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Substantial delays in care-seeking for post-vaccination abscesses: a threat to infant health and immunization trust in Timor-Leste

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Research Article

Keywords: Adverse events following immunisation, Healthcare-seeking behaviour, Hepatitis B vaccine, Abscess, Timor-Leste

Posted Date: March 8th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8704552/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Adverse events following immunisation (AEFI), such as injection-site abscesses, represent a critical but often neglected link in the immunisation cascade, especially in low-resource settings. While systemic barriers to healthcare are widely documented, quantitative evidence on how these barriers directly impact care-seeking for AEFIs—and consequently threaten immunisation program credibility—remains limited. This study examined care-seeking delays for abscesses following Hepatitis B birth dose (HepB-BD) administration in Timor-Leste as a case study of this global challenge.

Methods

This descriptive cross-sectional study was conducted using the 2024 AEFI surveillance line list of Timor-Leste. All reported cases of abscesses in infants (0–12 months old) following HepB-BD were included in this study. The primary outcome was care-seeking delay, defined as the number of days between the caregiver's notice of the abscess and the first formal healthcare consultation. Data were analysed using descriptive statistical methods.

Results

Among 41 reported cases, the median care-seeking delay was 17 days (range: 1–44 days). Only 36.6% of caregivers sought care within 10 days, whereas 43.9% delayed care-seeking beyond 20 days. Less than half of the infants (46.3%) received HepB-BD within 24 hours of birth.

Conclusion

The prolonged delays observed underscore a critical failure point in the immunisation continuum within fragile health systems, where logistical and financial barriers overwhelm caregivers’ decision-making. This study provides quantitative evidence that AEFI management is not merely a clinical concern but a pivotal trust-building interface between communities and health systems. Interventions must integrate active community education, healthcare worker training in AEFI communication, and tangible support to overcome systemic access barriers, a strategy relevant for similar low-resource settings globally.

1. Introduction

Hepatitis B virus (HBV) infection represents a significant global health issue. As reported in the "Global progress report on HIV, viral hepatitis, and sexually transmitted infections, 2021" by the World Health Organization (WHO), the prevalence of hepatitis B surface antigen (HBsAg) in the general population was 3.8% in 2019. Moreover, approximately 1.5 million new infections and 296 million individuals have

chronic HBV infection. Furthermore, HBV infection has resulted in 820,000 deaths due to liver failure, cirrhosis, and hepatocellular carcinoma (HCC) [1]. Vaccination against hepatitis B has been shown to confer over 95% protection from infection. According to estimates by the WHO, prior to the widespread implementation of vaccination in 2000, approximately 5% of children under the age of five were infected with the hepatitis B virus (HBV). By 2019, this proportion had declined to less than 1% [2].

WHO describes Adverse Events Following Immunization (AEFI) as any negative medical incident that occurs after vaccination, which may not necessarily be linked to the vaccine itself. These adverse events can encompass any undesirable or unexpected signs, unusual laboratory results, symptoms, or illnesses (1) and are categorized into five distinct types: vaccine product–related reactions, vaccine quality defect–related reactions, immunization error–related reactions, immunization anxiety–associated reactions, and coincidental events [3].

Globally, the reported incidence of AEFIs varies by country. According to WHO estimates, the occurrence of serious AEFIs is approximately 1 per 100,000 doses administered, whereas non-serious AEFIs are more prevalent and frequently underreported [4]. Injection-site reactions, such as swelling, redness, and abscesses, are among the most commonly reported non-serious events, particularly in low-resource settings where cold chain and aseptic techniques may be compromised.

Abscess formation following immunisation, particularly AEFIs such as subcutaneous abscesses, is frequently linked to immunisation errors and improper administration. These occurrences have been documented with vaccines such as Bacillus Calmette-Guérin (BCG) and hepatitis B, which predominantly affect young children. Such AEFI incidents can erode trust in vaccination programs, prompting individuals to seek care from traditional medicine practitioners or delay visits to formal healthcare facilities [5, 6].

