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Research Article

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Febrile Icteric Syndrome in Haiti: Surveillance Data, Diagnostic Challenges, and Implications for Health System Strengthening

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ABSTRACT

Background: Febrile icteric syndrome (FIS) represents a frequent and complex clinical presentation in tropical settings, encompassing multiple infectious etiologies. In Haiti, limited diagnostic capacity complicates etiological attribution and clinical management.

Methods: This narrative review integrates published literature with national laboratory surveillance data on leptospirosis (IgM) collected by the Directorate of Epidemiology, Laboratory and Research (DELR) between 2018 and 2025. Epidemiological, temporal, and geographical patterns were analyzed within a syndromic framework.

Results: A total of 7,105 leptospirosis test requests were recorded, with interpretable results available for 66.3% of cases. Overall positivity was 3.6%, higher among males, adults, and during the rainy season. Significant diagnostic delays were observed, limiting clinical utility. These findings are consistent with regional patterns reported in the Caribbean.

Conclusion: Leptospirosis represents a significant but under-recognized contributor to febrile icteric syndrome in Haiti. A syndromic approach integrating clinical algorithms, improved diagnostic capacity, and strengthened surveillance is essential to reduce misclassification and improve clinical outcomes.

Keywords: Febrile Icteric Syndrome, Leptospirosis, Surveillance, Haiti, One Health

Introduction

Febrile icteric syndrome (FIS), defined by the concurrent occurrence of acute fever and jaundice, represents a frequent and potentially severe clinical presentation in tropical and subtropical regions. It reflects hepatic, biliary, or hemolytic involvement arising from multiple etiologies—infectious or non-infectious—and poses major diagnostic challenges, particularly in resource-limited settings. In such environments, the diversity of circulating pathogens, the overlap of early clinical manifestations, and restricted access to specialized laboratory testing frequently result in empirical case management, with substantial consequences in terms of morbidity and mortality.

In low- and middle-income countries, FIS constitutes a common reason for medical consultation and hospitalization in both pediatric and adult populations. Evidence from tropical settings indicates that this syndrome is associated with a significant public health burden, especially when occurring in the context of comorbidities, malnutrition, or delayed diagnosis. In Haiti, a country characterized by pronounced health, environmental, and socio-economic vulnerabilities, FIS remains an insufficiently documented public health problem despite its apparent frequency in healthcare facilities.

From an etiological standpoint, febrile icteric syndrome encompasses a broad spectrum of infectious diseases. Acute viral hepatitis—particularly hepatitis A, B, and E—has traditionally been regarded as the predominant cause of FIS in many tropical regions. However, this diagnostic focus tends to obscure the contribution of other infectious conditions that may be equally prevalent but are less systematically investigated. Consequently, in numerous settings, a substantial proportion of FIS cases remains classified as being of undetermined etiology, reflecting the limitations of existing diagnostic strategies.

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Beyond viral hepatitis, a variety of bacterial, parasitic, and zoonotic infections may present as febrile icteric syndrome. Severe malaria, certain bacterial septicemias, viral hemorrhagic fevers, and emerging or neglected bacterial zoonoses have all been reported as causes of acute febrile jaundice. These conditions often share non-specific clinical features, making etiological differentiation difficult on clinical grounds alone, particularly during the acute phase of illness.

In this context, a syndromic approach emerges as a particularly relevant analytical framework for addressing FIS. Rather than considering individual diseases in isolation, this approach integrates multiple potential etiologies within a broadened differential diagnosis that accounts for local epidemiological realities. It is especially well suited to health systems constrained by limited diagnostic capacity, as it promotes rational prioritization of etiological hypotheses and more efficient use of available resources.

In the Caribbean region, and particularly within the Greater Antilles, several studies have highlighted the etiological diversity underlying acute febrile jaundice. Research conducted in Cuba, the Dominican Republic, Jamaica, and other Caribbean territories has underscored the significant contribution of certain bacterial zoonoses to these syndromes, particularly in contexts characterized by environmental conditions favorable to transmission, such as heavy rainfall, flooding, and unplanned urbanization.

