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ORIGINAL ARTICLE

Prospective Study

Testing for hepatitis B virus alone does not increase vaccine coverage in non-immunized persons

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Abstract

AIM

To determine whether hepatitis B virus (HBV)-testing could serve as a gateway to vaccinate non-immunized individuals in a low-prevalent country.

METHODS

Non-immunized subjects participating in a multi-center, HBV-testing campaign in Paris, France were identified and contacted via telephone 3-9 mo after testing in order to determine vaccination status. Vaccination coverage was evaluated in per-protocol (for all respondents) and intent-to-treat analysis (assuming all non-responders did not vaccinate).

RESULTS

In total, 1215/4924 (24.7%) enrolled subjects with complete HBV serology were identified as non-immunized and eligible for analysis. There were 99/902 successfully contacted subjects who had initiated HBV vaccination after screening: per-protocol, 11.0% (95%CI: 9.0-13.2); intent-to-treat, 8.2% (95%CI: 6.7-9.8). In multivariable analysis, vaccination was more likely to be initiated in individuals originating from moderate or high HBV-endemic countries (P < 0.001), patients with limited healthcare coverage (P = 0.01) and men who have sex with men (P = 0.02). When asked about the reasons for not initiating HBV vaccination, the most frequent response was "will be vaccinated later" (33.4%), followed by "did not want to vaccinate" (29.8%), and "vaccination was not proposed by the physician" (21.5%). Sub-group analysis indicated a stark contrast in vaccination coverage across centers, ranging from 0%-56%.

CONCLUSION

HBV-vaccination after HBV screening was very low in this study, which appeared largely attributed to physician-patient motivation towards vaccination. Increased vaccination coverage might be achieved by emphasizing its need at the organizational level.

Key words: Health service organization; Hepatitis B virus vaccination; Public health; Testing intervention; Vaccine coverage

Core tip: Testing for hepatitis B virus (HBV) not only serves as a means to identify HBV-infected individuals, but also those who are non-immunized and could further benefit from HBV vaccination. In this mass HBV-screening study within the Paris metropolitan region, vaccine uptake was achieved in 11% of non-immunized patients and was deemed poor. Strategies to increase vaccination after testing need to be considered.

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INTRODUCTION

Hepatitis B virus (HBV) is one of the most frequent chronic infectious diseases in Western countries[1], with a prevalence of roughly one million in the United States[2] and 14 million in Europe[3]. The effectiveness of HBV vaccination in reducing infection incidence has been demonstrated in several countries with varying HBV prevalence[4-6], making it the single most effective tool for prevention. Nevertheless, coverage rates remain insufficient despite the wide availability of vaccines[3,7] and are particularly low in certain at-risk infection groups[8,9].

In France, the proportion of vaccinated individuals is surprisingly modest compared to other industrialized countries[10], even though vaccination is reimbursed in part by the national healthcare system. Recent epidemiological studies have estimated vaccine coverage at 50%[6], compared to 83% worldwide and higher than 90% in the Western Pacific region[1]. Prevalence of individuals with hepatitis B surface antigen (HBsAg) positive serology has remained exceedingly low over the past decade (0.7%)[11]. Nevertheless, 2500 persons are acutely infected each year, with the majority belonging to high-risk groups[12]. Vaccination campaigns targeted at these risk groups could help curb incident infections.

Accordingly, in current national guidelines, vaccination of non-immunized individuals who fall into these high-risk categories is strongly recommended[13]. Considering that HBV testing is necessary in determining those eligible for vaccination and HBV tests are given frequently in France (at almost 3.4 million tests per year), HBV screening could serve as a wide-reaching gateway to vaccination. Unfortunately, vaccination practices, specifically following HBV-testing, are poorly understood. The objective of this study was then to describe rates of vaccination among non-immunized individuals during a mass-screening program. We also intended to evaluate the reasons for

not initiating HBV vaccination after testing.

