
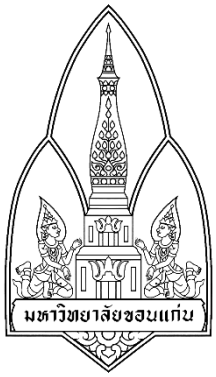


รายงานวิจัยฉบับสมบูรณ์

# โครงการสำรวจและศึกษาอย่างเป็นระบบถึงประสิทธิภาพและความพึงพอใจต่ออุปกรณ์ล้างจมูกในประเทศไทย

# (National Survey and Systematic Review on the Efficacy and Patient's Satisfaction of the Nasal Irrigation Device)

โดย

**ผศ.ดร.นพ.ภาธร ภิรมย์ไชย**

พฤศจิกายน 2561

สัญญาเลขที่ RSA6080040

รายงานวิจัยฉบับสมบูรณ์

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มหาวิทยาลัยขอนแก่น

สนับสนุนโดยสำนักงานกองทุนสนับสนุนการวิจัย และมหาวิทยาลัยขอนแก่น

(ความเห็นในรายงานนี้เป็นของผู้วิจัย สกว. และมหาวิทยาลัยขอนแก่น ไม่จำเป็นต้องเห็นด้วยเสมอไป)

# กิตติกรรมประกาศ

โครงการวิจัยนี้ไม่อาจสำเร็จได้หากขาดการสนับสนุนจากสำนักงานกองทุนสนับสนุนการวิจัย และมหาวิทยาลัยขอนแก่น นอกจากนี้คณะผู้วิจัยยังขอขอบคุณผู้บริหารของมหาวิทยาลัยเชียงใหม่และมหาวิทยาลัยสงขลา ที่เห็นถึงความสำคัญและอนุญาตให้คณะผู้วิจัยดำเนินงานจนสำเร็จลุล่วงดังที่หวัง

คณะผู้วิจัย

พฤศจิกายน 2561

**Abstract (บทคัดย่อ)**

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**Project Code (รหัสโครงการ):** RSA6080040

**Project Title (ชื่อโครงการ):** National Survey and Systematic Review on the Efficacy and Patient's Satisfaction of the Nasal Irrigation Device (โครงการสำรวจและศึกษาอย่างเป็นระบบถึงประสิทธิภาพและความพึงพอใจต่ออุปกรณ์ล้างจมูกในประเทศไทย)

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**Project Period (ระยะเวลาโครงการ):** 1 May 2017 to 29 November 2018 (1 พ.ค. 2560 ถึง 29 พ.ย. 2561)

**Abstract (บทคัดย่อ):**

**Section 1: Effects of nasal saline irrigation for upper airway diseases - an umbrella review of meta-analysis**

**Background:** Nasal saline irrigation is a common procedure for upper airway diseases. However, evidence of the overall efficacy of nasal irrigation are varied. We performed an umbrella review of systematic reviews and meta-analysis to summarize the current evidence for the benefits and harms of nasal saline irrigation for upper airway diseases.

**Methods:** MEDLINE, Scopus, Web of Science and the Cochrane library were searched from 1 January 2014 to 30 September 2018. Systematic reviews and meta-analysis of randomized controlled trials that investigated the efficacy of nasal saline irrigation for upper airway diseases were selected for the review. Outcomes were summarized narratively in four domains included patient's report symptom score, general and specific health-related quality of life score (HRQL), and adverse events.

**Results:** Four systematic reviews and meta-analysis were included in this study. The overall risk of bias for all four systematic reviews was low. However, the overall risk of bias for the primary study was high. Nasal saline might be effective than usual care to decrease the nasal symptoms of upper airway diseases. One review found the large effect to decrease nasal symptoms in

allergic rhinitis (SMD -1.44, 95% CI -2.39 to -0.48). There was a heterogeneous result for HRQL outcomes. The adverse events included epistaxis and nasal discomfort was ranged from zero to 30 percent.

**Conclusions:** Nasal saline irrigation appears to be effective among patients with allergic rhinitis and might be an effective treatment for other upper airway diseases. Further high-quality research is needed. PROSPERO No.: CRD42018110044.

**Keywords:** nasal irrigation, upper airway, upper respiratory tract, sinusitis, allergic rhinitis.

## ส่วนที่ 1: ประสิทธิภาพของน้ำเกลือล้างจมูกในโรคของทางเดินหายใจส่วนบน - การศึกษาอย่างเป็นระบบ

**ภูมิหลัง:** การล้างจมูกด้วยน้ำเกลือเป็นวิธีที่ใช้บ่อย ๆ ในการรักษาโรคของทางเดินหายใจส่วนบน อย่างไรก็ตาม หลักฐานเรื่องประสิทธิผลของการล้างจมูกยังไม่แน่นอน คณะผู้วิจัยได้ทำการศึกษาอย่างเป็นระบบจากหลักฐานเท่าที่มีอยู่ในปัจจุบัน เพื่อสรุปหลักฐานในเรื่องของประโยชน์และผลข้างเคียงของการใช้น้ำเกลือล้างจมูกสำหรับโรคของทางเดินหายใจส่วนบน

**วิธีการ:** คณะผู้วิจัยค้นหาข้อมูลในฐานข้อมูล MEDLINE, Scopus, Web of Science และ Cochrane library ระหว่างวันที่ 1 มกราคม 2557 ถึง 30 กันยายน 2561 โดยเลือกเฉพาะการศึกษาอย่างเป็นระบบที่ศึกษาประสิทธิผลของการล้างจมูกด้วยน้ำเกลือในโรคของทางเดินหายในส่วนบน ผลลัพธ์จากการค้นหาข้อมูลจะถูกสรุปใน 4 หัวข้อหลัก คือ อาการที่ผู้ป่วยรายงาน คุณภาพชีวิตทั้งที่เกี่ยวข้องกับโรคและคุณภาพชีวิตทั่วไป และผลข้างเคียง

**ผลการศึกษา:** รายงานผลการศึกษาอย่างเป็นระบบ 4 เรื่องได้ถูกนำมาสรุปในงานวิจัยนี้ ความเสี่ยงต่ออคติใน 4 รายงานค่อนข้างต่ำ แต่ว่าความเสี่ยงต่ออคติในงานวิจัยปฐมภูมิสูง การล้างจมูกด้วยน้ำเกลืออาจจะมีประสิทธิผลดีในการลดอาการทางจมูกในโรคของทางเดินหายใจส่วนบน ในรายงานฉบับหนึ่งพบว่าการล้างจมูกด้วยน้ำเกลือสามารถลดอาการทางจมูกในกลุ่มคนไข้ภูมิแพ้ (SMD -1.44, 95% CI -2.39 to -0.48) ส่วนคุณภาพชีวิตทั้งที่เกี่ยวข้องกับโรคและคุณภาพชีวิตทั่วไปมีความแตกต่างกันค่อนข้างมาก ผลข้างเคียงที่พบคือ เลือดกำเดาออกและไม่สบายจมูก พบตั้งแต่ร้อยละ 0 ถึง 30

**สรุป:** การล้างจมูกด้วยน้ำเกลือมีประโยชน์ในกลุ่มผู้ป่วยภูมิแพ้ และอาจจะมีประโยชน์ในกลุ่มโรคของทางเดินหายใจส่วนบนอื่น ๆ ผู้วิจัยเสนอว่าควรจะมีการศึกษาวิจัยที่มีคุณภาพในเรื่องนี้เพิ่มเติม

**คำหลัก:** การล้างจมูก ทางเดินหายใจส่วนบน ไซนัสอักเสบ ภูมิแพ้

**Section 2: Effectiveness of Nasal Irrigation Devices: A Thai National Survey**

**Background:** Nasal irrigation is widely used as an adjunctive treatment for nasal diseases. There is little evidence regarding the efficacy of the devices used in this procedure. The objective of this survey was to evaluate the effectiveness of the nasal irrigation devices according to patients and physian experience.

**Methods:** We conducted a multicentre survey study between November 2017 and October 2018. The questionnaire was developed based on the literature and expert opinion. The survey was divided into physician and patient questionnaire. The physician questionnaire was submitted to Otolaryngology residents and staffs of each centre and their network. The physicians were also asked to distribute the patient questionnaire to the patients in their practice.

