Journal of Infection and Public Health 19 (2026) 103054

Contents lists available at ScienceDirect

Journal of Infection and Public Health

journal homepage: www.elsevier.com/locate/jiph

Original Article

High hepatitis B exposure and HIV prevalence but no evidence of HDV among Haitian migrants in Chile: A cross-sectional study

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ARTICLE INFO

Article history:
Received 3 August 2025
Received in revised form 9 November 2025
Accepted 11 November 2025

Keywords:
Hepatitis B virus
Haitian migrants
HIV infection
Seroepidemiology
Hepatitis D virus
Chile

ABSTRACT

Background: Haitian migration to Chile has increased in recent years, raising public health concerns regarding viral hepatitis and HIV. Haitian migrants exhibit a distinct epidemiological profile compared to the native population, particularly for hepatitis B.
Methods: We conducted a cross-sectional study of 856 Haitian-born adults residing in urban Chile from January 2018 to January 2025. Data were collected via structured interviews, physical examinations, and serological testing for HBsAg, total anti-HBc (including anti-HBc IgM), anti-HAV, anti-HEV, anti-HCV, anti-HDV, and HIV antibodies.
Findings: The mean age was 34 ± 9 years, with 56.6 % females. HBsAg positivity was 3.1 %, and anti-HBc positivity reached 34.3 %, while anti-HBc IgM was detected in 0.24 % of participants. HDV was not found in any of the anti-HBc positive samples. HAV seroprevalence was nearly universal (96.7 %), anti-HEV antibodies were present in 9.34 %, HCV prevalence was 0.36 %, and HIV-1 was identified in 1.71 %.
Interpretation: Haitian migrants in Chile carry a significantly higher burden of HBV exposure and HIV infection than native Chileans, emphasizing the need for targeted screening, vaccination, and culturally sensitive public health interventions.

Introduction

Haiti has long been characterized by the high endemicity of certain viral hepatitis infections, most notably hepatitis A (HAV) and B (HBV) viruses, while hepatitis C virus (HCV) remains relatively uncommon [1]. Available information about the epidemiology of hepatitis in Haiti and the Caribbean over the past 30 years shows that HAV exposure is nearly universal in childhood—though improvements in sanitation have led to immunity gaps among adolescents and adults, heightening the risk of outbreaks [2]. In contrast, HBV in Haiti exhibits intermediate endemicity, with adult HBsAg prevalence averaging around 3.5 %, a figure that has declined gradually following the introduction of infant vaccination in 2012 [3]. Interestingly, there is no available information regarding hepatitis D virus (HDV) infection prevalence in this population. There is a low prevalence of HCV (< 1 %) [4] while emerging data suggest that HEV exposure—historically low—may be increasing among migrants due to exposure during transit or in settings with inadequate sanitation [2].

Haitian migrants may carry the epidemiological legacy of their country of origin, characterized by socioeconomic challenges, limited healthcare access, and suboptimal vaccination coverage,

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https://doi.org/10.1016/j.jiph.2025.103054

contributing to higher risks of viral hepatitis and human immunodeficiency virus type 1 (HIV-1) [5]. The purpose of this study is to determine the prevalence of hepatotropic viruses and HIV-1 among Haitian migrants residing in Chile, identify associated epidemiological patterns, and inform targeted public health interventions aimed at reducing disease burden and transmission risks in this vulnerable population.

This study builds upon our previous report of 498 Haitian migrants in Chile, where we described the burden chronic diseases and the prevalence of HBV, HCV, and HIV infection [6]. In the present analysis, we substantially expand both the cohort (n = 856) and the scope of viral infections assessed. By including HAV, HEV, and HDV, we provide the first comprehensive profile of hepatotropic viruses in this population, and to our knowledge, the first systematic evaluation of HDV among Haitian migrants. While HAV and HEV differ in their transmission pathways, they are of major public health relevance given the sanitary vulnerabilities of migrant settings. Thus, this study not only updates prior prevalence estimates with greater precision but also addresses critical knowledge gaps with direct implications for prevention and health policy.

Given that Haitian migration is a global phenomenon [7]—with substantial diaspora communities established in North America, Europe, and other regions—the findings of this study may yield critical insights extending beyond Chile [8]. Such insights can potentially inform public health policies and enhance targeted interventions across diverse settings that host Haitian migrant populations [9].