MATERIALS AND METHODS

Study design and participants

Participants were selected from the multi-center OPTISCREEN-B study, which took place in the Paris, France metropolitan region from 2011-2012[14,15]. Briefly, the study was conducted in two phases. The first phase was a cross-sectional study aimed at evaluating several rapid test candidates that could detect serological markers commonly used in HBV screening. The second phase was a parallel-group, randomized trial aimed at comparing the use of standard HBV serological tests versus rapid tests (NCT01767597). Participant recruitment occurred at 10 primary healthcare centers, with various objectives related to HBV screening, vaccination, and care - three were sexually transmitted disease (STD) clinics, three were clinics with predominately general practitioners, three focused on immigrant health, and one on incarcerated individuals. The study procedures of both phases have been described in detail[14,15]. The study was approved by the Hôtel-Dieu Hospital Ethics Committee (Paris, France) in accordance with the Helsinki Declaration.

Volunteers were asked to participate during their regular consultations if ⩾ 18 years old and could be available for further contact and medical follow-up at a single university teaching hospital. For both studies, only individuals eligible for HBV screening were invited to participate. Individuals were not included for the following reasons - for both phases: unwilling to participate; for Phase II only: already participated in the OPTISCREEN-B Phase I validation study or were not covered under the national healthcare system. Signed written informed consent was obtained for all eligible participants.

In this sub-study, we restricted our sample population to participants who were identified as non-immunized by complete HBV serological testing [*i.e.* HBsAg, anti-hepatitis B core (HBc) antibody, and anti-hepatitis B surface (HBs) antibody negative serology].

Hepatitis B virus serological testing

During the study visit, roughly 10 mL of blood was drawn and then tested for HBsAg, anti-HBs antibody, and anti-HBc antibody. Serostatus was determined using a commercially-available enzyme-linked immunoassay assay (MONOLISA AgHBs Ultra, anti-HBs plus, anti-hepatitis B core antibody-anti-HBc-plus; Bio-Rad, Hercules, California, United States of Americ). Results were provided 7-14 d after testing and, depending on the study center, were either mailed to the participants or left at the study center for collection.

Hepatitis B virus risk-factor questionnaire

Questionnaires were administered by a trained clinical research assistant during a face-to-face interview with the participant. Questions were asked in lay terms on a variety of sociodemographic characteristics, healthcare coverage, HBV transmission risk-factors, as well as other potential risk-factors. HBV-endemicity of birth country was established according to World Health Organization classification (prevalence of HBsAg-positive individuals): high (8%), intermediate (2%-8%), and low (2%).

Assessing post-test hepatitis B virus vaccination

Non-immunized individuals were identified by serology (HBsAg, anti-HBs antibody and anti-HBc antibody negative) and then contacted via telephone roughly 6-9 and 3-6 mo after testing in Phase I and II, respectively. If a participant could not be contacted after the third attempt, they were considered as having "no reply". Subjects were asked whether or not they initiated immunization against HBV and at which dates their injection(s) were administered. As we conducted follow-up during a telephone interview, physical verification of the participants' vaccination card was not performed. If they indicated no vaccination, they were asked to choose one or several reason(s) from a list for not initiating HBV immunization.

Statistical analysis

The primary outcome in per-protocol analysis was defined as the proportion of non-immunized participants initiating vaccination during follow-up who were able to be contacted. In intent-to-treat analysis, the outcome was defined as the proportion of non-immunized participants initiating vaccination assuming that those who were unable to be contacted did not initiate or complete vaccination. Clopper-Pearson 95% confidence intervals (CI) were calculated for these proportions.

In order to evaluate the determinants of HBV vaccination during follow-up (defined by per-protocol analysis), we used random-effects logistic regression to estimate univariate odds ratios (OR) of various risk-factors and their 95% CIs while accounting for within-center correlation. A multivariable model was then constructed in a backwards-stepwise fashion. A full model containing risk-factors with a P-value ⩽ 0.10 in univariable analysis was initially selected and covariates with a P-value > 0.10, as tested using a likelihood ratio test, were sequentially excluded from the model.

