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Prevention and Care of Hepatitis B in Senegal; Awareness and Attitudes of Medical Practitioners

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Abstract. In highly endemic settings for hepatitis B virus (HBV) infection such as Senegal, access to HBV prevention and care is rapidly evolving. In this context, all medical practitioners should have baseline knowledge on HBV infection and promote access to vaccination, screening, and care. A knowledge and attitudes survey on HBV infection was conducted among a randomly selected sample of medical practitioners in Senegal. Participants were asked to fill-out a questionnaire on the HBV epidemiology, prevention, and treatment. A 60-item knowledge score was computed; the lower quartile of the observed score was used to define poor knowledge. Factors associated with poor knowledge were assessed using a logistic regression model. A total of 127 medical practitioners completed the questionnaire. Only 14 (11.0%) participants knew that HBV vaccine could be safely administered to pregnant women and 65 (51.2%) to newborns. Older practitioners (> 40 years) as well as general practitioners (compared with specialists) were more likely to have a poor knowledge score with odds ratios (ORs) of 3.1 (95% confidence interval [CI] 1.0–9.2) and 2.6 (95% CI 1.0–7.3), respectively. Practitioners who declared not to recommend HBV screening frequently during their consultation were more likely to present a poor knowledge score [OR: 3.0; (95% CI 1.1–8.2)]. As universal HBV screening is being promoted in countries with endemic HBV infection, our finding that poor screening attitudes were associated with a poor knowledge is of concern. There is a need to raise awareness of medical practitioners in Senegal toward universal HBV screening and early vaccination of newborns.

BACKGROUND

Infection with hepatitis B virus (HBV) is highly endemic in sub-Saharan Africa. In Senegal, the prevalence of chronic HBV infection ranges from 11 to 15% in adults.[1–3] HBV infection is a leading cause of liver disease and the most important risk factor for liver cancer in sub-Saharan Africa.[4,5] Although an effective vaccine against HBV infection is available since the early 80s, HBV vaccination as part of the expanded program on immunization has only been introduced since 2005 with several challenges. First, the vaccination coverage remains low with only 46% of children presenting serological protection against HBV (anti-HBs antibody titer > 10 IU/mL) among 486 Senegalese hospitalized children.[6,7] Second, the timing of administration is suboptimal: HBV vaccination was first introduced as a combined vaccine (DTP-HepB-Hib) with a first dose at 6 months limiting its efficacy against mother-to-child transmission of HBV. Aside these challenges, it takes decades for a preventive strategy based on universal vaccination to reach its full effectiveness. In the meantime, thousands of chronically infected adults are in need for screening and care. Although universal use of effective anti-HBV therapy is still challenging, there are elements supporting a future expanded access to these treatments. In Senegal, tenofovir is part of the recommended first-line antiretroviral therapy regimen for HIV-infected patients and could become available for HIV-uninfected individuals in the near future.

Considering the particularly high burden of HBV in Senegal, the management and the prevention of chronic hepatitis B should not be restricted to a limited number of specialists. All medical practitioners should indeed have basic knowledge on HBV infection, should promote access to prevention through vaccination and should encourage screening. Our aim was to investigate knowledge and attitudes toward HBV infection among medical practitioners from three urban areas in Senegal.

METHODS

Study population. Three major urban areas in Senegal were selected for the present study: "Saint-Louis" in the north of the country, Dakar; the economic and the administrative capital, and Ziguinchor in southern Senegal. These three cities host university hospitals with the referral capacity to manage patients with chronic HBV infection.

The study population was composed of certified medical doctors (registered with a medical diploma that allowed them to practice medicine in their respective hospitals) from the public sector, currently in activity in these three urban areas during the study period (August to December 2015). All primary to tertiary health centers were mapped with their respective number of medical practitioners in activity using a March 2015 updated list provided by the ministry of health. All medical doctors from Saint-Louis and Ziguinchor were invited to participate. Considering the large number of practitioners in the urban area of Dakar, a sampling procedure was applied to randomly select a representative group of medical doctors from the public health sector, stratified at the level of health-care facilities. Of the nine tertiary hospitals, two were selected to participate; Hôpital de Fann and Hôpital Principal. Of the 15 health centers of primary and secondary levels, four were selected. Two clinical monitors

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provided self-administered questionnaires to practitioners working in medical units potentially involved in the care of HBV-infected patients in the selected health-care facilities. Questionnaires were distributed to participating medical units and collected back, once completed by medical doctors, a few days later.