In Timor-Leste, the government provides free public healthcare services, including vaccinations for children. However, numerous barriers hindered equitable access to these services. A significant study conducted in 2016 underscored this issue, citing a community member who expressed, “I go I die, I stay I die, better to stay and die in my house.” This statement reflects the profound frustration experienced by individuals due to these access challenges.[6]. The research identified onerous physical, financial, and sociocultural barriers—such as lack of patient transport, prohibitive out-of-pocket costs for families, and experiences of staff denigration—that deter hospital care-seeking. Moreover, a different study found that traditional medicine is often considered an affordable, accessible, and acceptable substitute for formal healthcare [7]. A three-dose infant hepatitis B vaccination series was implemented in Timor-Leste in 2007, with the introduction of a hepatitis B birth dose in 2016 [8]. According to the WHO/UNICEF joint estimates of national immunization coverage (WUENIC), the coverage of hepatitis B birth doses was 76% from 2021 to 2024 [9].

In numerous low- and middle-income countries (LMICs), health systems face structural weaknesses that manifest as barriers to access [6, 10, 11]. Consequently, responses to AEFIs, such as abscesses, are often suboptimal. A previous study in a limited setting found that parental concern of parents sought

medical attention due to an AEFI 6.9% of parents who reported no AEFI[12]. Timor-Leste [6], with its documented challenges in transportation, costs, and perceived quality of care, serves as a pertinent case study of a fragile health system. Within such contexts, responses to AEFIs are often suboptimal, yet quantitative data delineating the specific patterns and determinants of care-seeking behaviors remain critically deficient. By systematically analyzing caregiver responses to abscesses following HepB-BD, this study aims to quantify healthcare-seeking delays [1, 5, 6, 8]and frame them as symptomatic of systemic access failures. These findings are intended to generate evidence-based, transferable insights for strengthening AEFI management, safeguarding infant health, and protecting the credibility of immunization programs not only in Timor-Leste but in comparable settings worldwide.".

2. Methods

2.1 Study design and setting

We performed a descriptive cross-sectional analysis using the existing national surveillance data.

2.2 Data Source

The analysis employed secondary data from Timor-Leste's National Adverse Event Following Immunization (AEFI) Line List for 2024. This line list serves as the passive AEFI surveillance register for the country and is systematically compiled from reports submitted by health facility staff.

2.3 Study Population and Case Selection

This retrospective analysis used all data from the national 2024 Adverse Event Following Immunization (AEFI) line list. The initial dataset contained 58 reported AEFI cases during the surveillance period.

Cases were selected for inclusion in this analysis based on the following criteria.

- Vaccine: The reported adverse event following immunization (AEFI) must have occurred after the administration of the Hepatitis B birth dose (HepB-BD).
- Adverse Events: The reported outcome must be a suspected injection-site abscess.
- Data Completeness: The case record must contain comprehensive data for the core study variables, including infant age, vaccination details, and dates related to abscess onset and healthcare presentation.

The selection process is illustrated in the flowchart (Fig. 1). A total of 58 reports were evaluated for their eligibility. Seventeen cases were excluded: 15 unrelated to HepB-BD vaccination and 2 due to incomplete core data. Consequently, the final analytical sample comprised 41 confirmed cases of post-HepB-BD abscesses in infants aged 0–12 months with complete information.

2.4 Variables and Data Extraction

Using existing records, we extracted and analyzed the following variables for each identified case:

Infant characteristics	Vaccination details	Abscess episode
Sex	Health facility where the HepB-BD was administered,	Date of AEFI report
Age	Date of administration, and	Date of symptom onset (abscess noticed),
Municipality of residence	timeliness (based on date of birth	Date of first healthcare presentation for the abscess.

