

A cross-sectional study on dental surgeons' immune status against hepatitis B virus in the Public Health System

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ABSTRACT

Hepatitis B is a severe public health problem. The main world health centers have discussed it due to its pandemic proportion, high pathogenicity and infectivity. This study aimed to determine the immunization profile of dental surgeons - against hepatitis B virus (HBV) in the Public Health System (PHS) through the detection of anti-HBsAg antibodies by immunochromatography and associations with dental surgeons' social and educational profile, factors related to professional knowledge and practices. This is a cross-sectional study on the prevalence of vaccination and immune status to HBV in dentists of Sao Paulo State PHS. Data collection occurred in three stages: questionnaire application, analysis of adherence to the vaccination protocol and anti-HBsAg tests. Statistical analysis used the Bivariate Analysis and the Binary Logistic Regression. From the total of 219 interviewees, 74.9% reported having received three doses of the vaccine, but 35.6% were not immune to HBV. The dependent variable was associated with years in the public service (years) (OR [Odds Ratio]=1.04; 95% CI 1.00-1.08); knowledge on the subject (OR=6.93; 95% CI 1.39-34.40); incorrect answer concerning the etiological agent of the disease (OR=2.60; 95% CI 1.30-5.22); ignorance on the number of vaccine doses that have been administered (OR=3.43; 95% CI 1.14-10.30); and less than three doses of the vaccine in the immunization schedule (OR=8.76; 95% CI 3.50-21.91). A considerable portion of professionals non-immune to the HBV were found. We concluded that knowledge, years of practice and completion of the vaccination schedule (three doses) affected dental surgeons' immune status to HBV.

KEYWORDS: Hepatitis B. HBV. Anti-HBsAg. Australian antigen. Vaccination. Immunization. Dentistry.

INTRODUCTION

Hepatitis B consists of a severe infection in the liver. It is a pandemic disease with significant epidemiological indices. Estimates have suggested that about 2 billion people are infected with hepatitis B virus (HBV), and approximately 325 million live with chronic liver disease without access to diagnostic tests and treatments^{1,2}.

Among viral hepatitis, the B and C types account for 96% of deaths and morbidity rates due to cirrhosis and liver cancer in the world². For that reason, the World Health Organization (WHO) has published guidelines and recommendations to warn health services and professionals about the risks of infection, the importance of prevention and the need of implementing public health policies related to this disease¹. Likewise, a manual published in 2017 on tests to diagnose hepatitis B and C aimed at encouraging, expanding and strengthening health coordinated actions to make these laboratory tests available to the main vulnerable groups³.

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Received: 29 November 2019

Accepted: 3 February 2020

The great discussion about hepatitis B in the main world health centers is related to the high HBV infectivity and antiviral resistance which is up to 100 times higher than that of the human immunodeficiency virus (HIV)⁴ and 10 times higher than that of the hepatitis C virus (HCV)^{5,6}. This characteristic is related to the social conjecture, particularly in developing countries, since this disease is mainly silent and asymptomatic. Furthermore, it can evolve through different paths depending on the age, lifestyle and the patient's general health condition, aside from HBV genotypes and subgenotypes and mode of the pathogen's acquisition^{7,8}.

The vulnerable groups to this disease include health care professionals, who have a higher prevalence of HBV infections than the general population, regardless of the endemic condition in the region where they live^{9,10}. Therefore, approaching this subject in relation to dental professionals is essential, since they perform unsanitary activities in continuous and direct contact with the main modes of HBV transmission: blood and saliva^{11,12}. Besides, associated factors make dental surgeons more susceptible to this disease: high rates of laboratory accidents with contaminated sharp equipment, poor biosafety practices, negligent self-care, high virus pathogenicity and lack of immunization against HBV^{13,14}.

The vaccine against HBV was developed in the 1970s. Since 1986, it has been widely distributed and has demonstrated to be highly reliable, accurate and safe, so that it is considered the main preventive method against hepatitis B. For this reason, this preventive measure (vaccination) is not only a self-care practice of dental surgeons, but also the most efficient measure to protect patients' health, reducing the incidence of the disease¹⁵.