Methods

Study design

A cross-sectional study was conducted to assess the seroprevalence of hepatotropic viruses among Haitian migrants residing in Chile. Data were obtained through structured interviews and serological testing, enabling a comprehensive analysis of prevalence rates and associated risk factors. This investigation represents an extension of our previously published study in the same population [6], with an expanded sample size and the inclusion of additional viral markers.

Setting

The study was conducted from January 2018 to January 2025 in urban areas of Chile with substantial Haitian migrant populations, specifically in Santiago, the Metropolitan, and the Valparaíso Region. Participants were recruited, and data was collected in community-based locations such as churches, municipal facilities, and community outreach events organized in collaboration with Haitian community leaders to ensure diverse and representative participation. Initially, between 2018 and 2020, 498 participants were recruited, and the epidemiological profile of infectious diseases, including HIV-1, HBV, and HCV prevalences, was previously published [6]. In the current study, we have increased the number of participants and expanded the investigation to include additional hepatotropic viruses (HAV, HEV, and HDV), aiming for a more comprehensive understanding of the infectious disease burden within this migrant community. We report prevalences for the complete set of data.

Inclusion and exclusion criteria

Inclusion criteria comprised Haitian-born adults aged 18 years or older residing in Chile who provided informed consent and completed both the questionnaire and blood sampling. Individuals who declined blood testing or did not meet the age or consent criteria were excluded.

Variables

Primary outcomes included serological markers for hepatitis B (HBsAg, total anti-HBc, and anti-HBc IgM), hepatitis A (anti-HAV), hepatitis E (anti-HEV), hepatitis C (anti-HCV), hepatitis D (anti-HDV) and HIV-1/2. Blood pressure was measured using a calibrated automatic monitor (Omron HEM-7311 BP7100, Kyoto, Japan) after the patient had been seated for at least 5 min and before obtaining a venous blood sample; hypertension was defined as a systolic pressure > 140 mmHg and/or a diastolic pressure > 90 mmHg, with patients previously diagnosed with hypertension or taking antihypertensive medications also considered hypertensive [10]. Nutritional status was assessed by recording weight, height, and waist circumference according to WHO recommendations [11]; body mass index (BMI) was calculated by dividing weight in kilograms by the square of height in meters and classified as follows: BMI < 18.5 indicating malnutrition, 18.5–25 kg/m^2 as normal, 25–30 kg/m^2 as overweight, and > 30 kg/m^2 as obesity [11], with an abdominal circumference greater than 88 cm in women and 102 cm in men considered elevated (waist circumference was also measured in pregnant women). Fasting blood glucose was measured, with levels ≥ 100 mg/dL but < 126 mg/dL considered abnormal and values ≥ 126 mg/dL and/or self-reported diabetes defining diabetes mellitus. Serological tests were performed at the Central Laboratory of the UC-CHRISTUS Health Network. Hepatitis A antibodies were assessed with the Abbot Alinity i HAVAb-IgG assay; HBsAg was assessed with the Abbott Alinity i HBsAg Qualitative II; total anti-HBc antibodies with the Abbot Alinity i, Anti-HBc II; anti-HBc IgM antibodies with the Abbot Alinity i Anti-HBc IgM assay. Total anti-HBc was measured in all participants. Anti-HBc IgM was performed as an immediate reflex assay only when total anti-HBc was reactive; IgM was not assayed in anti-HBc-negative samples. For reporting, IgM prevalence is expressed over the same denominator as total anti-HBc to ensure comparability across HBV markers. Hepatitis C antibodies with the Alinity i Anti-HCV assay [12,13]. Abbott Alinity assays are from Abbott Laboratories, Chicago, IL, USA. All anti-HCV reactive specimens were referred to the National Reference Laboratory (Instituto de Salud Pública, ISP) for confirmatory testing (Roche COBAS® AmpliPrep/COBAS® TaqMan® HCV Test, v2.0, Roche Diagnostics, Basel, Switzerland). Confirmation HDV antibodies were assessed in all samples positive for HBsAg and/or anti-HBc using the LIAISON XL MUREX ANTI-HDV kit (DiaSorin S.p.A., Saluggia, Italy) [14]. Hepatitis E antibodies were assessed with the WANTAI HEV-IgG ELISA assay (Beijing Wantai Biological Pharmacy Enterprise Co., Ltd., Beijing, China) [15]. HIV antibody/antigen screening was performed using the Abbott Alinity i HIV Ag/Ab Combo assay. All reactive specimens were referred to the National Reference Laboratory (Instituto de Salud Pública, ISP) for confirmatory testing. Confirmation required concordant reactivity in at least two independent serological methods (e.g., immunoblot, line immunoassay, or alternative immunoassays). Only cases meeting confirmatory criteria were classified and reported as HIV positive. In addition, demographic variables (e.g., age, sex, duration of residence, educational level, and language proficiency) were collected to serve as potential predictors or confounders.

