Hepatitis B Seroprevalence among Petrochemical Workers: Workplace Versus Community Baseline in Nigeria

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ABSTRACT

Objectives: Hepatitis B virus (HBV) remains hyperendemic in Nigeria, with national HBsAg seroprevalence estimated at 8.1% among adults aged 15–64 years. Petrochemical workers face occupational blood-exposure risks through industrial injuries, yet facility-specific baseline data are scarce. This study aimed to establish facility-specific baseline seroprevalence among petrochemical workers, test the validity of community-extrapolation assumptions in occupational health policy, and examine plausible mechanisms for any observed divergence between workplace and community rates. Methods: We conducted a cross-sectional screening of 184 consecutive petrochemical workers undergoing mandatory periodic fitness-to-work evaluation at three operational locations in Nigeria between November 2018 and April 2019. HBsAg was detected using a rapid immunochromatographic assay (sensitivity ≥99.0%, specificity ≥99.0%). Prevalence was calculated with exact binomial 95% confidence intervals. Prevalence ratios and approximate 95% CIs were computed using the delta method on the log scale against community baselines. Fisher exact test was used for categorical associations. Results: The cohort comprised 178 males (96.7%) and 6 females (3.3%), with mean age 43.9 ± 5.4 years. One worker tested HBsAg-positive, yielding a prevalence of 0.54% (exact 95% CI: 0.01–2.99%). Compared with the Nigeria NAIIS 2018 baseline, the prevalence ratio was 0.07 (95% CI: 0.01–0.43), $p < 0.001$. Compared with the pooled Nigerian meta-analytic estimate, the prevalence ratio was 0.06 (95% CI: 0.01–0.40), $p < 0.001$. Neither community baseline confidence interval overlapped with the workplace estimate. Sensitivity analysis confirmed robustness: even with five positive cases, prevalence remained below the national lower bound. Conclusions: A 0.54% seroprevalence—approximately 15-fold below the national baseline—demands mechanistic explanation rather than celebration. Pre-employment screening, vaccination coverage, and workforce selection effects are plausible, non-mutually-exclusive drivers. Facility-specific seroprevalence monitoring, vaccination audits, and hiring-screening transparency are required before low workplace rates can be interpreted as prevention success.

Keywords: Hepatitis B virus; Occupational exposure; Petrochemical industry; Seroepidemiology; Nigeria

Abbreviations

BMI, Body mass index; BP, Blood pressure; CI, Confidence interval; ECG, Electrocardiography; ELISA, Enzyme-linked immunosorbent assay; FBS, Fasting blood sugar; GGT, Gamma-glutamyl transferase; Hb, Haemoglobin; HBsAg, Hepatitis B surface antigen; HBV, Hepatitis B virus; NAIIS, Nigeria AIDS Indicator and Impact Survey; PR, Prevalence ratio; PSA, Prostate-specific antigen; UPTH, University of Port Harcourt Teaching Hospital; WHO, World Health Organization

INTRODUCTION

Hepatitis B virus (HBV) infection remains a leading cause of morbidity and mortality worldwide, with sub-Saharan Africa carrying the highest burden [1]. Nigeria is classified as hyperendemic by World Health Organization (WHO) criteria, with the 2018 Nigeria AIDS Indicator and Impact Survey (NAIIS) reporting an HBsAg seroprevalence of 8.1% among adults aged 15–64 years [2]. A more recent narrative review indicates declining but still intermediate endemicity, with an estimated prevalence of 5.4% in 2022, corresponding to approximately 14.4 million people living with HBV in Nigeria [3]. A systematic review and meta-analysis of studies published between 2010 and 2019 reported a pooled prevalence of 9.5% [4], while the Global Burden of Disease Study 2019 estimated 9.9% [1]. The virus transmits parenterally, sexually, and perinatally, placing occupational groups with routine blood exposure at elevated theoretical risk [5].

Petrochemical operations present distinct occupational hazards: pressurized vessels, rotating machinery, and chemical handling create environments where lacerations, puncture wounds, and blood spills occur. Workers are distributed across multiple operational locations—onshore processing facilities, land-based installations, and remote swamp operations—each with differential access to post-exposure prophylaxis and specialist care. Shift patterns and remote site locations may further complicate timely medical intervention. These factors would reasonably predict HBV prevalence at or above community levels in this workforce. Yet national and regional averages mask systematic heterogeneity between occupational and community populations. Industrial cohorts differ from general populations through selection at hiring, differential vaccination access, and fitness-for-work requirements, a well-recognized phenomenon in occupational epidemiology. Extrapolating community data to structured workplace settings may therefore mislead policy and resource allocation.

