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Narrative Review

Challenges in the Differential Diagnosis of Acute Fever (Traveler's Fever) Following Tropical Ecotourism: A Narrative Review

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ABSTRACT

Background of study: The resurgence of global ecotourism has significantly increased travel to tropical destinations, exposing international tourists to a diverse array of endemic pathogens. Consequently, acute undifferentiated fever, commonly referred to as "traveler's fever," has become a frequent and complex presentation in primary care. **Aims and scope of paper:** This narrative review aims to evaluate the differential diagnosis challenges of acute fever in travelers returning from tropical ecotourism, focusing on clinical overlapping, immunologically naive populations, and diagnostic limitations. **Methods:** A comprehensive literature search was conducted, selecting 30 peer-reviewed journal articles published between 2021 and 2026. Data on epidemiology, clinical manifestations, and diagnostic algorithms were synthesized. **Result:** The primary etiologies of traveler's fever include Malaria, Dengue, Leptospirosis, and Scrub Typhus. The main diagnostic hurdles are atypical clinical presentations, overlapping prodromal symptoms, and limited availability of rapid multiplex diagnostics. Furthermore, incomplete travel history documentation exacerbates delayed diagnosis. Implementing Electronic Medical Records (EMR) for geographic tracking and integrating tropical medicine Problem-Based Learning (PBL) in medical education are proven mitigations. **Conclusion:** Effectively managing traveler's fever requires a high index of clinical suspicion, detailed geographical exposure history, and the integration of medical informatics to support syndromic surveillance.

Introduction

Background of the study: Nature tourism or ecotourism has experienced a massive surge in popularity over the past five years. International tourists are increasingly visiting remote destinations such as tropical rainforests, highland trekking routes, and nature conservation areas in Southeast Asia [1]. While providing positive economic impacts, this shift in travel trends increases tourists' exposure to disease vectors such as mosquitoes, ticks, and water sources contaminated with zoonotic pathogens. The most common clinical impact upon their return from these destinations is acute undifferentiated fever, which in travel medicine literature is known as Traveler's Fever [2].

Literature review: Traditionally, the evaluation of traveler's fever centered on ruling out malaria, which is the leading cause of death in cases of imported fever. However, the epidemiological landscape has fundamentally changed. Arbovirus infections (such as Dengue, Zika, and Chikungunya), zoonotic bacterial infections (such as Leptospirosis following white-water rafting), and rickettsial infections (such as Scrub Typhus from mite bites in the brush) now dominate the morbidity profile of adventure travelers [3–5]. Foreign travelers are generally an immunologically naive population to endemic tropical pathogens, often presenting with more severe or atypical clinical manifestations compared to the local population [6].

Gap analysis: Although clinical guidelines for individual tropical diseases are widely available, an integrated diagnostic approach for acute fever in travelers remains an unsolved challenge in primary care facilities [7]. There is a significant gap between the complexity of a patient's geographical exposure and the availability of rapid diagnostic tests at the primary care level. Furthermore, the fragmentation of patient data, unsupported by

integrated electronic medical record (EMR) systems, often results in the loss of crucial information regarding incubation periods and prophylaxis history [8].

Rationale and Purpose of the study: Based on these gaps, this review was compiled to synthesize current literature regarding the clinical challenges in establishing a differential diagnosis of traveler's fever post-tropical ecotourism. The primary purposes of this narrative review are to: (1) map the major etiologies causing acute fever in adventure travelers, (2) identify the main diagnostic barriers in primary healthcare facilities, and (3) explore potential solutions through the strengthening of basic clinical competencies via Problem-Based Learning (PBL) and the utilization of medical informatics [11, 12].

Methods

Research Design and Procedures: This study employs a narrative review design [14]. A comprehensive literature search was conducted using electronic databases including PubMed, Scopus, and Web of Science. The search strategy utilized Boolean operators with the following keywords: ("traveler's fever" OR "acute undifferentiated fever") AND ("ecotourism" OR "tropical medicine") AND ("diagnostic challenges" OR "medical informatics").

Scope and Limitations: The inclusion criteria were restricted to peer-reviewed journal articles published in English and Indonesian within the last five years (2021–2026) to capture the most recent post-pandemic travel trends and pathogen resistance patterns. Exclusion criteria included non-peer-reviewed articles, opinion pieces, and studies focusing strictly on non-infectious travel emergencies. A total of 30 articles, comprising multicenter observational studies, systematic reviews, and medical education reports, were selected and analyzed to form the basis of this review.

