Burden of Adult Pneumonia in Thailand: A Nationwide Hospital Admission Data 2010

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Objective: *To quantify the admission mortality, pathogens, factors related to mortality, length of hospital stay, and healthcare costs in adult hospitalized pneumonia in Thailand.*
Material and Method: *The data on hospitalized pneumonia for the 2010 fiscal year, extracted from the three main health insurance coverage schemes in Thailand (the Social Security System (SSS), the Medical Welfare System (MWS), and the Civil Servant Medical Benefit System (CSMBS)) were analyzed.*
Results: *Adult hospitalized pneumonia admissions numbered 136,696, with mortality rate 9.63%. The mortality increased with increasing age, 15.49% for age >80 years. Influenza virus was the major etiology for 19 to 25 years old (49.30%) with low mortality (1-2%). S. pneumoniae and typical pathogens were found in every age group. The mortality rate for S. pneumoniae increased with age, viz. 0%, 1.96%, 5.56%, 7.02%, 6.98%, and 24.24% for 19 to 25, 26 to 40, 41 to 60, 61 to 70, 71 to 80, and 81+ years old. The mortality rate from C. pneumonia was about 10% and high among the younger age group. Gram-negative bacilli and Staphylococcus caused high mortality (about 20 to 35%), especially in the older age group. The major risk factors for increasing mortality were: elderly (OR 3.46, 95% CI 3.27-3.77), alcoholic liver disease (OR 3.26, 95% CI 2.85-3.72), cirrhosis (OR 3.45, 95% CI 2.93-4.08), heart disease (OR 2.47, 95% CI 2.38-2.56), ischemic heart disease (OR 2.21, 95% CI 2.07-2.36), renal failure (OR 5.26, 95% CI 5.07-5.49), and cerebrovascular disease (OR 3.62, 95% CI 3.43-3.82). The median length of hospital stay was four days (IQR, 3-7 days) and the median cost of treatment per admission was US$ 256.63 (IQR, US$ 147.81-531.21). Complications such as acute respiratory failure, acute respiratory distress syndrome (ARDS), septicemia, shock, and acute renal failure made hospital stays two to three days longer and costs three to seven times higher than no complications.*
Conclusion: *The mortality from pneumonia among the elderly was high, especially for those over 80 and with multiple medical co-morbidities.*

Keywords: *Adult pneumonia, Mortality rate, Pathogens, Risk factors*

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According to the WHO, lower respiratory tract infection (LRTI), including pneumonia, ranks third among the ten leading causes of death in low- and middle-income countries, below ischemic heart disease and cerebrovascular disease[1]. In high-income countries, LRTI was the fifth leading cause of death behind ischemic heart disease, cerebrovascular disease, lung cancer, Alzheimer, and dementias[1]. Globally, pneumonia was the most common cause of death among infectious diseases, more than diarrhea, HIV/AIDS, tuberculosis, and malaria[2]. However, pneumonia can be prevented with vaccination and treated with appropriate antibiotics or antiviral drugs[3,4].

Annual epidemiological surveillance reporting on pneumonia for 2010 from Thailand's Bureau of Epidemiology, Ministry of Public Health, reported 170,487 cases of pneumonia, which is 267.63 cases per 100,000 populations[5]. These figures include both in- and out-patient cases. Mortality (1,240 cases) was 1.95 cases per 100,000 populations or 0.73%. The trend of pneumonia for the decade 2001 to 2010 remained high and was increasing year on year.

In the USA, pneumonia was responsible for an annual average of 4.5 million visits to physicians' offices, emergency departments, and outpatient clinics[6]. Although the greatest incidence of pneumonia occurs in the outpatient setting where the mortality is

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lower, among hospitalized patients the incidence varies between 5% and 15%, and is greater than 25% mortality rate if an intensive care unit admission is required[7]. Of the total $8.4 billion cost treating pneumonia, $7.5 billion (89.28%) was for inpatient treatment[6].