Among these zoonotic infections, some diseases long considered rare or anecdotal now appear to be substantially underdiagnosed, largely due to weaknesses in biological surveillance systems and their limited integration into routine clinical algorithms. This situation contributes to underestimation of the true disease burden and may result in suboptimal management of patients presenting with febrile icteric syndrome.

In Haiti, available data on the etiological spectrum of FIS remain fragmented. Published studies have primarily focused on specific diseases, without consistently adopting a comprehensive syndromic perspective. Moreover, limited access to specialized laboratory testing, delays in result reporting, and heterogeneity in diagnostic practices constitute major barriers to accurate characterization of the causes of febrile icteric syndrome.

Against this background, the present article provides a synthesis review of febrile icteric syndrome in Haiti, with the objective of analyzing its epidemiological profile, diagnostic challenges, and implications for health system strengthening. Drawing on regional and international literature, as well as national laboratory surveillance data from the Directorate of Epidemiology, Laboratory and Research (DELR), this study aims to illustrate the contribution of selected biologically confirmed infectious etiologies to the overall FIS landscape, without focusing on a single disease.

The overarching objective is to highlight the relevance of FIS as an analytical and operational framework capable of improving recognition of underdiagnosed infectious causes, guiding diagnostic strategies, and strengthening integrated surveillance of acute febrile jaundice in Haiti

Literature Review

Febrile Jaundice Syndrome: Definitions and Pathophysiological Basis

Febrile jaundice syndrome (FJS) is classically defined by the association of acute fever and jaundice, reflecting hepatic, biliary, or hemolytic involvement of infectious or non-infectious origin (World Health Organization [WHO], 2014). In tropical settings, this clinical presentation is particularly frequent and represents a complex diagnostic challenge due to the substantial overlap of clinical manifestations across multiple diseases.

From a pathophysiological perspective, jaundice in FJS may result from acute hepatocellular injury, intrahepatic or extrahepatic cholestasis, or extensive hemolysis. These mechanisms may be induced by viral, bacterial, or parasitic pathogens, as well as by severe systemic inflammatory responses (Bernuau & Durand, 2018). Fever, in turn, reflects a non-specific host immune response common to many tropical infections. The coexistence of these mechanisms largely explains the clinical non-specificity of FJS and the difficulty of rapid etiological identification in the absence of appropriate laboratory investigations.

Epidemiology of Febrile Icteric Sydrom in Tropical Settings

In tropical and subtropical countries, FJS represents a frequent cause of outpatient consultation, hospitalization, and, in some cases, death—particularly among vulnerable populations such as children, pregnant women, and older adults (Reddy et al., 2019). However, its true burden remains difficult to estimate due to the absence of standardized syndromic surveillance systems and the limited availability of etiological diagnostic tools.

Several studies conducted in sub-Saharan Africa, Southeast Asia, and Latin America indicate that a substantial proportion of FJS cases remain classified as of undetermined origin, even in tertiary referral hospitals. This situation reflects not only technical constraints but also diagnostic approaches often focused on a limited number of priority etiologies, particularly viral hepatitis.

In the Caribbean region, epidemiological data specifically addressing FJS are relatively scarce. Nevertheless, available studies suggest an etiological diversity comparable to that observed in other tropical regions, with variable contributions from viral hepatitis, parasitic infections, and systemic bacterial infections (Pan American Health Organization [PAHO], 2021).

Acute Viral Hepatitis: Dominant but Insufficient Causes

Acute viral hepatitis—particularly hepatitis A, B, and E—has historically been considered the leading cause of FJS in low-resource settings (WHO, 2017). Their high prevalence, modes of transmission often linked to poor sanitary conditions, and typical clinical presentation explain their predominance in diagnostic algorithms. However, several studies have shown that an almost exclusive focus on viral hepatitis leads to under-recognition of other FJS etiologies. In some hospital-based series, viral hepatitis accounts for only a fraction of confirmed cases, leaving a substantial proportion of patients without a precise etiological diagnosis (Fitzpatrick et al., 2018). This situation is especially concerning when non-viral etiologies are potentially curable, such as certain bacterial infections, for which early treatment can significantly reduce mortality.

