HBV Prophylaxis through vaccination in Romanian dental professionals exposed to *Toxoplasma gondii*

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Abstract: Background: Blood borne diseases are important diseases that can transmit their etiological agents in the medical office. One of the most feared due to its contagious remains hepatitis B virus (HBV). This infection is vaccine preventable. The present study aimed to assess the HBV infection and HBV vaccination status of Romanian dental professionals exposed to *Toxoplasma gondii*, a very common parasitic worldwide infection. We assessed HBV vaccination status, attitudes, knowledge, and fears.

Methods: In 2024, an analytical cross-sectional observational survey was carried out in six months, from February to August, in dental offices in Romania. Using SPSS (version 23), data collected through a self-administered questionnaire were examined. Where applicable, chi-square tests were employed.

Results: Responses from 1708 individuals were examined. The median age of the cohort under study was 31.22 ± 12.7 years (range: 18–76 years). 742 (43.44%) of the participants had worked in dental offices for more than three years, and 1470 (86.07%) were from urban dental offices. 322 (18.85%) nurses, 308 (18.03%) dental technicians, and 392 (22.95%) dentists were present. 1120 dentists (65.57%) had received an HBV vaccination. 420 (24.59%) had received an HBV vaccination before to beginning work at the dental clinic. The dental technician category had the highest rate of HBV not-vaccination, at 154 (13.75%). The urban dental office had a significant ($p<0.05$) correlation with HBV vaccination status (OR = 0.38; 95% CI: 0.28-0.51). More than half of the respondents, 1456 (85.25%), had not been exposed to HBV while

working in a dental office, and 882 (51.64%) were unaware of post-exposure HBV prophylaxis. 98 dentists (5.74%) were unaware of the HBV transmission mechanism. Of the dental professionals who worked with or for patients infected with HBV, 812 (47.54%) expressed fear of contracting the virus. Testing for antiHBs antibodies (OR = 0.38; 95% CI:0.29–0.51), knowledge of pre-exposure to HBV prophylaxis (OR = 0.49; 95% CI:0.37-0.67), and the respondents' role/occupation in the dental office (OR = 0.70; 95% CI:0.56–0.88) were all significantly correlated with the fear of contracting HBV ($p<0.05$, nonparametric Chi-square test).

Conclusions: The current study found disparities in knowledge, attitudes, and opinions within the group under investigation, as well as a low level of HBV immunization in the dentist's office. The dental technicians were terrified of the possibility of contracting HBV and had received fewer HBV vaccinations. They were unaware of the possibility of contracting HBV. Dental professionals in Romania should be encouraged to learn about HBV prevention before and after exposure. The level or titer of protective antiHBs antibodies should be measured to lessen the concern of contracting HBV while working with or for patients who have the virus. Romanian dental offices need to enhance their HBV vaccination status.

Keywords: Romanian dental office; blood borne disease; antiparasitic antibodies

1. Introduction

The hepatitis B virus (HBV) is the cause of hepatitis B, a potentially fatal illness that can be prevented by vaccination. This virus mostly targets the liver. Chronic infection, cirrhosis, hepatocellular carcinoma (HCC), liver failure, and ultimately death are all possible outcomes. This is a serious issue for world health [1]. HBV can easily spread by a variety of methods, primarily parenteral, including sharing syringes, needles, and injection equipment, as well as during pregnancy or childbirth [1]. Any bodily fluid that could impede dental procedures, including blood, perspiration, saliva, or bodily fluids from an HBV-infected individual, contains infectious complete particles. Like other blood-borne viruses like HCV or HIV, HBV can spread through direct contact, sharing of various contaminated dental materials, improperly sterilized dental equipment, or even the delivery of dentures between dental health care professionals like dentists, dental assistants, dental technicians, and anybody else working in the dental field [2–5]. Dentistry may result in occupational exposure to HBV due to its ability to persist outside the body and remain infectious for at least seven days [6]. Healthcare professionals who work in dentistry may be 10 times more likely than the general population to develop chronic hepatitis B [7]. A variety of HBV particles are produced during hepatitis B viral replication, including infectious HBV virions (Dane particles) and non-infectious HBV particles (naked nucleocapsids, encased capsids harboring immature DNA/RNA, and subviral spherical or filamentous particles) [8,9]. The emergence of a unique patient group known as surface antigen (HBsAg) carriers translates these replication mistakes into clinical practice. Of these, many are inactive HBsAg carriers, usually in a benign state; in fact, there are more than 300 million people known as inactive carriers. The absence of HBeAg and the presence of anti-HBe, undetectable or low amounts of HBV DNA in PCR-based assays, normal ALT levels, minor necroinflammation, slight fibrosis, or even normal histology on liver biopsy are characteristics of the inactive HBsAg carrier status [10]. Patients with chronic hepatitis B (CHB) in virological and biochemical remission as well as those with chronic necro-inflammatory liver disease brought on by a persistent HBV infection are additional groups of HBsAg carriers [11]. AntiHBs and HBsAg may coexist in patients with chronic hepatitis B and are linked to an increased risk of hepatocellular carcinoma (HCC) [12].

With 116 million and 81 million chronically infected individuals, respectively, the WHO Western Pacific and WHO African regions have the highest incidence of hepatitis B. The following are additional WHO data: The WHO Eastern Mediterranean Region has 60 million infected individuals, the WHO South-East Asia Region has 18 million, the WHO European Region has 14 million, and the WHO Region of the Americas has 5 million [13]. Vaccination is the most effective method of preventing hepatitis B, and a safe and efficient vaccine has been available since 1981 [14]. By preventing hepatitis B infection, consequences such hepatocellular cancer, chronic hepatitis, liver failure, and ultimately death are prevented. Depending on the vaccine's formulation and the recipient's immunological state, a course of two, three, or four hepatitis B vaccinations may be advised. In addition to children and adolescents who have not yet gotten the vaccine, the Centre's for Disease Control and Prevention (CDC) advises all newborns to have the hepatitis B vaccine within 24 hours of delivery (often in three doses spread out over six months) [15]. Vaccination is required for those who are more susceptible to contracting hepatitis B because of their job, such as healthcare personnel who handle blood or other infectious fluids. Individuals who go to endemic countries, engage in high-risk sexual behaviour, use injectable drugs, have low incomes, or have specific medical issues are additional risk groups. By following good clinical hygiene procedures, healthcare professionals in all specialties—including dentistry—can stop HBV from spreading, which is crucial for both them and their patients. HBV transmission can be prevented by a high standard of clinical hygiene practices, such as routine decontamination, appropriate instrument sterilization, cleanliness before and after treating each patient, and the use of disposal equipment.

Until there is no risk of spreading the virus, elective dental procedures for individuals who are likely to be infected with HBV should be delayed [2]. The risk of HBV infection transfer during dental care has decreased because to recently adopted decontamination and sterilizing procedures. However, it is necessary to design and implement standard procedures for instrument reprocessing, operatory cleansing, the use of protective equipment, infection control measures, appropriate sterilization or disinfection techniques, and injury treatment [6]. To avoid HBV infection, vaccination practices are crucial. Dental professionals exposed to *Toxoplasma gondii* may experience issues related to hepatitis B virus (HBV) infection status, particularly in the context of co-infections with other liver pathogens. The combined effect of viral replication and parasitic infection may lead to more severe liver inflammation and injury.

