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# Analysis of the Relationship Between Age and Acute Respiratory Infection Claim Costs in the Health Insurance Program of PT XYZ

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The frequency of health insurance claims in corporate insurance systems continues to increase, making the understanding of case characteristics and cost determinants essential for effective health risk management. This study aims to analyze the characteristics of patients with acute respiratory infection (ARI) and to examine the relationship between age and health insurance claim costs, measured by total charges and approved costs. A quantitative approach with a cross-sectional design was applied using secondary data from 401 health insurance claims at PT XYZ, including 46 ARI cases. Data normality was assessed using the Shapiro–Wilk test, and bivariate analysis was conducted using Spearman's rho correlation. The proportion of ARI cases accounted for 11.5% of all claims, with children representing the largest group of patients. The results indicate a significant negative correlation between age and total claim costs ($r = -0.350$; $p = 0.017$) as well as approved costs ($r = -0.316$; $p = 0.032$). These findings suggest that younger age groups, particularly children, tend to incur higher claim costs compared to older age groups. However, given the limited number of ARI cases, the results should be interpreted with caution and cannot be broadly generalized. Further studies with larger sample sizes and additional explanatory variables are recommended to strengthen the evidence base for health insurance risk management.
**Keywords:** Acute Respiratory Infection, Claim Costs, Age, Health Insurance



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## 1. Introduction

Acute Respiratory Infection (ARI) remains one of the major global public health problems. The World Health Organization (WHO) states that ARI is a leading cause of primary care and outpatient visits in many developing countries. ARI contributes substantially to the high burden of health financing due to its acute nature, high transmissibility, and frequent recurrence, particularly among children and older adults (WHO, 2023). In Indonesia, ARI consistently ranks among the ten most common diseases at primary healthcare facilities. Data from the Ministry of Health of the Republic of Indonesia indicate that ARI remains a leading cause of outpatient visits at community health centers and clinics. This condition not only affects population health status but also increases the financial burden of healthcare services. Within corporate health insurance systems, claims related to acute diseases such as ARI present a distinct challenge because their costs are highly fluctuating and difficult to predict.

Based on health insurance claim data from PT XYZ, of the total 401 claims analyzed, 46 cases were ARI (11.5%). Although the proportion is not dominant, the average total ARI claim cost reached IDR 1,092,659, with a maximum value of IDR 18,838,145. This wide range indicates substantial cost dispersion among ARI patients. In addition, among more than 110 recorded diagnostic categories, ARI constituted the diagnosis group with the highest frequency compared to other diagnoses. Therefore, this study is important for analyzing the characteristics of ARI patients and identifying the relationship between age and health

insurance claim costs, as a basis for formulating cost containment strategies and more targeted health promotion programs.

Acute Respiratory Infection (ARI) is an infection affecting the respiratory tract, either upper or lower, with a duration of less than fourteen days. ARI is caused by viruses, bacteria, or other pathogens and is characterized by symptoms such as cough, runny nose, fever, shortness of breath, and sore throat. According to WHO (2023), ARI is one of the leading causes of healthcare utilization worldwide, particularly among children and older adults. The high incidence of ARI is influenced by population density, air quality, nutritional status, and immune system resilience (WHO, 2023). Health insurance claim costs refer to the total expenses submitted by beneficiaries to insurance providers as reimbursement for healthcare services received, including consultation fees, diagnostic examinations, medications, medical procedures, and other necessary interventions during the care process. The magnitude of claim costs is influenced by various factors, such as disease type, severity, length of care, and patient characteristics, including age and health condition. Acute diseases such as ARI may generate substantial cost variation due to differences in diagnostic and therapeutic needs among individuals, even within the same diagnostic category (Dieleman, 2020; Organization, 2022).

Age is a key determinant of healthcare utilization and associated costs. Based on Andersen's Behavioral Model of Health Services Use, individual characteristics such as age shape healthcare needs and utilization patterns, which in turn influence healthcare expenditures (Andersen, 2020; Babitsch et al., 2021). Different age groups exhibit varying disease risks, immune responses, and service needs, resulting in heterogeneous healthcare costs. Previous research by Cherian et al. (2021) indicates that children tend to incur higher ARI treatment costs than adults due to immature immune systems, higher complication risks, and the need for more intensive clinical monitoring. Moreover, parents are more likely to seek medical care promptly when children develop symptoms, increasing service utilization. In contrast, adults generally have stronger immune resilience and greater capacity for self-care, leading to lower levels of medical intervention and relatively lower costs.