Bacterial and Parasitic Infections Associated with FJS

Beyond viral hepatitis, several bacterial and parasitic infections may present as febrile icteric sydrom. Severe malaria, particularly due to Plasmodium falciparum, is a well-documented cause of febrile jaundice, involving combined mechanisms of hemolysis and hepatic injury (White et al., 2014). Certain bacterial septicemias, including invasive salmonellosis and Rickettsia infections, may also be accompanied by jaundice and fever. In such cases, jaundice often serves as a marker of disease severity and multiorgan dysfunction (Parry et al., 2015). However, these causes are rarely investigated systematically in low-resource settings, contributing to empirical management strategies and an underestimation of their true impact within the spectrum of FJS.

Bacterial Zoonoses and Febrile Icteric Sydrom

Bacterial zoonoses occupy a particular place among the causes of FJS in tropical environments. Their transmission is closely linked to environmental, climatic, and socioeconomic factors, including exposure to animal reservoirs, flooding, unplanned urbanization, and agricultural activities (Hotez et al., 2014). Among these zoonoses, leptospirosis is one of the most widespread globally. It is recognized as a major cause of acute febrile illness in tropical regions and may progress to severe forms characterized by jaundice, renal failure, and hemorrhage—classically described as Weil's disease (Levett, 2001). The initial clinical presentation of leptospirosis is often non-specific, mimicking viral hepatitis, malaria, or other acute febrile infections. This clinical similarity substantially contributes to its underdiagnosis, particularly in settings with limited diagnostic capacity.

Leptospirosis in the Greater Antilles: Current State of Knowledge

In the Greater Antilles, several studies have documented active circulation of leptospirosis and its role in acute febrile syndromes, including icteric forms. In Cuba, the Dominican Republic, and Jamaica, leptospirosis is recognized as an endemic disease, with seasonal peaks associated with periods of heavy rainfall and flooding (Everard & Everard, 1993; Brown et al., 2020).

These studies highlight recurring epidemiological patterns, characterized by male predominance, increasing risk with age, and associations with specific occupational activities or living conditions. Despite these findings, leptospirosis remains insufficiently integrated into diagnostic algorithms for febrile jaundice in many countries of the region.

In Haiti, published data on leptospirosis are scarce and often limited to sporadic studies or small clinical series. This scarcity contrasts with the environmental and socioeconomic conditions favorable to disease transmission, suggesting a likely underestimation of its true burden.

Diagnostic Gaps and the Value of an Integrated Syndromic Approach

The literature review highlights several major gaps in the management of febrile icteric sydrom in tropical settings. These include limited access to laboratory diagnostics, delays in obtaining results, and the lack of systematic integration of certain etiologies into standard clinical algorithms (WHO, 2020).

In this context, a syndromic approach emerges as a strategic tool to improve the recognition of underdiagnosed causes of FJS. By integrating biological surveillance data—such as those generated by national reference laboratories—this approach can reduce diagnostic uncertainty and more effectively guide prevention and clinical management strategies.

Methods

Study Type and Setting

This study is a synthesis paper combining a narrative review of the scientific literature and a secondary descriptive analysis of laboratory surveillance data, with the aim of clarifying the issue of febrile icteric syndrome (FIS) in Haiti. The methodological approach adopted is syndromic, centered on the clinical presentation combining acute fever and jaundice, regardless of any initially presumed etiology. This choice aims to move beyond mono-etiological analyses and to better reflect the clinical and diagnostic reality observed in resource-limited settings.

Literature Review

Documentary Search Strategy

A narrative literature review was conducted to identify relevant publications related to febrile icteric syndrome, its main infectious etiologies, and leptospirosis in tropical and Caribbean settings.

The PubMed/MEDLINE, Scopus, and Google Scholar databases were consulted. Technical reports and institutional documents from the World Health Organization (WHO) and the Pan American Health Organization (PAHO) were also included.

