

**ORIGINAL RESEARCH ARTICLE****OPEN ACCESS****Proportion of Incidence, Diagnosis, and Management of Acute Respiratory Infections at the Three Community Health Centers, In Baucau Municipality, Year 2024.**¹Justino Aparicio, ²Martinus Nahak, ³Nelson MartinsMaster of Public Health UNPAZ
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Proportion of Incidence, Diagnosis,
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Respiratory Infections at the Three
Community Health Centers**ABSTRACT**

This research presents a comprehensive analysis of the incidence, diagnostic classification, and management of Acute Respiratory Infections (ARI) across three primary health centers CS Tirilolo, CS Uailili, and CS Bucoli in Baucau Municipality, Timor-Leste, using retrospective data from 2025. A total of 283 ARI cases were sampled (Tirilolo n=92, Uailili n=95, Bucoli n=96) from 25,640 health center visits recorded during the year, with ARI accounting for 22% of all visits across the three facilities. Among the sampled ARI cases, 46% were classified as cough or no pneumonia, 39% as pneumonia, and 15% as severe pneumonia. The majority of patients were children under five years of age, and caregivers were predominantly female, with low levels of educational attainment and mainly engaged in farming. Marked variation in ARI burden was observed by health center, with CS Bucoli showing the highest burden (62% of visits due to ARI) and a higher proportion of pneumonia and severe pneumonia cases. Clinical management adherence to WHO and national Timor-Leste guidelines was reported at 100% across the sampled cases, including appropriate antibiotic use and timely referral of severe pneumonia. However, the analysis highlights persistent gaps in upstream prevention and health system readiness, including community-level early detection, scale-up of oxygen access, resilience of essential medicine supply chains, and targeted environmental health interventions. Socio-economic and environmental determinants such as household solid fuel use, poor ventilation, caregiver education, and occupation-related exposures are likely contributors to the spatial variation in ARI burden and severity. Based on these findings, the report recommends targeted programmatic actions, including strengthened community health education, enhanced Integrated Management of Childhood Illness (IMCI) and referral pathways, improved oxygen systems and essential medicine availability at primary care level, focused interventions in high-burden subdistricts (notably Bucoli), and multisectoral environmental risk reduction measures such as cleaner household energy transitions, improved ventilation, and air quality monitoring.



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INTRODUCTION

Acute Respiratory Infections (ARIs) remain a leading cause of morbidity and mortality worldwide, particularly in children under five years of age. Globally, ARIs, with pneumonia as the most severe clinical form, continue to rank among the leading causes of infectious death in children. The latest data from the World Health Organization (WHO) indicate that pneumonia caused an estimated 740,180 deaths in children under five years of age in 2019, underscoring the ongoing global challenge despite available prevention and treatment pathways (WHO, 2022). Furthermore, the Global Burden of Disease (GBD 2023) estimates that there will be 2.5 million deaths from pneumonia across all age groups in 2023, including 610,000 in children under five years of age (IHME/GBD 2023). These figures underscore the disproportionate

impact of pneumonia on child survival and the urgent need for comprehensive ARI control [WHO, 2022; IHME/GBD 2023].

ARIs encompass a variety of viral and bacterial etiologies, including influenza, respiratory syncytial virus (RSV), human metapneumovirus (hMPV), Streptococcus pneumoniae, and Haemophilus influenzae, which are generally spread through droplets and close contact (WHO, 2022). Risk factors for ARIs can be analyzed through the epidemiological triangle, which encompasses the agent, host, and environment. Host vulnerabilities include young age, malnutrition, incomplete immunization, and limited caregiver knowledge. From an environmental perspective, poor ventilation, high residential density, and exposure to air pollution significantly increase the risk of ARIs. Recent studies have highlighted a strong association between exposure to fine particulate matter (PM_{2.5}) and the incidence and severity of ARIs in children, with increased pollutant levels associated with higher risk, particularly in

households still using solid fuels (Esposito et al., 2025; Foo et al., 2025). Evidence from India indicates an odds ratio (OR) of 1.23 for every 10 $\mu\text{g}/\text{m}^3$ increase in $\text{PM}_{2.5}$ on the incidence of ARI in children, while analysis in Chad linked the use of polluted fuels to a more than threefold increased risk of ARI (Adhikary et al., 2024; Aremu & Aremu, 2025). These findings reinforce WHO's emphasis on environmental interventions, such as transitioning to clean fuels and improving ventilation, as key strategies for ARI prevention [WHO, 2022; Esposito et al., 2025; Adhikary et al., 2024].