Even though the vaccine is highly immunogenic, around 10% of individuals who have completed their immunization schedule with three doses (0, 30 and 180 days) do not develop protective immunity, i.e., their antibody titers against HBV surface's antigen (anti-HBs) are lower than 10 mIU/mL. The main procedure to ascertain immunization is by performing a post-vaccination anti-HBs seroconversion test (6 to 8 weeks after the last dose) using enzyme immune assays and immunochromatography. The seroconversion status is an essential information for health professionals, as a booster dose may be necessary to stimulate the production of higher antibody levels^{16,17}.

Thus, considering that the Brazilian public health is one of the main sectors concentrating the labor force of dental surgeons in the country and that few researches have determined the vaccine protection status and prevalence in this risk group through a reliable, recommended, laboratory-based methodology, accessible to the population, this study aimed to determine in the dental surgeons working in the

Public Health System (PHS), their immune profile against HBV by means of anti-HBsAg enzyme immunoassays and immunochromatography, and its association with the social and educational profile of dental surgeons, as well as with factors related to professional knowledge and practices.

MATERIALS AND METHODS

Study design

This is a cross-sectional epidemiological study. Its population comprises all of the dental surgeons in the PHS, in all the 40 municipalities (a total of 774,441 inhabitants) in the Northwest region of Sao Paulo State covered by the Regional Health Department II (DRS II).

Sao Paulo State is located in the Southeast region of Brazil and has the highest number of dental surgeons in the country. Administratively, Sao Paulo is divided into 17 Regional Health Departments¹⁸ to meet the Brazilian Unified Health System's (SUS) guidelines and to comply with the institutional reforms agreed by the federated entities (the Union, States and municipalities) in the 2006 Covenant for Health Care (Pacto pela Saude) (Ordinance N° 3999/2006)¹⁹.

According to the information provided by the DRS II at the time of data collection, there were 276 active dental surgeons in the Public Health System. All the professionals who accepted participating in the study signed the Informed Consent. The exclusion criteria comprised municipal managers who did not authorize to carry out the study in their cities and dental surgeons who were laid off or were on work leave or maternal leave, retired, retirees of those who were absent after two visits during the data collection period.

Data collection

We divided the data collection into three stages as follows.

1st Stage

The first stage consisted of the application of a self-administered, semi-structured questionnaire. This instrument has been developed for this research. In order to design it, we conducted a wide bibliographic survey to include valid, sensitive and inferential variables. We divided the instrument into three dimensions: the first one has covered issues related to social, educational and demographic characteristics of the interviewees; the second dimension has investigated the representativeness of the professionals' knowledge and mastery regarding the hepatotropic virus type B, the transmissibility of viral

pathogens and the immunogenicity of the vaccine against HBV; and the third dimension determined the participants' valuation of their self-care practices.

We carried out a pilot study to investigate the instrument's applicability and operability to meet the study goal. The application of the instrument occurred in the participants' workplace, without disturbing or interfering with the clinic organization and the scheduled appointments.

2nd Stage

After the first stage, participants were individually forwarded to a private room provided by each health institution. At this moment, we requested the participants' immunization record and verified the completeness of the immunization protocol against HBV (three doses of the vaccine). In addition, we questioned the participants about the previous anti-HBs seroconversion test and its result.

3rd Stage

The last study stage verified the participants' immunization status through a rapid anti-HBsAg[®] immunochromatographic assay (Wama Diagnostica, Sao Carlos, SP, Brazil). The data collection procedures followed all biosafety rules and recommendations to protect the physical integrity of the participants and guarantee the tests reliability and sensitivity.

The rapid test is based on the immunochromatographic technology; it uses the sandwich principle to detect anti-HBsAg antibodies in human serum, plasma, or whole blood. Firstly, blood was collected through a fingerstick procedure with a sterile, disposable lancet. Then, blood from the fingertip was collected with a capillary tube. An approximate blood volume of 100 µL was immediately placed in the sample well indicated by the device. The result was read 15-20 min after the beginning of the assay.

The device employed is based on an immunochromatographic method. A positive result (the individual is considered immunized), occurs when the antibodies against the HBV surface antigen (anti-HBs) present in the sample bind to the HBsAg-colloidal gold conjugate, forming antigen-antibody complexes. This ensemble moves to the test area (T), where it binds to HBsAg antigens and shows a reddish pink band. Next, the remaining ensemble flows to the control area (C) and binds to anti-HBsAg antibodies in the control area, showing a second reddish pink band in this region, therefore determining the immunized status.

