob-

Table 1

Raw material, physical and chemical hazards in wood furniture industry according to the process, Songkhla Province, Thailand.

Process (no. of factory)	Raw material		Chemical hazard			Physical hazard				
	Rubber wood	Hard wood	Borax	Pesti-cide	Solvent	Noise	Heat	Dust	Ergo - nomic	Acci-dent
1. Sawmill (7)	7	-	5	-	-	+	-	+	+	+
2. Wood impregnation (9)	9	-	9	2	-	+	+	+	+	+
3. wood impregnation furniture (2)	2	-	2	2	2	+	+	+	+	+
4. Furniture production (22)	14	8	-	4	22	+	+	+	+	+
5. Wholesale and retail (14)	-	14	-	-	-	-	-	-	+	+
6. Window and door frame (13)	-	13	-	-	-	+	-	+	+	+
7. Wood bead (1)	1	-	1	1	1	+	+	+	+	+
8. Wood box (1)	1	-	-	-	-	-	-	-	+	+

lem and accident-prone working conditions, *eg*, sawing, drilling and cutting machines without an enclosing guard. In addition, the painting and enameling process was usually neither separated from the other processes nor established with adequate ventilation systems. There was also a lack of managerial policy and availability of personal protective devices. Only 42% of the factories were enrolled in social security or worker compensation program.

Out of 4,545 workers, 1,000 workers were randomly chosen and interviewed. Furniture production accounted for more than 70% of all workers. Females were more common than males in all types of factories except sawmill, wholesale and retail and window and door frame. Most workers were Buddhists, had completed primary or secondary school and, except in sawmill and wholesale and retail process, were single. Wood workers had a mean age of 24.8 years (range 15 to 60 years) with standard deviation of 6.8 years. Workers in sawmill and wholesale and retail trade were older than those in other processes (Table 2).

Table 3 shows that turnover rate of the workers in every process was high. Median period of employment ranged between 0.4 year to 1.2 years among female workers and 0.4 year to 2 years among male workers. Ninety-nine per cent of the workers worked 6 days per week and 61% had overtime jobs.

Quantitative estimates of chemical exposure (Table 4) showed that workers in furniture production process were exposed to large amounts of all chemicals while workers in wholesale and retail trade and window and door frame were seldom exposed to any chemicals. Female workers were exposed to chemicals more than male workers in every group of chemicals except paint.

The incidence rate of accidents in this study was 108 per 1,000 which is twice as high as that reported by Compensation Fund Registry in the same period in Southern Thailand (46 per 1,000).

Among 545 female workers, 194 were married or cohabiting. Contraceptive prevalence rate was 68% and oral pill was the most commonly employed method. Fifty-one cohabiting women did not use any kind of contraceptive since 39 of them wanted a baby and 12 had been pregnant. The average number of children of married female work-

Table 2

Demographic characteristics of the workers in wood industry by each process, Songkhla Province, Thailand (n= 1,000).

Demographic characteristies	Sawmill	Wood impreg-nation	Wood impreg-nation and furniture production	Wholesale and retail	Furniture produc-tion	Window and door frame	Total
Sex							
male	25	39	29	47	304	11	455
female	5	36	69	1	434	-	545
Age (year)							
15-20	3	19	47	4	240	2	315
21-25	5	24	29	9	239	6	312
26-30	8	16	16	16	147	1	204
31+	14	16	6	19	112	2	169
Education							
no school	-	2	-	-	6	-	8
primary school	24	55	71	39	468	7	664
secondary school	5	12	8	6	106	3	247
vocation school	-	1	3	1	47	1	53
university	-	-	-	-	1	-	1
other	1	-	2	1	13	-	17
Religion							
Buddhist	25	71	87	45	619	11	858
Moslem	5	7	11	3	116	-	139
Christian	-	-	-	-	3	-	3
Marital status							
single	8	41	61	22	442	11	585
married/ cohabiting	20	32	32	25	271	-	380
widowed	2	2	4	-	23	-	31
divorced/ separated	-	-	1	1	2	-	4

Table 3

Period of employment (year) among workers in wood furniture industry, Songkhla Province , Thailand.

	Male				Female			
Process	Min	Max	Mean	Median	Min	Max	Mean	Median
1. Sawmill (7)	0.1	6	1.1	0.8	0.1	6	1.9	1.1
2. Wood impregnation (9)	0.1	4	1	1	0.1	4	0.8	1
3. Wood impregnation and furniture production (10)	0.1	15	1.2	0.4	0.1	5	1.1	0.4
4. Furniture producing (32)	0.1	15	1.7	1.2	0.1	15.3	2.1	1.2
5. Wholesale and retail trade (14)	0.1	32	3.4	0.9	0.2	0.2	0.2	0.2
6. Window and door frame (13)	0.1	7	2.5	2	-	-	-	-

Table 4

Average person years exposure to industrial chemicals per 100 person years among workers in wood furniture industry, Songkhla Province, Thailand.

Process	Sex[a]	Penta chlorlo-phenol	Bo-rax	Alco-hol	Thin-ner	Sea-ler	Polyure than paint	Amino paint	Indus-trial paint
Swwmill	m	-	-	-	-	-	-	-	-
	f	-	21.4	-	-	-	-	-	-
Wood impregnation	m	-	25.2	-	-	-	-	-	-
	f	14	58.7	-	-	-	-	-	-
Wood impregnation	m	8.5	8.5	-	5.7	2.8	-	-	-
and furniture production	f	37.9	37.9	-	6.6	16.5	-	-	-
Whole sale and	m	-	-	-	0.6	-	-	-	-
retail trade	f	-	-	-	-	-	-	-	-
Furniture production	m	0.4	0.6	6.0	14.4	3.1	5.7	1.5	3.3
	f	-	0.6	3.9	34.5	22.3	-	3.3	3.5
Window and door	m	-	-	-	-	-	-	-	-
frame	f	-	-	-	-	-	-	-	-

[a]m = male workers; f=female workers

Table 5

Indirect standardization of general fertility rate of married female workers in wood furniture industry, Songkhla Province , Thailand.

Age group	No. of female workers in the industry	National general fertility rate 1990 (per 1,000)	expected livebirths	observed livebirths
15-19	145	42.2	6.1	5
20-24	190	110.5	21	8
25-29	106	102.7	10.9	4
30-34	61	64.2	3.9	4
35-39	18	31.3	0.6	0
40-44	7	14.2	0.1	1
Total	527		42.6	22

Standardized fertility ratio = 22/42.6 = 51.6%

ers was 1.4. Table 5 shows that standardized fertility ratio among female workers was 51.6% of the national fertility rate. Abortion rate was 19% when female workers became pregnant in the present wood factory but the rate was 5% when the same mother bacame pregnant before working in the present factory (data not shown).

DISCUSSION

This study shows that wood industry workers were young, Buddhist, of low educational level and were rapid turnover of the labor force. The male to female ratio was 1:1. They were exposed to high levels of both physical and chemical hazards. The common chemicals used in wood industry were borax and pentachlorophenol for wood preservative, solvent and paints. Female workers were exposed to chemicals more than male workers. The injury rate was higher than that reported by the government. Female workers had relatively low fertility rate. Abortion rate was higher when workers got pregnant in the present wood factory than when they got pregnant before working in the present factory.

This study is likely to have encountered the healthy worker effect. Such poor working conditions were likely to lead to health problems and injury which directly or indirectly forced the worker out of the industry. The injury rate and the reproductive health problems found in this study thus underestimate the real situation.

In this study, 13 factories which were found in the field trip were small-scale wood industries in the wholesale and retail trade and hard wood furniture shops. This may suggest some underreporting of small-scale factories in the registry we used. However, it was less likely that a medium and large-scaled factories were not registered in the database we used.

Although we employed the walk-through survey technic which included visiting chemical storage room, not all chemicals could be identified since there was no material safety data sheet providing generic names and properties of each substance. The generic name was sometimes classified by the factory as an industrial secret; or there was no response to the letter asking for the ingredients from any manufacturing factories. We were unable to analyze these compounds due to their wide variety and the limitation of laboratory resources. Exposure to chemicals was thus broadly specified. The quantitative chemical exposure in person-years depended on direct contact with chemicals while we observed that most hazardous procedures were not performed in a closed system; the workplaces were not equipped with adequate ventilation; and no personal protective device was available. As a result, most workers were unavoidably exposed to toxic substances, so chemical exposure might be higher than that shown in the study.

In this study, the accident incidence rate was twice as high as the regional official rate. This could be explained by the failure to enroll in the social welfare scheme by small-scale factories.

In our study, we found the standardized fertility ratio of female workers was half that of the general population. This could be a function of behavioral characteristics of young working couples to prolong time-to-pregnancy, it could be due to low fecundity among female workers or the fact that infertile women were more likely to stay in employment. It was not the aim of this survey, however, to determine the reason for low fertility in the wood workers.

Organic solvents are volatile liquids with lipid solubility, it is likely that most organic solvents easily cross the lipid barrier of the placenta and to a lesser degree, the testis. Previous epidemiological studies on the effect of solvent to spontaneous abortion have been reported both associations (Heidam, 1984a; Taskinen *et al,* 1986) and no associations (Axelsson *et al,* 1984; Heidam, 1984b). Differences in selection of study population and occupation, specific type of solvents used, low statistical power for separate solvent study, variation of solvent intensity and the fact that actual time of solvent exposure should be the first trimester may explain the inconsistent results. Two case-control studies nested in a cohort from Finland (Linbolm *et al,* 1990; Taskinen *et al,* 1989) monitored biologically for exposure to six organic solvents (styrene, toluene, xylene, tetrachloroethylene, trichloroethylene and 1,1,1-trichloroethane) reported a positive association between spontaneous abortion and maternal exposure to organic solvents during pregnancy, especially to aliphatic hydrocarbons (OR 3.9, 95% CI 1.1- 14.2) and paternal exposure to organic solvents in general (OR 2.3, 95% CI 1.1-5.0), high and frequent exposure to

toluene (OR 2.3, 95% CI 1.1-4.7) and miscellaneous organic solvents including thinners (OR 2.1, 95%CI 1.1-3.9). The high abortion rate in our study seemed to be consistent with previous findings, however, it should be noted that many strong confounders such as maternal age, parity or maternal physical workload etc, were not taken into consideration.

In conclusion, the wood furniture industry in Southern Thailand are likely to cause occupational health and safety problems. Employers should be encouraged to provide safe work environment and adequate protective equipment and workers should be regularly trained and monitored to perform safe work practice. The establishment of an action-oriented health and safety committee with employers and workers involvement is recommended as a first step.

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High prevalence of drink-driving in Thailand

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Abstract

This study was conducted to measure the prevalence of drivers with a blood alcohol concentration (BAC) over 50 mg/dl and to identify predictors for such an outcome. A cross-sectional study was conducted during March to August 1995 in eight provinces in Thailand. In each province, with the collaboration of the police, one checkpoint in a suburban area and one on a highway were used to collect data on drivers of 20 motorcycles, 20 4-wheel and 20 6 + -wheel motor vehicles, during 1300–1500 h, 1700–1900 h and 2200–2400 h. For each subject, a breath test for alcohol was undertaken using standard breath testing instruments. Four thousand, six hundred and seventy-five male drivers were tested. The crude prevalence of high BAC was 12.6% (range 4.5–23.7%). The differences in prevalence between the suburban area (8.7%) and the highway (8.4%) and between drivers tested on weekdays (9.8%) and on holidays (7.5%) were not statistically significant. The crude prevalences were 3.4–3.8% and 3.8–3.9% at 1300–1500 h and 1700–1900 h, respectively. During 2200–2400 h the prevalence rose to 19.2%, 16.0% and 11.9% among the motorcyclists, the 4-wheel vehicle drivers and the 6 + -wheel vehicle drivers, respectively. High BAC among Thai

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drivers in the study period was very common, especially at night. Efforts should be focused on these high-risk groups and this time period. [Chonsuvivatwong V, Ritsmitchai S, Surayawongpaisal P, Charyalertsak W, Kosuwan W, Punyaratabandhu P, Sutiwipakorn W, for the Traffic Behaviour Study Group of Thailand. *Drug Alcohol Rev* 1999;18:293–298]

Key words: blood alcohol; Thailand; traffic behaviours; night drivers; logistic regression.

Introduction

High blood alcohol concentration (BAC) is well known to be a major cause of road accidents [1,2]. BACs of 0.05 mg/dl or higher result in impairment of nearly all the important components of drivers' performance [3].

In Thailand, where the rate of traffic injury was as high as 302 per 100 000 population per year in 1992 [4], the regulation of BAC has not been settled and the law has not been fully enforced. The situation in the country represents what is happening in many countries where the economic growth rate is high, alcohol consumption and car ownership are increasing, but road and policy on drink driving are underdeveloped. Therefore, it is appropriate to conduct a study to obtain the baseline prevalence and to identify high-risk groups, places and times so that resource efficiency in the near future can be maximized.

This study was one of a series of multi-centre studies involving five universities in Thailand covering five domains of risk: blood alcohol, knowledge of road signs, road use (drivers and pedestrians) and road environments. The current report concerns only the first part.

The objective of this study was to obtain the prevalence of high BAC among different groups of drivers at different times of the day in a suburban area and on the highway in eight selected provinces.

Methods

The study was carried out during March to August 1995 as a cross-sectional survey. Study provinces were selected, based on a previous study of traffic behaviours carried out in 1992, to allow comparision of the results (although this is the first extensive alcohol study of the country). The selected provinces were: Bangkok and Ayutthya in the central region, Chiangmai and Tak in the northern region, Khon Kaen and Nakhon Ratchasima in the northeastern region and Songkla and Phuket in the southern region. In each region, the study team consisted of staff from the provincial university and the teaching college in the region.

The questionnaire taking information on sex and age of the driver and the observation checklists on driving licence and type of vehicle were prepared in the co-ordinating centre specifically for the purpose of this study. It was then pilot-tested in each region, and modified where necessary. After several meetings, a final common questionnaire and the checklists were used.

The study was designed originally to use the same model of breath test instruments (Lion Alcometer SL-400), obtained from the Department of Land Transportation. However, as the number of instruments was inadequate, the PBA 3000 model was used in the northern region. For all sites, the instruments were calibrated and the cut-off point for reporting high BAC was 50 mg/dl or above. A parallel study conducted by another research team in Thailand comparing readings from both instruments with the results from gas chromatography demonstrated high level of agreement (unpublished).

There were two checkpoints on two main roads in each province, one on a highway and the other in a suburb. Checkpoints were chosen on the basis of convenience for car stopping and breath testing. The research team spent 2 days at each checkpoint, one being a weekday and the other a holiday. In the case of rain, data collection was postponed to the next eligible day. During the data collection period, the police randomly requested 3–4 vehicles to stop at a time. The driver was approached and it was explained that this was part of a research project. Interview and breath testing was then conducted on voluntary basis. Data collection in the period finished when the number of drivers in each category (motorcycle, 4-wheel car or pick-up and 6 + -wheel truck or bus) reached 20 or the time was up. Data were computerized and statistical analysis was carried out at the co-ordinating centre.

Table 1. *Number of vehicles studied by time and province*

Province	1300–1500 h	1700–1900 h	2200–2400 h	Total
Bangkok	238	219	200	657
Ayutthya	233	228	231	692
Nakhon-Ratchasima	224	229	234	687
Khon Kaen	239	239	235	713
ChiangMai	0	0	387	387
Tak	0	0	295	295
Phuket	236	242	242	720
Songkhla	171	186	167	524
Total	1341	1343	1991	4675

For the statistical analysis, descriptive statistics and tabulation were used initially to obtain the breakdown of the crude prevalence. Logistic regression [5] was applied forcing type of checkpoint (highway vs. suburb), time (afternoon, evening and 2 hours before midnight) and day (weekday vs. holiday) of data collection and type of vehicle (motorcycle, 4-wheel and 6 + -wheel) in the model in order to show independent effects of all variables. Prevalence odds ratio and 95% confidence interval were used to compare the subgroups with adjustment for other variables. The reference level of each variable was given an odds ratio of 1. The odds ratios in other specific categories then indicate how many times the odds for subjects in that category are to have a high BAC compared to the reference category.

Results

Of the 4778 cars stopped the refusal rate for breath testing was less than 1%. One hundred and three (2%) had female drivers. This subgroup was excluded in subsequent multivariate analysis because the size was too small and was considered to be different from the remaining drivers. Table 1 shows the distribution of the sample by province and time. In the northern region, due to lack of police personnel, data collection was carried out only between 2200 h and 2400 h. The overall prevalence of BAC above 50 mg/dl was 8.68%.

The prevalence of drink driving in suburban areas and on highways were 8.7 and 8.4%, and those during weekdays and holidays were 9.8 and 7.5%, respec-

Table 2. *Summary of prevalence (%) of drivers having blood alcohol concentration exceeding 50 mg/dl from eight provinces*

	Motorcycle	4-wheel	6 + -wheel
1300–1500 h*			
Average	2.4	2.7	2.8
(min–max)	(0–3.7)	(0–3.8)	(0–3.7)
1700–1900 h*			
Average	3.8	3.8	3.9
(min–max)	(2.5–5.3)	(0–7.8)	(0–3.6)
2200–2400 h			
Average	19.2	16.0	11.9
(min–max)	(6.3–31.4)	(6.2–30.5)	(2.7–31.0)

*No data collected from the two northern provinces.