**Results:** The information of 331 devices used by the patients were collected. The mean age of the patients was 44.25 ± 16.785 year (from 5 to 81). There were equally half male and female (44.7% : 51.7%). Around half of the patients used syringe for nasal irrigation (60.7%). All devices were comparable in term of improving symptom. The syringe with nasal adapter and squeeze were better in clearing nasal secretion ($p < 0.001$). The syringe with nasal adapter and squeeze bottle were significently better than other device in ease of use, satisfaction score and recommendation to friends ($p < 0.05$). The most common side effects of nasal irrigation were retained fluid in sinuses and salty taste (16.9 and 14.2% respectively). The 90 questionnaire were collected from physicians. Most physicians prescribed syringe, syringe with nasal adapter and squeeze bottle (91.1, 41.1 and 12.2% respectively).

**Conclusion:** This survey supports the regular use of nasal irrigation with a positive-pressure device, particularly a squeezable bottle or syringe with nasal adapter, as an effective treatment nasal disease.

**Keywords:** nasal irrigation, devices, sinusitis, allergic rhinitis.

**ส่วนที่ 2: ประสิทธิภาพของอุปกรณ์ล้างจมูก: การสำรวจในประชากรชาวไทย**

**ภูมิหลัง:** การล้างจมูกด้วยน้ำเกลือเป็นวิธีที่ใช้บ่อย ๆ ในการรักษาโรคของทางเดินหายใจส่วนบน อย่างไรก็ตาม หลักฐานเรื่องประสิทธิผลของการล้างจมูกยังไม่แน่นอน ผู้วิจัยได้ทำการสำรวจในประชากรชาวไทยถึงประสิทธิภาพของอุปกรณ์ในการล้างจมูกชนิดต่าง ๆ

**วิธีการ:** คณะผู้วิจัยได้ทำการสำรวจโดยเก็บข้อมูลจากหลายสถาบันระหว่างเดือนพฤศจิกายน 2560 ถึง ตุลาคม 2561 โดยพัฒนาแบบสอบถามจากงานวิจัยอื่น ๆ และความเห็นของผู้เชี่ยวชาญ แบบสอบถามแบ่งเป็นส่วนของผู้ป่วยและส่วนของแพทย์ แบบสอบถามจะถูกส่งไปให้แพทย์ประจำบ้านสาขาโสต ศอ นาสิกวิทยาและโสต ศอ นาสิกแพทย์ในแต่ละสถาบัน โดยขอความร่วมมือให้ตอบแบบสอบถามและขอให้ช่วยแจกแบบสอบถามแก่ผู้ป่วยที่เคยใช้อุปกรณ์ล้างจมูกด้วย

**ผลการศึกษา:** คณะผู้วิจัยรวบรวมข้อมูลการใช้อุปกรณ์ล้างจมูกได้ 331 ตัวอย่าง อายุเฉลี่ยของผู้ป่วยเท่ากับ 44.25 ± 16.785 ปี (ตั้งแต่ 5 ถึง 81 ปี) จำนวนผู้ชายและผู้หญิงเท่า ๆ กัน (ร้อยละ 44.7ถึง 51.7) ประมาณครึ่งหนึ่งของผู้ป่วยทั้งหมดใช้กระบอกฉีดยาในการล้างจมูก (ร้อยละ 60.7) กระบอกฉีดยามีจุกและขวดล้างจมูกแบบบีบช่วยกำจัดน้ำมูกในจมูกได้ดีกว่าแบบอื่น ($p < 0.001$) นอกจากนี้กระบอกฉีดยามีจุกและขวดล้างจมูกแบบบีบยังได้คะแนนความใช้ง่าย ความพึงพอใจและแนะนำต่อให้เพื่อนมากกว่าอุปกรณ์อื่น ($p < 0.05$) อาการข้างเคียงที่พบได้บ่อย คือ น้ำเกลือข้างอยู่ในไซนัสและรสเค็มในคอ แพทย์ 90 คนได้เข้าร่วมในการสำรวจในครั้งนี้ ส่วนใหญ่สั่งใช้ กระบอกฉีดยา กระบอกฉีดยามีจุกและขวดล้างจมูกแบบบีบ (ร้อยละ 91.1, 41.1 และ 12.2 ตามลำดับ)

**สรุป:** การสำรวจนี้สนับสนุนการล้างจมูกด้วยอุปกรณ์ล้างจมูกที่มีความดัน คือ กระบอกฉีดยามีจุกและขวดล้างจมูกแบบบีบ ซึ่งมีประสิทธิภาพสูงกว่าอุปกรณ์ชนิดอื่น

# Section 1

## Effects of nasal saline irrigation for upper airway diseases - an umbrella review of meta-analysis

# Introduction

Nasal saline irrigation is a common procedure for upper airway diseases in which the nasal cavity is rinsed with isotonic or hypertonic saline (salt water) solutions. It is performed by instilling saline into one nostril and allowing it to drain out of the other nostril, bathing the nasal cavity. Nasal saline irrigation can be performed with low positive pressure from a spray, pump, or squirt bottle, with a nebulizer, or with gravity-based pressure using a vessel with a nasal spout such as a neti pot. These are available over the counter and can be used as standalone or adjunct treatments [1].

The nasal irrigation can immediately help to unblock the nose by a direct mechanical flush of the secretion [2, 3]. There was some evidence that the nasal irrigation can also decrease the inflammatory mediator's load [4, 5] and improve the muco-ciliary function [6, 7]. This procedure has been used to treat various kind of upper airway diseases e.g. common cold, rhinosinusitis. It can be traced back to the Ayurvedic era and remains a monotherapy or adjunct treatment for upper airway conditions nowadays.

The evidence of the overall efficacy of nasal irrigation is varied. In acute upper airway infection, including the common cold and acute rhinosinusitis, there were five randomized controlled trials comparing saline irrigation to routine care or other nose sprays. Majority of the trial (4 trials) showed no difference between nasal saline irrigation and control. However, one large trial found a significant reduction in nasal secretion score and nasal breathing in the saline group [8]. Moreover, the variety of the volume delivered by the devices and the tonicity of saline made an evaluation of nasal irrigation more complicated.

The Thailand Research Fund has endorsed a suit of the program to evaluate the efficacy of nasal saline irrigation in current practice (RSA6080040). One part of this suit including the systematic review of the efficacy and safety of a nasal saline irrigation.

To inform the health policy maker in an expedite timeline of 6 months, the Joanna Briggs Institute method to conduct the review of existing systematic review and/or meta-analysis was used. The objective of this umbrella review was to assess the efficacy and safety of nasal saline irrigation for an upper airway disease.

# Materials and methods

We conducted the umbrella approach to summarize the evidence from multiple research syntheses to address a broad topic of nasal irrigation in high-quality of evidence literature. This review was conducted to provide an overall efficacy of nasal irrigation by compare and contrast the results of published systematic reviews. The methodology of this review followed the recommendation from Joanna Briggs Institute, University of Adelaide, Adelaide, South Australia [9].

### Protocol registration

The protocol for this umbrella review was developed and registered prior to conducting the umbrella review and available on PROSPERO (Record ID: CRD42018110044), the international prospective register of systematic reviews [10].

### Search strategy

We systematically searched on 4 international databases including MEDLINE, ISI Web of Science, Scopus and the Cochrane Library. The search was limited to reviews recent studies published in the English language. The date was limited to 5 years (1 January 2014 to 30 September 2018) to include only current and updated evidence in nasal irrigation. The search strategies, shown in supplement material, used a combination of controlled vocabulary and keywords and were adjusted across the databases. In addition, the snowball method was applied to the reference of included studies to identify any possible missed systematic review. The search was performed on 2 October 2018. (Appendix 1)

### Study selection

We included systematic reviews that included randomized controlled trials (RCTs). A systematic review that included other trial designs such as quasi-RCT or controlled clinical trial may be included if the data from RCTs can be extracted.

The intervention of interest was nasal irrigation. The comparators could be placebo, usual care or no intervention.

Systematic reviews, meta-analysis or network meta-analysis were eligible for inclusion. The study will be considered as systematic reviews if the search strategy was provided and two or more databases were searched.

