Research Article

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# *Hepatitis B Virus Vaccination Rates among Medical Laboratory Workers: A Multi-centered Assessment*

## Tıbbi Laboratuvar Çalışanlarında Hepatit B Bağışıklama Oranları: Çok Merkezli Bir Değerlendirme

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***ABSTRACT***

**Objective:** In this multicenter study, we aimed to determine the rates of hepatitis B virus (HBV) in medical laboratory workers in Turkey and to discuss the current status.
**Materials and Methods:** We designed this study as prospective, descriptive, epidemiologic research to determine the rates of hepatitis B vaccination in medical laboratory workers. A total of 1359 medical laboratory workers from 26 medical centers, representative of different regions of Turkey, were included in this study. A questionnaire was designed to gather the data on subject planned to apply all the medical laboratory workers. The questionnaire had seven questions in total investigating demographical properties and professional experience of the participants.
**Results:** We determined that HBV vaccine was administered to the 1118 laboratory workers (82.3%). When anti-HBs titer levels of the vaccinated participants were investigated, 741 (54,4%) of the vaccinated participants stated that they had anti-HBs levels above 10 IU/mL. The results of statistical analysis revealed that vaccination rates and occupation groups were correlated among the laboratory staff ($p<0.05$). However, there was no significant difference between age groups and the duration in work and the vaccination rate ($p>0.05$). Anti-HBs positivity was not correlated with any of the groups ($p>0.05$).
**Conclusion:** Present study is the first multicenter study to reflect the HBV vaccination rates among laboratory workers across the entire country. Medical laboratory personnel possess the risk of acquiring hepatitis B infection, so that formation of awareness is necessary by education. Anti-HB positivity screened, seronegative all personnel should be vaccinated against hepatitis B and after vaccination anti-HBs should be monitored periodically.
**Keywords:** Hepatitis B virus, surveys, questionnaire, laboratory personnel, vaccination

***ÖZ***

**Amaç:** Bu çok merkezli çalışmada Türkiye genelindeki tıbbi laboratuvar çalışanlarının hepatit B virüsü (HBV) enfeksiyonuna karşı aşılanma durumunun saptanması ve belirlenecek durumun tartışılmasını amaçladık.
**Gereç ve Yöntemler:** Laboratuvar çalışanlarında hepatit B aşılama oranlarının belirlenmesi için prospektif, tanımlayıcı ve epidemiyolojik bir araştırma çalışması planladık. Bu çalışmaya ülkemizdeki farklı bölgelerdeki 26 sağlık kurumundan 1359 laboratuvar çalışanı katıldı. Konuyla ilgili veri toplamak için demografik bilgiler, mesleki tecrübe ve aşılarla ilgili genel bilgileri içeren toplam 7 sorudan oluşan anket formu kullanıldı.
**Bulgular:** Çalışmaya katılanların 1118'inde (%82,3) HBV aşısı uygulandığı saptandı. Katılımcılara anti-HBs titreleri sorulduğunda; 741 kişi (%54,5) antikor titresinin 10 IU/mL'nin üzerinde olduğunu belirtti. Aşılama oranları ile tıbbi laboratuvarda çalışan meslek grupları arasında anlamlı ilişki bulunurken ($p<0,05$), yaş grupları, cinsiyet ve çalışma yılları ile aşılama oranları arasındaki fark istatistiksel olarak anlamlı değildi ($p>0,05$). Anti-HBs pozitifliği açısından hiçbir grupta istatistiksel olarak anlamlı bir ilişki bulunamadı ($p>0,05$).
**Sonuç:** Bu çalışma, HBV aşılanma oranları ile ilgili olarak ülkemiz genelini yansıtabilecek düzeyde ilk çok merkezli çalışmadır. Tıbbi laboratuvar personeli hepatit B enfeksiyonu karşısında yüksek risk altında olduğundan, gerekli farkındalığın oluşması için hizmet içi eğitimler verilmeli, anti-HBs pozitifliği yönünden taranmalı, seronegatif bütün personel hepatit B yönünden aşılanmalı ve aşıdan sonra da periyodik olarak anti-HBs düzeyi yönünden takip edilmesi gereklidir.
**Anahtar Kelimeler:** Hepatit B virüsü, anket, sorgu formları, laboratuvar personeli, aşılama

