Original Article

Duration of Hospitalization and Risk Factors of Readmission of Community-Acquired Pneumonia Incidence in Hospitalized Toddlers

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Abstract

Background: The Indonesia Health Profile Report 2020 stated that pneumonia is one of the causes of high infant and toddler mortality in Indonesia. Length of stay and readmission are crucial indicators of service quality for hospitalized pneumonia patients. This study aims to determine the duration of hospitalization and identify risk factors for readmission among toddlers hospitalized with CAP.

Methods: This cross-sectional study was conducted with subjects of pneumonia toddlers hospitalized in Sarila Husada Hospital Sragen from November 2021 to Januari 2023

Results: A total of 357 toddlers were hospitalized with CAP (median age = 17 months; IQR 7–24); the majority were under 36 months old (309 subjects; 86%); male (54%) predominated than female (46%). Median duration of hospitalization for CAP=2 days with IQR=3.0-5.0. Readmission events were only 5, higher among toddlers aged 2-36 months but not statistically significant. Factors associated with readmission in CAP toddlers were the history of previous hospitalizations during the past year due to infection (*P*=0.012; adjusted odds ratio [aOR]=13.6; confidence interval [CI]=1.49–12.34).

Conclusion: The readmission rate was very low in our study. Toddlers 2–36 months of age and those with previous hospitalizations with infections are at higher risk of readmission in CAP.

Keywords: community-acquired pneumonia, risk factor, readmission

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INTRODUCTION

Community-acquired pneumonia (CAP) or community pneumonia is defined as an acute infection of the lung parenchyma, with initial transmission or symptoms occurring in the community, not due to hospitalization.[1] The prevalence of CAP in children is very high, based on data from the 2013 Riskesdas (*Riset Kesehatan Dasar*), the prevalence rate of toddlers with pneumonia in Indonesia is 4.5 per 100 toddlers.[2,3] In 2018, the prevalence of pneumonia decreased by 2.1%, with the highest prevalence in the group of children aged 12 to 23 months.[4]

Not only is the prevalence high, but childhood pneumonia is a significant contributor to death in the world, especially in developing countries, with approximately one-fifth of under-five-year-old deaths worldwide.[5,6] Pneumonia, apart from diarrhea, is still one of the causes of high infant mortality (14.5%) and toddler mortality (5.05%) in Indonesia.[7]

The cause of pneumonia is infection with bacteria, viruses, fungi, or exposure to chemicals that cause physical damage to the lungs, which can also be an indirect result of other diseases.[8] A prospective multisite study characterized the current epidemiology of CAP in children 2–59 months in Indonesia found that mixed bacterial and viral infection is the most frequent cause of childhood CAP in Indonesia.[9,10]

Many factors influence the increase in the incidence of pneumonia in toddlers, including individual aspects such as malnutrition, and history of low birth weight (LBW). The behavior of parents, especially mothers, previous illness, comorbid

condition such as congenital heart disease, cerebral palsy, asthma, were also risk factors that could increase the vulnerability of toddlers to pneumonia.[11–14] Incomplete basic-immunization also contributes to the high cases of childhood pneumonia.[15]

Clinical symptoms of CAP are classified by WHO based on clinical characteristics into mild and severe pneumonia. Mild pneumonia is characterized by coughing or difficulty breathing associated with rapid breathing or chest indrawing in children aged 2-59 months.[5,16] Severe pneumonia is a symptom of pneumonia accompanied by difficulty drinking, repeated vomiting, seizures, lethargy, stridor, or severe malnutrition.[5] Studies show that clinical definition of severity correlates with case fatality rates.

Presenting late to a hospital, the presence of co-morbidity especially being malnourished, and not being immunized were factors that can increase the duration of hospitalization, and within 30 days of being released from the hospital with pneumonia, 8% of children require a readmission.[17,18] Young children and people with chronic medical issues are more likely to experience readmissions, which are associated with high medical cost.[19]

Hospital readmissions have become a measure of healthcare quality; they account for a large proportion of health care expenditure.[20] The importance of identifying risk factors associated with readmission events of pneumonia and the duration of hospitalization are necessary for the evaluation and management of patients with pneumonia, as well as for measuring healthcare quality and reducing cost.[19,21,22]

Readmissions are a sign of poor disease management during the initial visit.[22] How to reduce cost expenses while achieving maximum outcomes is a challenge in the current world, particularly when it comes to funding at the Healthcare and Social Security Agency (BPJS).[18,23,24] The purpose of this study was to analyze the duration of hospitalization and readmission events in order to identify risk factors that may affect pneumonia readmission rates and estimate the overall disease burden caused by pneumonia.