**Data extraction and quality assessment**

Relevant articles were independently screened by two reviewers. The titles and abstracts were reviewed for any potentially relevant record. After the first screening, the full texts were reviewed for eligibility. Any disagreements were resolved by consensus between the authors.

We used the Risk of Bias in the Systematic Reviews (ROBIS) tool to assess the included studies. The ROBIS tool was primarily developed for guideline developers, authors of overviews of systematic reviews ("reviews of reviews"), and review authors who might want to assess or avoid the risk of bias in their reviews [11].

The ROBIS tool covers four domains of bias that may be introduced into a systematic review: study eligibility criteria; identification and selection of studies; data collection and study appraisal; and synthesis and findings [11]. Level of concern about bias associated with each domain is then judged as "low," "high," or "unclear". The overall risk of bias for each study was assessed according to the interpretation of review findings and limitations identified in any of the four domains.

**Outcomes**

The outcomes of this review were total combined symptom score, symptom score, disease-specific quality of life, general quality of life, treatment adherence and adverse events.

All assessment needed to describe the range and meaning of the scale e.g. 0 to 10 (higher score = better overall symptom) to judge the clinically significant effects except a meta-analysis using standardized mean difference method.

The disease-specific and general health-related quality of life (HRQL) questionnaire needed to be validated e.g. Sino-nasal Outcome Test 22 (SNOT-22) for rhinosinusitis or 36-Item Short Form Survey (SF-36) for the general health-related quality of life. The adverse events included but not limited to epistaxis, local irritation, aspiration, and headache.

**Synthesis**

The findings from reviews that reported pooled estimates of efficacy were grouped and synthesized with the use of a narrative approach.

# Results

### Literature search

We identified 1,736 records from MEDLINE, 737 records were published before 1 January 2014. In the Cochrane Library, we identified 74 Cochrane Reviews, 46 Cochrane Reviews were published before 1 January 2014. There were 10 records identified in ISI Web of Science, 7 records were published before 1 January 2014. Lastly, there were 334 records identified in Scopus, 173 records were published before 1 January 2014. (Figure 1)

Remaining 963 records were assessed for the potential to be included in the umbrella review. After reading the title and abstract, 14 records were included for further assessment. The authors were requested full-text article of these 14 records to assess for eligibility. After the full-text reading phase, 10 studies were excluded. Therefore, the final number of systematic reviews included in the present umbrella review was 4. The full list of included and excluded studies with the reason of exclusion is available in Appendix 2.

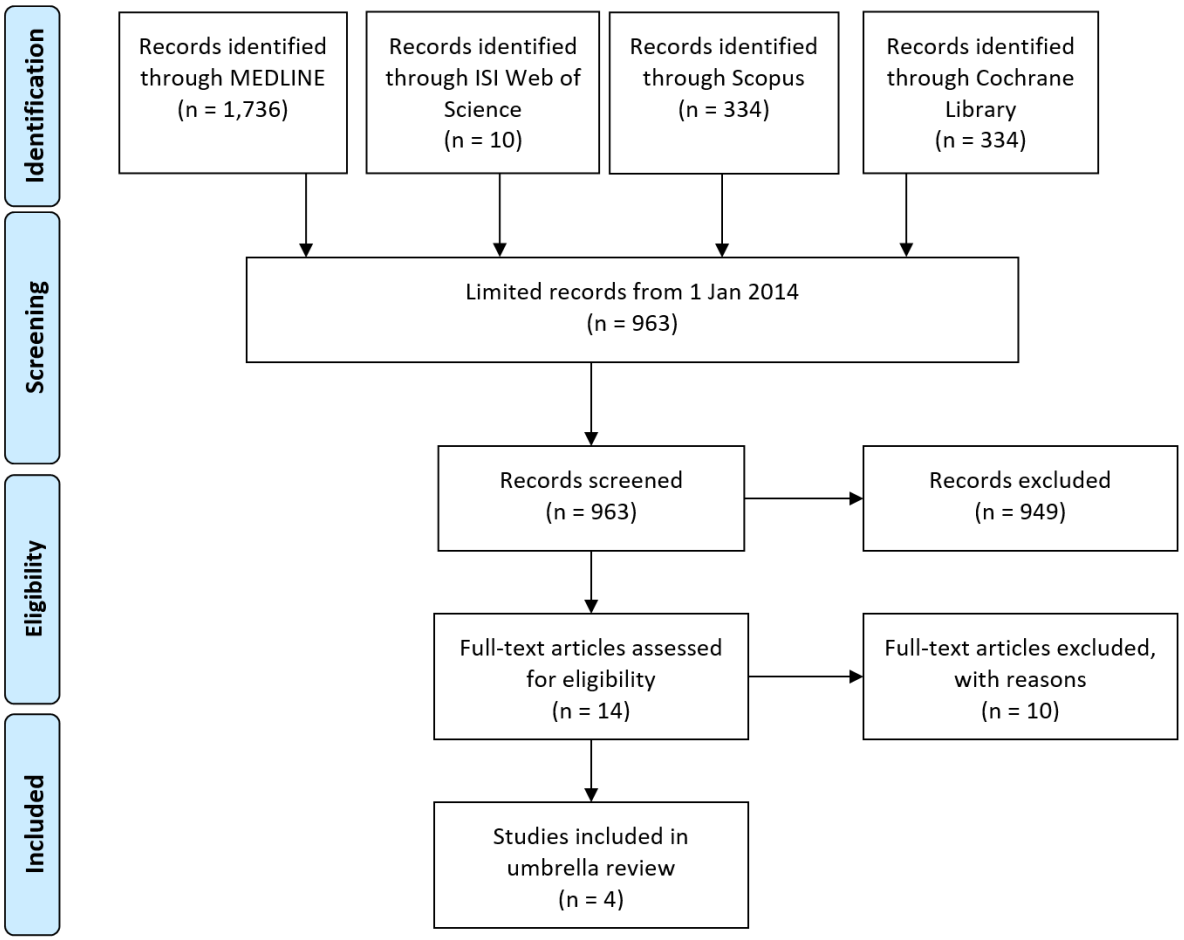

**Figure 1 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram showing a selection of included reviews.**

## Review characteristics

Of the four included reviews [1, 8, 12, 13], two involved patients with an acute upper airway infection including acute rhinosinusitis [8, 13], one involved patient with chronic rhinosinusitis [1] and one involved patient with allergic rhinitis [12]. Two of these reviews included both adult and children [8, 12] while the rest included only adult or children [1, 13]. All reviews investigate the nasal saline irrigation delivered by any means (douche, irrigation, drops, spray or nebulizer) compare with placebo, no nasal irrigation or other interventions. (Table 1)

**Table 1 Characteristics of the included reviews**

| Authors | Country | No. of included study | Population | Intervention | Comparator | Conditions | Outcomes | Type of analysis |
|---|---|---|---|---|---|---|---|---|
| Head 2018 | UK | 14 | Children and adult | Nasal saline irrigation, delivered by any means and with any volume, tonicity and alkalinity | (a) no nasal saline irrigation or (b) other pharmacological treatments | Allergic Rhinitis | Primary outcomes were patient-reported disease severity and a common adverse effect - epistaxis. | Meta-analysis |
| Chong 2016 | UK | 2 | Adult | Saline delivered to the nose by any means (douche, irrigation, drops, spray or nebulizer) | (a) placebo, (b) no treatment or (c) other pharmacological interventions. | Chronic rhinosinusitis | Primary outcomes were disease-specific health-related quality of life (HRQL), patient-reported disease severity and the commonest adverse event - epistaxis | Systematic review |
| King 2015 | Australia | 5 | Children and adult | Topical nasal saline treatment | Other interventions | Acute upper airway infections | Primary outcomes were 1. Change in severity of acute URTI-related symptoms (for example, nasal discharge, congestion, sneezing, headache, sore throat) over periods up to 28 days. 2. Time to resolution of symptomatic illness. | Meta-analysis |
| Shaikh 2014 | USA | 0 | Children | Nasal irrigation versus | No irrigation | Acute rhinosinusitis | Primary outcomes were 1. Symptom resolution - improvement in symptom score from enrolment to day five (+/- three days). 2. Symptom burden - average symptom score while on therapy. | Systematic review |

All reviews' outcome of interest was the patient's severity score [1, 8, 12, 13]. The additional outcomes were a disease-specific HRQL score, general HRQL score, time to resolution and adverse events. One review performed a meta-analysis [12] while the remaining conducted a narrative approach [1, 8, 13].