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## Introduction

Hepatitis B virus (HBV) infection is a major health problem in Turkey as in the whole world. According to 2014 data from the World Health Organization (WHO), approximately 240 million people are chronically infected with HBV worldwide and more than 780.000 people lose their lives due to the complications related with the chronic hepatitis B such as cirrhosis and liver cancer (1). Health care workers are particularly under high risk of blood-transmitted diseases because of occupational exposure. The frequency of HBV infection among health care workers is reported to be 3-8 times more than the normal population, particularly among emergency department, operating room, intensive care unit, and laboratory staff, who are frequently exposed to contaminated patient materials such as blood and other body fluids (2). WHO has reported that approximately 3 million (2 million HBV, 0.9 million HCV and 170.000 HIV) of the 35 million health workers worldwide are exposed to the viruses transmitted via injuries from contaminated medical instruments or direct contact with contaminated blood (1).

Turkey is located in the region with moderate endemicity in terms of HBV carriage. HBV carriage rate is between 2% and -10% in Turkey. It has been reported that this rate is 1.5-2 times more among health care workers (3,4). Hepatitis B is a preventable disease and all health care professionals should be involved in a vaccination program against hepatitis B. Antibody titers of 95-99% can be achieved after 3 dose vaccination in infants, children and adults. This vaccination also contributes to protection of relatives of vaccinated individuals as well. All health care workers should also be vaccinated (2,5). In 2010 the Immunization Advisory Board of the Ministry of Health of Turkey recommended the implementation of vaccines against adult type diphtheria-tetanus, measles-mumps rubella, hepatitis A, hepatitis B, varicella zoster, and seasonal influenza in health care workers (6).

Hepatitis B vaccination rates among health care workers from Turkey, generally evaluate single center data and are not inclusive of all health care workers (7,8). There are few papers from Turkey evaluating hepatitis B vaccination in medical laboratory workers (9). In this multicenter study, we aimed to determine the rates of hepatitis B vaccination in medical laboratory workers in Turkey and to evaluate the precautions to be taken on this special subject.

## Materials and Methods

We designed this study as prospective, descriptive, epidemiologic research to determine the rates of hepatitis B vaccination in medical laboratory workers. A total of 1359 medical laboratory workers from 26 medical centers, representative of different regions of Turkey, were included in this study. The 26 medical centers consisted of 17 university hospitals, 8 research and training hospitals, and 1 state hospital (Table 1). A questionnaire was developed to gather data on the subject planned to apply all the medical laboratory workers. The questionnaire had a total of seven questions investigating demographical properties and professional experience of the participants. Vaccination status and the antibody titers related to HBV were also investigated. All the questionnaires were filled upon face-to-face interviews held in the