Table 3. *Association between high blood alcohol concentration and various risk factors*

	BAC		
	< 50 mg dl	= > 50 mg dl	adj. OR* (95% CI)
Site			
Highway	2253	216	1
Suburb	2015	190	0.997 (0.80–1.24)
Day			
Weekday	2079	227	1
Holiday	2190	179	0.82 (0.66–1.02)
Province			
Bangkok	607	50	1
Ayutthya	661	31	0.52 (0.32–0.83)
Nakhon Ratchasima	613	74	1.40 (0.95–2.06)
Khon Kaen	686	27	0.44 (0.27–0.72)
Chiangmai	263	124	2.31 (1.57–3.38)
Tak	280	15	0.26 (0.14–0.48)
Phuket	672	48	0.80 (0.53–1.23)
Songkhla	487	37	0.86 (0.54–1.35)
Vehicle			
Motorcycle	1461	166	1
4-wheel	1443	141	0.82 (0.64–1.05)
6 + -wheel	1365	99	0.67 (0.51–0.88)
Time			
1300–1500 h	1305	36	1
1700–1900 h	1291	52	1.45 (0.94–2.23)
2200–2400 h	1673	318	5.80 (4.01–8.39)

tively. It is obvious that the rate sharply increased at night (Table 2). Motorcycle drivers had similar rates compared to other drivers during the daytime. In the 2 hours up to midnight, the rate increased to approximately every one in five of tested motorcyclists, which was the highest among all drivers.

Table 3 shows results from logistic regression, which computed the effects of each independent variable adjusted for all others. There was no significant difference between suburban and highway drivers, drivers on weekdays and on holidays. There was a significant difference among different provinces, with Chiangmai having the highest prevalence and Tak the lowest. The size of vehicle was negatively associated with the odds of drink driving. Four-wheel vehicle drivers had 0.82 and 6 + -wheel drivers had 0.67 the odds of drink driving, as did motorcyclists. During early evening the adjusted odds of having a high BAC driver increased from daytime by 45%. In the period up to midnight, the adjusted odds for all groups increased from daytime 5.8 times.

Discussion

We have found in this study that Thailand has a high prevalence of drink driving compared with studies conducted in other countries (see Table 4). Several factors have to be considered in relation to the results.

During the study period, legal action to control drink driving had been minimal. Breath testing was not a control measure and had never been carried out in Thailand before. As the test was not supported by law during the study period, it was difficult to obtain a representative sample for all drivers. There were fewer female drivers at night when most of the data

Table 4. *Prevalence of driver having blood alcohol concentration higher than 50 mg/dl by country*

Country	Year	Drivers tested	% BAC > 50 mg/dl
Denmark	1985–1987	60 500	1.14
Germany			
West	1992–1994	9 041	1.2
East		11 069	0.85
Spain	1991	1 044	8.90
France	1991–1992		4.5
Finland	1991	140 000	0.2
Netherlands	1994	16 326	4.9
Norway	1981–1982	71 999	0.27
Sweden	1975		0.1
Thailand (this study)		4675	8.68

*Source: see [8].

collection took place. This group of drivers might have a greater chance of being exempted and thus a high chance of bypassing the checkpoint. This bias might also happen with other privileged groups of drivers. Therefore, it is likely that our sample might be over-represented by lower middle-class males, who were likely to have higher levels of alcohol consumption. On the other hand, we had ensured that the checkpoints were not selected near any public house or restaurant, to avoid another potential cause of bias. Therefore, bias resulting from site selection was unlikely. The problem of drivers with high BAC missing the checkpoint was documented by Well *et al* [6]. When the test is enforced in Thailand in future, it will be necessary to establish a system to minimize such avoidance. In addition to these potential biases, accurate estimation of the traffic flow was not possible due to lack of electronic counting devices used in traffic engineering. The weighting factor for each province was therefore not available.

While different instruments were used in the northern province, we used only the common cut-off points for BAC of 50 mg/dl. The two types of instruments were shown to have high measurement agreement using gas chromatography. It is unlikely that comparability of the results from different instruments will present a major problem; both the highest and the lowest adjusted prevalences were found to be in the northern region.

The high prevalence of high BAC, especially at night, is vitally important information. Combined with poor visibility and relatively poor rescue facilities at night, travel during this period of the day in Thailand could be dangerous. This increased risk could be enhanced considering that modern life-styles increase night work and night transportation.

Motorcyclists were at highest risk of having a high BAC, especially around midnight. The motorcycle is the most commonly used vehicle in this country and contributes the highest mortality [7]. Thus, a random breath test programme must focus on this group in order to reduce the number of road accidents.

In general, the prevalence in this study of high BAC in Thailand was considerably greater than has been found in most European studies except in Spain (see Table 4). As BAC substantially and progressively increases the risk for road accidents [1,2], the high prevalence of this problem in Thailand is a major threat to the community. Breath testing for alcohol has been shown to be an effective measure against such risky behaviour [9,10]. It is recommended that such a measure should be planned as soon as possible. Emphasis on breath testing should be made at night, a period when the prevalence of elevated BAC is high.

In parallel to the current study, other research projects were carried out in the same provinces which showed that the prevalence of exceeding the speed limit was 37–54% and the average incidence of driving through a red traffic light was 0.6–3.7 vehicles per observed light cycle. High levels of such illegal high-risk driving suggest that legislation of measures to

control drink driving is unlikely to be enough to reduce the road accident rate. Further behavioural research and law enforcement are extremely important. Finally, more epidemiological research projects are necessary to monitor the effectiveness of the control programme for traffic accidents in this country.

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Soil Contamination and Infections by Soil-transmitted Helminths in an Endemic Village in Southern Thailand.

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Running title: Soil contamination and helminthic infections

Suggested key words: Soil-transmitted helminth, soil contamination, contamination infection correlation.

Summary

The aim of this study was to test the association between soil contamination and infection of the household members by soil-transmitted helminths in dry and rainy seasons.

A lake-side community in southern Thailand with a population of 2340 was studied twice, in the dry season and rainy season of 1995. Fifty households were randomly selected. Soil samples near the latrine, in the yard, at the foot-washing area and under the trees were taken and analysed for presence of helminthic eggs. All members of the selected household were interviewed and stool samples obtained.

Age-adjusted odds ratios of presence of Ascaris and Trichuris eggs in the household soil for ascariasis and trichuriasis were 10.5 (95% CI 1.5-77.1) and 5.5 (95% CI 2.4-12.7) in dry season and 10.4 (95% CI 2.5-43.8) and 8.3 (95% CI 3.4-20.0) in rainy season. The levels of hookworm eggs detected in the soil were too low to test the association.

Soil analysis for eggs of Ascaris and Trichuris may be used to predict infections among the household members but not that for hookworm.

Introduction

Southern Thailand has been known for its high prevalence of soil-transmitted helminths compared to other parts of the country (Vacharasathira and Harinasutha, 1957; Preuksaraj et al,1982; Jaranasri et al,1990). Despite an intensive control program started in 1990, the prevalence remains high. The pitfalls in control were lack of proper health education and program management (Chongsuvivatwong et al,1994). In addition, a recent study showed that within the village, risk for hookworm infection is not associated with status of use of latrine, but with status of shoe wearing (Chongsuvivatwong et al,1996). Thus, studies on soil contamination are needed to gain better understanding of infection in the population.

The objectives of current study were to document the level of contamination of helminthic eggs in the soil around the houses in the endemic villages in dry season and rainy season and to determine the level of association between such contamination and the specific infections. As obtaining soil sample is more convenient than obtaining stool specimen from the villagers, if the association is strong enough, in the future, assessment of soil contamination may be used to partially replace or to supplement study of stool samples.

Materials and Methods

Study Community

A village in Pattalung Province which had been shown to have high prevalence of soil-transmitted helminthic infection in the latest survey was chosen. It is situated on the west coast of Songkla Lake, which is fresh water. There were 426 families with a population of 2340, a mixture of Muslim and Buddhists. Major occupations are labour, fishing, farming and petty trading. Rainy season is between July and January. The remaining months are relatively dry. The total rainfall in the year of study was 2357.7 mm. The average temperature at soil level is 28.6 degree Celsius.

Sampling technique and data collection

Fifty households were randomly selected. The selected houses were visited twice, first in April 1995, representing dry season, and again in October 1995, representing rainy seasons. In each season, duplicate soil specimens were collected from four sites in the household, viz. around the latrine, from the foot-washing area (at the entrance of the house), from the yard and from a shaded area under trees in the yard. At each site, approximately 200 g of top soil (less than 3 cm depth, in an area of approximately 1 square foot) was dug up, put into a labelled polyethylene bag and carried to the laboratory on the same day. In separate visits in both seasons, each member of the family was requested to hand in a stool specimen in a container provided by the research team.

Laboratory work

The method for analysis of the soil sample followed a previous report (Uga et al,1993). Briefly, the soil specimen was dried overnight at

room temperature and sifted through sieves of 150 micron mesh. About 2 g powdered sand was suspended in about 8 ml sucrose solution with a specific gravity of 1.200 and centrifuged at 200 x g for 10 min. The tube was then filled to the brim with sucrose solution so that only a small bubble would form under a cover-slip placed on the tube. After the final centrifugation at 25 x g for 5 min., the cover-slip was removed onto a microscopic slide and examined for eggs. By this method, 200 g of soil can be examined at one time. The recovery rate efficiency has been reported at a level of 48 percent.

Stool specimens were examined by microscopy using modified Kato's thick smear technique (Kato and Miura, 1954).

Statistical analysis

Descriptive statistics and cross-tabulation were mainly used. Logistic regression (Breslow and Day, 1980) was used for multivariate analysis. The data from the two seasons were modelled separately. Specific infection status was taken as the outcome. The main independent variable was soil contamination in the household. Adjustment for age was made since it was shown to be major determinant of defecation behaviour. Computation for exact odds ratio was performed when the prevalence of exposure or outcome was too small for the regression.

Results

Not all of the 50 houses could provide soil specimens from all 4 sites. For example, in the dry season, 44 houses had latrines, 15 of which were inside houses paved with cement. Four latrines outside the houses were also surrounded with cement, leaving 25 houses eligible for analysis of soil surrounding the latrine. In the rainy season, two more houses had constructed latrines. The numbers of houses studied on soil contamination at each site are listed in Table 1.

Total number of subjects in the sample household was 248. After excluding infants under 2 years old, the total number of subjects who handed in stool samples in both seasons was 133. The reasons for non-response were not quantified, but the major reason was that the subjects had to leave the village early in the morning for work in the city.

Trichuris egg was the most common helminthic egg found in soil specimens. The yard was the most common place to find helminthic eggs, followed by foot-washing area and around the latrine. No egg could be detected from soil samples obtained from the shade under the tree. There are no significant differences in the rates between dry season and rainy season in any of the places.

Prevalence rates of ascariasis, trichuriasis and hookworm infection were 4, 50 and 44 percent, respectively, in the dry season. These rates increased to 8, 59 and 59 percent, respectively, in the rainy season. Changing of individual infection status is shown in Table 2.

The middle two columns of Table 2 give the numbers of subjects who changed infection status. The outer two columns are numbers of subjects who did not change status. Among those who changed status, the number which converted from negative to positive is significantly higher than the reverse in trichuriasis and hookworm infection but not in ascariasis.

The association between the infection of particular helminths and the presence of the eggs at each place is shown in Table 3.

Status of soil contamination with Ascaris and Trichuris eggs in the house is a strong predictor for specific helminthic infections among the household member. Age-adjusted odds ratios for ascariasis (10.5 in dry season and 10.4 in rainy season) and those for trichuriasis (5.5 in dry season and 8.3 in rainy season) were statistically significant. The prevalence of hookworm eggs in the soil sample was too low to test the association with hookworm infection.

Discussion

In summary, the prevalence rate of soil contamination and infection of soil-transmitted helminths in the study area was high. The presence of Ascaris and Trichuris egg in the house vicinity was strongly and moderately associated with infection of the household member. But the soil analysis technique was not sensitive enough to detect contamination of hookworm larva.

Despite the fact that 44 of the 50 houses had a latrine, the prevalence rate of infection was still high. The number of infected persons increased in the rainy season in spite of increasing latrine coverage. This suggests that availability of latrine in the study area neither adequately prevented soil contamination around the house nor adequately prevented the individual members from infection.

In both seasons, a consistent association between infection and soil contamination was found in ascariasis and trichuriasis, but not in hookworm infection. The 95 percent confidence interval for ascariasis was wide due to relatively low prevalence of infection. Although the associations are strong and statistically significant, the associations could not be used to define the exact direction of causal relation. In one direction, an infected resident may pass the helminthic eggs and contaminate the soil. In the opposite direction, contamination of helminthic eggs in the soil may increase the risk of infection among the residents.

Inconsistency between a rise in prevalence of infection and no rise in prevalence of soil contamination was found in hookworm infection.

This can be explained by current low detection rates. In contrast to a previous study in West Bengal (Hominick et al,1987) where hookworm larvae were harvested from soil at the defecation site, we have rather low recovery of the larvae in our study. This difference may be explained by the fact that the places where we collected the soil samples were far from the defecation sites than those in the previous study.

Many previous studies have tried to measure the level of contamination of helminthic eggs in soil (Dada, 1979; Dada and Lindquist, 1979; Quinn et al,1980; Nunes et al,1994), but to our knowledge, the current study is the first to report on the association between soil contamination and infection with human nematodes.

Soil contamination with helminthic eggs in the house vicinity of the study sample was an important problem in the study area. Status of soil contamination with Ascaris and Trichuris may predict infection status of the resident and thus could be a useful tool in evaluation of the helminthic control programme. Soil survey might be more feasible than stool survey in a situation where villagers are mobile and less co-operative. However, this technique is not useful for studying hookworm problems. Further research and development of assessment of hookworm contamination in the soil are needed.

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Table 1. Number of houses found to have helminthic eggs in the dry season and rainy season.

	Near latrine	Foot-washing area	Yard	Tree shade	Any of the four places
Dry season (n)	25	47	48	44	
Ascaris	0	2	6	0	6
Trichuris	1	7	10	0	14
Hookworm	1	0	0	0	1
Any helminth	2	8	12	0	17
Rainy season (n)	27	47	48	44	
Ascaris	2	3	8	0	10
Trichuris	2	6	15	0	19
Hookworm	0	0	1	0	1
Any helminth	3	6	18	0	21

Table 2. Change of infection status from dry season to rainy season among the study subjects

Infection in Dry season	Yes		No		P value*
Infection in rainy season	Yes	No	Yes	No	
Trichuriasis	63	3	16	51	0.0044
Ascariasis	3	2	7	121	0.1797
Hookworm infection	57	2	22	52	<0.0001

* 2-tailed sign test

Table 3. Association between specific infection and soil contamination in the household.

Presence of eggs in soil specimen	yes		no		
Infection of the individuals	yes	no	yes	no	Adjusted OR @ * (95% CI)
Dry season					
Trichuris	32	10	33	57	5.50(2.39-12.68)
Ascaris	3	13	2	115	10.55(1.50-74.14)
Hookworm	0	2	59	72	(0-6.67)**
Rainy season					
Trichuris	46	8	33	46	8.28(3.42-20.06)
Ascaris	7	23	3	100	10.45(2.49-43.84)
Hookworm	3	0	76	54	(0.28-infinity)**

@ having soil contaminated with specific helminthic egg v. otherwise

* Odds ratio adjusted for age of the subjects in ascariasis and trichuriasis computed by logistic regression.

** Point estimate of the odds ratio could not be defined due to zero value in one cell. 95% CI was computed by exact method.

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TITLE PAGE

Title Secular increases in weight, height and body mass index among school children of Hat Yai, Thailand : A 5 years follow-up study.

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ABSTRACT

Upward trend of growth and overweight has been reported from developed countries. As Thailand undergoing rapid economic transition over the previous decade, we conducted the analysis to demonstrate the secular changes of growth over the five years follow-up. Subjects were a cohort of 2253 primary school children recruited in 1992 for the Hat Yai Childhood Obesity Study. Baseline demographic and family data were collected by a questionnaire completed by parents. To quantify the cohort effect, a generalized estimating equations analysis for a cross sectional time series data was undertaken with weight, height, or body mass index (BMI, kg/m^2) as a dependent variable and containing a quadratic term of age, sex, year of birth and family variables. Results : 1094 (48.5%) children had completed 6 anthropometric measurements. Graphs of median weight, height, BMI and overweight prevalence of each birth cohort against age clearly showed secular increases of growth and overweight and age effect. Children who were born one year younger weighed 1.22 kg heavier, were 1.25 cm taller, and had a BMI of 0.23 kg/m^2 greater than those being born earlier. In conclusion, we demonstrated significant birth cohort effect and age effect on growth and overweight prevalence. An increasing trend of childhood overweight reported here signifies an immediate need of intervention aiming at preventing overweight and reducing weight in childhood and adolescence.

Keywords child, growth, overweight, secular trend, cohort effect.

INTRODUCTION

Child growth and nutrition has been suggested as a good indicator of health as well as socioeconomic well being of a country. Over the previous decades, upward change in growth and increasing prevalence of obesity have been observed in developed countries. Hughes et al (1997) has reported an average increase of 1 to 3 cm in English and Scottish primary school children from 1972 to 1994. During the same period, the adjusted increase in height of children aged 5 to 14 years old of the Bogalusa Heart Study was 1.6 cm (Freedman et al, 1997). Among inner city children and ethnic minorities of Britain, height increased approximately 1.5 cm over the period from 1983-1993 (Chinn et al,1998). While growing taller, these children were getting fatter too. The U.S. National Health and Nutritional Surveys showed that the prevalence of overweight based on the 85th percentile cutoff point for body mass index increased from 15% to 22% during 1963 to 1991 (Troiano et al, 1995). This trend of increasing prevalence of obesity found in developed countries was also documented in lower income countries e.g. China, Brazil, Cuba, Vietnam and Thailand (Popkin et al, 1998). From a longitudinal study of school children in Hat Yai, Thailand, obesity prevalence was reported to increase from 12% to 15.6% in two years (Mo-suwan et al,1993) Among school children of China obesity rates, associated with stunting though, were reaching the level comparing to those in the United States (Popkin et al, 1996).