Data collection. The questionnaire administered in French, the official language in Senegal, was divided in four sections: sociodemographic and professional characteristics of participants; epidemiology, natural history, and clinical complications of HBV infection; knowledge and attitudes related to HBV screening and vaccination; and knowledge on care and treatment of HBV infection. A list of knowledge items considered as essential to medical doctors was proposed in the three last sections based on a consensus agreement between infectious disease and liver diseases specialists from academic institutions in Senegal. A knowledge score was then computed based on the sum of correct answers to the 24 knowledge questions related to HBV epidemiology/natural history/complications, prevention, and treatment. One point was awarded for each correct answer; each question had a unique or multiple answer items for a total number of 60 items. Incorrect or missing answers had a null value.

Statistical analysis. Characteristics of participants were compared using Pearson's χ^2 test or Fisher's exact test for categorical variables and Kruskall–Wallis test for continuous variables. In the absence of validate score to accurately measure the knowledge of medical doctors toward HBV infection, we arbitrarily define what was considered as a poor knowledge in this particular population. Using as a threshold the 25th percentile of the distribution of the 60-item score, the observed population served as its own reference. A low knowledge score was thus defined as being below the lower inter-quartile value of the observed score distribution to identify a group of particularly uninformed practitioners toward HBV infection and compare them to the rest of the study population. An unconditional logistic regression model was used to identify factors associated with a low knowledge score including respondent characteristics as well as their screening and preventive practices. Variables that were statistically associated with a low knowledge score with a $P \leq 0.25$ in univariable analyses were selected for the multivariable model. The final model was explored using a manual descending procedure and taking into account potential confounders. A $P \leq 0.05$ was considered statistically significant in the final model. Factors associated with a low knowledge score were presented with their odds ratio (OR) and 95% confidence interval (95% CI). All statistical analyses were performed using SAS software 9.2 (SAS Institute Inc. NC).

RESULTS

Of a total of 110 questionnaires distributed in Dakar, 75 (68.2%) were completed. In Saint-Louis and Ziguinchor, all medical doctors surveyed completed the questionnaires with 22 and 30 forms returned, respectively.

The overall sample of respondents was thus composed of 127 medical doctors from the public sector working in these three cities. Their median was 35 years of age (interquartile range [IQR]: 31–49) and their median time since medical certification was 4 years (IQR: 1–9); 45 (35.4%) were general practitioners and 82 (64.6%) specialists, including seven gastroenterologists and 10 infectious disease specialists. There were no significant differences in these demographic and professional characteristics according to cities (Table 1).

Knowledge on HBV. The median value of the 60-item score was 38 (IQR: 34–44). A low knowledge score (< 34 points) was reported in 16 (21.3%) participants in Dakar, three (13.6%) in Saint-Louis, and eight (26.7%) in Ziguinchor ($P = 0.52$). Detailed responses are reported in a supplementary table (Supplemental Appendix 1).

HBV epidemiology, natural history and clinical complications. Routes of transmission of HBV were relatively well recognized with 84 (66.1%) medical doctors giving correct responses to all four items related to the routes of transmission. In contrast, only 53 (41.7%) participants knew that the risk of HBV acquisition was linked to age and 19 (15.0%) knew that the most at-risk period for HBV acquisition was < 5 years of age. Only 21 (16.5%) participants correctly responded to the eight items related to HBV complications. Although liver cancer and cirrhosis were identified as complications of HBV infection by 125 (98.4%) and 124 (97.6%) participants, only 50 (39.4%) knew that lung cancer was not related to chronic HBV infection. In total, 20 (15.7%) practitioners correctly responded to the five items related to liver cancer risk factors. Hepatitis C was not thought to be related to liver cancer by 25 (19.7%) participants and only 44 (34.6%) knew that hepatitis A was not a risk factor for liver cancer.

HBV screening and vaccination. A correct answer to all questions related to tests that should be part of the initial assessment was provided by 40 (31.5%) medical doctors. Although 124 (97.6%) participants knew that HBV infection could be screened for, the availability of a rapid diagnostic test was only known by 30 (23.6%) of them. HBV vaccine was reported to have a proven efficacy by 121 (95.3%) practitioners but only 48 (37.8%) knew that the vaccine was not linked to neurological disorders and 61 (48.0%) believed that it could lead to infertility (60.0% in general practitioners and 41.5% in specialists) ($P = 0.04$) (Table 2). Only 14 (11.0%) of participants believed that HBV vaccine could be safely administered to pregnant women and 65 (51.2%) to newborns.

HBV treatment. The existence of an efficient treatment against chronic HBV infection was reported by 102 (80.3%) participants. A correct answer to all items related to anti-HBV treatments was provided by four (3.1%) participants. The use of lamivudine and tenofovir was reported as efficient against HBV by 65 (51.2%) and 73 (57.5%) participants, respectively. A systematic anti-HBV treatment of all infected individuals was proposed by 23 (18.1%) practitioners while 101 (79.5%) believed that treatment indications should rely on the assessment of liver injury combined with biological markers. In case of HIV/HBV coinfection, 68 (53.5%) practitioners estimated that the treatment of HBV infection was needed for all patients. Only 41 (32.3%) participants believed that once initiated, the anti-HBV treatment was usually a lifelong treatment.