The present study aimed to assess the HBV infection and HBV vaccination status of Romanian dental professionals exposed to Toxoplasma gondii, a very common parasitic worldwide infection. We evaluated Romanian dentists' status, knowledge, attitudes, and opinions about HBV infection and vaccination, as well as their fears about working with or for patients who have been infected by the virus.

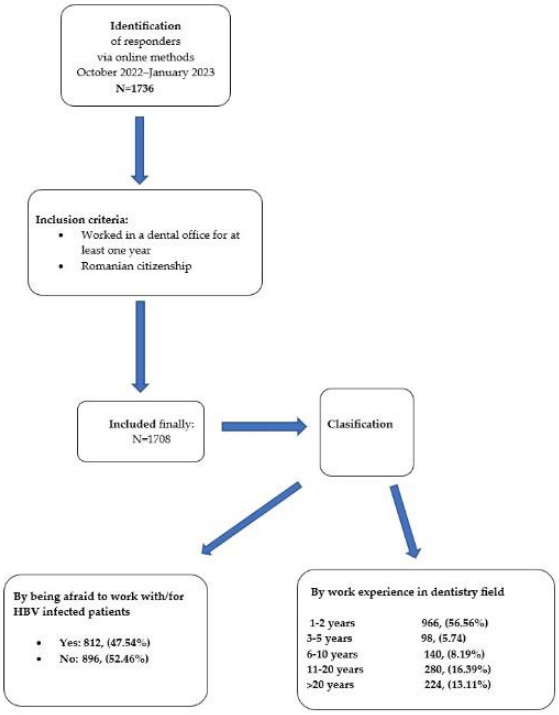
2. Materials and Methods

Participants, Study Design, and Environment

Over a six-month period in 2024, from February 2 to August 31, an analytical cross-sectional observational survey was carried out in dental practices in Romania. In addition to all dental professionals who worked in dental offices (dentists, dental technicians, dental nurses, and dentistry practitioner students), we also included other groups that had contact with the dental office, such

janitors, couriers, or receptionists. The recommendations of "The Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE) served as the foundation for the study's design. Supplementary Materials include the STROBE checklist (Supplementary Materials File S1). During dental procedures, contact with the saliva, blood, or tissue of a patient infected with HBV but not infected with HBV was considered exposure to HBV. Our goal was to sign up at least 1500 people. The tightly defined inclusion criteria required: Romanian citizenship; prior exposure to *Toxoplasma gondii* and at least one year of experience working in a dental practice. The exposure to *Toxoplasma gondii* was documented by the presence of antibodies against this parasitic microorganism. We provided a survey that included all required questions. We chose to exclude individuals from dental offices with response rates below 80%. Because of systematic sampling and stratified sampling, which identified people in the dentist office with strict attribution, our examined group was representative. We made the decision to create specific places where the questionnaire might be used to include as many dental offices as feasible. The capital, Bucharest, and 41 counties make up the Romanian population. As a result, we sampled the created areas using a straightforward random method. One town (as an urban residence) and one village (as a rural residence) were chosen from each county. We chose one dentist clinic at random from each location. Volunteer medical students from the "Carol Davila" University of Medicine and Pharmacy in Bucharest, Romania, helped with the study. Every employee at the chosen dental business was questioned, Figure 1.

Figure. 1. Flow diagram of the selection process



Survey Questionnaire and Data Collection

Only a self-administered questionnaire was used to collect data. Each respondent gave their informed consent before replying, and the medical volunteer students who assisted with distributing the questionnaire were prepared to clarify any questions if necessary. The online poll was anonymous and voluntary, but it was also monitored to be authentic, so no one answered the same question again. The study's goals were explained to the participants prior to their involvement, and each gave their consent before answering the questionnaire. The questionnaire was administered online using cloud-based Google Forms survey software. The available period for answering was six months, in 2024 from the 2nd of February 2024 to 31st of August 2024. It included 20 multiple-choice questions (Supplementary Material File S2). The time to complete the questionnaire was ten minutes.

Ethical Approval

The questionnaire was peer-validated and approved by the Ethics Committee of Carol Davila University of Medicine and Pharmacy, Bucharest, Romania (3504/ 2nd February 2024), and all procedures in the study respected the ethical standards of the Helsinki Declaration. Written informed consent was obtained from all participants, no minors included in the study.

Statistical Analysis

Data from the questionnaire were analyzed using Microsoft Excel and IBM® SPSS® Statistics Version 23.0. We confirm that we have obtained a copyright license for the statistic version used. For data processing, the COUNTIFS function in Excel was used to filter and sort the initial databases. Except for age, all data were categorical variables, and we applied a nonparametric chi-square test. The variables considered significant in relation to our main dependent variable were included in a logistic regression to identify the most important predictors that contributed to dental health care professionals' fear of becoming HBV-infected in the dental office while working for/with HBV-infected patients. For all tests, the threshold for statistical significance was set at $P < 0.05$.

3. Results

Genal data of responders and HBV vaccinated profile

There were 1708 completed surveys left after invalid ones were removed. All of the responses were fully supported by the evidence in File S3 of the Supplementary Materials. The majority of respondents, 1470 (86.07%), were from urban dental offices, and 742 (43.44%) had more than three years of experience in the dental office. The mean age of the respondents was 31.22 ± 12.7 years (limits: 18–76). Each respondent in our group had a distinct position or occupation in the dental office: 392 (22.95%) were dentists, 308 (18.03%) were dental technicians, 322 (18.85%) were dental nurses, 546 (31.96%) were dentistry practitioner students, and 140 (8.19%) were respondents in other categories who worked in dental offices (Table 1).

Table 1. General socio-demographic characteristics of respondents to the questionnaire.

Characteristic	Number (1708)	(%)
age in years, median (min-max)	24.5	(18-76)
feminine gender	1204	(70.49%)
urban residence	1470	(86.07%)
is HBV infected	84	(4.92%)
was exposed to HBV during practice	252	(14.75)
work experience in dentistry field		
1-2 years	966	(56.56%)
3-5 years	98	(5.74)
6-10 years	140	(8.19%)
11-20 years	280	(16.39%)
>20 years	224	(13.11%)

To establish a correlation between the HBV vaccination status and the general sociodemographic characteristics of the entire group, we computed Chi square and found statistically significant ($p<0.05$) relationships between the HBV vaccination status and the dental professionals' role/occupation in the dental office, the dental office's area of provenience, and their work experience in the dental field. Consequently, the following relationship between HBV vaccination status and role/occupation at the dental office was found: In contrast to 196 (17.5%) dental nurses and 154 (13.75%) dental technicians, 322 (28.75%) dentists have received an HBV vaccination. With 378 (33.75%) vaccinations, dental practitioner students were the group most immunized against HBV. There were statistically significant ($p<0.05$) correlations between the dental office's place of origin and HBV vaccination status; 1008 (90%) of respondents from urban dental offices had an HBV vaccination, compared to 112 (10%) from rural dental offices. We discovered a significantly significant ($p<0.05$) correlation between HBV vaccination status and dental job experience: In contrast to the 456 (42.5%) HBV vaccinated respondents who had more than three years of experience, 664 (57.5%) HBV vaccinated respondents had less than three years.