2.5 Data analysis

Data were analyzed using descriptive statistics in SPSS (version 26). Categorical variables are presented as frequencies and percentages. Continuous variables were summarized using the median and range. The primary outcome, delay in care-seeking, was calculated as the number of days between the caregiver-reported date of abscess notice and the date of the first formal healthcare presentation.

2.5 Ethics

This analysis utilized an anonymized secondary dataset from the national 2024 Adverse Events Following Immunization (AEFI) line list, a routine public health surveillance activity. The use of this de-identified data for epidemiological research aligns with the World Health Organization (WHO) guidelines for ethical issues in public health surveillance and the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER). The study protocol, as a non-interventional analysis of anonymized data, was exempt from formal ethics committee review.

3. Results

3.1 Infant and Vaccination Characteristics

Most infants were female (56.1%, n = 23/41), and the median age at abscess onset was 15 days (range: 2–53 days). The median time from birth to HepB-BD administration was 2 days (range, 0–28 days). Less than half of the infants (46.3%, n = 19/41) received the vaccine within the recommended 24 h after birth. The majority (65.9%, n = 27/41) received their HepB-BD at a community health centre (Table 1)

Table 1
Characteristics of infants with reported injection-site abscess after hepatitis B birth-dose vaccination, Timor-Leste, 2024 (n = 18)

Characteristic	n	%
Age (weekly Intervals)		
Median, Min-Max	15 (2–53) days	
Week 1 (1–7 days)	7	17.1
Week 2 (8–14 days)	10	24.4
Week 3 (15–21 days)	12	29.3
Week 4+ (22–53 days)	12	29.3
Sex		
Female	23	56.1
Male	18	43.9
HepB-BD Timeliness		
Median, Min-Max	2 (0–28) days	
Administered within 24 hours	19	46.3
Administered after 24 hours	22	53.7
Health Facility Received Hepatitis B dose		
Health Post	7	17.1
Community Health Center	27	65.9
Referral Hospital	7	17.1

3.2 Health-care-seeking delays following abscess recognition

Data on the delay between caregiver recognition of a suspected injection-site abscess and seeking formal healthcare were available for 41 patients. The median delay in seeking formal care was 17 days (range: 1–44 days; standard deviation: 12.24 days), indicating that half of the caregivers delayed seeking formal care for over two weeks after the initial observation of the condition. As illustrated in Fig. 1, the distribution of these delays shows that just over one-third of the caregivers (15/41, 36.6%) sought healthcare within 10 days. The most frequently observed delay interval was greater than 20 days (18/41, 43.9%). A significant proportion of patients (8/41, 19.5%) experienced delays of 11–20 days, with the longest delay being 44 days.

4. Discussion

This descriptive study, using national AEFI surveillance data, quantifies a critical gap in the immunization safety net within a fragile health system. The median 17-day delay in seeking care for post-vaccination abscesses, with 43.9% of caregivers waiting over 20 days, represents more than a behavioral pattern—it is a direct indicator of system failure. This delay, occurring alongside suboptimal HepB-BD timeliness (46.3% within 24 hours), highlights linked vulnerabilities across the immunization cascade, from service delivery to complication management. For similar LMICs, these co-occurring delays signal where program strengthening should be prioritized.

The observed delays must be interpreted within the specific, multilayered context of healthcare access in Timor-Leste. Price et al. (2016) conducted a pivotal study that highlighted the persistent "onerous physical, financial, and socio-cultural barriers" that remain in place, even though services are ostensibly offered for free [6]. The identified "critical cross-cutting issue" of lack of patient transport is directly relevant to our findings. For caregivers of infants developing an abscess, the logistical and financial burden of travelling to a health facility can be a prohibitive first barrier, prompting a "wait-and-see" approach. Furthermore, documented experiences of out-of-pocket ancillary costs, nepotism, and perceived poor treatment by staff create a powerful disincentive to engage with the formal system [6]. In this environment, traditional medicine often serves as an accessible, affordable, and culturally acceptable first-line response, potentially explaining the extreme delays recorded before formal healthcare was sought.