METHODS

This was a cross-sectional study with a study population of all under-five-year-old patients with a diagnosis of pneumonia or bronchopneumonia according to WHO criteria (2014) who were hospitalized at pediatric ward of Sarila Husada General Hospital, a private hospital in Sragen. The data were collected during the period of November 2021 to January 2023.

The inclusion criteria were hospitalized pneumonia or bronchopneumonia in children aged 2-59 months. The exclusion criteria were a history of hospitalization for the previous 48 hours at another hospital and incomplete medical record data. The sample size was the total sampling of all patients who met the inclusion and exclusion criteria.

The observed variables included the toddlers' health history and the mother's conditions. These variables included duration of hospitalization and readmission events within 30 days, history of prematurity, LBW babies, and basic immunization status based on age. Toddlers' comorbid factors included cerebral palsy, asthma, autoimmune disease, congenital heart disease, and previous hospitalizations during a year due to infection in patients observed in this study.[19,24] Being underweight or wasting were nutritional conditions that were also studied due to their association with pneumonia.[25] The mother's age, occupation, and economic status were also studied.

The dependent variable in this study was readmission, defined as rehospitalizations for pneumonia within 30 days of discharge. The readmission was obtained by reviewing hospital medical records for a maximum of 30 days following the initial discharge. The data obtained in this study were analyzed using SPSS. Bivariate analysis used the chi-square test. The magnitude of the role of risk factors will be displayed in the form of an adjusted odds ratio (aOR), 95% confidence interval (CI), and significance value (*P*). The results of the study were considered significant if the *P* value was 0.05.

RESULTS

During the 15-month study period, 365 toddlers were admitted to the pediatric ward of Sarila Husada General Hospital. Eight patients were excluded because their medical record data were incomplete or referred to other hospitals, leaving 357 eligible subjects. The median of duration of hospitalization in this study was 2 days, with an interquartile range (IQR) of 3.0–5.0 (Table 1).

Table 1. Subject Characteristic

Characteristic	n	%
Age		
2–36 month	309	86
4–5 y.o	48	13
Sex		
Female	163	46
Male	194	54
Stunting Status		
Stunting	64	18
Not Stunting	293	82
Nutritional Status		
Normal	262	74
Underweight	95	26
Mother's Age		
<19 years	2	1
>20 years	355	99
Mother's Occupation		
Working mother	166	46
Non-working	191	54
Anemia Status		
Anemia	86	24
Not anemia	271	76
Previous Hospitalization		
Yes	84	24
No	273	76
Comorbid Factor		
Yes	86	24
No	271	76
Immunization Status for age		
Complete	303	85
Not Complete	54	15
History of Birth Weight		
Low Birth Weight	14	4
Normal Birth Weight	343	96
Prematurity		
Premature	10	3
Aterm	347	97
Readmission		
Yes	5	2
No	352	98
Average duration hospitalization (day)	4.38	

The majority of the subjects were under 36 months old (309; 86%), with a slight male preponderance (54% male to 46% female). The subject's age range was 2–59 months, with a median of 17.0 and an interquartile range (IQR) of 7.0–24.0. Most of the subjects were not stunting (height-for-age at -2.0 z score), but the prevalence of stunting subjects in this study was 64 (18%), or lower than national standard 2022 (SSGI 2022) of 21.6%. The nutritional status (weight-for-height z score, WHZ) of most of the subjects was within normal limits, the prevalence of underweight was 95 (26%) or higher than national standard of 17%, according to SSGI (Survei Status Gizi Indonesia 2022).

In terms of mothers ages, 355 subjects (99%) were more than 20 years old. About 191 (54%) subjects had a non-working mother. Most of the subjects (85%) had complete immunization status for their age, according to the Indonesian National Programme on Immunization. The baseline demographic and clinical characteristics of the study population are shown in Table 1.