Epidemiology data on the etiology of pneumonia is needed for improving treatment strategies and patient outcomes. The Infectious Diseases Society of America (IDSA) and the American Thoracic Society (ATS) guidelines recommended a combination of beta-lactam and macrolide for hospitalized community-acquired pneumonia (CAP)[7], while the British Thoracic Society (BTS) guideline recommended this combination for only severe CAP[8]. However, these regimens of treatment do not cover *B. pseudomallei* a common pathogen causing severe pneumonia in Thailand, especially in the northern and northeastern regions[9,10]. The role of atypical pathogens for pneumonia in Thailand is still debated, despite being previously reported[11,12].

The primary objective of this study was to determine the admission and mortality rate of pneumonia among hospitalized adult patients (19 years of age and over), in Thailand in 2010. The secondary objectives were to identify the pathogens, risk factors for an increased pneumonia mortality rate, and to assess the impact of pneumonia on length of hospital stay and healthcare costs.

Material and Method

The authors analyzed the data on pneumonia among hospitalized patients in Thailand for the fiscal year 2010, using in-patient information from the three health insurance coverage schemes (viz. the Social Security System (SSS), the Medical Welfare System (MWS) and the Civil Servant Medical Benefit System (CSMBS)). The data received from analyst team was checked for accuracy by looking for (a) overlapping information (b) visit dates (c) missing items (d) incorrect coding and (e) correct fiscal year dating.

Pneumonia was code as per the ICD-10[13] (J11-J18, A24.1 and A48.1), which includes all of the following organisms: influenza virus (J11), other viral pneumonia (J12), *S. pneumoniae* (J13), *H. influenzae* (J14), *K. pneumoniae* (J150), *P. aeruginosa* (J151), Staphylococcus (J152), Streptococcus group B (J153), Other streptococci (J154), *E. coli* (J155), other aerobic Gram-negative bacteria (J156), *M. pneumoniae* (J157), other bacterial pneumonia (J158), bacterial pneumonia (unspecified) (J159), *C. pneumoniae* (J16), pneumonia (organism unspecified) (J18), *B. pseudomallei* (A24.1), and *Legionella pneumophila* (A48.1).

Adult pneumonia included patients 19 years of age and over. The etiology of hospitalized pneumonia among adults was analyzed, including the mortality rate caused by each pathogen. The data were also analyzed for frequency of common pathogens and the respective mortality rate for each age group of adult.

The risk factors related to increased pneumonia mortality were analyzed including: elderly (age >60 years old), chronic obstructive pulmonary disease (COPD) (J41-J44), HIV/AIDS (B20-B24), diabetes mellitus (E10-E14), hypertension (I10-I15), alcoholic liver disease (K70), cirrhosis (K70.3, K74), heart disease (I00-I02, I05-I09, I10-I15, I20-I25, I30-I52), ischemic heart disease (I20-I25), chronic renal failure (N17-N19), and cerebrovascular disease (I60-I69).

Complications that increased length of hospital stay and cost of treatment were determined. In order to identify the patients who needed a mechanical ventilator coding was done using the ICD-9 (i.e., mechanical ventilator = 96.70, 96.71, 96.72)[14]. Other complications were coded using the ICD-10: viz. acute respiratory distress syndrome (J80), septicemia (A40, A41), shock (R57, A41.9), and acute renal failure (N17)[13].

Length of stay in days and healthcare costs in US dollars were compared between patients with and without complications.

Statistical analysis

The data were analyzed using SPSS for Windows version 17. The continuous and categorical data were expressed in term of median (25^{th}-75^{th} percentile, IQR) and number (percentage), respectively. Multiple logistic regression analysis was used to adjust the odds ratio for factors influencing mortality rate. The odds ratio and 95% CI of each factor were presented.

Ethical approval followed an assessment by the Ethics Committee of the Faculty of Medicine, Khon Kaen University, as per the guidelines of the Helsinki Declaration.

Results

Adult hospitalized pneumonia admissions numbered 136,696 with overall mortality rate 9.63% (Table 1). The mortality rate increased according to

the patients' age. There was a strikingly high mortality rate for afflicted persons over 60 years of age. Likewise, the mortality rate for those 61 to 70, 71 to 80, and 81+ was 9.19%, 11.26%, and 15.49%, respectively. Table 2 showed the mortality rate caused by each pathogen. The respective mortality for Gram-negative organisms was 22.91%, 26.25%, 26.36%, and 35.46% for *K. pneumoniae*, Pseudomonas, *E. coli*, and other aerobic Gram-negative bacteria. For Gram-positive organisms, the respective was 28.68%, 8.75%, 9.52%, and 13.96% for Staphylococcus, *S. pneumoniae*, Streptococcus group B, and other Streptococci. The mortality for atypical pathogens was high for *C. pneumoniae* (10.29%).