**Table 1.** List of medical centres and number of participants

| No | Medical institution | City | Participants |
|---|---|---|---|
| 1 | Ondokuz Mayıs University Training and Research Hospital | Samsun | 151 |
| 2 | Ministry of Health Haydarpaşa Training and Research Hospital | İstanbul | 86 |
| 3 | Adana Numune Hospital | Adana | 64 |
| 4 | Ahi Evran University Faculty of Medicine Hospital | Kırşehir | 56 |
| 5 | Sakarya University Training and Research Hospital | Sakarya | 76 |
| 6 | Haydarpaşa Sultan Abdülhamid Numune Training and Research Hospital | İstanbul | 54 |
| 7 | İnönü University Training and Research Hospital | Malatya | 78 |
| 8 | Atatürk University Training and Research Hospital | Erzurum | 74 |
| 9 | Adnan Menderes University Training and Research Hospital | Aydın | 50 |
| 10 | Bülent Ecevit University Training and Research Hospital | Zonguldak | 50 |
| 11 | Giresun University Training and Research Hospital | Giresun | 50 |
| 12 | Necmettin Erbakan University Training and Research Hospital | Konya | 60 |
| 13 | Erciyes University Training and Research Hospital | Kayseri | 48 |
| 14 | Dicle University Training and Research Hospital | Diyarbakır | 48 |
| 15 | Van Training and Research Hospital | Van | 46 |
| 16 | Kocaeli University Training and Research Hospital | Kocaeli | 45 |
| 17 | Yüzüncü Yıl University Training and Research Hospital | Van | 45 |
| 18 | Osman Gazi University Training and Research Hospital | Eskişehir | 44 |
| 19 | Ankara Training and Research Hospital | Ankara | 43 |
| 20 | Siirt State Hospital | Siirt | 36 |
| 21 | Ordu University Training and Research Hospital | Ordu | 32 |
| 22 | Meram Training and Research Hospital | Konya | 53 |
| 23 | Düzce University Training and Research Hospital | Düzce | 25 |
| 24 | Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital | Ankara | 21 |
| 25 | İzmir University Training and Research Hospital | İzmir | 13 |
| 26 | Siyami Ersek Training and Research Hospital | İstanbul | 11 |
| **Total** | | | **1359** |

working places of the participants. Participants were included in the study after verbal approval; workers not willing to participate were excluded.

## Statistical Analysis

Statistical evaluations were performed by commercial statistical software SPSS version 21.0 (SPSS Inc., Chicago, IL, USA). Comparisons between profession groups were analyzed with chi-square test. Comparisons between categorical variables, ages and working years were examined with correlation tests. A p value of less than 0.05 was considered statistically significant.

## Results

A total of 1359 laboratory workers (578 male, 781 female) were included in this study. The study population comprised doctors (n=133), research assistants (n=78), laboratory technicians (n=196), biologists (n=750), students (n=24) and cleaning staff (n=161). Seventeen of the participants did not answer the question about the profession. The distribution of occupation of the laboratory personnel, vaccination and anti-HBs positivity rates are listed in Table 2. One thousand one hundred-eighteen of the 1359 laboratory workers replied the question whether they had hepatitis B vaccination as "I completed my vaccines". When anti-HBs titer levels of the vaccinated participants were investigated, 741 (54.5%) of the reported having anti-HBs levels above 10 IU/mL, 116 (8.5%) of the subjects reported below 10 IU/mL and 502 (36.9%) of them stated that they did not know their anti-HBs levels. Forty-eight of the workers did not reply this question (Table 2). The age distribution of the personnel demonstrated that most of the participants were aged 30-40 years (n=443, 32.5%). Occupational groups, age groups and vaccination status according to the duration of employment are summarized in Table 3. Vaccination rate among

**Table 2.** Vaccination rates of the medical laboratory workers according to professions, age groups and duration at work

| | n (%) | Vaccinated n (%) | p value | Anti-HBs positivity n (%) | p value |
|---|---|---|---|---|---|
| **Occupation groups** | | | | | |
| Doctor (Specialist) | 133 (9.7) | 123 (92.4) | <0.0001 | 80 (60.1) | 0.486 |
| Research assistant | 78 (5.7) | 71 (91.0) | | 46 (58.9) | |
| Student | 24 (1.7) | 17 (70.8) | | 12 (50) | |
| Technician/ Biologist | 946 (69.6) | 789 (83.4) | | 517 (54.6) | |
| Cleaning staff+Other | 161 (11.8) | 106 (65.8) | | 78 (48.4) | |
| Unanswered | 17 (0.07) | 12 (70.5) | | 8 (47) | |
| **Age groups** | | | | | |
| 20-30 ages | 252 | 202 (80.1) | 0.898 | 151 (59.9) | 0.859 |
| 30-40 ages | 443 | 374 (84.4) | | 211 (47.4) | |
| 40-50 ages | 300 | 251 (83.6) | | 183 (61) | |
| ≥50 ages | 87 | 67 (77) | | 41 (47.1) | |
| Not answered | 277 | 224 (80.6) | | 155 (55.9) | |
| **Total years at work** | | | | | |
| 0-10 years | 647 | 525 (77.8) | 0.296 | 329 (48.8) | 0.710 |
| 10-20 years | 362 | 319 (88.1) | | 194 (53.5) | |
| 20-30 years | 238 | 194 (81.5) | | 147 (61.7) | |
| >30 years | 25 | 17 (68) | | 16 (64) | |
| Not answered | 87 | 63 (72.4) | | 55 (63.2) | |