We assessed the quality of each systematic reviews using ROBIS tool [11]. In domain 1: study eligibility criteria, we assessed whether primary study eligibility criteria were prespecified, clear, and appropriate to the review question. We found that all reviews were low risk for this domain. In domain 2: identification and selection of studies, we assessed whether any primary studies that would have met the inclusion criteria were not included in the review. We found that all reviews were low risk for this domain. In domain 3: data collection and study appraisal, we assessed whether bias may have been introduced through the data collection or risk of bias assessment processes. We found that all reviews were low risk for this domain. In domain 4: synthesis and findings, we assessed whether, given a decision has been made to combine data from the included primary studies (either in a quantitative or nonquantitative synthesis), the reviewers have used appropriate methods to do so. We found that all reviews were low risk for this domain. We judged the overall risk of four systematic reviews as 'low risk'. (Table 2, Appendix 3)

**Table 2 Risk of biases in the systematic reviews (ROBIS) results**

| Review | Domains | | | | Judgment |
|---|---|---|---|---|---|
| | 1. STUDY ELIGIBILITY CRITERIA | 2. IDENTIFICATION AND SELECTION OF STUDIES | 3. DATA COLLECTION AND STUDY APPRAISAL | 4. SYNTHESIS AND FINDINGS | RISK OF BIAS IN THE REVIEW |
| 1. Head 2018 | ☺ | ☺ | ☺ | ☺ | ☺ |
| 2. Chong 2016 | ☺ | ☺ | ☺ | ☺ | ☺ |
| 3. King 2015 | ☺ | ☺ | ☺ | ☺ | ☺ |
| 4. Shaikh 2014 | ☺ | ☺ | ☺ | ☺ | ☺ |

☺ = low risk; ☹ = high risk; ? = unclear risk

## Conditions

### *Acute upper airway infection*

Two reviews assessed the benefits of nasal saline irrigation among patients with an acute upper airway infection [8, 13]. One review specifically assessed the acute rhinosinusitis in children [13], 44 full-text articles were reviewed, however, no studies met all inclusion criteria. (Table 2)

The remaining review assessed the effects of nasal saline irrigation in children and adult [8]. The outcomes include disease severity score, overall health status, time to resolution of symptomatic illness, adverse events, days off work or school and antibiotic/medication use.

*Disease severity score*: This remaining review [8] included three studies (2 published and 1 unpublished) using saline nasal spray or drops and rated symptoms on a four-point symptom scale, from zero (no symptoms) to three (severe symptoms) [14, 15]. At day three and seven, there was no difference between the saline nasal irrigation group and the observation-only group. One large nasal spray study (n = 401) reported a significant reduction in nasal secretion score at visit two for nasal saline groups compared to control (mean difference (MD) = -0.31 (95% confidence interval (CI) -0.48 to -0.14)) on a four-point scale [16]. One small study (n = 69) using saline nasal wash reported the no statistically significant difference in total nasal symptom score comparing the two groups except for daytime rhinorrhea and nocturnal nasal congestion [17].

*Disease-specific HRQL score*: One included study in remaining review [17] used Pediatric Rhinoconjunctivitis Quality of Life Questionnaire (PRQLQ) [18]. The PRQLQ has 23 items in the five areas of nasal symptoms, ocular symptoms, practical problems, other symptoms, and activity limitations. Each item is scored using a 7-point scale from 0 to 6. This study found normal saline irrigation group had slightly lower mean PRQLQ values compared with the placebo group after the 3 weeks of treatment. However, there was no data of the score in the published article.

*Adverse events*: From one remaining review [8], three studies reported adverse effects. One study in infant reported six out of 15 participants (40.0%) did not tolerate treatment with saline nasal drops [15]. In the second study in adult, the group using hypertonic saline irrigation seven out of 33 participants (21.2%) complained of dry nose and 11 out of 33 (33.3%) reported pain or irritation. Among the group treated with normal saline irrigation, 11 out of 36 (30.5%) complained of dry nose and four out of 31 (12.9%) reported pain or irritation from the treatment [14]. The third study in children found an overall rate of adverse events of 8.7% [16].

**Table 2 Benefits of nasal saline irrigation among participants with acute upper airway infection.**

| Authors | Condition | Comparison | Duration | Outcomes (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No. of studies/ participants | Patient-reported disease severity score | No. of studies/ participants | Disease-specific HRQL | No. of studies/ participants | General HRQL |
| King 2016 | Acute upper airway infections | Normal saline plus standard treatment compared to standard treatment alone | Up to 28 days | 5/740 | 4/5 No difference. 1/5 Significant reduction nasal secretion and breathing score. | - | - | - | - |
| Shaikh 2014 | Acute rhinosinusitis | Normal saline versus no saline treatment | - | No studies met inclusion criteria | - | No studies met inclusion criteria | - | No studies met inclusion criteria | - |

### Chronic rhinosinusitis

Only one review assessed the benefits of the nasal saline irrigation among patients with chronic rhinosinusitis [1]. The authors included two RCTs (116 adult participants). One compared large-volume (150 ml) hypertonic (2%) saline irrigation with usual treatment over a six-month period [19]; the other compared 5 ml nebulized saline twice a day with intranasal corticosteroids, treating participants for three months and evaluating them on completion of treatment and three months later [20]. (Table 3)

*Disease severity score*: Two included studies reported the symptom score using a Likert scale [19, 20]. However, the range of the scale was not described. So, there was limited data to interpret the clinical significance of the effect. The first study comparing hypertonic large-volume saline versus usual treatment found the mean difference in the Likert scale was -0.90 (95% CI -1.45 to -0.35; 76 participants) when they followed the patients for three months. At six months of follow-up, the MD was -1.59 (95% CI -2.15 to -1.04; 76 participants) favoring hypertonic nasal saline irrigation [19]. The second study comparing nebulized saline with intranasal corticosteroids found the MD was -13.50 (95%CI -14.44 to -12.56; 40 participants), with less severe symptoms in the intranasal corticosteroids group at three months follow-up (end of treatment). At six months follow-up (three months after the end of treatment), the MD was -7.71 (95% CI -8.72 to -6.70; 40 participants) with less severe symptoms in the intranasal corticosteroids group [20].

*Disease-specific HRQL score*: One study included in the review reported Rhinosinusitis Disability Index (RSDI) scores to measure the effects of hypertonic nasal saline irrigation (scale 0 to 100, higher score = better overall quality of life) [19]. At three months of follow-up, the MD in change between baseline and three months between the groups was 6.30 (95% CI 0.89 to 11.71; 76 participants). At six months follow-up, the MD in change between baseline scores and six months between the groups was 13.50 (95% CI 9.63 to 17.37; 76 participants) favoring nasal saline irrigation.

*General HRQL score*: One study included in the review reported the 12-Item Short Form Health Survey (SF-12). The range of this score is 0 to 100, with higher scores indicating better quality of life [19]. At three months follow-up (end of treatment), the MD in change from baseline between the two groups was 5.30 (95% CI -4.38 to 14.98; 76 participants). At six months follow-up, the MD in change from baseline between the two groups was 10.50 (95% CI 0.66 to 20.34; 76 participants).

*Adverse events*: In the study comparing hypertonic saline with usual care, ten subjects (23%) experienced side effects; 8 identified nasal irritation, nasal burning, tearing, nosebleeds, headache, or nasal drainage as occurring but not significant. Two out of 46 participants (4%) identified nasal burning, irritation, and headache as "significant" [19]. In the study comparing nebulized saline and intranasal steroids, The intranasal corticosteroids group (2/20) had epistaxis compared with the nasal saline group (1/20) [20].