These local systemic barriers interact with the global evidence on AEFI management. International studies suggest that experiences with AEFIs can erode vaccine confidence, and that parents who seek care for AEFIs often hold more cautious attitudes toward immunization [12, 13]. The Timor-Leste case illustrates a broader paradigm relevant to fragile health systems globally: when an AEFI occurs, it activates not just medical concern but also a calculus of access. The caregiver’s decision to delay formal care is often a rational response to anticipated logistical hardship, financial burden, and potential disrespect. Therefore, the prolonged delays documented here pose a multidimensional threat: to infant health through increased risk of severe infection, and to the immunization program through erosion of community trust. This risk is amplified in contexts where vaccine coverage is already suboptimal. Addressing this issue requires moving beyond AEFI reporting to actively managing the community experience of AEFIs—a lesson with direct applicability for other LMICs striving to maintain immunization confidence amidst systemic constraints..

Frontline healthcare workers (HCWs) play a pivotal role in this dynamic. Studies from similar low-resource settings, such as Uganda, indicate a common gap where HCWs may have theoretical knowledge of AEFIs but lack practical familiarity with reporting systems and, crucially, effective patient communication protocols [14]. This knowledge-to-practice gap likely exists in Timor-Leste and has direct consequences. Without proficient skills in AEFI recognition, empathetic counseling, and clear guidance on when and where to seek care, HCWs are ill-equipped to mitigate the barriers described by the

caregivers. Inadequate pre-vaccination counseling about common side effects, such as local reactions, leaves families unprepared, increasing alarm and potentially driving them towards informal care when such reactions occur.

Our study had several limitations. Although the sample size captured all reported serious abscess cases in 2024, it was small and limited the detailed subgroup analysis. Reliance on caregiver recall for dates introduces the potential for recall bias. Most significantly, our reliance on the national passive AEFI surveillance system means that we inherently miss cases where caregivers never sought formal care—precisely the population most affected by access barriers and likely to experience the longest delays. This selection bias suggests our findings, concerning as they are, may underestimate the true magnitude of delayed care-seeking and disengagement from the formal health system.

Conclusion and Recommendations

In conclusion, this analysis quantifies a severe care-seeking delay for AEFIs within a fragile health system, using Timor-Leste as an illustrative case. The delay is a symptom of systemic barriers that deter timely help-seeking. To address this, a multi-pronged strategy is required, the principles of which are generalizable to comparable settings:

Integrate AEFI management with access solutions: Community education must be coupled with practical support (e.g., transport mechanisms, community health worker follow-up) to overcome the primary logistical barriers that drive delays.

Reframe healthcare worker training: Capacity building must extend beyond AEFI identification to include competency in empathetic communication, counseling, and trust-building to mitigate negative perceptions and guide appropriate care-seeking.

Complement passive surveillance with active safety-nets: Systems should incorporate active follow-up for serious AEFIs to identify disengaged families, turning surveillance into a protective intervention.

Embed AEFI responses within broader health systems strengthening: Sustained improvement requires addressing foundational barriers—transport, financial protection, and quality of care—as part of universal health coverage agendas.

By demonstrating how systemic failures translate into dangerous care-seeking delays, this study underscores that robust AEFI management is a cornerstone of both infant safety and immunization program resilience in fragile health systems worldwide.

Declarations

Human Ethics and Consent to Participate declarations: not applicable.