Despite the industrial expansion across sub-Saharan Africa, occupational health surveillance for blood-borne infections remains fragmentary. In Nigeria, most seroprevalence data derive from community surveys, antenatal clinics, or healthcare worker cohorts; industrial workforces are rarely studied. This gap is particularly acute in the oil and gas sector, which employs large numbers of workers in high-exposure environments but lacks facility-specific baselines. This study aims to establish facility-specific baseline seroprevalence, test the community-extrapolation assumption, and disentangle plausible mechanisms for the observed divergence.

MATERIALS AND METHODS

Study Design and Setting

This was a cross-sectional workplace screening conducted at a Nigerian petrochemical company operating three locations: an onshore processing complex (PHC), a land-based installation (Land), and a remote swamp operation (Swamp). The study period was 21 November 2018 to 18 April 2019. The facility was selected as one site within a broader multi-site investigation entitled 'Health and Career Determinants Among Nigerian Professionals: A Multi-Site Cross-sectional Study' (ethical approval RSHMB/RSHREC/2026/075, Rivers State Health Research Ethics Committee, 1 June 2026). All active employees undergoing mandatory periodic fitness-to-work evaluation during the study period were eligible for participation.

Participants and Sampling

We employed consecutive sampling of all staff present for scheduled fitness-to-work screening. Inclusion criteria were: (1) active employee of the petrochemical company; (2) present for scheduled fitness-to-work evaluation during the study period; (3) age ≥18 years; and (4) HBsAg test performed during the screening. Exclusion criteria were: (1) refusal to participate; (2) incomplete or indeterminate HBsAg result; and (3) known hepatitis B infection with active treatment. Of the eligible workforce present during the screening window, 184 workers met all inclusion criteria and were enrolled. Demographic data collected included age, sex, body mass index (BMI), blood pressure (BP), operational location (PHC, Land, Swamp), duration of employment, and occupational exposure history (noise, chemical, smoke/gas). Age was grouped as <40 years, 40–49 years, and ≥50 years. BMI was categorized using WHO criteria: normal (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obese (≥30.0 kg/m²). Blood pressure was classified as elevated if systolic >140 mmHg

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or diastolic >90 mmHg at first contact. Vaccination history was not systematically recorded—a critical data gap identified a priori and addressed in the limitations.

Laboratory and Clinical Procedures

Capillary blood was obtained by trained phlebotomists via finger-prick and tested for HBsAg using a rapid immunochromatographic assay (HBsAg Rapid Test Strip, LabACON model, ACON Laboratories, Inc., San Diego, CA, USA; sensitivity ≥99.0%, specificity ≥99.0%) donated by Emzor Pharmaceutical Industries Ltd. Positive and negative controls were run with each testing batch to ensure assay validity. The accuracy of rapid diagnostic tests for HBsAg detection has been validated in multiple settings, with high concordance to enzyme-linked immunosorbent assay (ELISA) methods [6]. Reactive samples were scheduled for confirmatory testing by ELISA and HBV DNA quantification; however, logistical constraints meant that only clinical referral and counseling were completed during the initial study window. The single reactive result was therefore managed as a presumptive positive pending confirmatory work-up. Additional clinical assessments performed during the fitness-to-work evaluation included electrocardiography (ECG), chest radiography (CXR), prostate-specific antigen (PSA) for males, gamma-glutamyl transferase (GGT), fasting blood sugar (FBS), total cholesterol, haemoglobin (Hb), visual acuity testing, and audiometry.

Statistical Analysis

Prevalence was calculated as the proportion of HBsAg-positive individuals with exact binomial 95% confidence intervals using the Clopper-Pearson method. The workplace prevalence estimate and its confidence interval were compared against two community baselines: the 2018 Nigeria NAIIS estimate of 8.1% (95% CI: 6.9–9.4%) [2] and the pooled Nigerian meta-analytic estimate of 9.5% from studies published between 2010 and 2019 [4]. Prevalence ratios (PR) and approximate 95% confidence intervals were computed using the delta method on the log scale to quantify the magnitude of difference. Exact confidence intervals for prevalence ratios are not available with single-event numerators; the delta-method approximation is conservative and appropriate for this extreme proportion. Because the community estimates are ranges with their own confidence intervals, formal hypothesis testing against a single point estimate was supplemented by interval exclusion as the primary criterion for inferring a statistically meaningful difference. Fisher exact test was used for associations between HBsAg positivity and categorical variables (age group, sex, BMI category, location, elevated BP). Due to the single positive event, multivariable logistic regression was not feasible; stratified descriptive tables are reported instead. Sensitivity analysis was conducted to assess the robustness of the low-prevalence finding under scenarios of 2, 3, and 5 positive cases within the same denominator. All analyses were performed using Stata 17.0 (StataCorp LLC, College Station, TX, USA). A two-sided alpha of 0.05 was used throughout.

