

Application of Geographic Information System (GIS) for Management of Cleft Lip-Palate Care at The Tawanchai Cleft Center

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Objective: To use a Geographic Information System (GIS) approach to study the distribution and statistics of patients with cleft lip/palate in Thailand's Northeast region who get treatment at Srinagarind Hospital, Khon Kaen University.

Material and Method: Using a GIS approach, the researchers reviewed every case with cleft lip/palate treated at Srinagarind Hospital between 1984 and 2007 to study the distribution of cleft lip/palate in Northeast Thailand.

Results: Of the 1,950 patients, there were more male patients (56.3%) with cleft lip/palate than females (43.7%). One-third (31.8%) of the patients had cleft lip only, while 22.5% had cleft palate only and 45.7% had both cleft lip and cleft palate. Most of the patients (55.1%) lived in Khon Kaen, 24.9% in Mahasarakham and 16.9% in Kalasin provinces. Since 2002, more patients have had surgical treatment at the ages and intervals recommended by our centre's protocol.

Discussion and Conclusion: Most of the patients who have got treatment at The Tawanchai Center lived in central and northern Northeast Thailand: most lived in Khon Kaen province. More of the patients tended to get surgery on time, according to the establishment of The Tawanchai Center's interdisciplinary protocol for cleft lip and cleft palate care; however, some were still getting the surgery late. The GIS data was very useful for the Cleft Center for planning outreach, community-based interdisciplinary treatment, referrals, preparing a schedule for follow-up and follow-on treatments; thus, improving care for the patients with cleft lip/palate.

Keywords: Cleft lip-palate, Geographic Information System (GIS), Improved care

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In Thailand, most new cleft patients are found in the remote rural areas of the Northeast where the incidence is 1 in every 250-600 live births⁽¹⁻³⁾. The causes of the high incidence could be genetic⁽⁴⁾ and/or environmental (*i.e.*, from smoking, alcohol, malnutrition and drug use by the mothers during the first trimester)⁽⁵⁾. In Thailand, the cost of treatment is from 80,000-100,000 baht per case and can take more than 20 years, from birth to complete maturity at the age of 21 years^(6,7).

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Cleft patients need long-term treatment and holistic care from specialists in many disciplines, but with specialized skills for dealing with cleft lip/palate. Since it takes such a long time for treatment and the timing of each surgery is critical, a multi-disciplinary team approach needs to be developed. The readiness of the team and the potential of the hospital to give service is pivotal for safe and satisfactory treatment for the patients-which means that they will be able to look normal and live integrated in society^(1,5).

Srinagarind Hospital is a super-tertiary university hospital with ample potential for providing holistic treatment of patients with cleft lip/palate. It is, therefore, necessary to study the geographic

distribution of statistics on patients with cleft lip/palate and their tendencies so that they will get on-time surgical treatment. Such an analysis would assist with more effective planning of outreaches, determining referrals, and developing a treatment system for cleft lip/palate. This would also raise Srinagarind Hospital to the level of a treatment and research center of excellence for cleft lip/palate in Northeast Thailand and surrounding nations.

Objective

To use a Geographic Information System (GIS) approach to study the distribution and statistics of patients with cleft lip/palate in Thailand's Northeast region who get treatment at Srinagarind Hospital, Khon Kaen University.

Materials and Method

The researchers reviewed every in-patient case with cleft lip/palate that got treatment at Srinagarind Hospital between 1984 and 2007. Information collecting forms were created by the researchers then validated by specialists.

Basic information from the hospital and the patients' records was collected; for a total of 2,086 completed forms. The statistics used in the study included: percentages and averages.

GIS analysis was done using Arc View GIS version 3.1 (ESRI Thailand; available on <http://www.esrith.com/>). The program provides an analysis of the geographic distribution; in our case, of patients with cleft lip/palate.

Results

The information on patients with cleft lip/palate indicated that 1,950 patients received treatment between 1984 and 2007. The total number of hospital stays was 3,342; of which, 1,098 (56.3%) were males and 852 (43.7%) were females (Table 1).

From an epidemiological perspective, the

patients getting treatment between 1984 and 2007, were 621 (31.8%) with cleft lip only, 438 (22.5%) who had cleft palate only and 891 (45.7%) who had both cleft lip/palate (Fig. 1).

Between 1984 and 2007, the geographical distribution of patients with cleft lip/palate indicated that one-third (33.4% or 652 patients) lived in Khon Kaen, 16.3% (318) in Mahasarakham and 11.2% (219) in Kalasin (Fig. 2 and 3).

