Appendix 3

Presentation of the papers

This thesis includes research results that have been submitted for oral presentation in 2 conferences. The first conference was the 7^{th} National Graduate Research Conference held on 4 – 5 April 2007 at Surat Thani Campus, Prince of Songkla University. The paper entitled "Forecasting Hospital Infectious Disease Mortality among Patients Aged 40 and Over in Southern Thailand" was presented. The full paper was published and presented at this conference. The second conference was the 1^{st} International Conference on Health Promotion and Quality in Health Services (IHPQS) held on 19 – 21 November 2008 at Bangkok Convention Centre at Central World, Bangkok, Thailand. The paper entitled "Variation of Length of Hospital Stay for Inpatients Dying in Southern Thailand" was presented.

Acceptance letters, the details of each presented paper including cover, abstract or full paper, certificate and presentation award are shown in this appendix,

3.1 The 7^{th} National Graduate Research Conference

This conference is a national conference with the graduate schools in universities in Thailand rotating responsibility. The 7^{th} National Graduate Research Conference in April 2007 was \ held by Prince of Songkla University. The details of our paper, the basis of the oral presentation, are shown in the following.

ที่ ศธ 0521.1.13/155

บัณฑิตวิทยาลัย มหาวิทยาลัยสงขลานครินทร์
ตู้ ปณ. 8 ปทฝ. คอหงส์ อ.หาดใหญ่
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14 มีนาคม 2550

เรื่อง การตอบรับการนำเสนอผลงานวิจัยระดับบัณฑิตศึกษาแห่งชาติ ครั้งที่ 7

เรียน ผู้นำเสนอผลงานวิจัยฯ

ตามที่ท่านได้สมัครเข้าร่วมเสนอผลงานวิจัยระดับบัณฑิตศึกษาแห่งชาติ ครั้งที่ 7 ในวันที่ 4-5 เมษายน 2550 ณ มหาวิทยาลัยสงขลานครินทร์ เขตการศึกษาสุราษฎร์ธานี นั้น

บัดนี้ บัณฑิตวิทยาลัย ได้รับเอกสารของท่านของท่านเรียบร้อยแล้ว และยินดีให้ท่านให้ท่านเข้าร่วมเสนอผลงานดังกล่าวได้ และสามารถดูกำหนดการได้ที่เว็บไซต์ http://www.grad.psu.ac.th/grad_research/ ตั้งแต่วันที่ 26 มีนาคม 2550 เป็นต้นไป

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.ดำรงศักดิ์ ฟ้ารุ่งสาง)
ผู้ช่วยคณบดีบัณฑิตวิทยาลัย
ปฏิบัติราชการแทนคณบดีบัณฑิตวิทยาลัย

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Forecasting Hospital Infectious Disease Mortality among Patients Aged 40 and Over in Southern Thailand

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ABSTRACT

This study aims to investigate and forecast regional and temporal patterns of deaths reported as infectious disease in hospital (excluding HIV/AIDS) in all 14 provinces of southern Thailand over the period 1999-2004 using data obtained from the Thailand Bureau of Policy and Strategy, Ministry of Public Health. Mortality incidence rates were calculated using populations obtained from the 2000 population census. Causes of deaths were identified using the International Classification of Disease 10th revision (ICD10). Negative binomial lagged observation-driven regression models for mortality incidence were fitted to the data for infectious disease mortality. Overall hospital infectious disease mortality rates started to increase sharply in 2003 -2004. An upward trend in hospital mortality among patients aged 40 and over also started in 2003 - 2004, particularly those reported as dying from septicemia, while other infectious diseases showed a slightly increased trend. Identifying the real cause of hospital deaths recorded as septicemia would substantially improve hospital mortality data quality

KEYWORDS : Mortality, Infectious disease, Septicemia, Southern Thailand.