Variations in health insurance claim costs can be explained by differences in medical needs across age groups. From the healthcare utilization perspective, demographic characteristics such as age influence the level of need and service intensity, which ultimately affects expenditure levels (Babitsch et al., 2021). Younger age groups, particularly children, tend to require additional examinations, closer monitoring, and more cautious therapeutic approaches, thereby potentially increasing claim costs. International studies show that ARI treatment costs among children are higher than those among adults due to greater complication risks and more complex care requirements (Cherian, 2021; Xu et al., 2025). Thus, theoretically, there is an association between age and health insurance claim costs, particularly for acute conditions such as ARI that are characterized by heterogeneous clinical needs across age groups. In the context of corporate health insurance, analyzing claim costs by demographic characteristics such as age is essential for risk pooling and cost containment strategies. Information on age groups with higher claim burdens can be utilized by companies and insurers to design more targeted promotive and preventive programs, as well as more efficient benefit designs.

## 2. Literature Review and Problem Statement

### Acute Respiratory Infection and Health Insurance Claim Costs

Acute Respiratory Infection (ARI) is widely recognized as a major contributor to global morbidity and healthcare utilization, particularly in developing countries (WHO, 2023). ARI accounts for a substantial proportion of primary care and outpatient visits and generates a significant financial burden due to its acute

onset, high transmissibility, and recurrent nature. In health financing systems, including corporate health insurance schemes, ARI-related claims are characterized by high variability in costs, reflecting differences in disease severity, diagnostic procedures, and treatment pathways (Dieleman, 2020; Organization, 2022). Prior studies indicate that acute conditions such as ARI may lead to unpredictable claim patterns, creating challenges for insurers in managing financial risk and cost containment.

Health insurance claim costs are influenced by both clinical and non-clinical factors, including disease type, severity, length of care, healthcare provider practices, and patient characteristics. Among patient-level determinants, age has been consistently identified as a critical factor shaping healthcare utilization and expenditures (Babitsch et al., 2021). In the context of ARI, clinical management often varies across age groups due to differences in immune response, vulnerability to complications, and clinical monitoring requirements. Consequently, ARI-related claim costs are likely to differ across demographic segments.

### Age as a Determinant of Healthcare Utilization and Costs

Andersen's Behavioral Model of Health Services Use conceptualizes age as a predisposing characteristic that shapes healthcare needs and utilization patterns (Andersen, 2020). Empirical evidence suggests that children and older adults experience higher vulnerability to respiratory infections and are more likely to seek healthcare services, which may translate into higher treatment costs. Cherian et al. (2021) reported that pediatric ARI cases tend to incur higher medical costs due to greater clinical complexity, higher risks of complications, and more intensive monitoring requirements. Similarly, studies in health economics demonstrate that healthcare expenditures are not evenly distributed across age groups, but rather concentrated in specific demographic segments with higher clinical needs (Dieleman, 2020).

Despite the growing body of literature on ARI and healthcare costs, most existing studies focus on hospital-based costs or national health system expenditures. Relatively limited attention has been paid to ARI-related claim costs within corporate health insurance systems, which differ in benefit design, provider networks, and reimbursement mechanisms compared to public health insurance schemes. Moreover, many studies examine cost drivers in aggregate terms without disaggregating by specific diagnoses and demographic characteristics, such as age, within the corporate insurance context.

### Research Gap and Problem Statement

Although previous research has established that age is an important determinant of healthcare utilization and costs, empirical evidence on the relationship between age and ARI-related claim costs in corporate health insurance settings remains limited. Existing studies are predominantly conducted in public health system contexts or focus on general healthcare expenditures rather than diagnosis-specific claims within employer-sponsored insurance schemes. Furthermore, the majority of the literature emphasizes macro-level cost patterns, while micro-level analyses of claim characteristics in corporate insurance portfolios are still underexplored.