Data sources/measurement

Data were obtained via structured interviews adapted from the Chilean National Health Survey [16] and through physical examinations that recorded blood pressure and anthropometric measurements. Study data were collected and managed using REDCap electronic data capture tools (Vanderbilt University, Nashville, TN, USA) hosted at Pontificia Universidad Católica de Chile [17,18]. Venous blood samples were drawn from all participants and processed using standardized enzyme-linked immunosorbent assay (ELISA)

protocols in a certified laboratory. All procedures were standardized to ensure measurement consistency across participants.

Bias reduction

To minimize potential bias, participants were recruited from diverse communities and settings outside the healthcare system, participation was clearly separated from any expectation of treatment, only minimal reimbursement for transportation was provided, and strict confidentiality safeguards were implemented to prevent concerns about immigration status or deportation, as previously reported [6]. Laboratory analyses were conducted by personnel blinded to participants' clinical and demographic data.

Study size

The primary outcome of interest was the prevalence of HBsAg among Haitian migrants, anticipated to be around 3 %. We used the standard sample size calculation for a single proportion based on the normal approximation (Wald formula) to determine that approximately 500 participants would be necessary to achieve a 95 % confidence level with a ± 1.5 %age point margin of error. To account for potential non-response missing data and to ensure sufficient power for subgroup analyses (e.g., by age and sex), the final sample size was determined to be 856 participants. Because no reliable prevalence estimates were available for other markers (HAV, HEV, HDV, HCV, HIV), independent calculations were not feasible. To enhance power for secondary analyses, we deliberately recruited a larger cohort.

Sampling was non-probabilistic, relying on voluntary participation through community outreach and invitations, which allowed us to capture a broad cross-section of the Haitian migrant population.

Quantitative variables and statistical methods

Continuous variables were presented as means with standard deviations, and categorical variables as frequencies and percentages. Prevalence rates were calculated overall and stratified by sex. Between-group comparisons were performed using Fisher's exact test for categorical variables and Student's *t*-test for continuous variables (with $p < 0.05$ considered statistically significant). Marker-specific missingness reflects the reflex design of the IgM assay and, for HDV, eligibility plus residual serum volume. Primary analyses assume missing at random in this operational context; period-stratified prevalences were similar.

In addition to descriptive analyses, multivariate logistic regression models were used to identify factors independently associated with anti-HBc positivity and HIV infection, adjusting for age, sex, education, and years of residence in Chile.

Statistical analyses were performed using IBM Statistical Package for Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA).

Ethical approval and community engagement

The original study protocol was shared with and approved by local Haitian community leaders before the study commenced, ensuring that the research was culturally appropriate and had community support. The Ethics Committee of Pontificia Universidad Católica de Chile reviewed and approved the study protocol #180814005, which was conducted following the Declaration of Helsinki. The study was registered at ClinicalTrials.gov (ID NCT04326803). Written informed consent was obtained from all participants before enrollment, and strict measures were implemented to maintain the confidentiality and privacy of participant data throughout the study. Furthermore, in addition to a written consent form in Creole, a video summarizing the study procedures, potential risks, and benefits was provided to all participants to ensure a thorough understanding of their participation.

Table 1
General characteristics of the patients recruited in the study.

