



Pneumococcal, Influenza, Hepatitis B, and Tetanus Vaccination Rate and Vaccine Awareness in Patients with Type 2 Diabetes

Tip 2 Diyabetli Hastalarda Pnömonokok, İnfluenza, Hepatit B, Tetanoz Aşılama Oranları ve Aşı Farkındalığı

Arzu Cennet IŞIK, Seydahmet AKIN, Nazire ALADAĞ, Ersin Engin ŞİMŞEK*

Clinic of Internal Medicine, University of Health Sciences Kartal Dr. Lütfi Kırdar City Hospital, İstanbul, TURKEY

*Clinic of Family Medicine, University of Health Sciences Kartal Dr. Lütfi Kırdar City Hospital, İstanbul, TURKEY

Abstract

Objective: This study aimed to determine the vaccination rates and the levels of awareness on pneumococcal, influenza, tetanus and hepatitis B vaccination among patients with Type 2 diabetes mellitus (DM). **Material and Methods:** The study was performed on patients with DM who presented to the outpatient Clinic of Internal Disease at Kartal Dr. Lütfi Kırdar City Hospital. Patients were asked to fill out a questionnaire regarding their vaccination status, attitude, and awareness about vaccines. **Results:** A total of 293 patients [121 (41.3%) males and 172 (58.7%) females] with a mean age of 65 years were included in the study. The mean duration of diabetes was 15 years. Overall, 47.8% of patients reported awareness about the need for vaccination while the rate of being unvaccinated was 52.2%. Reasons for the lack of vaccination were as follows: 67.3% of patients were unaware of the reason for not receiving vaccines; 17.5% patients did not want to be vaccinated; 13.3% patients reported that their physicians did not recommend vaccination; 1.5% reported unavailability of vaccines, and 0.4% reported negligence. Among vaccinated cases, 34.1% were vaccinated against flu; 20.8% against tetanus; 9.9% against pneumonia; 7.8% against hepatitis; and 5.1% received vaccination for other diseases. **Conclusion:** The levels of vaccine awareness and vaccination rates are low among diabetic patients. It is essential to raise vaccination awareness among this patient population. The health authorities and departments need to develop effective strategies to increase vaccination rates across the country.

Keywords: Diabetes mellitus; pneumococcal vaccine; influenza vaccine; hepatitis B vaccine; tetanus vaccine

Özet

Amaç: Bu çalışma, Tip 2 diabetes mellitus (DM) hastalarında aşılanma oranlarını ve pnömonokok, influenza, tetanoz ile hepatit B aşısı konusunda farkındalık düzeylerini belirlemeyi amaçlamaktadır. **Gereç ve Yöntemler:** Çalışma, Kartal Dr. Lütfi Kırdar Şehir Hastanesi İç Hastalıkları Kliniğine başvuran DM'li hastalar üzerinde yapıldı. Hastalardan aşı durumları, tutumları ve aşılarla ilgili farkındalıkları hakkında bir anket doldurmaları istendi. **Bulgular:** Çalışmaya, yaş ortalaması 65 yıl olan toplam 293 [121 (%41,3)'i erkek, 172 (%58,7)'si kadın] hasta dâhil edildi. Ortalama diyabet süresi 15 yıl idi. Genel olarak, hastaların %47,8'i aşılanma ihtiyacı konusunda farkındalık bildirirken, aşı yaptırmama oranı da %52,2 idi. Hastaların %67,3'ü aşı olmama nedeninin farkında değildi. Yüzde 17,5 hasta aşı olmak istemediğini belirtirken; %13,3'ü, hekimlerinin kendilerine aşısı önermediğini belirtti. Ayrıca hastaların %1,5'i aşıları bulamadığını, %0,4'ü de aşı olmayı ihmal ettiğini bildirdi. Aşılanan olguların %34,1'i grip aşısı; %20,8'i tetanoz; %9,9'u pnömoni; %7,8'i hepatit ve %5,1'i de diğer hastalıklara karşı aşılanmıştır. **Sonuç:** Diyabetik hastalarda aşı farkındalığı ve aşılanma oranları düşük olarak bulundu. Bu hasta popülasyonunda aşılanma bilincinin artırılması esastır. Sağlık yetkilileri ve kuruluşlarının, ülke genelinde aşılanma oranlarını artırmak için etkili stratejiler geliştirmesi gerektiği düşünülmektedir.

Anahtar kelimeler: Diabetes mellitus; pnömonokok aşısı; influenza aşısı; hepatit B aşısı; tetanoz aşısı

Address for Correspondence: Arzu Cennet IŞIK, Clinic of Internal Medicine, University of Health Sciences Kartal Dr. Lütfi Kırdar City Hospital, İstanbul, TURKEY
Phone: +905058174519 **E-mail:** arzukaracelik@gmail.com

Peer review under responsibility of Turkish Journal of Endocrinology and Metabolism.