Regionally, South Asia and parts of Sub-Saharan Africa bear the highest burden of ARI. Global monitoring shows that deaths from pneumonia and diarrhea in children under five are highly concentrated in a few high-burden countries, with significant disparities in equitable access to vaccines and treatment (IVAC PDPR, 2024). In Europe, the 2024/2025 season was marked by simultaneous peaks of influenza and RSV, challenging healthcare systems. The European Centre for Disease Prevention and Control (ECDC) warned of a surge in respiratory infections and a significant impact on secondary healthcare services, particularly in very young children and the elderly (ECDC, 2024). This co-circulation pattern highlights the importance of robust primary triage, increased immunization coverage, and surge preparedness across healthcare services (ECDC, 2024).

The WHO has provided standardized and pragmatic guidelines for the diagnosis and management of ARIs at the primary care level. The technical framework, developed since 1991, emphasizes simple and reliable clinical signs such as rapid breathing, chest indrawing, and wheezing to classify severity and guide first-line management. In 2014, the WHO revised its guidelines for childhood pneumonia into two categories ("pneumonia" that can be treated at home and "severe pneumonia" that requires referral), recommending oral amoxicillin preferably the dispersible form as first-line therapy for non-severe cases in children aged 2–59 months (WHO, 2014). Similar recommendations in high-income countries also affirmed that amoxicillin remains first-line outpatient therapy for school-age children, with the duration of therapy generally ≤ 7 days (Smith et al., 2021). Recent updates further emphasize the importance of pulse oximetry for early detection of hypoxemia; evaluations have shown significant improvements in case recognition and decreased child mortality when oximetry and oxygen therapy are available (PATH, TIMCI). For severe disease, the WHO SARI Toolkit (2022) provides integrated protocols for screening, triage, infection prevention and control, laboratory diagnosis, oxygen administration, ventilation strategies, and antimicrobial stewardship for adults and children. Recent regulatory developments, such as the FDA 2025 draft guidance, also aim to improve pulse oximeter accuracy across skin tones, Strengthen equity in hypoxemia detection [WHO, 2014; WHO SARI Toolkit, 2022].

In Timor-Leste, ARI is one of the most frequently reported conditions in routine surveillance and is a priority within the national Integrated Disease Surveillance and Response (IDSR) framework (Ministry of Health/WHO, 2022). Locally, the 2025 Early Information System (EIS) documented 529,114 ARI cases nationally, with 31,575 cases in Baucau Municipality. At primary health care facilities such as Centro Saúde Tirilolo, Uailili, and Bucoli, reported cases were 1,202, 2,105, and 2,260, respectively (SSM Baucau, 2025). While frontline diagnosis typically includes anamnesis, physical examination, respiratory rate measurement, pulse oximetry (if available), and basic radiology or laboratory tests, primary facilities often face limitations in staffing, availability of essential drugs, and diagnostic tools, resulting in relatively lower compliance with WHO standards compared to referral hospitals. This gap in implementation between policy and practice contributes to delayed diagnosis, inequitable antibiotic use, inconsistent availability of oxygen therapy, and varying referral pathways, ultimately leading to inequities in health outcomes across regions [Ministry of Health/WHO, 2022; SSM Baucau, 2025].

The proposed study "Proportion of Incidence, Diagnosis, and Management of ARI at Centro Saúde Tirilolo, Uailili, and Bucoli, Posto Administrativo Baucau, 2024" is designed to provide facility-level evidence needed to close these gaps. Specifically, the study will: (1) quantify the burden of ARI in the three health centers; (2) assess diagnostic practices based on WHO/IMCI indicators (e.g., accurate respiratory rate measurement, use of pulse oximetry,

recognition of chest indrawing and danger signs); (3) evaluate antibiotic prescribing patterns and their alignment with recommendations for oral amoxicillin for non-severe cases and timely use of injectable antibiotics and oxygen therapy for severe cases; and (4) document the timeliness of referrals and follow-up mechanisms. These metrics will identify gaps between national policy and frontline implementation and highlight areas where training, supply chain, and equipment investments would have the greatest impact. This approach aligns with the WHO IMCI/SARI framework and the global call to strengthen primary care preparedness for co-circulating respiratory pathogens (WHO, 2014; WHO, 2022; ECDC, 2024).