Variable	
Female gender n/N (%)	485/855 (56.7)
Age	
Mean ± SD (years)	34.3 ± 9.1
Age range distribution n/N (%)	
18–24 years	93/855 (10.9)
25–44 years	652/855 (76.3)
≥ 45 years	110/855 (12.9)
Level of education n/N (%)	
Elementary education	108/489 (22.1)
Secondary education	204/489 (41.7)
Higher education	177/489 (36.2)
Hypertension n/N (%)	255/805 (31.7)
Mean systolic pressure mmHg ± SD	126.7 ± 18.6
Mean diastolic pressure mmHg ± SD	81.1 ± 12.8
Diabetes n/N (%)	20/821 (2.4)
Mean blood glucose mg/dL ± SD	88.8 ± 17.8
Nutritional status	
Malnutrition n/N (%)	10/782 (1.3)
Normal n/N (%)	339/782 (43.4)
Overweight n/N (%)	267/782 (34.1)
Obesity n/N (%)	166/782 (21.2)
Mean BMI kg/m² ± SD	26.3 ± 5.2
Median waist circumference cm (IQR)	86.5 (11.9)
Waist circumference > 88 cm in women n/N (%)	220/438 (50.2)
Waist circumference > 102 cm in men	19/343 (5.5)

Abbreviations: BMI: Body Mass Index; N: total number of patients with available information; n: number of patients; SD: Standard Deviation; IQR: Interquartile range.

Results

A total of 856 Haitian-born adults were enrolled, with a mean age of 34 ± 9 years. Females comprised 56.7 % of the study population. Most participants had lived in Chile for less than five years, and most reported limited proficiency in Spanish, highlighting potential barriers to healthcare access (Table 1). The aggregated results of all viral serologies are shown in Table 2.

Serological testing revealed that 3.1 % of participants were HBsAg positive, with a higher rate among men (3.7 %) than women (2.6 %). No significant differences were found in the clinical characteristics between HBsAg-positive and HBsAg-negative patients (Table 3). Notably, 34.3 % of the cohort had anti-HBc antibodies, indicative of prior exposure to HBV. A significant difference was observed between men and women: 39.8 % [34.7–44.9] in men versus 30.2 % [26.0–34.4] in women (p-value = 0.004). None of the participants reported previous HBV vaccination; therefore, anti-HBs positivity exclusively reflects natural infection. We categorized HBV serological profiles as follows: (i) Natural immunity: anti-HBs+ /anti-HBc+ ; (ii) Past exposure without protection: anti-HBs−/anti-HBc+ ; (iii) Susceptible: anti-HBs−/anti-HBc−; (iv) Chronic infection: HBsAg+ ; (v) Isolated anti-HBs seropositivity. Stratified analyses by age and years of residence are provided in Supplementary Table 1, showing that older participants were more likely to have been exposed to HBV, as evidenced by a higher prevalence of anti-HBc positivity. Agreement between anti-HBs and anti-HBc as serological markers of previous viral infection was evaluated, with a kappa coefficient of 0.801.

Importantly, anti-HBc IgM, a marker of acute HBV infection, was detectable in 0.24 % of participants. While this finding may suggest that HBV transmission is still occurring within this population, the very small number of cases precludes drawing definitive conclusions and should be interpreted with caution.

HIV prevalence in this Haitian cohort was 1.71 % (14/818), and women comprised 71.4 % (10/14) of infections. This sex distribution contrasts sharply with Chile, where women constitute only 16 % of

Table 2
Results of viral serologies of the recruited patients.

Condition	Total, % (n/N; 95 % CI)	Women, % (n/N; 95 % CI)	Men, % (n/N; 95 % CI)	*p*-value
Confirmed HIV infection	1.7 % [14/818] (0.8–2.6)	2.2 % [10/464] (0.8–3.5)	1.1 % [4/354] (0.0–2.2)	0.292
HBsAg positive	3.0 % [25/821] (1.9–4.2)	2.6 % [12/467] (1.1–4.0)	3.7 % [13/354] (1.7–5.6)	0.415
Anti-HBs	32.0 % [241/753] (28.7–35.3)	27.7 % [120/434] (23.4–31.9)	37.9 % [121/319] (32.6–43.3)	0.003
Total anti-HBc (IgM + IgG) positive	34.3 % [283/824] (31.1–37.6)	30.2 % [141/467] (26.0–34.4)	39.8 % [142/357] (34.7–44.9)	0.005
Anti-HBc (IgM) positive	0.24 % [2/824] (0.00–0.91)	0.00 % [0/467] (0.00–1.00)	0.56 % [2/357] (0.10–2.20)	0.187
HDV infection	0.00 % [0/251] (0.00–1.50)	0.00 % [0/124] (0.00–2.90)	0.00 % [0/127] (0.00–2.90)	—
Confirmed HCV infection	0.36 % [3/823] (0.00–0.80)	0.21 % [1/468] (0.00–0.60)	0.56 % [2/355] (0.00–1.40)	0.581
Anti-HAV seropositivity	96.7 % [382/395] (94.9–98.5)	96.8 % [240/248] (94.5–99.0)	96.6 % [142/147] (93.6–99.6)	1.000
Anti-HEV seropositivity	9.3 % [37/396] (6.4–12.2)	8.5 % [21/248] (5.0–12.0)	10.8 % [16/148] (5.8–15.9)	0.477

