Euras J Fam Med 2023;12(3):109-116. doi:10.33880/ejfm.2023120301 **Original Research**

Evaluation of Hepatitis B Vaccine Awareness in Diabetic Patients Admitted to Diabetes Clinic

Busra Aybike Kumcu[1], Ali Ozdemir[2], Muzeyyen Eryilmaz[3], Berrin Telatar[4]

[1]*Atasehir District Health Directorate, Family Medicine Specialist, Istanbul, Türkiye. ORCID iD: 0000-0001-8745-6972. aybike.akca14@gmail.com (Corresponding Author)*
[2]*Department of Internal Medicine, University of Health Sciences, Fatih Sultan Mehmet Training and Research Hospital, Istanbul, Türkiye. ORCID iD: 0000-0002-8087-9654*
[3]*Department of Internal Medicine, University of Health Sciences, Fatih Sultan Mehmet Training and Research Hospital, Istanbul, Türkiye. ORCID iD: 0000-0002-1027-3200*
[4]*Department of Family Medicine, University of Health Sciences, Fatih Sultan Mehmet Training and Research Hospital, Istanbul, Türkiye. ORCID iD: 0000-0001-8502-3022*

ABSTRACT

Aim: This study aimed to evaluate the awareness of diabetic patients about the hepatitis B vaccine, hepatitis B vaccination rates, and the effect of our recommendations on vaccination status.

Methods: This is a cross-sectional study carried out in 627 adult diabetic patients who were admitted to our diabetes outpatient clinic between October 2019 and December 2019. We prepared the hepatitis B vaccine awareness questionnaire, consisting of 14 items, and administered it to the patients through face-to-face interviews.

Results: The study included 627 diabetic patients (59.8% female, mean age=58.9±9.5). Only 9.3% (n=58) of the patients were previously vaccinated against hepatitis B and 90.7% (n=569) were not. There was a significant difference between the education level and hepatitis B vaccination status of the patients ($p<0.001$). The most common reason with 94.7% (n=539) for not being vaccinated was the lack of information that diabetics should be vaccinated against hepatitis B. After the patients were informed, the hepatitis B vaccination rates increased from 9.3% to 68.1% at the end of the study.

Conclusion: The hepatitis B vaccination rates were found to be quite low in diabetic patients, yet increased seriously after the patients were informed. This result revealed that informing patients and increasing their awareness can positively affect vaccination rates.

Keywords: diabetes mellitus, hepatitis B vaccines, awareness

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Introduction

Diabetes mellitus (DM) is an important disease that has become a serious health problem worldwide due to its frequency and the problems it causes. The prevalence of diabetes is increasing rapidly in all developed and developing societies due to changes in lifestyles. The International Diabetes Federation (IDF) predicts that the number of diabetic people (18-99 years old) in the world was 451 million in 2017 and this number will reach 693 million in 2045 (1). In an epidemiological study carried out in 2013, the prevalence of diabetes was found to be 16.5%, which means that approximately 6.5 million adults had diabetes in Turkiye (2). According to the IDF, Turkiye will be among the top 10 countries with the highest diabetes prevalence, with an estimated number of 10.4 million cases by 2045 (3). In a study conducted in Turkiye, 9.5% of individuals aged 20-64 years will have DM in the next 10 years (4).

Hepatitis B is a serious disease caused by the hepatitis B virus (HBV) that can lead to acute and chronic infection of the liver. The World Health Organization (WHO) estimates that in 2015, 257 million people, 3.5% of the population, were living with chronic HBV infection worldwide (5). Various studies in Turkiye have shown that the prevalence of HBV infection ranges from 4% to 5% (6).