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INTRODUCTION

Setting up health planning and policy making are base on the accuracy and complete data. Thailand is still facing with the low quality of mortality data. Approximately 65 percent of deaths occur outside hospital (Tangcharoensathien et al., 2004). The completeness of death registration in Kanchanaburi province indicated 12.5 percent of deaths were not registered (Prasartkul and Vapattanawong, 2006) while over 30 percent of those unregistered for the whole country (Mathers et al., 2004). The lowest death completeness of registration was found in the south (Rukumnuaykit, 2006). However reliable mortality data are those with cause of death certified in a hospital by a medical professional but such information is available for less than 30 percent of the 50.5 million deaths estimated to occur annual worldwide (Murray and Lopez, 1997). Moreover, hospital statistics tend to under-estimate the prevalence of mortality in under-developed countries such as Ethiopia (Reniers et al., 2005).

Infectious diseases account for over a quarter of all global deaths (National Intelligence Council, 2000). The trend of infectious disease mortality has declined in developed countries with better living conditions and good available treatments now available (Dore et al., 1998; Serraino et al., 2004; Bi et al., 2003; Gage, 1994; Wolleswinkel-van den Bosch et al., 2001) but not in some developing countries with the reemerging of infectious disease (Chow et al., 2003). Infectious diseases are still among the leading causes of deaths in Thailand (Rukum nuaykit, 2006; Rumakom et al., 2001).

People living in southern Thailand over the six years 1999-2004, of the 6885 deaths from infectious diseases excluding HIV/AIDS certified in hospitals, 61.2% had principal diagnosis recorded as ìsepticemia,unspecifiedî (ICD10: A41.9). The aim of this study is to find the suitable statistical model for predicting incidence rates of hospital infectious disease mortality adjusted by two monthly period and area effect in Southern Thailand.

MATERIALS AND METHODS

Mortality data from 1999 to 2004 in the 14 provinces in Southern Thailand were obtained from the Bureau of Policy and Strategy, Ministry of Public Health. For these data, the principal diagnosis and demographic information are given on death certificates that include sex, age, place of residence, place of death, death date, having death certificate and cause of death. Causes of deaths were identified using the International Classification of Disease in its 10th revision (ICD10). Based on the ICD10 disease classification system and WHO recommendations (Mathers et al., 2002, pages 55-59), we grouped cause of death into two categories: (1) septicemia (A41) and other infectious diseases other than HIV/AIDS (A00-A19, A25-40, A42-B99, G00, G03-G04, N70-73). Population denominators were obtained from the Population and Housing Census of Thailand in year 2000 undertaken by the National Statistics Office of Thailand.

To simplify the effect of location of residence when calculating death rates, one or more contiguous districts in each province were grouped together to form "super-districts" containing populations of 200,000 on average, as shown in Table 1, where they are listed in order of geographical location from north to south (keeping super-districts within the same province together) with their 2000 census populations.

The numbers of deaths in each demographic group defined by age and/or gender and super-district of residence of the deceased were aggregated in intervals of two months: January-February, March-April, etc, giving six annual seasonal periods.

Super-district	Code	Population	Super-district	Code	Population
Chumpon North	1	246,279	Trang City	20	190,340
Chumpon South	2	199,927	Trang South	21	219,955
Ranong	3	161,210	Pattalung City	22	251,029
SuratThani NW	4	243,238	Pattalung West	23	247,442
SuratThani City	5	241,373	Songkhla North Coast	24	149,706
SuratThani East	6	168,801	Songkhla West	25	205,607
SuratThani South	7	215,998	Songkhla City	25	162,700
Phang-nga	8	234,188	HatYai	27	324,596
NakornST North	9	176,496	Songkhla SE Coast	28	177,396
NakornST NW	10	163,187	Songkhla South	29	235,657
NakornST North Coast	11	212,903	Satun	30	247,875
NakornST Central	12	164,324	Pattani City-West	31	253,567
NakornST City	13	267,560	Pattani Central	32	219,932
NakornST South Coast	14	238,059	Pattani East	33	122,486
NakornST SW	15	297,282	Yala City	34	228,042
Krabi North	16	130,564	Yala South	35	187,495
Krabi South	17	205,646	Narathiwat Coast	36	250,997
Phuket	18	249,446	Narathiwat Central	37	234,441
Trang North	19	184,815	Narathiwat SW	38	176,912

Table 1: Populations (2000 census) of super-districts in Southern Thailand

Statistical methods

Subjects age 40 and over were selected. Two-monthly intervals from 1999-2004 were grouped together such as January with February, March with April and so on. Person died at the same province with living were selected. Numbers of deaths were aggregated by whether death from septicemia or other infectious diseases, two-monthly interval and super-district.