Attitudes related to HBV screening and vaccination. *Screening of chronic HBV infection.* Forty-six (36.2%) practitioners stated that they never or only rarely proposed

TABLE 1
Main characteristics of medical doctors by city (*N* = 127), Senegal, 2015

	Dakar (*N* = 75)	Saint-Louis (*N* = 22)	Ziguinchor (*N* = 30)	*P*	Total (*N* = 127)
Age (median, [IQR])	33 (30–38)	37 (31–46)	38 (32–50)	0.03	35 (31–49)
Gender				0.56	
Women	28 (37.3)	7 (31.8)	8 (26.7)		43 (33.9)
Men	47 (62.7)	15 (68.2)	22 (73.3)		84 (66.1)
Type of facility				0.12	
Referral hospital	60 (80.0)	14 (63.6)	26 (86.7)		100 (78.7)
Primary care clinic	15 (20.0)	8 (36.4)	4 (13.3)		27 (21.3)
Medical activity				0.17	
General practitioners	22 (29.3)	11 (50.0)	12 (40.0)		45 (35.4)
Specialists*	53 (70.7)	11 (50.0)	18 (60.0)		82 (64.6)
Median number of years since medical certification†	4 (1–8)]	3 (1–11)	2 (1–9)	0.81	4 (1–9)
Attended a lecture on HBV‡				0.75	
No	52 (69.3)	14 (63.6)	22 (73.3)		88 (69.3)
Yes	23 (30.7)	8 (36.4)	8 (26.7)		39 (30.7)
Source of information on HBV					
Initial medical training				0.43	
No	3 (4.0)	2 (9.1)	3 (10.0)		8 (6.3)
Yes	72 (96.0)	20 (90.9)	27 (90.0)		119 (93.7)
National guidelines				0.07	
No	55 (73.3)	18 (81.8)	28 (93.3)		101 (79.5)
Yes	20 (26.7)	4 (18.2)	2 (6.7)		26 (20.5)
Internet				0.48	
No	19 (25.3)	3 (13.6)	6 (20.0)		28 (22.0)
Yes	56 (74.7)	19 (86.4)	24 (80.0)		99 (78.0)
Conferences				0.87	
No	55 (73.3)	15 (68.2)	21 (70.0)		91 (71.6)
Yes	20 (26.7)	7 (31.8)	9 (30.0)		36 (28.3)

IQR = inter quartile range

* Pneumologists (*N* = 11), internal medicine (*N* = 10), infectious disease specialists (*N* = 10), psychiatrists (*N* = 10), hepato/gastroenterologists (*N* = 7), pediatricians (*N* = 6), cardiologists (*N* = 6), neurologists (*N* = 6), dermatologists (*N* = 3), biologists (*N* = 3), gynecologists (*N* = 2), critical care medicine/anesthesiologists (*N* = 2), occupational health physician (*N* = 2), nephrologists (*N* = 2), radiologist (*N* = 1), rheumatologist (*N* = 1).

† Last medical diploma that allowed them to practice medicine as a general practitioner or specialist.

‡ Practitioners that attended at least one dedicated lecture on HBV infection after their initial medical training.

HBV testing to their patients. In the hypothetical context of free access to HBV screening, 105 (82.7%) medical doctors would propose the test to all unvaccinated persons, whereas 22 (17.3%) would restrict it to high-risk populations (men who have sex with men, blood product recipients, health professionals, and sex workers). A personal history of HBV screening was reported by 101 (79.5%) medical doctors, whereas 91 (72.2%) declared usually advising their relatives to test for HBV.

Anti-HBV vaccination. Of the 126 participants, 90 (71.4%) declared being personally vaccinated against HBV. Medical doctors > 40 years were less likely to be vaccinated (51.1%) compared with those ≤ 40 years (76.9) ($P = 0.03$). If confronted to children, 88 (69.3%) medical doctors stated they usually checked their HBV vaccination status. Of the 73 respondents reporting having children themselves, 57 (73.1%) declared that they were already vaccinated against HBV.