**Table 3.** Hepatitis B vaccination rates and anti-HBs titre levels of the medical laboratory workers

| Hepatitis B vaccination status | n | % |
|---|---|---|
| Vaccinated | 1118 | 82.4 |
| Unvaccinated | 241 | 17.7 |
| Anti-HBs titre level | | |
| <10 IU/mL | 116 | 8.5 |
| >10 IU/mL | 741 | 54.5 |
| Unknown titre | 502 | 36.9 |

**Table 4.** Hepatitis B vaccination status and antibody levels of the health care workers in our country reported in the last decade

| Article year | Study period | Study group (n) | Vaccination status % (occupation) | Anti-HBs positivity (%) |
|---|---|---|---|---|
| Öncül et al. (13) | 2009 | 503 | 83.5 (NU)/78.8 (TEC)/64.2 (HCW) | 62.2 |
| Koruk et al. (20) | 2013 | 327 | 63.8 | - |
| Cılız et al. (11) | 2011-2012 | 309 | 83.9 (DR)/75.8 (NU)/45.6 (HCW) | 84.1 |
| Boşnak et al. (2) | - | 199 | 82.8 (NU)/69.3 (HCW) | 81.4 |
| Altun et al. (16) | 2010-2011 | 705 | 86.9 | 88.3 |
| Koçak et al. (17) | 2012 | 276 | 81.2 (DR)/48.2 (HCW) | 61.2 |
| İnci et al. (3) | 2009 | 292 | 80 (DR)/54.2 (NU)/29 (HCW) | 62.7 |
| Karacaer et al. (14) | 2014 | 219 | 90 (DR)/89 (NU)/50 (HCW) | - |
| Akçalı et al. (8) | 2009-2010 | 256 | 64 | 73.4 |
| Baysal and Kaya (18) | 2010-2012 | 823 | 67.9 | 81.8 |
| Demir et al. (4) | - | 402 | 55.8 (DR)/74.2 (TEC)/57.5 (NU) | 58.3 |
| Karaosmanoğlu et al. (10) | 2010 | 150 | 89 | 83 |
| Tekin and Deveci (19) | 2008-2009 | 180 | 73 (DR)/78.5 (NU)/65.4 (TEC) | 68.3 |
| Koruk et al. (15) | 2008 | 303 | 80.5 (DR)/58.7 (HCW) | 63 |
| Omaç et al. (28) | 2010 | 860 | 70.5 | 60.6 |
| Aşkar (21) | 2005 | 648 | 59.6 | 73 |

DR: Doctor, NU: Nurse, TEC: Technician, HCW: Health-care worker

female workers was 83.4% whereas the rate was 80.7% among male participants (p>0.005).

The results of the statistical analysis revealed that there was a positive correlation between vaccination rates and occupation groups (p<0.05). However, there was no significant difference between age groups and the duration of employment in respect to vaccination rates (p>0.05).

## Discussion

Health care professionals should develop a habit of getting vaccinated in addition to implementation of standard infection control procedures to protect themselves from hepatitis infections (7). Injuries with contaminated needles and other percutaneous injuries appear to be a major problem among health care workers in Turkey. Injury rates specified in various studies range from 46% to 57% (9,10,11,12). Vaccination, use of protective equipment, taking the standard precautions to reduce the risk of exposure, such as hand washing, can prevent the spread of the infectious agents (13,14). The WHO accepted hepatitis B infection as an occupational disease in 1996 for health care workers and the Ministry of Health of Turkey implemented hepatitis B vaccination program determination of the vulnerable workers and vaccination of appropriate population for health care workers (2). HBV seroprevalence and vaccination rates among health care professionals covering the last decade in Turkey are listed in Table 4. Hepatitis B vaccination rate ranges between 29% and 90% (3,14,15,16,17,18,19,20,21). It is observed that vaccination rates increased in recent years. Studies that have investigated vaccination rate among health care professionals in general and were single center studies. There has been only one study including medical laboratory workers in the literature in the last decade (9). This makes it difficult for us to set a clear comment on medical laboratory workers.