Negative results indicate that the individual was not immunized at all or that there is an insufficient level of antibodies, determining the non-immune status of individuals (<10 mIU/mL). This confirmation occurs when

there is only one reddish pink band in the control area (C), while the test area does not show any reaction (pink band).

Data analysis

We performed data tabulation and statistical analysis using the Statistical Package for the Social Sciences (SPSS for Windows, version 22.0, IBM, Armonk, New York, USA), and carried out the bivariate analysis using the Pearson's chi-square test, Fisher's exact test or the maximum likelihood ratio test, with a p-value <0.050 to verify associations between dependent and independent variables. Concerning the quantitative variables analyses (age, years after graduation, years in the public service), we initially applied the Kolmogorov-Smirnov test for normality (p≤0.05). However, as this test did not meet our purpose, we used the Mann-Whitney non-parametric test, considering a significance level of 5% (p≤0.05).

Next, we conducted a binomial logistic regression analysis with gross and adjusted estimates of odds ratios (OR) in order to control confounding variables and to identify factors modifying the mentioned event. This model included all the associations found between the dependent variable and the corresponding independent variables, considering a p-value <0.001. The confidence interval was adjusted to 95% and results were displayed as ORs.

Ethical and legal aspects

This research was approved by the Ethics and Research Committee (Protocol N° CAAE 54227416.0.0000.5420) and it complied with all ethical principles for research with human beings according to Resolution N° 466/2012 of the Brazilian National Health Council.

RESULTS

From a total population of 276 dental surgeons, four were on work or maternal leave, 24 did not want to participate in the study and 16 were not present after two interview attempts. In addition, 13 professionals did not participate in the study because three managers did not authorize the study in their cities. Therefore, the sample comprised 219 (79.4%) dental surgeons from 37 cities. We identified that 95.9% of participants reported to be immunized against HBV and 74.9% received at least three doses of the vaccine. However, the anti-HBsAg seroconversion test indicated that 35.6% of dental surgeons were not immunized against HBV.

Table 1 shows the dental surgeons' social and educational profile. Most participants were female (65.8%),

Table 1 - Bivariate analysis of social and educational factors with respect to the dependent variable (immunization to hepatitis B). Sao Paulo, Brazil, 2019.

Social and educational factors	What is the result of the immunization test?				Total		p-value
	Non immunized		Immunized		n	%	
	n	%	n	%			
Sex							0.062
Male	33	42.3	42	29.8	75	34.2	
Female	45	57.7	99	70.2	144	65.8	
Marital status							0.298
Not married	28	35.9	41	29.1	69	31.5	
Married/Common-law marriage	50	64.1	100	70.9	150	68.5	
Age group (years)							0.493**
20 to 29	9	11.5	16	11.3	25	11.4	
30 to 39	12	15.4	34	24.1	46	21.0	
40 to 49	31	39.7	48	34.0	79	36.1	
50 to 59	20	25.6	37	26.2	57	26.0	
60 or older	6	7.7	6	4.3	12	5.5	
Ethnicity							0.262**
White	60	76.9	116	82.9	176	80.4	
Mixed (black and white)	6	7.7	4	2.9	10	5.0	
Asian	12	15.4	20	14.3	32	14.6	
Years after graduation							0.189
< 5	7	9.0	12	8.5	19	8.7	
5 to 10	6	7.7	17	12.1	23	10.5	
11 to 20	13	16.7	38	27.0	51	23.3	
21 to 30	39	50.0	49	34.8	88	40.2	
>30	13	16.7	25	17.7	38	17.4	
Years in the public healthcare service							0.172**
<5	7	9.0	27	19.1	34	15.5	
5 to 10	11	14.1	26	18.4	37	16.9	
11 to 20	27	34.6	42	29.8	69	31.5	
21 to 30	32	41.0	43	30.5	75	34.2	
>30	1	1.3	3	2.1	4	1.8	
Workload							0.106
Up to 20 HPW***	54	69.2	82	58.2	136	62.1	
>20 HPW	24	30.8	59	41.8	83	37.9	
Schooling							0.575**
Undergraduate Course	40	51.3	60	42.6	100	45.7	
Specialist Degree	35	44.9	72	51.1	107	48.9	
Master's Degree	2	2.6	7	5.0	9	4.1	
PhD	1	1.3	2	1.4	3	1.4	
Smoker							1.000*
No	73	93.6	133	94.3	206	94.1	
Yes	5	6.4	8	5.7	13	5.9	
Use of alcoholic beverages							0.014
No	28	35.9	75	53.2	103	47.0	
Yes	50	64.1	66	46.8	116	53.0	
Sexual orientation							0.289*
Heterosexual	76	97.4	140	99.3	216	98.6	
Homosexual	2	2.6	1	0.7	3	1.4	
Relative who had or has hepatitis B							0.776*
No	74	94.9	132	93.6	206	94.1	
Yes	4	5.1	9	6.4	13	5.9	
Total	78	100.0	141	100.0			-