Funding:

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contribution

Name Contribution(s)Filipe de Neri Machado Conceptualization, Methodology, SupervisionNoel Soares Gama Validation, Writing – Original Draft PreparationNazario Barreto dos Santos Conceptualization, Data Curation, Project AdministrationBenigna Veneranda da Costa Amaral Formal Analysis, Writing – Original Draft PreparationJimmi Bruno de Oliveira Software, Formal Analysis, VisualizationVenesia Tirana Guterres Methodology, Data Curation, Project AdministrationAloto Ximenes Belo Amaral Software, Writing – Review & EditingDioneia Benevides Monteiro Validation, Writing – Review & EditingMariano da Silva Marques Conceptualization, Methodology, SupervisionAll authors reviewed the manuscript

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Figures

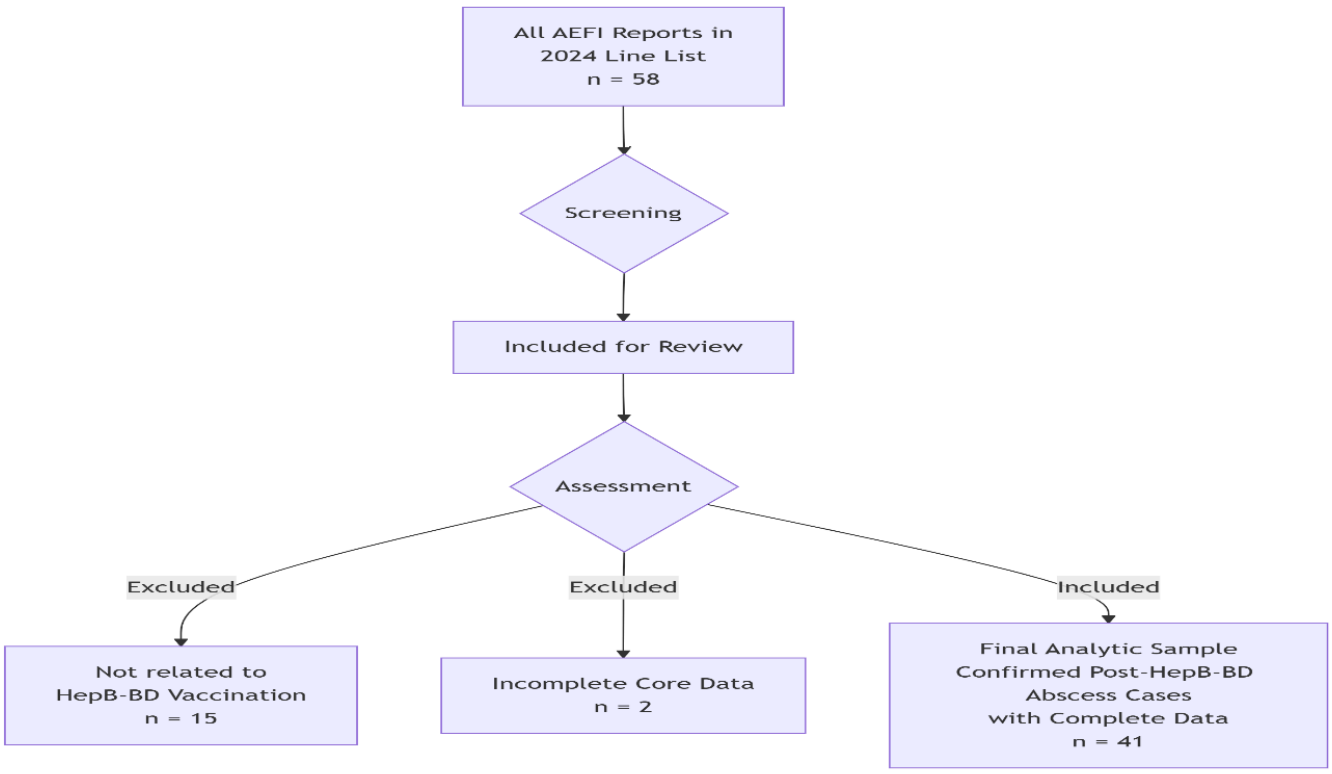


Figure 1

Flowchart of case selection from the 2024 AEFI line list

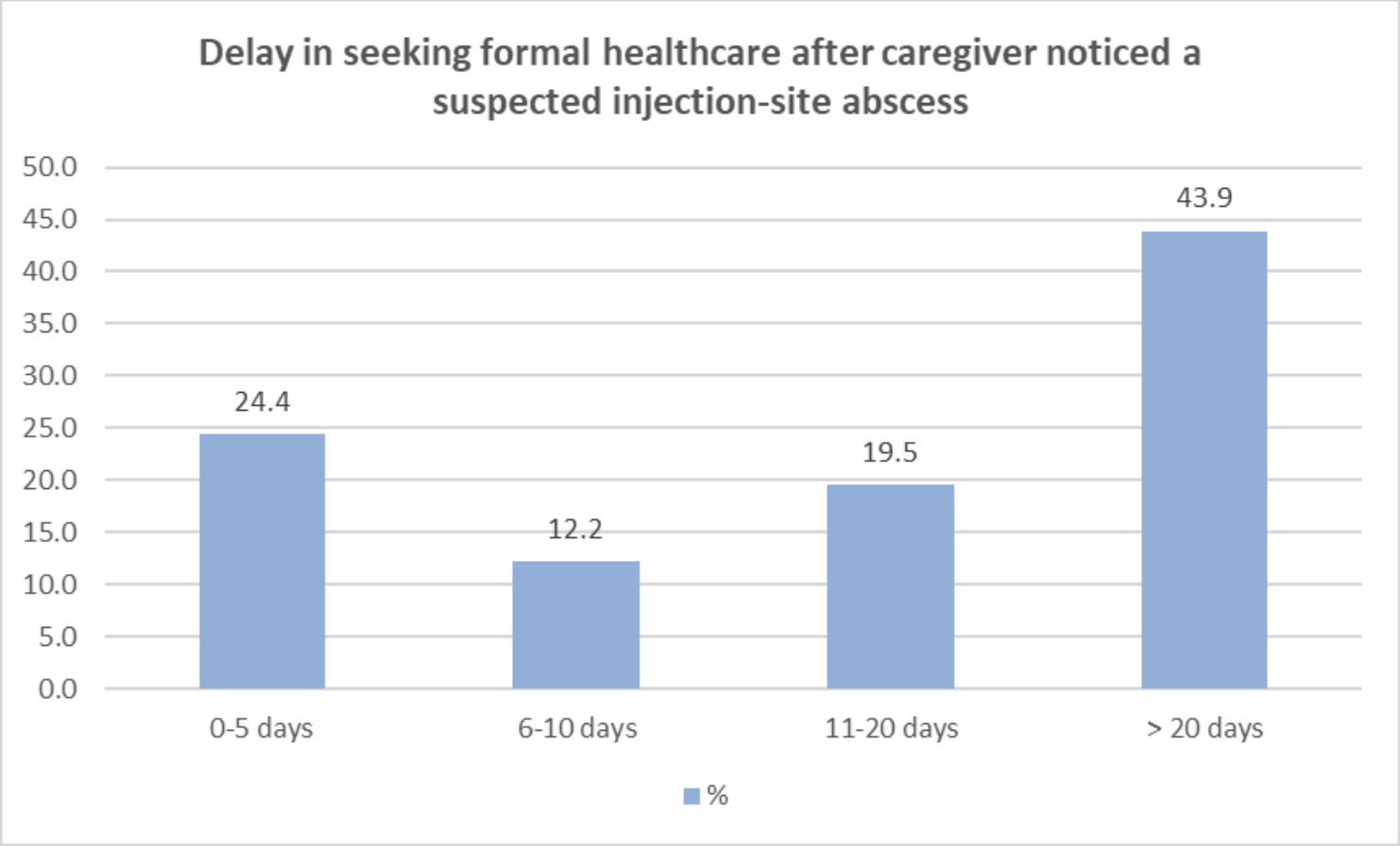


Figure 2

Figure 1. Delay in seeking formal healthcare after the caregiver noticed a suspected injection-site abscess (n=41) *(min=1, max=44, median=17, SD=12.24)*.