Ethical Considerations

The study was conducted under the occupational health mandate of the participating petrochemical company. All data were de-identified before analysis; no individual identifiers were accessed by the research team. The study was conducted in accordance with the Declaration of Helsinki and the Nigerian National Code of Health Research Ethics. Ethics approval was granted by the Rivers State Health Research Ethics Committee (reference RSHMB/RSHREC/2026/075, dated 1 June 2026). The single HBsAg-positive participant was de-identified in all reporting as 'Participant 08' to protect confidentiality. Counseling was provided on-site, and referral for confirmatory testing and clinical management was arranged through the facility occupational health unit in collaboration with the University of Port Harcourt Teaching Hospital (UPTH). Consent for fitness evaluation was obtained as per company policy; de-identified data were used for epidemiological analysis.

RESULTS

Participant Characteristics

A total of 184 workers were screened across three operational locations. Table 1 presents the demographic, anthropometric, and occupational characteristics of the study population. The workforce was overwhelmingly

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male (96.7%), reflecting the gender distribution typical of petrochemical operations in the region. Mean age was 43.9 ± 5.4 years (median 44 years), with two-thirds (67.4%) aged 40–49 years. The mean BMI was 29.8 ± 4.6 kg/m², indicating that the average worker was overweight. Only 10.3% had normal BMI; 51.1% were overweight, and 38.7% were obese. Elevated blood pressure (>140/90 mmHg at first contact) was present in 27.2% of participants. The majority worked at the PHC location (55.4%), with smaller proportions at Land (28.3%) and Swamp (16.3%) installations.

Table 1. Demographic, Anthropometric, and Occupational Characteristics of Participants (n = 184)

Characteristic	**n (%) or Mean ± SD**	**HBsAg Positive**	**HBsAg Negative**
Sex			
Male	178 (96.7)	1 (100.0)	177 (96.7)
Female	6 (3.3)	0 (0.0)	6 (3.3)
Age (years)	43.9 ± 5.4	46.0	43.9 ± 5.4
Age group			
<40 years	35 (19.0)	0 (0.0)	35 (19.1)
40–49 years	124 (67.4)	1 (100.0)	123 (67.2)
≥50 years	25 (13.6)	0 (0.0)	25 (13.7)
BMI (kg/m²)	29.8 ± 4.6	29.8	29.8 ± 4.6
BMI category			
Normal (18.5–24.9)	19 (10.3)	0 (0.0)	19 (10.4)
Overweight (25.0–29.9)	94 (51.1)	1 (100.0)	93 (50.8)
Obese Class I (30.0–34.9)	49 (26.6)	0 (0.0)	49 (26.8)
Obese Class II (35.0–39.9)	16 (8.7)	0 (0.0)	16 (8.7)
Obese Class III (≥40.0)	7 (3.8)	0 (0.0)	7 (3.8)
Elevated BP (>140/90 mmHg)	50 (27.2)	0 (0.0)	50 (27.3)
Operational location			
PHC	102 (55.4)	1 (100.0)	101 (55.2)
Land	52 (28.3)	0 (0.0)	52 (28.4)
Swamp	30 (16.3)	0 (0.0)	30 (16.4)

Note: BMI = body mass index; BP = blood pressure; PHC = onshore processing complex. Due to the single positive event, Fisher exact test p-values are not informative for stratified comparisons.

HBsAg Seroprevalence and National Comparison

Of the 184 workers screened, one tested HBsAg-positive, yielding a crude prevalence of 0.54% (exact 95% CI: 0.01–2.99%). Table 2 presents the comparison against community baselines. The 2018 Nigeria NAIIS estimate of 8.1% (95% CI: 6.9–9.4%) [2] and the pooled Nigerian meta-analytic estimate of 9.5% [4] both fall entirely outside the workplace confidence interval. The prevalence ratio was 0.07 (95% CI: 0.01–0.43) against the NAIIS baseline and 0.06 (95% CI: 0.01–0.40) against the pooled meta-analytic estimate, both $p < 0.001$. The 95% confidence intervals for the prevalence ratios exclude the null value of 1.0, confirming statistical significance. Figure 1 illustrates the magnitude of this divergence.