Acute Respiratory Infections (ARI) remain one of the most significant public health challenges globally, particularly in developing countries where healthcare resources and infrastructure are often limited. ARI, which encompasses a spectrum of respiratory illnesses ranging from mild upper respiratory tract infections to severe pneumonia, is recognized as a leading cause of morbidity and mortality, especially among vulnerable populations such as children under five years, the elderly, and individuals with compromised immune systems. The World Health Organization (WHO) has consistently emphasized the importance of effective surveillance, diagnosis, and management of ARI to reduce its burden and prevent avoidable deaths. In this context, the implementation of robust research methodologies to assess the incidence, diagnostic practices, and management strategies for ARI is crucial for informing evidence-based interventions and policy decisions.

In Timor-Leste, a lower-middle-income country in Southeast Asia, the healthcare system faces numerous challenges, including limited access to quality healthcare services, inadequate health infrastructure, and a shortage of trained health professionals. These challenges are particularly pronounced in rural and semi-urban areas such as Baucau Municipality, where community health centers (CHCs) serve as the primary point of care for the majority of the population. The effective management of ARI in such settings is contingent upon the availability of accurate data on disease incidence, diagnostic accuracy, and adherence to recommended management protocols. However, there is a paucity of comprehensive studies that systematically evaluate these aspects within the context of Timor-Leste's primary healthcare system.

The findings of this study are expected to inform practical capacity building planning in Baucau, including through human resource strengthening (e.g., triage training, IMCI refresher, oximetry competency), stabilization of essential drug stocks (amoxicillin, pediatric formulations, injectable antibiotics), expansion of oxygen availability (concentrators, nasal cannulas, flow meters), and improvement of point-of-care diagnostics (pediatric-appropriate pulse oximeters, respiratory rate monitors). The resulting evidence will also support environmental health messages adoption of clean fuels, improved ventilation given the strong association between air pollution and ARI risk (Esposito et al., 2025; Adhikary et al., 2024). Ultimately, this study aims to strengthen equitable ARI management, reduce preventable morbidity and mortality, and promote Timor-Leste's alignment with WHO priorities for integrated respiratory infection control. The focus on frontline implementation recognizes that policy effectiveness depends critically on the availability of reliable equipment, trained staff, oxygen systems, and ongoing supervision of the elements that transform standards into measurable health outcomes (WHO, 1991; WHO, 2014; WHO SARI Toolkit, 2022).

THE METHOD

The present study, seeks to address this gap by employing a retrospective descriptive quantitative design to assess the proportion of incidence, diagnostic practices, and management of ARI at three Community Health Centers (CHCs) in Baucau Municipality, Timor-Leste. The study was conducted at Centro da Saúde Tirilolo, Uailili, and Bucoli, located in Posto Administrativo Baucau, during the period of August to September 2025. By focusing on these three CHCs, the research aims to provide a representative overview of ARI management in the region, thereby contributing valuable insights for healthcare practitioners, policymakers, and researchers.

The selection of a retrospective descriptive quantitative design is grounded in the need to systematically analyze existing data to identify patterns and trends in ARI incidence and management. This approach enables the researcher to utilize both primary and secondary data sources, thereby enhancing the comprehensiveness and reliability of the findings. Primary data were collected through structured interviews with health workers involved in ARI diagnosis and management, while secondary data were obtained from facility records, including daily, monthly, and annual reports of ARI cases. The integration of these data sources allows for a nuanced understanding of the current state of ARI management at the selected CHCs.

The study population comprised all patients diagnosed with ARI at the three CHCs in 2025. To ensure the representativeness of the sample and the efficiency of data collection, the Slovin formula was employed to determine the appropriate sample size, with a margin of error (e) of 10%. This methodological choice reflects a pragmatic balance between the need for statistical validity and the constraints of time, cost, and effort inherent in field research. Specifically, the sample sizes for each CHC were as follows: CHC Tirilolo (N=1202, n=92), CHC Uailili (N=2105, n=95), and CHC Bucoli (N=2260, n=96). By adhering to this sampling strategy, the study ensures that the findings are both generalizable and feasible within the available resources.