Factors associated with a low HBV knowledge score. In multivariate analyses, older practitioners (> 40 years) as well as general practitioners (compared with specialists) were more likely to have a low knowledge score with ORs of 3.1 (95% CI 1.0–9.2) and 2.6 (95% CI 1.0–7.3), respectively (Table 3). Practitioners who did not attend any lecture dedicated to HBV infection after their initial medical training were also more likely to have a low knowledge score [OR 6.0 (95% CI 1.4–26.4)]. Finally, medical doctors who declared not to recommend HBV screening frequently during their consultation were more likely to present a low knowledge score [OR 3.0 (95% CI 1.1–8.2)]. The absence of personal history of HBV screening or HBV vaccination were not associated with a low knowledge score among these medical doctors with OR of 0.8 (95% CI 0.3–2.3) and 1.1 (95% CI 0.4–2.9), respectively.

DISCUSSION

The overall HBV-related knowledge of medical doctors in urban Senegal in 2015 was relatively good although marked differences were observed according to the specific themes assessed. A good understanding of the epidemiology and natural history of HBV infection was the rule. Our results contrasts with the poor understanding of HBV infection usually reported among health-care workers in sub-Saharan Africa.[8,9] In Cameroun, the level of education was a main determinant for good knowledge on HBV infection among health-care workers of various background. This factor might partially explain the relatively good knowledge reported in our sample constituted solely of medical doctors. Poor knowledge on HBV infection was also reported among medical students entering the profession in Ethiopia highlighting the need for early dedicated and adapted training courses.[10,11]

Although routes of transmission were correctly identified, other essential aspects such as the most at-risk period of HBV acquisition and the importance of early administration of the vaccine were only known by a minority of respondents. Although these notions might also be challenging for numerous medical doctors not familiar with HBV infection

TABLE 2
Knowledge toward Hepatitis B in general practitioners compared with specialists (*N* = 127), Senegal 2015

	General practitioners (*N* = 45)	Specialists (*N* = 82)	*P*	Total (*N* = 127)
HBV epidemiology				
Route(s) of transmission for hepatitis B				
Sexual transmission			0.65	
Yes	44 (97.8)	79 (96.3)		123 (96.8)
No	1 (2.2)	3 (3.7)		4 (3.2)
Contaminated blood			0.02	
Yes	34 (75.6)	74 (90.2)		108 (85.0)
No	11 (24.4)	8 (9.8)		19 (15.0)
Mother-to-child transmission			0.28	
Yes	40 (88.9)	67 (81.7)		107 (84.3)
No	5 (11.1)	15 (18.3)		20 (15.7)
HBV screening				
Hepatitis B can be screened in asymptomatic patients			0.36	
Yes	43 (95.6)	81 (98.8)		124 (97.6)
No/unknown	2 (4.4)	1 (1.2)		3 (2.4)
Rapid diagnostic tests can be used to screen hepatitis B			0.25	
Yes	8 (17.8)	22 (26.8)		30 (23.6)
No/unknown	37 (82.2)	60 (73.2)		97 (76.4)
HBV vaccination				
The hepatitis B vaccine can be safely administered to pregnant women			0.53	
Yes	6 (13.3)	8 (9.8)		14 (11.0)
No/unknown	39 (86.7)	74 (90.2)		113 (89.0)
The hepatitis B vaccine can be safely administered to Newborn			0.45	
Yes	21 (46.7)	44 (53.6)		65 (51.2)
No/unknown	24 (53.3)	38 (46.4)		62 (48.8)
The hepatitis B vaccine can lead to infertility			0.04	
Yes/unknown	27 (60.0)	34 (41.5)		61 (48.0)
No	18 (40.0)	48 (58.5)		66 (52.0)
The hepatitis B vaccine can lead to neurological disorders			0.12	
Yes/unknown	32 (71.1)	47 (57.3)		79 (62.2)
No	13 (28.9)	35 (42.7)		48 (37.8)
HBV treatment				
Is there any existing efficient treatment against chronic HBV infection?			0.94	
Yes	36 (80.0)	66 (80.5)		102 (80.3)
No/unknown	9 (20.0)	16 (19.5)		25 (19.7)
In case of treatment with antiviral therapy, what is the usual duration of such treatment?			0.31	
Lifelong treatment	12 (26.7)	29 (35.4)		41 (32.3)
Other duration/unknown	33 (73.3)	53 (64.6)		86 (67.7)

in developed countries, these knowledge gaps are problematic in our study population as an important part of HBV transmission occurs in early childhood or through mother-to-child transmission in sub-Saharan Africa.