Table 2. HBsAg Seroprevalence: Workplace vs. Community Baselines

Population	n	HBsAg+ve	Prev (%)	95% CI	PR	95% CI	p-value
Petrochemical workforce (This study)	184	1	0.54	0.01–2.99	1.00 (ref)	—	—
Nigeria (NAIIS 2018)	[Survey]	—	8.1	6.9–9.4	0.07	0.01–0.43	<0.001
Nigeria (Ajuwon 2021 meta-analysis)	[Meta]	—	9.5	[Various]	0.06	0.01–0.40	<0.001

PR = prevalence ratio; CI = confidence interval.

Figure 1. HBsAg Seroprevalence: Petrochemical Workforce vs. Community Baselines. The workplace prevalence (0.54%, exact 95% CI 0.01–2.99%) is shown alongside the Nigeria NAIIS 2018 estimate (8.1%, 95% CI: 6.9–9.4%) and the pooled Nigerian meta-analytic estimate (9.5%). Neither community baseline confidence interval overlaps with the workplace estimate.

Sensitivity Analysis

To assess the robustness of the low-prevalence finding, we modeled scenarios with 2, 3, and 5 positive cases within the same denominator of 184. Even under the extreme scenario of 5 positives, the prevalence would be 2.72% (95% CI: 0.89–6.23%), which remains below the lower bound of the NAIIS 95% confidence interval (6.9%). The low-prevalence finding is therefore robust to moderate increases in case count. However, precision is limited by the sample size: the observed 95% CI spans nearly three percentage points, and a second positive case would shift the point estimate to 1.09% (95% CI: 0.13–3.87%). Figure 3A presents these sensitivity scenarios graphically.

Index Case: Participant 08

One participant (de-identified as Participant 08) tested HBsAg-positive. The following clinical profile and care cascade were documented:

Clinical Profile: Male, 46 years, BMI 29.8 kg/m² (overweight). Blood pressure: 120/90 mmHg. ECG: old myocardial infarction. PSA: 1.8 ng/mL. GGT: 39.1 U/L. FBS: 6.0 mmol/L. Total cholesterol: 3.8 mmol/L. Haemoglobin: 13.6 g/dL. Visual acuity: fit. Audiometry: normal hearing. Occupational injury history: nil.

Care Cascade Initiated: (1) Confirmatory testing: referral for quantitative HBsAg, HBeAg, anti-HBc, and HBV DNA viral load. (2) Clinical staging: liver function tests (ALT, AST, bilirubin, albumin) and abdominal ultrasound. (3) Hepatology referral: for assessment of treatment eligibility per Nigerian and WHO guidelines at UPTH. (4) Contact tracing: family and household screening offered. (5) Occupational counseling: advised to avoid sharing razors, nail clippers, needles, or other sharp objects; use barrier protection; cover open cuts; report any bleeding incidents immediately. (6) Cardiac follow-up: ECG finding of old MI warrants cardiology review given occupational demands.

Figure 2. Study Flow Diagram. All active employees at three operational locations (PHC, Land, Swamp) during the study period (21 November 2018 to 18 April 2019) were eligible. Of 184 consecutive staff undergoing mandatory fitness-to-work evaluation, 183 tested HBsAg-negative and were returned to routine workplace health records. One participant (Participant 08, male, 46 years, BMI 29.8 kg/m²) tested HBsAg-positive and was enrolled in a care cascade including confirmatory testing, hepatology referral, contact tracing, and behavioral counseling. The exact 95% binomial CI for prevalence is 0.01–2.99%; prevalence ratios are PR = 0.07 vs. Nigeria NAIIS ($p < 0.001$) and PR = 0.06 vs. pooled meta-analytic estimate ($p < 0.001$).

DISCUSSION

Principal Finding in Context

A 0.54% HBsAg prevalence in a Nigerian workforce is not merely low—it is suspiciously low. The approximately 15-fold gap with the national NAIIS baseline (8.1%) and 18-fold gap with the pooled meta-analytic estimate (9.5%) exceeds what random variation explains, and the exact binomial confidence interval (0.01–2.99%) excludes both community baseline confidence intervals entirely (NAIIS: 6.9–9.4%). The prevalence ratio confidence intervals (0.01–0.43 and 0.01–0.40) exclude the null, confirming statistical significance. This finding challenges the default assumption that occupational cohorts in high-burden settings will mirror—or exceed—community prevalence. Instead, it suggests that structured industrial environments with mandatory fitness-to-work programs may operate as epidemiological 'filters' that systematically alter workforce composition relative to the general population.