Between 1984 and 1992, 14.3% of the patients 3 to 4 months of age received cheiloplasty and 28.6% between 9 and 12 months received palatoplasty. For the same period, 39.7% of the patients between 3 and 4 months received cheiloplasty, 52.8% of those between 9 and 12 months of age received palatoplasty and 13.4% of those between 4 and 5 years of age received lip/nose corrective surgery.

Discussion

The GIS analysis revealed that most of the patients with cleft lip/palate who have got treatment from Srinagarind Hospital lived relatively nearby. However, the greatest incidence of cleft lip/palate was in central and northern Northeast Thailand whereas the southern part of the region had the lowest incidence. Inconvenience and cost of travelling such as distance may explain why those further afield do not come in for treatment. Or, there may be a lack of public relations about the services provided at The Center for Cleft Lip/Palate and Craniofacial Deformities, Srinagarind Hospital, Khon Kaen University in Association with Tawanchai Project. Finally, it might simply be because of the incidence of cleft lip/palate in the province around the hospital is particularly high.

At the present time at Srinagarind Hospital, more patients with cleft lip/palate are getting surgery and treatment on time because: 1) in Northeast Thailand, there is a well-known, high incidence of here dietary transmission as well as other known prevalent risk factors occurring during the first three months of

Table 1. Information on the types of cleft lip/palate among in-patients between 1984 and 2007

| Patients | Cleft lip | | | Cleft palate | | | Cleft lip & palate | | | Total | | |
|------------|-----------|--------|-------|--------------|--------|-------|--------------------|--------|-------|-------|--------|-------|
| | male | female | total | male | female | total | male | female | total | male | female | total |
| Number | 482 | 409 | 891 | 388 | 401 | 789 | 980 | 682 | 1,662 | 1,850 | 1,492 | 3,342 |
| Percentage | 26.1 | 27.4 | 26.7 | 21.0 | 26.9 | 23.6 | 53.0 | 45.7 | 49.7 | 55.4 | 44.6 | 100.0 |
| Amount | 356 | 265 | 621 | 200 | 238 | 438 | 542 | 349 | 891 | 1,098 | 852 | 1,950 |
| Percentage | 32.4 | 31.1 | 31.8 | 18.2 | 27.9 | 22.5 | 49.4 | 41.0 | 45.7 | 56.3 | 43.7 | 100.0 |

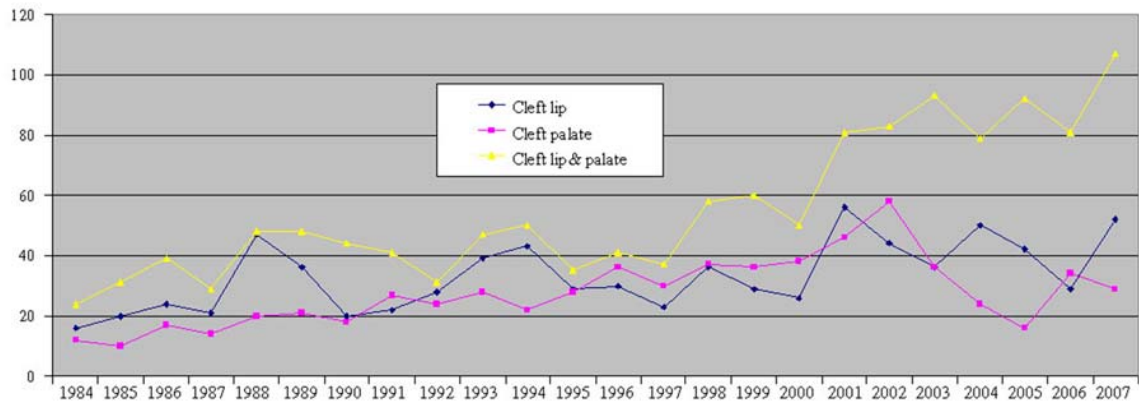


Fig. 1 Epidemiology on the types of cleft lip/palate among in-patients between 1984 and 2007