All statistical analysis was performed using STATA (v13.1, College Station, TX, United States of America) and reviewed by two biomedical statisticians. Significance was determined using a P-value < 0.05.

RESULTS

Study participants

The flow of study participants is represented in Figure

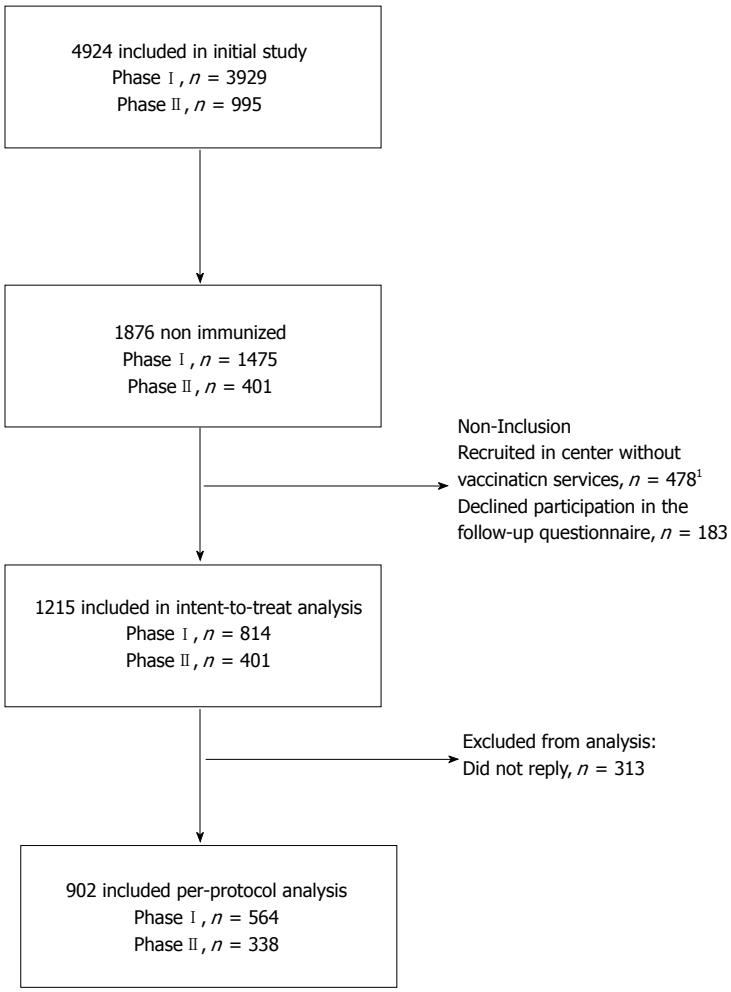

Figure 1 Study flow chart. [1]Only applies to certain participants in Phase Ⅰ.

1. A total of 4924 participants were included in the OPTISCREEN-B study, 1876 (38.1%) of whom were non-immunized and considered for the present sub-study. Of them, 661 were not included because they sought care at a center where, at the time of Phase I, did not offer vaccination services (*n* = 478) or declined participation in the follow-up questionnaire (*n* = 183). In total, 1215 participants were included in analysis.

Description of the study population

Table 1 provides a summary of the study population. The majority of individuals was male, coming from a country of low HBV-prevalence, and covered under the French national healthcare system. Included participants were born in the following geographical regions: West/East Europe, *n* = 710 (58.4%); Mediterranean, *n* = 183 (15.1%); Asia, *n* = 90 (7.4%); Sub-Saharan Africa, *n* = 135 (11.1%); South America, *n* = 43 (3.5%); other, *n* = 54 (4.4%). A total of 1043 (85.8%) of participants were indicated for vaccination according to French recommendations, the most frequent reasons for which were multiple lifetime sexual partners, originating from a moderate/high HBV-endemic country and traveling to high endemic countries. A smaller proportion was men who had sex with men (MSM) or partook in nasal or intravenous drug-use. Characteristics of study participants were compered between enrollment phases in Supplementary Table 1.