Keywords used alone or in combination included: febrile jaundice, acute febrile icteric syndrome, leptospirosis, viral hepatitis, zoonoses, Caribbean, and Haiti.

Inclusion and Exclusion Criteria

Included were:

- original studies, narrative reviews, and systematic reviews;
- publications addressing febrile icteric syndrome or comparable clinical presentations;
- conducted in tropical regions, particularly in the Caribbean;
- documents published in French or English.

Excluded were publications not directly related to a syndromic approach or those not allowing meaningful interpretation in the Haitian context.

Source and Nature of Leptospirosis Data

Institutional Origin of Data

The quantitative data analyzed in this study originate exclusively from the Directorate of Epidemiology, Laboratory and Research (DELR) of the Ministry of Public Health and Population of Haiti, the national structure responsible for laboratory surveillance of priority diseases.

No data from clinical facilities or care centers—including the GHESKIO Centers—were used for leptospirosis analysis in this study.

Study Period and Type of Testing

Data cover the period from March 6, 2018 to May 31, 2025 and include all leptospirosis serologic test requests (IgM) recorded by the DELR as part of the national laboratory surveillance

system.

Detection of anti-Leptospira IgM antibodies was used as an indicator of recent or ongoing infection in a clinical context compatible with acute infection.

Study Population and Variables Analyzed

The study population includes all individuals for whom a leptospirosis test request was recorded by the DELR during the study period, regardless of the site of clinical care.

Variables analyzed included:

- sex;
- age;
- department of origin;
- sample collection date;
- date of laboratory reception;
- date of result validation;
- serologic result (positive or negative).

Incomplete records were considered in the descriptive analysis of data completeness.

Data Analysis

A descriptive analysis was conducted to:

- assess database completeness;
- estimate overall and stratified positivity according to demographic characteristics;
- describe the geographic distribution of tests and positive results;
- analyze temporal distribution and seasonality;
- examine delays between sample collection, laboratory reception, and result validation.

Results are presented as proportions, medians, and interquartile ranges (IQR), depending on the type of variables analyzed.

Integration of DELR Data Within the Syndromic Framework

Leptospirosis data from the DELR were integrated analytically within the broader febrile icteric syndrome framework. They are not intended to estimate population incidence of leptospirosis, but rather to illustrate the contribution of a biologically confirmed bacterial etiology among potential causes of FIS in Haiti.

This integration helps clarify current limitations of etiological diagnosis and highlights the value of strengthened laboratory surveillance within a syndromic approach.

Ethical Considerations

The data used in this study consist of anonymized secondary data derived from routine surveillance activities. No personally identifiable information or data allowing direct patient identification were used. In accordance with prevailing practices, the analysis of these data did not require individual informed consent or specific ethical approval, as it falls within the scope of public health objectives and secondary research.

Methodological Limitations

Several limitations should be considered when interpreting the results. The analysis is based on requests for biological testing rather than on clinically documented cases of febrile icteric sydrom. The completeness of biological test results is imperfect, and the exclusive reliance on IgM serology may limit the detection of early-stage infections.

These limitations are inherent to the use of routine biological surveillance data; however, they do not undermine the descriptive and operational value of the findings within a syndromic surveillance perspective.

Results

Overview of Available Data within the Syndromic Framework

The results are presented within a syndromic approach to febrile icteric syndrome (FIS) and are based on the analysis of national laboratory surveillance data from the Directorate of Epidemiology, Laboratory and Research (DELR). Within this framework, FIS is considered a clinical entity integrating several infectious etiological groups (viral hepatitis, parasitic infections, systemic bacterial infections, and zoonoses), as well as a substantial proportion of cases remaining of undetermined etiology due to diagnostic limitations. Figure 4 illustrates this overall syndromic framework and positions leptospirosis as one biologically documented etiology among other potential causes of FIS in Haiti.

The data analyzed concern exclusively leptospirosis serologic testing (IgM) and are used here to illustrate a biologically confirmed infectious etiology among the potential causes of FIS in Haiti. The results are not intended to estimate population incidence of leptospirosis, but rather to describe current laboratory detection capacity and associated demographic, geographic, and temporal patterns.