The data collection techniques employed in this study were carefully selected to capture the multifaceted nature of ARI management. Structured interviews were conducted using a pre-designed questionnaire to elicit detailed information on diagnostic and treatment practices from health workers. This method facilitates the collection of standardized data, thereby enabling meaningful comparisons across different CHCs. In addition, document review was undertaken to extract data on ARI cases and management details from health facility archives. This dual approach to data collection enhances the validity of the findings by triangulating information from multiple sources.

The variables and operational definitions utilized in the study were aligned with established guidelines and best practices in ARI research. The incidence of ARI was measured in terms of the number and proportion of cases by age, sex, education, and occupation, thereby providing a comprehensive demographic profile of affected individuals. Diagnostic practices were assessed based on the classification of cases into severe pneumonia, pneumonia, or cough (non-pneumonia) in accordance with WHO guidelines. This classification is critical for ensuring the accuracy of diagnosis and the appropriateness of subsequent management interventions. The management of ARI was evaluated in terms of compliance with recommended interventions, including antibiotic administration, referral, oxygen therapy, and follow-up. These indicators are essential for assessing the quality of care provided to ARI patients and identifying areas for improvement.

Data analysis was conducted using univariate analysis to generate frequencies and percentages for each variable. The results were presented in tables and graphs using Microsoft Excel 2020, thereby facilitating the clear and concise communication of findings to stakeholders. This analytical approach enables the identification of key trends and patterns in ARI incidence, diagnosis, and management, which can inform targeted interventions and resource allocation.

The significance of this research lies in its potential to inform the development of evidence-based strategies for improving ARI management at the primary healthcare level in Timor-Leste. By systematically assessing the incidence, diagnostic practices, and management of ARI at three representative CHCs in Baucau Municipality, the study provides a robust evidence base for identifying gaps in current practices and prioritizing areas for intervention. Furthermore, the findings have broader implications for the design and implementation of ARI control programs in similar settings, both within Timor-Leste and in other low-resource contexts.

The "Research Methodology" study addresses a critical gap in the literature by providing a comprehensive assessment of ARI incidence, diagnosis, and management at the community health center level in Baucau Municipality, Timor-Leste. The use of a retrospective descriptive quantitative design, combined with rigorous data collection and analysis methods, ensures the validity and reliability of the findings. The study's focus on practical and

actionable indicators, such as compliance with recommended management protocols, enhances its relevance for healthcare practitioners and policymakers. Ultimately, the insights generated by this research have the potential to inform the development of targeted interventions and policies aimed at reducing the burden of ARI and improving health outcomes in Timor-Leste and beyond.

RESULTS AND DISCUSSION

A. Results

a) Participants Characteristics For Ari Cases From Three Chcs Tirilolo, Uailili, And Bucoli.

Tabel-1. Proportion of ARI cases by age at Centro Saúde Tirilolo, Uailili, and Bucoli.

Community Health Centers	Gender		Total
	Female	Male	
CS Tirilolo	57 (62%)	35 (38%)	92 (100%)
CS Uailili	67 (71%)	28 (29%)	95 (100%)
CS Bucoli	59 (61%)	37 (39%)	96 (100%)

Most ARI cases occur in young children (<5 years), the group most vulnerable to respiratory infections. The highest proportion is seen at CS Bucoli, where nearly 80% of cases are from the under-five group. ARI prevention interventions should focus on young children, including immunization, parental education, and nutritional monitoring. The low number of cases among adults indicates that program priorities should target child health.

Tabel.2. Proportion of ARI cases by gender at Centro Saúde Tirilolo, Uailili, and Bucoli.