Post-test hepatitis B virus vaccination rates

Among the 1215 participants included in analysis, 99 (8.2%) claimed to have initiated HBV vaccination, while the first injection was given a median 31 d (IQR = 12-55) after testing; 803 (66.1%) did not initiate vaccination; and 313 (25.7%) did not respond after the third contact attempt. Participants who did not respond were significantly younger ($P = 0.02$), more likely to come from an intermediate HBV-endemic country ($P < 0.001$), did not have any healthcare coverage ($P < 0.001$), and had a lower number of lifetime sexual partners ($P = 0.001$) (Table 1).

In per-protocol analysis (Table 2), immunization coverage was 11.0% (95%CI 9.0-13.2) during follow-up. This proportion varied substantially across centers (0%-55.6%), with the lowest vaccine coverage observed in STD clinics (7.5%) and centers with mainly general practitioners (6.3%) and the highest

Table 1 Description of the study population *n* (%)

	Total (*n* = 1215)	Follow-up contact		*P* value
		Reply (*n* = 902)	No reply (*n* = 313)	
Male	702 (57.8)	511 (56.7)	191 (61.0)	0.18
Age (yr), mean ± SD	36 ± 15	37 ± 15	34 ± 14	0.02
HBV prevalence of birth country				< 0.001
Low (< 2.0%)	670 (55.1)	527 (58.4)	143 (45.7)	
Intermediate (2.0%-8.0%)	331 (27.2)	222 (24.6)	109 (34.8)	
High (> 8.0%)	214 (17.6)	153 (17.0)	61 (19.5)	
Parents from high endemic region	276 (22.7)	205 (22.7)	71 (22.7)	0.9
Traveled to high endemic region[1]	284 (23.4)	204 (22.6)	80 (25.6)	0.3
Healthcare in high endemic region	177 (14.6)	124 (13.8)	53 (16.9)	0.17
Health insurance plan				< 0.001
Social security/CMU[2]	913 (75.2)	719 (79.7)	194 (62.0)	
CMUc[3]	61 (5.0)	47 (5.2)	14 (4.5)	
AME[4]/Other/ None	241 (19.8)	136 (15.1)	105 (33.6)	
Received transfusion	48 (4.0)	33 (3.7)	15 (4.8)	0.4
Received tattoos	151 (12.4)	100 (11.1)	51 (16.3)	0.02
Received piercing	510 (42.0)	387 (42.9)	123 (39.3)	0.3
Close contact with HBV^+ individual	75 (6.2)	57 (6.4)	18 (5.8)	0.7
Number of life-time sexual partners				0.001
0-1	181 (14.9)	118 (13.1)	63 (20.1)	
2-9	560 (46.1)	409 (45.3)	151 (48.2)	
⩾ 10	474 (39.0)	375 (41.6)	99 (31.6)	
> 1 sexual partner within 12 mo	593 (48.8)	447 (49.6)	146 (46.7)	0.4
Men who have sex with men	93 (8.9)	73 (8.1)	20 (6.4)	0.3
Nasal drug-use	145 (11.9)	108 (12.0)	37 (11.8)	0.9
Intravenous drug-use	5 (0.4)	5 (0.6)	0	0.3
Long-term stay at a medical center	50 (4.1)	38 (4.2)	12 (3.8)	0.8
Previously incarcerated	87 (7.2)	63 (7.0)	24 (7.7)	0.7

Participants with reply and no reply were compared using Kruskal-Wallis test for continuous variables and Pearson χ^2 test or Fisher's exact test for categorical variables. [1]Period of stay was longer than 3 mo; [2]Couverture médicale universelle, minimum health insurance coverage that is given to persons living in precarious situations (*i.e.* unemployed, poverty, etc.); [3]Couverture médicale universelle complémentaire, additional health insurance coverage that is given to stable residents in France living with limited financial resources; [4]Aide médicale d'état, health insurace generally given to immigrants without proper documentation.