Database Description and Completeness

Between March 6, 2018 and May 31, 2025, a total of **7,105 leptospirosis IgM test requests** were recorded by the DELR. The sex distribution included **3,792 females (53.4%), 3,204 males (45.1%),** and **109 records (1.5%)** with missing sex information. The median age of tested individuals was **10 years** (interquartile range [IQR]: 3–29). An interpretable result (positive or negative) was available for **4,712 test requests,** corresponding to an analytical completeness of **66.3%.** The remaining records reflected missing, indeterminate, or non-validated results at the time of data extraction.

Overall Positivity and Contribution of Leptospirosis

Among the 4,712 interpretable results, **170 IgM tests were positive,** corresponding to an overall positivity of **3.6%.** Within a syndromic perspective, this proportion—although moderate—has particular significance, as it is based on biological confirmation in a context where many febrile icteric syndromes are managed without formal etiological diagnosis.

Demographic Profile of Positive Cases

Positivity was higher among males **(4.9%)** than females **(2.5%).** The median age of positive cases was **29 years** (IQR: 18–46), substantially higher than that of the overall tested population.

A progressive increase in positivity with age was observed (Table 2), suggesting cumulative exposure to risk factors compatible with environmental and occupational determinants associated with icteric forms of zoonotic infections.

Geographic Distribution

The highest testing volumes originated from the Ouest (OST:

1,451 tests), Artibonite (ART: 861), Centre (CEN: 603), and Nord-Est (NIP: 501) departments. The highest positivity rates were observed in Centre (5.8%), Artibonite (4.4%), Nord-Est (3.8%), and Ouest (3.3%).

This distribution highlights marked spatial heterogeneity in risk, suggesting the influence of environmental, climatic, and socio-economic factors in the occurrence of leptospirosis-associated FIS.

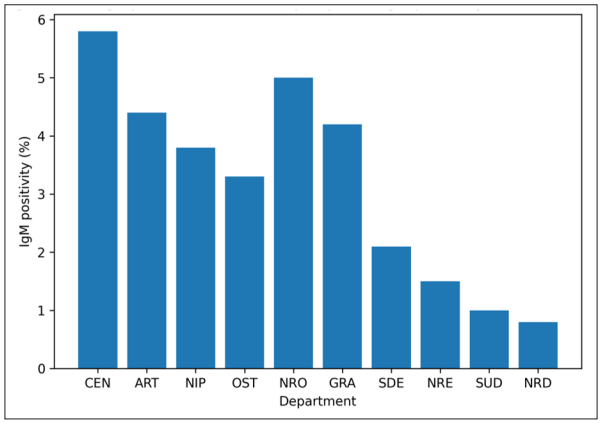

Figure 1: Geographic Distribution of Leptospirosis IgM Positivity by Department.

Temporal distribution and seasonality

Annual testing volumes were highest in **2018 and 2019,** followed by a gradual decline in subsequent years. A marked seasonal pattern was observed, with higher positivity during the **rainy season (4.1%)** compared with the **dry season (2.8%).** The months with the highest positivity were **April, May, and June.** This temporal pattern is consistent with known environmental transmission mechanisms of leptospirosis and reinforces its plausibility as a cause of acute febrile jaundice in Haiti. **Figures 2 and 3** present annual trends in testing and positivity, as well as monthly distribution and seasonality.

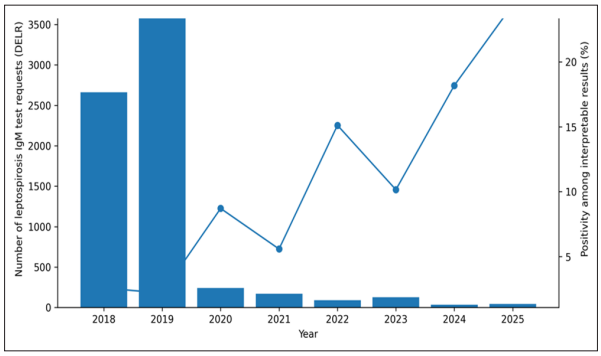

Figure 2: Annual distribution of leptospirosis IgM test requests and positivity, Haiti, 2018–2025

Legend: Bars represent the total number of IgM test requests per year, while the line indicates the percentage of positive results among interpretable tests. Data source: Directorate of Epidemiology, Laboratory and Research (DELR), Haiti.