When subdivided patients into six age ranges, 19 to 25, 26 to 40, 41 to 60, 61 to 70, 71 to 80, and 81+ years. Influenza virus was the major etiology for the 19 to 25 (49.30%) and 26 to 40 (33.64%) years old while pneumonia from an unspecified organism and Gram-negative pneumonia were common pathogens in older patients (Table 3). Mortality from influenza virus and other viral pneumonias was low in every age group (about 1 to 2%). Pneumonia from atypical pathogens, *C. pneumoniae* caused higher mortality than *M. pneumoniae*. Mortality from *C. pneumoniae* was high (60%) among 26 to 40 years old (Table 4). Gram-negative bacilli and Staphylococcus caused high (30-40%) mortality in the older age group compared

Table 1. Report of adult pneumonia admissions by age group and deaths

Pneumonia	Number of admissions (n)	Percentage of admissions (%)	Number of deaths (n)	Mortality rate (%)
19-25 years	6,825	4.99	130	1.90
26-40 years	16,428	12.02	699	4.25
41-60 years	33,421	24.45	2,789	8.35
61-70 years	23,425	17.14	2,153	9.19
71-80 years	32,331	23.65	3,641	11.26
80+ years	24,266	17.75	3,759	15.49
Total	136,696	100.00	13,171	9.63

Table 2. Report of adult pneumonia admissions by etiology and deaths

Pneumonia	Number of admissions (n)	Number of deaths (n)	Mortality rate (%)
Pneumonia, organism unspecified	82,163	8,072	9.82
Bacterial pneumonia, unspecified	4,442	2,083	8.52
Influenza virus	15,095	23	0.15
Other viral pneumonia	1,421	18	1.27
K. pneumoniae	3,693	846	22.91
Pseudomonas	2,236	587	26.25
E. coli	645	170	26.36
H. influenzae	129	14	10.85
Other aerobic gram negative bacteria	1,063	377	35.46
Melioidosis	1,624	185	11.39
S. pneumoniae	377	33	8.75
Staphylococcus	631	181	28.68
Streptococcus, group B	63	6	9.52
Other streptococci	659	92	13.96
M. pneumoniae	190	3	1.58
C. pneumoniae	68	7	10.29
Other bacterial pneumonia	2,197	474	21.57
Total	136,696	13,171	9.63