Only one studied variable was significantly associated with HBV vaccination status: area of dental office (OR =0.38; 95% CI:0.28-0.51),$p <0.05$, Table 2.

Table 2. Logistic regression for HBV vaccination status in the 1708 studied group

Variable	B	E.S.	Wald	*p*	OR	Lower CI 95%	Upper CI 95%
Role/ocupation in the dental office	.816	.124	43.525	.000	2.26	1.77	2.88
work experience in dentistry field	.398	.120	10.897	.001	1.48	1.17	1.88
area of dental office	-.960	.146	43.074	.000	0.38	0.28	0.51

Legend: B (coefficient), E.S. (standard error), Wald (Wald test), p (p-value), OR (odds ratio), CI (confidence interval)

We assessed the knowledge, beliefs, and attitudes of dental healthcare workers, including dentists, dental nurses, dental technicians, dental practitioner students, receptionists, janitors, and couriers, regarding HBV vaccination practices because the virus is easily spread in dental offices. In our cohort, 1120 patients (65.57%) had received an HBV vaccination. We found that 700 (40.98%) of the HBV responders were vaccinated at birth, and 420 (24.59%) were immunized when they began working in the dentistry office. 910 (53.28%) of the respondents were unsure on the duration of protection provided by the HBV vaccine. There were 1274 (74.59%) respondents who were unaware that the HBV vaccine prevents hepatocellular cancer, and 1050 (61.48%) respondents were unaware of the HBV vaccination algorithm. Additionally, 1400 respondents (81.97%) did not test for the antiHBs antibody titer, which measures immunological HBV status. Following HBV vaccination more than half of the respondents (1092, 63.93%) were unaware that they might not produce an immune response and protective antibodies, which could result in a lack of HBV protection. Of the respondents, 1456 (85.25%) had not been exposed to HBV while working in a dental office, and more than half (882, 51.64%) were not aware of post-exposure HBV prophylaxis. about the respondents, 98 (5.74%) were unaware about the mode of HBV transmission. Table 3 displays all of the data we collected from our respondents.

Table 3. Knowledge, opinions, and attitudes about HBV vaccination in the dental healthcare workers

Knowledge, practices, and attitudes discussed	Number (1708)	(%)
trained in HBV prophylaxis during dental practice	518	(30.33%)
knew that HBV is easily transmitted during dental practice	1610	(94.26%)
HBV vaccinated just one year ago	154	(9.02%)
knew how much time HBV vaccine offers protection	70	(4.10%)
know the HBV vaccination algorithm	658	(38.52%)
tested the level of antiHBs antibodies after vaccination	308	(18.03%)
knew that HBV vaccine protects against hepatocellular carcinoma	434	(25.41%)
knew that re-vaccination is recommended in case of non-responders	616	(36.07%)
knew pre-exposure HBV prophylaxix	1022	(59.84%)
knew post-exposure HBV prophylaxis	826	(48.36%)
didn't get HBV immunoglobulins after HBV expposure	252	(14.75)
knew correctly how HBV is transmitted	1610	(94.26%)

Additionally, we posed specific questions about how dental professionals handled dealing with HBV-infected patients in their offices and their reactions to such situations. Only a tiny portion of respondents

(294 [17.21%]) did not attempt to ascertain their HBV status. Table 4 displays all of the information that was obtained.

Table 4. Attitudes in management of HBV infected patients

Attitude	N=1708	(%)
refused to work with/for an HBV infected patient	98	(5.74%)
worked with/for an HBV infected patient	686	(40.16%)
found out that the patients is HBV infected from patient chart	784	(45.90%)
found out that the patients is HBV infected from patient himself	630	(36.88%)
were afraid to work with/for HBV infected patients	812	(47.54%)
when working with an HBV infected patients used better protection	1414	(82.78%)
when working with an HBV infected patients protected as usual	196	(11.47%)

Fear to become HBV infected while working with/for the HBV infected patient in the dental office

In the study group there were 812, (47.54%) responders afraid that they may become HBV infected while working in the dental office. We examined a number of variables to ascertain their association with the fear of contracting HBV by using a nonparametric Chi-square test.

First, we tested the role of each dental professional in the dental office. We found an association ($p<0.05$) between role and the fear of working with or for HBV-infected patient. Respondents who were not scared to work for or with HBV-infected patients outnumbered those who were in certain respondent categories. There were equal numbers in the following categories: 252 vs. 140 dentists; 182 vs. 140 dental nurses. 70 vs. 70 other categories; 154 vs. 154 dental technicians. In the dental practitioner student group, 238 students were not scared to work with patients infected with HBV, whereas 308 students were.

Second, we looked for a correlation between dental work experience and the dread of working with or for patients infected with HBV. The Chi-square test confirmed this correlation ($p<0.05$). Compared to respondents with more experience, individuals with less dental office experience and those who had only worked there for one to two years expressed more fear about working with or for patients who were infected with HBV. Fear was reported by 546 out of 420 respondents in the group with 1-2 years of experience, 42 out of 56 in the group with 3-5 years of experience, 70 out of 70 in the group with 6-10 years of experience, 56 out of 224 in the group with 11-20 years of experience, and 98 out of 126 in the group with more than 20 years of experience.

Third, we investigated the relationship between the risk of HBV infection and transmission at the dentist office and the dread of working with or for HBV-infected patients, given that HBV is generally easily spread. Compared to 14 (14.28%) respondents who were afraid but did not acknowledge HBV transmission, 798 (49.56%) respondents acknowledged that HBV was easily transferred and were afraid ($p<0.05$). As a result, those who knew that HBV is easily spread were more terrified to work with or for patients who had the virus than those who did not.

Fear of contracting HBV from working with an infected patient and testing for the titer or amount of antiHBs antibodies—antibodies that demonstrate protection against HBV infection—was the fourth association we examined. Testing for this kind of antibody is generally rare, but in this instance, it could be helpful for dental healthcare professionals. A statistically significant correlation was discovered ($p<0.05$). Out of the 308 respondents who had their antiHBS antibody levels checked, 98 (31.81%) expressed fear of contracting HBV while working with or for patients who had the virus, while 210 (68.18%) did not ($p<0.05$). Less anxiety of contracting HBV was linked to testing for and understanding the titer/level of antiHBS antibodies.

The fifth association we observed to be statistically significant ($p<0.05$) was between the awareness of pre-exposure to HBV prophylaxis and the fear of contracting HBV while working for or with the patient who has HBV. In contrast to 322 (35.93%) respondents who were unaware and unafraid, 364 (44.82%) respondents were afraid and did not know about pre-exposure prophylaxis.