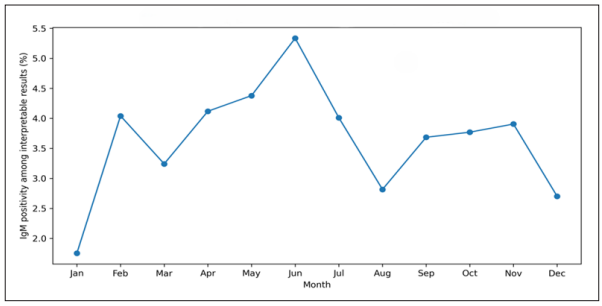

Figure 3: Monthly Distribution of Leptospirosis IgM Positivity and Seasonality, Haiti.

The figure illustrates monthly variations in IgM positivity rates, highlighting higher positivity during the rainy season, particularly between April and June. Percentages are calculated among interpretable test results. A clear seasonal pattern was observed, with higher positivity during the rainy months (Figure 2).

Diagnostic delays

The median delay between sample collection and laboratory reception was **1 day** (IQR: 1–3). In contrast, the median delay between sample collection and validation of laboratory results was **18 days** (IQR: 13–25), with extreme values reaching **199 days.** These delays substantially limit the clinical usefulness of biological diagnosis for the immediate management of patients presenting with febrile icteric syndrome.

Synthesis of Results within the Syndromic Approach

Taken together, the DELR data highlight:

- documented circulation of leptospirosis in Haiti;
- a measurable contribution of this infection to acute febrile illnesses with potential jaundice;
- probable underestimation of the true burden due to diagnostic limitations and reporting delays;
- demographic, geographic, and seasonal patterns consistent with regional data from the Greater Antilles.

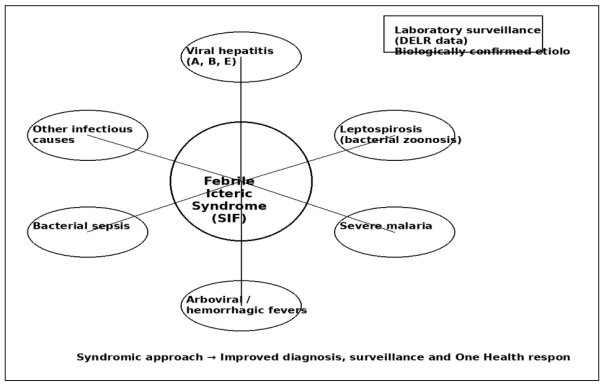

Figure 4: Conceptual Framework of Febrile Icteric Sydrom (SIF) Etiologies in Haiti illustrates febrile icteric sydrom as a central clinical entity encompassing multiple infectious etiological groups reported or suspected in Haiti and the Greater Antilles. These include viral hepatitis, parasitic infections, bacterial zoonoses (with leptospirosis biologically documented through national surveillance data), other bacterial infections, and undetermined etiologies related to diagnostic limitations.

Discussion

Contribution of National Surveillance Data to the Syndromic Analysis of FIS in Haiti

This study provides a structured contribution to the understanding of febrile icteric syndrome (FIS) in Haiti by combining an in-depth narrative review of the literature with the integration of national laboratory surveillance data from the Directorate of Epidemiology, Laboratory and Research (DELR). By explicitly adopting a syndromic approach, it moves beyond mono-etiological analyses and more accurately reflects the clinical and epidemiological complexity of acute febrile jaundice in a resource-limited context.

The conceptual framework presented (Figure 4) positions FIS as a central clinical entity resulting from the convergence of multiple infectious etiological groups, including viral hepatitis, parasitic infections, systemic bacterial infections, and zoonoses. Within this framework, leptospirosis emerges not as the primary focus of the study, but as one of the few bacterial etiologies for which biologically confirmed national data are available, illustrating both the potential and the current limitations of laboratory surveillance in Haiti.