Table 2 Hepatitis B virus vaccination and no reply rates across study centers

	n	No reply *n* (%)	Immunization coverage		
			Vaccinated *n*[3]	Per protocol[1] (%)	ITT[2] (%)
Total	1215	313 (25.8)	99	11	8.2
General practitioner	418	85 (20.3)	21	6.3	5
Policlinique Saint Antoine	165	47 (28.5)	10	8.6	6.1
Travel clinic Saint Antoine	31	5 (16.1)	3	11.5	10
CPAM	222	33 (14.9)	8	4.2	3.6
STD clinics	635	166 (26.1)	35	7.5	5.5
CDAG Saint Antoine	51	10 (19.6)	0	0	0
CDAG Figuier	275	78 (28.4)	22	11.2	8
CDAG Belleville	309	78 (25.2)	13	5.6	4.2
Immigrant-health clinics	140	61 (43.6)	37	46.8	26.4
Croix-Rouge Moulin Joly	9	0 (0)	5	55.6	55.6
CRAMIF	18	0 (0)	9	50	50
Médecin du Monde	113	61 (54.0)	23	44.2	20.4
Prison (UCSA Paris)	22	0 (0)	6	27.3	27.3

[1]Per-protocol end-point defined as the proportion of non-immunized participants initiating vaccination who were contacted; [2]Intent-to-treat (ITT) end-point defined as the proportion of non-immunized participants initiating vaccination assuming that those who were unable to be contacted did not initiate or complete vaccination; [3]Participants initiating HBV vaccination sequence after HBV testing in the OPTISCREEN-B study. CDAG: Centre de dépistage anonyme et gratuit; CPAM: Caisse primaire d'assurance maladie; CRAMIF: Caisse régionale d'assurance maladie d'Ile-de-France; UCSA: Unité de consultations et de soins ambulatoire; STD: transmitted disease.

rates in immigrant-health clinics (46.8%). Assuming those with no reply did not initiate HBV vaccination (intent-to-treat analysis), immunization coverage was 8.2% (95%CI 6.7-9.8), also with high between-center

Table 3 Determinants for initiating hepatitis B virus vaccination sequence

Risk-factor	Univariate		Multivariable[5]	
	OR (95%CI)	*P* value	OR (95%CI)	*P* value
Female *vs* male	0.61 (0.37-0.99)	0.04		
Age (per yr)	1.00 (0.98-1.02)	0.8		
Parents from high endemic region	1.52 (0.89-2.58)	0.12		
Traveled to high endemic region[1]	1.43 (0.83-2.45)	0.19		
Care in high endemic region	1.45 (0.79-2.67)	0.2		
Transfusion	0.28 (0.03-2.28)	0.2		
Tattoos	1.26 (0.63-2.55)	0.5		
Piercing	1.05 (0.66-1.67)	0.8		
Close contact with HBV^+ individual	1.14 (0.48-2.70)	0.8		
Men who have sex with men	2.05 (0.97-4.34)	0.06	2.53 (1.14-5.60)	0.02
Nasal drug-use	0.37 (0.13-1.07)	0.07	0.41 (0.14-1.21)	0.1
Intravenous drug-use	3.42 (0.41-28.40)	0.3		
Long-term stay at a medical center	1.02 (0.33-3.14)	0.9		
Previously incarcerated	0.71 (0.24-2.06)	0.5		
HBV-prevalence of birth region				
Low (< 2.0%)	1		1	
Intermediate (2.0%-8.0%)	4.39 (2.35-8.19)	< 0.001	3.58 (1.85-6.95)	< 0.001
High (> 8.0%)	4.43 (2.24-8.75)	< 0.001	3.44 (1.65-7.15)	0.001
Health insurance plan				
Social security or CMU[2]	1		1	
CMUc[3]	1.13 (0.35-3.62)	0.8	0.76 (0.23-2.58)	0.7
AME[4], Other, or none	4.54 (2.21-9.30)	< 0.001	2.60 (1.23-5.52)	0.01
Number of life-time sexual partners				
0-1	1			
2-9	0.93 (0.47-1.87)	0.8		
⩾ 10	0.75 (0.35-1.60)	0.5		