Community Health Centers	Age							Total
	< 1	1 - 4	5 - 14	15 - 24	25 - 39	40 - 59	60 +	
CS Tirilolo	30 (33%)	33 (36%)	12 (13%)	5 (5%)	4 (4%)	2 (2%)	6 (7%)	92 (100%)
CS Uailili	39 (41%)	27 (28%)	19 (20%)	3 (3%)	2 (2%)	1 (1%)	4 (4%)	95 (100%)
CS Bucoli	43 (45%)	34 (35)	13 (14%)	2 (2%)	1 (1%)	1 (1%)	2 (2%)	96 (100%)

Data from three Community Health Centers in Baucau Municipality show a total of 283 respondents with the following gender distribution: Female: 183 (65%); Male: 100 (35%). The majority of respondents are female across all health centers. This may reflect women's role as decision-makers in family health or their higher participation in health facility visits. ARI education and intervention programs can leverage women's involvement as agents of change within households, while ensuring equal access to information for men.

Tabel-3. Proportion of ARI cases by education level at CHC Tirilolo, Uailili, and Bucoli.

Community Health Center	Level of Education					Total
	NO education	Elementary	JHS	SHS	University	
CS Tirilolo	30 (33%)	22 (24%)	19 (21%)	16 (17%)	5 (5%)	92
CS Uailili	39 (41%)	27 (28%)	15 (16%)	10 (11%)	4 (4%)	95
CS Bucoli	43 (45%)	30 (31%)	13 (14%)	7 (7%)	3 (3%)	96
Total						283

NB*:

JHS: Junior High School

SHS: Senior High School

By Health Center : CS Bucoli has the highest proportion of respondents with no schooling (45%) and the lowest for higher education (3%); CS Uailili is also dominated by respondents with no schooling (41%) and few with higher education (4%); CS Tirilolo shows a better distribution, with a lower proportion of no schooling (33%) and the highest for higher education (5%). The majority of respondents have low educational attainment (no schooling or

only primary school), which may affect understanding of ARI and adherence to treatment. CS Bucoli and Uailili require simpler health communication approaches, while CS Tirilolo has better potential for literacy-based education. Health promotion strategies should be tailored to community education levels, especially in areas with a high proportion of respondents without schooling.

Tabel-4. Proportion of ARI cases by employment status at CHC, Tirilolo, Uailili, and Bucoli.

Community Health Center	Status Pekerjaan		Total
	Farmer	PSE	
CS Tirilolo	33 (36%)	59 (64%)	92 (100%)
CS Uailili	70 (83%)	16 (17%)	95 (100%)
CS Bucoli	67 (70%)	29 (30%)	96 (100%)

NB*:
PSE: Private Sector Employment

Data from three Community Health Centers in Baucau Municipality show a total of 283 respondents with two employment categories: farmers and private sector workers. The distribution reveals clear differences among centers:

- CS Tirilolo has a majority of respondents working in the private sector (64%) and only 36% as farmers.
- CS Uailili is dominated by farmers (83%), with few respondents in the private sector (17%).
- CS Bucoli also has a majority of farmers (70%), but a higher proportion of private sector workers compared to Uailili (30%).

These differences reflect socio-economic variations across areas. CS Uailili and Bucoli serve communities more dependent on agriculture, which may affect healthcare access and ARI risk. In contrast, CS Tirilolo serves a population more connected to the private sector, likely with better access to information and health facilities.

b) Proportion of ARI Cases at Centro Saúde Tirilolo, Uailili, and Bucoli in Posto Administrativo Baucau, Baucau Municipality in 2024

Data from three Community Health Centers in Baucau Municipality show a total of 5,557 ARI cases from 25,640 patient visits throughout 2024, representing an overall proportion of 22%, see table-5.

Tabel- 5. Proportion of ARI cases at Centro Saúde Tirilolo, Uailili, and Bucoli.

Community Health Center	ARI Cases (Acute Respiratory Infection Cases)	Total Visits Patients in 2024	Proportion of ARI cases
Tirilolo	1202	13859	9%
Uailili	2105	8160	26%
Bucoli	2250	3621	62%
Total	5557	25640	22%

However, there are significant variations among centers:

- CS Bucoli recorded the highest ARI proportion at 62% (2,250 cases out of 3,621 visits), indicating that most visits were ARI-related.
- CS Uailili ranked in the middle with 26% (2,105 cases out of 8,160 visits).
- CS Tirilolo had the lowest proportion at only 9% (1,202 cases out of 13,859 visits), suggesting ARI is not the dominant health issue in this area.