Individuals with type 1 and type 2 diabetes are at higher risk of HBV infections than the general population. This may be due to contact with infected blood or the use of improper material (blood glucose meter and infected needles) (7). In addition, diabetic patients may be at increased risk of HBV infection due to impaired immune function (8). Long-term continuous hyperglycemia has accelerated the occurrence and development of chronic complications of diabetes, such as retinopathy, neuropathy, and immune disorders (9). In a study carried out by Reilly et al. (10), diabetic adults between the ages of 23 and 59 years have a risk of acute HBV approximately twice that of the healthy population. Additionally, DM is associated with the progression of severe liver outcomes in adults with HBV (11). In another study, the prevalence of chronic HBV infection was higher in patients with type 2 diabetes (13.5%) than in controls (10.0%) (12). The data show that diabetic individuals who are infected with acute HBV may have a higher case-fatality rate than nondiabetic individuals (13,14).

Vaccination is one of the most effective and safe health services for preventing infectious diseases. In a placebo-controlled randomized study involving individuals with and without diabetes, HBV vaccination reduced the risk of infection from 10.7% to 4.1% in diabetic individuals (15). Hospitalization due to acute and chronic HBV infection increases in adult diabetic individuals and brings along an increase in costs. Studies have shown that the HBV vaccine in the adult age group reduces the total costs (15).

The American Diabetes Association (ADA), American Immunization Advisory Committee (ACIP), Canadian Diabetes Clinical Practice Guidelines Expert Committee, and Turkiye Endocrinology and Metabolism Association recommend the HBV vaccine to diabetic patients in their published guidelines (7,14,16,17).

We aimed to determine the awareness of diabetic patients about HBV vaccination, the demographic characteristics of the patients, HBV vaccination rates, information sources of those who had HBV vaccination before, and the effect of our recommendations on HBV vaccination rates.

Methods

This is a cross-sectional study that included diabetic patients over 18 years of age who were admitted to our hospital's diabetes outpatient clinic between October 2019 and December 2019 and agreed to participate in the study. We prepared a questionnaire with 14 questions about hepatitis B vaccine awareness in diabetic patients. The questionnaire was administered to 627 patients who participated in the study by face-to-face interviews. Some of the questions were about the patients' sociodemographic characteristics, duration and types of their diabetes, vaccination status and HBV vaccination status, reasons for not having received the HBV vaccine before, and information sources for those who had received the HBV vaccine before. The patients who

had not been vaccinated against HBV before were informed verbally by the same person about the HBV infection. They were informed that HBV infection is a contagious infection caused by the HBV virus and that it can cause both acute and chronic liver disease and cirrhosis. They were also informed about its frequency in the community, and its transmission routes that diabetic patients are at higher risk for this infection and they can be protected from this infection with the HBV vaccine. After the given information, they were asked whether they wanted to have the HBV vaccine or not. Serological markers related to HBV were obtained in patients who wanted to be vaccinated against HBV. Those who were serologically suitable for vaccination were referred to the vaccination unit in our hospital. The answers of the patients to the questionnaire, serological results related to HBV, and vaccination status after information were analyzed.

The data were analyzed using IBM SPSS Statistics software, version 22.0. The parameters were evaluated in compliance with the normal distribution of the Shapiro-Wilk test. In addition to descriptive statistical methods (mean, standard deviation, frequency), the chi-square test, Fisher-Freeman Halton test, and continuity (Yates) correction were used for the comparison of qualitative data. The statistical significance was accepted at the level of $p<0.05$.

Approval was obtained from the Fatih Sultan Mehmet Training and Research Hospital Clinical Research Ethics Committee on 26 September 2019 with the FSMEAH-KAEK 2019/84 code and 179 decision number from the Health Sciences University Academic Board. A written informed consent was obtained from all patients.

Results

Our study included 627 diabetic patients, consisting of 375 (59.8%) females and 252 (40.2%) males. The patients' ages ranged from 25 to 82 years and the mean age was 58.9±9.5 years. Demographic and diabetes-related characteristics of the patients are shown in Table 1.