Table 3. Report of etiology of adult pneumonia admissions by age

Organism	Age range of pneumonia admissions						
	19-25 years (n = 6,825)	26-40 years (n = 16,428)	41-60 years (n = 33,421)	61-70 years (n = 23,425)	71-80 years (n = 32,331)	81+ years (n = 24,266)	Total (n = 136,696)
Pneumonia, organism unspecified (n, %)	2,438 (35.72)	7,730 (47.05)	20,058 (60.02)	14,967 (63.89)	21,160 (65.45)	15,810 (65.15)	82,163 (60.10)
Bacterial pneumonia, unspecified (n, %)	658 (9.64)	1,936 (11.79)	5,787 (17.32)	4,702 (20.07)	6,593 (20.39)	4,766 (19.64)	24,442 (17.88)
Influenza virus (n, %)	3,365 (49.30)	5,526 (33.64)	3,726 (11.15)	1,094 (4.67)	907 (2.81)	477 (1.97)	15,095 (11.04)
Other viral pneumonia (n, %)	148 (2.17)	247 (1.50)	451 (1.35)	228 (0.97)	209 (0.65)	138 (0.57)	1,421 (1.04)
K. pneumoniae (n, %)	34 (0.50)	217 (1.32)	768 (2.30)	676 (2.89)	1,022 (3.16)	976 (4.02)	3,693 (2.70)
Pseudomonas (n, %)	49 (0.72)	131 (0.80)	438 (1.31)	397 (1.70)	629 (1.95)	592 (2.44)	2,236 (1.64)
E. coli (n, %)	1 (0.02)	24 (0.15)	118 (0.35)	97 (0.42)	183 (0.57)	222 (0.92)	645 (0.47)
H. influenzae (n, %)	1 (0.02)	13 (0.08)	30 (0.09)	22 (0.10)	38 (0.12)	25 (0.10)	129 (0.09)
Other aerobic gram negative bacteria (n, %)	13 (0.19)	45 (0.27)	224 (0.67)	148 (0.63)	325 (1.00)	308 (1.27)	1,063 (0.78)
Melioidosis (n, %)	19 (0.28)	195 (1.19)	840 (2.51)	333 (1.42)	179 (0.55)	58 (0.24)	1,624 (1.19)
S. pneumoniae (n, %)	9 (0.13)	51 (0.31)	108 (0.32)	57 (0.24)	86 (0.27)	66 (0.27)	377 (0.28)
Staphylococcus (n, %)	15 (0.22)	46 (0.28)	115 (0.34)	110 (0.47)	173 (0.54)	172 (0.71)	631 (0.46)
Streptococcus, group B (n, %)	2 (0.03)	4 (0.02)	15 (0.04)	14 (0.06)	13 (0.04)	15 (0.06)	63 (0.05)
Other streptococci (n, %)	18 (0.26)	58 (0.35)	164 (0.49)	138 (0.59)	169 (0.52)	112 (0.46)	659 (0.48)
M. pneumoniae (n, %)	9 (0.13)	33 (0.20)	68 (0.20)	24 (0.10)	40 (0.12)	16 (0.06)	190 (0.14)
C. pneumoniae (n, %)	2 (0.03)	5 (0.03)	19 (0.06)	10 (0.04)	15 (0.05)	17 (0.07)	68 (0.05)
Other bacterial pneumonia (n, %)	44 (0.64)	167 (1.02)	492 (1.47)	408 (1.74)	590 (1.82)	496 (2.04)	2,197 (1.61)

Table 4. Report of mortality of adult pneumonia admissions by age and organism

Organism	Mortality of pneumonia						
	19-25 years (death/cases, %)	26-40 years (death/cases, %)	41-60 years (death/cases, %)	61-70 years (death/cases, %)	71-80 years (death/cases, %)	81+ years (death/cases, %)	Total (death/cases, %)
Pneumonia, organism unspecified	88/2,438 (3.61)	489/7,730 (6.33)	1,748/20,058 (8.71)	1,297/14,967 (8.67)	2,212/21,160 (10.45)	2,238/15,810 (14.16)	8,072/82,163 (9.82)
Bacterial pneumonia, unspecified	19/658 (2.89)	99/1,936 (5.11)	462/5,787 (7.98)	338/4,702 (7.19)	593/6,593 (8.99)	572/4,766 (12.0)	2,083/24,442 (8.52)
Influenza virus	0/3,365 (0)	1/5,526 (0.02)	7/3,726 (0.19)	7/1,094 (0/64)	4/907 (0.44)	4/477 (0.84)	23/15,095 (0.15)
Other viral pneumonia	0/148 (0)	1/247 (0.40)	7/451 (1.55)	1/228 (0.44)	6/209 (2.87)	3/138 (2.17)	18/1,421 (1.27)
K. pneumoniae	3/34 (8.82)	23/217 (10.60)	144/768 (18.75)	144/676 (21.30)	235/1,022 (22.99)	297/976 (30.43)	846/3,693 (22.91)
Pseudomonas	9/49 (18.37)	17/131 (12.98)	83/438 (18.95)	102/397 (25.69)	170/629 (27.03)	206/592 (34.80)	587/2,236 (26.25)
E. coli	0/1 (0)	4/24 (16.67)	24/118 (20.34)	23/97 (23.71)	51/183 (27.87)	68/222 (30.63)	170/645 (26.36)
H. influenzae	0/1 (0)	0/13 (0)	2/30 (6.67)	5/22 (22.73)	3/38 (7.89)	4/25 (16.0)	14/129 (10.85)
Other aerobic gram negative bacteria	2/13 (15.38)	8/45 (17.78)	64/224 (28.57)	50/148 (33.78)	126/325 (38.77)	127/308 (41.23)	377/1,063 (35.47)
Melioidosis	2/19 (10.53)	19/195 (9.74)	104/840 (12.38)	37/333 (11.11)	19/179 (10.61)	4/58 (6.90)	185/1,624 (11.39)
S. pneumoniae	0/9 (0)	1/51 (1.96)	6/108 (5.56)	4/57 (7.02)	6/86 (6.98)	16/66 (24.24)	33/377 (8.75)
Staphylococcus	2/15 (13.33)	6/46 (13.04)	27/115 (23.48)	34/110 (30.91)	54/173 (31.21)	58/172 (33.72)	181/631 (28.68)
Streptococcus, group B	0/2 (0)	0/4 (0)	1/15 (6.67)	1/14 (7.14)	1/13 (7.69)	3/15 (20.0)	6/63 (9.52)
Other streptococci	1/18 (5.56)	3/58 (5.17)	21/164 (12.80)	15/138 (10.87)	27/169 (15.98)	25/112 (22.32)	92/659 (13.96)
M. pneumoniae	0/9 (0)	1/33 (3.03)	0/68 (0)	1/24 (4.17)	1/40 (2.50)	0/16 (0)	3/190 (1.58)
C. pneumoniae	0/2 (0)	3/5 (60.0)	2/19 (10.53)	1/10 (10.0)	1/15 (6.67)	0/100 (0)	7/68 (10.29)
Other bacterial pneumonia	4/11 (9.09)	24/167 (14.37)	87/492 (17.68)	93/408 (22.79)	132/590 (22.37)	134/496 (27.02)	474/2,197 (21.57)
Total	130/6,825 (1.90)	699/16,428 (4.25)	2,789/33,421 (8.35)	2,153/23,425 (9.19)	3,641/32,331 (11.26)	3,759/24,266 (15.49)	13,171/136,696 (9.64)

