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The challenges of integrating an immigrant population with chronic hepatitis B into long-term hepatology care: Lessons learned from a Bronx West African screening program

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ABSTRACT

Objectives: Hepatitis B virus (HBV) is endemic in West Africa. Because of immigration to the United States, screening and transition to long-term care is a significant public health concern. We describe the challenges of integrating individuals identified in a screening program into long-term care and the spectrum of disease severity.
Methods: Between 2019 and 2023, 749 individuals were screened. Beginning 2022, all were offered a free serologic evaluation. Details of the previous diagnosis, HBV care, the serologic evaluation, aspartate aminotransferase to platelet ratio index, and Fibrosis index-4 scores were recorded. The results of transient elastography (TE) were correlated with the serologic evaluation.
Results: A total of 75 (10%) individuals were hepatitis B surface antigen–positive, including 58 (77.3%) previously and 17 (22.7%) newly diagnosed. Despite attempts at linkage to care, only 14 (37.8%) of those diagnosed before the offer continued and/or entered long-term care. A total of 63 of 75 (84%) returned for the evaluation. Among 56 HBV treatment-naïve individuals, 66.1% had a serologic profile consistent with the carrier state. A total of 10 (18.2%) individuals met the criteria for HBV therapy, and 10 (21.7%) had ≥F2 fibrosis on TE. There was no correlation between aspartate aminotransferase to platelet ratio index and Fibrosis index-4 scores and TE. Eight (29.6%) of 27 patients with a profile of the HBV carrier state had ≥F2 fibrosis.
Conclusion: Integration of individuals with HBV from West Africa identified in a screening program into long-term care is challenging. Inclusion of a serologic evaluation in programs for immigrant communities should be considered. Up to 30% of individuals with a serologic profile consistent with the HBV carrier state may have ≥F2 fibrosis.

Introduction

Hepatitis B virus (HBV) is a major health burden affecting West Africa (WA) [1–5], where it is the primary cause of liver cancer and the most common cause of cancer in men [6]. Unfortunately, screening for HBV in WA is low due to multiple barriers [7,8] and only approximately 1% of patients have been diagnosed [9]. Immigration from WA to the United States has steadily increased with the borough of the Bronx a frequent destination [10,11]. With increasing numbers, HBV constitutes a significant public health concern.

Most studies on hepatitis B in disadvantaged communities focus on screening [1–3,12]. Identification of infected individuals, however, is only the first step. Evaluation of the severity of disease of individuals who are chronically infected to determine the need for antiviral therapy and transition to long-term care are essential.

There are challenges to the long-term care of an immigrant population with chronic HBV. There is limited integration into the US health care system among new immigrants due to low socioeconomic status, low insurance coverage, cultural differences, legal status concerns, and lack of familiarity with the US health system [13–15]. Further exacerbating the situation is the need for an expensive evaluation and for life-long hepatology care. In this report, we describe these challenges and the importance of the performance of an immediate evaluation for those identified in a screening program.

Materials and methods

Serologic screening

The core members of the program included medical professionals of West African origin, the most important of which was a patient naviga-

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tor. Individuals were recruited for screening from participation in community health fares or from educational programs at local religious organizations. Religious leaders were contacted directly or by email and/or telephone to request a meeting during which the impact of hepatitis B on the West African community and the importance of education and screening for the infection were reviewed and a date for an educational event for the members of the church or mosque scheduled. Information regarding the events was disseminated by the religious leaders through flyers, social media, and announcements at weekly worship times. Participants who wished to be screened for hepatitis B provided their name and telephone numbers so that they can be contacted after the event. Medical record numbers for the participants were created, and specific appointments were scheduled in a dedicated schedule in the scheduling system of the electronic medical record for each person requesting testing. If a participant did not show for the scheduled appointment, two additional attempts were made [16,17]. At the time of screening, demographics, and history of hepatitis B testing were recorded.

Clinical characteristics

Individuals who tested positive for hepatitis B surface antigen (HBsAg) were contacted for a discussion with the supervising hepatologist (SHS) during which the country of origin, duration in the United States, and family history of hepatitis B and liver cancer were recorded. A previous history of HBV testing and results were again queried. Those with a known history of hepatitis B, reason for retesting, country of initial diagnosis, and duration of known infection were recorded. Details of previous hepatitis B care (monitoring, antiviral treatment, hepatocellular carcinoma screening, and interruption of care before screening) were recorded. Although the emotional responses of the individuals to the diagnosis of a positive HBsAg test result were not recorded, a general retrospective assessment of the responses was made by the program hepatologist (SHS) and coordinator (FO) for those determined to be HBsAg-positive before and after the offer of the free evaluation.

Potential sources of infection, variable natural history, requirements for a complete evaluation, importance of regular hepatocellular carcinoma surveillance, and screening of close contacts were reviewed. A culturally sensitive educational brochure on the requirements for an evaluation was provided in English, French, and three West African languages (Twi, Hausa, and Igbo). Referral for transition to ongoing care based on the individual's circumstances and request (primary care provider, Montefiore Liver Program, municipal hospital liver clinic) was made for all patients.

Comprehensive hepatitis B evaluation

Funding was initially not available for a comprehensive serologic evaluation (complete blood count, hepatitis B e antigen [HBeAg], hepatitis B e antibody [HBeAb], hepatitis D antibody, hepatitis C antibody, HBV viral load, HBV genotype, and α fetoprotein level) when the program was initiated. After funds were obtained in January 2022, individuals previously screened (cohort A) were contacted to determine if an assessment had been performed, were in ongoing care, and were receiving antiviral therapy and they were offered the opportunity to return for a free assessment. All individuals screened after January 2022 (cohort B) were offered the free comprehensive assessment at the time of screening.