Received: 05 Apr 2020 **Received in revised form:** 21 Jun 2020 **Accepted:** 23 Jul 2020 **Available online:** 31 Aug 2020

1308-9846 / © Copyright 2020 by Society of Endocrinology and Metabolism of Turkey.
Publication and hosting by Türkiye Klinikleri.

This is an open access article under the CC BY-NC-SA license (<https://creativecommons.org/licenses/by-nc-sa/4.0/>)

Introduction

Diabetes mellitus (DM) remains a significant cause of morbidity and mortality (1). Patients with DM are more susceptible to developing infections as well as macro- and microvascular complications. Immune system dysfunction associated with immunosuppression such as dysregulated or depressed phagocytosis, chemotaxis, and leukocyte binding is commonly seen in diabetes (2).

Epidemiological data indicate that patients with Type 1 and Type 2 diabetes are more likely to be infected with pneumococcal and influenza infections. Diabetic patients experience a further severe clinical course during pneumococcal and *Haemophilus influenzae* infections than the non-diabetic populations (3). Mortality due to influenza infections is 2-4 times higher in diabetic patients compared to the non-diabetic populace. Patients with diabetes have presented higher hospitalization rates (5.7-6.2%) for pneumococcal influenza as compared to the non-diabetic counterparts (4). Pneumococcal vaccine is associated with fewer deaths, hospitalizations, admissions to intensive care units, and higher recovery rates from respiratory failure (4). Mortality was reported in 25.7% of unvaccinated diabetic patients hospitalized for pneumonia during the influenza pandemic between 1976 and 1978 in the Netherlands. The rates of hospitalization and mortality in diabetic patients are expected to decrease with pneumococcal and influenza vaccination programs (4-6).

The American Diabetes Association (ADA) and the Advisory Committee on Immunization Practices (ACIP) recommends the pre-season influenza vaccine once every year and pneumococcal vaccine at least once in a lifetime in diabetic patients. According to the current guideline of the Society of Endocrinology and Metabolism of Turkey, diabetic patients must be vaccinated against influenza every year in the fall, against pneumococcal infections at least once in a lifetime, and hepatitis B vaccine should be given in 3 doses at 0, 1 and 6 months (7). This study aimed to determine the rates of vaccination and the level of awareness for pneumococcal, influenza, and hepatitis B vaccines in patients with Type 2 DM in İstanbul population.

Material and Methods

This cross-sectional study included patients with Type 2 DM who presented to the outpatient Clinic of Internal Diseases at Kartal Dr. Lütfi Kırdar City Hospital İstanbul, Turkey between March and April 2020.

Patients who were diagnosed with Type 2 diabetes for at least one year were included in the study. Patients with Type 1 diabetes, pregnant women, patients with active malignancy, and severe neurological and psychiatric conditions were excluded from the study. A total of 293 patients were included. After assessment at the outpatient department, a questionnaire enquiring about the patient's vaccination status, attitude, and awareness toward vaccination for the last one year, which included items about gender, age, diabetes duration (years), was obtained.

Besides demographic characteristics, the patients were also questioned about previous vaccination, the name of vaccination they had received (if any), whether a physician recommended the vaccination, and the reason for not being vaccinated.

Data were recorded and analyzed using the Student's t-test, Mann-Whitney U test, Fisher's exact test, and the chi-squared test. For statistical analysis, SPSS 18 software was used, and a p-value of less than 0.001 was considered significant.

The Ethics Committee of Dr. Lütfi Kırdar Kartal City Hospital approved the study (26 February 2020, no 2020/514/172/2). All the procedures conformed to the ethical standards of the Declaration of Helsinki.

Results

A total of 293 [121 men (41.3%) and 172 women (58.7%) patients; mean age 65 years; mean duration of diabetes 15 years] who presented to the outpatient department of diabetes and met the inclusion criteria were enrolled in the study. The rate of vaccination was found to be a little more than half, with 54.3 (n=159) vaccinated and 45.7 (n=134) unvaccinated patients (Table 1). Among the unvaccinated group, the majority of patients (67.3%) stated unawareness about the vaccine to be the reason for being unvaccinated; the other reasons mentioned were unwillingness for vaccination (17.5%), lack of physician's recommendation

Table 1. Data representing the rate of vaccination in patients.

	n	%
Mean age (year)	65	20-91
The duration of diabetes (year)	15	1-44
Gender (F/M)	121/172	41.3/58.7
Did the patient know that he/she should be vaccinated?		
No	153	52.2
Yes	140	47.8
Was the patient vaccinated before?		
No	134	45.7
Yes	159	54.3
If not, why?		
Did not know	177	67.3
Knew, but was unwilling	46	17.5
Physician did not recommend	35	13.3
Vaccination was unavailable	4	1.5
Economic	0	.0
Fear	0	.0
Negligence	1	0.4
Influenza	100	34.1
Pneumonia	29	9.9
Tetanus	61	20.8
Hepatitis	23	7.8
Other	15	5.1

F: Female, M: Male.