*Fisher's exact test; **Maximum likelihood ratio; *** HPW – hours per week.

married (68.5%), have graduated from 21 to 30 years ago (34.2%), have worked for 1 to 20 years in the public service and held a specialist degree (48.9%). We found a statistically significant association between the use of alcoholic beverages and the participants' immunization (Table 1).

Table 2 shows that most professionals reported having received guidance on hepatitis B (94.5%), and this information was provided during their undergraduate program (48.3%). However, the average years after graduation is 20.93 (SD±10.08), and 92.7% have not attended any course in the past two years. Half (50.2%) of interviewees were wrong in answering what is the etiological agent of hepatitis B, 72.1% confused or gave an incomplete answer on the modes of transmission of the disease, and only 19.2% correctly answered the preventive measures

against the disease in the dental clinic. The dependent variable showed statistically significant associations with "He/She received guidance on hepatitis B" (p=0.009) and "He/She knows the etiologic agent" (p=0.000) (Table 2).

Table 3 shows the dental surgeons' self-care practices with 95.9% having stated that they had been vaccinated against HBV; however, 23.8% of participants did not know how many doses they had received or they had received less than three doses. This situation occurred because some participants did not bring their immunization card to the interview, as previously requested. Only 80 (36.5%) dental surgeons had performed the anti-HBs assay previously, and 32.8% of them had a negative immunization result. Another result had great representativeness in almost half of the participants (48.4%) who reported having already

Table 2 - Bivariate analysis of knowledge factors and the dependent variable (immunization to hepatitis B), Sao Paulo, Brazil, 2019.

Knowledge factors	What is the result of the immunization test?				Total		p-value
	Non immunized		Immunized		n	%	
	n	%	n	%			
Received guidance on hepatitis B							0.009*
No	9	11.5	3	2.1	12	5.5	
Yes	69	88.5	138	97.9	207	94.5	
If yes, where?							0.003
Undergraduation	30	43.5	70	51.5	100	48.3	
Graduation	3	4.3	25	18.4	28	13.5	
Public Service	12	17.4	18	13.2	30	14.5	
Media	24	34.8	23	16.9	47	22.7	
Attended any course in the past two years							0.480
No	71	91.0	132	93.6	203	92.7	
Yes	7	9.0	9	6.4	16	7.3	
Knowledge the etiologic agent							0.000
Incorrect answer	52	66.7	58	41.4	110	50.2	
Correct answer	26	33.3	82	58.6	108	49.3	
What is the risk of contracting hepatitis B?							0.894**
High	59	78.7	107	75.9	166	75.8	
Medium	13	17.3	28	19.9	41	18.7	
Low	3	4.0	6	4.3	9	4.1	
Modes of transmission of hepatitis B							0.855
Incorrect answer	9	11.5	13	9.2	22	10.0	
Correct answer	21	26.9	40	28.4	61	27.9	
Incomplete answer	48	61.5	88	62.4	136	62.1	
The main preventive measure against hepatitis B in the dental clinic							0.885
Incorrect answer	10	12.8	20	14.2	30	13.7	
Correct answer	14	17.9	28	19.9	42	19.2	
Incomplete answer	54	69.2	93	66.0	147	67.1	
Does the vaccination against hepatitis B last a lifetime?							0.683
No	39	56.5	69	53.5	108	49.3	
Yes	30	43.5	60	46.5	90	41.1	
Total	78	100.0	141	100.0			-

*Fisher's exact test; **Maximum likelihood ratio

had a history of accident with sharp instruments, with recurrence in 62.2% of the cases, mainly when recapping needles (66%). Even though 76% of participants were aware of the protocol for accidental puncture wounds, less than half (53%) sought medical care or performed any exams (Table 3).