to about 10% in the younger age group. The respective mortality rate from *S. pneumoniae* increased with age, that is, 0%, 1.96%, 5.56%, 7.02%, 6.98%, and 24.24% for 19 to 25, 26 to 40, 41 to 60, 61 to 70, 71 to 80, and greater than 81 years old (Table 4). The mortality rate for melioidosis was about 10% for all age groups.

The risk factors most related with mortality rate were analyzed (Table 5). The major risk factors that increased mortality rate among adult pneumonia patients were elderly (OR 3.46, 95% CI 3.27-3.77), alcoholic liver disease (OR 3.26, 95% CI 2.85-3.72), cirrhosis (OR 3.45, 95% CI 2.93-4.08), heart disease (OR 2.47, 95% CI 2.38-2.56), ischemic heart disease (OR 2.21, 95% CI 2.07-2.36), renal failure (OR 5.26, 95% CI 5.07-5.49), and cerebrovascular disease (OR 3.62, 95% CI 3.43-3.82). The minor risk factors included COPD (OR 1.20, 95% CI 1.14-1.27), HIV/AIDS (OR 1.38, 95% CI 1.23-1.55), diabetes mellitus (OR 1.57, 95% CI 1.50-1.64), and hypertension (OR 1.32, 95% CI 1.27-1.38).

Table 5. Factors related to mortality in adults with pneumonia

Risk factors	Mortality rate (%)	Odd ratio (95% CI)
Elderly		
60+ years	10.88	3.46 (3.27-3.77)
19-60 years	3.41	
COPD		
Yes	10.95	1.20 (1.14-1.27)
No	9.29	
HIV/AIDS		
Yes	12.55	1.38 (1.23-1.55)
No	9.43	
Diabetes mellitus		
Yes	13.27	1.57 (1.50-1.64)
No	8.90	
Hypertension		
Yes	11.54	1.32 (1.27-1.38)
No	8.97	
Alcoholic liver disease		
Yes	25.15	3.26 (2.85-3.72)
No	9.35	
Cirrhosis		
Yes	26.38	3.45 (2.93-4.08)
No	9.40	
Heart disease		
Yes	15.69	2.47 (2.38-2.56)
No	7.01	
Ischemic heart disease		
Yes	18.07	2.21 (2.07-2.36)
No	9.08	
Renal failure		
Yes	28.28	5.28 (5.07-5.49)
No	6.95	
Cerebrovascular disease		
Yes	25.13	3.62 (3.43-3.82)
No	8.49	