The risk factors for readmission are presented in Table 2. Only five readmission events were reported for the total sample. But in this study, toddlers aged 2–36 months were more likely to experience a readmission after hospitalization due to CAP, as were toddlers from non-working mothers, but statistically, this was not significant.

The readmission (Table 2) event was not associated with gender, nutritional status, mother's age and occupation, economic status, the presence of stunting, anemia, or immunization status, a history of low birth weight, a history of prematurity, also comorbid factors.

Factors associated with readmission in CAP toddlers included the history of previous hospitalizations during the past year due to infection (Table 2). Toddlers who had a history of previous hospitalization experienced nearly fourteen times the odds of readmission (adjusted odds ratio [aOR]=13.6; confidence interval [CI]=1.49–12.34; *P*=0.012).

Table 2. Patients Characteristics and Their Ascociation with Readmission

Variables	Readmission				*P*	OR
	Readmission		Not Readmission			
Age						
2–36 months	5	1.6%	305	98.4%	1.000	0.984
4–5 years	0	0.0%	47	100.0%		
Sex						
Male	3	60.0%	191	54.3%	1.000	1.264
Female	2	40.0%	161	45.7%		
Stunting Status						
Stunting	1	20.0%	63	17.9%	1.000	1.147
Not Stunting	4	80.0%	289	82.1%		
Nutritional Status						
Normal	2	0.8%	260	99.2%	0.120	0.236
Underweight	3	3.2%	92	96.8%		
Mother's Age						
<19 years	0	0.0%	2	100.0%	1.000	0.984
>20 years	5	1.4%	350	98.6%		
Mother's Occupation						
Working	0	0.0%	166	47.2%	1.000	1.264
Non-Working	5	100.0%	186	52.8%		
Economic Status						
Middle low	3	60.0%	246	69.9%	1.000	1.147
Middle upper	2	40.0%	106	30.1%		
Anemia Status						
Anemia	1	20.0%	85	24.1%	0.120	0.236
Not Anemia	4	80.0%	267	75.9%		
Previous Hospitalization						
Yes	4	80.0%	80	22.7%	1.000	0.984
No	1	20.0%	272	77.3%		
Comorbid Factors						
Yes	1	20.0%	85	24.1%	1.000	0.785
No	4	80.0%	267	75.9%		
Immunization Status for age						
Complete/	3	60.0%	300	85.2%	0.166	0.260
Not Complete	2	40.0%	52	14.8%		
History of Birth Weight						
LBW*	0	0.0%	14	4.0%	1.000	1.015
NBW**	5	100.0%	338	96.0%		
History of Prematurity						
Premature	1	20.0%	9	2.6%	0.133	9.528
Aterm	4	80.0%	343	97.2%		

Note: *Low Birth Weight; **Normal Birth Weight

DISCUSSION

This study explores readmission and length of stay (LoS) as quality aspects of CAP patients' hospitalization care. In Indonesia, studies about readmission rates were limited. Meanwhile, in other countries, more studies about readmission rates and interventions to reduce the rate of readmission for some medical conditions have also identified several potentially modifiable factors that can be targeted for interventions. Several studies have analyzed the hospital readmission rates for pediatric pneumonia, which vary substantially based on the population, area being studied, and other variables.

In this study, only five cases of readmission were reported, which was less than 1%. The possibility of lower readmissions in this study was because only readmissions due to pneumonia were included, and the medical record system in Indonesia has yet to be fully integrated as planned in SATU SEHAT. Therefore, patients may visit other hospitals

after receiving treatment at the hospital under study, and not all re-admission data can be identified.

This study had a limited number of subjects. We need to perform longer research with a larger pediatric population as a representative sample of admissions from community hospitals within our country. This condition is different from other research. Neuman et al. stated that thirty-day all-cause and pneumonia-specific readmission rates were 7.7% and 3.1%, respectively.[19] In 2022, Lewis et al found that the rate of 30-day all-cause readmissions for pneumonia was 5.9% for the total sample.[22] Readmission served as an indicator of inadequate disease management during an initial visit. Readmission rates were higher among younger children.[19] This also confirms that in this study, all the readmission events happened in toddlers younger than 36 months.