Concerning the bivariate analyses, the immunization profiles of participants had statistically significant

associations with the variable “How many doses of the vaccine against hepatitis B have you received?” ($p=0.000$) and “Do you wash your hands after each clinical appointment?” ($p=0.036$). Furthermore, the Mann-Whitney test found associations with the number of years in the public service ($p=0.038$).

The multivariate analysis (Table 4) carried out through the binomial logistic regression indicated that the number

Table 3 - Bivariate analysis of factors related to professional practices and the dependent variable (immunization to HBV) –Brazil, 2019.

Factors related to professional practices	What is the result of the immunization test?				Total		p-value
	Non immunized		Immunized		n	%	
	n	%	n	%			
Received the vaccine							0.072*
No	6	7.7	3	2.1	9	4.1	
Yes	72	92.3	138	97.9	210	95.9	
How many doses of the vaccine against hepatitis B did you receive?							0.000
Do not know/ Do not remember	14	18.2	7	5.0	21	9.6	
Less than three doses	21	27.3	10	7.2	31	14.2	
Three doses or more	42	54.5	122	87.8	164	74.9	
Have you ever performed the anti-HBs test?							0.375
No	52	66.7	83	60.6	135	61.6	
Yes	26	33.3	54	39.4	80	36.5	
If yes, what was the result?							0.053
Negative	13	54.2	14	30.4	27	27	
Positive	11	45.8	32	69.6	43	43	
Do you wash your hands after each clinical appointment?							0.036
Always	58	74.4	121	85.8	179	81.7	
Sometimes	20	25.6	20	14.2	40	18.3	
Use of personal protective equipment							0.681
Always	69	88.5	122	86.5	191	87.2	
Sometimes	9	11.5	19	13.5	28	12.8	
Adherence to the biosafety protocol							0.627
Always	68	87.2	126	89.4	194	88.6	
Sometimes	10	12.8	15	10.6	25	11.4	
Have you ever had an accident with sharp instruments?							0.725
No	39	50.0	74	52.5	113	51.6	
Yes	39	50.0	67	47.5	106	48.4	
If yes, how many times?							0.599**
Once	18	46.2	22	32.8	40	37.7	
Twice	13	33.3	27	40.3	40	37.7	
Three times	5	12.8	11	16.4	16	15.1	
Four times	3	7.7	7	10.4	10	9.4	
If yes, which instruments?							0.748
Needle (recapping)	25	64.1	45	67.2	70	66.0	
Other	14	35.9	22	32.8	36	34.0	
If yes, did you follow the protocol?							0.171
No	15	38.5	35	52.2	50	47.2	
Yes	24	61.5	32	47.8	56	52.8	
Total	78	100.0	141	100.0			-

*Fisher's exact test; **Maximum likelihood ratio

Table 4 - Gross and adjusted multivariate analysis of the associations between the dependent variable and factors related to social and educational aspects, knowledge and professional practices, Sao Paulo, Brazil, 2019.

Variables	Logistic regression			
	OR _{Crude} (95% CI)	p-value	OR _{Adjusted} (95% CI)	p-value
Years in the public healthcare service	1.033 (1.001-1.065)	0.044	1.041 (1.001-1.081)	0.043
Sex				
Male	1.729 (0.971-3.076)	0.063	1.580 (0.782-3.193)	0.202
Female	-	-	-	-
Use of alcoholic beverages				
No	-	-	-	-
Yes	2.029 (1.149-3.584)	0.015	1.741 (0.875-3.466)	0.114
Received guidance on hepatitis B				
No	6.000 (1.574-22.873)	0.009	6.935 (1.398-34.408)	0.018
Yes	-	-	-	-
Knowledge on the etiologic agent				
Incorrect answer	2.828 (1.585-5.043)	0.000	2.609 (1.303-5.226)	0.007
Correct answer	-	-	-	-
How many doses of the vaccine against hepatitis B did you receive?				
Do not know/Do not remember	5.810 (2.196-15.366)	0.000	3.437 (1.147-10.300)	0.028
Less than three doses	6.100 (2.658-13.999)	0.000	8.760 (3.502-21.913)	0.000
Three doses or more	-	-	-	-
Do you wash your hands after each clinical appointment?				
Always	-	-	-	-
Sometimes	2.086 (1.042-4.177)	0.038	1.292 (0.558-2.993)	0.550