Most growth studies, however, were carried out in cross-sectional samples. Investigations of birth cohort or secular trend effects on growth and obesity are limited in such design. With the longitudinal data from a cohort of school children residing in Hat Yai in the southern part of Thailand, we conducted the analysis to demonstrate the secular changes of weight, height and body mass index over the five years.

SUBJECTS AND METHODS

Study site: Hat Yai, a city in Songkhla province, is the center of economy of the southernmost part of Thailand. It is about 1,000 km from the capital city (Bangkok) and 100

km from the Malaysian border. Rubber, sea-food, wood furniture and tourism industry are its main economy. Population was about 290,000 in 1997, 53.5% residing in the municipality. The Faculty of Medicine, Prince of Songkla University situates 6 km from the city center..

Subjects : A cohort of 2253 primary school children was recruited in 1992 for the Hat Yai Childhood Obesity Study using two stage sampling. Six schools (two municipality-operated and four private) were randomly selected from 13 primary schools in the Hat Yai municipality area, then one or two classes of each grade were randomly selected from each school. Parental consent was obtained and the study was approved by the Committee for Research in Humans, Faculty of Medicine, Prince of Songkla University.

Collection of data : Subjects were weighed wearing school uniforms without belts and shoes and with empty pockets. Weight and height were measured annually (in January) from 1992-1997 with a beam balance Detecto scale and stadiometer (Dectecto Scales, Inc, Brooklyn, NY) to the nearest 0.1 kg and 0.5 cm, respectively. We used the same and careful quality control of measurement techniques over time. Incomplete data was due to either children move to other schools or to other places where we could not follow. Baseline demographic and family data were collected by a questionnaire completed by parents as described in the previous report (Mo-suwan and Geater, 1996).

Data analysis : Only subjects with complete 6 anthropometric measurements were included in the analysis. To examine for possibility of selection bias, a chi-square test was used to detect differences between selected and non-selected groups. Due to its high correlation with total body fat (Roche et al, 1981), we used the body mass index (BMI, body weight (kg) divided by height (m) squared) to define obesity in our study. A child with a BMI value above the U.S. First National Health and Nutrition Examination Survey (NHANES-I) 85th percentile for age and sex was considered overweight (Must et al, 1991).

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Secular changes of growth and overweight and age effect were demonstrated by plotting of median weight, median height, median BMI and overweight prevalence of each birth cohort against age. To quantify the cohort effect, a generalized estimating equations analysis for a cross sectional time series data was undertaken with weight, height, or BMI as a dependent variable and containing sex, year of birth, and quadratic term of age (age and age^2). Quadratic term of age is used instead of linear term because we expected that the age effect on weight, height and BMI will decrease as children grow into adolescence and adulthood. Family variables including parental education and occupation, and parental income was retained in the models only if it was statistically significant at the 5% level. All analysis were done using the STATA statistical software version 5 (StataCorp, 1997).

RESULTS

Of 2253 subjects followed from 1992 to 1997, 1094 (48.5%) had complete 6 anthropometric measurements and hence were included in this report. Comparison of characteristics of the selected group and the rest is presented in Table 1. The selected group contained more females and had higher socioeconomic status.

Figures 1 and 2 show median weight for age of each cohort of males and females, respectively. For males, at each age point, latter cohort was heavier than the former ones with the youngest cohort being the heaviest. Similar trend was observed for the females. The youngest cohort had a median weight higher than the elder cohorts. In contrast to males, median weights of females appeared to stabilize at mid adolescence.

Median height for age of female cohorts stabilized earlier than those of males (Figs 3 and 4). Similar to weight, younger cohort was taller than the elder ones. Girls born in 1978, the eldest cohort, were approximately 6-10 cm shorter than those born later.

Like weight and height, median BMI of the younger cohort of both sexes was greater than those of the elders (Figs 5 and 6). Because they were 6-10 cm shorter but only 2-5 kg lighter than other cohorts, the eldest female cohort exceptionally had the highest BMI. While BMI of

males increased linearly with age from 6 to 17 years old, BMI increment in females appeared to slow down after thirteen years of age.

Figures 7 and 8 depicted prevalence of overweight for age for males and females, respectively. Females had a lower prevalence than males. With exception of some birth cohorts, the younger cohort tended to have a greater prevalence of overweight than the elder ones. However, a decreasing prevalence of overweight was observed in females entering adolescence.

Result of the generalized estimating equations analysis is shown in Table 2. Each model was adjusted with age, sex and a quadratic term of age. Birth cohort effect on weight, height and BMI was significant. Children who were born one year younger weighed 1.22 kg heavier, were 1.25 cm taller, and had a BMI of 0.23 kg/m^2 greater than those being born earlier. Similar findings of a greater value of weight, height and BMI were observed in children of the high income family.

DISCUSSION

The present longitudinal study of school children demonstrated significant birth cohort effect and age effect on growth and overweight prevalence. New birth cohort had a greater value of weight, height and BMI than the elder cohorts. The difference was mostly noticeable in the youngest group. Prevalence of overweight was also increased with age up to early adolescence then had a downward trend. Males and females had a different pattern of age effect. Anthropometric parameters of females reached plateau earlier than those of males. Prevalence of overweight of females was lower than that of males and decreased when reaching adolescence.

Our findings of secular increases of growth and overweight support previous reports from developed countries (Chinn et al,1998; Freedman et al, 1997; Hughes et al, 1997; Starks et al, 1981; Troiano et al, 1995). These studies (Chinn et al,1998; Freedman et al, 1997; Hughes et al, 1997) reported height increments of 0.1 to 3.3 cm over the period of 10 to 22 years. Using

birth cohort analysis, we demonstrated much greater increase, 1.25 cm per birth year. This enlarged effect probably reflected a wide gap between the actual growth and the growth potential among children of a country undergoing an economic transition like Thailand (Kachondham et al, 1993). For children of high-income countries who almost grew to their fullest potential, economic effect on height would then take a longer time to be noticeable.

Use of different anthropometric index to define obesity renders a direct comparison of prevalence of obesity across studies infeasible. However, no matter which index was utilized, an increasing trend of obesity has been documented. BMI was recommended as a screening index of obesity for adolescents (Himes and Dietz, 1994). From the Bogalusa Heart study, BMI increased by 1.5 kg/m^2 over the twenty years or 0.075 $kg/m^2/y$ (Freedman et al, 1997). Again, we found a greater increase of 0.23 kg/m^2/birth year. From our previous report, a significant trend of increased risk for childhood obesity was associated with higher family income (Mo-suwan and Geater, 1996). The bias of subjects included in our analysis towards upper income groups may partly explain this observation.

Different patterns of overweight by sex were observed. From 9 U.S. surveys (a mix of cross-sectional and cohort studies) including 66,772 children aged 5 to 17 years, mean BMI increased with age and was slightly higher for girls than for boys (Rosner et al, 1998). Mean BMI of white female cohort of Bogalusa Heart Study leveled off around 15 years of age, whereas those of white males did a little later at 20s (Freedman et al, 1997). On the contrary, mean BMIs of black cohorts of both sexes showed rather steady increase up to 25 years of age. BMI pattern of our female subjects was similar to that of Bogalusa white female cohort, while that of our male cohorts behaved like Bogalusa black subjects. Consequently we found a higher percentage of overweight for boys than for girls.

The use of NHANES-I BMI data to classify our subjects may need justification. Lack of local BMI reference and upper height limit of 170 cm of the local weight-for-height curves restrict the use of local standard for overweight categorization in our study. Due to notable ethnic

difference (Rosner et al, 1998), utilization of NHANES-I reference may underestimate overweight prevalence of our pre-pubertal children.

Concern of overweight in children comes from its long term morbidity and mortality. From the Harvard Growth Study of 508 lean (BMI value below 25th percentile of the NHANES-I reference for age and sex) or overweight (BMI value above 75th percentile of the NHANES-I reference) adolescents 13 to 18 years old, after 55 years of follow-up overweight was associated with an increased risk of mortality among men (Must et al, 1992). The relative risks were 1.8 (95% confidence interval (CI), 1.2 - 2.7) for mortality from all causes and 2.3 (95% CI, 1.4 to 4.1) for mortality from coronary heart disease. Another report of 57 years follow-up of the Boyd Orr cohort of children aged 2 y to 14 y 9 mo (Gunnell et al, 1998), the hazard ratio for all cause mortality in those with BMIs above the 75th percentile for age and sex was 1.5 (95% CI, 1.1 -2.2) and for ischemic heart disease it was 2.0 (95% CI, 1.0-3.9). Providing an observed increasing trend of childhood overweight, there is an immediate need of intervention aiming at preventing overweight and reducing weight in childhood and adolescence.

Acknowledgment

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Table 1

Baseline characteristics of the selected and non-selected subjects

Variables	Selected (%)	Non-selected (%)	Chi-square [a]
Overweight at entry	1094 (18.1)	1155 (14.6)	11.7
Sex = male	456 (41.7)	643 (55.7)	44.0
Father's education	887	892	17.7
no	16 (1.8)	26 (2.9)	
primary	195 (22.0)	263 (29.5)	
secondary	278 (31.3)	265 (29.7)	
higher than secondary	398 (44.9)	338 (37.9)	
Mother's education	916	926	19.0
no	29 (3.2)	52 (5.6)	
primary	332 (36.2)	398 (43.0)	
secondary	193 (21.1)	176 (19.0)	
higher than secondary	362 (39.5)	300 (32.4)	
Father's occupation	889	905	28.2
no	4 (0.5)	6 (0.7)	
casual	191 (21.5)	230 (25.4)	
farmer	12 (1.4)	43 (4.8)	
trader	405 (45.6)	348 (38.5)	
government officer	201 (22.6)	218 (24.1)	
office worker	76 (8.6)	60 (6.6)	
Mother's occupation	918	933	23.5
no	176 (19.2)	161 (17.3)	
casual	129 (14.1)	161 (17.3)	

farmer	10 (1.1)	33 (3.5)	
trader	402 (43.8)	390 (42.0)	
government officer	158 (17.2)	166 (17.8)	
office worker	43 (4.68)	22 (2.4)	
Parent monthly income [b]	936	930	24.8
<5,000 baht	141 (15.1)	211 (22.7)	
5-10,000 baht	319 (34.1)	337 (36.2)	
1-<30,000 baht	360 (38.5)	293 (31.5)	
≥30,000 baht	116 (12.4)	89 (9.6)	

[a] All were significant at p level less than 0.05.

[b] Parental monthly income, 1 baht = 0.04 U S. dollar at the time of data collection.

Table 2

Birth cohort effect on weight, height and BMI by generalized estimation equations analysis

Variables	Weight (kg)		Height (cm)		Body mass index (kg/m^2)	
	Coefficient	P	Coefficient	P	Coefficient	P
Age [a]	6.16	<0.001	10.93	<0.001	1.20	<0.001
Age^2	-0.09	<0.001	-0.26	<0.001	-0.03	<0.001
Birth year	1.22	<0.001	1.25	<0.001	0.23	0.001
Sex = female	-0.35	0.023	-0.52	<0.001	-0.002	NS [b]
Parental income	2.69	0.001	1.41	0.019	0.92	0.001

[a] Age = age in year at the time of data collection.