**Table 3 Benefits of nasal saline irrigation among participants with chronic rhinosinusitis.**

| Authors | Condition | Comparison | Duration | Outcomes (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No. of studies/ participants | Patient-reported disease severity score | No. of studies/ participants | Disease-specific HRQL | No. of studies/ participants | General HRQL |
| Chong 2016 | Chronic rhinosinusitis | Large-volume, hypertonic nasal saline versus usual care | Three months | 1/76 | Range not described | 1/76 | MD 6.3 (0.89 to 11.7) | 1/76 | MD 5.30 (-4.38 to 14.98) |
| | | | Six months | 1/76 | Range not described | 1/76 | MD 13.5 (9.63 to 17.37) | 1/76 | MD 10.5 (0.66 to 20.34) |
| | | Low-volume, nebulised saline versus intranasal corticosteroids | Three months | 1/40 | MD -13.50 ( -14.44 to -12.56) | - | - | - | - |
| | | | | 1/40 | MD -7.71 (-8.72 to -6.70) | - | - | - | - |

Green – saline was better; Yellow – no difference; Blue – control was better

**Allergic rhinitis**

One review assessed the benefits of nasal saline irrigation among patients with an allergic rhinitis [12]. The authors included 14 studies (747 participants). The studies included children (seven studies, 499 participants) and adults (seven studies, 248 participants). No studies reported outcomes beyond three months follow-up. (Table 4)

*Disease severity score*: Seven studies comparing nasal saline versus no saline treatment [21-27]. This comparison used different scoring systems, so, the authors pooled the data using the SMD. At up to four weeks, pooled data from 6 studies [21-24, 26, 27] with a total of 407 patients found SMD was -1.32 (95% CI -1.84 to -0.81) and between four weeks and three months from 5 studies [21-25] with the total of 167 patients, the SMD was -1.44 (95% CI -2.39 to -0.48).

Three studies comparing saline versus no saline treatment (adjuvant to intranasal steroids or oral antihistamines) [28-30]. Two studies (18 children, 14 adults) reported patient-reported disease severity at up to four weeks [28, 29]. The pooled data found the SMD was -0.60 (95% CI -1.34 to 0.15). Two studies (18 children; 40 adults) in which all participants used intranasal steroids reported patient-reported disease severity at three months [28, 30]. The pooled data found the SMD was -0.32 (95% CI -0.85 to 0.21).

Three studies compared saline nasal irrigation with intranasal steroids [28, 30, 31]. One study (14 children) reported patient-reported disease severity at up to four weeks [28]. They found mean symptom severity score between the intranasal steroid and the saline irrigation groups at four weeks was 1.06 (95% CI -1.65 to 3.77). Three studies (83 adults, 14 children) reported patient-reported disease severity at three months [28, 30, 31] found the SMD was 1.26 (95% CI -0.92 to 3.43).

*Disease-specific HRQL score*: One study (48 children) [21] reported disease-specific HRQL using a modified Rhinoconjunctivitis Quality of Life questionnaires (RCQ-36) scale for comparing nasal saline versus no saline treatment. This questionnaire has 36 items each measured on a 0 to 4 scale, however, only 35 items were used in this study (range 0 to 140), higher score = worse quality of life. There was no statistical difference in the score between the group at up to four weeks and three months (MD -3.32, 95% CI -11.35 to 4.71 and MD -2.06, 95% CI -8.38 to 4.26) respectively.

Two studies (54 adults) reported disease-specific HRQL score comparing saline versus no saline treatment (adjuvant to intranasal steroids or oral antihistamines) [29, 30], however, there

was no statistical difference in the score between group at up to three months SMD -1.26, 95%CI -2.47 to -0.05).

Two studies (83 adults) reported disease-specific HRQL score comparing saline versus intranasal steroids [30, 31]. however, there was no statistical difference in the score between the group at three months (SMD 0.01, 95% CI -0.73 to 0.75).

*Adverse events*: There was no report of epistaxis in all studies (0/747 patients). One study specifically mentioned local irritation or discomfort, where 6/22 (27.3%) of participants using intranasal steroids reported pharyngitis (a sore throat) compared to no reports in the group using saline treatment [31].

**Table 4 Benefits of nasal saline irrigation among participants with allergic rhinitis.**

| Authors | Condition | Comparison | Duration | Outcomes (95% CI) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No. of studies/ participants | Patient-reported disease severity score | No. of studies/ participants | Disease-specific HRQL | No. of studies/ participants | General HRQL |
| Head 2018 | Allergic rhinitis | Nasal saline versus no saline treatment | Up to four weeks | 6/407 | SMD -1.32 (-1.84 to -0.81) | 1/42 | MD -3.32 (-11.35 to 4.71) | - | - |
| | | | Between four weeks and three months | 5/167 | SMD -1.44 (-2.39 to -0.48) | 1/42 | MD -2.06 (-8.38 to 4.26) | - | - |
| | | Nasal saline versus no saline with adjuvant use of intranasal steroids or oral antihistamines | Up to four weeks | 2/32 | SMD -0.60 (-1.34 to 0.15) | - | - | - | - |
| | | | Between four weeks and three months | 2/58 | SMD -0.32 (-0.85 to 0.21)[a] | 2/54 | SMD -1.26 (-2.47 to -0.05) | - | - |
| | | Nasal saline versus intranasal steroids | Up to four weeks | 1/14 | MD 1.06 (-1.65 to 3.77) | - | - | - | - |
| | | | Between four weeks and three months | 3/97 | SMD 1.26 (-0.92 to 3.43) | 2/83 | SMD 0.01 (-0.73 to 0.75) | - | - |

Green – saline was better; Yellow – no difference; Blue – control was better

# Discussion

As part of a national review on the efficacy of nasal saline irrigation, we performed a rapid overview of systematic reviews (umbrella review) to assess the benefits and harms of nasal saline irrigation in upper airway diseases.

To date, very few systematic reviews have investigated the efficacy of nasal saline irrigation. All of the reviews included in this umbrella review were addressed by Cochrane Collaboration (4 out of 4). Two reviews reported the efficacy of nasal saline irrigation for upper airway infection [8, 13], one review for chronic rhinosinusitis [1] and one review for allergic rhinitis [12]. To our knowledge, this is the first umbrella review that grouped the currently available evidence on the efficacy of nasal saline irrigation in upper airway diseases from 21 studies summarized in 4 reviews. The biases in four Cochrane's systematic reviews were 'low risk' according to ROBIS tool [11]. However, most studies included in these reviews were small and had a high risk of bias.

### Upper airway infection

Summary: Two reviews assessed the benefits of nasal saline irrigation among patients with an acute upper airway infection. Five included studies (740 participants) found no difference in patient's reported total symptom score between the saline nasal irrigation and the observation-only group. Two studies reported a reduction in nasal secretion and breathing score. No data on the quality of life of the patients.

Implementation: The nasal saline irrigation may be useful in the patients with upper airway infection which main complaints were a runny nose or nasal congestion.

### Chronic rhinosinusitis

Summary: One review assessed the benefits of nasal saline irrigation among patients with a chronic rhinosinusitis. There was inadequate data on the patient's reported symptom score between nasal saline versus usual care. One study (76 participants) reported disease-specific HRQL in patients using saline were better at 6 months (MD 13.5 points, 95% CI 9.63 to 17.37; scale 0-100).

Implementation: The nasal saline irrigation had ‘small effect’ to improve the quality of life in chronic rhinosinusitis patient.

**Allergic rhinitis**

Summary: One review assessed the benefits of nasal saline irrigation among patients with an allergic rhinitis. Seven studies (444 participants) comparing nasal saline versus no saline treatment found the significant difference in patient-reported disease severity score (SMD -1.44, 95% CI -2.39 to -0.48). However, three studies (119 participants) with adjuvant use of intranasal steroids or oral antihistamines) found no difference in patient-reported disease severity score and disease-specific HRQL score

Implementation: The nasal saline irrigation can significantly improve the patient’s symptoms of allergic rhinitis.

**Limitations**

Umbrella reviews provide a ready means for decision makers in healthcare to gain a clear understanding of a broad topic area [9]. The knowledge base at the primary research level is not being examined and discussed here. This umbrella is a summary of the syntheses from the systematic reviews that exist of the evidence.

We limited the date of the systematic reviews to five years and in English language. The reason underlying this limit was the systematic review was found to be outdate after 5.5 years (95% CI, 4.6 to 7.6 years) [32]. We comprehensively search four international medical science databases. However, some of the systematic reviews from the journals that were not indexed in these databases may be missing.