Classification of disease stage and treatment eligibility

Patients not receiving antiviral therapy at the time of the evaluation were categorized as having normal alanine transaminase (ALT) levels (<35 U/L for men, <25 U/L for women), high normal (between the upper limit of normal and upper normal range, as per laboratory reference range), and abnormal (higher than the upper limit of normal). HBV viral loads were categorized as undetectable, 5-<2000 IU/mL, 2000-20,000 IU/mL, and ≥20,000 IU/mL. Individuals were classified as HBV carrier, chronic active hepatitis, and cirrhosis and treatment eligibility was assessed, as per the American Association for the Study of Liver Diseases 2018 Hepatitis B guidelines [18].

Consistency of aminotransferase levels and hepatitis B viral loads and hepatitis B surface antigen seroconversion

Among individuals who had repeat liver tests and HBV viral loads available, the results were evaluated to determine consistency of the initial evaluation, i.e. the development or resolution of elevated liver tests, i.e. a normal ALT level that increased into the abnormal range, or an elevated ALT level that decreased into the normal range on repeat testing, respectively. Similarly, an HBV DNA level that was initially less than 2000 IU/mL that increased to a level greater than 2000 IU/mL or one greater than 2000 IU/mL that decreased to a level less than 2000 IU/mL on repeat testing was recorded. HBsAg seroconversion or permanent loss of HBsAg in an individual who was initially HBsAg-positive on repeat testing was recorded.

Fibrosis classification

Aspartate aminotransferase to platelet ratio index and Fibrosis-4 indexes

The aspartate aminotransferase to platelet ratio index (APRI) and Fibrosis-4 index (FIB-4) scores were calculated for individuals not on antiviral therapy at the time of the evaluation and categorized into fibrosis stages [19].

Transient elastography

The results of transient elastography (TE) (FibroScan, Echosens) were recorded when available. Liver fibrosis was categorized F0-1 (<7.2 kPa), F2-3 (7.2-9.4 kPa), F3-4 (9.4-12.2 kPa), and F4 fibrosis (>12.2 kPa), and findings were correlated with APRI and FIB-4 scores and serologic stage of infection for those not on antiviral therapy at the time of the evaluation [20].

Statistical analysis

Demographic information, clinical characteristics, and serological screening data were recorded as means and SDs, median and interquartile ranges, or counts and percentages. The correlation between quantitative variables was performed with the Spearman correlation analysis. P <0.05 was assessed as significant. Data collection was performed using Microsoft Excel. The statistical program IBM SPSS Statistics (version 22.0; SPSS, Chicago, IL, USA) was used for all computations.

Institutional review board

Screening serologic testing and complete serologic evaluation were performed as free clinical services, and verbal informed consent was obtained for the completion of the initial questionnaire. Written informed consent was obtained for the analysis of the results of the serologic evaluation. The protocol was approved by the Albert Einstein Institutional Review Board.

Role of the funding source

Study sponsor provided funding for the initial screening program and for the serologic evaluation of participants determined to be HBsAg-positive. The study sponsor had no role in study design; collection, analysis, or interpretation of data; writing of the report; or the decision to submit the paper for publication.

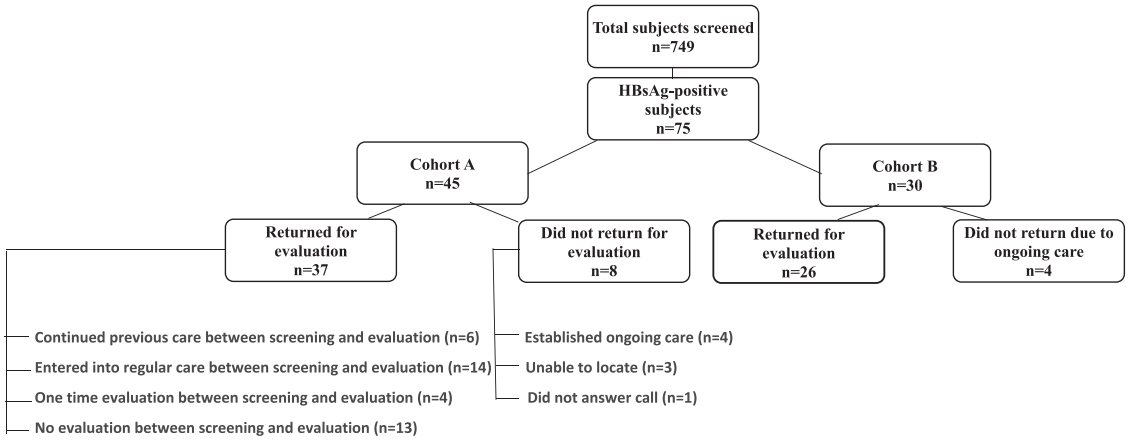

Figure 1. Evaluation history of the participants determined to be HBsAg-positive before (cohort A) and after 2021 (cohort B) when a free complete serologic evaluation was offered. HBsAg, hepatitis B surface antigen.

Results

Clinical characteristics

A total of 75 (10%) individuals were HBsAg-positive among 749 screened between April 2019 and October 2023. At the screening visit, reports of previous HBV testing were frequently unreliable. A total of 58 (77.3%) individuals had been previously diagnosed, including 14 who did not report the diagnosis at the time of screening. A total of 17 (22.7%) individuals were newly diagnosed.

The mean age was 46.0 ± 9.0 years vs 45.4 ± 13.5 years, and the percentage of men 63.8% vs 64.7% for those previously vs newly diagnosed, respectively. All were born in Africa (39 [52%] Ghana, 36 [48%] other countries). A total of 16 (21.3%) individuals reported a family history of HBV at diagnosis and an additional four at the time of a return visit. Six (8%) individuals reported a family history of liver cancer. The median duration in the United States was 15 and 6 years for those with and without a previous history of positive testing, respectively.