of years of practice is a risk factor, as each additional year increased the risk of non-immunization was OR=1.041; 95% CI 1.00-1.08. Likewise, participants who did not receive any guidance on hepatitis B and those who confused the etiologic agent had OR=6.935; 95% CI 1.39-34.40 and OR=2.609; 95% CI 1.30-5.22. i.e. had more chances not to be immunized, respectively. Participants who did not know/did not remember how many vaccine doses they had received showed OR=3.437; 95% CI 1.14-10.30, having more chances not to be immunized, while those who had received less than three doses had OR=8.760; 95% CI 3.50-21.91 of non-immunization compared to those who had three or more doses (Table 4).

DISCUSSION

This is one of the first studies carried out with dental surgeons in the PHS, in Brazil, aiming at mapping the immunization of these professionals using the immunochromatographic technology to identify the level of anti-AgHBs antibodies in this specific population.

This investigation found that 35.6% of dental surgeons in the PHC were not immunized against HBV, pointing out

a contrast between professional vulnerability and self-care negligence.

In Brazil, after more than 30 years since the vaccine against hepatitis B was introduced in the national immunization program in the PHS, the adhesion of dental academics and dental surgeons is still inconsistent and negligent, as shown by the anti-HBs seroconversion assay¹⁷. Although health institutions recommend and guide immunization, some professionals do not follow the regulations, causing a failure in their self-care. In addition, the lack of efficient mechanisms for inspection and control of these health actions contributes to this negligent and reckless behavior.

By analyzing studies performed with dental professionals in other countries, we observed a different situation in comparison with the one identified in this study. In Iran, 11.5%²⁰ of professionals were not immunized against HBV; in Spain, the estimate was 27.02%²¹; in Italy, 17%²²; in the Netherlands, 12%²³; and in the USA, only 7.1%²⁴. What may justify this high prevalence of non-vaccination or non-protection among Brazilian dental surgeons is the possibility of a gradual decline of antibody levels, from 13 to 60%, one year after the end of the immunization schedule²¹.

Other factors associated to anti-HBs seroconversion can affect the production of antibodies, reducing the effectiveness of vaccinated individuals' immunization, such as vaccine storage methods, correct administration of doses, the immunization program and the protocol followed by each healthcare service²⁵. In addition, we verified through a systematic review and meta-analysis that male, adult, elderly individuals with BMI (Body Mass Index) ≥ 25 , who smoke and have concomitant comorbidities, have higher risks of immunization failure, reinforcing the importance of performing the anti-HBs evaluation, and providing booster doses of the vaccine against HBV²⁶.

Another expressively relevant issue in this study was the association between the number of vaccine doses and the non-immunization of dental surgeons. This association was due to the non-completion of the immunization schedule by the study participants (they did not remember or they received less than three doses), justifying the deficient immune protection^{20,27}.

Nowadays, thanks to the evolution of genetic engineering, the immunization schedule comprises three doses, which must respect the administration interval between them (0, 30, 180 days), so that the immunization against the virus is guaranteed, with anti-HBs titers higher than 10 mIU/mL². Concerning the vaccine coverage, a study conducted with participants in Australia, Belgium, Canada, Czech Republic, Germany, New Zealand, the Philippines, Russia, Spain, and the United States determined that the protective response occurs in 95% of children and adolescents, 90% of health young adults up to 49 years old, and $\geq 80\%$ of individuals aged 60 years old or over²⁸. In addition, according to WHO, immunosuppressed and hemodialysed individuals have 50-70% of immunization against HBV, and individuals with liver disease have 60-70%²⁹.