According to our results, it is important to stress the need for future investigations for policy determinants of nasal irrigation for upper airway diseases. The high quality, prospective randomized controlled trials with a large sample size were needed.

# Conclusion

Nasal saline irrigation appears to be effective among patients with allergic rhinitis and might be an effective treatment for other upper airway diseases. Further high quality, adequately powered, randomized controlled trials in this area is warranted

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**Appendix 1. Search strategy: key words used for the literature search.**

| Set | Search terms (MEDLINE) [Cochrane] /ISI/ <Scopus> |
|---|---|
| #1 | saline OR “sodium chloride” OR saltwater OR hypertonic* OR hypotonic* OR isotonic* OR hypersaline OR “sea water” OR seawater OR ((salt* OR thermal OR mineral) AND (water* OR solution*)) (451,686) [206] /46,356/ <1,209,228> |
| #2 | douch* OR spray* OR lavag* OR wash* OR rinse* OR rinsing OR irrigat* OR pulsed OR nebulise* OR aerosol* OR buffer* OR atomis* OR atomiz* OR (squeeze AND bottle) (835,237) [386] /220,633/ <1,539,217> |
| #3 | intranasal OR inhalation* OR irrigator (146,151) [311] /12,939/ <203,063> |
| #4 | (nasal OR intranasal OR sinus OR nose OR sinonasal) AND (irrigation* OR rinsing OR rinse* OR wash* OR lavage OR douch* OR hygiene) (12,234) [22] /493/ <12,531> |
| #5 | “systematic review” OR “meta-analysis” (217002) [3,556] /151,690/ <341,799> |
| #6 | #1 AND (#2 OR #3) (58,570) [60] /1,959/ <118,933> |
| #7 | (#4 OR #6) AND #5 (1,736) [74] /10/ <334> |

**Appendix 2. Included and excluded studies**

**A. Included studies**


1. Head K, Snidvongs K, Glew S, Scadding G, Schilder AG, Philpott C, Hopkins C. Saline irrigation for allergic rhinitis. Cochrane Database Syst Rev. 2018 Jun 22;6:CD012597. doi:10.1002/14651858.CD012597.pub2.
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**B. Excluded studies with reasons**

| | |
|---|---|
| 1. | Chen XZ, Feng SY, Chang LH, Lai XP, Chen XH, Li X, Zhang GH. The effects of nasal irrigation with various solutions after endoscopic sinus surgery: systematic review and meta-analysis. J Laryngol Otol. 2018 Aug; 132(8), pp. 673-679. |
| | Exclude reason: Comparing various type of solutions for irrigation |
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| | Exclude reason: Comparing between isotonic and hypertonic saline. |
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**Appendix 3. Quality of the reviews**

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**Summary of concerns identified**

| Domain | Concern | Rationale for concern |
|---|---|---|
| 1. Concerns regarding specification of study eligibility criteria | Low | Clear focused objective; provide sufficient detail to enable judgement about whether the studies that are included are appropriate to the question. |
| 2. Concerns regarding methods used to identify and/or select studies | Low | A substantial effort has been made to identify as many relevant studies as possible through a variety of search methods using a sensitive and appropriate search strategy |
| 3. Concerns regarding used to collect data and appraise studies | Low | Risk of bias was assessed using appropriate criteria, data extraction and risk of bias assessment involved two reviewers, and relevant study characteristics and results were extracted. |
| 4. Concerns regarding the synthesis | Low | All predefined analyses were followed; methodology of the synthesis was appropriate. |
| 5. Overall risk of bias | Low | The findings of the review are likely to be reliable. Domain 1-4 did not raise any concerns with the review process or concerns were appropriately considered in the review conclusions. The conclusions were supported by the evidence and included consideration of the relevance of included studies. |

2. Chong LY, Head K, Hopkins C, Philpott C, Glew S, Scadding G, Burton MJ, Schilder AG. Saline irrigation for chronic rhinosinusitis. Cochrane Database Syst Rev. 2016 Apr 26;4:CD011995. doi:10.1002/14651858.CD011995.pub2.

**Summary of concerns identified**

| **Domain** | **Concern** | **Rationale for concern** |
|---|---|---|
| 1. Concerns regarding specification of study eligibility criteria | Low | Clear focused objective; provide sufficient detail to enable judgement about whether the studies that are included are appropriate to the question. |
| 2. Concerns regarding methods used to identify and/or select studies | Low | A substantial effort has been made to identify as many relevant studies as possible through a variety of search methods using a sensitive and appropriate search strategy |
| 3. Concerns regarding used to collect data and appraise studies | Low | Risk of bias was assessed using appropriate criteria, data extraction and risk of bias assessment involved two reviewers, and relevant study characteristics and results were extracted. |
| 4. Concerns regarding the synthesis | Low | All predefined analyses were followed; methodology of the synthesis was appropriate. |
| 5. Overall risk of bias | Low | The findings of the review are likely to be reliable. Domain 1-4 did not raise any concerns with the review process or concerns were appropriately considered in the review conclusions. The conclusions were supported by the evidence and included consideration of the relevance of included studies. |

3. King D, Mitchell B, Williams CP, Spurling GK. Saline nasal irrigation for acute upper respiratory tract infections. Cochrane Database Syst Rev. 2015 Apr 20;(4):CD006821. doi:10.1002/14651858.CD006821.pub3.

**Summary of concerns identified**

| **Domain** | **Concern** | **Rationale for concern** |
|---|---|---|
| 1. Concerns regarding specification of study eligibility criteria | Low | Clear focused objective; provide sufficient detail to enable judgement about whether the studies that are included are appropriate to the question. |
| 2. Concerns regarding methods used to identify and/or select studies | Low | A substantial effort has been made to identify as many relevant studies as possible through a variety of search methods using a sensitive and appropriate search strategy |
| 3. Concerns regarding used to collect data and appraise studies | Low | Risk of bias was assessed using appropriate criteria, data extraction and risk of bias assessment involved two reviewers, and relevant study characteristics and results were extracted. |
| 4. Concerns regarding the synthesis | Low | All predefined analyses were followed; methodology of the synthesis was appropriate. |
| 5. Overall risk of bias | Low | The findings of the review are likely to be reliable. Domain 1-4 did not raise any concerns with the review process or concerns were appropriately considered in the review conclusions. The conclusions were supported by the evidence and included consideration of the relevance of included studies. |

4. Shaikh N, Wald ER. Decongestants, antihistamines and nasal irrigation for acute sinusitis in children. Cochrane Database Syst Rev. 2014 Oct 27;(10):CD007909. doi: 10.1002/14651858.CD007909.pub4.

**Summary of concerns identified**

| Domain | Concern | Rationale for concern |
|---|---|---|
| 1. Concerns regarding specification of study eligibility criteria | Low | Clear focused objective; provide sufficient detail to enable judgement about whether the studies that are included are appropriate to the question. |
| 2. Concerns regarding methods used to identify and/or select studies | Low | A substantial effort has been made to identify as many relevant studies as possible through a variety of search methods using a sensitive and appropriate search strategy |
| 3. Concerns regarding used to collect data and appraise studies | Low | Risk of bias was assessed using appropriate criteria, data extraction and risk of bias assessment involved two reviewers, and relevant study characteristics and results were extracted. |
| 4. Concerns regarding the synthesis | Low | All predefined analyses were followed; methodology of the synthesis was appropriate. |
| 5. Overall risk of bias | Low | The findings of the review are likely to be reliable. Domain 1-4 did not raise any concerns with the review process or concerns were appropriately considered in the review conclusions. The conclusions were supported by the evidence and included consideration of the relevance of included studies. |

# Section 2

## Effectiveness of Nasal Irrigation Devices: A Thai National Survey

# Introduction

Nasal irrigation is a procedure in which the nasal cavity is rinsed with isotonic or hypertonic saline (salt water) solutions. It is performed by instilling saline into one nostril and allowing it to drain out of the other nostril, bathing the nasal cavity. Saline nasal irrigation can be performed with low positive pressure from a spray, pump, or squirt bottle, with a nebuliser, or with gravity-based pressure using a vessel with a nasal spout such as a neti pot. These are available over the counter and can be used as standalone or adjunct treatments1.