Abbreviations: HIV: Human Immunodeficiency Virus; HBsAg: Hepatitis B Surface Antigen; Anti-HBc: Hepatitis B Core antibody; HCV: Hepatitis C virus; Anti-HBs: Antibody against hepatitis B surface antigen; HAV: Hepatitis A Virus; HDV: Hepatitis D virus; HEV: Hepatitis E virus.
Percentages ≥ 1 % are shown with 1 decimal; percentages < 1 % with 2 decimals.

people living with HIV [19], implying a > 4-fold higher female share in our cohort (71.4 % vs 16 %). Together with the higher overall prevalence relative to Chile's general population, these data underscore a distinct—and likely migration-linked—epidemiologic profile [20], contrasts, reinforcing the need for culturally and linguistically tailored prevention, testing, and care strategies focused on Haitian women.

In multivariate logistic regression models adjusting for age, sex, educational level, and years of residence in Chile, only older age was independently associated with HBV exposure (anti-HBc positivity), with an adjusted OR of 1.74 (95 % CI: 1.35–2.27). For HIV infection, no independent associations were observed in multivariate models, although the number of cases was limited. For other outcomes (HCV, HEV, HDV), multivariate analyses were not feasible due to the very low number of events (Supplementary Table 2).

Anti-HDV testing was performed in 251 individuals who were HBsAg- or anti-HBc-positive and had sufficient serum available. No anti-HDV positive cases were identified.

Confirmed hepatitis C infection, defined as detectable HCV RNA, was identified in 3 participants (0.36 %, 95 % CI: 0.0–0.8 %). Prevalence was 0.21 % among women (1/468) and 0.56 % among men (2/355), with no statistically significant difference between sexes (p = 0.58). All viremic individuals were younger than 45 years, and none reported a history of blood transfusion or injection drug use. The low number of cases precluded further subgroup analyses.

Almost all participants (96.7 %) demonstrated serological evidence of past HAV exposure, consistent with the high endemicity observed in Haiti. The prevalence of anti-HEV antibodies was 9.34 %, which may reflect limited exposure during transit or within migrant communities. In contrast, anti-HCV antibodies were detected in only 0.36 % of individuals. HIV-1 serology was present in 1.71 % of the study population, with a slightly higher prevalence observed among females (2.16 %) than males (1.13 %).

Results were stratified by enrollment period (2017–2020 vs. 2021–2024), showing no significant temporal variation in the prevalence of HBV, HIV, or other viral markers (Supplementary Table 3).

Marked differences were observed in the prevalence of viral infections between Haitian migrants and the Chilean population. Chronic hepatitis B infection (HBsAg) was found in 3.1 % of migrants compared to 0.15 % in Chile, and markers of past HBV exposure (anti-HBc) were present in 34.3 % versus 0.6 %. HIV and HCV infections were also several-fold more frequent among migrants, while anti-HAV antibodies were nearly universal (96.7 %) and anti-HEV seropositivity was lower (9.3 %) than that reported in Chilean blood donors (Supplementary Table 4).

Discussion

The seroepidemiological profile observed among Haitian migrants in Chile reflects the complex interplay between the epidemiological patterns in Haiti and the challenges associated with migration. The near-universal presence of anti-HAV antibodies is consistent with historical data from Haiti, where poor sanitation and overcrowding have resulted in early-life exposure and are consistent with previous reports [21]. However, improvements in sanitation may have also created immunity gaps among older children and adults, potentially predisposing them to more severe outbreaks—a

Table 3
General characteristics of patients with chronic HBV infection vs controls.