Statistical methods

Incidence death rates per 1000 in each super-district were calculated to analyze the level and pattern of mortality. Incidence rates generally have positively skewed distributions so we transformed them by taking logarithms. A model for incidence mortality rate in infectious disease group, two-monthly interval and super-district were created. Negative binomial lagged observation-driven regression models for mortality incidence together with super-district, two-month period, and diagnosis group were fitted to the data. It should be noted that, as in all time series regression models that include lagged observations, the regression coefficients reflect the effects of the predictor variables on the outcomes after these outcomes have been adjusted for the autocorrelations, rather than the direct effects of the predictors on the outcomes.

RESULTS

According to records from death certificates, 250,175 deaths were recorded among residents of the 14 southern Thai provinces for the calendar years 1999 to 2004, corresponding to an average annual death rate of 5.16 per 1000 based the total population of 8.087 million residents according to the 2000 Population and Housing Census. From this total deaths, there were 59,055 (23.6%) died in hospital with 6,885 died from infectious diseases. Table 2 shows the proportions of hospital deaths from septicemia by year for person aged 40 or over. It can be seen that the percentage of deaths from septicemia inc reased gradually by year.

Year	Infectious disease	Septicemia	Percent
1999	421	241	57.2
2000	477	283	59.3
2001	439	290	66.1
2002	645	458	71.0
2003	1,037	783	75.5
2004	1,359	1,035	76.2
total	4,378	3,090	70.6

Table 2: Percentages of hospital deaths from septicemia in Southern Thailand by year among persons aged 40 or more

For hospital deaths only, Figure 1 graphs the distribution of mortality incidence by both reported death cause and super-district among persons aged 40 or over. The chart shows a broad trend of decreasing in-hospital mortality with increasing distance south (away from Bangkok). The rates for septicemia were approximately double those for other infectious diseases. The peaks appeared for the super-districts containing urban districts. The highest peaks in the chart correspond to Hat Yai (27) in Songkhla province. The lower troughs correspond to Narathiwat province.