In the studied dental offices 686, (40.16%) responders had already worked with or for an HBV-infected patient. Therefore, the sixth association was between the fear of becoming HBV-infected while working for/ with the HBV-infected patient and working during dental practice with/for the HBV-infected patient. We found a statistically significant association ($p< 0.05$) between these variables: the fear generated by working with the HBV-infected patient was present in 280 (40.81%) vs. 406 (59.18%) from the 686 responders who worked with the HBV-infected patients compared with 532 (52.05%) vs. 490 (47.94%) responders from the 1022 responders who did not work with the HBV-infected patient in the dental office. It seems that the responders who effectively worked with HBV-infected patients were afraid because they realized the danger of HBV infection.

There was no correlation ($p>0.05$) between the dental office's location (rural or urban) and the fear of contracting HBV while caring for or working with an infected patient; 112 (13.79%) respondents in rural areas reported feeling afraid, while 700 (86.20%) respondents in urban areas reported feeling afraid. We linked the fear of contracting HBV when working with or for an HBV-infected patient to anti-HBV vaccination status; however, there was no statistically significant correlation ($p>0.05$). 602 (53.73%) respondents were HBV vaccinated and unafraid, while 518 (46.25%) respondents were vaccinated and worried about contracting HBV while caring for or working with HBV-infected patients, even if anxiety had no bearing on their HBV vaccination status.

Furthermore, there was no correlation between having knowledge of post-exposure prophylaxis and being afraid of contracting HBV while working with or for an HBV-infected patient: 378 (45.76%) respondents who were afraid and knew about it compared to 448 (37.04%) respondents who were not afraid but knew about post-exposure prophylaxis ($p>0.05$).

The following studied variables were substantially linked to the concern of contracting HBV when caring for or working with an infected patient in a dental office: AntiHBs antibody levels following vaccination (OR = 0.38; 95% CI:0.29–0.51), $p<0.05$; awareness of HBV prophylactic exposure prior to vaccination (OR = 0.49; 95% CI:0.37-0.67), $p<0.05$, Table 5.

Table 5. Logistic regression for the 1708 total studied group for fear to become HBV infected while working with/for the HBV infected patient in the dental office with knowledge, attitudes and practices

Variable	B	E.S.	Wald	*p*	OR	Lower CI 95%	Upper CI 95%
level of antiHBs antibodies after vaccination	-.951	.144	43.445	.000	.38	.29	.51
knowledge of pre-exposure HBV prophylaxis	-.697	.152	20.963	.000	.49	.37	.67
knowledge of post-exposure HBV prophylaxis	.589	.154	14.732	.000	1.80	1.33	2.43
working during dental practice with/for the HBV infected patient	.692	.149	21.711	.000	1.99	1.49	2.67

Legend: B (coefficient), E.S. (standard error), Wald (Wald test), p (p-value), OR (odds ratio), CI (confidence interval)

Respondents who are aware of post-exposure HBV prophylaxis have a 1.8-fold greater anxiety of contracting HBV than those who are unaware of this kind of prophylaxis. Conversely, people who are aware about HBV pre-exposure prophylaxis have a 0.49-fold greater dread of contracting the virus than people who are unaware of it.

The role or occupation of the respondents in the dental office was found to be the most statistically significant factor for the fear of contracting HBV. We also looked at some of the general sociodemographic characteristics of the questionnaire respondents as potential influencing factors for the fear of contracting HBV while working with or for the HBV-infected patient in the dental office. Table 6 (OR = 0.70; 95% CI:0.56–0.88), $p<0.05$. Respondents who think they could contract HBV while receiving dental care had a 6.1-fold higher fear of contracting the virus than those who think they cannot.

Table 6. Logistic regression for the 1708 total studied group for fear to become HBV infected while working with/for the HBV infected patient in the dental office with general characteristics

Variable	B	E.S.	Wald	*p*	OR	Lower CI 95%	Upper CI 95%
Role/ocupation in the dental office	-.348	.115	9.208	.002	.70	.56	.88
work experience in dentistry field (under 3 years vs. over 3 years)	.681	.114	35.517	.000	1.97	1.57	2.47
area of dental office	-.237	.149	2.535	.111	.78	.58	1.05
possibility of HBV transmission in the dental office	1.813	.298	37.155	.000	6.13	3.42	10.98

Legend: B (coefficient), E.S. (standard error), Wald (Wald test), p (p-value), OR (odds ratio), CI (confidence interval)

Respondents with less experience (less than three years) are 1.97 times more afraid of contracting HBV than those with more experience (more than 3.1 years at the dental office).

4. Discussion

Presenting data on Romanian dentistry professionals' HBV vaccination status, knowledge, attitudes, and opinions was the goal of the current study. Our group was prior exposed to a common parasitic infection, *Toxoplasma gondii* infection. A sample of 1708 dental professionals from both rural and urban areas across the nation served as the basis for the study. While both HBV and, *Toxoplasma gondii* are occupational health concerns for dental professionals due to potential exposure to bloodborne pathogens and zoonotic infections, respectively, current research does not suggest a direct correlation between HBV vaccination and *Toxoplasma gondii* exposure. HBV vaccination is specifically aimed at preventing hepatitis B infection and does not influence susceptibility to *Toxoplasma gondii*.

For comprehensive protection, dental professionals are advised to adhere to standard infection control practices, including the use of personal protective equipment, proper sterilization of instruments, and adherence to hygiene protocols, to minimize the risk of various infections.

Effective HBV vaccination deployment has reduced HBV infection morbidity and mortality as well as HBV carrier rates globally. Around 30% of people globally received three doses of the HBV vaccine in 2000; by 2019, that number had risen to 85% [16]. Both the vaccination trends for HBV and other viral