Table 1. Demographic and diabetes-related characteristics of patients

		Min-Max	Mean±SD
		n	%
Age		25-82	58.9±9.5
Gender	Female	375	59.8
	Male	252	40.2
Education Level	Illiterate	60	9.6
	Barely literate	40	6.4
	Primary School	304	48.5
	Secondary School	60	9.6
	High School	97	15.5
	University	66	10.5
Diabetes Type	Tip 1 DM	5	0.8
	Tip 2 DM	202	32.2
	Not Knowing	420	67
Duration of Diabetes	0-5 years	197	31.4
	6-10 years	177	28.2
	11-15 years	105	16.7
	16-20 years	76	12.1
	More than 20 years	72	11.5

Min-max: Minimum – maximum, DM: Diabetes Mellitus, SD: Standard Deviation

Considering the HBV vaccination status according to the education level, the vaccination rate was 'zero' for illiterate patients, 7.5% (n=3) for barely literate patients, 6.3% (n=19) for primary school graduates, 5% (n=3) for secondary school graduates, 20.6% (n=20) for high school graduates and 19.7% (n=13) for university graduates. A statistically significant difference was found between the education level and the HBV vaccination rates of the patients ($p<0.001$).

We found that 8.3% (n=31) of females and 10.7% (n=27) of males were previously vaccinated against HBV. When compared in terms of gender, there was no significant difference in HBV vaccination rates ($p=0.300$). Similarly, there was no significant difference between diabetes duration and HBV vaccination status of the patients ($p=0.236$).

After being informed about the HBV vaccine, 95.6% (n=544) of the patients wanted to be vaccinated against HBV, while 4.4% (n=25) did not. A total of 98.2% (n=314) of the vaccinated patients against any disease in the last 10 years wanted to receive the HBV vaccine after being informed. 93% (n=286) of nonvaccinated patients against any disease in the last 10 years wanted to receive the HBV vaccine. After being informed, the desire for HBV vaccination in

nonvaccinated patients was significantly lower than in vaccinated patients (p=0.005) (Table 2).

Table 2. Information about the vaccination status of patients

		n	%
Have you had any vaccine in the last 10 years?	Yes	320	51
	No	307	49
Did you have the HBV vaccine before?	Yes	58	9.3
	No	569	90.7
What is your reason for not being vaccinated against HBV?	I don't know that diabetics should have HBV vaccine	539	94.7
	I think it is not necessary to have an HBV vaccine	18	3.2
	I think the vaccine is harmful	9	1.6
	Other reasons (afraid of vaccinations or injections etc.)	3	0.5
Do you want to have the HBV vaccine after being informed?	Yes	544	95.6
	No	25	4.4
What was your information resource?	Physician's recommendation	53	91.4
	Television	2	3.4
	Other sources (social contacts, neighbors, etc.)	3	5.2
What was the department of the physician?	Family Medicine	19	35.8
	Internal Medicine	23	43.4
	Endocrinology	9	17
	Infectious Diseases	2	3.8
When did you have the HBV vaccine?	0-5 years ago	19	32.8
	6-10 years ago	15	25.9
	11-15 years ago	19	32.8
	16-20 years ago	2	3.4
	More than 20 years ago	3	5.2
Where did you have the HBV vaccine?	Family Health Center	34	58.6
	Hospital	24	41.4

HBV: Hepatitis B virus

Considering the nonvaccinated patients against HBV before, we compared their wishes for HBV vaccination after being informed that 97.6% (n=526) of those who stated 'I did not know that the diabetics should have HBV vaccine', wanted to have the vaccine. A total of 72.2% (n=13) of those who said 'It is not necessary to have HBV vaccine', wanted to have the vaccine. A total of 44.4% (n=4) of those who said 'The vaccine is harmful', wanted to have the vaccine. Thirty-three percent (n=1) of those stating 'I did not have the vaccine for other reasons' wanted to have the vaccine. There was a significant difference between patients' wishes for HBV vaccination after being informed, according to their reasons for not being vaccinated against HBV before (p<0.001) (Figure 1).