The median duration of known infection among those previously diagnosed was 6 years. The location of diagnosis was the United States in 40 (78.4%) and Africa in 11 (21.6%) patients among the 51 for whom data were available. All indicated that the reason for screening was an incomplete understanding of the infection and a desire to obtain more information. Among the 58 individuals with a previous diagnosis, 13 (22.4%) had had no evaluation, including three women who had been diagnosed during delivery of a child 8, 22, and 23 years before screening. Eight (13.8%) individuals had a limited previous evaluation with one to two abdominal ultrasounds over a mean of 6.9 ± 7.5 years. A total of 28 (48.3%) of 58 individuals who had been previously diagnosed were receiving regular care prior to screening. A total of 13 (22.4%) had been on antiviral therapy for a mean 2.9 ± 3.5 years, including eight who had discontinued therapy after a mean of 1.3 ± 0.9 years without follow-up for a mean of 3.6 ± 3.0 years. Details of previous care were not available for nine individuals.

A total of 45 (60%) individuals were screened before and 30 (40%) after the availability of the comprehensive assessment. The retrospective impression of the physician and coordinator responsible for relaying the information between the two periods was significantly different. Before the offer of the evaluation, individuals who were aware of their diagnosis exhibited a calm demeanor when screening results were provided. Those newly diagnosed were invariably tearful, anxious, and/or angry upon learning of the diagnosis before the offer of a free comprehensive evaluation; however, all who were diagnosed after the availability of the free evaluation appeared grateful when learning of the diagnosis and the immediate offer of the complete serologic evaluation.

After the offer of a free evaluation was initiated, the 45 individuals screened before that time (cohort A) were contacted to ensure that they had received adequate follow-up and to provide the offer of the evaluation (Figure 1). A total of 37 individuals returned for the evaluation. Of those who returned, six (16.2%) indicated that they were continuing their previous routine care, including two who had started antiviral therapy. A total of 14 (37.8%) had entered regular care with virologic testing and an abdominal ultrasound every 6-12 months, including three who had started antiviral therapy. Four (10.8%) had had a one-time evaluation with liver tests and HBV viral load without an abdominal ultrasound. A total of 13 (35.1%) had not undergone an evaluation, including two individuals who had relocated to another state and one who had returned to Africa. There was significant difficulty in locating the three individuals who had relocated. However, all promptly returned for the evaluation after learning about the offer. Eight individuals did not return for the evaluation, including four who had established ongoing care, three who could not be located due to a change or discontinuation of their cell phone number, and one who did not answer despite multiple attempts. Among 30 individuals diagnosed after the availability of the evaluation (cohort B), 26 (86.7%) readily returned for testing within a median of 7 days. Four (13.3%) declined due to regular ongoing care.

Comprehensive hepatitis B evaluation

The complete serologic evaluation was available for 56 individuals who were not on antiviral therapy at the time of the comprehensive evaluation. The results of the liver tests, virologic profile, and APRI and FIB-4 scores for the treatment-naïve individuals after excluding an additional one due to the presence of myositis with an elevated aspartate transaminase level are presented in Tables 1 and 2.

Liver tests

ALT levels were normal in 47 (83.9%), high normal in five (8.9%), and abnormal in four (7.1%) patients. Aspartate transaminase levels were normal in 50 (89.3%), high normal in four (7.1%), and abnormal in one (1.8%) patient. Alkaline phosphatase and albumin levels were normal in all patients. Total bilirubin levels were normal in 52 (92.9%) and mildly elevated (1-2.0 mg/dl) in four patients.

Complete blood count

The results are provided in Table 1. Platelet counts ranged from 127 to 308 k/uL (mean 224.3 ± 41.76). Three (5.4%) individuals had mild thrombocytopenia (<150 k/uL).

Table 1
Biochemical characteristics of 56 individuals not on anti-viral therapy at time of screening.

	Total (n = 56) n (%) or mean ± SD	Cohort A (n = 33) n (%) or mean ± SD	Cohort B (n = 23) n (%) or mean ± SD	*P*
Liver tests				
ALT, mean (IU/l)	26.05 ± 24.27	28.52 ± 30.72	22.52 ± 8.82	0.582[a]
ALT (number, %)				
Normal	47 (83.9)	26 (78.8)	21 (91.3)	-
High normal	5 (8.9)	5 (15.2)	0 (0)	
Abnormal	4 (7.1)	2 (6.1)	2 (8.7)	
AST, mean (IU/l)[b]	26.86 ± 14.57	27.33 ± 14.89	23.5 ± 6.73	0.182[a]
AST (number, %)[b]				
Normal	50 (89.3)	29 (87.9)	21 (95.5)	-
High normal	4 (7.1)	3 (9.1)	1 (4.5)	
Abnormal	1 (1.8)	1 (3)	0 (0)	
Alkaline phosphatase (IU/l)	74.89 ± 24.15	78.46 ± 23.72	69.78 ± 24.35	0.189
Albumin (g/dl)	4.24 ± 0.28	4.31 ± 0.26	4.14 ± 0.27	**0.002**[a]
Total protein (g/dl)	7.59 ± 0.5	7.6 ± 0.36	7.58 ± 0.65	0.916
Total protein (elevated)	8 (14.3)	4 (12.1)	4 (17.4)	0.704
Total bilirubin, mean (mg/dl)	0.68 ± 0.31	0.77 ± 0.34	0.54 ± 0.2	**0.004**[a]
Total bilirubin (elevated)	4 (7.1)	4 (12.1)	0 (0)	0.136
Complete blood count				
White blood cell (k/ul)	4.63 ± 1.34	4.71 ± 1.22	4.52 ± 1.51	0.297[a]
Absolute neutrophil count (k/ul)	2.03 ± 0.83	2.09 ± 0.89	1.95 ± 0.74	0.443[a]
Eosinophil count (k/ul)	0.24 ± 0.67	0.32 ± 0.86	0.12 ± 0.08	0.347[a]
Hemoglobin (g/dl)	13.69 ± 1.44	13.93 ± 1.56	13.34 ± 1.19	0.058[a]
Platelet count, mean (k/ul)	224.3 ± 41.76	227.36 ± 34.65	219.91 ± 50.78	0.516

ALT, alanine transaminase; AST, aspartate transaminase.
Independent samples *t* test, chi-square test.
[a] Mann–Whitney U test.
[b] One patient with an abnormal AST level was excluded from this categorization due to accompanying myositis.