Variable	HBsAg negative	HBsAg positive	P value
Female gender n/N (%)	455/796 (57.2)	12/25 (48.0)	0.415
Age			
Mean ± SD (years)	34.3 ± 9.1	34.4 ± 9.6	0.969
18–24 years n (%)	87/796 (10.9)	3/25 (12.0)	
25–44 years n (%)	608/796 (76.4)	19/25 (76.0)	
> 45 years n (%)	101/796 (12.7)	3/25 (12.0)	
Hypertension n/N (%)	232/750 (30.9)	10/23 (43.5)	0.253
Mean systolic pressure mmHg ± SD	126.5 ± 18.5	127.4 ± 20.9	
Mean diastolic pressure mmHg ± SD	81.0 ± 12.9	82.0 ± 10.1	
Diabetes n/N (%)	20/785 (2.5)	0/25 (0)	1.000
Mean blood glucose mg/dL ± SD	89.0 ± 18.1	84.8 ± 8.1	0.355
Nutritional status			0.725
Malnutrition n/N (%)	10/728 (1.4)	0/22 (0)	
Normal n/N (%)	315/728 (43.3)	12/22 (54.5)	
Overweight n/N (%)	249/728 (34.2)	6/22 (27.3)	
Obesity n/N (%)	154/728 (21.2)	4/22 (18.2)	
Mean body mass index (BMI kg/m²) ± SD	26.3 ± 5.1	25.4 ± 5.4	0.38
Median waist circumference cm (IQR)	86.6 ± 11.6	83.6 ± 14.0	0.229
Waist circumference > 88 cm in women n/N (%)	205/410 (50.0)	5/10 (50.0)	1.000
Waist circumference > 102 cm in men n/N (%)	17/316 (5.4)	1/13 (7.7)	0.526

Abbreviations: BMI: Body Mass Index; N: total number of patients with available information; n: number of patients; SD: Standard Deviation; IQR: Interquartile range.

dynamic that may have important implications for public health in Haiti and migrant settings abroad.

We have previously reported an HBV prevalence (HBsAg positivity) of 3.4 %, HIV-1 prevalence of 2.4 %, and notably low HCV prevalence (0 %) among Haitian immigrants residing in Chile. Additionally, we documented high exposure to HBV, as indicated by anti-HBc positivity (36.5 %). Building upon these findings, the current study further investigates the seroprevalence of hepatitis viruses among Haitian migrants in Chile, extending the scope beyond HBV, HCV, and HIV to include assessments for hepatitis A virus (HAV), hepatitis E virus (HEV), and hepatitis delta virus (HDV). This expanded analysis aims to provide a more comprehensive understanding of the infectious disease burden and inform targeted public health interventions within this vulnerable population.

The 3.1 % prevalence of HBsAg in this study align with prior research indicating an intermediate to high endemicity in Haiti, with HBsAg positivity ranging around 3–3.5 % among adults. The high prevalence of anti-HBc (34.3 %) underscores extensive prior exposure, likely resulting from a combination of perinatal transmission, early childhood exposure, and sexual transmission. Multivariate analyses confirmed that HBV exposure was independently associated with older age, consistent with known epidemiological patterns. HIV infection did not show significant independent predictors, likely reflecting the small number of cases. For markers with very low prevalence (HCV, HEV, HDV), multivariate modeling was not feasible.

Notably, the detection of anti-HBc IgM in 0.2 % of participants may indicate ongoing HBV transmission among adults. Although this finding is based on very few cases and should be interpreted with caution, it reinforces the importance of implementing targeted vaccination programs for Haitian migrants who remain susceptible. The substantial proportion of individuals with serological evidence of past exposure further suggests that many carriers may remain undiagnosed and asymptomatic until advanced liver disease develops. None of the participants reported previous HBV vaccination, as universal infant vaccination was only introduced in 2012 in Haiti (the last country in the Americas to introduce this policy). Therefore, the observed anti-HBs positivity indicates immunity from natural infection only. The agreement between anti-HBs and anti-HBc results as serological markers of past hepatitis B virus (HBV) infection was assessed in our sample. The Kappa coefficient was 0.801, indicating very good agreement between the two tests. A small subset of subjects showed isolated anti-HBs positivity. While this pattern is typically vaccine-related, explanations for this pattern in this unvaccinated population include anti-HBc antibody loss, which may occur in 3–13 % of positive subjects and assay-related false-negatives [22].