(13.3%), unavailability of vaccines (1.5%), and negligence (0.4%). Overall, 47.8% of the patients reported that they were aware of the importance of vaccination.

In the vaccinated group, 34.1% received vaccination against influenza, 20.8% against tetanus, 9.9% against pneumonia, 7.8% against hepatitis, while 5.1% of patients received other vaccines. The rate of vaccination was higher in females, the elderly population, and patients with long-standing Type 2 DM; however, these differences were not statistically significant (Table 2). The rate of vaccination among patients who reported awareness regarding the need for vaccination was 82.9%.

Females were more aware of vaccination as compared to the males (60.7% vs. 39.3%), presenting a higher rate of vaccination (54.1% vs. 45.9%) (Table 3). No significant difference in the type of vaccination was noted between males and females, except for the tetanus vaccine, which

was higher in men than in women (28.6% vs. 11.3%; $p < 0.001$). Although the hepatitis vaccination rate was also higher in males, the difference did not reach the level of significance. Females reported more reasons than males for not receiving vaccines.

Discussion

This study found lower pneumococcal vaccination rates than those in the European population in patients with Type 2 diabetes. A lower vaccination rate of 9.9% was identified compared to the vaccination rates reported in Europe and the USA. According to the 2015 Centers for Disease Control and Prevention (CDC) data, the rate of pneumococcal vaccination was determined to be 23% in high-risk individuals aged 19-64 years, rising to 63.6% in older adults over 65 years of age (8). Krasselt, et al., reported a pneumococcal vaccination rate of 33% in patients with rheumatoid arthritis (9).

Table 2. Characteristics of the vaccinated and unvaccinated groups.

	Unvaccinated (109)		Vaccinated (140)		p
	n	%	n	%	
Age (year)	59.9	13.5	60.5	14.8	0.737
<45	9	40.9	13	59.1	0.220
45-49	8	50	8	50	
50-54	7	33.3	14	66.7	
55-59	22	62.9	13	37.1	
60-64	19	37.3	32	62.7	
65-69	27	51.9	25	48.1	
70-74	18	43.9	23	56.1	
75-79	12	35.3	22	64.7	
>80	12	57.1	9	42.9	
The duration of diabetes (years)	15	(1-42)	15.6	(1-15)	0.954
<5	21	46.7	24	53.3	0.795
5-9	20	48.8	21	51.2	
10-14	24	44.4	30	55.6	
15-19	24	42.9	32	57.1	
20-24	26	54.2	22	45.8	
25-29	10	43.5	13	56.5	
>30	9	34.6	17	65.4	
Gender					
Male	48	39.7	73	60.3	0.81
Female	86	50.0	86	50.0	
Did the patient know that he/she should be vaccinated?					
No	110	71.9	43	28.1	<0.001
Yes	24	26.9	116	82.9	

The rate of vaccination against the flu was 34% in the present study. The CDC's 2015 data declared the rate of vaccination against influenza to be 44.8% in individuals aged 19 years and above (8). According to the Eurostat data, the vaccination rate against influenza in EU member countries was 44.3% in 2017. Among the European Union, UK has the highest vaccination rate of 72.6% against influenza (10). A German study reported a vaccination rate of 53% against influenza (9).

This study found that the level of awareness about vaccination and the rate of vaccination were low in diabetic patients. Unfortunately, the success rates seen in the adult population worldwide are far from reaching those achieved for childhood vaccination (5). In the present study, the rate of vaccine awareness was 47.8% among adult patients with Type 2 diabetes and a mean age of 65.

Similar to the present study, Canadian research on influenza vaccination rates in 2009 found lower vaccination rates than expected in patients of all ages with or without diabetes, and 34-50% in the non-diabetic population (11). A computer-assisted telephonic survey in Australia found low rates of immunization coverage among individuals at high-risk and chronic conditions, being 47% for influenza and 31% for *S. pneumoniae* (12).

Of the few studies on the rates of vaccination in the Turkish diabetic population, all reported unsatisfactory vaccination rates (13,14). In the present study, vaccination coverage included influenza in 34.1%, tetanus in 20.8%, pneumonia in 9.9%, hepatitis in 7.8%, and other conditions in 5.1%. Şahin, et al. documented the overall vaccination rates as 34% for influenza, 9.5% for pneumococcal infections, and 10.6% for

Table 3. Vaccine status of males and females.