Table 2
Clinical fibrosis stage of individuals not on anti-viral therapy.

APRI score[a] (n = 55)	
≤0.44 (F0-1)	52 (94.6)
0.45-0.63 (F2)	2 (3.6)
≥0.88 (F4)	1 (1.8)
FIB-4 score[a] (n = 55)	
≤0.94 (F0-1)	22 (40)
0.95-1.45 (F2)	25 (45.5)
1.46-1.76 (F3)	2 (3.6)
>1.76 (F4)	6 (10.9)
Transient elastography result (n = 39)	
<7.2 kPa (F0-1)	30 (44.8%)
7.2-9.4 kPa (*F2-3)*	5 (7.5%)
9.4-12.2 kPa (F3-F4)	3 (4.5%)
>12.2 kPa (F4)	1 (1.5%)

APRI, aspartate aminotransferase to platelet ratio index; FIB-4, Fibrosis index-4.
[a] APRI and FIB-4 scores were evaluated in 55 individuals by excluding the one patient with myositis.

Hepatitis B e antigen and antibody

HBeAg was non-reactive in 53 (98.2%) of 54 individuals, and HBeAb was reactive in 50 (94.3%) of 53 individuals. HBeAb testing was not available in two individuals who were HBeAg–non-reactive. HBeAg testing was not available in one individual who was HBeAb-reactive. HBeAg and HBeAb testing were not available in one individual.

HBV viral load and genotype

HBV viral load was undetectable in three (5.4%), <2,000 IU/mL in 38 (67.9%), 2000-20,000 IU/mL in 10 (17.9%), and >20,000 IU/mL in five (8.9%) patients. HBV genotype could be identified in 31 (55.4%) patients. HBV genotypes was E in 30 (96.8%) and A in one (3.2%). HBV polymerase mutations were present in two patients (2/31, 6.5%). Basic core promoter mutations were present in 13 (13/31, 41.9%).

Hepatitis C virus and Hepatitis D virus co-infection

Hepatitis C virus (HCV) antibodies were detected in two (3.6%) patients. HCV RNA viral load was undetectable in both. Hepatitis D virus (HDV) antibody was positive in one (1.8%) patient in whom HDV RNA level was undetectable and whose evaluation was consistent with the HBV carrier state.

Alpha fetoprotein levels

The mean α fetoprotein level was 4.36 ± 4.12 ng/mL (range 1-28.5 ng/mL). A total of 54 (96.4%) were below the upper limit of normal (10 ng/mL) and two (3.6%) were slightly elevated (11 ng/mL and 28.5 ng/mL).

Classification of disease stage and treatment eligibility criteria

Among the 63 subjects who underwent the comprehensive evaluation, seven (11.1%) were on antiviral therapy at the time of screening. Of the 55 patients not on antiviral therapy, 37 (67.3%) had a serologic evaluation consistent with the HBV carrier state and 11 (20%) with chronic active hepatitis. Six (10.9%) patients had elevated HBV DNA levels with normal aminotransferase levels. A total of 10 (18.2%) patients met the eligibility criteria for HBV therapy.

Consistency of liver test levels and hepatitis B viral loads and hepatitis B surface antigen seroconversion

A total of 46 individuals had repeat liver tests and HBV viral loads available after approximately 6 months. Among the 35 individuals who initially had normal liver tests and a viral load less than 2000 IU/mL, 26 (74.3%) had similar repeat measurements and nine (25.7%) had either abnormal aminotransferase levels (14.3%) and/or an HBV viral load greater than 2000 IU/mL on repeat testing (20%). Among 11 individuals who had either an elevated ALT (four) or HBV viral load (seven), 4 (36.4%) remained abnormal and seven (63.6%) had normal liver tests and an HBV viral load less than 2000 IU/mL on repeat testing. Two (3.6%) individuals demonstrated HBsAg seroconversion.

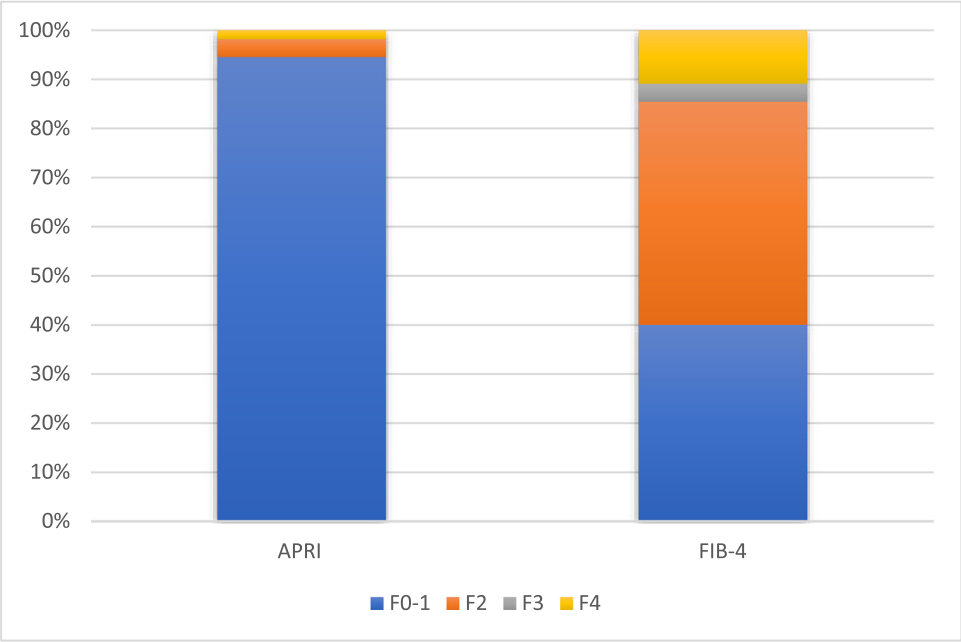

Figure 2. Distribution of APRI and FIB-4 scores among the study participants. APRI, aspartate aminotransferase to platelet ratio index; FIB-4, Fibrosis index-4. APRI levels were categorized using cut-off values of ≤0.44 for F0-1, 0.45-0.63 for F2, 0.64-0.88 for F3, and >0.88 for F4 fibrosis. Fib-4 scores were categorized using cut-off values of ≤0.94 for F0-1, 0.95-1.45 for F2, 1.46-1.76 for F3, and >1.76 for F4 fibrosis.