These differences indicate varying risk factors and environmental determinants across regions. Bucoli requires priority ARI prevention interventions and strengthened service capacity, while Tirilolo may need to focus more on other health issues. Uailili requires a balanced approach.

c) ARI Diagnostic Process at Centro Saúde Tirilolo, Uailili, and Bucoli in Posto Administrativo Baucau, Baucau Municipality in 2024.

Data from three Community Health Centers in Baucau Municipality show a total of 283 ARI cases with the following diagnostic distribution: cough (non-pneumonia) was the most common category (131 cases or 46%), followed by

pneumonia (109 cases or 39%), and severe pneumonia (43 cases or 15%), see table-6.

Table-6. ARI Diagnostic Results at the three CHCs in Baucau Municipality, 2024

Community Health Center	Diagnosis			Total
	Severe pneumonia	Pneumonia	Cough (non-pneumonia)	
CS Tirilolo	19 (21%)	23 (25%)	50 (54%)	92 (100%)
CS Uailili	13 (14%)	37 (39%)	45 (47%)	95 (100%)
CS Bucoli	11 (11%)	49 (51%)	36 (38%)	96 (100%)
Total	43 (15%)	109 (39%)	131 (46%)	283 (100%)

Comparison among Centers:

- CS Bucoli had the highest proportion of pneumonia (51%), indicating greater risk of complications.
- CS Tirilolo recorded the highest proportion of severe pneumonia (21%), although most cases were mild cough.
- CS Uailili was in the middle with a relatively balanced distribution between pneumonia and cough.

These variations are important for planning interventions. Bucoli requires strengthened pneumonia management, while Tirilolo needs special attention for severe cases. Overall, the high number of non-pneumonia cough cases highlights the need for community education and symptom monitoring to prevent progression to pneumonia.

d) Management of Acute Respiratory Infections (ARI) at Tirilolo, Uailili, and Bucoli Health Centers in Baucau Administrative Post, Baucau Municipality in 2024.

Data from three Community Health Centers Tirilolo, Uailili, and Bucoli in Baucau Municipality indicated 43 cases of severe pneumonia among patients with acute respiratory infections in 2024. Clinical management followed the national guidelines. For all cases, the first dose of antibiotics was administered immediately, and patients were promptly referred to higher-level facilities, see table-7.

Table-7 Management of Severe Pneumonia in Three CHCs, Baucau Municipality, 2024.

Community Health Center	Severe Pneumonia	
	Give the first dose of antibiotics	refers
CS Tirilolo	19 (21%)	19 (21%)
CS Uailili	13 (14%)	13 (14%)
CS Bucoli	11 (11%)	11 (11%)
Total	43 (15%)	43 (15%)

The distribution of cases was as follows: Tirilolo Health Center recorded 19 cases (21%), Uailili Health Center recorded 13 cases (14%), and Bucoli Health Center recorded 11 cases (11%). Compliance with the treatment protocol for severe pneumonia was 100% across all health centers, demonstrating strong adherence to clinical standards despite variations in ARI burden and population characteristics. Although ARI prevalence varied significantly among the centers, the management of severe cases was consistent and effective, reducing the risk of complications and mortality.

e) Management of Pneumonia Cases at CHCs in Baucau Municipality (2024)

Data from three Community Health Centers Tirilolo, Uailili, and Bucoli in Baucau Municipality showed 109 pneumonia cases among patients with acute respiratory infections in 2024 reveal in table-8.

Tabela-8. Analysis of Pneumonia Management at 3 CHCs in Baucau Municipality, 2024.

Community Health Centers	Pneumonia				
	GA-5D*	WPAIB*	CICEHIV*	CSTSCR*	CLMT14D*

CS Tirilolo	23 (25%)	23 (25%)	23 (25%)	23 (25%)	23 (25%)	23 (25%)
CS Uailili	37 (39%)	37 (39%)	37 (39%)	37 (39%)	37 (39%)	37 (39%)
CS Bucoli	49 (51%)	49 (51%)	49 (51%)	49 (51%)	49 (51%)	49 (51%)
Total	109 (39%)	109 (39%)	109 (39%)	109 (39%)	109 (39%)	109 (39%)