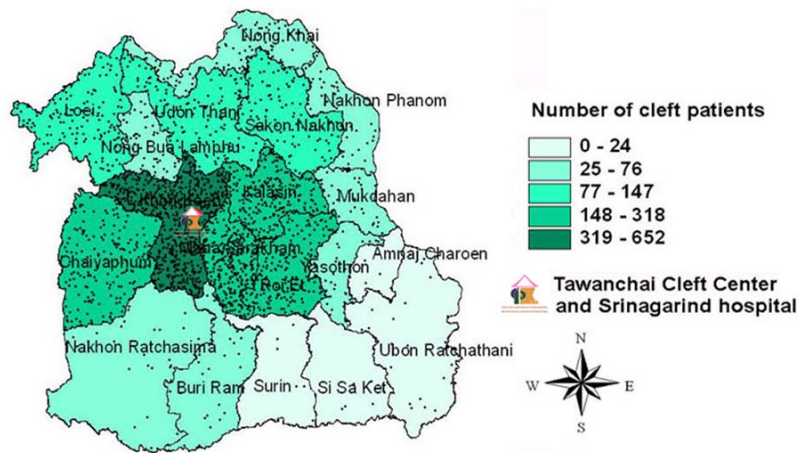


Fig. 2 Geographic intensity distribution of patients with cleft lip/palate between 1984 and 2007

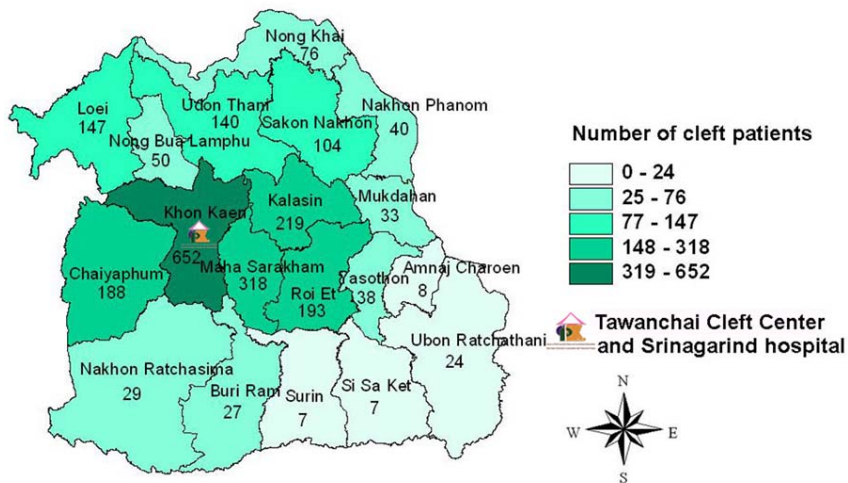


Fig. 3 Numbers of patients with cleft lip/palate by province between 1984 and 2007

pregnancy; 2) the public health system of Thailand works actively to raise awareness and support families with a children with cleft lip/palate; 3) Srinagarind Hospital is well-known for its treatment centre for cleft lip/palate and craniofacial deformities, the readiness of its staff and the modernity of the medical appliances doing first-rate treatments; 4) there is greater understanding among affected families about bringing patients to receive timely interventions; and 5) improvements of the information system that increases the ease of getting information by staff, families and project overseers so that they can make informed choices on the best treatments for the patients.

Using a GIS analysis for an epidemiology study of cleft lip/palate should prove helpful for service provision planning since many medical centers use GIS system to analyze and work on targeted disease prevention programs based on the information it can provide. In some countries, GIS is already applied for use in cleft lip/palate epidemiology. There are reports about epidemiology of patients with cleft lip/palate such as the studies by Hwang and Jaakkola⁽⁸⁾, who studied whether ozone (O₃) and air pollution increased the incidence of cleft lip/palate. They found that the incidence of cleft lip/palate rose with the quantity of ozone (O₃) but that it was not related to air pollution. Vinceti et al⁽⁹⁾ used GIS to determine whether being handicapped at birth was related to the quantity of the pollution from a community waste burner and similarly found that pollution was not related to being handicapped at birth.

Nieuwenhuijsen et al⁽¹⁰⁾ studied the risk of being handicapped by chlorinated water. Briefly, they used a GIS geographic analysis to evaluate 12 chlorination plants in England and found that there was no statistical relationship between being handicapped at birth and home-use of chlorinated water. GIS has been applied for use in many fields and for geographical analyses in health science. Robert et al⁽¹¹⁾ suggested that using GIS can reveal geographical distribution differences from complicated information; by converting the data into an easy to interpret picture. Policy planning and information analysis has thereby been made more effective place-specific.

Conclusion

Most of the patients who received treatment at Srinagarind Hospital lived in central and the northern Northeast Thailand and most lived in Khon Kaen, Mahasarakham and Kalasin. The least number of patients with cleft lip/palate came from Surin and Sisaket.