HBV vaccine is now part of the national immunization program in Senegal. However, several challenges currently limit its field efficacy including a limited coverage of the target population and delays in the administration of the first dose of vaccine that may not occur during the first 24 hours after birth as recommended. Considering that half of medical doctors in this sample believe that pregnancy is a contraindication to HBV vaccination and that this vaccine should not be used in newborns, efforts are needed to inform the medical community throughout sub-Saharan Africa about the benefits of HBV screening of pregnant women and vaccination of newborns right after birth. There are growing concerns related to the knowledge of health-care professionals toward prevention of mother-to-child transmission of HBV in high-prevalence settings.[12,13] Indeed, screening of pregnant women is now of particular interest as a recent clinical trial showed a significant reduction of HBV mother-to-child transmission among HBV-positive mother with high viral load receiving antiviral therapy during pregnancy.[14] Medical doctors, specialists or not, could play a key role to promote early HBV screening and vaccination through programs designed to prevent mother-to-child transmission.

Although the majority of participants were not directly in charge of treating HBV infection, baseline knowledge on available treatment options is essential to inform and guide patients if confronted with a positive HBV screening result. Indeed, poor HBV knowledge among health-care professionals was reported to be a major barrier to linkage to HBV care in Burkina Faso.[15] Lamivudine and tenofovir are two nucleosidic reverse transcriptase inhibitors active against HBV replication that are now freely available for HIV-infected persons in many African countries. Although the access to these drugs is currently not guaranteed for all eligible HBV-infected patients, several initiatives are ongoing to expand their free access for this particular population. Although the majority of respondents were aware that anti-HBV therapy was not systematically indicated in the case of chronic HBV infection, only half of them identified HIV infection as a priority indication for HBV treatment. This poor knowledge of treatment needs in the context of HIV/HBV coinfection is particularly worrying as access to anti-HBV therapy is free of charge for HIV-infected persons and international as well as national guidelines clearly

TABLE 3
Factors associated with a low knowledge score on hepatitis B in medical doctors from Dakar, Saint-Louis, and Ziguinchor (N = 127), Senegal, 2015

	Univariate analysis			Multivariable analysis	
	n/N	OR (95% CI)	*P*	OR (95% CI)	*P*
Age			0.20		0.04
≤ 40 years	17/92	1		1	
> 40 years	10/35	1.8 (0.7–4.3)		3.1 (1.0–9.2)	
Gender			0.19		0.28
Women	12/43	1		1	
Men	15/84	1.8 (0.7–4.2)		1.7 (0.6–4.4)	
City			0.23		0.39
Dakar	16/75	1		1	
Saint-Louis	3/22	0.6 (0.2–2.2)		0.3 (0.1–1.5)	
Ziguinchor	8/30	1.3 (0.5–3.6)		0.8 (0.3–2.5)	
Medical practice			0.12		0.05
Specialist	14/82	1		1	
General practitioner	13/45	2.0 (0.8–4.7)		2.6 (1.0–7.3)	
Time since first medical certification			0.43		
< 4 years	15/62	1			
≥ 4 years	12/65	0.7 (0.3–1.7)			
Lectures on HBV*			0.009		0.02
Yes	2/39	1		1	
No	25/88	7.3 (1.6–32.8)		6.0 (1.4–26.4)	
HBV screening proposed†			0.02		0.03
Frequent/systematic	12/81	1		1	
Never/rarely	15/46	2.8 (1.2–6.6)		3.0 (1.1–8.2)	
Personal history of HBV screening			0.72		
Yes	21/101	1			
No	6/25	0.8 (0.3–2.3)			
HBV vaccination status assessed‡			0.99		
Yes	19/88	1			
No	6/27	1.0 (0.3–2.7)			
Personal history of HBV vaccination			0.83		
Yes		1			
No		1.1 (0.4–2.9)			

CI = confidence interval; HBV = hepatitis B virus; OR = odd ratio; *n/N* = number of practitioners with a low knowledge score/total number of practitioners for a specific category.
* Practitioners that attended at least one lecture or other didactic event dedicated to HBV infection aside their initial medical training.
† In your medical practice, do you propose the screening of HBV infection to your patients?
‡ In case of a pediatric patient, would you usually check his/her HBV vaccination status?

recommend treatment of all HIV/HBV co-infected individuals independently of their CD4 cell counts.[16]

Older age, being a general practitioner (versus a specialist) and no prior history of continuing medical education on HBV infection were associated with a lower knowledge score. Interventions to promote knowledge on HBV infection such as dedicated courses or conferences should be proposed and organized among medical doctors after their initial medical training. These initiatives should not be restricted to specialists but adapted to general practitioners as they are expected to play a central role in HBV prevention through the promotion and application of universal HBV vaccination and testing. The association reported here between poorer screening attitudes and low knowledge score is in line with a previous survey conducted in a group of 240 health care and public health professionals in China.[17] These results emphasize the importance of dedicated training initiatives to promote universal screening of HBV infection as recently advocated by the World Health organization (WHO).[18]