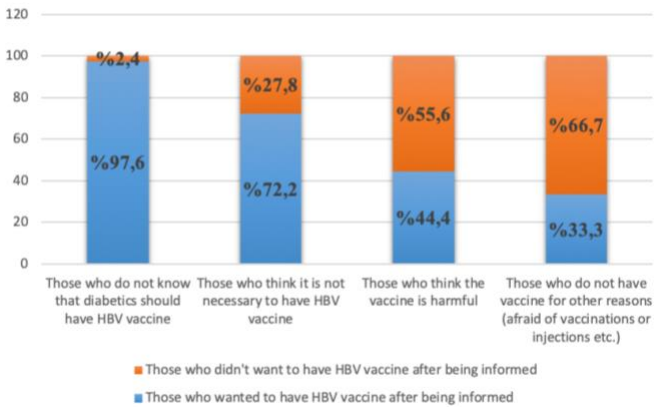


***Figure 1**. Patients' wishes for HBV vaccination after being informed according to their reasons for not being vaccinated against HBV before*

We examined serological markers of 544 patients who wanted to be vaccinated after being informed. 13.7% (n=75) of the patients had natural infection and previously had gained immunity (HBsAg (-), anti-HBc (+), anti-HBs (+)), although they were not aware that they had been infected before. 4.7% (n=26) of the patients were unaware that they had received the HBV vaccine before, but they obtained serology results (HBsAg (-), anti-HBc (-), anti-HBs (+)). HBsAg and anti-HBc IgG were positive in 0.9% (n=5) patients. Those five patients with positive HBsAg were not aware that they were carriers of HBV infection. For follow-up of those patients, HBV DNA levels were examined. The HBV DNA levels of the three patients were 95 IU/ml, 87 IU/ml and 30 IU/ml. The HBV DNA levels of two patients were <10 IU/ml. The HBeAg levels of the five patients were negative, and one of those five patients had a slight increase in the level of transaminase (ALT:51). We considered those patients as inactive HBV carriers and we recommended them to visit the infectious disease clinic. We also warned them about the vaccination of their family members and relatives living in the same house. Isolated anti-HBc IgG positivity was detected in 1.4% (n=8) patients. HBV DNA and other serological markers were tested with negative results

to exclude latent infection. We thought that those patients did not have an adequate immune response and we referred them to the vaccine unit.

In total, 544 patients wanted to be vaccinated after being informed, 438 of whom were suitable for vaccination serologically and were referred to the vaccination unit. At the end of the three months of the study, 369 of the 438 referred patients had received the HBV vaccine. The vaccination rate of the referred patients was measured as 84.2%. The HBV vaccination rate was 9.3% for all 627 patients who participated in our study; then, the rate increased to 68.1% at the end of the study.

Discussion

HBV vaccination rates were as low as 9.3% in diabetic patients who participated in the study. The most common reason (94.7%) for not being vaccinated was the lack of information that diabetics should be vaccinated against HBV. It was an important finding that vaccination rates increased from 9.3% to 68.1% after informing the patients.

In a study in Brazil of diabetic patients over the age of 18 years, 13.7% of the patients had three doses of HBV vaccine before, 4.7% could not complete three doses of vaccine, and 81.6% did not have HBV vaccine before (18). In a similar study in the United States (USA) in 2009 in adult diabetic patients, 16.6% of the patients had three doses of HBV vaccine before, 19.5% could not complete three doses of vaccine, and 63.9% did not have HBV vaccine before (19). In another study in the USA in 2015, 17.1% of adult diabetic patients received three doses of the HBV vaccine (20). In the study carried out by Arslan et al. (21) in Turkiye in adult diabetic patients, the HBV vaccination rate was 15.5%. These results show that the rate of HBV vaccination in diabetic patients is far below the desired value worldwide and is similarly low in Turkiye as in the world.

Our study found a significant difference between the education levels of the patients and their HBV vaccination status. The HBV vaccination rates were higher in individuals with higher education levels. It was a remarkable finding that the HBV vaccination rate was "zero", especially in illiterate patients. A study conducted in Brazil had similar findings with the HBV vaccination rate among illiterate patients reported as "zero". In the studies, the vaccination rates were higher in individuals with higher education levels (18,19,21). The results obtained from studies in Turkiye and worldwide showed that education made positive contributions to HBV vaccination.

We found no significant difference between the patients' gender and HBV vaccination status. Neither did we find a significant difference between their diabetes duration and HBV vaccination status. Previous studies yielded similar results (18,19).