Readmission is also associated with a history of previous hospitalizations, a longer index of hospitalizations, and the severity of pneumonia. This study only proved that previous hospitalization was an important predictor of readmission in toddlers with CAP. Although this study could not prove the association between gender, nutritional status, stunting, anemia, comorbid factors, history of prematurity, and low birth weight on readmission events, many studies did. Wang et al in 2022 said that hospitalized patients who experienced adverse events were at greater risk of readmissions. Not only as risk factors, comorbidity, malnutrition, and immunization status were significantly predictive factors for recovery in pneumonia patients.[21]

The average duration of hospitalization in this study was 4.38 days. This result is similar to Toomey et al in 2016,[26] who mentioned that the research readmission rate for the hospital was 6.5%, and Rozenbaum et al. in 2015,[27] with an average LoS of 6.7 days (3.6–7.7 days).

This study shows that the LoS of CAP patients is quite short. The average length of hospitalization is also considered a measure of efficiency. According to the US Centers for Disease Control and Prevention, the average LoS for pneumonia in children is five days. A hospitalization lasting longer than five days is considered a longer duration of hospitalization and is associated with severe pneumonia. The brief hospital stay could reflect the good quality of the patient care and the adherence of the service provided to standard treatment. Median time to recovery and duration time of hospitalization, which last longer, also serve as predictors of CAP severity.[28] Longer LOS during hospitalization contributed to a greater risk of readmission.

LIMITATION

Several weaknesses in this study need to be noted. This research is a single-site study at a private hospital in a city in Central Java with a medical record system in Indonesia that has yet to be fully integrated as planned in SATU SEHAT. Therefore, patients may visit other hospitals after receiving treatment at the hospital under study. Hence, not all re-admission data can be identified, and rehospitalizations due to other diagnoses were not included in this study. Further research also requires data from nearby hospitals in the same area, a larger number of research samples, and a longer research duration to get a more comprehensive picture of re-admissions and their risk factors.

CONCLUSION

Less than 1% of toddlers experience a readmission within 30 days of CAP hospitalization, and the readmission rate was very low in our study. Toddlers 2-36 months of age and those with previous hospitalizations with infections are at higher risk of readmission. The average duration of hospitalization for CAP toddlers was also considered within the normal limit in our study. Our results may help target interventions and provide anticipatory guidance for clinicians and patients at greatest risk of hospital readmission, but they need further improvement.

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CONFLICT OF INTEREST

The authors declare that there is no potential conflict of interest concerning the authorship and publication of this article.

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REFFERENCE

1. Morgan AJ, Mrcp M, Fficm F, Glossop Bmedsci AJ, Bs BM, Frca M, et al. Severe community-acquired pneumonia. BJA Educ. 2016;16(5):167–72.
2. Badan Pusat Statistik. Survei demografi dan kesehatan Indonesia. 2013.
3. Badan Kependudukan dan Keluarga Berencana (BKKBN), Statistic Indonesia, Ministry of Health, The DHS Program, ICF. Indonesia demographic and health survey 2017. 2018.
4. Centauri C. Kenali dan cegah pneumonia pada anak [Internet]. Rumah Sakit Universitas Indonesia. 2022 [cited 2023 Jan 27]. Available from: https://rs.ui.ac.id/umum/berita-artikel/artikel-populer/kenali-dan-cegah-pneumonia-pada-anak
5. World Health Organization. Revised WHO classification and treatment of childhood pneumonia at health facilities: Evidence summaries. Vol. 2012. 2014.
6. United Nations Children's Fund (UNICEF). Lembaga kesehatan dan anak memeringatkan satu anak meninggal akibat pneumonia setiap 39 detik [Internet]. United Nations Children's Fund (UNICEF). 2019 [cited 2020 Jan 21]. Available from: https://www.unicef.org/indonesia/id/siaran-pers/lembaga-kesehatan-dan-anak-memeringatkan-satu-anak-meninggal-akibat-pneumonia-setiap-39
7. Kementerian Kesehatan Republik Indonesia. Profil kesehatan Indonesia 2020. Jakarta: Kementerian Kesehatan RI; 2021.
8. Verduci E, Banderali G, Barberi S, Radaelli G, Lops A, Betti F, et al. Epigenetic effects of human breast milk. Nutrients. 2014;6(4):1711–24.
9. Lokida D, Farida H, Triasih R, Mardian Y, Kosasih H, Naysilla AM, et al. Epidemiology of community-acquired pneumonia among hospitalised children in Indonesia: A multicentre, prospective study. BMJ Open. 2022;12(6):e057957.
10. Oumei H, Xuefeng W, Jianping L, kunling S, Rong M, Zhenze C, et al. Etiology of community-acquired pneumonia in 1500 hospitalized children. J Med Virol. 2018;90(3):421–8.
11. Dina RA, Djuwita R. The role of exclusive breastfeeding in reducing pneumonia prevalence in children under five. Jurnal Gizi Pangan. 2021;16(Supp.1):89–98.
12. Windi R, Efendi F, Qona'ah A, Adnani QES, Ramadhan K, Almutairi WM. Determinants of acute respiratory infection among children under-five years in Indonesia. J Pediatr Nurs. 2021;60:e54–9.
13. Anwar A, Dharmayanti I. Pneumonia pada anak balita di Indonesia. Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal). 2014;8(8):359–65.
14. Resmi M, Dokter P, Indonesia P, Arifin PM, Faisal N, Agus Y, et al. Faktor risiko kejadian pneumonia sangat berat pada anak. Jurnal Respirologi Indonesia. 2014;40(4):243–50.
15. Leung DT, Chisti MJ, Pavia AT. Prevention and control of childhood pneumonia and diarrhea. Pediatr Clin North Am. 2016;63(1):67–79.
16. Gupta N, Bhadrala N. Risk factors for acute severe pneumonia in under five children. Int J Contemp Pediatrics. 2019;6(3):949–54.
17. Jahan Y, Rahman A. A case report on management of severe childhood pneumonia in low resource settings. Respir Med Case Rep. 2018;25:192–5.
18. Amare R, Fisseha G, Berhe A, Tirore L. Incidence of recovery from severe pneumonia and its predictors among children 2-59 months admitted to pediatric ward of Ayder Comprehensive Specialized Hospital, Tigray, Ethiopia: A