[b] NS = non significant

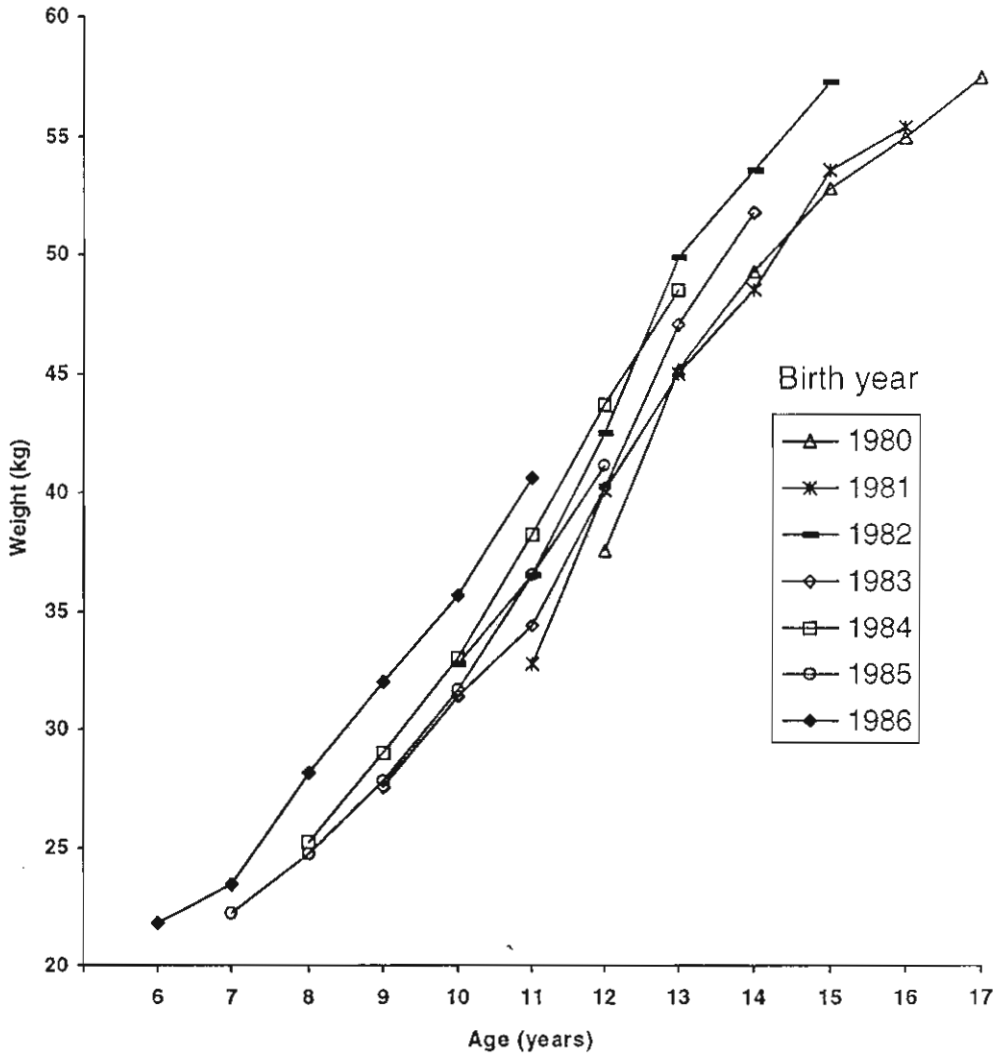

Fig 1 Median weight for age of male birth cohorts from 1992-1997

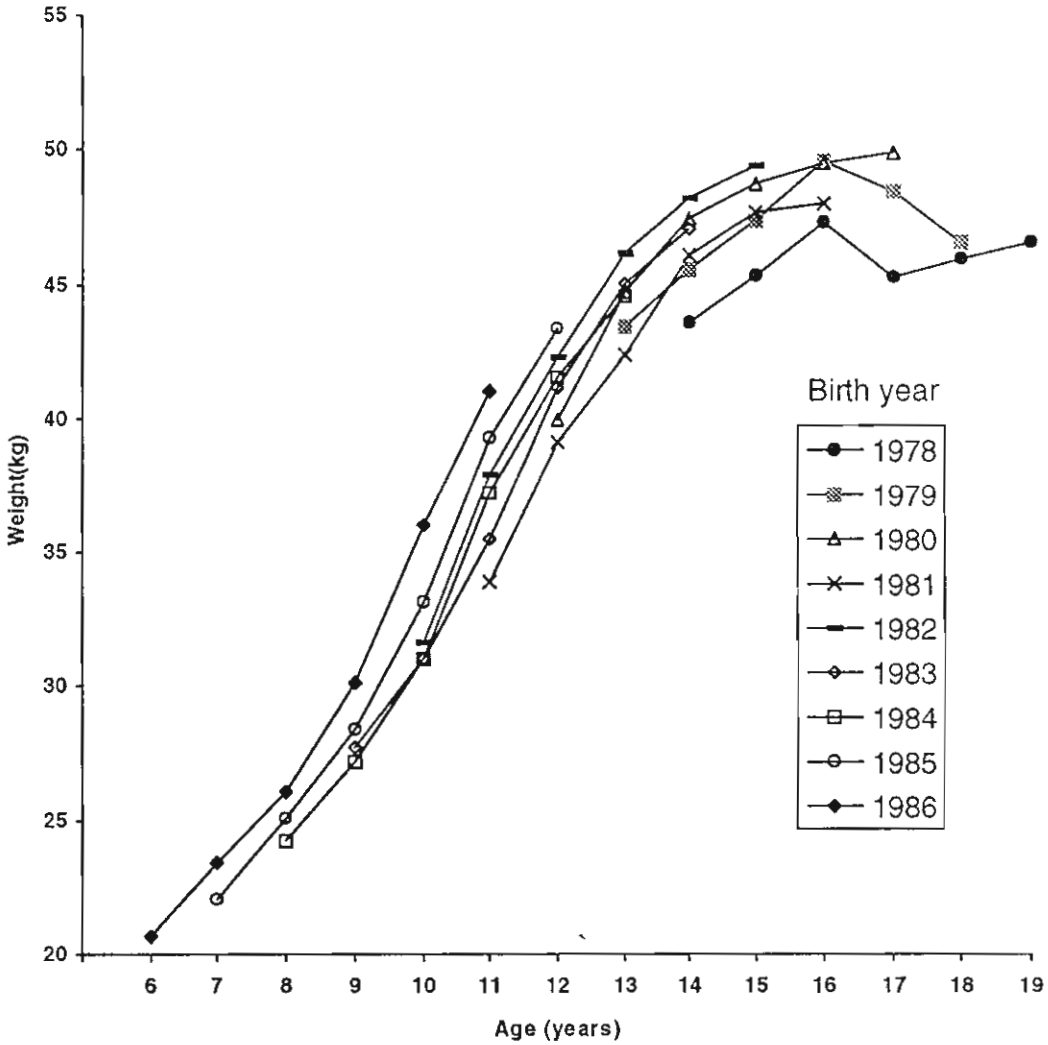

Fig 2 Median weight for age of female birth cohorts from 1992-1997

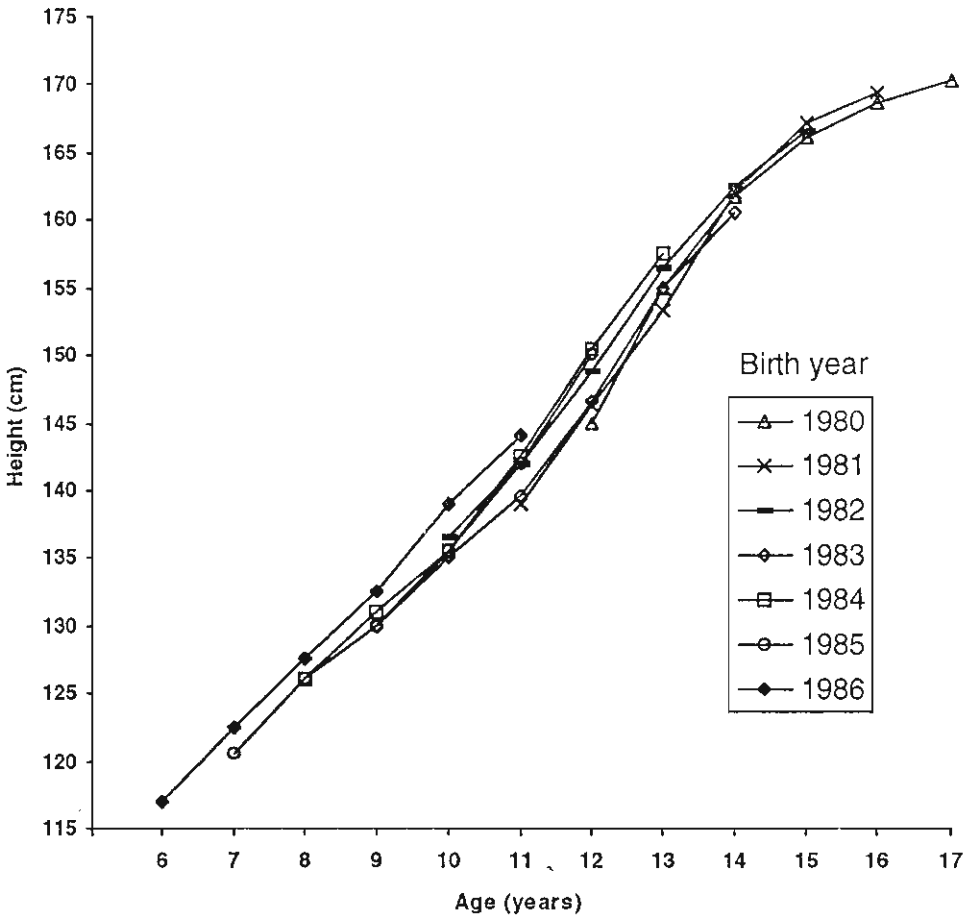

Fig 3 Median height for age of male birth cohorts from 1992-1997

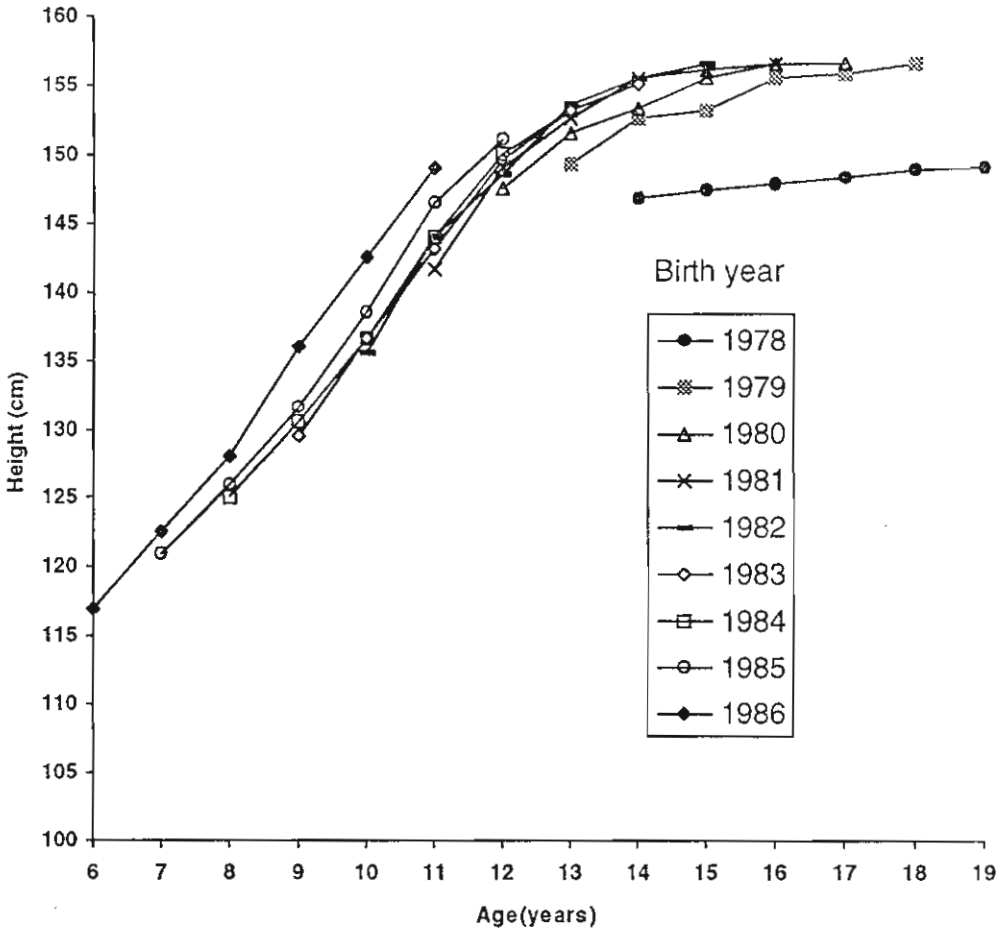

Fig 4 Median height for age of female-birth cohorts from 1992-1997

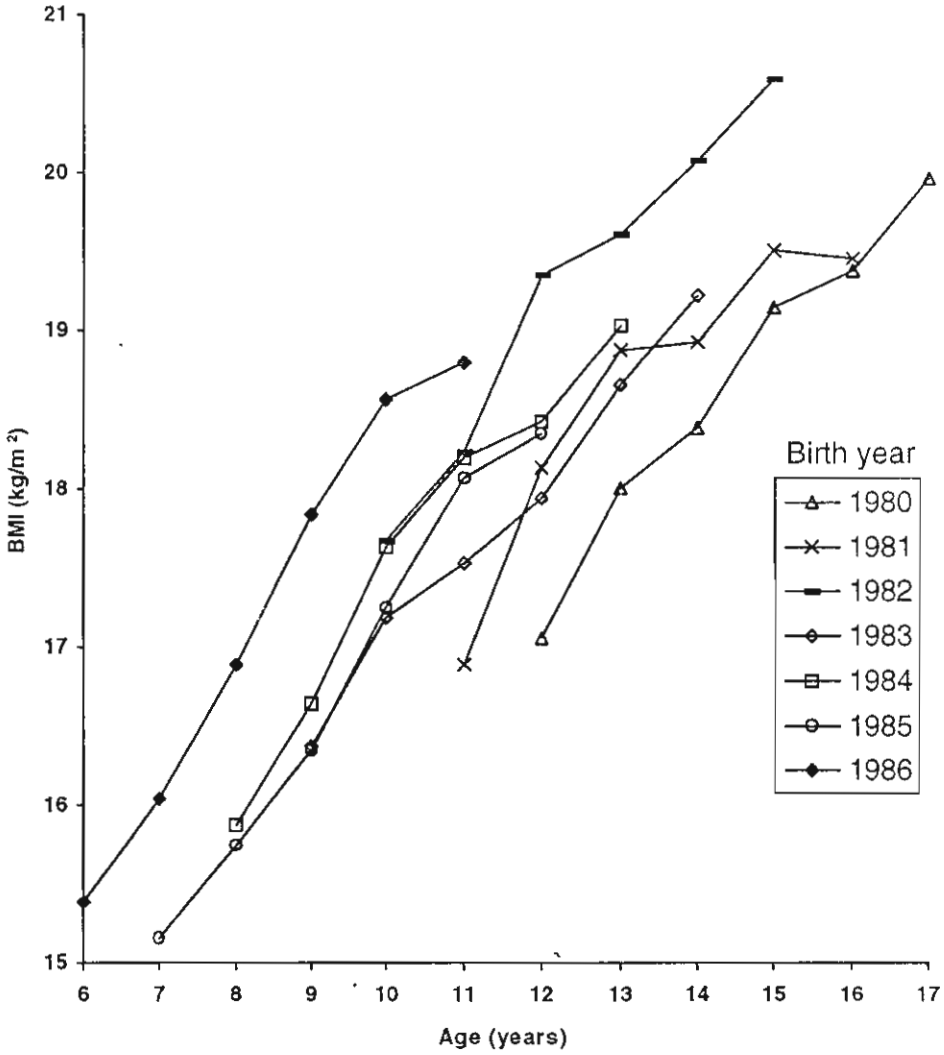

Fig 5 Median BMI for age of male birth cohorts from 1992-1997

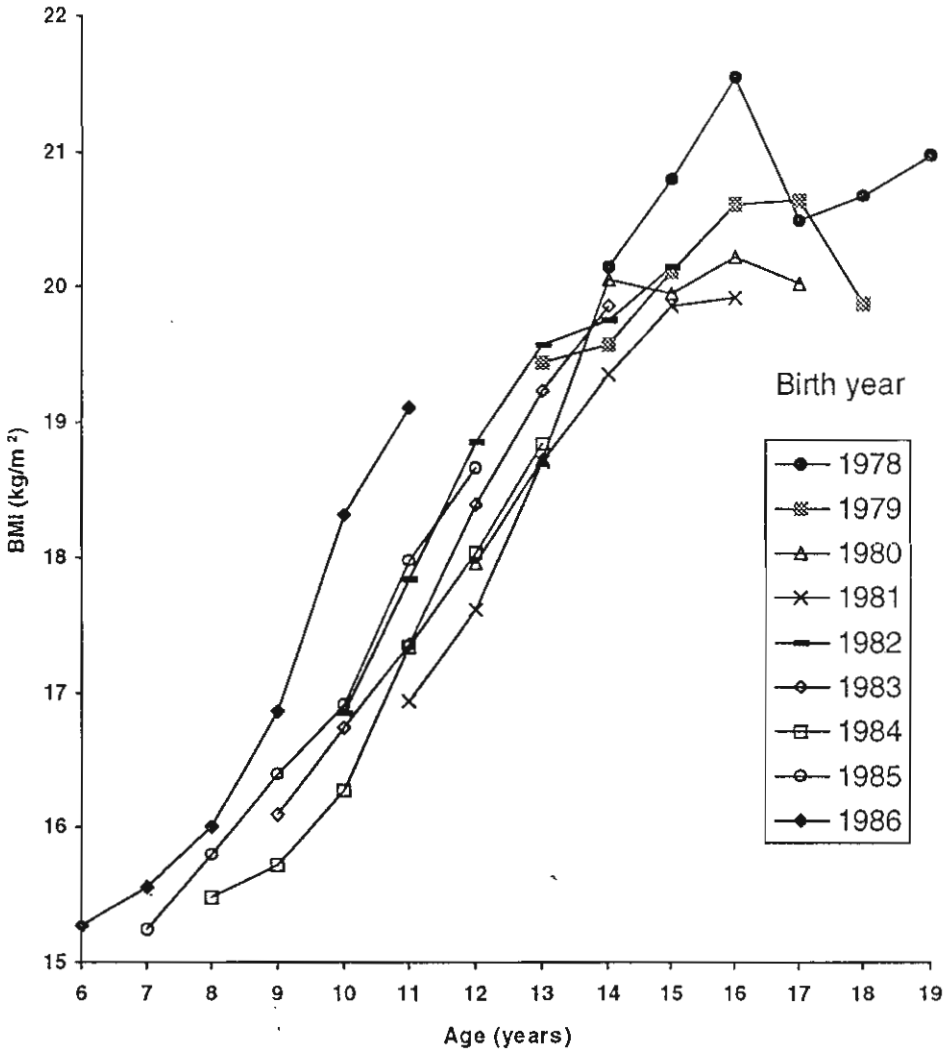

Fig 6 Median BMI for age of female birth cohorts from 1992-1997

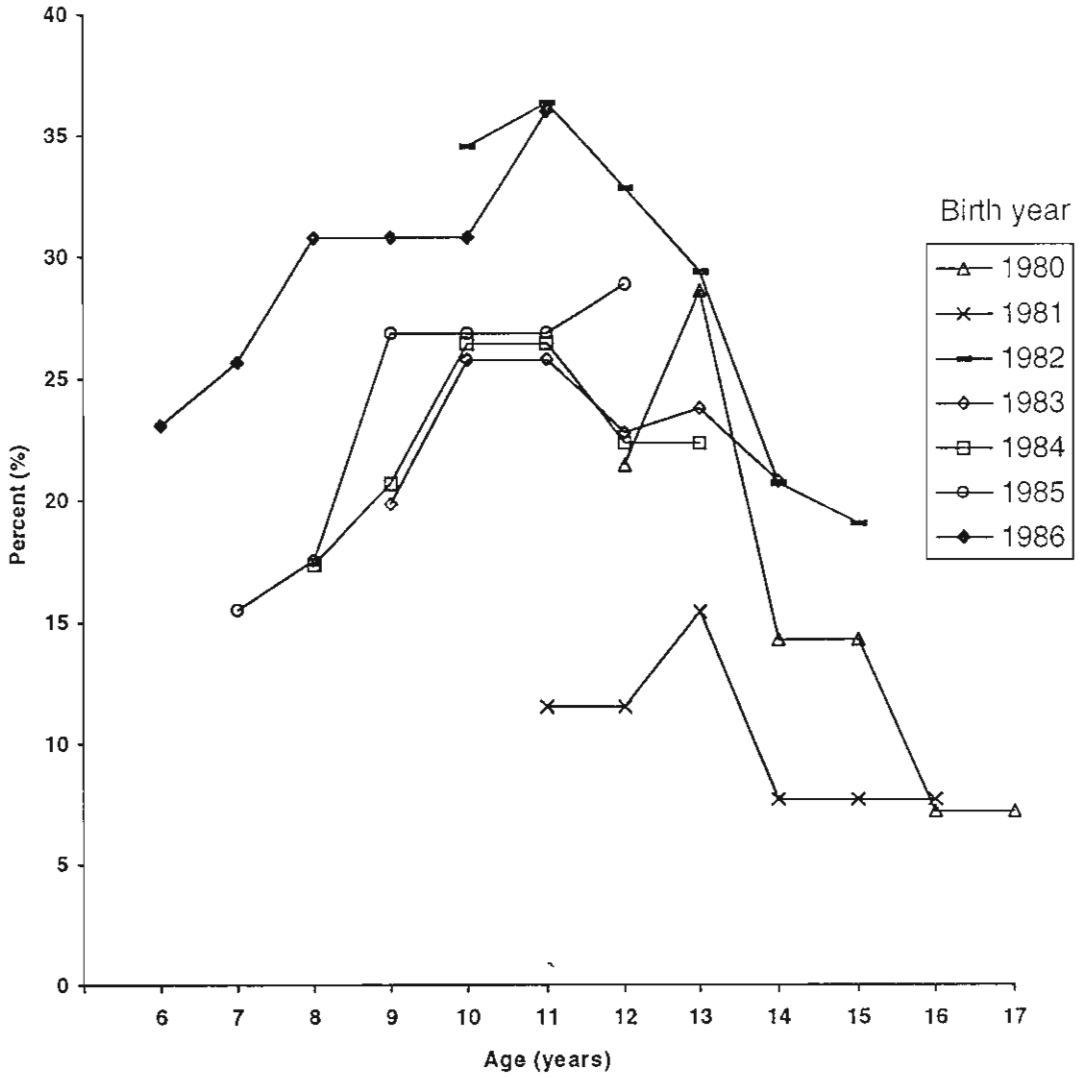

Fig 7 Percent overweight for age of male birth cohorts from 1992-1997

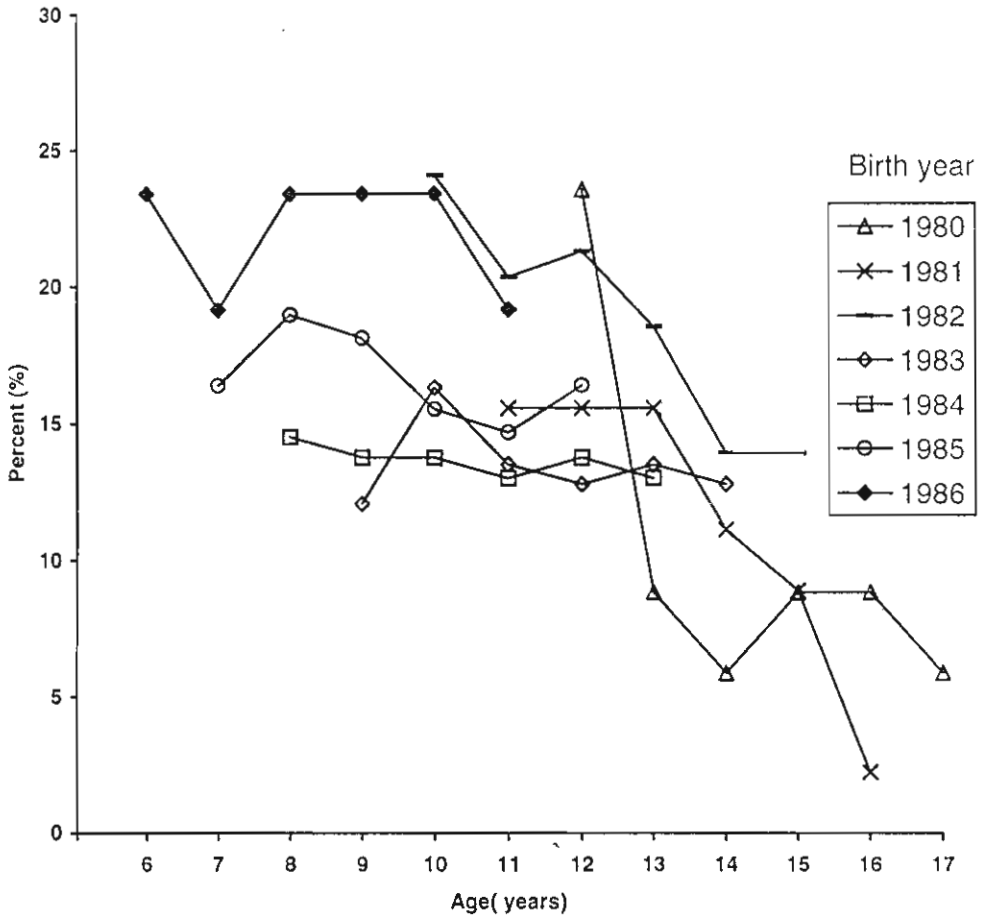

Fig 8 Percent overweight for age of female birth cohorts from 1992-1997

Delay in breast cancer care: a study in Thai women.