In our study, most patients (94.7%) were not vaccinated because they did not know that they should receive the HBV vaccine. A study of 579 diabetic patients conducted in Turkiye investigated the reasons for not being vaccinated against HBV, finding that the most common responses were "I do not need to be vaccinated" and "Physicians did not say I should be vaccinated" (22). In another study conducted in Turkiye on diabetic patients, only 34.5% of the patients knew that they should be vaccinated against HBV (21). There are not enough studies on this subject, yet the results show that the awareness of HBV vaccination among diabetic patients is low. In our opinion, the most important role here falls on physicians. If physicians update their knowledge on this subject and inform patients, this can positively affect vaccination rates. During our study, we observed the same effect on the vaccination rates. While only 9.3% of patients had been vaccinated before they were informed, this rate increased to 68.1% after they were informed. In other studies, the vaccination rates increased after the patients were informed about the HBV vaccine (22,23). We asked the HBV-vaccinated patients about sources of information for the vaccination and found that 91.4% of them were informed by a doctor's recommendation, 3.4% by television, and 5.2% by other sources (neighbors, social contacts, etc.). In a study in Turkiye, the knowledge resources of HBV-vaccinated diabetic patients were mostly physicians (71.6%) and television (18.6%) (21). In a study in the USA,

physicians were asked whether they recommended the HBV vaccine to diabetic patients and only 22.9% of them had recommended it, while 77.1% had not made any recommendations (23). In our study, we observed that among the nonvaccinated patients against HBV who were unaware that diabetics should receive the HBV vaccine, almost all (97.6%) wanted to receive the vaccine after being informed. This result led us to think about the importance of recommending the vaccine and informing patients. However, among the patients who thought that the vaccine was harmful, their willingness to take the HBV vaccine after being informed was lower (44.4%) than that of the unaware patients. This result brings to mind 'anti-vaccination' that has been increasing in recent years.

During the study, we found that 16.07% of the patients had previous contact with HBV (anti-HBc reactive). In a study in Brazil, 8.19% of diabetic patients had previous contact with HBV (anti-HBc reactive) (24). In the study carried out by Reilly et al. (10), anti-HBc seroprevalence in diabetic patients was 60% higher than that in nondiabetic individuals. A large population-based study in China found that HBV exposure was significantly higher in diabetic individuals than in healthy individuals and the relative risk of HBV infection was 43% higher in diabetic patients than in the healthy population (8). In another study, HBsAg seroprevalence was found to be 21.30% in diabetic patients, which was significantly higher than 15.53% in nondiabetic patients (p=0.003) (25). In a study by Gülcan et al. (26) in Turkiye, in which 630 diabetic and 314 nondiabetic people were compared, significant positive associations were found between HBsAg-positive serology and hospitalization history, longer diabetes duration and insulin use (26). We may attribute the higher HBV risk in diabetic patients to their more frequent use of medical equipment and weaker immune functions. Management of diabetic patients, active treatment and adequate blood glucose control, HBV vaccination and continuous infection control practices can help reduce HBV transmission in this vulnerable population. In addition, hospitalization due to acute and chronic HBV infection increases in diabetic patients, bringing along an increase in costs. A study conducted in the USA between 2006 and 2014 found that health service usage and costs were higher in diabetic patients with HBV than in patients who had only diabetes (27). These results show that diabetic patients must pay attention to HBV carriage, chronic HBV infection and severe outcomes caused by HBV. Vaccination is the most effective and inexpensive way to prevent HBV infection. Therefore, we think that more awareness of diabetic patients should be raised about the HBV vaccine. First, it is necessary to increase the knowledge and awareness of health professionals about the HBV vaccine in diabetic patients. Organizing various meetings with healthcare professionals on this issue, increasing the outpatient clinic times allocated to diabetic patients, evaluating patients more comprehensively, preparing brochures to inform patients about vaccines and actively using media can increase the rates of HBV vaccination in diabetic patients.