Self-reported practices of personal HBV screening and vaccination were not associated with good knowledge on HBV infection as previously reported among medical students in Ethiopia.[10] The declared rates of screening and vaccination were relatively high among the responding medical doctors despite HBV vaccination not being mandatory for health-care personnel in Senegal. Previous studies have reported anti-HBV vaccination practices among health-care workers in Africa but their results were quite contrasted. In several surveys conducted in West and Southern Africa, hepatitis B vaccine coverage reported by health-care professionals was close to what we observed in our survey, with rates of 64.5% in Nigeria and 67.9% in South Africa.[19,20] In other contexts, particularly in East and Central Africa, declared immunization coverage appeared to be significantly lower with rates ranging from 4.5 to 12.8%.[21–23] Health-care workers are highly exposed to health-care-associated infections trough occupational exposures to percutaneous injuries in sub-Saharan Africa.[24–26] WHO estimated that 6,200 new HBV infections contracted by health professionals occurred each year in this region of the world.[27] The optimal strategy to prevent such health-care-associated HBV infections in high-prevalence settings still needs to be determined. Indeed, some authors have argued that considering the particularly high proportion of adults naturally protected against HBV infection, universal vaccination of health-care workers was not a relevant strategy.[28] An alternative approach to universal vaccination would be to implement a systematic HBV screening and provide vaccination only to those eligible never exposed to HBV. However, this "screen and vaccinate" strategy raises concerns about acceptability, risk of stigma and needs feasibility

studies. Previous studies from Tanzania and Rwanda have found poor HBV screening and vaccination uptake among health-care workers despite them knowing that working in health-care settings increases their risk to acquire HBV.[21,29] In our population, the natural history of HBV infection as well as its clinical complications were relatively well mastered, potentially explaining the good self-reported practices of personal HBV screening and vaccination. Nevertheless, more education about the drastic effects of the virus is needed in health-care settings throughout sub-Saharan Africa.

Limitations. The representativeness of our study sample might have been distorted by a relatively low response rate in Dakar compared with Saint-Louis and Ziguinchor. As a consequence, specialists may have been over-represented compared with general practitioners in Dakar. However, in Saint-Louis and Ziguinchor all practitioners identified from the public sector responded to the questionnaire; the proportion of specialists was also high and not significantly different compared with Dakar. General practitioners practicing in the private sector were not represented. It is however rather unlikely that gaps reported in knowledge and attitudes toward HBV of our population might be lower among general practitioners outside the public health sector in Senegal. Other clinical centers in Senegal from the private sector and outside the three targeted cities are also currently managing HBV-infected persons and might differ in terms of knowledge and practices toward HBV infection. We estimate, however, they represented a small number of practitioners at the time of the survey.

We opted for a self-administered questionnaire, potentially overestimating the true knowledge of respondents as they may have been able to consult sources of information on HBV infection before filling in the form. To prevent this kind of behaviors, participants were clearly informed about the objectives and expected results of the study and the need to honestly respond without any additional help. It was clearly stated that participants were not personally evaluated and that questionnaires were collected and processed anonymously.

Only medical doctors were included in this survey. Other health-care professionals are likely to get involved in the prevention and care of HBV-infected persons in Senegal. Expanding knowledge, attitudes, and practices studies to other caregivers is needed. In particular, surveys targeting midwives and nurses should be conducted as they are in the frontline for the prevention of mother-to-child transmission of HBV infection trough screening and vaccination.

CONCLUSION

In the Senegalese context of high prevalence of HBV infection and shortages of hepatologists and infectious diseases specialists, all medical practitioners are expected to become involved in the prevention and care of HBV infection. Although general knowledge related to risk factors and potential complications of HBV infection was relatively good among medical doctors in major urban settings, efforts are needed to improve their knowledge on prevention and care of HBV. As WHO now recommends HBV testing of the general population in settings with HBV prevalence above 5%, screening practices, which seem to be associated with low knowledge on HBV, need to be drastically improved. There is an urgent need to inform and raise awareness toward HBV prevention among medical practitioners in Senegal, a country example where public health efforts to control and eliminate HBV infection are possible and urgently needed.