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Keywords: breast cancer, patient delay, system delay, help-seeking behavior

Word length: 2082

Abstract

Background Breast cancer is the second most common cause of cancer death in Thai women. Cancer registry data reveal a high prevalence of late stage disease at diagnosis. Factors resulting in delay in Thailand have not yet been investigated.

Objectives To determine the extent of and the factors contributing to delay in breast cancer care.

Design Women with breast cancer who were first treated at Songklanagarind Hospital between June 1994-June 1996 were interviewed with retrospective chart audits of care.

Measures Dependent variables included patient delay (symptom recognition to first care) and system delay (first care to treatment). Independent variables tested included demographic factors, help-seeking behavior and cancer knowledge. Non-parametric rank sum tests were used for univariate analysis and Cox regression was used for multivariate analysis.

Results Ninety-four cases were included in the study. The median patient and system delay were 4 weeks. 26.6% and 24.4% of patients experienced patient and system delay longer than 12 weeks respectively. Only marital status (unmarried compared to married women) was significantly associated with patient delay (Hazard ratio 2.78, 95% CI 1.23-6.25). Contacting a provincial hospital instead of a university hospital as first medical care (HR 2.50, 1.23-5.26), being given a diagnosis rather than being told nothing (HR 2.04, 1.14-3.57) and being given treatment rather than being immediately referred (HR 4.55, 2.22-9.09) were associated with system delay.

Conclusions Patient delay and system delay in breast cancer care are important weaknesses of disease control in Thailand. Educational program should target unmarried women who are at higher risk of delay. System delay in hospitals outside the university needs to be improved by a good referral system.

269 words

Introduction

Delay in diagnosis and treatment of breast cancer leads to progression of disease with late stage and is associated with high mortality.[1-3] Furthermore, smaller tumors are more likely to be treated successfully with limited breast surgery.[4-6] Understanding the nature of delay in each society should lead to earlier diagnosis and treatment, thus improving outcome.

In Thailand, breast cancer is the second most common cancer in women. The data from our Cancer Registry revealed that most patients receive treatment at a late stage (56% at stage III & IV). These figures suggest delay in breast cancer care, which needs to be investigated.

Delay in breast cancer care can be divided into patient delay (time since symptom recognition to initial medical consultation) and system delay (time from first medical consultation to treatment).[7] A number of studies concerning delay in breast cancer care have been reported.[7-14] Factors that have been found to be associated are age, economic status, education, history of chronic disease, symptom perception, cancer knowledge and previous health care experience. However, most of these studies are from developed countries or high incidence areas. It is appropriate to gain insight into the nature of delay and the association of delay with these factors in Thailand. This is true because socio-cultural aspects of care or help-seeking behavior particular to Thailand are unknown and because cancer education is not well developed.

Thai Health Care System

Health services in Thailand are mainly provided by public hospitals, run by the Ministry of Public Health, university hospitals and the private sector. Public health services include small health centers covering 3,000-5,000 people, 10-60 bed community hospitals covering 20,000-40,000 people and 100-400 bed provincial hospitals covering more than

200,000 people. A patient can visit any of these health services and be referred to larger hospital. The services are free for civil servants and the poor who have registered and received a government health card.

Cancer has just been recognized as an important health problem for Thai people since 1994. University hospital is the main provider of cancer care, especially radiation and chemotherapy. There are less than ten university hospitals in Bangkok, the capital city, and one or two in each region of the country. Songklanagarind hospital, the study site, has 700 beds and is the only university hospital in the southern region of Thailand; serving 14 provinces with a population of 8 million people.

Materials and methods

Subject selection

Eligible subjects included patients with histologically-confirmed primary invasive carcinoma of breast who were admitted to Songklanagarind Hospital for initial treatment between June 1994 to June 1996. Cases were excluded if they did not cooperate or data concerning delay were unreliable.

Number of subjects was determined by sample size calculation which is based on testing a null hypothesis of no difference between the incidence rates of 2 (or more) groups.[15] Assuming an independent factor is present with 2 levels with approximately median survival time of 3-5 and 5-8 weeks and approximately 50% of the subjects in each level. At 5% level of significance and with 80% power, 44 to 130 subjects are required.

Data collection

Data on personal and health care behavior were obtained by interview by a trained ward nurse using a structured questionnaire. Clinicopathological data, for example type of surgery, laboratory results and pathologic results, were abstracted from hospital and

pathological records. Duration of delay was also determined from hospital records and compared with interview data. If a large discrepancy existed, the case was excluded due to possible unreliability of the data.

Study variables

The independent variables included sociodemographic background, patient assessment of first symptom and date on which it was recognized, source and date of first care, diagnosis and treatment by first doctor, past health care practice and cancer knowledge. Pathological TNM staging was based on the staging system of the American Joint Committee on Cancer.[16]

The dependent variables were patient delay and system delay. Patient delay was calculated in weeks from the date on which a patient first noticed the symptom to the date of first medical consultation. System delay was the interval from first medical consultation to the date of admission for treatment at the study hospital.

Statistical analysis

Non-parametric statistics using Kruskal-Wallis and Wilcoxon rank sum tests were initially used to explore the association between delay and independent variables. Cox regression for survival time data was used in multivariate analysis. Hazard ratios (HR) for each level of a factor have been reciprocated in order to denote the ratio of the natural logarithm of the probability of delay among subjects at that level to that among subjects at the reference level at any given time. Thus a ratio greater than one indicates a greater probability of delay, and a ratio less than one a lower probability of delay, compared with the reference level. The best fitted models were obtained by backward elimination guided by the change in log-likelihood, using a p-value of greater than 0.05 as the criterion for removal.

Results

There were a total of 101 eligible cases during the study period. Seven cases were excluded because of non-cooperation and unreliability of delay data. These cases were not different from the included cases regarding to stage of disease. Four of these had stage II disease, 2 with stage III and 1 with stage IV. The final number of cases used in the analysis was 94.

Patient delay ranged from 1-207 weeks with a median of 4 weeks. 26.6% of patients experienced patient delay longer than 12 weeks. Breakdown of duration of patient delay by demographic characteristics, symptom-related factors and tumor stage are shown in Table 1. Unmarried women had remarkably long patient delay compared to married women. However, the difference is not significant in univariate analysis. Tumor stage was also not significant if separated into 4 stages but appeared significant when grouped into stage I +II and stage III + IV (p value = 0.038, Wilcoxon rank sum test). In multivariate analysis, only marital status was statistically significant with a hazard ratio of 2.78 (95% CI 1.23-6.25).

The system delay ranged from under a week to 104 weeks with a median of 4 weeks. 24.4% of patients had system delay longer than 12 weeks. Diagnosis and management of first physician were statistically significant in univariate analysis. These two variables and source of first care were assessed separately in Cox regression because they were correlated. All these three variables gave statistically significant hazard ratios (Table 2). Since no other factor was significant, the results in the Table 2 are presented without adjustment.

None of the factors related to past health care utilization was associated with patient or system delay (Table 3).

Discussion

The present study demonstrates a high proportion of patient and system delay in breast cancer care. Being unmarried is the only significant predictor for patient delay, whereas sources of first care and diagnosis and treatment of first contacting physician were associated with system delay.

In our study, the proportion of study subjects who experienced delay of 3 months or longer is comparable to other studies but the median delay is longer. In the literature, the proportion of delay over 3 months was reported mainly for patient delay. In a large review of this topic in 1974 by Antonousky et al., patient delay of 3 months or longer ranged from 35-50%.[17] The results of a meta-analysis of 12 publications during 1975-1992 found a 3-month delay of 34.2% (range 9-50%)[18] ;and other recent individual studies reported a range of 19-27%.[7,10-12,19] However, our median patient and system delay were two weeks longer than in other studies.[7,8,12,19] These results indicate the existence of delay in diagnosis and treatment of breast cancer in our country. However, the comparison of delay duration with other studies has to be interpreted with caution because different definitions and terms were used.

Sociodemographic background has long been found to be associated with delay in breast cancer care[9,17,20,21] although conflicting results exist.[7,13,22] The fact that unmarried women had a significantly longer patient delay in this study contrasts with other studies.[7,12,13,23] We have no data to argue why these unmarried women had such a long delay. It may be due to shyness concerning consultation and exposure of their breast to another person or it may be due to lack of psychosocial network and support.[18] Since this delay is quite significant and the incidence of breast cancer is expected to rise due to an increasingly westernized life-style, this issue should be considered in attempts to improve breast cancer care. Further study to gain insight into causes the delay which might lead to intervention is necessary.

Our data suggest that the first doctor plays a very important role in determining the duration of system delay. The subjects who had their first consultation at a provincial hospital experienced longer system delay than those who contacted the university hospital. Referred cases without prior treatment had shorter system delay. Thus the development of good referral system may shorten delay. Most patients did not have access to the university hospital for first care; and approximately 20% of cases were given medical treatment by their first doctor. This resulted in a median system delay of 13 weeks. Thus, these doctors need feedback, and perhaps a refresher course to improve case management.

However, the fact that not being informed of the diagnosis by the first doctor was associated with shorter delay is problematic. We have no data whether in fact the doctor did use verbal communication to encourage the patient to go to the referral center quickly or whether not being informed of the diagnosis increased the patient's anxiety and thus led the patient to go to the referral center more quickly or in contrast if being informed of the diagnosis of possible cancer frightened the woman and made her avoid further treatment.

Health beliefs[23-25], health education exposure[26] as well as family factors[27] have been shown to be associated with help-seeking behavior. However the present study could not demonstrate the relationship of these factors to the delay. Although it was shown that unmarried women had higher risk of delay, unfortunately other detailed reason such as shyness of a woman, gender of physician etc, were not explored. Further study aimed to elucidate these relationships should be considered, then public education health efforts can be better directed.

Our study has some limitations including sampling bias. Our hospital is a referral center and patients who suffer from advanced disease may be less likely to seek treatment; this was shown by the very few stage IV disease in our sample. So in fact, the extent of delay might be more severe than observed. This sampling bias could also be responsible for the

non-association of many variables tested. Another limitation is the reliability of the data as a result of recall bias. The patients were asked to recall the time at which they first recognized the lump, the first medical consultation, etc. Reliability should be more questionable in those with longer delay before data collection. The last major limitation was an inability of the study to give in detail the associated reason for the observed association. However, because this is an exploratory study and since there are no other data concerning this problem available in our country, our results will serve as a guide for further investigation.

The study, however, had some strength. Most previous studies used simple statistical tests by dichotomizing the time into two or more intervals. By using this method, significant factors may appear insignificant. In contrast, by using Cox regression for the continuous timing data, even a small difference will be detected.[28] Just a few recent studies have used Cox regression analysis.[8,19] The final strength of this study is that the study explored many potential variables which allowed us to identify factors independently associated with delay.

In summary, patient and system delay in breast cancer care are important weaknesses of breast cancer control in Thailand. Unmarried women are more vulnerable to prolonged patient delay but the reason for this remains unknown. Educational programs should address this expanding high-risk group. System delay in hospitals outside the university needs to be minimized by a good referral system. General practitioners in this country may need a refresher course to improve case management, avoid unnecessary medical treatment and properly refer patients.

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Table 1. Demographic characteristics of the patients and duration of patient delay.

Relationship of demographic and symptom-related factors to patient delay.

Study variables	Number of cases	Median duration (interquatile range in week)
Age (years)		
≤ 40	31	2 (1-8)
41-50	36	8 (1-22)
>50	27	2 (1-12)
Marital status		
Unmarried	9	29 (2-104)
Married	85	3 (1-10)
Education level		
≤Primary school	66	3 (1-12)
Secondary-high	14	3 (1-32)
> High school	14	4.5 (2-9)
Family monthly income (Baht)		
≤ 5000	50	2.5 (1-12)
5001-10000	17	2 (1-7)
>10000	27	8 (2-24)
Type of symptom		
Mass	80	4 (1-12)
Pain or other	13	2 (1-7)
Patient symptom assessment at first recognition		
Benign	77	5 (1-12)
Tumor/ cancer	15	2 (1-5)
Tumor stage		
Stage I	6	3 (1-6)
Stage II	66	2.5 (1-12)
Stage III	15	8 (2-27)
Stage IV	4	28 (3.5-67.5)

Table 2. Relationship between current health care utilization and system delay.

Study variables	Number of cases	Median duration (weeks)	Hazard ratio (95% CI)
Source of first medical care			
Private clinic	22	3.5 (1-12)	1.85 (0.91-3.85)
Community hospital	22	4 (3-8)	1.69 (0.81-3.45)
Provincial hospital	28	4 (2-21)	2.50 (1.23-5.26)
Private hospital	10	4 (2-11)	1.79 (0.77-4.17)
University hospital	12	2 (1-3.5)	1
Diagnosis of first physician			
Benign	23	7 (2-19)	2.04 (1.14-3.57)
Tumor/possible cancer	42	4 (1-12)	1.69 (1.02-2.70)
Not informed of diagnosis	28	2 (1-4)	1
Management of first physician			
Medicine	20	13 (3-28)	4.55 (2.22-9.09)
Biopsy	49	4 (2-9)	5.56 (2.04-1.56)
Others	6	3 (1-4)	2.00 (0.76-5.26)
No treatment	6	6 (3-7)	3.70 (1.39-11.11)
Refer	13	1 (0-1)	1
Transportation condition to study hospital			
Easy	35	3	1
Fair	35	4	0.99 (0.62-1.58)
Difficult	24	7	0.67 (0.96-2.86)

Table 3. Relationship of patient and system delay with past health care practices and cancer knowledge.

Study variables	Number of cases	Patient delay		System delay	
		Median	HR (95% CI)	Median	HR (95% CI)
Cancer history in family					
No	79	3	1	4	1
Yes	14	4	1.14 (0.63-2.00)	3	1.00(0.55-1.82)
History of chronic disease					
No	68	4.5	1	4	1
Yes	25	1	0.73 (0.46-1.18)	4	0.84 (0.52-1.33)
Usual help-seeking behavior					
Non-professional	19	5	1	3	1
Professional	75	2	1.01 (0.61-1.69)	4	1.19 (0.72-2.00)
Past experience with hospital admission					
No	41	5	1	4	1
Yes	45	3	0.76 (0.49-1.18)	4	1.19 (0.78-1.82)
Ever heard of breast disease					
No	47	5	1	3	1
Yes	45	2	0.79 (0.51-1.25)	3	1.04 (0.66-1.67)
Ever practiced breast self-examination					
No	50	3	1	4	
Yes	30	3	0.78 (0.49-1.23)	2.5	0.79 (0.50-1.27)
Think cancer is curable					
No	13	1	0.94 (0.51-1.75)	3	1.23 (0.65-2.33)
Don't know	35	6	1.28 (0.81-2.04)	3	1.04 (0.66-1.61)
Yes	45	4	1	4	1

RISK FACTORS FOR SURGICAL SITE INFECTION AND FEBRILE MORBIDITY FOLLOWING CESAREAN SECTION: A PROSPECTIVE STUDY

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Précis

Post-Cesarean infection complications compare favorably with those of other reports. Host susceptibility and existing infections are the most important predictors of surgical site infection and febrile morbidity following Cesarean section.

Abstract

Objective: to determine post-Cesarean infection complications and to identify the independent risk factors for surgical site infections.

Methods: a cohort of 969 Cesarean sections from May to August 1997 were prospectively studied. Infections were identified by ward rounds, review of laboratory results and patient follow-up until 30 days after hospital discharge. Risk factors were identified via unconditional multiple logistic regression.