Our study has several strengths, including being one of the few studies on HBV vaccine awareness, especially in diabetic patients, and the large sample size. However, being conducted at a single center limits it in terms of generalizing the results to the entire diabetic population. More studies are needed on this subject.

Conclusion

Our study and studies conducted worldwide show that the rate of getting the HBV vaccine in diabetic patients is quite low. While only 9.3% of the patients were vaccinated against HBV at the beginning of our study, this rate increased to 68.1% after the patients were informed about the vaccination. The significant increase in vaccination rates after informing the patients revealed that the patients needed information about vaccination and their diseases. We think that using written and visual media, increasing the time allocated to the patients in the outpatient clinic, providing health consultancy services for patients, and providing regular training for physicians can help to increase awareness of HBV vaccination among diabetic patients. Because of the regular follow-up of patients in all age groups, primary care physicians play

an important role in this respect.

References

1. Cho N, Shaw J, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, et al. IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Res Clin Pract 2018;138:271-81. doi: 10.1016/j.diabres.2018.02.023
2. Satman I, Omer B, Tutuncu Y, Kalaca S, Gedik S, Dinccag N, et al. Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. Eur J Epidemiol 2013;28(2):169-80. doi: 10.1007/s10654-013-9771-5
3. International Diabetes Federation [Internet]. IDF Diabetes Atlas 2019 [cited 2023 May 16]. Available from: https://www.diabetesatlas.org/upload/resources/material/20200302_133351_IDFATLAS9e-final-web.pdf
4. Sezer Ö, Özdoğan Lafçi N, Korkmaz S, Dağdeviren HN. Prediction of a 10-year risk of type 2 diabetes mellitus in the Turkish population: A cross-sectional study. Medicine 2021;100(44):e27721. doi:10.1097/MD.0000000000027721
5. World Health Organization [Internet]. Global Hepatitis Report 2017 [cited 2023 May 16]. Available from: https://www.who.int/publications/i/item/global-hepatitis-report-2017
6. Tozun N, Ozdogan O, Cakaloglu Y, Idilman R, Karasu Z, Akarca U, et al. Seroprevalence of hepatitis B and C virus infections and risk factors in Turkey: a fieldwork TURHEP study. Clin Microbiol Infect 2015;21(11):1020-6. doi: 10.1016/j.cmi.2015.06.028
7. American Diabetes Association. 4. comprehensive medical evaluation and assessment of comorbidities: standards of medical care in diabetes-2019. Diabetes Care 2019;42(1):S34-S45. doi: 10.2337/dc19-S004
8. Zhang X, Zhu X, Ji Y, Li H, Hou F, Xiao C, et al. Increased risk of hepatitis B virus infection amongst individuals with diabetes mellitus. Biosci Rep 2019;39(3): BSR20181715. doi: 10.1042/BSR20181715
9. Shan S, Gu L, Lou Q, Ouyang X, Yu Y, Wu H, et al. Evaluation of glycemic control in patients with type 2 diabetes mellitus in Chinese communities: a cross-sectional study. Clin Exp Med 2017;17(1):79-84. doi:10.1007/s10238-015-0406-x
10. Reilly ML, Schillie SF, Smith E, Poissant T, Vonderwahl CW, Gerard K, et al. Increased risk of acute hepatitis B among adults with diagnosed diabetes mellitus. J Diabetes Sci Technol 2012;6(4):858-66. doi: 10.1177/193229681200600417
11. Younossi Z, Kochems K, de Ridder M, Curran D, Bunge EM, de Moerlooze L. Should adults with diabetes mellitus be vaccinated against hepatitis B virus? A systematic review of diabetes mellitus and the progression of hepatitis B disease. Hum Vaccin Immunother 2017;13(11):2695-706. doi: 10.1080/21645515.2017.1353850
12. Lu J, Hou X, Tu H, Tang Z, Xiang Y, Bao Y, et al. Chronic hepatitis B virus infection status is more prevalent in patients with type 2 diabetes. J Diabetes Investig 2017;8(4):619-25. doi:10.1111/jdi.12609
13. Kirkman MS, Schaffner W. Another shot to protect people with diabetes: add hepatitis B vaccination to the checklist. Diabetes Care 2012;35(5):941-2. doi: 10.2337/dc12-0164
14. Centers for Disease Control and Prevention (CDC). Use of hepatitis B vaccination for adults with diabetes mellitus: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Morb Mortal Wkly Rep 2011;60(50):1709-11.
15. Hoerger TJ, Schillie S, Wittenborn JS, Bradley CL, Zhou F, Byrd K, et al. Cost-effectiveness of hepatitis B vaccination in adults with diagnosed diabetes. Diabetes Care 2013;36(1):63-9. doi: 10.2337/dc12-0759