This study addresses this gap by examining the characteristics of ARI claims and analyzing the relationship between age and claim costs within a corporate health insurance scheme. Understanding whether and how age is associated with ARI-related claim costs is essential for strengthening risk management strategies, designing targeted preventive interventions, and improving benefit design in corporate insurance programs. Therefore, the problem addressed in this study is the lack of empirical evidence on age-related variations in ARI claim costs within corporate health insurance systems, which limits the ability of insurers and employers to develop evidence-based cost containment and health promotion strategies.

## 3. Method

This study employed a quantitative approach with a cross-sectional design to analyze the relationship between age and the magnitude of health insurance claim costs in cases of Acute Respiratory Infection (ARI). The study was grounded in Andersen's Behavioral Model of Health Services Use, which posits that individual characteristics (predisposing factors) such as age influence the level of healthcare need, which in turn affects the intensity of healthcare utilization and the associated costs. In the context of ARI, children tend to have higher healthcare needs due to immature immune systems and a greater risk of complications, thereby potentially increasing health insurance claim costs.

The data used in this study were secondary data derived from employee health insurance claims recorded at PT XYZ in 2024. A total of 401 claims were analyzed, of which 46 were ARI cases. All claims with an ARI diagnosis were included as the study sample using a total sampling technique. The independent variable in this study was patient age, while the dependent variables were health insurance claim costs, including total charges and approved costs. Data processing and statistical analyses were conducted using statistical software. Univariate analysis was applied to describe the distribution of diagnoses, age characteristics, and ARI claim costs. Data normality was tested using the Shapiro–Wilk test, and the results indicated that the data were not normally distributed ($p < 0.05$); therefore, the relationship between variables was examined using Spearman's rho correlation test. This study utilized secondary data without personal identifiers, ensuring confidentiality and adherence to research ethics.

## 4. Results and Discussion

### Results

The findings of this study are consistent with several international studies indicating that the cost of ARI treatment among children is higher than that of adult age groups. Cherian et al. (2021) and Wang et al. (2021) reported that higher costs in pediatric patients are associated with the need for additional diagnostic examinations, closer clinical observation, and parents' tendency to seek medical care at the early onset of symptoms. This strengthens the evidence that age is an important determinant of variation in ARI claim costs, particularly within corporate health insurance systems.

**Table 1.** ARI Cases Among Employees of PT XYZ

| Diagnosis | Frequency | Percentage (%) |
|---|---|---|
| ARI | 46 | 11.5 |
| Non-ARI | 355 | 88.5 |
| Total | 401 | 100 |

Based on Table 1, 11.5 percent of claims were ARI cases, while 88.5 percent involved other diagnoses. The proportion of ARI cases was higher than that of other communicable diseases. In addition, claim records showed more than 110 different diagnostic categories, and no diagnosis other than ARI accounted for more than 10 percent of total claims.

The World Health Organization (WHO, 2023) reports that ARI remains one of the leading causes of outpatient and inpatient visits in developing countries, particularly among vulnerable age groups such as children. Although the proportion of ARI cases is relatively small, the service burden can be substantial due to recurrent episodes. In corporate health insurance schemes, acute diseases with high recurrence such as ARI may increase the total cost burden because one individual can submit multiple claims within a given period. This is consistent with global evidence showing that acute respiratory diseases contribute to increased healthcare utilization and high cost variability among patients (Troeger, 2020).

**Table 2.** Age Characteristics of ARI Patients at PT XYZ

| Age Group | Frequency | Percentage (%) |
|---|---|---|

| | | |
|---|---|---|
| Children | 21 | 45.7 |
| Adults | 19 | 41.3 |
| Elderly | 6 | 13.0 |
| Total | 46 | 100 |

As shown in Table 2, the highest proportion of ARI patients was observed among children (45.7 percent), followed by adults (41.3 percent) and the elderly (13.0 percent). The predominance of pediatric cases indicates that younger age groups are more vulnerable to acute respiratory infections. Biologically, children have immature immune systems, making them more susceptible to viral and bacterial pathogens. In addition, narrower airways in children mean that even mild inflammation can lead to more severe symptoms, prompting parents to seek medical care promptly. According to WHO (2023), children under five years of age face up to twice the risk of ARI compared with adults. From a health-seeking behavior perspective, parents tend to be more protective of their children's health, resulting in more frequent healthcare utilization. This is consistent with Andersen's Behavioral Model, which emphasizes that demographic characteristics such as age influence healthcare needs and utilization, ultimately affecting healthcare expenditures (Andersen, 2020; Babitsch et al., 2021).