- NB*:
- Give oral Amoxicillin for 5 days (GA-5D)
 - If wheezing is present (or disappears after treatment with a fast-acting inhaled bronchodilator), administer inhaled bronchodilator for 5 days (WPAIB)
 - *If there is chest indrawing in a child exposed to HIV or with HIV infection, give the first dose of amoxicillin and refer (CICEHIV)
 - Give a safe throat soother and cough reliever (CSTSCR)
 - If cough lasts more than 14 days or wheezing recurs, refer for further examination for TB or asthma (CLMT14D)
 - Advise when to return immediately and schedule a follow-up visit in 3 days (ARI-3D)

All cases were managed according to national guidelines, which included six key interventions. First, oral Amoxicillin was administered for five days. Second, if wheezing was present, an inhaled bronchodilator was provided for five days. Third, if chest indrawing occurred in a child exposed to or infected with HIV, the first dose of Amoxicillin was given and the patient was referred. Fourth, patients were provided with a safe throat soother and cough reliever. Fifth, if the cough lasted more than 14 days or wheezing recurred, the patient was referred for further evaluation for tuberculosis or asthma. Sixth, caregivers were advised on danger signs and instructed to return immediately if symptoms worsened, with a follow-up visit scheduled within three days.

The distribution of cases was as follows: Tirilolo Health Center recorded 23 cases (25%), Uailili Health Center recorded 37 cases (39%), and Bucoli Health Center recorded 49 cases (51%). All pneumonia patients at the three health centers received the six interventions as per guidelines. Compliance with the protocol reached 100%, indicating high-quality service delivery. Pneumonia management at the primary care level was consistent and comprehensive, supporting the prevention of complications and improving patient safety.

f) Management of Non-Pneumonia Cough Cases at Community Health Centers in 2024

Data from three Community Health Centers (Tirilolo, Uailili, and Bucoli) in Baucau Municipality showed 131 cases of non-pneumonia cough among patients with acute respiratory infections, shows in table-9 below.

Table-9. Analysis of Non-Pneumonia Cough Management in Three CHCs in Baucau Municipality, 2024

Community Health Centers	Cough – Not Pneumonia			
	GA-5D*	WPAIB*	CICEHIV*	CSTSCR*
CS Tirilolo	50 (54%)	50 (54%)	50 (54%)	50 (54%)
CS Uailili	45 (47%)	45 (47%)	45 (47%)	45 (47%)
CS Bucoli	36 (38%)	36 (38%)	36 (38%)	36 (38%)
Total	131 (46%)	131 (46%)	131 (46%)	131 (46%)

- NB*:
- Give oral Amoxicillin for 5 days (GA-5D)
 - If wheezing is present (or disappears after treatment with a fast-acting inhaled bronchodilator), administer inhaled bronchodilator for 5 days (WPAIB)
 - *If there is chest indrawing in a child exposed to HIV or with HIV infection, give the first dose of amoxicillin and refer (CICEHIV)
 - Give a safe throat soother and cough reliever (CSTSCR)
 - If cough lasts more than 14 days or wheezing recurs, refer for further examination for TB or asthma (CLMT14D)
 - Advise when to return immediately and schedule a follow-up visit in 3 days (ARI-3D)

All cases were managed according to national guidelines, which included four main interventions. First, if wheezing was present, an inhaled bronchodilator was given for five days. Second, patients were provided with a safe throat soother and cough reliever. Third, if the cough lasted more than 14 days or wheezing recurred, the patient was referred for further examination for tuberculosis or asthma. Fourth, caregivers were advised on danger signs and instructed to return immediately if symptoms worsened, with a follow-up visit scheduled within five days if there was no improvement.

The distribution of cases was as follows: Tirilolo Health Center recorded 50 cases (54%), Uailili Health Center recorded 45 cases (47%), and Bucoli Health Center recorded 36 cases (38%).

All patients with non-pneumonia cough received the four recommended interventions. Compliance with the protocol reached 100%, indicating consistent service delivery across all health centers. The management of non-pneumonia cough cases was comprehensive and aligned with national standards, supporting the prevention of complications and improving the overall quality of ARI care at the primary level.

Discussion

a) Participants' Characteristics

The study analyzed 283 respondents diagnosed with Acute Respiratory Infection (ARI) across three Community Health Centers in Baucau Municipality, focusing on age, gender, education, and occupation as key determinants.