Per-protocol analysis on the 902 non-immunized participants who were able to be contacted. [1]Period of stay was longer than 3 mo; [2]Couverture médicale universelle, health insurance coverage that is given to persons living in precarious situations (*i.e.* unemployed, poverty, *etc*; [3]Couverture médicale universelle complémentaire, additional health insurance coverage that is given to stable residents in France living with limited financial resources; [4]Aide médicale d'état, health insurace generally given to immigrants without proper documentation; [5]When constructing the multivariable model, gender was not included due to collinearity with men who have sex with men.

variability (Table 2).

Table 3 describes the per-protocol analysis of risk-factors associated with HBV vaccination. Of note, there was no association between vaccination and study phase (Phase II versus I, OR = 0.66, 95%CI 0.27-1.62, *P* = 0.4). In multivariable analysis, vaccination was more likely to be initiated in MSM (*P* = 0.02), participants born in intermediate/high endemic zones (*P* < 0.001) and those without national healthcare coverage (*P* = 0.006). When replacing gender with MSM in the multivariable model, there was no significant difference between males and females (adjusted - OR = 0.66, 95%CI 0.40-1.10).

Reasons for not initiating vaccination

In the 803 non-vaccinees who were able to be contacted, Table 4 summarizes their reasons for not vaccinating. Roughly one-third stated that they would vaccinate at a later time. Other reasons included no desire to vaccinate (29.8%), vaccination was not suggested by their physician (21.5%), or the participant did not return to obtain their serological results confirming non-immunized status (14.0%). Participants who preferred not to vaccinate were significantly more likely to be male (*P* = 0.002), older (*P* < 0.001), come from a low endemic country (*P* < 0.001), be covered under the French national healthcare system (*P* < 0.001), and have higher number of lifetime sexual partners (*P* = 0.004) (Supplementary Table 2).

DISCUSSION

HBV testing has been proposed as a useful gateway to identify non-immunized individuals and encourage them to initiate vaccination[16], yet data regarding the extent of how successful this strategy would be, if applied, are sparse. Previous studies in France and California have shown that vaccine coverage ranges from 8.6%-11.2% after testing for HBV in the context of STD clinics[17,18]; however, these results were obtained from mostly younger, sexually-active individuals or more specifically, among adults diagnosed with chlamydia, gonorrhoae and/or syphilis who were still susceptible to HBV infection. In the OPTISCREEN-B studies, serving as a testing campaign against HBV infection in a population with diverse at-risk characteristics, we similarly observed a low vaccination rate of 11.0% in per-protocol and 8.2% in intent-to-treat analysis.

The reasons for low vaccine coverage are somewhat difficult to pinpoint. While examining individual characteristics, it was interesting to find that those originating from regions of moderate or high HBV

Table 4 Reasons for not initiating hepatitis B virus vaccination

Reason	*n* (%)
Serology results were never obtained	112 (14.0)
Vaccination was not proposed by physician	173 (21.5)
Vaccination was not indicated (according to physician)	26 (3.2)
Not at risk	14 (1.7)
Vaccination was already done[1]	12 (1.5)
Participant did not want to be vaccinated	239 (29.8)
Not perceived to be at risk	95 (11.8)
Vaccination was already done	21 (2.6)
Not receptive to vaccinations in general	44 (5.5)
Not receptive to HBV vaccination	89 (11.1)
Will be vaccinated later	268 (33.4)

Among the 803 contacted individuals who did not initiate HBV vaccination. More than one response was possible (only applies to 15 participants). [1]No indication for revaccination despite undetectable anti-HBs antibodies.