Since 2002, more of the patients tended to get surgery on time, according the THAICLEFT protocol; however, some were still getting the surgery late. In order to manage giving treatment more effectively (*i.e.*, in a timely manner), the multi-disciplinary teams need to emphasize improving the scheduling of treatment and planning with families.

The GIS treatment of the data provided very useful information for treatment-planning for the family of patients with cleft lip/palate. In this large region of Thailand with many remote villages, such detailed geographical analysis is critical for preparing: outreach programming, referrals, continual treatments, and partnership with other emerging local cleft centers.

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การใช้ระบบภูมิสารสนเทศ (GIS) ในการดูแลผู้ป่วยปากแหว่งเพดานโหว่ในศูนย์ตะวันฉาย

สุธีรา ประดับวงษ์, อรทัย เล็กบุญญาสิน, วาสนา จันทะชุม, สุพิชฌาย์ อุดมธนทรัพย์, กฤษฎา สิมมะลี, บวรศิลป์ เชาวน์ชื่น

วัตถุประสงค์: เพื่อประยุกต์ใช้ระบบภูมิสารสนเทศ (Geographic information system, GIS) ศึกษาสถิติ และการกระจายตัวของผู้ป่วยปากแหว่งเพดานโหว่ที่เข้ามารับการรักษา ณ โรงพยาบาลศรีนครินทร์ ภาคตะวันออกเฉียงเหนือ ประเทศไทย ซึ่งเป็นข้อมูลพื้นฐานที่มีความจำเป็นในการวางแผนการดูแลรักษาผู้ป่วยปากแหว่งเพดานโหว่อย่างครบวงจรในภาคตะวันออกเฉียงเหนือ ประเทศไทย

วัสดุและวิธีการ: ทำการศึกษาผู้ป่วยปากแหว่งเพดานโหว่ทุกราย ที่เข้ามารับการรักษาในโรงพยาบาลศรีนครินทร์ ตั้งแต่ปี พ.ศ. 2527-2550 โดยใช้แบบบันทึกข้อมูลผู้ป่วยและใช้ระบบภูมิสารสนเทศ (Geographic information system, GIS) ในการศึกษาข้อมูลสถิติและการกระจายตัวของผู้ป่วย

ผลการศึกษา: สถิติของผู้ป่วยปากแหว่งเพดานโหว่พบว่าเป็นเพศชาย (ร้อยละ 56.3) มากกว่าเพศหญิง (ร้อยละ 43.7) เป็นผู้ป่วยปากแหว่ง ร้อยละ 31.8 ผู้ป่วยเพดานโหว่ ร้อยละ 22.5 และเป็นผู้ป่วยทั้งปากแหว่งและเพดานโหว่ ร้อยละ 45.7 รวมทั้งหมด 1,950 ราย ในการกระจายตัวของผู้ป่วย ส่วนใหญ่อาศัยอยู่ในจังหวัดขอนแก่นมากที่สุด รองลงมาคือ มหาสารคาม กาฬสินธุ์ คิดเป็นร้อยละ 55.1, 24.9 และ 16.9 ตามลำดับ และแนวโน้มที่ผู้ป่วยเข้ารับการรักษาผ่าตัดตามช่วงอายุเพิ่มมากขึ้นในปี พ.ศ. 2545 เป็นต้นมา ซึ่งเป็นตามข้อกำหนดของศูนย์ตะวันฉาย

สรุป: ผู้ป่วยปากแหว่งเพดานโหว่ที่เข้ามารับการรักษาในศูนย์ตะวันฉาย ส่วนใหญ่อาศัยอยู่ในภาค ตะวันออกเฉียงเหนือ ตอนกลาง และตอนบนและมีจำนวนมากที่สุด ในเขตจังหวัดขอนแก่น โดยผู้ป่วยมีแนวโน้มในการ เข้ารับการรักษาตามช่วงอายุเพิ่มมากขึ้น อย่างไรก็ตามยังมีผู้ป่วยบางรายที่ได้รับการผ่าตัดช้ากว่าเกณฑ์ที่กำหนด ข้อมูลจาก GIS เป็นประโยชน์อย่างมากสำหรับศูนย์การดูแลผู้ป่วย ในการจัดกิจกรรมส่งเสริมงานสถาบัน การดูแลแบบทีมสหวิทยาการในรูปแบบชุมชนเป็นฐานการส่งต่อผู้ป่วย และการนัดหมายติดตามผู้ป่วยในการรักษาซึ่งจะส่งผลให้การดูแลผู้ป่วยปากแหว่งเพดานโหว่ดียิ่งขึ้น
