



Factors associated with Children Under Five Years of age with 30-day Readmissions after Hospitalization for Pneumonia in Yala Hospital

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Abstract Pneumonia is a common cause of early readmission and a leading cause of death among children. This study aimed to identify factors associated with readmission after hospitalization within 30 days for pneumonia in children aged less than 5 in Yala Hospital in the southernmost provinces of Thailand. Pneumonia data used from 2015 to 2020 was obtained from Yala hospital. Descriptive analysis was used to describe the characteristics of the patients. A Chi-squared test was used to investigate the association between readmission and determinants. Multiple logistic regression was used to identify the factors associated with readmission. The results showed that about 7.71 percent of patients had readmitted within 30 days. The significant factors were gender, place of residence, and hospital cost per visit. This finding may be useful for screening and prevention of factors associated with readmission within 30 days among children in the area.

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1. INTRODUCTION

Globally, pneumonia is one of the world's most severe public health problems and a common cause of early readmission (within 30 days) after hospitalization in children under five years old. However, pneumonia readmission is still potentially avoidable, especially in Thailand. Therefore, identifying factors associated with readmission from pneumonia could enable hospitals to identify high-risk patients and deploy interventions to reduce 30-day readmissions.

As reported by several studies, the pneumonia-related early readmission rates are varied in different countries. While it was 16.2% in the United States (U.S.) [1], it was only 7.2%

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in Spain [2]. The admission rate also varies by age. For instance, the rate was 12.4% for people aged 18-44 years, 16.1% for 45-64 years, and 16.7% for those who are over 65 years [1]. Another study in the U.S. reported that children's overall early readmission rate was 8.0%, while only 3.1% related to pneumonia early readmission [3]. In the Asian contexts, especially in Singapore, the 30-day readmission rate was 19.2%, of which 6.0% was related to pneumonia [4]. However, in Thailand, the overall rate of 30-day readmission was 13.5% [5].

The 30-day readmission rate after hospitalization for pneumonia is also related to the rate of 30-day mortality after discharge, increases medical costs, and is used as an indicator of the quality of care [1]. According to the World Health Organization (WHO), pneumonia killed more than 80,000 children around the world in 2017, or about 2,216 children daily [6]. A study in the U.S. reported that readmitted patients had a higher mortality rate than those who had not been readmitted within 30 days [7]. Another study in the U.S. found that the mortality rate for 30-day readmission with a principal diagnosis of pneumonia was 11.6%, which is relatively high [8]. A high readmission rate leads to a high cost for the health care system. A previous study reported that the cost of pneumonia readmission in the U.S. was about \$1.0 billion, and of these total costs, readmissions were accounted for about \$163 million (16.0%) [3]. These unnecessary medical costs can be reduced by increasing the awareness of the quality of care during hospitalization and controlling the possible causes of readmission.

In Thailand, pneumonia readmission is less well understood, and very few studies have focused on factors influencing pneumonia readmission, especially in the southernmost of Thailand which include Yala Hospital. This study aimed to identify factors associated with readmission after hospitalization within 30 days for pneumonia in children aged less than 5 in Yala Hospital.

2. MATERIALS AND METHODS

2.1. DATA SOURCES AND VARIABLES

This study is a retrospective cross-sectional study. The pneumonia data used was obtained from all admitted patients databases at Yala Hospital from 2015 to 2020. The total number of patients admitted aged under 5 was 9,260. The outcome variable was readmission within 30 days after discharge, it was calculated by readmission date minus the previous discharge date if it was less than or equal to 30 days, coded as 1 (yes) otherwise coded as 0 (no). The determinants were gender, religion, place of residence, hospital costs per visit, and length of stay.

2.2. DATA ANALYSIS

Descriptive analysis was used to present the characteristics of the patients. Preliminary analysis was performed using cross-tabulation. A chi-squared test was used to investigate the association between readmission and determinants. A logistic regression model was used to identify the factors associated with readmission. The odds ratio and 95% CI of each factor were also presented. All statistical analyses were performed using the R

program [10].

3. RESULT

From 2015 to 2020, the total number of pneumonia patients aged under 5 was 9,262. Of these, 7.71% were readmitted within 30 days after hospitalization.

TABLE 1. Characteristics of pneumonia patients aged less than 5

Variable		Frequency	Percentage (%)
Gender	Female	3,663	39.55
	Male	5,599	60.45
Religion	Muslim	7,955	85.89
	Other	1,307	14.11
Length of stay	Less than 4 days	5,087	54.92
	Less than 6 days	2,044	22.07
	More than of equal 6 days	2,131	23.01
Place of residence	Yala	8,078	87.22
	Pattani	765	8.26
	Narathiwat	226	2.44
	Other	193	2.08
Hospital cost	Less than 4,000 Bath	2,041	22.04
	Less than 6,000 Bath	1,929	20.83
	Less than 9,000 Bath	1,801	19.45
	Less than 16,000 Bath	1,500	16.20
	More than or equal 16,000 Bath	1,991	21.49

Table 1 shows the characteristics of the patients. Most of the patients were male (60.45%), Muslim (85.89%), and from Yala Province (87.22%). About 54.92% were hospitalized for fewer than four days. The majority of patients (22.04%) paid less than 4,000 Baht per visit, followed by 16,000 Baht or over (21.49%), and 4000 to less than 5,999 Baht (20.83%), respectively.