Fibrosis classification

Aspartate APRI and Fibrosis index-4 indices

APRI and FIB-4 scores were evaluated in 55 individuals after excluding the seven individuals on antiviral therapy and one patient with myositis. The APRI scores ranged from 0.14 to 1.14 (mean 0.26 ± 0.15). A total of 52 (94.6%) were F0-1, two (3.6%) F2, and one (1.8%) individual had a score that was worrisome for the presence of advanced fibrosis or F4 (1.14). The FIB-4 scores ranged from 0.52 to 2.65 (mean 1.13 ± 0.43). A total of 22 (40%) were F0-1, 25 (45.5%) F2, two (3.6%) F3, and six (10.9%) F4 (Figure 2) (Table 2).

Transient elastography

The results of TE were available for 46 patients. Fibrosis scores ranged from 2.8 to 13 kPa (mean 6 ± 2.43). A total of 36 individuals (78.2%) had a fibrosis score is F0-1, five (10.9%) a score F2-3, four (8.7%) a score F3-4, and one (2.2%) a score F4 (Table 2). A total of 10 individuals (21.7%, 10 of 46) had stage 2 to pre-cirrhotic fibrosis. Controlled attenuation parameter scores ranged from 166 to 370 dB/M, with a median of 228 (23, grade 0 steatosis; six, grade 1 steatosis; eight, grade 2 steatosis; and six, grade 3 steatosis).

TE results were available for 39 individuals who were not on antiviral therapy and without myositis. Among the 27 patients who were not on antiviral therapy with a serologic evaluation consistent with the HBV carrier state, 19 (70.4%) had F0-1, four (14.8%) had F2-3, three (11.1%) had F3-4, and one (3.7%) had F4 fibrosis. Eight (29.6%) patients with a serologic profile of the HBV carrier stage had a significant fibrosis (≥F2) based on TE. Among the seven individuals with a serologic evaluation consistent with chronic active hepatitis (elevated ALT, HBV viral load >2000), six (85.7%) had F0-1 and one (14.3%) F2-3 fibrosis. Four individuals with normal ALT and HBV viral load >2000 had F 0-1 fibrosis. There was no statistically significant correlation between the APRI and FIB-4 scores and TE scores (Figure 3).

Discussion

The important findings in our study include the importance of a prompt evaluation and the challenges of the integration of an immigrant community into the US health care system. The diagnosis of a stigmatized condition which requires an expensive and complex evaluation can be emotionally overwhelming for an immigrant who may not be integrated into the US health care system. By immediately providing this evaluation, a very strong message is given that the program is committed to the individual's welfare. We also provide an assessment of the spectrum of disease severity in a community-based population, with the important finding that those with a serologic evaluation consistent with the HBV carrier stage may have significant fibrosis, as determined by TE.

Our finding of a high HBV prevalence of 10% is in accordance with previous studies that report that HBV is hyperendemic in WA. In a meta-analysis of reports from 1995 to 2015 in Ghana, the seroprevalence rate was 12.3% nationally [1]. Similarly, high prevalence rates of 9.5% and 13.6% in Nigeria in two meta-analyses were reported [3,4]. In Burkina Faso, the prevalence of HBV was reported at 11.21% [2].

Knowledge and awareness of hepatitis B are very low in WA. In a population survey in Senegal, less than one-third had previously heard of the infection or of a term similar to hepatitis B in their local language [21]. In a survey of pregnant Nigerian women, 76% reported inadequate knowledge about HBV [7], and only 54% of parturient Bronx WA immigrant women had heard of HBV [8]. Among those with knowledge of the infection, transmission routes of the infection are frequently not known [22]. In a community-based screening program in which 88 individuals among 955 African-born individuals were newly diagnosed, an additional 36 individuals requested testing despite an established diagnosis [23]. In our study, 77.3% of individuals determined to be HBsAg-positive already knew the diagnosis but requested screening because they did not understand its significance. One individual who had been diagnosed with cirrhosis and treated twice for hepatocellular carcinoma was overwhelmed when informed of these conditions. Eight of 13 individuals who had been started on antiviral therapy before screening had self-discontinued therapy because they did not understand the importance of long-term therapy.

Our findings highlight the challenges with transition to care for individuals determined to be HBsAg-positive during screening of a medically disadvantaged immigrant population. Immigrants disproportionally endure many serious diseases. In a study of African women in Utah, only 42.31% of African immigrants had a regular health care provider compared with 80.46% of African Americans [15]. Due to multiple possible