endemicity and those in difficult socioeconomic situations, based on their healthcare plan, were significantly more likely to initiate HBV vaccination after testing. These data are relieving considering that these two risk-factor groups constitute the largest number of newly identified infections in France[12]. However, it should be mentioned that these groups also had the highest proportions of non-response, particularly individuals without healthcare or from intermediate HBV-endemic countries. MSM were also observed to have a significantly higher vaccination initiation rates, while this key population has shown rather high vaccine uptake in previous intervention studies[19,20]. Unfortunately, two groups with high HBV-infection risk, namely persons having close contact with an infected individual or engaging in nasal or intravenous drug use, were not more likely to become vaccinated.

When addressing the reasons for not vaccinating, approximately one-third responded that they did not want to be vaccinated, mainly because they were not receptive to HBV vaccination or not perceived to be at risk. Vaccine hesitancy has already been illustrated in a study from a French STD clinic, where most non-immunized persons did not trust the safety of HBV vaccines or viewed it as "not well characterized"[21]. We also observed that individuals covered under the French national healthcare plan or those coming from a low HBV-endemic country were more likely not to vaccinate. Their lack of motivation could stem from a lower perception of HBV-transmission risk, which has been previously evidenced in persons with higher socioeconomic status in France[22].

Another one-fifth of non-vaccinated individuals claimed that their physician did not propose vaccination. This result is rather surprising given that professionals have been recommended to initiate vaccination for all non-immunized persons susceptible to transmission since 1995. Few (3.2%) participants stated that they were not indicated for vaccination by their physician, implying that recommendation criteria did not play a major role in the low vaccine coverage observed with this group. One striking feature of our data, however, was that post-testing vaccination rates varied from 0% to 56% across study centers, largely implicating organizational factors in promoting HBV vaccination.

These results support the need for structural reorganization in testing facilities as a means to encourage vaccination. Promising data on interventions at the organization level have been presented in other research, in which increased vaccination rates were achieved after providing focused training to healthcare professionals and individuals seeking testing[23] or when free vaccinations were offered directly after HBV serological results were returned[17]. Other interventions involving financial incentives have also shown substantial effects in at-risk populations, such as intravenous drug-users[24,25]. These strategies would certainly be helpful in counterbalancing vaccine hesitancy, which has been an emerging topic over the past decades[10], notably among health-care providers in general and in France[26-28]. Without these interventions, the proportion of individuals at risk of HBV-infection could rebound and persist as a public health issue[6].

Nevertheless, many of the participants in this analysis came from difficult socioeconomic backgrounds. Past research has underscored the lack of access to preventative health services especially among migrants[29], certain racial/ethnic groups[30], and homeless individuals[31]. Since the majority of vaccination occurs within the context of these services, social inclusion of disadvantaged groups, particularly at primary care centers, would probably be necessary in order to achieve greater vaccine outreach. Although the French healthcare system attempts at addressing care in these groups[32], further improvements could be made with other strategies, such as mobile clinics providing vaccinations[33] or culturally-adapted text message reminders[34]. The services provided at these healthcare centers should also emphasize education on HBV disease and the benefits of vaccination, possibly in combination with care related to other health issues.

There were several noteworthy parallels with the results from this study compared to previous analyses in the OPTISCREEN-B program. The profile of participants accepting vaccination (*i.e.* from regions of moderate to high HBV endemicity, without health care coverage) were also those who more frequently tested for HBV in the past[35], which are perhaps indicators of effective prevention efforts in these at-risk groups. In addition, the between-center variability in the proportion receiving vaccination mirrored that of the proportion of physicians who would propose HBV testing[35]. The similar variation offers evidence that any organizational changes to promoting vaccination would have to include a more comprehensive HBV prevention strategy. Finally, our study group has

observed in a past evaluation that roughly 20%-50% participants newly diagnosed with HBV returned for further consultation at a referent center[15], reflecting the potential for inadequate transition to "appropriate care"[36]. The increased need to foster individuals into appropriate care appears to be shared among non-immunized patients.