retrospective Cohort study. J Family Med Prim Care. 2022;11(9):5285–92.
19. Neuman MI, Hall M, Gay JC, Blaschke AJ, Williams DJ, Parikh K, et al. Readmissions among children previously hospitalized with pneumonia. Pediatrics. 2014;134(1):100–9.
20. Alba I De, Amin A. Pneumonia readmissions: Risk factors and implications. Ochsner J. 2014;14(4):649–54.
21. Wang Y, Eldridge N, Metersky ML, Rodrick D, Faniel C, Eckenrode S, et al. Analysis of hospital-level readmission rates and variation in adverse events among patients with pneumonia in the United States. JAMA Netw Open. 2022;5(5):e2214586.
22. Lewis MO, Tran PT, Huang Y, Desai RA, Shen Y, Brown JD. Disease severity and risk factors of 30-day hospital readmission in pediatric hospitalizations for pneumonia. J Clin Med. 2022;11(5):1185.
23. Firmansyah Y, Subhandi Bakhtiar H, Firmansyah AK. Implementation of the clinical pathway paradigm in achieving cost-effectiveness in health financing (systematic literature review). Jurnal Medika Hutama. 2022;3(02 Januari):1855–76.
24. Chen L, Miao C, Chen Y, Han X, Lin Z, Ye H, et al. Age-specific risk factors of severe pneumonia among pediatric patients hospitalized with community-acquired pneumonia. Ital J Pediatr. 2021;47(1):100.
25. Dean P, Florin TA. Factors associated with pneumonia severity in children: A systematic review. J Pediatric Infect Dis Soc. 2018;7(4):323–34.
26. Toomey SL, Peltz A, Loren S, Tracy M, Williams K, Pengeroth L, et al. Potentially preventable 30-day hospital readmissions at a children's hospital. Pediatrics. 2016;138(2):e20154182.
27. Rozenbaum MH, Mangen MJJ, Huijts SM, van der Werf TS, Postma MJ. Incidence, direct costs and duration of hospitalization of patients hospitalized with community acquired pneumonia: A nationwide retrospective claims database analysis. Vaccine. 2015;33(28):3193–9.
28. Mengist B, Tesfa M, Kassie B. Time to recovery and predictors of severe community-acquired pneumonia among pediatric patients in Debre Markos referral hospital, North West Ethiopia: A retrospective follow-up study. PLoS One. 2020;15(9):e0239655.