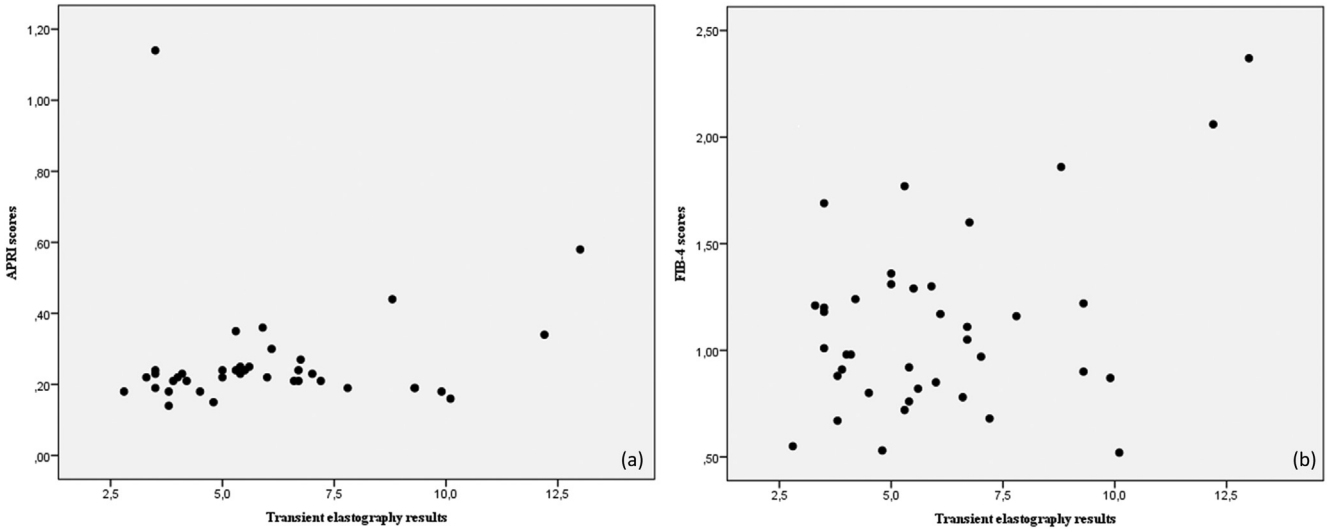

Figure 3. The scatter plot of transient elastography results with APRI (a) and FIB-4 (b) scores. APRI, aspartate aminotransferase to platelet ratio index; FIB-4, Fibrosis index-4.

barriers (insurance status, language barriers, limited health literacy, fear of deportation, jeopardization of immigrant status), adoption of culturally sensitive practices to deal with barriers to integration into long-term care is very important [24]. Although a culturally targeted community-based screening program was able to link 97% of HBV-infected African immigrants in New York to a first visit, only 82% of 11 treatment-eligible persons attended a second follow-up visit [23]. Similarly, only 77% of 40 participants who were HBsAg-positive among 444 WA immigrants in Spain had a one-time visit with a specialist [25]. Both programs required a large number of personnel, including coordinators, study nurses, community health agents, and volunteers [23,25].

Our experience emphasizes the importance of including a comprehensive serologic assessment at the time of diagnosis. Despite an attempt at linkage to care, only six (66.7%) of the newly diagnosed cases entered appropriate long-term hepatology care, and only 14 (37.8%) of those who knew their diagnosis before screening continued and/or entered appropriate care before our offer of an evaluation. Our results confirmed the finding of the challenge of linkage to care reported in previous HBV outreach screening programs in immigrant populations in which only 46% and 57% of screened individuals attended a first medical appointment [26,27]. Although the design of the study precludes a formal assessment, newly diagnosis patients were emotionally distraught when informed of the diagnosis and required complex and expensive evaluations. Attitudes toward the diagnosis were subjectively strikingly different for those in whom the evaluation was immediately offered. All appeared grateful, and 86.7% returned for the evaluation within a median 7 days.

Rapid point-of-care testing and immediate linkage to care is an alternative approach to HBV screening in an immigrant community. Picchio *et al.* [25,28] reported two studies that included rapid tests for HBsAg screening and linkage to care or vaccination in African immigrants in Spain. Among 444 people screened for HBV, the prevalence of HBsAg positivity was 9.2% and the linkage to care rate was 72%. Similarly, Ho *et al.* [29] have emphasized that linkage to care was significantly higher with the use of finger stick blood point-of-care testing (86%) than venipuncture (34%) for screening in Asian migrants in Belgium. Finally, linkage to care was 100% among Asian, Middle Eastern, and Africans who were screened using point-of-care testing [30].

Studies evaluating the spectrum of disease severity in WA communities are scarce. Many involve HIV co-infection [5,31], and important parameters (HBeAg status, co-infection with HDV/HCV, well-classified HBV viral load data, HBV genotype/mutations) are frequently not provided. In a cross-sectional study from Senegal, the prevalences of significant liver fibrosis and an HBV viral load ≥2000 IU/mL were 12.5% and 28.3%, respectively [32]. In a study of 1206 newly diagnosed individuals in Senegal, 13% of the participants were eligible for the treatment at the first visit with a similar rate of significant fibrosis (12.3%) [33]. In a vulnerable population of prisoners and sex workers who were screened for HBV infection, 41.8% had elevated ALT levels, 29.5% had an HBV viral load above 20,000 IU/mL, 10% had significant liver fibrosis, and 2.7% had cirrhosis. Genotype E is the most common genotype, followed by genotypes A and D [34].

Our findings are unique in that we provide information on the disease spectrum from a community screening program compared with previous studies conducted in a hospital setting, clinic, or prison population [31,32,35]. Most had an evaluation consistent with HBV carrier state. Only 10 (21.7%) had stage 2 to pre-cirrhotic fibrosis and one (1.6%) cirrhosis and hepatocellular carcinoma. The rate of liver fibrosis progression in the West African community has not previously been reported. A potentially important finding was the unexpected presence of significant fibrosis (≥F2) based on TE in 29.6% of patients with a serologic profile of the HBV carrier stage. The frequent development and resolution of mild asymptomatic flares has previously been reported in the Asian population and might lead to a slow development of fibrosis [36], explaining the frequent presence of significant fibrosis in individuals with a serologic evaluation consistent with the HBV carrier state. This is the first report that a similar phenomenon might also occur in the African community.

There are several important limitations to our study. The number of patients is relatively small, and 52% were from Ghana. The individuals determined to be positive at the onset of the program could not always be contacted after several years for a variety of reasons, including relocation, ongoing established care, change or discontinuation of their cell phone number, and not answering despite multiple attempts. As a result, a complete serologic assessment and TE was not available for all. A total of 16% participants did not have the complete serologic evaluation, and only 73% had TE. However, the lack of this important data because of inadequate follow-up emphasizes the importance of including an evaluation as part of the screening program. We provide very important insight into the condition from the patients' perspective in terms of the importance of education, the challenges of obtaining an expensive evaluation and transition to long-term care, and the importance of providing the serologic evaluation at diagnosis. The confirmation of our finding of the presence of significant fibrosis in patients with a serologic evaluation consistent with the HBV carrier state would have important implications because it would emphasize

the need of obtaining TE in the evaluation of all cases and raise the question as to whether the treatment guidelines should be modified for those from WA to a lower threshold for the initiation of antiviral therapy.