16. Diabetes Canada Clinical Practice Guidelines Expert Committee, Husein N, Chetty A. Influenza, pneumococcal, hepatitis b and herpes zoster vaccinations. Can J Diabetes 2018;42(1):142-4. doi: 10.1016/j.jcjd.2017.10.016
17. Türkiye Endokrinoloji ve Metabolizma Derneği (TEMD.) Diabetes mellitus ve komplikasyonlarının tanı, tedavi ve izlem kılavuzu 2019. Ankara: TEMD, 2019:97-9.
18. Arrelias CC, Bellissimo-Rodrigues F, Lima LC, Silva AS, Lima NK, Zanetti ML. Hepatitis B vaccination coverage in patients with diabetes mellitus. Rev Esc Enferm USP 2016;50(2):255-62. doi: 10.1590/S0080-623420160000200011
19. Byrd KK, Lu PJ, Murphy TV. Baseline hepatitis B vaccination coverage among persons with diabetes before implementing a U.S. recommendation for vaccination. Vaccine 2012;30(23):3376-82. doi: 10.1016/j.vaccine.2012.03.055
20. Villarroel MA, Vahratian A. Vaccination coverage among adults with diagnosed diabetes: United States, 2015. NCHS Data Brief 2016;(265):1-8.
21. Arslan IE, Altinova A, Törüner FS, Yalcin MM, Ozkan C, Cakir N, et al. Awareness of hepatitis b, influenza, and pneumococcal vaccine among diabetic patients. Gazi Medical Journal 2016;27(3):115-7. doi: 10.12996/gmj.2016.35
22. Altay M, Ateş İ, Altay FA, Kaplan M, Akça Ö, Özkara A. Does education effect the rates of prophylactic vaccination in elderly diabetics? Diabetes Res Clin Pract 2016;120:117-23. doi: 10.1016/j.diabres.2016.08.002
23. Matta TJ, O'Neal KS, Johnson JL, Carter SM, Lamb MM, Planas LG. Interventions to improve dissemination and implementation of Hepatitis B vaccination in patients with diabetes. J Am Pharm Assoc 2017;57(2):183-7. doi: 10.1016/j.japh.2016.11.004
24. Villar LM, Geloneze B, Vasques ACJ, Pires MLE, Miguel JC, da Silva EF, et al. Prevalence of hepatitis B and hepatitis C among diabetes mellitus type 2 individuals. PloS One 2019;14(2):e0211193. doi: 10.1371/journal.pone.0211193
25. Zhu H, Wang Y, Yu L, Xu Y, Zhou H, Ding Y, et al. Serological and molecular analysis on the relationships between type 2 diabetes mellitus and hepatitis B virus infection. J Infect Dev Ctries 2016;10(8):837-44. doi:10.3855/jidc.7656
26. Gulcan A, Gulcan E, Toker A, Bulut I, Akcan Y. Evaluation of risk factors and seroprevalence of hepatitis B and C in diabetic patients in Kutahya, Turkey. J Investig Med 2008;56(6):858-63. doi: 10.2310/JIM.0b013e3181788d28
27. Deshpande G, Klink AJ, Shenolikar R, Singer J, Eisenberg Lawrence DF, Krishnarajah G. Economic burden of hepatitis B infection among patients with diabetes. Hum Vaccin Immunother 2016;12(5):1132-40. doi: 10.1080/21645515.2015.1127488