Contribution of Leptospirosis to the Etiological Spectrum of FIS

The overall leptospirosis positivity observed in this study (3.6%) may appear modest in absolute terms. However, from a syndromic perspective, this proportion is particularly meaningful, as it is based on biological confirmation in a context where a large proportion of febrile icteric syndromes are managed without formal etiological diagnosis.

These findings suggest that leptospirosis represents a documented but likely underestimated cause of acute febrile jaundice in Haiti. This underestimation is consistent with reports from other tropical and Caribbean settings, where leptospirosis remains largely underdiagnosed due to non-specific clinical presentations, limited access to laboratory testing, and persistent logistical constraints.

Demographic Patterns and Clinical Implications for FIS

The higher positivity observed among males and the progressive increase in positivity with age are consistent with epidemiological profiles described for bacterial zoonoses. These patterns suggest cumulative exposure to environmental and occupational risk factors, particularly among adults.

The contrast between the relatively low median age of tested individuals and the higher median age of confirmed positive cases warrants particular attention. It indicates that clinical suspicion of FIS is frequent in children, whereas the likelihood of biological confirmation of a bacterial etiology is higher in adults. This dissociation underscores the importance of an expanded differential diagnosis of FIS in adults, particularly when viral hepatitis is not confirmed or when clinical evolution is atypical.

Geographic Distribution and Environmental Determinants

The geographic heterogeneity observed in both testing volumes and positivity rates likely reflects a combination of differences in environmental exposure and inequalities in access to laboratory diagnosis. Departments with higher positivity rates are also characterized by conditions conducive to zoonotic transmission, such as unplanned urbanization, inadequate waste management, and vulnerability to flooding.

From a syndromic perspective, these findings suggest that FIS may serve as an indirect indicator of interactions between environmental conditions, living environments, and infectious diseases, reinforcing its relevance as a tool for integrated public health surveillance.

Seasonality and Sentinel Value of FIS

The marked seasonality observed, with higher positivity during the rainy season, is consistent with known environmental transmission mechanisms of leptospirosis. This seasonal dynamic confers particular sentinel value to FIS in high-risk climatic contexts. Operationally, these results support increased vigilance for acute febrile jaundice occurring during the rainy season, a period during which bacterial zoonoses should be systematically included in the differential diagnosis, alongside viral hepatitis and arboviral infections.

Diagnostic Delays and limitations of Biological Confirmation

One of the major findings of this analysis concerns the prolonged delays observed between sample collection and validation of laboratory results. A median delay of 18 days is largely incompatible with the clinical management requirements of acute febrile jaundice, which often demand rapid therapeutic decision-making.

This situation highlights a structural paradox: although some causes of FIS—particularly bacterial infections—are potentially treatable, laboratory system constraints limit their effective clinical recognition. In this context, the syndromic approach retains its full relevance, enabling rational probabilistic management when clinical and epidemiological conditions are suggestive.

Strategic Value of an Integrated Syndromic Approach to FIS

Beyond leptospirosis, this study underscores the strategic value of FIS as an analytical and operational framework for improving recognition of underdiagnosed infectious causes in Haiti. By integrating clinical, biological, and environmental data, FIS can be considered a relevant sentinel tool for strengthening surveillance of emerging or neglected infectious diseases. Leptospirosis thus appears as a revealing condition at the intersection of climatic, environmental, socio-economic, and health system organizational factors. Its systematic integration into FIS diagnostic algorithms could reduce the proportion of cases classified as of undetermined etiology and improve the overall relevance of clinical management.

Scope and Interpretation of the findings

Although subject to limitations inherent to routine laboratory surveillance data, this analysis relies on a robust and longitudinally coherent institutional dataset. It therefore provides high descriptive and operational value, useful for clinical practice, epidemiological surveillance, and public health policy orientation.