COPD = chronic obstructive pulmonary disease

The median length of hospital stay among adult pneumonia patients was four days (IQR, 3-7 days) while the median cost of treatment per admission was US$ 256.63 (IQR, US$ 147.81-531.21) (1 US dollar = 31.5 Thai baht). The complications of hospitalized adult pneumonia were respiratory failure on mechanical ventilator (n = 17,522, 12.82%), acute respiratory distress syndrome (n = 1,007, 0.74%), septicemia (n = 16,050, 11.74%), shock (n = 15,723, 11.50%), and acute renal failure (n = 7,494, 5.48%). The length of hospital stay and cost of treatment increased according to the complications (Table 6). Among patients with respiratory failure needing a mechanical ventilator, the median length of stay was seven days (IQR, 3-17 days). The length of stay for complications with acute respiratory distress syndrome (ARDS) was seven days (IQR, 3-16 days), septicemia six days (IQR, 2-13 days), shock five days (IQR 2-12 days), and acute renal failure seven days (IQR 3-15 days). The cost of treatment increased especially in cases complicated with ARDS, US$ 1,755.90 (IQR, US$ 695.59-3,866). The cost of treatment for complications with respiratory failure on mechanical ventilator was US$ 1,102.63 (IQR, US$ 477.30-2,716.86), septicemia US$ 691.75 (IQR, US$ 298.95-1,875.40), shock US$ 616.57 (IQR, US$ 276.95-1,683.84), and acute renal failure US$ 920.67 (IQR, US$ 387.97- 2,316.28).

Discussion

In Thailand and other developing countries, pneumonia is still the greatest cause of death from infectious diseases[15]. The WHO also reported that globally, lower respiratory tract infection is the most common cause of death among infectious diseases[2,16]. Thus, lower respiratory tract infection has a great impact on morbidity, mortality, and health-care costs worldwide[17].

In the present report, the high mortality rate from hospitalized pneumonia occurred among the elderly (over 60). Annual epidemiological surveillance of both in- and out-patients in 2010 by the Bureau of Epidemiology, Ministry of Public Heath, Thailand, showed the highest mortality in those 65 and over

Table 6. Length of hospital stay and cost of treatment for adult pneumonia

Complications	Length of stay (median, IQR) (days)	Cost of treatment (median, IQR) (US$)*
Mechanical ventilator		
Yes	7 (3-17)	1,102.63 (477.30-2,716.86)
No	4 (3-7)	227.75 (137.78-415.40)
Acute respiratory distress syndrome (ARDS)		
Yes	7 (3-16)	1,755.90 (695.59-3,866)
No	4 (3-7)	254.73 (147.27-522.06)
Septicemia		
Yes	6 (2-13)	691.75 (298.95-1,875.40)
No	4 (3-7)	236.03 (140.63-450.79)
Shock		
Yes	5 (2-12)	616.57 (276.95-1,683.84)
No	4 (3-7)	237.75 (141.21-458.44)
Acute renal failure		
Yes	7 (3-15)	920.67 (387.97-2,316.28)
No	4 (3-7)	245.23 (143.97-484.16)

* 1 US dollar = 31.5 Thai baht

(1.82%), followed by 55 to 64 (1.43%), and 45 to 54 (1.20%) years old[5]. The reasons for the high mortality rate among the elderly may be due to their having more medical co-morbidities. Previous reports indicated the important risk factors for an increase in mortality were age ≥65 years, male sex, the presence of co-morbidities (consisted mainly of chronic heart failure, chronic obstructive pulmonary disease, neurological disease, and liver cirrhosis)[18].