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SUPPLEMENTAL APPENDIX 1
Knowledge score items (*N* = 127)

I. Epidemiology and natural history	*N* (%)
1. According to you, hepatitis B is caused by which type of infectious agent:	
Virus (1)*	124 (97.6)
Bacteria (0)	2 (1.6)
Unknown (0)	1 (0.8)
2. The evolution of hepatitis B can be:	
Acute and/or chronic (1)	98 (77.2)
Only acute (0)	1 (0.8)
Only chronic (0)	20 (15.7)
Unknown (0)	8 (6.3)
3. According to you, what is the prevalence of hepatitis B among the adult general population in West Africa	
2–6% (0)	12 (9.4)
6–15% (1)	50 (39.4)
> 15% (0)	52 (40.9)
Unknown (0)	13 (10.2)
4. What (is) are the route(s) of transmission for hepatitis B	
Sexual	
Yes (1)	123 (96.8)
No (0)	4 (3.2)
Contaminated blood	
Yes (1)	108 (85.0)
No (0)	19 (15.0)
Airborne	
Yes (0)	16 (12.6)
No (1)	111 (87.4)
Contaminated water	
Yes (0)	2 (1.6)
No (1)	125 (98.4)
Mother to child	
Yes (1)	107 (84.2)
No (0)	20 (15.8)
5. The risk of developing a chronic hepatitis B is related to the age of acquisition of hepatitis B?	
Yes (1)	53 (41.7)
No (0)	59 (46.5)
Unknown (0)	15 (11.8)
6. Which is the most "at risk" period in life for the acquisition of hepatitis B in Senegal	
0–5 years (1)	19 (15.0)
5–15 years (0)	7 (5.5)
15–35 years (0)	55 (43.3)
> 35 years (0)	14 (11.0)
Unknown (0)	32 (25.2)
7. Among these factors, which one(s) is (are) associated with the acquisition of hepatitis B	
Multiple sexual partners	
Yes (1)	123 (96.8)
No (0)	1 (0.8)
Unknown (0)	3 (2.4)
Intravenous drug use	
Yes (1)	119 (93.7)
No (0)	0 (0.0)
Unknown (0)	8 (6.3)
Tobacco use	
Yes (0)	2 (1.6)
No (1)	56 (44.1)
Unknown (0)	69 (54.3)
Therapeutic abortion	
Yes (0)	13 (10.2)
No (1)	43 (33.9)
Unknown (0)	71 (56.0)
II. Clinical complications	*N* (%)
8. According to you, which complication(s) can be related to a chronic hepatitis B	
Liver cancer	
Yes (1)	125 (98.4)
Unknown (0)	2 (1.6)
Diabetes	
Yes (0)	2 (1.6)
No (1)	53 (41.7)
Unknown (0)	72 (56.7)

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SUPPLEMENTAL APPENDIX 1
Continued

Dementia	
Yes (0)	5 (4.0)
No (1)	48 (37.8)
Unknown (0)	74 (58.3)
Lung cancer	
Yes (0)	8 (6.3)
No (1)	50 (39.4)
Unknown (0)	69 (54.3)
Stillbirth	
Yes (0)	20 (15.7)
No (1)	36 (28.4)
Unknown (0)	71 (55.9)
Liver cirrhosis	
Yes (1)	124 (97.6)
Unknown (0)	3 (2.4)
Esophageal varicose	
Yes	95 (74.8)
No	7 (5.5)
Unknown (0)	25 (19.7)
Hepatocellular impairment	
Yes (1)	118 (92.9)
Unknown (0)	9 (7.1)
9. Which of the following risk(s) factor(s) are associated with liver cancer	
Hepatitis B	
Yes (1)	126 (99.2)
Unknown (0)	1 (0.8)
Hepatitis C	
Yes (1)	102 (80.3)
No (0)	4 (3.2)
Unknown (0)	21 (16.5)
Hepatitis A	
Yes (0)	8 (6.3)
No (1)	44 (34.6)
Unknown (0)	75 (59.1)
Alcohol	
Yes (1)	110 (86.6)
No (0)	4 (3.1)
Unknown (0)	13 (10.2)
Tobacco	
Yes (0)	31 (24.4)
No (1)	28 (22.1)
Unknown (0)	68 (53.5)
III. HBV screening	*N* (%)
10. Hepatitis B can be screened in asymptomatic patients	
Yes (1)	124 (97.6)
No (0.0)	0 (0.0)
Unknown (0)	3 (2.4)
11. Which kind of tests can be used to screen hepatitis B	
Serological assay	
Yes (1)	125 (98.4)
No (0)	0 (0.0)
Unknown (0)	2 (1.6)
Rapid diagnostic tests	
Yes (1)	30 (23.6)
No (0)	25 (19.7)
Unknown (0)	72 (56.7)
PCR quantification of hepatitis B	
Yes (0)	34 (26.8)
No (1)	20 (15.7)
Unknown (0)	73 (57.5)
12. Which test(s) should be part of the initial assessment in case of first positive test for hepatitis B	
ALT	
Yes (1)	121 (95.3)
No (0)	0 (0.0)
Unknown (0)	6 (4.7)
AST	
Yes (1)	117 (92.1)
No (0)	0 (0.0)
Unknown (0)	10 (7.9)

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SUPPLEMENTAL APPENDIX 1
Continued