Conclusion

Febrile icteric syndrome represents a major public health problem in Haiti, situated at the intersection of multiple potentially severe infectious diseases whose etiological distinction remains complex in a context of limited diagnostic resources. This

synthesis review highlights the persistent challenges associated with the classical etiological approach to FIS, characterized by restricted availability of laboratory testing, diagnostic delays incompatible with clinical urgency, and fragmented surveillance.

By adopting an explicitly syndromic approach, this study emphasizes the value of considering FIS as an integrative clinical entity reflecting the co-circulation of multiple infectious etiological groups, including viral hepatitis, parasitic infections, systemic bacterial infections, and zoonoses. The proposed conceptual framework repositions FIS as a relevant analytical and operational tool to improve recognition of underdiagnosed infectious causes and to guide more effective clinical management.

The integration of national laboratory surveillance data from the Directorate of Epidemiology, Laboratory and Research (DELR) provides original insight into certain components of the FIS etiological spectrum. Without constituting the primary focus of the study, leptospirosis emerges—through biologically confirmed data—as a documented but likely underestimated cause of acute febrile jaundice in Haiti. Its demographic, geographic, and seasonal profile, consistent with patterns observed in the Greater Antilles and other tropical regions, reinforces the plausibility of its role within the FIS landscape.

Beyond this specific etiology, the findings highlight structural limitations of the diagnostic and surveillance system, particularly regarding result turnaround times and data completeness. These constraints reduce the clinical impact of etiological diagnosis and reinforce the need for integrated syndromic management protocols allowing timely and appropriate therapeutic decisions, especially in high-risk contexts.

Ultimately, improving the management of febrile icteric syndrome in Haiti depends less on focusing on a single etiology than on strengthening the health system's overall capacity to identify, document, and respond effectively to the diversity of underlying causes. Viewed as a sentinel indicator, FIS offers a strategic opportunity to enhance integrated surveillance, improve quality of care, and support evidence-based public health action within a resolutely interdisciplinary and One Health perspective.

Très bien. Je poursuis avec la **Section 7 – Recommandations**, en **anglais académique standard,** fidèle au texte français et adaptée à une revue scientifique [1-9].

Recommendations

Strengthening Clinical and Laboratory Diagnosis

- Systematically integrate febrile icteric syndrome (FIS) into national algorithms for the management of acute febrile illnesses, using a differentiated approach according to epidemiological and seasonal context.
- Improve access to priority laboratory tests for the main etiologies of FIS (viral hepatitis, leptospirosis, malaria, hemorrhagic fevers), particularly in departments with a high burden of morbidity.
- Reduce delays in validation and transmission of laboratory results in order to ensure effective use of diagnostic data in clinical decision-making.

Improving Integrated Epidemiological Surveillance

- Consolidate the role of the Directorate of Epidemiology, Laboratory and Research (DELR) as the central structure for laboratory surveillance and analysis of data related to infectious syndromes.
- Develop strengthened syndromic surveillance of FIS, integrating clinical, laboratory, and environmental data.
- Use FIS data as an early warning signal for the detection of emerging or re-emerging infectious diseases, particularly during the rainy season.

Strengthening Health System Capacity

Train clinicians in a rational syndromic approach, including recognition of clinical presentations suggestive of bacterial zoonotic infections.

- Strengthen the capacity of national and peripheral laboratories in terms of human resources, equipment, and logistics.
- Improve coordination between healthcare facilities, laboratories, and epidemiological surveillance authorities.

Research Perspectives and one Health Approach

- Encourage complementary studies aimed at better documenting the relative contribution of different etiologies of FIS in Haiti.
- Promote research integrating human, animal, and environmental dimensions, in line with the One Health approach, to better understand risk determinants.
- Leverage existing surveillance data to inform prevention policies and epidemic preparedness strategies.

Declarations

Acknowledgments

We express our gratitude to the staff of the Direction of Epidemiology, Laboratory and Research **(DELR)** of the Ministry of Health and Population in Haiti for the data on. **Febrile Icteric Syndrome in Haiti.**

Conflicts of Interest

Both authors declared that there are no conflicts of interest.

Ethical Approval and Consent to Participate

Not applicable

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