The nasal irrigation can immediately help to unblock the nose by a direct mechanical flush of the secretion2,3. There were some evidences that the nasal irrigation can also decrease the inflammatory mediator's load4,5 and improve the mucociliary function6,7.

The syringe has several limitations. First, it does not allow for a good connection with the nostril. This reduces the efficacy of the nasal irrigation because some of the solutions may leak from the nostril before reaching the nasal cavity. Moreover, pressure can be quite different according to the force applied by the operator. In some cases, this pressure may be too strong, which causes discomfort, or it could be too light, resulting in the ineffective application. Finally, when a high volume of saline solution is needed, and a relatively small syringe is being used, the syringe must be filled several times, creating a risk of the operator using an incorrect amount8.

The nasal irrigation devices were developed to address the above limitation. However, in Thailand, the syringe is the most common prescribe device as it is readily available in all hospital and relatively inexpensive.

The Thailand Research Fund has endorsed a suite of the program to evaluate the efficacy of nasal saline irrigation in current practice (RSA6080040). One part of this suit including the survey of the effectiveness and safety of nasal saline irrigation. This survey was designed to determine the effectiveness and safety of various nasal irrigation devices from the perspective of patients and physicians according to their previous experience.

# Methods

### Study design and setting

We conducted a multicentre survey study between November 2017 and October 2018. The questionnaires were distributed from 3 university hospital in difference region (Khon Kaen University, Chiang Mai University and Prince of Songkhla University) of Thailand.

### Questionnaire

The questionnaire was developed based on the literature and expert opinion. The survey was divided into physician and patient questionnaire.

The patient questionnaire contained general personal information, the information on the devices used, the effectiveness score from 0 to 10 in difference aspect, i.e. disease severity, convenient of use, ease of learning, and device satisfaction.

The physician questionnaire contained information on the experience of their prescribed device, i.e. the advantage, disadvantage of each device and the most ineffective device.

### Participants

The physician questionnaire was submitted to Otolaryngology residents and staffs of each centre and their network. The physicians were also asked to distribute the patient questionnaire to the patients in their practice. All participants were informed that filling in the questionnaire was considered consent to use the collected data for research. Participation was voluntary.

### Ethical consideration

The research protocol was reviewed and approved by the Khon Kaen University Ethics Committee for Human Research (HE601419).

### Statistical Analysis

Statistical analyses were performed using the SPSS version 20 and Stata version 14. Data were described as either means (for the continuous variables) or frequencies and percentages (for the categorical variables). Significant differences between groups were determined using the Student t-test or the Mann-Whitney U test for continuous variables. The chi-square test or the Fisher-exact test were used to determine whether there was a significant

difference between the expected frequencies and the observed frequencies. For all tests, $p < 0.05$ was considered statistically significant.

# Results

### Patient's survey

The information of 331 devices used by the patients were collected, 256 records were from Khon Kaen University, 75 records were from Chiangmai University and 56 records were from Prince of Songkhla University.

The mean age of the patients was 44.25 ± 16.785 year (from 5 to 81). There were equally half male and female (44.7 %: 51.7%). Most of the patients did not smoke (85.1%). Around half of the patients used the syringe for nasal irrigation (60.7%).

**Table 1. Demographic data**

| | N | % |
|---|---|---|
| **Centre** | | |
| - Khon Kaen Univesity | 256 | 60.4 |
| - Chiangmai University | 75 | 22.7 |
| - Songkhla University | 56 | 16.9 |
| **Sex** | | |
| - Male | 158 | 44.7 |
| - Female | 171 | 51.7 |
| - Missing | 2 | 0.6 |
| **Smoke** | | |
| - Yes | 34 | 10.3 |
| - No | 285 | 85.1 |
| - Missing | 2 | 0.6 |
| **Type of Devices** | | |
| - Syringe | 201 | 60.7 |
| - Syringe with nasal adapter | 27 | 8.2 |
| - Squeeze bottle | 50 | 15.1 |
| - Neti pot | 9 | 2.7 |

| | | |
|---|---|---|
| - Bulb | 13 | 3.9 |
| - Spray | 31 | 9.4 |

The patients used the devices ranged from 1 month to 216 months (mean 23.35 ± 29.32 months). The patients most commonly did nasal irrigation in allergic rhinitis and chronic sinusitis (46.8 and 32.0% respectively). Most of the patients did nasal irrigation twice a day (51.4%). Physician (47.4%) and nurse (35.6%) were the major person to teach the patients how to use the device.

**Table 2. Diseases and irrigation details**

| | **N (331)** | **%** |
|---|---|---|
| **Diseases** | | |
| - Allergic rhinitis | 155 | 46.8 |
| - Acute sinusitis | 31 | 9.4 |
| - Chronic sinusitis | 106 | 32.0 |
| - Post-surgery | 79 | 23.9 |
| - Common cold | 35 | 10.6 |
| - Nasal polyps | 13 | 3.9 |
| - Nasopharyngeal cancer | 23 | 6.9 |
| - Sinus cancer | 5 | 1.5 |
| - Epistaxis | 1 | 0.3 |
| **Frequency** | | |
| - Once a day | 80 | 24.2 |
| - Twice a day | 170 | 51.4 |
| - More than twice | 31 | 9.3 |
| **Instructors** | | |

| | | |
|---|---|---|
| - Physician | 157 | 47.4 |
| - Nurse | 118 | 35.6 |
| - Pharmacist | 59 | 17.8 |
| - Parent | 4 | 1.2 |
| - Self-learning | 36 | 10.9 |

The most common side effects of nasal irrigation were retained fluid in sinuses and salty taste (16.9 and 14.2% respectively). Most patients flex neck (72.8%) and not breathing (65.3%) during irrigation.

**Table 3. Problems and positions**

| | **N (331)** | **%** |
|---|---|---|
| **Problems** | | |
| - Pain/discomfort | 19 | 5.7 |
| - Retained fluid in sinuses | 56 | 16.9 |
| - Epistaxis | 7 | 2.1 |
| - Headache | 15 | 4.5 |
| - Aspiration | 30 | 9.1 |
| - Ear pain/hearing loss | 32 | 9.7 |
| - Salty taste | 47 | 14.2 |
| **Positions** | | |
| - Flex neck | 241 | 72.8 |
| - Extend neck | 44 | 13.3 |
| - Others | 10 | 3.0 |

| | | |
|---|---|---|
| **Breathing** | | |
| - Nose breathing | 12 | 3.6 |
| - Not breathing | 216 | 65.3 |
| - Mouth breathing | 71 | 21.5 |

The mean durability of all devices was 6.47 ± 12.7 months. Most patients got the devices from the hospital (72.8%). Most patients clean the device in warm water (40.2%).

**Table 4. Durability and caring of the devices**

| | **N (331)** | **%** |
|---|---|---|
| **Source of the devices** | | |
| - Hospital | 241 | 72.8 |
| - Pharmacy | 50 | 15.1 |
| - Clinics | 18 | 5.4 |
| **Methods of cleaning** | | |
| - Soap | 24 | 7.3 |
| - Saline | 63 | 19.0 |
| - Warm water | 133 | 40.2 |
| - Cold water | 55 | 16.6 |
| - Boil | 14 | 4.2 |
| - Others | 19 | 5.7 |

All devices were comparable in term of improving most symptoms except syringe with nasal adapter and squeeze were better in clearing nasal secretion ($p < 0.001$).