infections improved [17, 18]. The examined dental professional group had a 65.57% (N=1120) HBV vaccination rate; nevertheless, 378 (33.75%) of the group were dental students, making them the most vaccinated group. This can be explained by the introduction of HBV vaccine at birth in Romania starting in 1995. Few references to HBV immunization in dentistry workers could be found in the literature search. We discovered that different dental professional groups had varying HBV vaccination rates. For example, Japan had 62.4% of its dental professionals (N=521). 61% of the 1044 healthcare personnel, including dentists, were from Africa (Kenya, Egypt, Sudan, Tanzania, Ethiopia, Uganda, Malawi, Madagascar, Nigeria, Cameroon, Ghana, and Sierra Leone) [19]. Jordan, 14% of the 200 dental technicians (N = 20) [21]; Scotland, 86.66% (13/15 health board areas of dental primary care healthcare) [22]; Saudi Arabia, 40.4% (N=121 dental technicians) [23]; and India, 78.84% (N= 104 dental technicians) [24]. The results of the current study showed that HBV vaccination in Romanian dentistry offices is mostly based on HBV vaccination at birth, and that the dental technician group was the most HBV unvaccinated in the dental offices, with only 154 (13.75%) of the HBV vaccinated. Dental technicians who work with HBV-infected dentistry materials run the risk of contracting the virus because it is known that HBV can remain infectious on various materials outside the body for at least seven days [6]. This makes this discovery crucial to acknowledge. Unlike other diseases that exist in Romania but for which vaccinations are not yet available globally,[25-27] or vaccination starts later in life [28]. HBV infection can be avoided in Romania by receiving an HBV immunization from the moment of birth. In Romania, HBV infection can be prevented by HBV vaccination starting on the first day of life, compared to other diseases that are present in our country, but for which vaccines are not yet available worldwide [25-27] or vaccination starts later in life [28]. As far as we are aware, a recent Romanian study from 2022 highlights the need to raise awareness of HBV infection control in Romanian dental offices with regard to knowledge, attitudes, and opinions. However, this study only included young dentists and dental students in Romania [29]. The HBV immunization rate (N=150 students and young dentists) was 40% lower than in the current study. A percentage of 35.33% (N=150) of the studied subjects knew the means of transmission of HBV compared to our findings, where the majority, 1610 (94.26%) of the responders knew the correct way of HBV transmission, which is similar to the results of a recent Mexican study, where 99.5% (N=232 dental students) knew the correct HBV transmission route [30]. The danger of bodily fluids from exposure events in dental practice emphasizes the necessity for dental workers to be knowledgeable about HBV prophylaxis both before and after exposure. Studies on HIV prophylaxis in dental offices are numerous [31–34], while there are few on HBV prophylaxis. A study by Georgia [35] found that respondents were poorly informed on pre-exposure prophylactic rules, with 37.3% (N=244 oral health care workers) feeling better informed than the current study group (59.84%; N=1022). In contrast to a German study [36], our study group had a vaccination rate of 65.57% (N=1120) and 308 (18.03%) respondents who tested for antiHBs antibodies. In contrast, the HBV vaccination rate was significantly higher (94%) (N=258 dentists, dental assistants, and dental students), but the percentage of individuals who tested for antiHBs antibodies was nearly equal at 21% (N=58). The prophylactic hepatitis B vaccination has proven crucial in preventing hepatitis B because it effectively creates protective immunity against hepatitis B viral infection. Prophylactic vaccinations only need to produce neutralizing antibodies against the HBV envelop proteins, as opposed to therapeutic vaccines, which ideally comprise additional HBV antigens such as HBV core and polymerase to elicit a complete T cell response. By neutralizing antibody generation, the currently employed vaccines have demonstrated a high level of efficacy in preventing HBV infection [37]. Our study took into account the possibility of contracting HBV while working in a dental clinic. The present study's respondents (94.26%) were aware that HBV is easily spread during dental practice, which is comparable to a 2013 study at private and public dental practices in Harare [38], where 81 (92%) participants felt they were at risk of getting an

HBV infection while working in a dental office 1610. In the current sample, 1414 (82.78%) respondents believed that they needed to employ stronger protection when interacting with a patient who had HBV. We evaluated the dread of working with or for an HBV-infected patient because the risk causes fear. 812 (47.54%) of the respondents in this study group expressed fear about working with or for a patient who had HBV. Consequently, we discovered a high correlation between the function or occupation at a dentist office and the dread of working with or for an HBV-infected patient using the chi-square test. Dental technicians (18.03%) and dental nurses (18.85%) were less terrified about working with or for HBV-infected patients than dentists (22.95%) and dental practitioner students (31.97%). In total, 686 (40.16%) of the respondents were dental professionals who worked with or for an HBV-infected patient; however, N=98, or 5.74% of the respondents, refused to work with or for an HBV-infected patient. These numbers are less than those seen in a Saudi Arabian study where the refusal rate was significantly higher; 94.5% of the dentists examined were HBV-vaccinated, yet 89.8% (N=246) of them were unwilling to treat patients who had the virus [39]. A higher percentage than in our survey, 44.4% (N=133) of dentists in another Tehran study [40] expressed a reluctance to handle a patient with HBV. At the group level, the attitude was to protect better when working with an HBV-infected patient, 1414 (82.78%) studied responders. Out of the studied group there were almost half of the responders, 812 (47.54%), who were afraid to work with/for the HBV infected patient.

A Croatian study [41] of 534 predoctoral students at the University of Zagreb's School of Dental Medicine revealed that dental office experience had a favorable impact on dental professionals and suggested more professional attitudes toward patients infected with HBV ($p=0.0002$). This was comparable to our findings that respondents with more than three years of dental office experience and those with greater experience were less scared to work for or with patients who had HBV than those with less experience. The more experience a dentist had, the less scared they were to work with or for an HBV-infected patient: 224 out of 56 in the group with 11–20 years of experience were not afraid, and 126 out of 98 in the group with more than 20 years of experience were not afraid. When evaluating the associations with fear of working with or for the HBV-infected patient, knowledge is crucial. In the current study group, we discovered no link ($p > .0.05$) with post-exposure prophylaxis, but a statistically significant ($p<0.05$) correlation between the awareness of pre-exposure prophylaxis and the fear of contracting HBV while working for or with the HBV-infected patient. Of the 812 respondents who expressed fear about working with or for an HBV-infected patient, 364 (44.82%) expressed fear without knowing about HBV pre-exposure prophylaxis, whereas 448 (55.17%) expressed fear while being aware of it. Fear of contracting HBV while working with or for an HBV-infected patient did not correlate with knowledge of post-exposure prophylaxis; 434 (55.44%) of the respondents who were afraid did not know anything about post-exposure prophylaxis, while 378 (45.76%) of the respondents who were afraid did.

According to studies, it is critical for all healthcare practitioners, including dentists, to understand pre-exposure and post-exposure prophylaxis [42–52].

Individuals exposed to *Toxoplasma gondii* may experience issues related to hepatitis B virus (HBV) infection status, particularly in the context of co-infections. Research indicates that co-infections involving *Toxoplasma gondii* and HBV can exacerbate liver-related health problems. For instance, a study found that active co-infection with *Toxoplasma gondii* was present in 33.3% of patients with chronic HBV infection. Moreover, *Toxoplasma gondii* infection has been associated with various liver pathologies, including necrosis, hepatomegaly, granuloma formation, and hepatitis [53]. These liver complications

can potentially worsen the clinical outcomes for individuals already dealing with chronic HBV infection. Therefore, while *Toxoplasma gondii* exposure alone does not directly affect HBV infection status, the presence of both pathogens can lead to more severe liver disease manifestations. It is crucial for healthcare providers to monitor and manage such co-infections carefully to mitigate potential complications [54]. *Toxoplasma gondii* infection can adversely affect the liver, leading to various pathological changes. Here are the key aspects of its impact on the liver. Infected individuals may experience liver enlargement (hepatomegaly) and inflammation (hepatitis) [55].

The parasite can cause the formation of granulomas and tissue necrosis within the liver. There is an association between T. gondii infection and the development of liver cirrhosis [56].

Limitations of the Study

This study had several limitations. First, the cross-sectional design of the study and the default selection of respondents (those with digital abilities, those with Internet access, and those with electronic documents) reduced the study's representativeness. The six-month timeframe was the study's second drawback. The third drawback is the smaller sample size (1708 respondents), however systematic sampling allowed us to identify known groups at the dentist office with strict attribution, thus the sample is representative. Since no other recent study has addressed HBV vaccination, Romanian dentistry professionals' anxieties, opinions, knowledge, and attitudes toward HBV infection and vaccine, our study may be significant. Similar studies only looked at dental students. Monitoring this issue could be helpful because it might capture the actual state of the medical community in Romanian dentistry offices and highlight possible requirements and improvements [57-66].

