GEO-INFORMATICS FOR HEALTH SURVEILLANCE OF NONTHAI HOSPITAL A CASE STUDY OF NONTHAI DISTRICT NAKHONRATCHASIMA PROVINCE, THAILAND

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Abstract: In Thailand, good health is essential for Thai people especially rural area so health surveillance of admitted patients is one important duty for the governmental hospitals. This study aims to rank the admitted patients in Nonthai hospital for health surveillance after such patients back to recuperate at their homes. The study area is Nonthai district, Nakhonratchasima province of Thailand. Herein, the admitted patients were selected by responsible officials and then were committed to team of patient visiting, officially called 'Home Health Care'. There were 79 admitted patients who were visited and recorded coordinates with GPS at patient's home. These admitted patients were ranked based on 9 hospital factors of Non Thai hospital (1) illness level, (2) Emergency of rehabilitation, (3) re-admit within 48 hours, (4) ability of patient, (5) ability of family for patient caring, (6) requirement for re-visiting, (7) environment for health patient, (8) distance from hospital to patient's home, and (9) adjacent between homes. Herewith each factor is determined by weighting factor and rating factor based on hospital experts and then both are combined by weighting linear total. The total weight of each assigned patient is grouped into three levels for access: group of first access, group of second access and group of third access). As a result, there are 25 patients for group of first access (score 104-166); 32 patients for group of second access (score 85-102); 22 patients for group of third access (score 60-84). Importantly, these results will be useful for other related hospital officials for considering health surveillance for villages.

1. Introduction

Health is vital for all of us and understanding the determinants of a disease, its spread from person to person and community to community has become increasingly global (ESRI, 1999 and Garg et al., 2009). GIS has several advantages over conventional methods used in health planning, management and research (Brewer, 2002). GIS research in the informal sector is more limited but with an increasing interest in the wider health/social care nexus (Milligan, 2000). GIS can acquire, store, manage, and geographically integrate large amounts of information from different sources, programmers and sectors. GIS serves as a common platform for the convergence of multi-disease surveillance activities. It helps generate thematic maps that depict the intensity of a disease or vector. GIS can identify catchment areas of health centre and also locate suitable sites for a new health facility. (Najafabadi, 2009). Surveillance of diseases requires continuous and systematic collection and analysis of data. GIS can eliminate the duplication of effort involved in data collection across an organization, and hence substantially reduce the cost involved in it (Brewer and Pickle, 2002). This study aims to rank the admitted patients in Nonthai hospital for health surveillance after such patients back to recuperate at their homes.

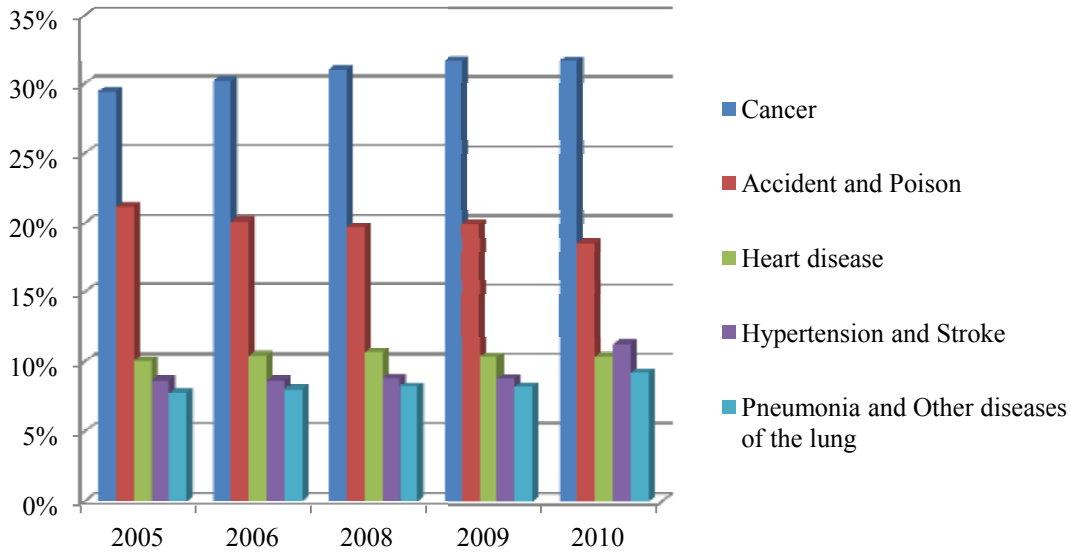

Figure 1: The five-first cause for death between 2005-2010 (Ministry of Health, 2010)