Viral pathogens were common in the younger age group but mortality was low. Among the elderly, bacterial pathogens caused common etiologies (especially Gram-negative pneumonia) and high mortality. Atypical pathogens an occasional finding in every adult age group caused especially high mortality among those between 26 and 40 years, while *C. pneumoniae* caused a higher mortality than *M. pneumoniae*. *S. pneumoniae* caused a remarkably higher mortality with increased age while mortality among those 81+ years was high to be one-quarter of the cases. Melioidosis and *S. aureus* usually occurred among patients with underlying diseases and commonly resulted in bacteremia, with a high mortality in all age groups, (about 10% for melioidosis and 20 to 30% for *S. aureus*). This findings may indicated a relationship between the severity of pneumonia and mortality rates, which were 5 to 20% among hospitalized pneumonia and 30 to 50% among those intensive care patients[19]. In Thailand, Gram-negative bacilli, melioidosis and *S. aureus* were the common pathogens for severe pneumonia, which needed intensive care admission[9,12,20].

Risk factors increased mortality rate in adult pneumonia 2- to 5-fold were aging, alcoholic liver disease, cirrhosis, heart disease, ischemic heart disease, renal failure and cerebrovascular disease. While COPD, HIV/AIDS, diabetes mellitus, and hypertension were associated with a 1-to 1.5-fold increase in the pneumonia mortality rate. In previous research, elderly (65+ years of age) was a significant risk factor for increased pneumonia mortality (OR 2.88, 95% CI 2.65-3.13)[21]. Other than aging, multiple medical co-morbidities (e.g., liver disease, congestive heart failure, cerebrovascular disease, renal disease, chronic obstructive pulmonary disease and neoplastic disease) increased mortality and including in severity scoring system for site of care[23,24]. Then patients with multiple medical co-morbidities and aging will likely have a higher mortality rate.

Pneumonia complicated with respiratory failure and shock occurred in about 10% of hospitalized patients, as in previous reports[7,8]. Patients with these complications had two to three days longer median hospital stays. The costs of treatment were 3-fold higher for patients with septicemia or shock, 4-fold for acute renal failure, 5-fold for mechanical ventilator, and 7-fold for ARDS. The economic impact of pneumonia treatment was especially great for hospitalized patients, especially those in the intensive care unit[6,24,25]. In rural Thailand, among all age groups, the

cost of hospitalization for an episode of pneumonia ranged between US$ 490.80 and US$ 628.60[26].

Conclusion

In Thailand, the overall mortality in adult hospitalized pneumonia was 9.63%. Gram-negative pathogens were common pathogens among the elderly and caused a high mortality rate. Viral pneumonia occurred common among younger age group with low mortality rate. Atypical pathogens were found in every age group and caused a high mortality rate in age between 26 and 40 years. The mortality rate for *S. pneumoniae* pneumonia increased with age and was highest (24.24%) in persons over 80 years of age. The significant risk factors related to increased mortality were elderly (>60 years), alcoholic liver disease, cirrhosis, heart disease, ischemic heart disease, renal failure, and cerebrovascular disease. Patients complicated with acute respiratory failure, ARDS, septicemia, shock and acute renal failure had longer hospital stays and higher costs of treatment.

What is already known on this topic?

National guideline of pneumonia in Thailand had been written on 2001. At that time, local data of pneumonia were sporadic report by each center or hospital. Some reports were from tertiary care hospital, which may not a good representative data for adult pneumonia in Thailand.

The WHO report that pneumonia was the first leading cause of death among the infectious diseases. Then burden of this disease in Thailand will help to prepare a strategy of treatment and prevention guidelines.

What this study adds?

This study analyzed the data on pneumonia among adult hospitalized patients in Thailand for the fiscal year 2010, using in-patient information from the three health insurance coverage schemes (viz. the Social Security System (SSS), the Medical Welfare System (MWS), and the Civil Servant Medical Benefit System (CSMBS)).

The results of this study will add on national problem of adult pneumonia in Thailand including admission and mortality, pathogens, age related mortality, medical co-morbidities that increased mortality, length of hospital stay, cost of treatment per admission, and complications that will increase length of hospital stay and cost of treatment.

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Potential conflicts of interest

None.