Repeated serology at six months	
Yes (1)	80 (63.0)
No (0)	8 (6.3)
Unknown (0)	39 (30.7)
Abdominal ultrasounds	
Yes (1)	93 (73.2)
No (0)	13 (10.2)
Unknown (0)	21 (16.5)
PCR quantification of hepatitis B	
Yes (1)	90 (70.8)
No (0)	9 (7.1)
Unknown (0)	28 (22.1)
IV. HBV vaccination	
13. The Hepatitis B vaccine can be safely administered to:	
Every patient without restriction	
Yes (1)	68 (53.5)
No (0)	31 (24.4)
Unknown (0)	28 (22.1)
Young children	
Yes (1)	91 (71.6)
No (0)	1 (0.8)
Unknown (0)	35 (27.6)
Pregnant women	
Yes (1)	14 (11.0)
No (0)	113 (89.0)
Newborn	
Yes (1)	65 (51.2)
No (0)	13 (10.2)
Unknown (0)	49 (38.6)
14. The Hepatitis B vaccine has a proven efficacy	
Yes (1)	121 (95.3)
No (0)	1 (0.8)
Unknown (0)	5 (4.0)
15. The Hepatitis B vaccine can lead to infertility	
Yes (0)	0 (0.0)
No (1)	66 (52.0)
Unknown (0)	61 (48.0)
16. The Hepatitis B vaccine can lead to neurological disorders	
Yes (0)	4 (3.2)
No (1)	48 (37.8)
Unknown (0)	75 (59.1)
17. How many injections are needed to complete the HBV vaccination in children	
3 injections (1)	79 (62.2)
Others (0)	27 (21.3)
Unknown (0)	21 (16.5)
18. In which period of time does the HBV vaccination need to be completed in children	
3 months (0)	25 (19.7)
6 months (1)	13 (10.2)
12 months (0)	35 (27.6)
24 months (0)	12 (9.4)
Unknown (0)	42 (33.1)
19. How many injections are needed to complete the HBV vaccination in adults	
3 injections (1)	81 (63.8)
Others (0)	28 (22.0)
Unknown (0)	18 (14.2)
20. In which period of time does the HBV vaccination need to be completed in adults	
3 months (0)	27 (21.3)
6 months (1)	27 (21.3)
12 months (0)	23 (18.1)
24 months (0)	5 (4.0)
Unknown (0)	45 (35.4)
V. HBV treatment	*N* (%)
21. Is there any existing efficient treatment against chronic HBV infection?	
Yes (1)	102 (80.3)
No (0)	15 (11.8)
Unknown (0)	10 (7.9)

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SUPPLEMENTAL APPENDIX 1
Continued

22. Which of the following treatment(s) have a proven efficacy against HBV infection	
Interferon?	
Yes (1)	96 (75.6)
No (0)	20 (15.7)
Unknown (0)	11 (8.7)
Ribavirine	
Yes (1)	20 (15.7)
No (0)	96 (75.6)
Unknown (0)	11 (8.7)
Lamivudine	
Yes (1)	65 (51.2)
No (0)	51 (40.2)
Unknown (0)	11 (8.7)
Tenofovir	
Yes (1)	73 (57.5)
No (0)	43 (33.9)
Unknown (0)	11 (8.7)
Zidovudine	
Yes (0)	9 (7.1)
No (1)	107 (84.2)
Unknown (0)	11 (8.7)
Traditional medicine	
Yes (0)	1 (0.8)
No (1)	115 (90.5)
Unknown (0)	11 (8.7)
Surgery	
Yes (0)	4 (3.2)
No (1)	112 (88.2)
Unknown (0)	11 (8.7)
Penicillin	
Yes (0)	0 (0.0)
No (1)	116 (91.3)
Unknown (0)	11 (8.7)
23. In case of chronic HBV infection, in which situation(s) is a treatment needed?	
In any case, with a confirmed chronic HBV infection	
Yes (0)	19 (14.9)
No (1)	104 (81.9)
Unknown (0)	4 (3.2)
According to the level of liver injuries (fibrosis/cirrhosis) combined with biological criteria (liver enzymes and HVB viral load)	
Yes (1)	101 (79.5)
No (0)	22 (17.3)
Unknown (0)	4 (3.2)
In case of HIV coinfection, regardless of the immunological status	
Yes (1)	68 (53.5)
No (0)	55 (43.3)
Unknown (0)	4 (3.2)
24. In case of treatment with antiviral therapy, what is the usual duration of such treatment?	
Lifelong treatment (1)	41 (32.3)
Limited duration (0)	56 (65.3)
Unknown (0)	3 (2.4)

* Each item is followed by its attributed points (0) or (1).