Results: Surgical complication was rare. Febrile morbidity and infection complications were documented in 16.2% and 12.4% of subjects, respectively. Eighty-five subjects developed 95 surgical site infection (9.8%). Eight risk factors are independently associated with post-Cesarean surgical site infections. Identified here are preoperative remote infections (adjusted OR =16.1, 95%CI = 2.1-125.2); chorioamnionitis (aOR = 9.1, 95%CI = 1.8-45.2); preoperative condition of patient (aOR = 5.1 for ASA score ≥ 3, 95%CI = 1.1-23.1); rupture of membrane (aOR= 2.5 for ROM ≥ 24 hours, 95%CI= 1.1-3.1); pre-eclampsia (aOR = 2.2, 95%CI = 1.03-4.7); higher body mass index (aOR = 2.0 for every 5-unit increment, 95%CI = 1.3-3.0); nulliparity (aOR = 1.8, 95%CI = 1.1-3.2); and increased volume of surgical blood loss (aOR = 1.3 for every 100-ml increment, 95%CI = 1.1-1.5).

*{Other five factors were documented as independent predictors of febrile morbidity following Cesareans section. They are chorioamnionitis (aOR = 16.0, 95%CI = 3.1-83.3); preoperative condition of patient (aOR = 13.6 for ASA≥ 3, 95%CI = 2.8-65.7); preoperative fever (aOR = 9.5, 95%CI = 3.8-23.7); preeclampsia (aOR = 2.4, 95%CI = 1.2-4.6); and blood loss (aOR = 1.3 for every 100-ml increment, 95%CI = 1.1-1.5)

Conclusion: Post-Cesarean complications compare favorably with those of other reports. Host susceptibility and exiting infections are important predictors of surgical site infection and febrile morbidity after Cesarean section. High-risk patients should be more carefully monitored and preoperative infection should be properly intensively treated as soon as possible.

{---}:*this paragraph was not present in the submitted manuscript.*

Introduction

The number of abdominal deliveries has been steadily increasing worldwide, making Cesarean section one of the most common major operations nowadays[1]. Maternal morbidity related to infections after Cesarean delivery was eight-fold higher than that after vaginal delivery[2]. Surgical site infection (SSI), accounting for almost one-third of nosocomial infections[3], results in discomfort for obstetric patients with many quantifiable consequences in terms of morbidity, time and money. Total cost, including indirect expenses related to SSI, in the United States may exceed 10 billion dollars annually[4].

Reported rates of post-cesarean SSI vary greatly from 0.3% in Turkey[5] to 18.3% in Saudi Arabia[6]. Rates of only superficial and deep SSI in some settings were surprisingly as high as 25.6% in New Zealand[7] and 36.6% in Canada[8]. Despite numerous investigations, there has been a lack of agreement about the risk factors of SSI. A wide variety of factors affects infection rate differently in different settings. Moreover, confounding variables were not sufficiently controlled in many of those reports. Therefore, we conducted this prospective study to determine the postoperative infection complications and to identify the risk factors for surgical site infection after Cesarean section in the context of multivariate analysis. A better understanding of the predictors may improve our infection control program in reducing the clinical impact of SSI.

Materials & Methods

We carried out a prospective study of a cohort of 969 Cesarean sections in Hungvuong obstetric and gynecological (Ob/Gyn) Hospital in HoChiMinh City, Vietnam. It is a 450-bed tertiary-care Ob/Gyn hospital with an average of 1,300 deliveries and 350 major operations per month. It serves not only the population of 2.5 million women in HoChiMinh city but as a tertiary-level supervisory center for 18 district hospitals and the Ob/Gyn departments of all other hospitals in HoChiMinh city as well.

From May to August 1997, all Cesarean deliveries were recruited into the study. The principal investigator visited each postoperative ward twice weekly and collected all pertinent data. Demographic, putative factors and surgical indications were recorded. The host-related variables included age, residence, parity, body mass index, preoperative stay, existing co-morbidity, prior amniocentesis, rupture of membrane (ROM) duration, and preoperative condition of patient. Surgery-related variables included emergency, Cesarean hysterectomy, surgical duration, wound class, type of anesthesia, type of abdominal incision, experience of surgeon, volume of blood loss, and timing of prophylactic administration of antibiotics. The variable residence was defined as urban or rural. Body mass index was calculated using postpartum weight and height, which were measured at the third-postoperative day by the research assistants. Preoperative stay was the interval in days between hospital admission and

surgery. The existing co-morbidities investigated were diabetes mellitus, remote infection, pre-eclampsia, anemia, and chorioamnionitis. Preoperative condition of patient was assessed by the American Society of Anesthesiologists preoperative assessment score (ASA score)[9]. We modified the classical wound classification to make it more appropriate for obstetric operation. A Cesarean section was classified as class I if there was no ROM nor labor; class II if there was less than 2 hours of ROM without labor or labor of any length with no ROM; class III for ROM greater than 2 hours and class IV for purulent amniotic fluid[10]. ROM duration was the interval in hours between the recorded timing of ROM and the onset of surgical incision. The variable anesthesia was defined as general or epidural. An emergency Cesarean delivery was a section performed for immediate and compelling reasons, which had not been planned well in advance. In contrast, an elective Cesarean section was defined as an operation which had been planned in advance and performed at the scheduled time or sooner if the onset of labor accelerated the time of delivery[11]. We classified experience of surgeon into three levels: supervisor, attending physician, and resident. The volume of blood loss was first calculated by subtracting total irrigation fluid used and amount of amniotic fluid from the total amount of fluid in the suction container at the end of surgery, then adding the amount of blood on the sponges, determined by weight. The true volume of blood loss was finally recorded after subtracting volume of possible blood replacement. The timing of antibiotic

prophylaxis was classified as early (2 to 24 hours before the surgical incision), preoperative (0 to 2 hours before the incision), perioperative (within 3 hours after the incision) and postoperative (more than 3 hours after the incision)[12].

The postoperative patients were monitored for signs of infections. Temperature measurement was done every four, six and twelve hours for the first, second and following postoperative days, respectively. The temperature of patients who manifested fever (temperature ≥ 38.0°C) was obtained every four hours until it was less than 37.5°C in two consecutive measurements. Leukocyte count was routinely performed when a patient's temperature was over 38.5°C. Further laboratory tests such as urine analysis, urine culture, and chest X-ray or wound culture were not performed routinely unless infection was suspected. The surgical sites were re-examined by the research assistants, when the patient returned to the outpatient clinic as scheduled after discharge from the hospital.

Surgical complications included intraoperative hemorrhage necessitating blood transfusion; postoperative hemorrhage; and injury to adjacent organs. Any bleeding event requiring intervention postoperatively was known as postoperative hemorrhage complication. The standard criterion of postoperative febrile morbidity was the presence of an oral temperature higher than or equal to 38.0°C on any two of the first ten days postpartum, excluding the first 24 hours[13]. Postoperative infections were

diagnosed using the Centers for Disease Control and Prevention (CDC) definitions[13,14]. Surgical site infections comprised superficial, deep and space/organ SSI. Endometritis and vaginal cuff infection constituted organ SSI[15]. SSI was identified when there was the presence of either purulent discharge, positive culture, deliberate reopening of the surgical wound, any evidence of abscess, or diagnosis of the attending physician[15].

Data management and analysis were performed using the statistical software EPI INFO version 6.04b (CDC 1997 Atlanta) and STATA version 5.0 (StataCorp. 1997 USA). Potential risk factors of SSI were tested first by univariate analysis. Chi-squared test or Fisher's Exact Test and Student's t test or Mann-Whitney test were used for discrete and continuous variables, where appropriate. A P-value less than 0.05 was considered as a statistically significant level. Odds ratios (OR) and their corresponding 95% confidence interval (95% CI) were computed to indicate the association between putative factors and postoperative SSI. Multiple logistic regression analysis was then performed to obtain an adjusted estimate of the ORs and to identify risk factors independently associated with SSI. Variables which were likely to be associated with the outcome (P value $\leq$ 0.2 from univariate analysis) or those which were considered to be potential confounders were included in the multiple logistic regression model.

Results

During the four-month study period, there were 969 Cesarean sections among 5,181 deliveries, yielding the Cesarean delivery rate of 18.7%. There were five obstetric hysterectomies, two of which were selectively indicated for different extent of placenta increta. More than four-fifths of the sample were free from any co-morbidity (Table 1). Ovarian carcinoma was histologically confirmed in a Cesarean section accompanying oophorectomy. Radical hysterectomy was then performed one month later. Although 19.4% of our subjects experienced repeated Cesarean section, in only 15.4% was previous operation the only indication for the current Cesarean delivery (Table 2). Placenta previa rather than previous Cesarean section was recorded as the indication if this placental abnormality resulted in the need for the current operation. Fetal distress or umbilical cord compression was diagnosed using the evidence of external cardiotocography.

The rate of surgical complications was low. Estimated volume of blood loss over 1000 ml occurred in 15 cases, in which 12 were associated with abnormal implantation of placenta; and blood replacement was indicated for 27 cases (2.8%). There was only one postoperative hemorrhage, which was diagnosed four hours after surgery. Partial bladder injury occurred in two cases of repeated cesarean section; one was complicated by placenta increta.

We documented 157 patients suffering febrile morbidity and identified 120 infections among post-Cesarean patients, yielding rates of 16.2% and 12.4%, respectively (Table 3). Surgical site infections contributed 79.0% of all postoperative infections. Eighty-five patients developed 95 SSI among 969 abdominal deliveries, yielding the rate of 9.8%. One vaginal cuff infection was identified after a Cesarean hysterectomy. Ten SSI were documented after discharge from the hospital.

We identified nine factors with some evidence of association with SSI in univariate analysis ($P< 0.05$). Table 4 outlines all variables likely to be associated with this study outcome and thus included into the multivariate modeling progress. Despite the fact all Cesarean deliveries received parenteral antibiotics for prophylaxis, timing of administration appeared not to be closely associated with subsequent infections ($P=0.28$). Similarly, the association with patient age less than 20, even though it increased the risk of infection 1.7 times did not achieve the significant level ($P=0.27$).

Finally the multiple logistic regression revealed eight predictors independently associated with the occurrence of post-cesarean SSI (Table 5). Host susceptibility plays an essential role in the prediction of SSI.

*{The association between some putative factors and post-Cesarean section are listed in Tables 6 and 7.}

Discussion

The present prospective study emphasized the importance of post-Cesarean infection complications. The prospective nature of the study accompanied by a follow-up component enabled us to address precisely the magnitude and to identify the independent predictors of SSI after Cesarean delivery. Moreover, the short duration of the study as well as the application of the CDC definitions allowed uniformity in the criteria for diagnosis of various sources of post-Cesarean infections.

Our rather high rate of Cesarean section reflects the common phenomenon in the modern obstetrics[1,16-18]. It is hard to justify this trend in current medicine since the increasing rate of abdominal delivery has not been independently linked with the improvement of neonatal mortality and morbidity[19]. Medical professionals should focus more efforts to optimize Cesarean birth rate and consequently reduce maternal morbidity.

The surgical complications were rare in our data. Our blood transfusion rate is within the limit of those other reports which varied from 1.2% to 6.3%[16-18,20]. Most blood transfusion was given to patients with different extents of abnormal placental implantation. The incidence of reoperation because of intra-abdominal hemorrhage in Nielsen's study (0.3%)[20] was triple that in ours. The likelihood of bladder injury in our data is identical with the finding of Nielsen et al[18] and Eisenkop et al[22]. There was

no ureter injury in our study, whilst Eisenkop reported the rate of 0.09%[22].

We identified 16.2% of study subjects complicated by postoperative febrile morbidity. Although Pothinam et al[23] documented a significantly low rate (5.5%), recent reports in different settings around the world indicated post-Cesarean febrile morbidity rates ranging from 15.5% to 25.0%[16,17,24,25]. In a large meta-analysis study, recruiting 6,760 Cesarean deliveries, Hirsch et al[26] identified rates of 18% and 44% among patients with and without antibiotic prophylaxis, respectively. Differences in febrile morbidity definition, population studied and settings may bring about the different rates between others and ours.

The overall rate of postoperative infection was 12.4%, which is consistent with the rate of 13.9% reported from a prospective study of 1,319 Cesarean sections in Denmark[21]. In addition, our SSI rate, contributing four-fifths of all postoperative infections, was 9.8%, falling within the extremes reported by others also applying CDC definition of SSI[5,6,8,27,28]. However, neither Yacin's rate[5] nor Elhatawy's rate[6] was detected from a large-scale study, and so may be distorted to either side. Comparable rates to that found in our study have been documented from Brazil (11.6%)[27], Canada (8.8%[28] and 9.6%[16]), and the United States (10.8%)[20].

Risk factors for post-Cesarean surgical site infections

Multiple logistic regression revealed eight variables independently associated with the occurrence of post-Cesarean SSI.

We have corroborated the independent risk of preoperative remote infection and chorioamnionitis on the development of subsequent post-Cesarean SSI[11,29-32]. Remote infection not only compromises immune status of the patient but can increase the innoculum of microorganisms contaminating the surgical site as well. Further, the presence of a remote infection reflects heavy abnormal bacterial colonization that can readily contaminate the surgical site. Suonio et al[29], Garibaldi et al[30] and Hagglund et al[11] have shown that the presence of distant infections carried risks 8.7, 2.8 and 2.6 fold, respectively. Similarly, the presence of either intrauterine infection[31] or pathological[31] or clinical intra-amniotic infection[32] as risk factors of subsequent endometritis were demonstrated. This association remained valid when potential confounding variables were eliminated by multivariate[29-31] or stratified analysis[32]. In current medicine, prompt and aggressive antibiotic therapy should be started as soon as the suspected infection is established to reduce subsequent postoperative infections[11].

The ASA physical status classification is a standardized, reproducible numerical determination, which is used routinely to stratify severity of illness for surgical patients and known to be a good indicator of host susceptibility[9]. Surprisingly, no study to

date has investigated the potential association of ASA score and post-Cesarean infection. A concept of antepartum risk factors, a complex proxy of host susceptibility, was proven to be closely correlated with post-Cesarean endometritis[4]. Unfortunately, this association was not examined in the light of multivariate analysis. Our data supported Garibaldi's finding[30] in which the association between preoperative health status of patient and the development of wound infection remained valid even after multivariate modeling analysis. Severe systemic disease (ASA class of 3 or more) can increase the risk of infection by five times.

Similarly, we substantiated ROM duration as the independent predictor for post-Cesarean surgical site infections[4,10,21,33,34]. ROM lasting 24 hour or more carried 2.5- fold increased risk of infection after controlled for possible confounding effects. Further, despite the fact that ROM duration and level of wound contamination was closely related (P-value of Spearman's test for independence <0.0001), the former independently affected the outcome. Prolonged ROM duration increased the risk of bacterial contamination into the uterine cavity through vagina. Since ROM complicates 10%[35] to 18%[36] of term pregnancies, a proper intervention for this group of patients would result in large clinical implications.

Pre-eclampsia is also not uncommon since it is identified in approximately 6.1% of pregnancies[37]. This co-morbidity increases the risk of post-cesarean SSI by a factor of two. The immune

status of pre-eclampsia woman is compromised by several mechanisms. The generalized maternal endothelial cell dysfunction, a part of abnormally excessive systematic inflammatory response in pre-eclampsia, can result in a deterioration of function in a number of organs and systems[38]. Further, a woman with severe pre-eclampsia, who consequently lacks normal pregnancy hypervolemia, is much less tolerant of blood loss than is the normotensive pregnant women. At last, the abnormal vasospasm temporarily reduces blood perfusion of the incision site and thereby renders it liable to invasion by micro-organisms[39].

The role of obesity as a risk of post-Cesarean wound infection has been established for years[7,10,21,33,34]. Furthermore, multivariate analysis indicated that obesity remained a risk factor independently of other confounding variables[7,33]. However, the use of either prepregnancy[34] or antenatal[7] or delivery data[21] limited their findings. The postpartum data ènabled us to more precisely investigate this association. Rather than using a dichotomous variable as obesity, a controversial term, we attempted to identify the correlation between the increment of body mass index and the occurrence of SSI. The risk of SSI doubled for every 5-unit increment of body mass index. There are many explanations for this finding. Specially included are a relative avascularity in adipose tissue or technical difficulties of handling adipose tissue that are associated with longer operation and can result in more trauma to the abdominal wall or the difficulties to obliterate dead space in the fat abdominal wall. Additionally, a

greatly increased wound area found in obese patients also contributes to the increasing incidence of SSI among obese patients.

We have confirmed the adverse effect of nulliparity on post-Cesarean wound infection[24,40]. The risk of wound infection was reduced by 39% and 60% when the patient had one and more than one children, respectively. The precise reason for the increased risk of SSI in a nullipara has not been fully understood. It has been postulated that the adaptation of nulliparous patient is not as good as that of multipara. Besides, a nullipara may have little experience of postpartum self-care.

The role of high volume of blood loss in increasing the risk of SSI[11,41] was reaffirmed in the present data. In addition, Ott et al[2] identified a significant association between postoperative anemia, a proxy of intra-operative blood loss, and postoperative endometritis. Risk of SSI increased 30% for every 100 ml-increment of blood loss. A high volume of blood loss is usually associated with poor control of bleeding, an increase in tissue damage from prolonged retraction and manipulation, and an increase in amount of suture. Suture, a foreign body, can promote the contamination and reduce local resistance mechanisms. Consequently, high volume of blood loss results not only in an immuno-compromised status of the patient but also in a directly increased possibility of wound contamination.

Finally, we could not reaffirm some variables, which had been demonstrated as the predictors of post-cesarean SSI, namely surgical duration[17,23,44] and experience of surgeon[43]. Unfortunately, confounding effects were sufficiently controlled by multiple logistic regression in some studies[29,42]. Prolonged surgical duration and resident as a lead surgeon carried the risk of 2.4 and 2.1, respectively. The significance however was lost when the confounding effects were controlled in multiple logistic regression.

In conclusion, eight factors were documented to be independently associated with post-Cesarean SSI. High-risk nulliparous patients with higher ASA score, pre-eclampsia, ROM, or increased body mass index should be more carefully managed. Moreover, the proper treatment of preoperative infection prior to Cesarean delivery should be more rigorous. A further intervention would target high-risk group of patients whose fetal membrane was ruptured prior to labor.