Several methodological limitations need to be noted when interpreting the results of our study. First, we used a convenience sample combining participants from two studies. Certain risk-factor groups, such as intravenous drug-users and sex-workers, might not be adequately represented and could have different vaccine coverage than those reported herein. In addition, the lack in numbers may have resulted in inadequate power in order to establish whether they were less likely to complete vaccination. Second, the time-frame of follow-up was relatively short and perhaps some participants received vaccination 6-9 mo or more after their interview. Non-immunized patients did vaccinate a median 30 d, suggesting that few individuals would have initiated vaccination after the end of follow-up and vaccine coverage would have been similar if follow-up were prolonged. Nevertheless, roughly one-third of unvaccinated individuals stated that they would do so in the future. Third, the short time-frame also made it impossible to ascertain whether participants completed HBV vaccination, as the date of last vaccination would have fallen outside the follow-up period. Lastly, the proportion with no reply, which was comparable to other studies[17], could have biased results.

Furthermore, we should highlight that individuals with low levels of anti-HBs antibodies (> 0-10 mIU/mL), who could possibly benefit from booster HBV vaccination, were not included in this analysis. The results from our study might not be generalizable to these individuals.

In conclusion, HBV vaccination after screening was very low in this study, implying that HBV testing alone cannot encourage non-immunized individuals to vaccinate. The fact that large discrepancies in vaccine coverage were observed across centers and that both physician and participant motivation towards vaccination was rather limited provides evidence that involvement at the health structure level is crucial in increasing vaccination coverage. Future interventions and campaigns should work at increasing local awareness of low vaccine coverage rates, especially in groups with poor access to health services, and the need to vaccinate non-immunized individuals as soon as they are identified.

ARTICLE HIGHLIGHTS

Research background

Testing campaigns for hepatitis B virus (HBV) have often focused on identifying infected patients [*i.e.* those with hepatitis B surface antigen (HBsAg)-positive serology] and increasing disease-status awareness. Few evaluations have been performed on how testing campaigns can impact vaccination uptake after receiving non-immunized status.

Research motivation

Since France has a low proportion of vaccinated individuals compared to other Western countries, interventions to increase HBV vaccination rates need to be evaluated in this population. This analysis addressed vaccination initiation among non-immunized participants in a large-scale screening campaign within the Paris metropolitan region. These individuals reflect a wide range of groups at-risk of HBV infection, allowing potential identification of subgroups with low vaccination coverage.

Research objectives

We aimed to describe rates of vaccination among non-immunized individuals during a mass-screening program. We also intended to evaluate the reasons for not initiating HBV vaccination after testing. This allows a first-hand account of why individuals do not vaccinate and helps tailor the needs for future intervention campaigns.

Research methods

Participants were recruited from two large phases of a multi-center, HBV-testing campaign in Paris, France. Non-immunized subjects were identified and contacted via telephone 3-9 mo after testing in order to determine whether they initiated vaccination. We considered vaccination coverage of all respondents (in a per-protocol analysis) and the overall non-immunized study population while assuming no vaccination in non-responders (in an intent-to-treat analysis).

Research results

Overall vaccination uptake was low with 11% of respondents declaring HBV vaccination initiation within 3-6 mo of testing. Few risk-factors for increased vaccination initiation were identified: from moderate or high HBV-endemic countries, with limited healthcare coverage, and men who have sex with men. Compelling differences were observed between centers with vaccination coverage ranging from 0%-56%.

Research conclusions

Given the low vaccine uptake in individuals at potential risk of HBV-infection, there is a major concern in the cascade of care among non-immunized individuals. The contrasting vaccination rates between centers indicate that the challenge to increase vaccination initiation lies within center-specific practices. At the individual level, increasing motivation to vaccinate among physicians and non-immunized persons alike

should be stressed.

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