2. The study area

The study area is Nonthai district of Nakhon Ratchasima province where situated on the northeastern Thailand with WGS 1984 UTM easting from 807000 to 842000 and northing from 1665000 to 1695000 (Northing). Area of Nonthai district comprises 542 sq.km. (Figure 2) and the general administration includes as following:

North attached to Phra Thong Kham sub-district and Kham Sakaesaeng district in Nakhon Ratchasima province

South attached to Muang Nakhoratchasima district and Kham Thale So district in Nakhon Ratchasima province

East attached to Kham Sakaesaeng district and Non Sung district in Nakhon Ratchasima province

West attached to Dan Khun That district in Nakhon Ratchasima province

Population of Nonthai district on December, 2008 comprises of all 72,378 people (male 35,848 people and female 37,122 people. Herein, there are 10 sub-districts that each sub-district includes 131 villages as shown in Table 1.

3. Methodology

The methodology of this study can be explained by flowchart as Figure 3. This study intends to causes and factors for home health care in Nonthai distriict of Nakhon Ratchasima province. Herein, the output is determined and processed by map that shows the coordinate of the patient home for heath surveillance of home visiting. Therefore, research divides 3 main steps as follows:

3.1 Determination of name list and preliminary data

3.1.1 Name list is determined by user, called 'nurse official' where works the patient building of Nonthai hospital. Herewith, the recorded data include ID of patient, the first name, the last name, date (day/month/year), address, and patient resume. Furthermore, Geo-informatics data include administration data of Nonthai district (polygon layer), village data (point layer), road data (line layer), and patient's home coordinate (point layer).

3.1.2 Preliminary data is patient data, Geo-informatics data, and illness data. Herewith, these data are developed that are used for the second step (Analysis of Patient Data based on Application of Geo-Informatics).

3.2 Analysis of patient data based on application of Geo-informatics

The patient data based on Geo-informatics is joined with Potential Surface Analysis (PSA) for data decision via ranking of factor that influence to patient visiting. Herein, PSA is divided into 2 parts: (1) determination of weighting factors based on healthy criteria (Ministry of Public Health, 2009) and then weighting factors is scored by healthy expert, and (2) determination of rating factor for each factor from the first part is given by healthy expert. Then, both weighting factor and rating factor are calculated by the below equation as:

$$S = W_1R_1+W_2R_2+\ldots..+W_nR_n \quad (1)$$

Where S = Total score of factor

W_{1-n} = Score for weighting factor from 1 to n

W_{1-n} = Score for rating factor from 1 to n

In this study, there are 9 weighting factors and their rating factors as Table 2 below