***{ Risk factor for post-Cesarean febrile morbidity**

Factors related independently to post-Cesarean febrile morbidity by multiple logistic regression analysis include chorioamnionitis, severe systematic diseases, preoperative fever, pre-eclampsia, and volume of blood loss.

***{---}:** *this paragraph was not present in the submitted manuscript.*

Whilst pre-Cesarean chorioamnionitis remained the strongest predictor of febrile morbidity after controlling for confounding effects, none of four cases experiencing remote infections developed fever postoperatively. Suonio et al.[29] also documented a strong association between the presence of amnionitis and post-Cesarean fever (RR=3.1, P=0.04). This association, however, was no longer valid when controlling for confounding effects in multivariate analysis[29]. In contrast, our data indicate that the presence of chorioamnionitis appears to be the important predictor of febrile morbidity after Cesarean delivery. The unadjusted odds ratio for the development of post-Cesarean FM associated with chorioamionitis (OR= 16.1, 95%CI= 3.2-80.5) remained the same in the multivariate analysis (OR= 16.0, 95CI= 3.1-83.3) after adjusting for all other putative factors. Chorioamnionitis increased the contamination of the uterine cavity and surgical field, thereby increasing the risk of postoperative febrile morbidity.

Despite the fact that obstetric patients are usually healthy, a patient with severe systematic disease (ASA ≥ 3) was placed at a very high risk of developing both SSI and PFM, perhaps owing to decreased immunocompetence. Further, the preoperative condition of patient was an independent predictor after controlling for underlying co-morbidity, such as severe pre-eclampsia, anemia, and heart diseases. The preoperative assessment would be widely used to indicate the group of high-risk patients for whom intensive

monitoring during labor should be required and the administration of antibiotics for prophylaxis should be considered.

In addition to chorioamnionitis, other co-morbidities, namely preoperative fever and pre-eclampsia turned out to be risk factors independently associated with post-Cesarean FM. The strength of the crude association between either fever or pre-eclampsia and PFM in univariate analysis was not appreciably changed in the multiple logistic regression analysis. Patients who manifested fever preoperatively could have infection etiology which remained the reason for the development of fever in the postoperative period. Further, like other co-morbidities, fever and pre-eclampsia could compromise the immune status, thereby increasing the risk for postoperative FM.

Volume of blood loss during Cesarean section has been identified as a predictor of PFM for years[23,25,29]. Pothinam et al[23], directly measuring estimated volume of blood loss, documented that the risk of PFM paralleled the increase in volume of blood loss during Cesarean section. However, the association lost its significance in the multivariate logistic regression analysis (adjusted OR=0.27, 95%CI= 0.02-5.54 for blood lost from 500 to 1000ml, compared with more than 1000ml). Similarly, using postoperative anemia as a proxy for intra-operative hemorrhage, both Guldholt[25] and Suonio[29] substantiated the risk of excessive blood loss for the subsequent development of PFM. Approximately one third of

postoperative anemia patients manifested fever, whereas the rate of PFM was only around 12.5% among patients without anemia identified after the operation[25]. Further, the multivariate analysis corroborated the independent prognostic value for intra-operative blood loss[25,29]. Like other co-morbidities, excessive blood lost intra-operatively could decrease the host defense, consequently increasing the risk of PFM.

Some factors documented as the independent determinants of post-Cesarean FM were not reaffirmed in our study. Specially included here are duration of ROM[29,43], preoperative anemia[29,44], obesity[44] and general anesthesia[44]. In fact, there was marginal evidence of an association between ROM duration and the development of PFM in the multivariate analysis (P=0.08).

In conclusion, host susceptibility was demonstrated to be the strongest independent predictor of post-Cesarean febrile morbidity. Chorioamnionitis should be extensively treated prior to the operation, minimizing the risk for post-Cesarean infection complications. The commonness and the considerable risk of ROM duration on the development of SSI and PFM could have large implication in both clinical and research aspects.}

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Table 1 *Demographic characteristics and co-morbidity of study subjects*

Characteristics	N=969
Age* (years)	29.7 ± 5.7
Nulliparous	44.7%
Body mass index*	22.6 ± 2.9
Residence (% rural)	31.4%
Repeated Cesarean section (%)	19.4%
Number patients having co-morbidity (%)	
None	85.2%
Pre-eclampsia	6.0%
Hypertension	3.5%
Preoperative fever	2.3%
Chorioamnionitis	0.8%
Anemia	0.6%
Diabetes mellitus	0.6%
Preoperative infection	0.5%
Heart diseases	0.3%
Others†	0.4%

* Mean ± standard deviation

† Comprised ovarian carcinoma(1), asthma(2), and hyperthyroidism(1).

Table 2 *Surgical indications for Cesarean section*

Surgical indications	Percent
Dystocia	35.2
Repeated Cesarean section*	15.4
Breech and malpresentation	13.8
Cephalopelvic disproportion	13.3
Fetal distress†	9.8
Fetal umbilical cord compression	4.5
Placenta previa	4.9
Placenta aruptio	1.4
Placenta increta	0.2
Others‡	1.5

* Indicated purely because of previous operation.

† Included acute fetal distress and intrauterine growth retardation.

‡ Included maternal diseases, failed forceps trial, failed labor induction, twin pregnancy, malformation of reproductive tract.

Table 3 Rate of post-cesarean febrile morbidity and infection complications*

Type of Cesarean section	Number	Febrile	Surgical Site Infection					UTI†	Others‡
		Morbidity	Superficial	Deep	Vaginal cuff	Endometritis	Organ/space		
Cesarean section	955	16.2	6.6	0.1	-	2.7	0.2	2.0	0.5
Cesarean section+ Gyn operation	14	14.3	-	7.1	7.1	-	-	-	-
Total	969	16.2	6.5	0.3	0.1	2.7	0.2	2.0	0.5

* Calculated as number of infections per 100 operations.

† Urinary tract infection

‡ Comprised pneumonia(2) and gastro-enteritis(3).

Table 4 *Crude association between selected variables and SSI*

Variables	SSI (n=85)	No SSI (n=884)	OR	95% CI	P-value
Nulliparity	56	480	1.6	1.02-2.6	0.04
Residence (rural)	32	272	1.4	0.9-2.1	0.20
Body mass index*	23.9± 3.7	22.5± 2.8	2.0†	1.4-2.9	<0.0001
Pre-eclampsia	13	43	3.5	1.8-6.9	<0.0001
Remote infection‡	2	2	10.6	1.5-76.5	0.003
Chorioamnionitis	4	4	10.9	2.7-44.3	0.001
Prior hospitalization (d)*	2.4± 6.9	1.5± 2.8	1.1§	1.0-1.1	0.04
ROM-operation interval (h)	7.9± 10.3	5.9± 8.5	1.2‖	1.0-1.3	0.04
ASA score					<0.0001
1	67	802	1	1	
2	14	76	2.2	1.2-4.1	
≥ 3	4	6	9.6	2.5-36.6	
Level of surgeon					0.08
Supervisor	14	187	1	1	
Attending physician	54	589	1.2	0.7-2.3	
Resident	17	108	2.1	1.1-4.1	
Cesarean hysterectomy	2	3	7.1	1.2-43.0	0.01
Abdominal incision¶	16	122	1.5	0.8-2.6	0.20
Wound class					0.12
Clean	18	279	1	1	
Clean-contaminated	15	152	1.5	0.7-3.1	
Contaminated	52	453	1.8	1.01-3.1	
Surgical duration ≥ 1 hour	5	22	2.4	0.9-6.6	0.07
Blood loss (ml)*	421.9±160.7	372.5±126.3	1.3**	1.1-1.4	0.001

* Mean ± standard deviation
† OR for every 5-unit increment of BMI; ‡ Preoperative infections other than chorioamnionitis; § OR for every 1-day increment. ‖ OR for every 6-hour increment ROM duration. ¶ Vertical incision versus others; ** OR for every 100-ml increment

Table 5 Multiple logistic regression analysis and independent risk factors for surgical site infections following Cesarean section

Variables	Coefficient	OR	95% CI	P-value
Constant	-7.7			
Preoperative remote infection	2.6	12.9	1.6-102.0	0.015
Chorioamnionitis	2.1	8.2	1.7-40.3	0.010
ASA score ≥ 3	1.7	5.5	1.2-25.4	0.029
PROM ≥ 24 hours	0.9	2.5	1.1-5.4	0.021
Pre-eclampsia	0.8	2.2	1.02-4.7	0.044
Body mass index (5-unit increment)	0.7	2.0	1.4-3.0	0.001
Nulliparity	0.6	1.8	1.03-3.2	0.04
Blood loss (every 100-ml increment)	0.2	1.3	1.1-1.5	0.003

Table 6 *Crude association between selected variables and PFM*

Variables	FM (n=157)	No FM (n=812)	OR	95% CI	P-value
Body mass index*	23.0± 2.7	22.6± 3.0	1.3†	1.0-1.7	0.06
Pre-eclampsia	19	37	2.9	1.6-5.2	<0.0001
Preoperative fever	13	9	8.1	3.4-19.2	<0.0001
Placental abnormality‡	18	48	2.1	1.2-3.6	0.013
Chorioamnionitis	6	2	16.1	3.2-80.5	0.001
Prior hospitalization (d)*	2.3± 4.9	1.4± 2.6	1.6§	1.1-2.5	0.021
Preoperative amniocentesis	13	14	1.7	0.9-3.2	0.110
ROM-operation interval (h)	8.1± 12.1	5.7± 7.8	1.2‖	1.1-1.3	0.002
ASA score					<0.0001
1	128	741	1	1	
2	22	68	1.9	1.1-3.1	
≥ 3	7	3	13.5	13.4-52.9	
Antibiotic administration					0.013
Early	13	27	2.4	1.1-5.0	
Preoperative	42	207	1	1	
Perioperative	102	578	0.9	0.6-1.3	
Level of surgeon					0.09
Supervisor	33	168	1	1	
Attending physician	96	547	1.2	0.8-1.8	
Resident	28	97	1.8	1.1-3.0	
Cesarean hysterectomy	2	3	3.5	0.6-21.0	0.17
Wound class ≥ 3	88	417	1.2	0.9-1.7	0.28
Surgical duration ≥ 1 hour	10	17	3.2	1.4-7.1	0.003
Blood loss (ml)*	422.2±182.7	368.1±115.7	11.3¶	1.21-1.5	<0.0001

* Mean ± standard deviation

† OR for every 5-unit increment of BMI; ‡ Placenta previa, placenta aruptio, placenta increta; § OR for every 3-day increment; ‖ OR for every 6h increment of ROM duration; ¶ OR for every 100ml increment.

Table 7 *Multiple logistic regression and independent predictors of post-Cesarean febrile morbidity (PFM)*

Variables	Coefficient	OR	95% CI	P-value
Constant	-4.1			
Chorioamnionitis	2.8	16.0	3.1-83.3	0.001
ASA score ≥ 3	2.6	13.6	2.8-65.7	0.001
Preoperative fever	2.2	9.5	3.8-23.7	<0.0001
Pre-eclampsia	0.9	2.4	1.2-4.6	0.012
Blood loss (every 100-ml increment)	0.2	1.3	1.1-1.5	0.003

Biotypes of oral *Candida albicans* isolated from AIDS patients and HIV-free subjects in Thailand

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Teanpaisan R., Nittayananta W., Chongsuvivatwong V. Biotypes of oral *Candida albicans* isolated from AIDS patients and HIV-free subjects in Thailand. J Oral Pathol Med

Abstract

This study was conducted to examine biotypes and antifungal susceptibility patterns of oral *Candida albicans* isolated from HIV-infected patients, HIV-free patients with candidiasis and healthy subjects. All isolates were biotyped using a typing system based on enzyme profiles, carbohydrate assimilation patterns and boric acid resistance. A total of 38 biotypes were found amongst 218 oral *C. albicans* isolates. The major biotype found was A1S, which accounted for 32.6% of all isolates and this biotypes was the most common in all groups. There were more different biotypes of *C.albicans* in HIV-infected groups than the in others; however, there was no statistically significant difference between the groups. The minimum inhibitory concentrations (MICs) of a total of 118 isolates were determined for amphotericin B, and ketoconazole using the National Committee for Clinical Laboratory Standards (NCCLS) broth macrodilution method and the E-test. When the antifungal susceptibility pattern among the groups were compared, a statistically significant difference was found only with amphotericin B. The median MIC of amphotericin B in the HIV-infected group was higher than in the healthy group ($p = 0.013$, NCCLS's method; $p = 0.002$, E-test). However, this difference in sensitivity was not restricted to any sub-type investigated.

Our results showed that the biotype patterns of *C.albicans* isolates that colonize HIV-infected patients are similar to HIV-free subjects, and there is no relation between antifungal susceptibility patterns and the biotypes.

Key words: Biotypes, *Candida albicans*, HIV infection, Thailand

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Introduction

A number of reports have revealed that the frequency of isolation of *Candida* and clinical signs of oral candidiasis increase with advancing HIV infection (1-4). Although among the *Candida* species isolated in these studies, *C.albicans* is the most common (1-4); relatively few details of the pathogenic features of this organism and AIDS associated oral candidiasis are known. In healthy humans, *C.albicans* is present as part of the normal floras of the oral cavity and gastrointestinal tract; however, in immunosuppressed patients, it can cause severe mucosal or invasive disease (5). The high incidence of mucosal candidiasis in patients with AIDS may be due to infection with the same strains that are non-pathogenic in healthy subjects but that become pathogenic in AIDS patients due to impaired host defence mechanisms. Alternatively, it may be due to infection with unique or more virulent strains. In addition, the significance of oral candidiasis as a disease entity in HIV-related immunosuppression is its frequent recurrence (6,7). The mechanism behind the ability of this fungus to cause recurrent disease is unknown. It is postulated that one factor that may influence this is a decrease in susceptibility to antifungal agents (7,8), and this may be related to certain types of *C.albicans* (9). Because of this, many attempts have been made to search for particularly virulent types of *C.albicans* using a number of techniques such as serotyping (10), biotyping (11), morphotyping (12, 13) and genotyping (14, 15). On account of the difficulty with some of these techniques, a standardised, simple and highly specific biotyping system developed by WIALLIAMSON *et al.* (11), which is technically undemanding and utilises relatively inexpensive commercially available quality controlled media, has been increasingly used in recent years (16-19).

In a previous paper (4) we showed that there is an association between candidal load and HIV infection. The aims of this study were to determine whether any sub-strains of *C.albicans*

isolated from HIV patients, HIV-free subjects with candidiasis and healthy subjects are particularly associated with health or disease using the biotyping method of WILLIAMSON *et al.* (11), and to compare isolates for their susceptibility to two commonly used antifungal agents (amphotericin B and ketoconazole).

Material and methods

Sources of *C.albicans*

A total of 218 isolates of *C.albicans* were included in this study which comprised 82 isolates from salivary samples of 15 HIV-infected patients, 76 isolates from 15 HIV-free patients with oral candidiasis and 60 isolates from 16 healthy subjects. The specimen collection and methods used for fungal cultivation and identification have been described previously (4). Briefly, an oral rinse specimen was obtained from each subject using 10 ml sterile phosphate buffered saline according to the method of SAMARANAYAKE *et al.* (20). Colonies showing yeast-like morphology within the 48-72 h incubation period were selected for study. All colonies showing variation in morphology, as well as identical colonies, were picked from the same isolation plate. The number colonies picked depended on the density of growth recovered on the primary culture plate. For examples, 10-20 colonies from 20-40 colonies on the same plate were picked for identification and biotyping but when recovery was lower (e.g. from healthy subjects), fewer colonies could be picked. All isolates were identified by using production of chlamydospores, production of germ tubes and carbohydrate assimilation with API 20 C AUX (Bio Merieux).

Biotyping of *C.albicans* isolates

All isolates of *C.albicans* were biotyped using the method of WILLIAMSON *et al.* (11) which employs two commercially available kits, API ZYM and API 20 C AUX (Bio Merieux), and a boric acid resistance test. In brief, the API ZYM system evaluates the enzyme activity of the isolates by means of a set of 19 enzyme substrates contained in a tray of miniaturised plastic cupules. After inoculation of a standard suspension of the organism and incubation for 4 h at 37°C, the colour reactions in each cupule were read according to the manufacturer instructions. The API 20 C AUX system utilises the ability of *C.albicans* isolates to

assimilate 19 different carbohydrates as sole sources of carbon. The results were determined by comparison of the opacity in the test and the control cupules. Finally, the boric acid resistance test assesses the sensitivity of the isolates to 1.8 mg/ml of boric acid incorporated into agar medium.

Antifungal susceptibility testing

A total of 118 isolates of *C.albicans* were chosen to represent strains with either different or the same colony morphology and biotype. These included 52 isolates from the HIV-infected group, 33 isolates from the HIV-free candidiasis group and 33 isolates from the healthy group. For each isolate, minimal inhibitory concentrations (MIC) for amphotericin B and ketoconazole were determined using NCCLS macrodilution method (21) and the E-test strip (AB Biodisk, Sweden).

The NCCLS broth dilution method was performed according to NCCLS document M27 – P (21). A working suspension of the inoculum was made by a 1:100 dilution of the 0.5 McFarland standard yeast suspension in 0.85% saline followed by a 1:20 dilution in RPMI broth. Two fold dilutions of the antifungal agents from 64 to 0.015 ug/ml were prepared and inoculated with the working suspension. The tubes were incubated at 37°C for 48 h. The MIC was read as the concentration which inhibited growth (amphotericin B) or produced an 80% reduction of turbidity in comparison with drug-free control (ketoconazole). For the E-test, colonies of each yeast were suspended in saline to produce a turbidity equivalent to a 0.5 McFarland standard. The inoculum was swabbed on to Saboraud's Dextose Agar and allowed to dry for 10-15 min before each of the antifungal E-test strips were applied. Plates were read at 24 h and 48 h according to the E-test technical guide for antifungal susceptibility testing.