**Table 5. Comparing symptoms score**

| Scale (0-10; higher is better) | Syringe | Syringe with nasal adapter | Squeeze bottle | Neti pot | Bulb | Spray | p-value |
|---|---|---|---|---|---|---|---|
| 1. Improve overall symptom | 7.90 (7.63-8.17) | 8.44 (7.85-9.04) | 8.48 (8.01-8.95) | 7.67 (6.28-9.05) | 7.17 (6.16-8.17) | 7.45 (6.67-8.23) | 0.058 |
| 2. Improve nasal congestion | 7.74 (7.44-8.03( | 8.40 (7.82-8.98) | 8.22 (7.67-8.78) | 7.78 (6.40-9.15) | 7.00 (5.99-8.01) | 7.33 (6.47-8.20) | 0.133 |
| 3. Decrease runny nose | 7.54 (7.22-7.85) | 8.23 (7.62-8.84) | 7.96 (7.34-8.57) | 7.67 (6.34-9.00) | 6.92 (5.92-7.91) | 7.23 (6.39-8.08) | 0.284 |
| 4. Decrease blowing nose | 7.63 (7.29-7.98) | 7.71 (6.66-8.75) | 8.10 (7.52-8.69) | 7.56 (6.11-9.00) | 7.08 (6.05-8.11) | 7.23 (6.40-8.07) | 0.560 |
| 5. Decrease viscosity | 7.93 (7.62-8.24) | 8.46 (7.88-9.05) | 8.24 (7.64-8.85) | 7.38 (5.77-8.98) | 7.60 (6.58-8.62) | 7.50 (6.79-8.21) | 0.402 |
| 6. Improve sinus pain/headache | 6.77 (6.28-7.25) | 7.96 (7.19-8.73) | 7.71 (6.92-8.49) | 6.25 (3.65-8.85) | 6.50 (5.02-7.98) | 6.26 (4.98-7.55) | 0.102 |
| 7. Decrease post-nasal drip | 7.30 (6.94-7.67) | 8.04 (7.12-8.96) | 7.81 (7.10-8.52) | 7.67 (6.51-8.82) | 6.89 (5.71-8.07) | 6.13 (4.96-7.30) | 0.054 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8. Improve taste and smell | 6.93 (6.44-7.42) | 8.09 (7.11-9.07) | 7.59 (6.60-8.58) | 6.67 (4.36-8.97) | 6.63 (4.02-9.23) | 6.35 (5.10-7.60) | 0.299 |
| 9. Decrease sneezing | 7.50 (7.12-7.88) | 7.70 (6.67-8.73) | 7.49 (6.69-8.28) | 7.33 (5.75-8.91) | 6.89 (4.77-9.01) | 6.83 (5.66-8.00) | 0.797 |
| 10. Decrease cough | 7.19 (6.75-7.62) | 7.55 (6.66-8.44) | 6.94 (5.80-8.08) | 7.40 (5.14-9.66) | 6.22 (4.23-8.21) | 6.50 (4.89-8.11) | 0.733 |
| 11. Clear the secretion | 8.02 (7.73-8.31) | 8.52 (7.91-9.13) | 8.27 (7.64-8.90) | 6.40 (3.83-8.97) | 7.30 (5.95-8.65) | 6.30 (5.12-7.49) | 0.001 |
| 12. Improve sleep quality | 8.07 (7.73-8.40) | 8.35 (7.59-9.10) | 8.35 (7.69-9.01) | 6.83 (4.59-9.08) | 7.67 (6.45-8.88) | 7.1 (5.93-8.27) | 0.190 |

All devices got a high level of score in the ease of use, learning and satisfaction aspect. Syringe with nasal adapter and squeeze bottle were significantly better than another device in ease of use, satisfaction score and recommendation to friends ($p < 0.05$).

**Table 6. Comparing ease of use, learning and satisfaction**

| **Scale (0-10; higher is better)** | **Syringe** | **Syringe with nasal adapter** | **Squeeze bottle** | **Neti pot** | **Bulb** | **Spray** | **p-value** |
|---|---|---|---|---|---|---|---|
| 1. Easy to use | 8.51 (8.22-8.79) | 8.85 (8.23-9.46) | 8.83 (8.29-9.38) | 8.33 (6.38-10.29) | 6.40 (4.40-8.40) | 8.61 (7.84-9.38) | 0.019 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2. Can use without instruction | 7.54 (7.15-7.93) | 8.12 (6.97-9.27) | 8.23 (7.54-8.92) | 6.83 (2.88-10.78) | 7.60 (6.12-9.08) | 7.32 (6.16-8.48) | 0.517 |
| 3. Easy to learn | 8.49 (8.21-8.78) | 8.92 (8.20-9.64) | 9.02 (8.64-9.41) | 7.50 (4.95-10.05) | 7.70 (6.23-9.17) | 8.71 (8.00-9.43) | 0.157 |
| 4. Easy to remember | 8.89 (8.64-9.15) | 9.20 (8.68-9.72) | 9.25 (8.91-9.59) | 8.20 (5.51-10.89) | 7.90 (6.71-9.09) | 8.61 (7.84-9.38) | 0.151 |
| 5. Satisfaction score | 8.67 (8.39-8.95) | 9.12 (8.59-9.64) | 8.85 (8.25-9.46) | 8.17 (5.92-10.41) | 6.70 (4.36-9.04) | 8.19 (7.41-8.96) | 0.021 |
| 6. Recommend to friends | 8.44 (8.13-8.75) | 9.04 (8.47-9.60) | 8.98 (8.42-9.54) | 8.00 (5.11-10.89) | 6.50 (3.88-9.12) | 7.86 (6.86-8.86) | 0.012 |

**Physician's survey**

The 90 questionnaires were collected, 23 records were from Khon Kaen University, 32 records were from Chiangmai University, and 35 records were from Prince of Songkhla University.

Most physicians prescribed the syringe, syringe with nasal adapter and squeeze bottle (91.1, 41.1 and 12.2% respectively).

**Table 7. Device prescribed**

| | **N (90)** | **%** |
|---|---|---|
| **Devices precribed** | | |
| - Syringe | 82 | 91.1 |

| | | |
|---|---|---|
| - Syringe with nasal adapter | 37 | 41.1 |
| - Squeeze bottle | 11 | 12.2 |
| - Neti pot | 0 | 0 |
| - Bulb | 0 | 0 |
| - Spray | 10 | 11.1 |

Most physicians recommend nasal irrigation in all kind of nasal diseases including chronic sinusitis, postnasal operation, acute sinusitis and allergic rhinitis (87.8, 84.4, 73.3 and 64.4% respectively).

**Table 8. Indication of use**

| | **N (90)** | **%** |
|---|---|---|
| Allergic rhinitis | 58 | 64.4 |
| Acute sinusitis | 66 | 73.3 |
| Chronic sinusitis | 79 | 87.8 |
| Post nasal operation | 76 | 84.4 |
| Common cold | 18 | 20.0 |
| Nasopharyngeal cancer | 2 | 2.2 |
| Other rhinitis | 2 | 2.2 |

Most physician was not familiar to use the neti pot (60%) and syringe with nasal adapter (45.5%).

**Table 9. No experience devices**

| | **N (90)** | **%** |
|---|---|---|
| Syringe | 6 | 6.6 |
| Syringe with nasal adapter | 41 | 45.5 |
| Squeeze bottle | 1 | 1.1 |
| Neti pot | 54 | 60 |
| Bulb | 12 | 13.3 |
| Spray | 4 | 4.4 |

# Discussion

Nasal irrigation is widely used as an adjunctive treatment for allergic rhinitis. A recent Cochrane's review 9 found that saline irrigation may improve patient-reported disease severity compared with no saline at up to four weeks (SMD -1.32, 95% confidence interval [CI] -1.84 to -0.81; 407 participants; six studies; low quality) and between four weeks and three months (SMD -1.44, 95% CI -2.39 to -0.48; 167 participants; five studies; low quality). Although the evidence was low quality, the SMD values at both time points were considered as indicating a large effect.

It has been suggested that squeezable bottles can more effectively release the correct volume of solution into the nasal cavity, as the tip of the bottle fits into each nostril resulting in minimal leaking of the irrigated solution. This more effectively clears mucus from the nasal cavity, thereby allowing the sinus ostium to open secretions to be drained from the sinus. The squeezable bottle is easier to hold, and the volume of the irrigated solution can be adjusted by controlling squeezing pressure.

All devices were comparable in term of improving most symptoms except syringe with nasal adapter and squeeze were better in clearing nasal secretion ($p < 0.001$). We found that all devices were well-tolerated by the patients and neither had any major side effects.

The most common side effects of nasal irrigation were retained fluid in sinuses and salty taste (16.9 and 14.2% respectively). Most patients flex neck (72.8%) and not breathing (65.3%) during irrigation.

In conclusion, this survey supports the regular use of nasal irrigation with a positive-pressure device, particularly a squeezable bottle or syringe with a nasal adapter, as an effective treatment nasal disease. It is effective to clear the nasal secretion and can be used by patients with good compliance and minimal side effects.

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