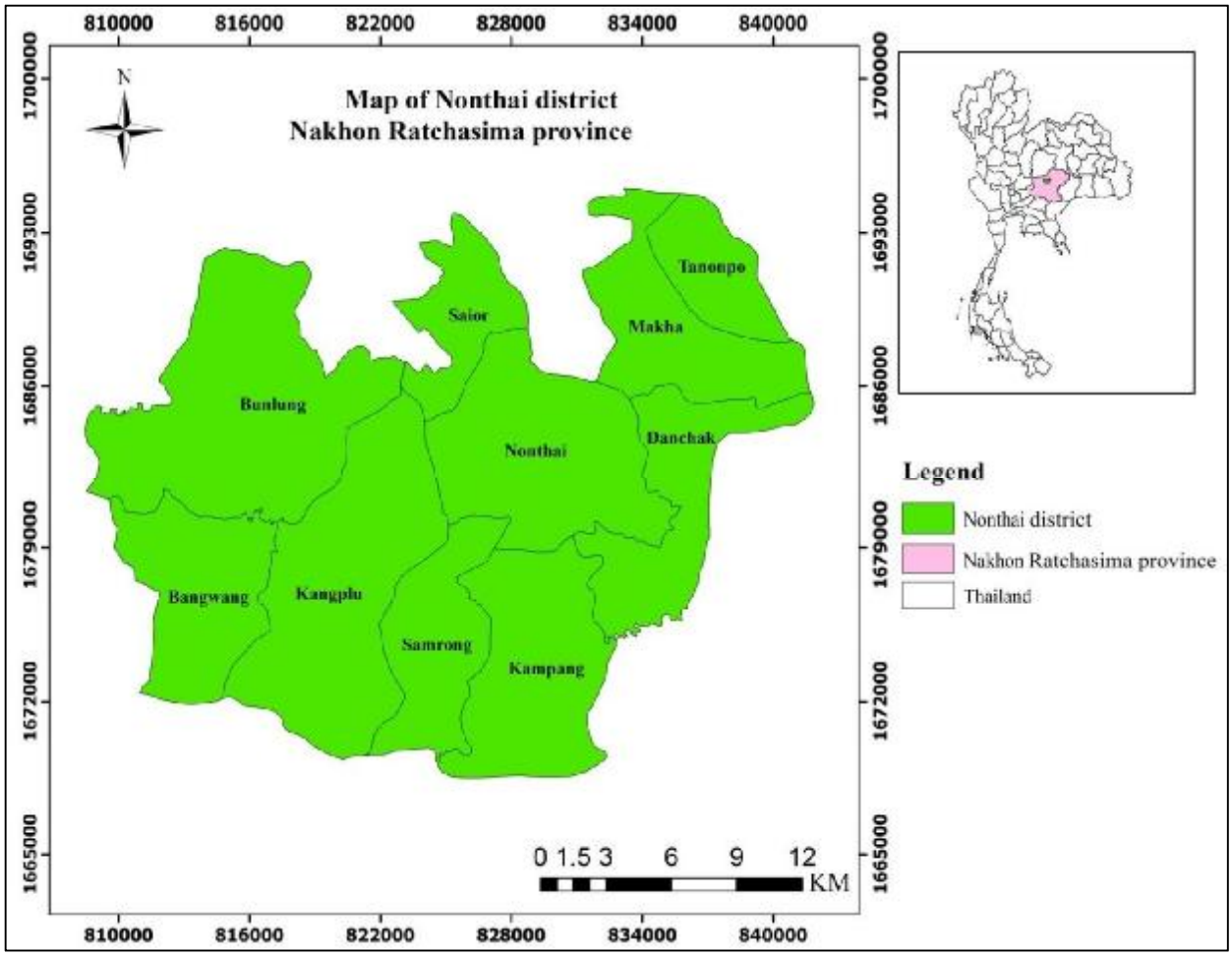

Figure 2: Study area

Table 1: Village data and population data of 10 sub-districts in Nonthai district, Nakhon Ratchasima province

Sub-district name	Villages	No. of Population
1. Makha sub-district	10	4,135
2. Thanon sub-district	9	4,065
3. Saior sub-district	11	2,084
4. Bunlung sub-district	19	8,623
5. Nonthai sub-district	17	9,484
6. Kangplu sub-district	10	5,447
7. Danchak sub-district	13	8,850
8. Banwang sub-district	10	4,833
9. Samrong sub-district	17	6,924
10. Kampang sub-district	15	9,522