However, the knowledge and confirmation on the immunization status through the anti-HBs test is not recommended to the whole population because of the vaccine effectiveness. Nevertheless, health professionals, due to their vulnerability and exposure to occupational unhealthy procedures, are supposed to confirm their protection and be concerned with the maintenance of this status^{20,30,31}. For the same reason, individuals with low antibody levels and complete immunization schedule need to receive a booster dose, because, despite the premise of immunological memory, this supplementary dose is recommended to this vulnerable group, given their exposure to the main modes Hepatitis B transmission².

Regarding the knowledge of dental surgeons about the subject approached, we found gaps concerning elementary issues of hepatitis B, modes of transmission, and disease prevention in the dental clinic context. The statistical

analysis pointed out the influence of this dimension on the representativeness of non-immunized individuals.

This association confirms the relevance of professional training, since acquiring this knowledge reflects in the practices and self-care conducts of dental professionals. Costa *et al.*³² observed that primary health care workers who have more knowledge on occupational health are more favorable to vaccination. Other studies observed this same behavior in Brazilian and Lithuanian dental surgeons, especially in the younger ones^{33,34}. Garbin *et al.*³⁵ analyzed the knowledge of PHC dental surgeons and concluded that the representativeness of hepatitis B in the professionals' concept does not match its actual pathogenic and epidemiological significance, requiring more professional preparation measures to face diseases in public health and disrupt critical nodes.

Regarding professional practices, even without the confirmation of statistically significant associations, we found a high percentage of participants with a recurrent history of accidents with sharp equipments, mainly when recapping needles. Other studies have also observed this occurrence^{11,32}, and they suggested the need for a continuous training of dental professionals and thematic debates in the workplace to provide dental surgeons with knowledge and showing them the value of self-care measures.

A decrease in diseases caused by work activities in healthcare settings happened after recognizing the biosafety axiom in the medical practice, the use of personal protective equipment, and the creation of protocols on pre- and post-exposure to contaminated materials and fluids³⁶. However, even with minimized occupational risks, accidents are still significantly frequent. Their potential of developing diseases in non-immunized individuals must be considered, particularly regarding HBV, since its infectivity ranges from 6 to 30% in accidents with sharp materials and blood known to be contaminated. A tiny amount of contaminated blood (0.0001 mL) is enough to transmit the pathogen³⁷.

The laboratory method used in this study was the immunochromatographic technology-based rapid assay due to its suitability for the investigation and screening at the population level, in endemic areas or in vulnerable groups. This method's advantages are the low cost, high specificity, rapid test processing, easy technical features, diagnosis efficiency, high patient's acceptance, and no need for a laboratory infrastructure³⁸⁻⁴⁰. Further, we chose this technology based on the WHO's guidelines to track the HBV antigen and antibody levels and to eliminate hepatitis B as one of the main threats to public health³.

Due to the cross-sectional, epidemiological nature of this study, its limitations included the use of a questionnaire assessing memory-based variables, so the answers given

in the questionnaire application have a potential for bias. The study results indicated the presence of individuals immunized against HBV who stated they were not vaccinated (n = 3) and had less than three doses of the vaccine (n = 10). This contradiction can be explained by the fact that these participants did not show their immunization record during data collection and, due to the memory-based variables, these data can be biased. In addition, we used the rapid immunochromatographic assay to analyze the immunization of participants against HBV, which has a lower specificity and sensitivity rate when compared to other laboratory methods. However, this technique has several advantages and is used in population studies.

CONCLUSION

We found a considerable number of dental surgeons in the Public Health System non-immunized against HBV. They are vulnerable and exposed to the main modes of virus transmission, especially due to the high prevalence of occupational accidents. Furthermore, knowledge, years in the public service and the value given to self-care related to the immunization schedule completion affected the vaccine protection.

ACKNOWLEDGMENTS

This study was financed in part by the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brazil (CAPES) - Finance Code 001*.

AUTHORS' CONTRIBUTIONS

CAS Garbin and TA Saliba designed the study, the data collection tool and wrote the article; B Wakayama and OA Saliba Junior carried out the data collection, the analysis and interpretation of data and wrote the article; AJI Garbin designed the study and critically reviewed the article.

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