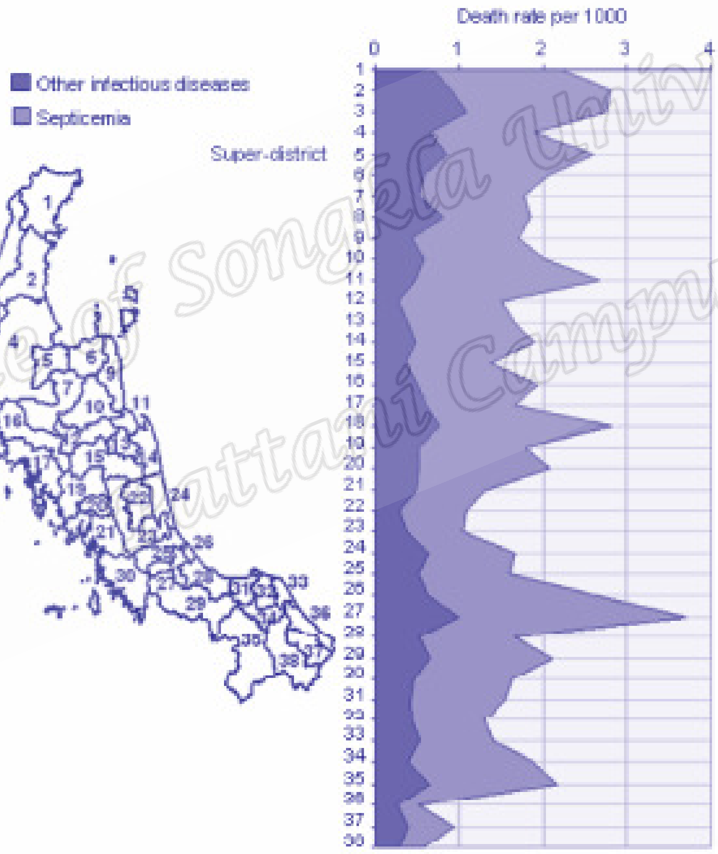


Figure 1: Distribution of death rates for infectious disease by diagnosis groups and residence location for persons aged 40 or over

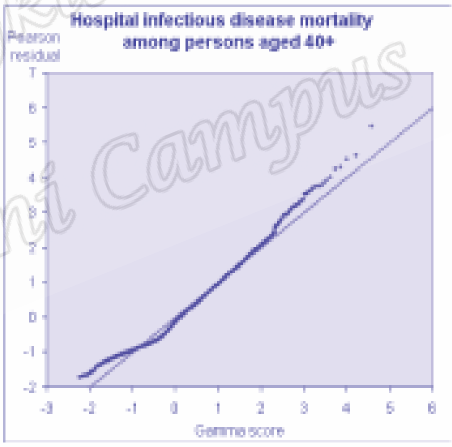
We separated the data cells according to whether or not the principal diagnosis was unspecified septicemia, but only considered in-hospital deaths, given that the percentage of deaths so diagnosed outside hospital was less than 30% compared with more than 60% in hospital. In this analysis we aggregated the data by gender but restricted analysis to those aged 40 or more, because both the numbers of deaths and the "unspecified septicemia" diagnosis are much less frequent for persons dying in the younger age groups.

We fitted the negative binomial GLM to these data, with m = 3 lags, with no demographic subgroups. We separated cells according to whether or not the death had "unspecified septicemia" as its principal cause and included an additional parameter in the model for this effect. We also chose K to be 1,000,000 because substantially lower values of K give autoregressive coefficients that sum to more than 1. The results are shown in Table 3 and Figure 2.

Code	Coeff	SE	Code	Coeff	SE	Code	Coeff	SE	Code	Coeff	SE
1	0	-	11	0.192	0.127	21	-0.368	0.156	31	-0.293	0.149
2	0.247	0.131	12	-0.273	0.161	22	-0.652	0.151	32	-0.376	0.163
3	0.296	0.140	13	-0.167	0.154	23	-0.543	0.159	33	-0.279	0.180
4	-0.112	0.138	14	-0.129	0.135	24	-0.218	0.153	34	-0.069	0.143
5	0.161	0.131	15	-0.408	0.144	25	-0.248	0.150	35	0.050	0.149
6	-0.004	0.147	16	0.006	0.168	26	0.187	0.139	36	-1.167	0.210
7	-0.131	0.145	17	-0.134	0.156	27	0.457	0.121	37	-0.674	0.178
8	-0.084	0.138	18	0.262	0.130	28	-0.138	0.152	38	-0.983	0.233
9	-0.237	0.146	19	-0.086	0.152	29	-0.020	0.139			
10	-0.052	0.145	20	-0.017	0.142	30	-0.245	0.149	K	1,000,000	

Table 3: Regression coefficients and standard errors for super-district effects in negative binomial GLM fitted to age 40+ hospital infectious disease deaths in Southern Thailand

Predictor		Coeff.	SE
	Constant	-1.891	0.146
Season:	Jan - Feb	0	-
	Mar - Apr	-0.022	0.067
	May - Jun	-0.028	0.067
	Jul - Aug	0.007	0.064
	Sep - Oct	-0.263	0.067
	Nov - Dec	-0.174	0.066
Diagnosis:	Other cause	0	-
Unspecified	Septicemia	0.089	0.050
Autoregressive	Lag 1	0.077	0.014
	Lag 2	0.014	0.013
	Lag 3	0.038	0.013
Other districts	Lag 1	0.814	0.046
Dispersion parameter		8.300	1.400