Interestingly, despite the high prevalence of HBV exposure among Haitian migrants, hepatitis delta virus (HDV) was not detected in this population. HDV coinfection typically correlates strongly with HBV prevalence, as HDV infection can only occur in hepatitis B-infected individuals.

International guidelines for hepatitis D recommend an initial screening with anti-HDV antibodies, followed by HDV RNA testing in positive cases to confirm active infection. In our study, all HBsAg positive and/or anti-HBc-positive individuals were tested for anti-HDV antibodies, and no positive cases were identified. Unfortunately, HDV RNA testing is not currently available in Chile, which prevented further confirmation. This limitation should be considered when interpreting our findings, although the absence of anti-HDV positivity already argues against a relevant burden of HDV in this population.

To our knowledge, no other surveys for HDV have been performed in the Haitian population, with a recent systematic review of the prevalence of hepatitis virus in Haiti reporting no study found for HDV prevalence [4], so our study fills an existing knowledge gap. This finding could reflect differences in transmission routes, geographic variability of HDV endemicity, or possibly historical differences in viral strain distribution between regions.

The relatively low prevalence of HCV (0.36 %) is consistent with the notion that hepatitis C is not a significant public health concern in Haiti [23], in contrast to regions where unsafe transfusions or injection practices are more common. Nonetheless, given the potential for coinfection to accelerate liver disease, even low prevalence levels warrant attention. The HIV prevalence of 1.71 % among Haitian migrants, particularly with a higher rate among females, is in line with the reported prevalence [24] and signals a need for targeted interventions. Only one patient was found to have HBV-HIV coinfection, suggesting that the transmission pathways may be distinct.

The comparison with national Chilean data reveals that Haitian migrants have a dramatically higher prevalence of blood-borne viral infections. Chronic HBV infection (HBsAg) was about 24-fold higher (3.1 % vs 0.13 %), past HBV exposure (anti-HBc) was 57-fold higher (34.3 % vs 0.6 %), HIV infection was 3.4-fold higher (1.7 % vs 0.5 %), and HCV infection was 1.9-fold higher (0.36 % vs 0.19 %). These striking disparities point to persistent gaps in access to vaccination, screening, and treatment prior to migration, as well as the continued vulnerability of this population. Conversely, HAV seroprevalence was almost universal among migrants but much lower in Chilean youth, while HEV seropositivity was lower among migrants than in Chilean blood donors, reflecting different environmental exposures. Although Haitian migrants now live in Chile, integration remains limited due to recent arrival and language barriers. This suggests that most HBV and HIV infections were acquired before migration; HBV genotyping will clarify whether transmission occurs within the migrant group or involves local strains.

A limitation of our study is that recruitment was based on non-probabilistic, community-based sampling rather than random selection. A truly probabilistic design was not feasible because the exact size of the Haitian migrant population in Chile is unknown, particularly as many migrants are in irregular migratory situations and therefore not captured in official registries. In addition, this population is characterized by high mobility, unstable housing conditions—including individuals living on the street—and the absence of reliable data on the age and sex distribution of Haitian migrants in Chile. Together, these factors make the construction of a valid sampling frame impossible, precluding random sampling. While our approach does not guarantee strict representativeness, community outreach through churches, municipal facilities, and local organizations allowed us to capture a broad cross-section of the Haitian migrant population.

Although the sample size was calculated based on HBV prevalence, the expanded recruitment increased the precision of estimates for less common markers. Nevertheless, the study was not formally powered for all secondary endpoints, and results for low-prevalence infections should be interpreted with caution.

Research on migrant health faces several barriers, including the scarcity of studies specifically addressing migrants, inadequate recording of nationality or country of origin within healthcare systems and clinical records, and difficulties in engaging migrants due to language barriers, fear of deportation, and lack of systematic surveillance of their living and health conditions. Furthermore, researchers face additional complexities arising from the ethical obligations and extra safeguards required by ethics committees when conducting studies involving vulnerable populations.

Beyond infection prevalence, Haitian migrants in Chile face multiple social and structural vulnerabilities. In our previous work with this same community, we reported high rates of lack of health insurance (22.9 %), unstable or temporary employment (55.9 %), significant language barriers (67.1 % reported difficulty speaking Spanish), and frequent markers of anxiety and depression [6]. These

findings highlight how structural factors may compound the risk of acquiring and managing infections. While the current study focuses mainly on serological markers, integration of social determinants with biological outcomes will be essential for future studies and for designing effective public health interventions.