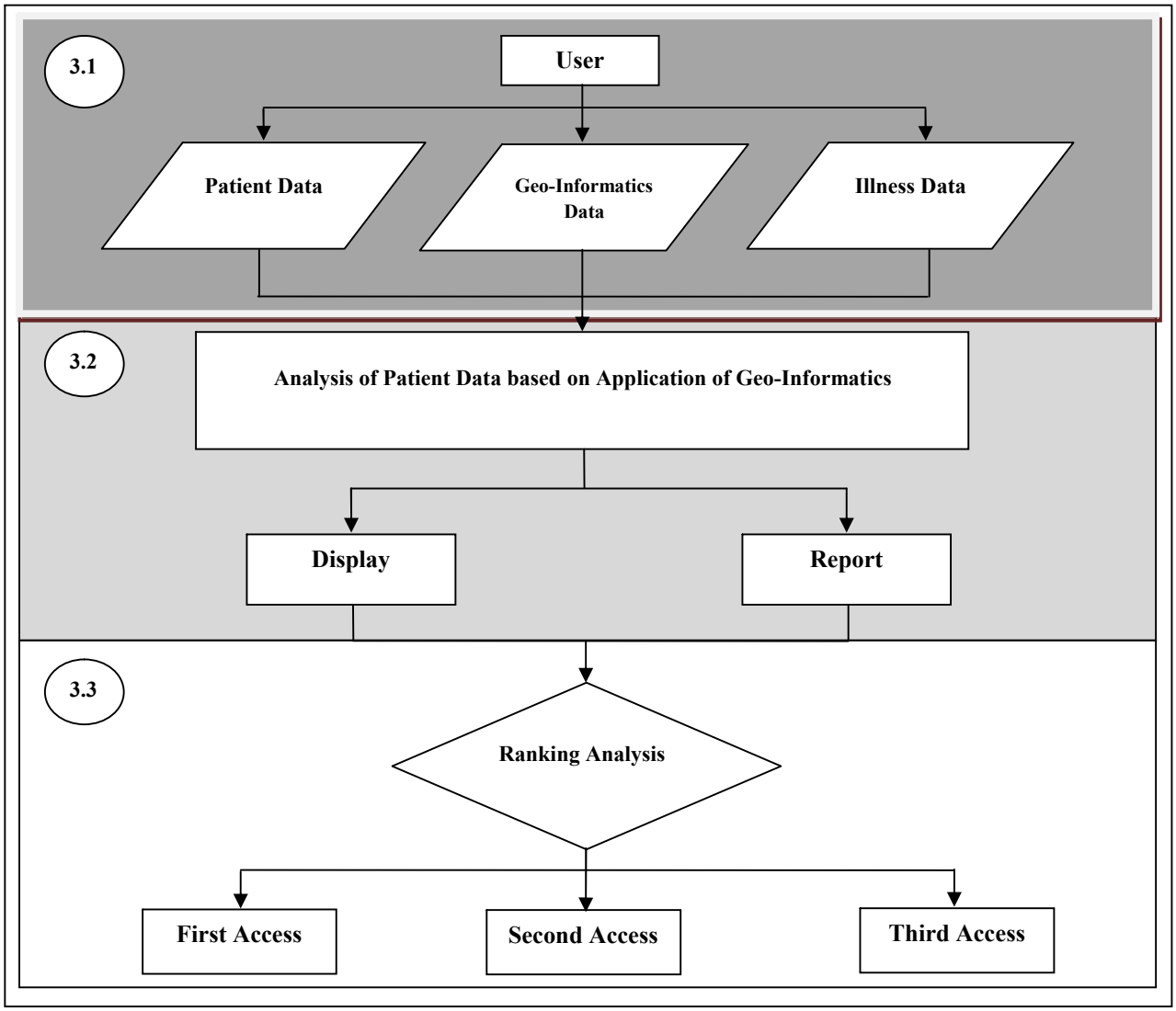

Figure 3: Flowchart of this study

Table 2: Ranking of weighting factor and their rating factors

Factor	Weighting	Ability level	Rating
1. Illness level	9	- Highest level	3
		- Moderate level	2
		- Low level	1
2. Emergency of rehabilitation	8	- Within 7 days	4
		- 8-14 days	3
		- 15-28 days	2
		- 29 days up	1
3. Re-admit within 48 hours	7	- 3 times/month	4
		- 2 times/month	3
		- 1 time/month	2
		- 0 time/month	1
4. Ability of patient	6	- cannot take caring	4
		- Low take caring	3
		- Moderate take caring	2
		- 100% for take caring	1
5. Ability of family for patient caring	5	- the least of take caring	4
		- Low take caring	3
		- Moderate take caring	2
		- Good take caring	1
6. Requirement for re-visiting	4	- Never visiting	5
		- Re-visiting after 2 weeks	4
		- Re-visiting after 3 weeks	3
		- Re-visiting after 4 weeks	2
		- Do not re-visit	1
7. Environment for health patient	3	- The highest risk	4
		- The moderate risk	3
		- The low risk	2
		- Safety	1
8. Distance from hospital to patient's home	2	- less than 5 km	3
		- between 5 km to 30 km	2
		- 30 km up	1
9. Adjacent between homes	1	- less than 5 km	3
		- between 5 km to 10 km	2
		- good take caring	1

3.3 Ranking Analysis

The output of the second step is ranked by class interval. In statistics, the range of each class of data, used when arranging large amounts of row data into grouped data (Wasserman, 2012). To obtain an idea of the distribution, the data are broken down into convenient classes (commonly 6-16), which must be mutually exclusive and are usually equal in width to enable histograms to be drawn. The class boundaries should clearly define the range of each class. When dealing with discrete data, suitable intervals would be, for example, 0-2, 3-5, 6-8, and so on. When dealing with continuous data, suitable intervals might be $170 \leq x < 180$, $180 \leq x < 190$, $190 \leq x < 200$, and so on. Finally, these results will be display on ArcMap 9.X to easily decide for accessibility of home care team from Non Thai hospital.