Residual Deviance : 2765.2 df: 2460

Figure 2: Coefficients for other model parameters and Pearson residuals plot

The model fits well. It shows that neither unspecified septicemia reported cause nor season of the year is related to infectious disease mortality. The highest outlier in the residuals plot is 5.4 for just 7 deaths from septicemia in South-west Surat Thani province in November - December 2000. Figure 5 shows the forecasts based on the model for aggregated hospital deaths in this age group from infectious diseases from all 14 provinces.

Figure 3 shows the forecasts based on the full model (Table 3 and Figure 2) applied to aggregated data for hospital septicemia deaths among aged 40 or over. The graph clearly shows that reported unspecified septicemia cause of death sharply increased at the end of 2002. Whereas other hospital infectious disease mortality remained relatively stable.

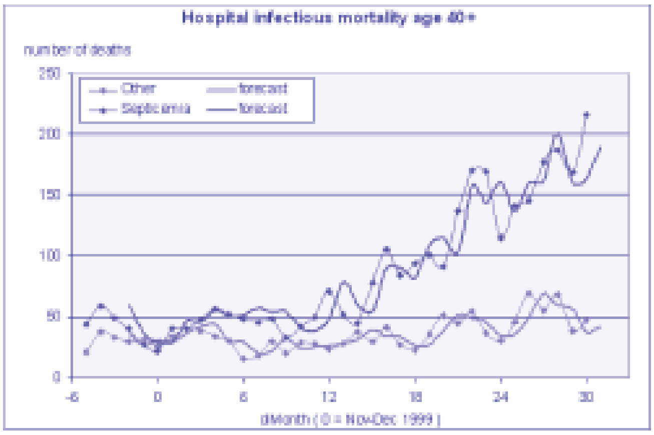


Figure 4: Hospital infectious disease mortality forecasts based on past observations in two-month periods for persons aged 40 or over

DISCUSSION

In this study, the preliminary results revealed that the overall hospital mortality rate in southern Thailand was 23.6 percent, whereas, the average of hospital mortality for the whole country was 35 percent (Thangcharoensathein et al., 2006). Deaths from septicemia were gradually increased by year. These results were consistent with a change in trends for septicemia found in United States with the hospitalization rate for septicemia doubled during the 1980s (Salive et al., 1993). In addition, the in-hospital of infectious disease mortality pattern also had a pronounced geographical pattern in southern Thailand over this six-year period, decreasing from north to south away from Bangkok, and with peaks in urban areas served by large district hospitals where people can access health care and awareness of their health care more easily than those in rural areas.

Other studies have used statistical models for time series counts in spatial regions to account for unexplained data variation, spatial correlation and deficiencies (Congdon, 2006; Lix et al., 2006; Rutaremwa, 2000). Poisson models and Generalized Linear Models with Generalized Estimation Equations (GLM with GEE) were reported by Condon (2000) and Lix et al. (2006). In our study, over-dispersion violated the Poisson model assumption, so a negative binomial GLM was used instead. Spatial-time series modeling for infectious disease revealed that the reported incidence rate for each diagnosis class was stable from 1999 until the end of 2002, when a sharp increase occurred septicemia mortality. There are many causes of death leading to septicemia. A study of risk factors for septicemia mortality in older adult in United States reported that septicemia mortality was associated with history of diabetes and cancer (Salive et al., 1993). However, our forecasting model is base on the constant population structure in each super-district and had no information on original sources of infection. These are the limitations of our study.

In order to propose health policy and implementation plan, our study raises questions about the real causes of death attributed to unspecified septicemia in Southern Thailand. Further studies are needed to answer these questions.

ACKNOWLEDGEMENTS

We are grateful to Prof. Don McNeil for his helpful guidance. This study was funded by the Graduate School, Prince of Songkla University.

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