Table 2 shows the association between determinants and readmission. Gender, place of residence, and hospital cost per visit all had statistically significant associations with 30-day readmission. However, there were no statistically significant associations between readmission (within 30 days) and religion and length of stay.

TABLE 2. Association between determinants and outcomes (readmission within 30 days)

Variable		Readmission within 30 days		P-value
		Yes (%)	No (%)	
Gender	Female	250 (6.82)	3413 (93.17)	0.011
	Male	464 (8.29)	5135 (91.71)	
Religion	Muslim	627 (7.88)	7328 (92.12)	0.138
	Other	87 (6.66)	1220 (93.34)	
Length of stay	Less than 4 days	357 (7.02)	4730 (92.98)	3.552
	Less than 6 days	146 (7.14)	1898 (92.86)	
	More than or equal 6 days	211 (9.90)	1920 (90.10)	
Place of residence	Yala	654 (7.88)	7424 (91.90)	0.003
	Pattani	41 (5.36)	724 (94.64)	
	Narathiwat	8 (3.54)	218 (96.64)	
	Other	11 (5.70)	182 (94.30)	
Hospital cost	Less than 4,000 Baht	119 (5.83)	1922 (94.17)	< 0.001
	4,000 to 5,999 Baht	99 (5.13)	1830 (94.87)	
	6,000 to 8,999 Baht	130 (7.22)	1671 (92.78)	
	9,000 to 15,999 Baht	133 (8.67)	1367 (91.13)	
	More than or equal 16,000 Baht	233 (11.70)	1758 (88.30)	

Table 3 shows the results from the multiple logistic regression model. Omitting determinants with p-values greater than 0.05. The statistically significant factors associated with readmissions were gender, place of residence, and hospital cost per visit. According to the table above, male patients were 1.23 times more likely to be readmitted within 30 days than female patients. Patients from Yala Province were 1.55 times more likely to be readmitted within 30 days than patients from the neighboring Pattani Province. Hospital costs per visit between 9,000 and 15,999 Baht and 16,000 Baht or over were 1.60 and 2.19 times were more likely to be readmitted within 30 days than hospital costs per visit less than 4,000 Bath, respectively.

TABLE 3. Factors associated with readmission within 30 days from multiple logistic regression model

Variables		Adjusted OR (95% CI)	P-value
Gender	Female	1	0.010
	Male	1.23 (1.05,1.45)	
Place of residence	Pattani	1	0.009
	Yala	1.55 (1.13,2.18)	
	Narathiwat	0.54 (0.23,1.11)	
	Other	1.01 (0.48,1.93)	
Hospital cost	Less than 4,000 Baht	1	< 0.001
	4,000 to 5,999 Baht	0.87 (0.66,1.14)	
	6,000 to 8,999 Baht	1.27 (0.98,1.64)	
	9,000 to 15,999 Baht	1.60 (1.23,2.07)	
	More than or equal 16,000 Baht	2.19 (1.74,2.77)	

4. DISCUSSION

The present study has found that gender, place of residence, and hospital cost per visit were statistically significant associations with 30-day readmission.

Readmission within 30 days among children under five years of this study was 7.7%. This finding shows a higher readmission rate than Singapore (6.0%) [4] and the U.S. (3.1%). [3]. The low percentage of readmission in developed countries was contributed by the readmission policy for pneumonia patients, an important indicator of hospital quality [9, 11].

Male patients were more likely to be readmitted than female patients. This result was consistent with other studies, which suggested that the influence of the inflammatory system in males is more likely to be readmitted than females [3].

Patients from Yala Province have a higher chance of readmission than patients from the neighboring Pattani Province. This is because the hospital policy has prioritized the hospitalization of patients resided within the province, except for emergencies [6].

Patients with higher hospital costs (9,000 Baht or more per visit) had a higher readmission rate, consistent with the study of Neuman et al. 2014, which suggested chronic medical conditions. [12], also found that readmission has increased the cost of hospitalization by more than 16%. Important intervention is needed to reduce health care costs.

Readmission for pneumonia patients among children is a common cause of readmission after discharge. Therefore, a deep evaluation of associated factors before discharge may play an important role in reducing the readmission rate. The results from this study can be used as a guideline for policymakers to take early intervention to prevent readmission in children.

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