The vaccination rate of 82.4% that was found to be quite high in our study can be assumed to represent the profile of the whole country. However, approximately 20% of staff was not protected by vaccination and this vulnerable population needs immediate intervention. Vaccination rates among health care workers across the world differ by country according to the socioeconomic status and range from 11% to 89.8% (22,23,24,25,26). The major challenging problem indicated in these studies is the implementation of the three dose of the vaccine (24,25,27). After implementation of the hepatitis B vaccine schedule for health workers, anti-HBs titers should be checked at the appropriate time. Anti-HBs positivity rate was found to range from 41.2% to 88.3% among health care workers in various studies conducted in our country. Higher anti-HBs levels are remarkable findings of recent studies (Table 4). When different studies across the world were examined, anti-HBs positivity among medical laboratory workers was determined to be 66.7% in Saudi Arabia, which was significantly higher than in other health care workers (21). Anti-HBs seropositivity rate was determined as 75.4% among 474 dentists in Brazil (25). In our study, anti-HBs positivity rate was 54.5% among the participants and 36.9% of the participants were not tested for anti-HBs levels. Despite high rates of HBV vaccination, anti-HBs positivity was relatively low and this fact was the result of participants' unawareness of their antibody titers. It is a remarkable finding that approximately one-third of the staff was not tested for anti-HBs or did not know their titers. Among these staff, there might be ones with antibody titers below 10 IU/mL and surely, they were vulnerable to HBV infection. This indicative situation is due to lack of education and awareness together with personal neglect among our study group. Vaccination rates remained higher among doctors, the research assistants, technicians and biologists compared to that in cleaning staff and other personnel (p<0.05). Except for one study, which was conducted ten years ago, the vaccination rates among doctors working in our country were determined as highest compared to other workers (Table 4). This situation indicates that personnel who are not educated for basic health care, namely the cleaning staff, medical secretaries, technical staff, and security guards should be trained for infection control measures especially for blood-borne diseases. They should be tested before recruitment and in certain intervals thereafter. It will be also logical to include these staff in vaccination programs. In this study, HBV vaccination rates were not correlated with the age and duration of employment (p>0.05).

This study is the first multicenter study to reflect the HBV vaccination rates among laboratory workers across the entire country. According to the findings obtained from this study, it was understood that approximately 20% of the laboratory staff is not vaccinated, and 8% of the staff, although vaccinated, do not have protective levels of antibody titers. By this way, it is clear that approximately 30% of the laboratory workers included in this study were unprotected and were vulnerable to HBV infections.

As a result, medical laboratory personnel possess the risk for acquiring hepatitis B infection, so that awareness raising is necessary by way of education. All laboratory staff should be screened for hepatitis B virus and all seronegative staff should be vaccinated. Periodic monitoring of anti-HBs levels is also essential. Within the scope of workers' health and safety and infection control measures, this assessment is a necessity.

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**Ethics**

Ethics Committee Approval: The study was approved by the Sakarya University of Local Ethics Committee, Informed Consent: Consent form was filled out by all participants.

Peer-review: Externally and Internally peer-reviewed.

**Authorship Contributions**

Concept: Özlem Aydemir, Design: Mehmet Köroğlu, Data Collection or Processing: Özlem Aydemir, Lab BioSafety TR working group, Büşra Yüksel, Analysis or Interpretation: Özlem Aydemir, Mehmet Köroğlu, Büşra Yüksel, Tayfur Demiray, Ahmet Özbek, Selma Altındiş, Ferhat Gürkan Aslan, Mustafa Altındiş, Literature Search: Özlem Aydemir, Writing: Özlem Aydemir, Mehmet Köroğlu.

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