The sensitivity analysis strengthens this interpretation. Even under pessimistic scenarios with up to five positive cases, the workplace prevalence would remain below the national lower bound (6.9%). This robustness is reassuring, though it does not resolve the mechanistic question: why is this workforce so different from the community it draws from?

Competing Hypotheses

Three mechanisms, not mutually exclusive, may drive the observed divergence.

Hypothesis 1: Pre-employment screening effect. Petrochemical employers in Nigeria may screen for HBsAg at hiring, either formally or informally, and exclude or redirect positive applicants. If so, the 0.54% reflects workforce filtering, not protection. The low rate masks rather than eliminates occupational risk; the burden is simply displaced to the unemployed, underemployed, or informal-sector populations who fail the health screen. This is the most concerning explanation from a health equity perspective, as it implies that workplace 'success' is achieved by shifting disease burden rather than preventing it. We were unable to obtain hiring records to test this hypothesis directly, but it is consistent with anecdotal reports of pre-employment medical screening in Nigerian formal-sector industries. If widespread, such practices may violate the Nigerian Discrimination Against Persons with Disabilities (Prohibition) Act 2018, which protects against discrimination based on chronic health conditions including viral hepatitis [7].

Hypothesis 2: Vaccination coverage. Formal sector workers may have higher hepatitis B immunization rates than the general population through occupational health programs, private healthcare access, or health-seeking behavior correlated with employment and education. Nigeria introduced hepatitis B vaccine into the national immunization program in 2004, but coverage remains uneven across socioeconomic strata. Vaccination coverage among healthcare workers in Nigeria has been reported to be suboptimal, with significant gaps between policy and practice [8, 9, 10]. If this workforce has higher vaccine-derived immunity, the low HBsAg prevalence would represent genuine prevention success. This dataset cannot test this hypothesis—vaccination history was not recorded, representing a critical information gap.

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Hypothesis 3: Healthy worker effect. Industrially employed populations undergo fitness-for-work assessments and maintain lower baseline morbidity than community averages. This well-recognized phenomenon in occupational epidemiology arises from selection at entry (healthy individuals are more likely to be hired and retained) and survival bias (unhealthy individuals exit the workforce). While this effect typically explains modest prevalence differences, it may act as a partial contributor that amplifies the effects of screening and vaccination in this setting.

Implications for Policy and Practice

If pre-employment HBsAg testing is widespread, it represents a form of health discrimination that may violate Nigerian law [7]. The Nigerian Discrimination Against Persons with Disabilities (Prohibition) Act 2018 explicitly protects individuals with chronic health conditions, including viral hepatitis, from discrimination in employment [7]. However, enforcement remains weak, and anecdotal evidence suggests that informal screening persists in Nigeria's formal-sector industries. From an ethical standpoint, pre-employment HBsAg testing creates a perverse incentive: employers achieve apparent 'workplace health' not by preventing infection, but by excluding infected individuals from economic participation. This displaces disease burden to unemployed and informal-sector populations who lack occupational health protections, exacerbating health inequity. International human rights frameworks, including the WHO guidelines on ethical considerations in hepatitis B screening, caution against using serological testing for employment decisions without robust legal safeguards and access to treatment [12]. The absence of hiring-screening transparency in Nigerian industry means that workers cannot verify whether they were excluded on health grounds, undermining accountability. Facility-specific audits of hiring practices, combined with legal enforcement of anti-discrimination statutes, are essential to ensure that low workplace seroprevalence reflects genuine prevention rather than workforce filtering.

Limitations

This study has several limitations that constrain interpretation. Table 3 summarizes these limitations and their directional impacts on the findings.

Table 3. Study Limitations and Their Impact on Interpretation

#	**Limitation**	**Impact on Interpretation**
1	Selection bias: If HBsAg-positive individuals were excluded at hiring, prevalence reflects workforce filtering, not protection.	The rate may underestimate true occupational risk; findings are not generalizable to unemployed or informal-sector populations.
2	Vaccination history unknown: No systematic data on prior HBV immunization.	Natural immunity cannot be distinguished from vaccine-induced protection; prevention program effectiveness cannot be assessed.
3	Unconfirmed reactive result: Single positive test without HBsAg neutralization or HBV DNA confirmation.	Possible false positive; acute vs. chronic infection unresolved; clinical management initiated on unconfirmed serology.
4	Precision: With n=184, the 95% CI spans 0.01–2.99%. A second positive case would shift prevalence to 1.09% (CI 0.13–3.87%).	The 'surprisingly low' finding is sensitive to small absolute changes in case count; larger samples are needed for precise estimation.
5	Single-centre, single-industry: Findings from one petrochemical company may not generalize to other sectors or regions.	External validity is limited; multi-site replication is needed before national policy extrapolation.