Results

The biotyping system employed in this study utilized three tests: the API ZYM test (the first letter of the code), the API 20 C system (the middle digit of the code), and resistance or sensitivity to boric, denoted as either R or S (the last letter of the code). The reproducibility of the results obtained by these methods has not been tested on a broad scale, but some isolates chosen at random were tested on multiple occasions and have shown clearly reproducible results. A total of 38 biotypes was found among the 218 oral *C.albicans* isolates (Table 1). The major biotype, A1S, accounted for 32.6% of the isolates and this biotype was commonly found in HIV-infected patients, HIV-free candidiasis and healthy subjects (31.7%, 32.8%, and 33.3% respectively). The second most common biotype was B4S, which represented 14.7% of total isolates. The other biotypes found were A4S, B1S and B1R (7.8%, 7.8% and 5.0% respectively). When the number of each biotype in each of the HIV-infected patients, HIV-free with candidiasis and healthy subjects was compared, the first group had a higher number of biotypes than the others (Fig.1); however, this difference was not statistically significant (Kruskal-Wallis test).

A total of 118 strains of *C.albicans* obtained from HIV-infection patients, HIV-free candidiasis and healthy subjects were compared for their MICs against amphotericin B and ketoconazole using the NCCLS macrodilution method and the E-test, and the results are shown in Table 2. Generally, results obtained by NCCLS broth method were largely in agreement with those obtained by the E-test. Pearson correlation coefficients of both methods for amphotericin B and ketoconazole were 0.89 and 0.57, respectively. The median MICs for amphotericin B in of isolates from the HIV-infected group was statistically significantly higher than in that of isolates from the healthy subjects ($p = 0.013$, NCCLS method; $p = 0.002$, E-test). Also, there were statistically significant differences in the mean MIC for

amphotericin B between the HIV-infected group and the HIV-free subjects with candidiasis ($p = 0.01$, NCCLS method) and between the HIV-free candidiasis group and the healthy group ($p < 0.03$, E-test). When the patients' history of antifungal therapy was taken into account, it showed that there was no significant difference between the MIC and whether a patient had taken amphotericin B previously. The mean MICs of ketoconazole among isolates from the three groups showed no significant differences using either the NCCLS method or the E-test.

Discussion

Among the numerous AIDS-associated oral diseases, oral candidiasis is the most frequent, with up to 90% of HIV-infected patients being affected (22, 23). The clinical syndrome is not life-threatening; but it is painful and its recurrent nature makes it of importance. Oral candidiasis is caused mainly by *C.albicans*, although its pathogenesis is still unclear. The condition of the patient is probably the major factor governing the development of clinical candidiasis, and this is often associated with immunodeficiencies (24). However, as recently shown for many other microbial pathogens, the possibility that certain strains or groups of strains are more likely to be involved in clinical disorders cannot be excluded (25). Whether or not HIV-patients are colonized with selected strains of *C.albicans* has been a matter of debate. Using DNA fingerprinting, the results of two studies showed that no particular strain was associated with HIV-infected patients and that *C.albicans* populations from the oral cavities of HIV-infected and HIV-negative persons have a similarly disparate clonal origin (26, 27). Some researchers used a DNA probe to track the *C.albicans* isolates from oral lesions in HIV-seropositive individuals and their data suggested that each patient carriers a unique strain of *C.albicans.* Furthermore, it was shown that the strains present during both symptomatic and asymptomatic states of candidiasis were the same (28, 29). However, others have produced evidence that there is increased genetic variation of *C.albicans* isolates in HIV-infection compared to controls (30, 31). And the differences were noted when the appropriate molecular technique coupled with appropriate analyses were used (31).Also, SWEET *et al.* (32, 33) showed that more biotypes of *C.albicans* were present in HIV/AIDS groups than in control subjects, and that almost all *Candida* species isolated from HIV subjects adhered to buccal epithelial cells in higher numbers than did those strains isolated from controls.

Here, we used the biotyping method of WILLIAMSON *et al.* (11) to evaluate the biotypes of isolates from a range of patient groups. It is known that genetic typing methods provide more sensitive and specific means to discriminate among isolates. However, biotyping has the advantages of being simple to perform, technically undemanding and inexpensive compared to molecular techniques. In addition, it also has the advantage of allowing more meaningful comparison of the present studies with those of previous studies of a similar nature. The first study of *C.albicans* biotypes in HIV-infected patients was conducted by KORTING *et al.* (34) and employed the API 20 C (carbohydrate assimilation) system. Their results showed that from a total of 61 oral *C.albicans* strains isolated from HIV-infected individuals, with or without signs of candidiasis, the majority (64%) of isolates belonged to group 1. However, there was no detail given of the incidence and proportions of each of the biotypes between the groups with and without signs of clinical candidiasis and no HIV-negative subjects were included in the study. Since the API 20 C carbohydrate assimilation system has a relatively poor discriminatory power, API ZYM and boric sensitivity tests were added to complement the API 20 C profiles (11). Results from previous studies of others (16-19) and ours demonstrated that this system serves to further differentiate the biotypes into smaller sub-groups. Using this biotyping system, TSANG *et al.* (17) showed that there are many different sub-strains of oral *C.albicans* in HIV-infected patients. However, no data on healthy subjects were provided. Our results showed that there were 38 biotypes among 218 strains. When the results were compared among the groups, HIV-infected patients had many sub-types (1 - 8) more than HIV-free candidiasis (1 - 4) or healthy subjects (1 - 4), and there were no significant differences in the biotypes between the three groups. The results of statistical analysis suggested that this is may be affected by the small sample size in this study. Thus, larger numbers of patients will be need to be studied for further confirmation.

With regard to the geographic distribution of the different biotypes, it has been shown that some biotypes are globally prevalent. However, almost one third of the biotypes reported here have not been previously described and may reflect geographical exclusivity. TSANG *et al.* (17) has reported that A1R (18%) and A1S (11%) are the most common biotypes among the oral *C.albicans* isolates deriving from HIV-infected patients in Hong-Kong, Australia, England and Germany. Another previous study in healthy individuals in Britain, found that A1R and A1S were also the commonest biotypes, accounting for 23% and 26% of the total isolates, respectively (11). The biotypes A1S and J1S have been found to predominate in China (18) and in Tanzania (19). Our results concur with the findings in China and Tanzania that the most common biotypes is A1S, accounting for 32.6% in all groups investigated. It is noted that in previous studies (17-19), only a single representative isolate was selected from each culture plate; whereas, multiple colonies from each plate were collected in this study. It is assumed that the colonies examined represent the predominant strains present on the plate. No clear explanation for the widespread overrepresentation of such biotypes has been given. It may be hypothesized that they are better adapted than other sub-types to life on or in the human body. They may also be more easily transmitted between humans than are other sub-types. When compared with previous data of new biotypes from the foregoing countries, our results showed that almost one third (65 of 218) of isolates were previously undescribed new biotypes. As the previous reports were from Scotland (11), Germany, Australia, England and Hong-Kong (17), China (18) and Tanzania (19), it is likely that there are geographical variations in *C.albicans* biotypes.

Up to now, there is no general agreement about a standardized method of *in vitro* antifungal susceptibility testing, since results show great inter- and intra- laboratory variations. The NCCLS has established a broth macrodilution method as a reference method for antifungal

susceptibility testing; however, it is labor-intensive and time consuming. We are in agreement with the previous studies that E-test appears to be equivalent to the NCCLS reference macrobroth method for testing of *Candida* species susceptibility to azole antifungal agents (35, 36). WAGNER *et al.* (37) has concluded that the E-test is comparable to the NCCLS method for testing of susceptibility to amphotericin B and fluconazole; in addition, E-test appears to be superior for the detection of resistance to amphotericin B. Our results have shown that the NCCLS reference macrodilution method and the E-test gave very similar results for amphotericin B and showed moderate agreement for ketoconazole. Generally, the endpoints obtained were identical or different by no mean than 2 twofold dilutions. However, when the MIC level is high, the results of both methods show greater difference: if the MICs given by NCCLS method is more than 1-4 μg/ml, it would be >32 μg/ml by the E-test. This may be due to the problem of diffusion of the agent through the agar medium necessary for the E-test. In the present study, we have shown that susceptibility of our isolates to amphotericin B was significantly different between the patient groups but there was no difference in sensitivity to ketoconazole. It was found that isolates from the AIDS group were more resistant to amphotericin B than were isolates from the HIV-free candidiasis group and the healthy group. This resistance is not associated with a history of amphotericin B therapy or restricted to any sub-type investigated (data not shown). GALLAGHER *et al.* (38) have shown that phenotypically switched variants of *C.albicans* can develop decreased azole susceptibility even though these strains remained genetically identical. The results of MCCULLOUGH (39) showed that the same *C.albicans* genotypes tended to persist during the course of disease progression, but that the colonial morphologies of the isolates changed. Also, SOLL *et al.* (40) found that despite a high frequency of phenotypic switching by *C.albicans*, nucleic acid hybridization of DNA from multiple phenotypes from a single

culture site consistently yielded identical genotypes. These observations have shown that it is not necessary to have alterations in the type of strain present for there to be changes in the drug susceptibility of *C.albicans*. This may explain our finding of increased resistance to amphotericin B among *C.albicans* strains isolated from HIV-infected patients but no difference in biotypes. However, further work on genetic analysis is required to clarify this.

To conclude, it is worth emphasizing here that the present data are the first base line information for the studies of oral candidal infection in different cohorts (AIDS patients, HIV-free healthy subjects and HIV-free with candidiasis) of the Thai population. Our results show that the biotype patterns of *C.albicans* that colonize AIDS patients are similar to those in normal Thai subjects. This suggests that there may be no particular biotypes of *C.albicans* linked with specific clinical characteristics. Similarly, the oral *C.albicans* isolates showing *in vitro* susceptibility to amphotericin B and ketoconazole were not restricted to any sub-group investigated. However, the concept of phenotypic switching of *C.albicans* among HIV-infected patients could not be excluded and the resistance of these isolates to amphotericin B needs further explanation.

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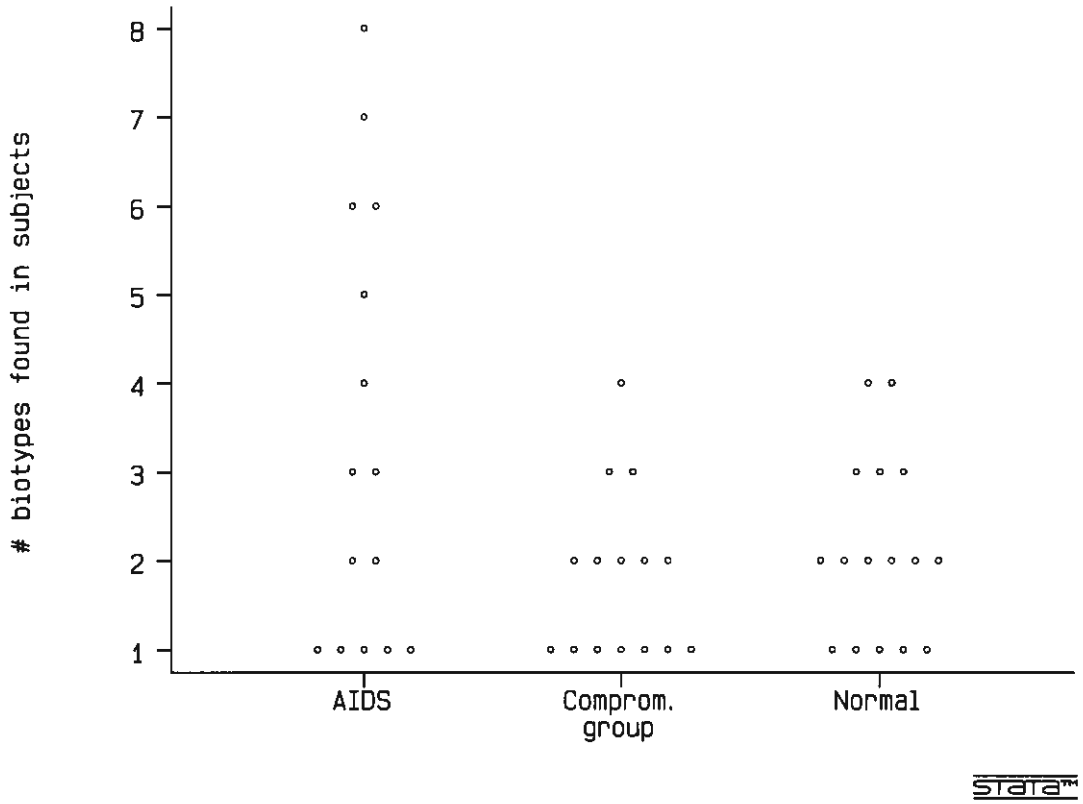

Fig.1 Number of biotypes identified in AIDS groups, HIV-free with candidiasis (comprom.) group and normal subjects.

Table 1. Biotype profiles of oral *Candida albicans* isolated from HIV-infected patients, HIV-free with candidiasis and healthy subjects

Biotypes	HIV-infected group	HIV-free with candidiasis	Healthy subjects	Total
	No. (%)	No. (%)	No. (%)	No. (%)
A1R	3 (3.6)	0	1 (1.7)	4 (1.8)
A1S	26 (31.7)	25 (32.8)	20 (33.3)	71 (32.6)
A4R	1 (1.2)	0	1 (1.7)	2 (0.9)
A4S	6 (7.3)	6 (7.8)	5 (8.3)	17 (7.8)
A6S*	0	0	1 (1.7)	1 (0.5)
A7S*	1 (1.2)	0	0	1 (0.5)
A8S	4 (4.9)	2 (2.6)	0	6 (2.8)
A14R	1 (1.2)	0	0	1 (0.5)
A17S	0	1 (1.3)	1 (1.7)	2 (0.9)
A18S	0	2 (2.6)	3 (5.0)	5 (2.3)
A19S*	1 (1.2)	0	0	1 (0.5)
A20S*	1 (1.2)	0	0	1 (0.5)
A23S*	0	1 (1.3)	1 (1.7)	2 (0.9)
A24S*	0	0	1 (1.7)	1 (0.5)
B1R	0	6 (7.9)	5 (8.3)	11 (5.0)
B1S	4 (4.9)	6 (7.9)	7 (11.7)	17 (7.8)
B2S*	0	0	1 (1.7)	1 (0.5)
B4R*	1 (1.2)	2 (2.6)	0	3 (1.4)
B4S*	13 (15.9)	12 (15.8)	7 (11.7)	32 (14.7)
B6S*	2 (2.4)	1 (1.3)	0	3 (1.4)
B15S*	0	0	1 (1.7)	1 (0.5)
B16S*	0	0	1 (1.7)	1 (0.5)
B18R*	0	2 (2.6)	0	2 (0.9)
B18S*	1 (1.2)	0	0	1 (0.5)
B19S*	1 (1.2)	0	0	1 (0.5)
B20S*	2 (2.4)	0	0	2 (0.9)
B21S*	1 (1.2)	1 (1.3)	0	2 (0.9)
B22S*	1 (1.2)	0	0	1 (0.5)
B24S*	1 (1.2)	0	0	1 (0.5)
C1S	1 (1.2)	2 (2.6)	0	3 (1.4)
D1R	1 (1.2)	1 (1.3)	0	2 (0.9)
D1S	6 (7.3)	2 (2.6)	0	8 (3.7)
D6S*	0	2 (2.6)	1 (1.7)	3 (1.4)
D8S	3 (3.6)	0	0	3 (1.6)
D14S*	0	0	1 (1.7)	1 (0.5)
E1R	0	0	1 (1.7)	1 (0.5)
F4S*	0	0	1 (1.7)	1 (0.5)
I4S*	0	2 (2.6)	0	2 (0.9)
Total	**82 (100)**	**76 (100)**	**60 (100)**	**218 (100)**
***New biotypes**	**26 (31.7)**	**23 (30.3)**	**16 (26.7)**	**65 (29.8)**

Table 2. Median of MICs (μg/ml) of amphotericin B and ketoconazole

Group	Amphotericin B				Ketoconazole	
	NCLLS	p-value	E-test	p-value	NCLLS	E-test
HIV-infection:	0.500 (0.062 – 4.0)	0.013[a]	0.315 (0.032 - >32)	0.002[a]	0.062 (0.015 – 16.0)	0.094 (0.012 - >32)
Taken antifungals	0.500 (0.250 – 1.0)		0.380 (0.032 - >32)		0.062 (0.031 – 1.0)	0.094 (0.012 - >32)
No antifungals	0.500 (0.125 – 0.500)		0.250 (0.190 – 0.500)		0.062 (0.015 – 4.0)	0.125 (0.032 – 0.500)
HIV-free candidiasis:	0.250 (0.062 – 1.0)	0.01[b]	0.250 (0.038 – 0.500)	0.49[b]	0.062 (0.015 – 8.0)	0.094 (0.032 - >32)
Taken antifungals	0.310 (0.125 – 0.500)		0.380 (0.125 – 0.500)		0.062 (0.062 – 0.125)	0.079 (0.032 – 0.094)
No antifungals	0.250 (0.062 – 1.0)		0.250 (0.038 – 0.500)		0.062 (0.015 – 8.0)	0.125 (0.032 - >32)
Healthy subjects	0.250 (0.031 – 1.0)	0.96[c]	0.190 (0.032 – 0.500)	0.03[c]	0.062 (0.015 – 8.0)	0.094 (0.047 - >32)

[a] Median MICs of HIV group vs healthy subjects

[b] Median MICs of HIV group vs HIV-free candidiasis

[c] Median MICs of HIV-free candidiasis vs healthy subjects