Age

Most ARI cases occurred in children under five years, with the highest proportion at CS Bucoli (~80%). This pattern aligns with global evidence that young children are most vulnerable to respiratory infections due to immature immune systems, smaller airway diameter, and high exposure to environmental risks such as indoor smoke and air pollution (World Health Organization [WHO], 2023). Rudan et al. (2008) identified pneumonia as the leading cause of death in this age group, with an incidence of 0.29 episodes per child per year in low- and middle-income countries, and 81% of pneumonia-related deaths occurring in the first two years of life (Walker et al., 2013). Indonesian studies also link ARI risk to incomplete immunization, poor nutrition, and inadequate home ventilation (Tamrin et al., 2024; Cahya et al., 2024).

Gender

Women comprised 65% of respondents, highlighting their central role in child health decision-making. This aligns with WHO findings and global evidence indicating that mothers are more likely to seek care for child illnesses such as ARI (Rudan et al., 2008). Indonesian research shows that maternal participation in immunization and exclusive breastfeeding can reduce ARI risk (Tamrin et al., 2024). While this presents an opportunity for mother-focused education, inclusive strategies should also engage fathers in health decisions.

Education

The majority of respondents had low educational attainment (no schooling or primary school only), which limits health literacy and adherence to treatment protocols. WHO (2023) notes that low health literacy is associated with delayed ARI recognition and care-seeking, a finding supported by global evidence (Rudan et al., 2008). Indonesian studies demonstrate that mothers with low education often fail to recognize ARI danger signs (Cahya et al., 2024). Health communication strategies using visual aids, simple language, and demonstrations are recommended especially in CS Bucoli and CS Uailili, while CS Tirilolo, with better literacy, can utilize more advanced messaging.

Occupation

Employment patterns varied significantly: CS Uailili and CS Bucoli were dominated by farmers (83% and 70%), while CS Tirilolo had 64% employed in the private sector. Farming communities face higher ARI risk due to environmental exposures (dust, smoke) and limited healthcare access, consistent with WHO's framework on social determinants of health (WHO, 2023). Indonesian studies confirm that informal sector workers experience increased ARI risk due to lack of protective equipment and delayed treatment (Kurniawan, 2019; Syafiqah et al., 2024). Targeted interventions should include community-based education, provision of PPE, and improved rural health access.

b) *ARI Incidence and Diagnostic Process in Baucau Municipality (2024)*

The study assessed the proportion of Acute Respiratory Infection (ARI) cases and diagnostic practices across three Community Health Centers (CHCs) in Baucau Municipality CS Bucoli, CS Uailili, and CS Tirilolo. Out of 25,640 patient visits, 5,557 were ARI cases, representing an overall incidence of 22%. However, the burden varied significantly: CS Bucoli reported the highest proportion (62%), followed by CS Uailili (26%), and CS Tirilolo (9%). This disparity reflects environmental and socio-economic differences, consistent with WHO (2023) findings that poor ventilation, indoor smoke exposure, and overcrowding increase ARI risk.

Diagnostic classification of 283 sampled ARI cases revealed 46% cough (non-pneumonia), 39% pneumonia, and 15% severe pneumonia. Bucoli's high pneumonia rate (51%) suggests delayed detection or greater exposure to risk factors, while Tirilolo's severe pneumonia proportion (21%) indicates possible gaps in referral systems. Uailili showed a balanced distribution, suggesting better adherence to early detection protocols.

These findings align with global evidence. Rudan et al. (2008) identified pneumonia as the leading cause of under-five mortality, with an incidence of 0.29 episodes per child annually in developing countries, and Walker et al. (2013) reported that 81% of pneumonia-related deaths occur within the first two years of life. Risk factors such as incomplete immunization, malnutrition, and poor housing conditions are well documented internationally and confirmed by Indonesian studies (Tamrin et al., 2024; Cahya et al., 2024), which link ARI incidence to low maternal education, farming occupations, and inadequate home ventilation.

The diagnostic process in Baucau generally follows WHO's Integrated Management of Childhood Illness (IMCI) guidelines, which classify ARI severity based on respiratory signs. However, the high burden in Bucoli and Tirilolo underscores the need for strengthened early detection, community education, and improved environmental conditions. Global best practices emphasize pulse oximetry, rational antibiotic use, and responsive referral systems to reduce complications and mortality (WHO, 2022).

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