We align with the World Health Organization's stance on migration and health, particularly their recommendation against mandatory health or infectious disease screenings, as these practices discourage migrants from seeking medical care and undermine efforts to identify high-risk individuals [25]. Instead, voluntary health assessments, performed in a manner respectful of migrants' human rights and dignity, represent a more effective strategy for detecting health issues, providing necessary treatments, facilitating migrants' integration into the public health system, and delivering preventive measures such as vaccination when indicated [26]. Evidence consistently demonstrates that infectious disease transmission from migrants to host populations remains low [27]; therefore, public health efforts should prioritize preventing transmission within migrant communities. A European systematic review found proactive infectious disease screening among migrants to have high uptake and acceptability, with moderate to high cost-effectiveness [26].

These results have several implications for public health policy. First, there is an urgent need for comprehensive screening programs targeting Haitian migrants in Chile, particularly for HBV and HIV, to facilitate early diagnosis and linkage to care. Second, culturally tailored vaccination campaigns (including HBV birth dose and catch-up immunization for older individuals) should be prioritized to reduce transmission and future disease burden. Finally, integrating viral hepatitis services into primary care for migrant populations, supported by community outreach and education in Haitian Creole, could help overcome barriers related to language and stigma.

Conclusions

This cross-sectional study demonstrates that Haitian migrants in Chile exhibit a distinct seroepidemiological profile characterized by high HAV immunity, intermediate to high HBV prevalence with substantial past exposure, low HCV rates, and a higher prevalence of HIV compared to the native population. These findings underscore the importance of targeted public health interventions, including enhanced screening and vaccination, as well as culturally sensitive health education, to address the unique needs of Haitian migrants. Future research should explore additional sociodemographic factors and potential barriers to care to refine intervention strategies further.

Abbreviations

Anti-HBc, Hepatitis B Core Antibody; Anti-HBs, Antibody against hepatitis B surface antigen; BMI, Body Mass Index; CI, Confidence Interval; ELISA, Enzyme-linked immunosorbent assay; HAV, Hepatitis A virus; HBsAg, Hepatitis B Surface Antigen; HBV, Hepatitis B virus; HCV, Hepatitis C virus; HDV, Hepatitis D virus; HEV, Hepatitis E virus; HIV, Human Immunodeficiency Virus; IQR, Interquartile Range; ISP, Instituto de Salud Pública; OR, Odds Ratio; SD, Standard Deviation; WHO, World Health Organization.

Author contributions

A.S. conceived the study, supervised data collection, and led manuscript drafting. J.U. and J.P.V. performed data analysis and interpretation. R.N. performed questionnaires and blood samples. P.A. and K.P. contributed to laboratory coordination and quality assurance. All authors critically revised and approved the final version of the manuscript.

Ethical approval

The study was approved by the Ethics Committee of the Pontificia Universidad Católica de Chile (protocol #180814005) and conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent.

Funding

This study was supported by FONDECYT Regular 2019 grant #1191389, a Gilead Investigator Sponsored Research grant (IN-US-988-5623), and institutional funds from the Pontificia Universidad Católica de Chile.

Conflict of interest

A.S. reports speaker fees from MSD, Roche, BMS, Gilead, and Gador, and consulting/advisory board fees from MSD, Abbvie, Gilead, Vertex, Roche, and Janssen. Investigational grant from Gilead. The remaining authors declare no conflict of interest.

Data availability

Deidentified participant data and statistical code are available from the corresponding author upon reasonable request.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Dr. Soza discloses the following potential conflicts of interest: Speaker for MSD, Roche, BMS, Gilead, Gador; Consulting / Advisory Board Meetings for MSD, Abbvie, Gilead, Vertex, Roche, Janssen; Investigational grant from Gilead. The other authors don´t have conflicts of interest.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT (OpenAI, GPT-4, March 2024 version) to improve language clarity and readability. After using this tool, the authors reviewed and edited the content and take full responsibility for the final text.

Acknowledgments

We thank the Haitian community leaders in Chile for their invaluable collaboration and support during study recruitment and fieldwork.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jiph.2025.103054.

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