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สภาวะปัญหาโรคปอดบวมในผู้ใหญ่ในประเทศไทยจากข้อมูลสุขภาพ ปี พ.ศ. 2553

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วัตถุประสงค์: *เพื่อศึกษาการเข้าพักรักษาตัวในโรงพยาบาลด้วยโรคปอดบวมในผู้ใหญ่ การเสียชีวิต เชื้อสาเหตุ ปัจจัยที่สัมพันธ์กับการเสียชีวิต ระยะเวลาที่พักรักษาตัว และค่ารักษาพยาบาล ในประเทศไทย*

วัสดุและวิธีการ: *วิเคราะห์ข้อมูลผู้ป่วยที่เข้าพักรักษาในโรงพยาบาลด้วยโรคปอดบวมในผู้ใหญ่ โดยใช้ระบบ ICD 10 และ ICD 9 จากฐานข้อมูลระบบประกันสุขภาพ 3 แหล่ง คือ ระบบประกันสุขภาพถ้วนหน้า ระบบประกันสังคม และระบบสวัสดิการรักษาพยาบาลข้าราชการ ในปีงบประมาณ พ.ศ. 2553*

ผลการศึกษา: *มีผู้ป่วยโรคปอดบวมในผู้ใหญ่ที่เข้าพักรักษาในโรงพยาบาลจำนวน 136,696 ราย และเสียชีวิต 9.63% โดยพบการเสียชีวิตสูงในผู้ป่วยสูงอายุ คืออายุมากกว่า 80 ปี พบการเสียชีวิต 15.49% การติดเชื้อไวรัสไข้หวัดใหญ่พบบ่อยในช่วงอายุ 19-25 ปี (49.30%) แต่พบการเสียชีวิตต่ำ (1-2%) ส่วนการติดเชื้อ S. pneumoniae และ atypical pathogens พบได้ทุกช่วงอายุ โดยการเสียชีวิตจากการติดเชื้อ S. pneumoniae จะพบสูงขึ้นในผู้ป่วยมีอายุมากขึ้น คือ 0%, 1.96%, 5.56%, 7.02%, 6.98% และ 24.24% ในกลุ่มผู้ป่วยช่วงอายุ 19-25, 26-40, 41-60, 61-70, 71-80 และมากกว่าหรือเท่ากับ 81 ปี ตามลำดับ การติดเชื้อ C. pneumoniae พบการเสียชีวิต ~10% โดยพบได้บ่อยในผู้ป่วยอายุน้อย ส่วนการติดเชื้อแกรมลบรูปแท่งและการติดเชื้อ Staphylococcus พบการเสียชีวิตสูงประมาณ 20-35% และพบบ่อยในผู้สูงอายุ ปัจจัยที่สัมพันธ์กับการเสียชีวิตจากโรคปอดบวม คือ สูงอายุ (OR 3.46, 95% CI 3.27-3.77) ดื่มสุราเรื้อรัง (OR 3.26, 95% CI 2.85-3.72) โรคตับแข็ง (OR 3.45, 95% CI 2.93-4.08) โรคหัวใจ (OR 2.47, 95% CI 2.38-2.56) โรคหัวใจขาดเลือด (OR 2.21, 95% CI 2.07-2.36) โรคไตวาย (OR 5.26, 95% CI 5.07-5.49) และโรคหลอดเลือดสมอง (OR 3.62, 95% CI 3.43-3.82) ระยะเวลาของการพักรักษาตัวในโรงพยาบาล 4 วัน (IQR, 3-7 วัน) และค่ารักษาพยาบาล US$ 256.63 (IQR, US$ 147.81-531.21) ผู้ป่วยที่มีภาวะแทรกซ้อนจากการติดเชื้อโรคปอดบวม ได้แก่ ภาวะหายใจล้มเหลวเฉียบพลัน ภาวะ ARDS การติดเชื้อในกระแสเลือด ภาวะช็อก ภาวะไตวายเฉียบพลัน จะทำให้ระยะเวลาในการพักรักษาตัวในโรงพยาบาลนานขึ้น 2-3 วัน และค่าใช้จ่ายในการรักษาสูงขึ้น 3-7 เท่า เมื่อเทียบกับกลุ่มผู้ป่วยที่ไม่มีภาวะแทรกซ้อน*

สรุป: *โรคปอดบวมในผู้ใหญ่ที่เข้าพักรักษาตัวในโรงพยาบาลมีอัตราการเสียชีวิตสูงในกลุ่มผู้ป่วยสูงอายุโดยเฉพาะอายุมากกว่า 80 ปี และมีโรคประจำตัว*