Declarations of competing interest

The authors have no competing interest to declare.

CRediT authorship contribution statement

Asli Akin Belli: Conceptualization, Investigation, Data curation, Formal analysis, Visualization, Writing – original draft. **Fatima Omarufilo:** Conceptualization, Investigation, Methodology, Data curation, Visualization, Project administration. **Jessie Birnbaum:** Conceptualization, Investigation, Methodology, Data curation. **Emmanuel U. Emeasoba:** Conceptualization, Investigation, Methodology, Data curation, Visualization. **Samuel H. Sigal:** Conceptualization, Funding acquisition, Methodology, Supervision, Visualization, Project administration, Writing – review & editing.

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References

[1] Abesig J, Chen Y, Wang H, Sompo FM, Wu IXY. Prevalence of viral hepatitis B in Ghana between 2015 and 2019: a systematic review and meta-analysis. *PLoS One* 2020;**15**:e0234348. doi:10.1371/journal.pone.0234348.
[2] Lingani M, Akita T, Ouoba S, Sanou AM, Sugiyama A, Tarnagda Z, et al. High prevalence of hepatitis B infections in Burkina Faso (1996–2017): a systematic review with meta-analysis of epidemiological studies. *BMC Public Health* 2018;**18**:551. doi:10.1186/s12889-018-5432-7.
[3] Musa BM, Bussell S, Borodo MM, Samaila AA, Femi OL. Prevalence of hepatitis B virus infection in Nigeria, 2000–2013: a systematic review and meta-analysis. *Niger J Clin Pract* 2015;**18**:163–72. doi:10.4103/1119-3077.151035.
[4] Ajuwon BI, Yujuico I, Roper K, Richardson A, Sheel M, Lidbury BA. Hepatitis B virus infection in Nigeria: a systematic review and meta-analysis of data published between 2010 and 2019. *BMC Infect Dis* 2021;**21**:1120. doi:10.1186/s12879-021-06800-6.
[5] Leumi S, Bigna JJ, Amougou MA, Ngouo A, Nyaga UF, Noubiap JJ. Global burden of hepatitis B infection in people living with human immunodeficiency virus: a systematic review and meta-analysis. *Clin Infect Dis* 2020;**71**:2799–806. doi:10.1093/cid/ciz1170.
[6] Jaquet A, Tchounga B, Tanon A, et al. Etiology of hepatocellular carcinoma in West Africa, a case-control study. *Int J Cancer* 2018;**143**:869–77. doi:10.1002/ijc.31393.
[7] Adeyemi AB, Enabor OO, Ugwu IA, Bello FA, Olayemi OO. Knowledge of hepatitis B virus infection, access to screening and vaccination among pregnant women in Ibadan, Nigeria. *J Obstet Gynaecol* 2013;**33**:155–9. doi:10.3109/01443615.2012.711389.
[8] Shah SA, Chen K, Marneni S, Benchekroune G, Ariganjoye R, Purswani M, et al. Hepatitis B awareness and knowledge in hepatitis B surface antigen-positive parturient immigrant women from West Africa in the Bronx, New York. *J Immigr Minor Health* 2015;**17**:302–5. doi:10.1007/s10903-013-9914-5.
[9] World Health Oorganization. Global hepatitis report. Geneva: World Health Organization, 2017.
[10] NY Times. Influx of West Africans in the Bronx Spurs Demand for Interpreters. https://www.nytimes.com/2015/11/27/nyregion/influx-of-west-africans-in-the-bronx-spurs-demand-for-interpreters.html?bgrp=t&smid=url-share; 2015 [accessed 28 March 2023].
[11] Census US. DP02: Selected Social Characteristics in the United States, https://data.census.gov/table?q=immigrant&t=International+and+Domestic+Migration&g=0600000US3600508510&tid=ACSDP5Y2021.DP02; 2024 [accessed 04 March 2024].
[12] Osei E, Lokpo SY, Agboli E. Sero-prevalence of hepatitis B infection among blood donors in a secondary care hospital, Ghana (2014): a retrospective analysis. *BMC Res Notes* 2017;**10**:391. doi:10.1186/s13104-017-2733-3.
[13] Bustamante AV, Van der Wees PJ. Integrating immigrants into the U.S. health system. *Virtual Mentor* 2012;**14**:318–23. doi:10.1001/virtualmentor.2012.14.4.stas1-1204.
[14] Roberts DA, Abera S, Basualdo G, Kerani RP, Mohamed F, Schwartz R, et al. Barriers to accessing preventive health care among African-born individuals in King County, Washington: a qualitative study involving key informants. *PLoS One* 2021;**16**:e0250800. doi:10.1371/journal.pone.0250800.
[15] Ahad FB, Zick CD, Simonsen SE, Mukundente V, Davis FA, Digre K. Assessing the likelihood of having a regular health care provider among African American and African immigrant women. *Ethn Dis* 2019;**29**:253–60. doi:10.18865/ed.29.2.253.
[16] Emeasoba EU, Omarufilo F, Bosah JN, Sigal SH. Breaking down barriers for hepatitis B screening in the Bronx West African community through education in collaboration with faith-based organizations: a cohort study. *Lancet Reg Health Am* 2022;**7**:100120. doi:10.1016/j.lana.2021.100120.
[17] Nguyen J, Shashank M, Birnbaum JA, Omarufilo F, Emeasoba EU, Boakye K, et al. Screening for hepatitis B in the Bronx West African community with a blood pressure cuff: a cohort study. *Lancet Reg Health Am* 2024;**35**:100780. doi:10.1016/j.lana.2024.100780.