5. Conclusions

There were only 84 (4.92%) HBV-infected dental healthcare professionals in our study group, and over half of the 1120 (65.57%) were vaccinated against HBV, indicating that the status of HBV immunization among Romanian dental professionals has improved. Dental technicians, who were the most unvaccinated and at the highest risk of contracting HBV in our study group, should be encouraged to get vaccinated against the virus. Dental technicians were less concerned about the risk of contracting HBV than dentists or dental nurses, according to our group's knowledge, attitudes, and opinions. It is necessary to raise awareness among Romanian dentists on HBV prophylaxis before and after exposure. Romanian dental healthcare personnel should be tested for the level and titer of protective antiHBs antibodies to lessen their worry of contracting HBV while working with patients who have the virus. Positive attitudes and behaviors toward patients with HBV would also rise with increased dental professionals' knowledge.

Supplementary Materials: The following information was downloaded: File S1: The STROBE checklist; File S2: The administered questionnaire; File S3: The questionnaire responses.

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Institutional Review Board Statement: The questionnaire was peer-validated and approved by the Ethics Committee of Carol Davila University of Medicine and Pharmacy, Bucharest, Romania (3504/ 2nd February 2024), and all procedures in the study respected the ethical standards of the Helsinki Declaration. Written informed consent was obtained from all participants, no minors included in the study.

Informed Consent Statement: "Informed consent was obtained from all the subjects involved in the study."

Data availability statement: "The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

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References

1. Centres for Disease Control and Prevention, Hepatitis B. Available online: Hepatitis B - FAQs, Statistics, Data, & Guidelines | CDC (accessed on 8 June 2023).
2. Woods, R. Prevention of transmission of hepatitis B in dental practice. *Int Dent J.* **1984** Jun;34(2):122-6. PMID: 6234233. Prevention of transmission of hepatitis B in dental practice - PubMed (nih.gov)
3. Mihaila RG, Nedelcu L, Fratila O, Retzler L, Domnariu C, Cipaian RC, Rezi EC, Beca C, Deac M. Effects of simvastatin in patients with viral chronic hepatitis C. Hepatogastroenterology. 2011 Jul-Aug;58(109):1296-300. doi: 10.5754/hge08074. PMID: 21937398.
4. Biset Ayalew M, Adugna Horsa B, 2017. Hepatitis B vaccination status among health care workers in a tertiary hospital in Ethiopia. Hepat Res Treat 2017: 6470658.
5. Adefolalu A, 2014. Needle stick injuries and health workers: a preventable menace. Ann Med Health Sci Res 4 (Suppl 2): S159–S160.
6. Bond WW, Favero MS, Petersen NJ, Gravelle CR, Ebert JW, Maynard JE. Survival of hepatitis B virus after drying and storage for one week. *The Lancet.* **1981**;1(8219):550–1.
7. Araujo, M.W. and Andreana, S. Risk and prevention of transmission of infectious diseases in dentistry. *Quintessence Int.* **2002** May;33(5):376-82. PMID: 12014168
8. Domnariu, Carmen Daniela, Andreea Ilies and Florentina Ligia Furtunescu. "Influence of Family Modelling on Children's Healthy Eating Behaviour." Revista De Cercetare Si Interventie Sociala (2013): 77-95
9. Tsukuda, S. and Watashi, K. Hepatitis B virus biology and life cycle. *Antiviral Res.* **2020** Oct; 182:104925. doi: 10.1016/j.antiviral.2020.104925. Epub 2020 Aug 28. PMID: 32866519.
10. Sharma, S.K.; Saini, N.; Chwla, Y. Hepatitis B virus: inactive carriers. *Virol J.* **2005** Sep 28;2:82. doi: 10.1186/1743-422X-2-82. PMID: 16191199; PMCID: PMC1253537.
11. EASL Clinical Practice Guidelines: management of chronic hepatitis B virus infection. J Hepatol **2012**;57:167-85.
12. Kwak, M.S.; Chung, G.E.; Yang, J.I. et al. Long-term outcomes of HBsAg/anti-HBs double-positive versus HBsAg single-positive patients with chronic hepatitis *B. Sci Rep* .**2019**, 9, 1941. https://doi.org/10.1038/s41598-019-56015-8
13. World health organisation, Hepatitis B. Available online: https://www.who.int/news-room/fact-sheets/detail/hepatitis-b (accessed on 14 June 2023).

14. Centre Hepato-biliaire Paul Brousse, La vaccination contre l'Hépatite B. Available online: Hepatitis B vaccination | Paul Brousse Hepato-Biliary Centre (centre-hepato-biliaire.org) (accessed on 14 June 2023).
15. The Centres for Diseases Control and Prevention, Hepatitis B Vaccines. Available online: https://www.cdc.gov/vaccinesafety/vaccines/hepatitis-b-vaccine.html (accessed on 14 June 2023).
16. Pattyn, J.; Hendrickx, G.; Vorsters, A.; Van Damme, P. Hepatitis B Vaccines. *J Infect Dis.* **2021** Sep 30;224(12 Suppl 2):S343-S351. doi: 10.1093/infdis/jiaa668. PMID: 34590138; PMCID: PMC8482019.
17. Dragomirescu CC, Lixandru, BE, Coldea IL, Palade AM, Baltoiu M, Dinu S, Cristea VC, Manolescu L, Popa MI. Comparative analysis of different phenotypic and molecular methods used for the taxonomic identification of Corynebacterium spp. isolated from clinical samples in Romania. Rom. Biotechnological Lett. 2017, 22, 5, 12926-33. ISSN: 2248-3942.
18. Kisangau EN, AwourA, Juma B, Odhiambo D, Muasya T, Kiio SN, Too R, Lowther SA, 2019. Prevalence of hepatitis B virus infection and uptake of hepatitis B vaccine among healthcare workers,MakueniCounty,Kenya2017.JPublicHealth(Oxf)41: 765–771.
19. Roien R, Mousavi SH, Ozaki A, Baqeri SA, Hosseini SM, Ahmad S, Shrestha S: Assessment of knowledge, attitude, and practice of health-care workers towards hepatitis B virus prevention in Kabul, Afghanistan. J Multidiscip Healthc. 2021, 14:3177-86. 10.2147/JMDH.S334438
20. Nagao, Y.; Kimura, T.; Tomooka, K.; Wakita, H. Education and Awareness Activities Regarding Hepatitis B and C Among Japanese Dental Health Workers in the Oita Prefecture. *Cureus.* **2022** Sep 27;14(9):e29670. doi: 10.7759/cureus.29670. PMID: 36320995; PMCID: PMC9613444.
21. Shah, S.M.; Rodin, H.; Pogemiller, H.; Magbagbeola, O. et all. Hepatitis B Awareness and Vaccination Patterns among Healthcare Workers in Africa. *Am J Trop Med Hyg*. **2020** Dec;103(6):2460-2468. doi: 10.4269/ajtmh.20-0521. Epub 2020 Oct 1. PMID: 33025875; PMCID: PMC7695068.
22. Al-Dwairi, Z.N. Infection control procedures in commercial dental laboratories in Jordan. *J Dent Educ.* **2007** Sep;71(9):1223-7. PMID: 17761630
23. Moore, M.A.; Macpherson, L.M.; Kennedy, C.; Bagg, J. Provision of hepatitis B vaccination for primary care dental staff in Scotland. *J Infect*. **2003** Nov;47(4):322-7. doi: 10.1016/s0163-4453(03)00094-x. PMID: 14556757
24. Al-Aali, K.; Binalrimal, S.; AlShedokhi, A.; Al Saqer, E.; AlHumaid, M. Infection control awareness level among dental laboratory technicians, Riyadh, Saudi Arabia. *J Family Med Prim Care.* **2021** Apr;10(4):1540-1546. doi: 10.4103/jfmpc.jfmpc_2258_20. Epub 2021 Apr 29. PMID: 34123889; PMCID: PMC8144774.
25. Gupta, S.; Rani, S.; Garg, S. Infection control knowledge and practice: A cross-sectional survey on dental laboratories in dental institutes of North India. *J Indian Prosthodont Soc.* **2017** Oct-Dec;17(4):348-354. doi: 10.4103/jips.jips_5_17. PMID: 29249878; PMCID: PMC5730926.
26. Manolescu, L.; Marinescu, P. Sex differences in HIV-1 viral load and absolute CD4 cell count in long term survivors HIV-1 infected patients from Giurgiu, Romania. Romanian Review of Laboratory Medicine. 2013, 21(2):217-24. DOI:10.2478/rrlm-2013-0010.
27. Muntean MM, Muntean AA, PredaM, Manolescu LSC et al. Phenotypic and genotypic detection methods for antimicrobial resistance in ESKAPE pathogens. Experimental and Therapeutic Medicine.2022. (24):2, nr 508, https://doi.org/10.3892/etm, 2022.11435