**Table 3.** ARI Claim Costs Among Employees of PT XYZ

| Variable | Minimum | Maximum | Mean | Standard Deviation |
|---|---|---|---|---|
| Total Cost | 0 | 18,838,145 | 1,092,659 | 1,435,687 |
| Approved Cost | 0 | 16,500,000 | 986,5 | 1,287,000 |

As presented in Table 3, the mean total ARI claim cost was IDR 1,092,659, with a maximum value of IDR 18,838,145. The mean approved cost was IDR 986,500, with a maximum of IDR 16,500,000. The standard deviations exceeding the mean values indicate substantial variability in costs across patients. This wide dispersion suggests that although most ARI cases are mild, a small number of cases require additional diagnostic procedures, hospitalization, or more intensive therapy, resulting in disproportionately high costs. This phenomenon is commonly referred to as cost outliers, where a small proportion of patients accounts for a large share of total healthcare expenditures (Kwon, 2021). This pattern is critical for corporate insurance schemes, as extreme costs may threaten financial stability. According to WHO (2022), acute diseases with wide clinical variability such as ARI are classified as high-risk conditions in claims management due to their unpredictability.

**Table 4.** Shapiro–Wilk Normality Test

| Variable | p-value | Interpretation |
|---|---|---|
| Total Cost | < 0.001 | Not normally distributed |
| Approved Cost | < 0.001 | Not normally distributed |

Based on Table 4, the Shapiro–Wilk test results indicate that both total and approved costs are not normally distributed ($p < 0.001$). This non-normal distribution suggests the presence of extreme values, resulting in a right-skewed distribution. Such patterns are common in healthcare cost data, as a small proportion of patients typically incur substantially higher costs than others (Dieleman, 2020). Therefore, the use of non-parametric tests such as Spearman's rho is statistically appropriate.

**Table 5.** Correlation Between Age and ARI Claim Costs

| Relationship | r | p-value |
|---|---|---|
| Age vs Total Cost | –0.350 | 0.017 |
| Age vs Approved Cost | –0.316 | 0.032 |

As shown in Table 5, there was a significant negative correlation between age and total claim costs ($r = -0.350$; $p = 0.017$) as well as approved costs ($r = -0.316$; $p = 0.032$). The negative correlation indicates that younger patients tend to incur higher claim costs. Clinically, children often require additional procedures such as nebulization, laboratory tests, or longer observation periods, which increase treatment costs. Studies by Cherian et al. (2021) and Zhou et al. (2021) similarly found that ARI treatment costs are higher among children due to greater risks of complications and stricter clinical management protocols. From a health financing perspective, younger age groups exhibit higher need factors, leading to increased healthcare utilization and expenditures (Babitsch et al., 2021). This explains why age constitutes a key determinant of claim cost magnitude in ARI cases.

## Discussion

This study provides empirical evidence that age is significantly associated with the magnitude of health insurance claim costs for Acute Respiratory Infection (ARI) cases within a corporate health insurance scheme. The negative correlation between age and both total and approved claim costs indicates that younger patients, particularly children, tend to generate higher healthcare expenditures compared to adult and elderly groups. This finding reinforces the notion that demographic characteristics are not merely descriptive variables but constitute substantive determinants of healthcare utilization patterns and financial burden within insurance systems.

From a clinical perspective, higher costs among younger age groups can be explained by biological vulnerability and clinical management practices. Children have immature immune systems and narrower airways, making them more susceptible to respiratory infections and complications. Consequently, physicians often adopt more cautious diagnostic and therapeutic approaches for pediatric patients, including additional laboratory tests, nebulization therapy, closer monitoring, and, in some cases, hospital observation. These clinical practices, while medically justified, inevitably increase the total cost of care. Similar patterns have been reported in previous studies, which demonstrate that pediatric ARI cases tend to incur higher treatment costs than adult cases due to the greater risk of complications and the need for more intensive clinical supervision (Cherian et al., 2021; Wang et al., 2021).

The findings of this study are also consistent with Andersen's Behavioral Model of Health Services Use, which posits that predisposing characteristics such as age influence perceived need and actual utilization of health services, thereby shaping healthcare expenditures (Andersen, 2020; Babitsch et al., 2021). In the context of ARI, children are perceived as having higher health risks, prompting caregivers to seek medical attention earlier and more frequently. This behavior increases service utilization and, consequently, insurance claim costs. Conversely, adults are more likely to engage in self-care or delay seeking professional treatment for mild respiratory symptoms, which may partially explain the lower average costs observed in older age groups.