[18] Terrault NA, Lok ASF, McMahon BJ, Chang KM, Hwang JP, Jonas MM, et al. Update on prevention, diagnosis, and treatment of chronic hepatitis B: AASLD 2018 hepatitis B guidance. *Hepatology* 2018;**67**:1560–99. doi:10.1002/hep.29800.
[19] Teshale E, Lu M, Rupp LB, Holmberg SD, Moorman AC, Spradling P, et al. Apri and FIB-4 are good predictors of the stage of liver fibrosis in chronic hepatitis B: the Chronic Hepatitis Cohort Study (CHeCS). *J Viral Hepat* 2014;**21**:917–20. doi:10.1111/jvh.12279.
[20] Li Y, Huang YS, Wang ZZ, Yang ZR, Sun F, Zhan SY, et al. Systematic review with meta-analysis: the diagnostic accuracy of transient elastography for the staging of liver fibrosis in patients with chronic hepatitis B. *Aliment Pharmacol Ther* 2016;**43**:458–69. doi:10.1111/apt.13488.
[21] Boye S, Shimakawa Y, Vray M, Giles-Vernick T. Limited awareness of hepatitis B but widespread recognition of its sequelae in rural Senegal: a qualitative study. *Am J Trop Med Hyg* 2020;**102**:637–43. doi:10.4269/ajtmh.19-0477.
[22] Adoba P, Boadu SK, Agbodzakey H, Somuah D, Ephraim RKD, Odame EA. High prevalence of hepatitis B and poor knowledge on hepatitis B and C viral infections among barbers: a cross-sectional study of the Obuasi municipality, Ghana. *BMC Public Health* 2015;**15**:1041. doi:10.1186/s12889-015-2389-7.
[23] Shankar H, Blanas D, Bichoupan K, et al. A novel collaborative community-based hepatitis B screening and linkage to care program for African immigrants. *Clin Infect Dis* 2016;**62**:S289–97. doi:10.1093/cid/ciw090.
[24] Kreps GL, Sparks L. Meeting the health literacy needs of immigrant populations. *Patient Educ Couns* 2008;**71**:328–32. doi:10.1016/j.pec.2008.03.001.
[25] Picchio CA, Nomah DK, Rando-Segura A, Buti M, Lens S, Forns X, et al. Community-based screening enhances hepatitis B virus linkage to care among West African migrants in Spain. *Commun Med (Lond)* 2023;**3**:182. doi:10.1038/s43856-023-00420-8.
[26] Harris AM, Schoenbachler BT, Ramirez G, Vellozzi C, Beckett GA. Testing and linking foreign-born people with chronic hepatitis B virus infection to care at nine U.S. Programs, 2012–2014. *Public Health Rep* 2016;**131**:20–8. doi:10.1177/00333549161310S204.
[27] Perumalswami PV, Factor SH, Kapelusznik L, Friedman SL, Pan CQ, Chang C, et al. Hepatitis Outreach Network: a practical strategy for hepatitis screening with linkage to care in foreign-born communities. *J Hepatol* 2013;**58**:890–7. doi:10.1016/j.jhep.2013.01.004.
[28] Picchio CA, Nomah DK, Araujo SG, Rando-Segura A, Fernández E, Buti M, et al. A novel model of care for simplified testing of HBV in African communities during the COVID-19 pandemic in Spain. *Sci Rep* 2021;**11**:17063. doi:10.1038/s41598-021-96350-3.
[29] Ho E, Michielsen P, Van Damme P, Ieven M, Veldhuijzen I, Vanwolleghem T. Point-of-care tests for hepatitis B are associated with A higher linkage to care and lower cost compared to venepuncture sampling during outreach screenings in an Asian migrant population. *Ann Glob Health* 2020;**86**:81 PMID:32742939. doi:10.5334/aogh.2848.
[30] Ho E, Vanderlinden A, Govaerts L, De Fooz B, Van Damme P, Michielsen P, et al. Opportunistic screening using point-of-care testing leads to successful linkage to care of HBV-infected migrant populations in a low endemic country. *J Virus Erad* 2024;**10**:100369. doi:10.1016/j.jve.2024.100369.
[31] Hawkins C, Agbaji O, Ugoagwu P, Thio CL, Auwal MM, Ani C, et al. Assessment of liver fibrosis by transient elastography in patients with HIV and hepatitis B virus coinfection in Nigeria. *Clin Infect Dis* 2013;**57**:e189–92. doi:10.1093/cid/cit564.
[32] Ramírez Mena A, Ngom NF, Tine J, Ndiaye K, Fortes L, Ndiaye O, et al. Prevalence and predictors of liver fibrosis in people living with hepatitis B in Senegal. *Viruses* 2022;**14**:1614. doi:10.3390/v14081614.
[33] Ramírez Mena A, Thioubou MA, Diallo K, Tine J, Ngom NF, Fortes L, et al. Liver disease and treatment needs of asymptomatic persons living with hepatitis B in Senegal. *Open Forum Infect Dis* 2022;**9**:ofac558. doi:10.1093/ofid/ofac558.
[34] Jaquet A, Nouaman M, Tine J, Tanon A, Anoma C, Inwoley A, et al. Hepatitis B treatment eligibility in West Africa: uncertainties and need for prospective cohort studies. *Liver Int* 2017;**37**:1116–21. doi:10.1111/liv.13484.
[35] Jaquet A, Wandeler G, Tine J, Dagnra CA, Attia A, Patassi A, et al. HIV infection, viral hepatitis and liver fibrosis among prison inmates in West Africa. *BMC Infect Dis* 2016;**16**:249. doi:10.1186/s12879-016-1601-4.
[36] Nguyen K, Pan C, Xia V, Hu J, Hu KQ. Clinical course of chronic hepatitis B (CHB) presented with normal ALT in Asian American patients. *J Viral Hepat* 2015;**22**:809–16. doi:10.1111/jvh.12388.