28. Nita I, Nitipir C, Toma SA, Limbău AM, Pîrvu E, Bădărău IA, Suciu I, Suciu G, Manolescu L.S.C. Histological Aspects and Quantitative Assessment of Ki67 as Prognostic Factors in Breast Cancer Patients: Result from a Single-Center, Cross Sectional Study. Medicina 2020, 56, 600; doi:10.3390/medicina56110600
29. Stetiu AA, Stetiu M, Burlibasa M, Perieanu VS, et al. "FEM analysis of masticatory induced stresses over surrounding tissues of dental implant." ROMANIAN BIOTECHNOLOGICAL LETTERS 24, no. 3 (2019): 472-478.
30. Saveanu, C.I.; Meslec, M.D.; Saveanu, A.E.; Anistoroaei, D.; Bobu, L.; Balcos, C.; Tanculescu, O. Knowledge Level on Infection Control among Romanian Undergraduate and Postgraduate Dental Students. *Medicina* (Kaunas). **2022** May 13;58(5):661. doi: 10.3390/medicina58050661. PMID: 35630077; PMCID: PMC9145850.
31. Aguilar-Díaz, F.C.; Ponce-Cruz, Y.R.; Mortellaro, C.; Giacomello, M.; Manfredi, B.; Khijmatgar, S.; Biagi, R.; Greco-Lucchina ,A.; Del Fabbro, M. Knowledge, practices and perceptions regarding oral health preventive measures among Mexican dental students: a cross-sectional survey study. *J Biol Regul Homeost Agents*. **2021** Mar-Apr;35(2 Suppl. 1):163-171. doi: 10.23812/21-2supp1-16. PMID: 34281313.
32. Kasat, V.; Saluja, H.; Ladda, R.; Sachdeva, S.; Somasundaram, K.; Gupta, A. Knowledge, Attitude and Practices toward Post Exposure Prophylaxis for Human Immunodeficiency Virus among Dental Students in India. *Ann Med Health Sci Res.* **2014** Jul;4(4):543-8. doi: 10.4103/2141-9248.139308. PMID: 25221701; PMCID: PMC4160677.
33. Shintani, T.; Iwata, T.; Okada, M.; Nakaoka, M.; Yamasaki, N.; Fujii, T.; Shiba, H. Clinical Outcomes of Post-exposure Prophylaxis following Occupational Exposure to Human Immunodeficiency Virus at Dental Departments of Hiroshima University Hospital. *Curr HIV Res.* **2020**;18(6):475-479. doi: 10.2174/1570162X18666200804151118. PMID: 32753017; PMCID: PMC8388063.
34. Cleveland, J.L.; Barker, L.; Gooch, B.F.; Beltrami, E.M.; Cardo, D. National Surveillance System for Health Care Workers Group of the Centers for Disease Control and Prevention. Use of HIV postexposure prophylaxis by dental health care personnel: an overview and updated recommendations. *J Am Dent Assoc.* **2002** Dec;133(12):1619-26. doi: 10.14219/jada.archive.2002.0109. PMID: 12512659.
35. Wu, L.; Yin, Y.L.; Song, J.L.; Chen, Y.; Wu, Y.F.; Zhao, L. Knowledge, attitudes and practices surrounding occupational blood-borne pathogen exposure amongst students in two Chinese dental schools. *Eur J Dent Educ.* **2016** Nov;20(4):206-212. doi: 10.1111/eje.12162. Epub 2015 Jul 16. PMID: 26184829.
36. Kochlamazashvili, M.; Kamkamidze, G.; McNutt, L.A.; DeHovitz, J.; Chubinishvili, O.; Butsashvili, M. Knowledge, attitudes and practice survey on blood-borne diseases among dental health care workers in Georgia. *J Infect Dev Ctries*. **2018** Oct 31;12(10):864-870. doi: 10.3855/jidc.9911. PMID: 32004155.
37. Ramich, T.; Eickholz, P.; Wicker, S. Work-related infections in dentistry: risk perception and preventive measures. *Clin Oral Investig*. **2017** Nov;21(8):2473-2479. doi: 10.1007/s00784-017-2046-x. Epub 2017 Jan 18. PMID: 28097434.
38. Mahmood F, Xu R, Awan MUN, Song Y, Han Q, Xia X, Wei J, Xu J, Peng J, Zhang J. HBV Vaccines: Advances and Development. Vaccines (Basel). 2023 Dec 18;11(12):1862. doi: 10.3390/vaccines11121862. PMID: 38140265; PMCID: PMC10747071