The substantial variability in ARI claim costs observed in this study further highlights the inherent uncertainty associated with acute respiratory diseases. Although most ARI cases are clinically mild and managed on an outpatient basis, a small proportion of cases result in disproportionately high costs due to complications, comorbidities, or the need for advanced diagnostics and treatment. This phenomenon aligns with the concept of cost outliers in health economics, where a limited number of patients account for a large share of total healthcare expenditures (Kwon, 2021). Such cost concentration poses challenges for corporate health insurance schemes, as unpredictable high-cost cases can disrupt financial planning and risk pooling mechanisms. As noted by Dieleman (2020), healthcare expenditure distributions are typically right-skewed, reflecting the unequal distribution of costs across patient populations.

From a health insurance management perspective, the dominance of ARI among claim frequencies, despite its relatively modest proportion of total diagnoses, suggests that recurrent acute conditions can generate a cumulative financial burden. This pattern is particularly relevant for corporate insurance systems, where employees or their dependents may submit multiple claims for recurrent respiratory infections within a short period. Troeger (2020) emphasizes that acute respiratory infections contribute significantly to global healthcare utilization due to their high incidence and recurrent nature, even when individual episodes are relatively inexpensive. Therefore, insurers and employers should not only focus on high-cost chronic diseases but also consider the cumulative financial impact of frequent acute illnesses such as ARI.

The practical implications of these findings are substantial for corporate health risk management. The identification of children as a high-cost subgroup suggests the need for targeted preventive strategies, such as workplace-based family health education, promotion of vaccination programs, and early preventive interventions aimed at reducing ARI incidence among employees' dependents. Preventive approaches may reduce both the frequency and severity of ARI episodes, thereby lowering aggregate claim costs over time. Furthermore, the results support the development of age-sensitive benefit design and disease management programs within corporate insurance schemes, allowing insurers to better anticipate cost patterns and allocate resources more efficiently.

Despite its contributions, this study has limitations that should be acknowledged. The relatively small number of ARI cases limits the generalizability of the findings to broader populations or different insurance settings. In addition, the cross-sectional design precludes causal inference, as the observed associations reflect correlations rather than definitive cause–effect relationships. Future studies with larger sample sizes, multi-year data, and the inclusion of additional variables such as disease severity, comorbidities, and treatment modalities would provide a more comprehensive understanding of cost determinants in ARI cases. Longitudinal designs could further elucidate how age-related cost patterns evolve over time and how preventive interventions influence claim trajectories.

This study contributes to the literature by highlighting the role of age as a key determinant of ARI-related healthcare costs in corporate insurance systems. By integrating clinical insights, behavioral theory, and health financing perspectives, the findings underscore the importance of demographic-sensitive risk management strategies in ensuring the financial sustainability of employer-based health insurance programs.

## 5. Conclusion

This study shows that out of 401 health insurance claims analyzed, 46 cases were Acute Respiratory Infections (ARI), accounting for 11.5 percent of total claims. Although the proportion of ARI cases was relatively small compared to other diagnoses, ARI exhibited a wide variation in claim costs, with the average total cost exceeding one million rupiah and the maximum value reaching more than eighteen million rupiah. This indicates that ARI has the potential to impose a substantial financial burden on companies. The results of Spearman's rho correlation test demonstrate a significant negative relationship between age and both total costs and approved costs, meaning that the younger the patient, the higher the ARI claim costs incurred. These findings confirm that age is an important factor associated with the magnitude of ARI claim costs.

Based on these results, companies and insurance providers are encouraged to prioritize promotive and preventive efforts for ARI, particularly among children, through health education programs, improvements in environmental hygiene, and measures to prevent transmission. In addition, healthcare facilities should develop more efficient and evidence-based ARI management standards to reduce cost variability without

compromising service quality. For insurance providers, the findings of this study can serve as a basis for developing age-based risk management policies for claims control and cost containment. Future studies are expected to use broader datasets and incorporate additional variables, such as disease severity, type of services, and length of care, in order to produce more comprehensive and generalizable results.

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