Comparison with Existing Literature

Published studies of HBV seroprevalence among Nigerian healthcare workers report rates of 2.5–12.3% [8, 9, 10, 13, 14], closer to or within the national range. A 2020 study of healthcare workers in Enugu State reported 8.3% HBsAg positivity with only 18.5% vaccination coverage [8], while a 2022 study in a Nigerian tertiary hospital found 5.4% among exposed healthcare workers [9]. A 2021 study of a large population of healthcare workers across Nigeria reported 6.3% seroprevalence with 77.2% unvaccinated [10]. Studies of industrial workers in Nigeria are scarce, representing a critical gap in the occupational health literature. Our finding of 0.54% is substantially lower than these occupational benchmarks, reinforcing the need for facility-specific rather than occupation-generic baselines. The discrepancy may reflect sectoral differences (petrochemical vs. manufacturing vs. healthcare), regional variation (Rivers State vs. Enugu vs. Nasarawa), or the mechanistic factors discussed above. No prior study has explicitly tested the healthy worker effect or pre-employment screening hypotheses in Nigerian industrial settings.

Figure 3. Sensitivity Analysis and Competing Hypotheses. Panel A: Robustness of the low-prevalence finding under scenarios of 2, 3, and 5 positive cases within the same denominator (n = 184). Even under the extreme scenario of 5 positives, the prevalence (2.72%, 95% CI 0.89–6.23%) remains below the lower bound of the NAIIS 95% confidence interval (6.9%). The red shaded band represents the national range. Panel B: Three non-mutually-exclusive hypotheses for the observed divergence: (1) pre-employment screening effect, (2) vaccination coverage, and (3) healthy worker effect. All three require facility-specific testing to disentangle.

CONCLUSION

The 0.54% HBsAg seroprevalence in this petrochemical workforce—approximately 15-fold below the national Nigerian baseline (8.1% in NAIIS 2018) and 18-fold below the pooled meta-analytic estimate (9.5%)—demands explanation rather than celebration. If driven by pre-employment screening, the low rate reflects workforce selection, not successful prevention, and raises serious ethical concerns about health discrimination in hiring. If driven by vaccination, it validates occupational health investment and should prompt expansion of workplace immunization programs. If driven by workforce selection effects, it reminds us that occupational cohorts are not miniature communities and cannot be analyzed as such.

The single positive case (Participant 08) requires confirmatory testing, clinical staging, and contact tracing before definitive management decisions are made. Workplace HBV policy should not extrapolate from community data; facility-specific seroprevalence monitoring, vaccination audit, and hiring-screening transparency are prerequisites for interpreting these findings correctly. Until those mechanisms are tested, the 0.54% figure is a statistical fact in search of an epidemiological explanation—and a warning against the complacency that low numbers can breed.

Conflict Of Interest

The authors declare no competing interests. No commercial entity was involved in the design, conduct, analysis, or reporting of this study.

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Ethics Approval And Consent To Participate

The study was conducted in accordance with the Declaration of Helsinki and the Nigerian National Code of Health Research Ethics. Written informed consent was obtained from all participants as part of the mandatory fitness-to-work evaluation. Ethics approval was obtained from the Rivers State Health Research Ethics Committee (reference RSHMB/RSHREC/2026/075, dated 1 June 2026). The approving committee was chaired by Dr. Ishmael D. Jaja (MBBS, FWACP, Community Health). The study was part of a broader multi-site investigation entitled 'Health and Career Determinants Among Nigerian Professionals: A Multi-Site Cross-sectional Study.'

Availability Of Data And Materials

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request. De-identified summary data are provided in the manuscript tables. Raw individual-level data are retained under secure storage at the University of Port Harcourt Teaching Hospital and will be made available to qualified researchers subject to ethics committee approval and a data sharing agreement.

Authors' Contributions

CAO conceived the study, designed the methodology, supervised data collection, performed statistical analysis, and drafted the manuscript. MMS contributed to data curation, formal analysis, critical revision of the manuscript, and international context interpretation. Both authors read and approved the final manuscript.

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