39. Mucheto, P.; Chidzonga, M.M.; Masiiwa, A. Knowledge, attitudes and practices of oral health professionals with regard to the hepatitis B virus in their workplace, Harare. *Cent Afr J Med.* **2013** Sep-Dec;59(9-12):57-63. PMID: 29144621.
40. Khalil, H. Willingness of Saudi dental professionals to treat Hepatitis B virus-infected patients. *Niger J Clin Pract*. **2015** Mar-Apr;18(2):247-50. doi: 10.4103/1119-3077.151053. PMID: 25666001.
41. Khosravanifard, B.; Rakhshan, V.; Najafi-Salehi, L.; Sherafat, S. Tehran dentists' knowledge and attitudes towards hepatitis B and their willingness to treat simulated hepatitis B positive patients. *East Mediterr Health J.* **2014** Aug 19;20(8):498-507. PMID: 25150357
42. Brailo, V.; Pelivan, I.; Škaricić, J.; Vuletić, M.; Dulcić, N.; Cerjan-Letica, G. Treating patients with HIV and Hepatitis B and C infections: Croatian dental students' knowledge, attitudes, and risk perceptions. *J Dent Educ.* **2011** Aug;75(8):1115-26. PMID: 21828306.
43. Rostamzadeh, M.; Afkhamzadeh, A.; Afrooz, S.; Mohamadi, K.; Rasouli, M.A. Dentists' knowledge, attitudes and practices regarding Hepatitis B and C and HIV/AIDS in Sanandaj, Iran. *BMC Oral Health.* **2018** Dec 18;18(1):220. doi: 10.1186/s12903-018-0685-1. PMID: 30563497; PMCID: PMC6299669.
44. Ishimaru, T.; Wada, K.; Huong, H.T.X.; Anh, B.T.M.; Hung, N.D.; Hung, L.; Smith, D.R. Nurses' Attitudes Towards Co-Workers Infected With HIV Or Hepatitis B Or C In Vietnam. *Southeast Asian J Trop Med Public Health*. **2017** Mar;48(2):376-85. PMID: 29642300
45. Ishimaru, T.; Wada, K.; Arphorn, S.; Smith, D.R. Barriers to the acceptance of work colleagues infected with Hepatitis B and Hepatitis C in Japan. *J Occup Health.* **2016** Jun 16;58(3):269-75. doi: 10.1539/joh.15-0288-OA. Epub 2016 Apr 22. PMID: 27108645; PMCID: PMC5356951.
46. Sofola, O.O.; Uti, O.G. Hepatitis B virus infection and prevention in the dental clinic: knowledge and factors determining vaccine uptake in a Nigerian dental teaching hospital. *Nig Q J Hosp Med*. **2008** Jul-Sep;18(3):145-8. PMID: 19062478.
47. Temereanca A, Ene L, Mehta S, Manolescu LSC, Duiculescu D, Ruta S. Transmitted HIV drug resistance in newly diagnosed, treatment-naive Romanian patients. Journal of Medical Virology. 2013. 85(7): 1139-47. doi: 10.1002/jmv.23572. PMCID: PMC3896237. NIHMSID: NIHMS545760. PMID: 23592112
48. Saleem, H.; Waly, N.; Abdelgawad, F. Knowledge, Attitude, and Practice (KAP) of post exposure prophylaxis for fifth year dental students at a private Egyptian university: a cross-sectional study. *BMC Oral Health.* **2023** Mar 24;23(1):167. doi: 10.1186/s12903-023-02890-7. PMID: 36964540; PMCID: PMC10039496.
49. Kamil, M.A.; Osman, H.A.; Elamin, N.M.H. Knowledge, Attitudes, and Practices of Dental Healthcare Workers toward Hepatitis B Virus in Khartoum/Sudan. *J Contemp Dent Pract*. **2022** Sep 1;23(9):924-929. doi: 10.5005/jp-journals-10024-3410. PMID: 37283000.
50. Qin YL, Li B, Zhou YS, Zhang X, Li L, So, B et al. Chinese Military Medical Experts Group in Sierra Leone. Prevalence and knowledge of hepatitis B infection among healthcare workers in Freetown, Sierra Leone. *BMC Infect Dis.* **2018** Jul 9;18(1):315. doi: 10.1186/s12879-018-3235-1. PMID: 29986658; PMCID: PMC6038231.
51. Marinescu P, Manolescu LSC. Association of hepatitis B infection in patients with HIV Encephalopathy. Romanian Biotechnological Letters. 2012.17(6):7817-24. ISSN: 2248-3942. IF=0.382

52. Manolescu L, Temereanca A, Diaconu CC, Ruta S. Correlation between resistance profile and immunosuppression in heavily treated HIV-1 infected Romanian patients. Romanian Biotechnological Letters. 2011.16 (4):6439-49. ISSN: 2248-3942
53. Babekir A, Mostafa S, Minor RC, Williams LL, Harrison SH, Obeng-Gyasi E. The Association of Toxoplasma gondii IgG and Liver Injury in US Adults. Int. J. Environ. Res. Public Health 2022, 19, 7515. https://doi.org/10.3390/ijerph19127515
54. El-Sayed NM, Ramadan ME, Ramadan ME. Toxoplasma gondii Infection and Chronic Liver Diseases: Evidence of an Association. Trop Med Infect Dis. 2016 Nov 1;1(1):7. doi: 10.3390/tropicalmed1010007. PMID: 30270858; PMCID: PMC6082049.
55. Alvarado-Esquivel C, Torres-Berumen JL, Estrada-Martínez S, Liesenfeld O, Mercado-Suarez MF. Toxoplasma gondii infection and liver disease: a case-control study in a northern Mexican population. Parasit Vectors. 2011 May 13;4:75. doi: 10.1186/1756-3305-4-75. PMID: 21569516; PMCID: PMC3105944.
56. Baldwin N, Gray M, Chirag R. Patel Sameer Al Diffalha. Acute Liver Failure Due to Toxoplasmosis After Orthotopic Liver Transplantation. ournal of Investigative Medicine High Impact Case ReportsVolume 9, 202. https://doi.org/10.1177/23247096211014691
57. Agostinho AM, Miyoshi PR, Gnoatto N, Paranhos HF, Figueiredo LC, Salvador SL. Cross-contamination in the dental laboratory through the polishing procedure of complete dentures. Braz Dent J 2004;15:138-43.
58. Boyce R, Mull J. Complying with the occupational safety and health administration: Guidelines for the dental office. Dent Clin North Am 2008;52:653-68.
59. Ajantha H, Kumar B. Infection control in the dental office-A review. Indian Journal of Dental Advancements 2011;3(03):577-82.
60. Diaconu D, Vitalariu A, Tatarciuc M, Murariu A. The economic crisis effects on the cross-contamination control in dental laboratories. Rev Cercet Interv 2014;47:105-16.
61. Ezzat A. Practice of cross-contamination prevention among dental laboratory technicians in the city of Jeddah in Saudi Arabia. EC Dent Sci 2018;17:2227-38.
62. Moh.gov.sa. 2018. Manual of Infection Prevention & Control in Dental Settings.
63. Nimonkar SV, Belkhode VM, Godbole SR, Nimonkar PV, Dahane T, Sathe S. Comparative evaluation of the effect of chemical disinfectants and ultraviolet disinfection on dimensional stability of the polyvinyl siloxane impressions. J Int Soc Prev Community Dent 2019;9:152-8.
64. Kimondollo PM. Guidelines for developing a dental laboratory infection-control protocol. Int J Prosthodont 1992;5:452-6.
65. Oțelea M, Handra C, Rașcu A. Registered cases of occupational n-hexane intoxication in Bucharest. Rom J Leg Med [23] 279-284 [2015], DOI: 10.4323/rjlm.2015.279
66. Radu MC, Manolescu LSC, Chivu R, et al. 2022. Pregnancy in Teenage Romanian Mothers. Cureus 14(1): e21540. doi:10.7759/cureus.21540