Discussions

Epidemiological Profile and Major Etiologies Fever is the chief complaint in nearly 30% of travelers seeking medical attention upon returning from tropical regions [9]. The first challenge for clinicians is recognizing that the disease spectrum varies drastically based on the micro-geography of the ecotourism destination and the pathogen's incubation period.

- *Malaria:* Remains a "can't-miss diagnosis." The incubation period for *Plasmodium falciparum* ranges from 7-14 days but can be prolonged in patients taking inadequate chemoprophylaxis [10]. A major current challenge is the emergence of artemisinin-resistant strains, which alters empirical management algorithms.
- *Dengue and Arboviruses:* Dengue virus infection is the second most common cause of acute fever in returning travelers [11]. Prodromal dengue symptoms such as myalgia, cephalgia, and maculopapular rash are very difficult to distinguish from other systemic viral infections on days 1 to 3 of the fever.
- *Ecotourism-Related Zoonotic Diseases:* Travelers engaging in jungle trekking or river rafting have a high risk of exposure to Leptospirosis and Scrub Typhus. An eschar, which is a pathognomonic sign of Scrub Typhus, is often missed during physical examinations due to its hidden location in body folds [12].

Clinical Differential Diagnosis Challenges

Most pathogens causing traveler's fever manifest as an acute fever syndrome without clear focal localization. The overlap of symptoms makes empirical diagnosis highly prone to error.

Retro-orbital pain, thrombocytopenia, and leukopenia are classically associated with Dengue; however, these basic laboratory findings

are also common in the acute phases of Malaria, Typhoid, and Leptospirosis [13]. Establishing an empirical diagnosis based solely on clinical presentation has an accuracy rate of less than 40% in the first 72 hours [14]. Furthermore, foreign travelers are prone to more rapid hyperinflammation (cytokine storms) in primary infections compared to locals. The absence of protective IgG antibodies in the early phase of the disease often results in false-negative outcomes on conventional serological tests [15].

Table 1. Common Incubation Periods for Traveler's Fever Etiologies

Pathogen / Disease	Minimum Incubation	Maximum Incubation	Common Ecotourism Exposure
Dengue Virus	3 days	14 days	Urban and peri-urban mosquito bites
Plasmodium falciparum	7 days	30+ days (with prophylaxis)	Rural/Jungle mosquito bites
Leptospirosis	2 days	30 days	Fresh water, river rafting, caving
Scrub Typhus	6 days	21 days	Trekking through dense brush/vegetation

The Role of Medical Informatics

Detecting and managing traveler's fever relies heavily on detailed geo-medical anamnesis [29]. Facilities adopting standardized Electronic Medical Records (EMR) can significantly reduce diagnostic delays [16]. Integrating a travel history module equipped with a Geographic Information System (GIS) into the EMR can provide clinical decision support alerts to physicians [17]. For example, if a patient has recently returned from a high-rainfall endemic area, the EMR can automatically recommend specific examination

algorithms for Leptospirosis and Dengue, preventing over-reliance on broad-spectrum antibiotics.

Enhancing Competency through Medical Education

The high rate of misdiagnosing imported fevers is often due to a low index of suspicion among primary care physicians. Addressing this requires early intervention in medical education. The utilization of Problem-Based Learning (PBL) and Objective Structured Practical Examination (OSPE) checklists focused specifically on travel medicine has shown promising results [18, 19]. Within the Medical Education Unit (MEU) framework, exposing medical students to complex PBL scenarios—such as managing undifferentiated fever in an elderly tourist post-jungle trekking—enhances essential clinical reasoning skills and prepares future doctors for the realities of tourism-heavy regions [20].

Conclusion

Establishing the differential diagnosis of traveler's fever following tropical ecotourism remains one of the most complex challenges in primary care practice. The similarities in initial clinical presentations among Malaria, Dengue, Leptospirosis, and Rickettsial infections, coupled with the immunological responses of immunologically naive populations, lead to a high risk of misdiagnosis. The limited availability of rapid diagnostic panels further complicates early management. Therefore, strengthening precise geo-medical anamnesis, integrating EMR-based clinical decision support systems, and enhancing clinician competency through robust PBL scenarios in basic medical education are fundamental steps to safely mitigate morbidity in international travelers.

Author Contribution Statement

The authors performed all aspects of this study.

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