4. Results

This study ranked 79 patient homes based on 3 interval classes (score from 60 to 166). Herewith each patient home was positioned with GPS tool in Universal Transverse Mercator (UTM) as shown in Figure 4. There are 25 patient home for group of first access (score 104-166); 32 patients for group of second access (score 85-102); 22 patients for group of third access (score 60-84).

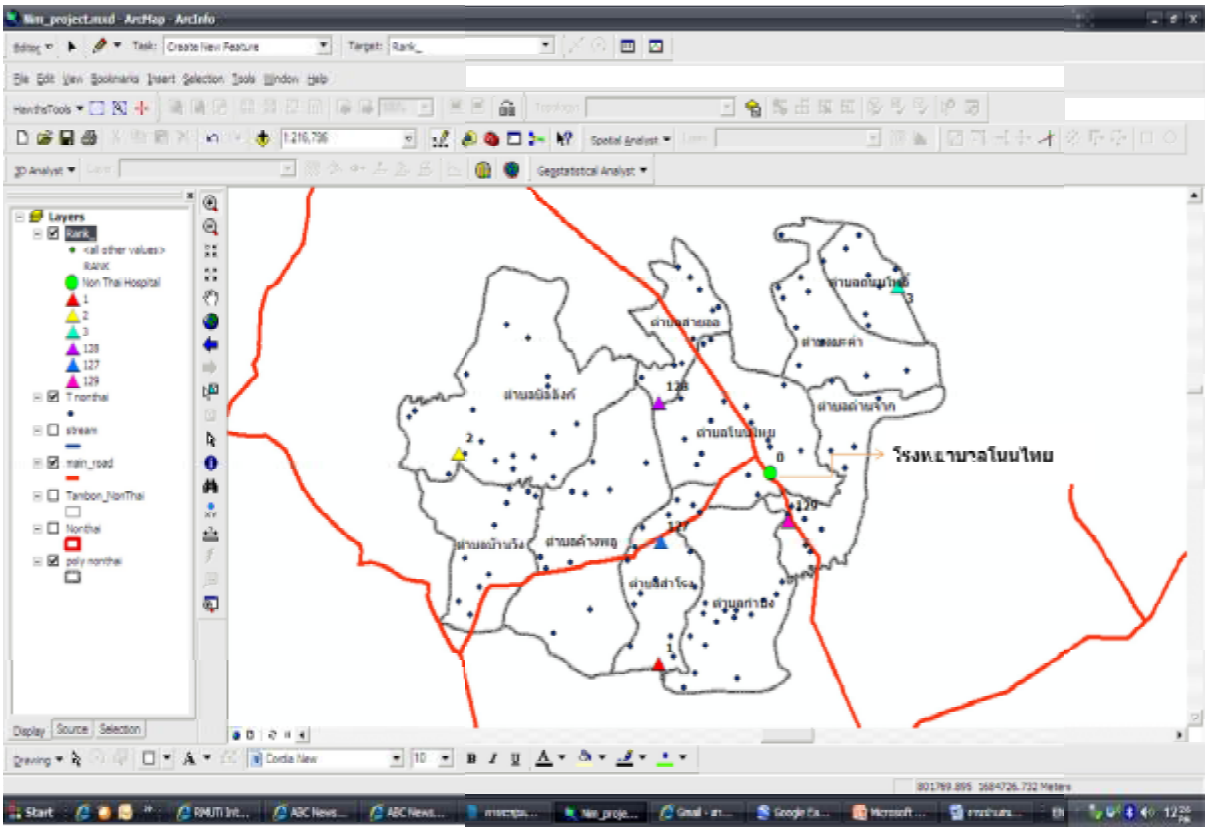

Figure 4: Ranking analysis for 79 patient homes of Non Thai hospital.

5. Conclusions

The accessibility of 79 patient homes was able to set 3 groups as follows:

5.1 First access for 25 patient homes based on score 104-166 is mainly caused by illness level.

5.2 Second access for 32 patients for group of second access based on score 85-102 is mainly caused by ability of patient.

5.3Third access for 22 patients for group of third access based on score 60-84 is mainly caused by Distance from hospital to patient's home

6. Discussion

The health factors were defined in each level of accessibility for patient's home should be checked to build confidence of the above results.

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