	Male		Female		p
	n	min-max	n	min-max	
Age	63.9	(24-87)	63.5	(20-91)	0.557
The duration of diabetes (years)	14.7	(1-40)	15.8	(1-44)	0.269
Did the patient know that he/she should be vaccinated?					
No	66	43.1%	87	56.9%	0.504
Yes	55	39.3%	85	60.7%	
Was the patient vaccinated before?					
No	48	35.8%	86	64.2%	0.081
Yes	73	45.9%	86	54.1%	
Influenza	44	44%	56	56%	0.499
Pneumonia	14	48.3%	15	51.7%	0.421
Tetanus	40	65.6%	21	34.4%	<0.001
Hepatitis	14	60.9%	9	39.1%	0.047
Other	5	33.3%	11	66.7%	0.520
If not, why?					
Did not know	69	39.00%	108	61.00%	0.274
Knew, but was unwilling	16	34.8%	30	65.2%	
Physician did not recommend	16	45.7%	19	54.3%	
Vaccination was unavailable	0	0.0%	4	100%	0
Economic	0	0.0%	0	0.0%	
Fear	0	0.0%	0	0.0%	
Negligence	1	100.0%	0	0.0%	

tetanus in 244 patients aged 60 years or older. In diabetic and non-diabetic groups, the corresponding vaccination rates were 38.1% and 31.8%; 13.4% and 7.39%; and 9.28% and 11.36%, respectively, with no significant difference between the two groups (15). Arslan et al. revealed that of 318 diabetic patients, 46.3%, 18.9%, and 34.5% were aware of the need for influenza, pneumococcal, and hepatitis B vaccines (13). Another study on 2,383 Turkish patients described the awareness of the need for pneumococcal vaccination in 10.7% of patients, though only 0.9% were vaccinated (16).

A literature review conducted in Turkey observed that approximately 27 to 33 million people were in the risk groups, out of which 428,000 healthcare providers were at high risk for influenza infections. The lowest and the highest rates of vaccination were reported in the elderly population ≥ 65 years of age (5.9%) and patients with chronic obstructive pulmonary disease (27.3%), respectively (17).

The current study found that diabetic patients most commonly received influenza vaccination, recording 34.1%. Seasonal influenza is caused by influenza A or B and affects 5-15% of people worldwide each year (18). Although influenza is commonly responsive to supportive treatment, it can cause complications in the elderly and those with comorbidities. Epidemiological studies conducted on large groups of patients have noted severe influenza and its complications in the population over 65 years of age and immunocompromised patients (19). The clinical course of influenza infections in diabetic patients is severe. According to the Turkey's national treatment guideline, all diabetic patients should be vaccinated once a year (7). The efficacy of the flu vaccine is short-lived (6-8 months), especially in the elderly. Currently, the flu vaccines in Turkey are trivalent and quadrivalent inactivated vaccines. The former protects against two influenza A strains and one influenza B strain, while the latter protects against one more influenza B strain in addition to the

protection coverage of the trivalent vaccine. The protective effect of influenza vaccines begins 1-2 weeks after vaccination and lasts for about 6-8 months or longer in healthy adults. This period is shorter in elderly and immunosuppressed patients and is around 100 days. Since flu infections start to appear in November-December and continue until April-May in Turkey, vaccination in October seems to be a rational approach.

International authorities such as the ADA, World Health Organization, and ACIP recommend influenza, hepatitis B, and pneumococcal vaccines for all diabetic patients. As per the New Global Vaccine Action Plan recommendations, influenza vaccination is targeted to reach 90% of the high-risk individuals between 18 and 64 years and the entire population above 65 years of age, in the United States. In Turkey, the Ministry of Health implements the EPI (Expanded Program on Immunization) campaign, emphasizing the importance of vaccination and providing support to high-risk (including DM) patients. Also, the 2019 Diabetes Mellitus Diagnosis and Treatment Guideline, and the Turkish Diabetes Foundation 2019 Diabetes Mellitus Diagnosis and Treatment Guideline recommend vaccination against influenza, pneumococcal, hepatitis B in individuals with DM.

The attitude of healthcare personnel toward vaccination is closely related to their approach to the patient. Physicians who receive the influenza vaccine recommend vaccination more often and take the vaccination procedure more seriously (20). A study in Spain reported an incremental increase in vaccination rates from 50.1% in 1993 to 63.7% in 2003, and 65% in 2010, for influenza. Factors that were found to increase vaccination rates included advanced age, male sex, chronic diseases, and a visit to a physician in the last two weeks (21).

Low vaccination rates in Turkey may be associated with the anti-vaccination movement, also fueled by social media. The attitude of health personnel, especially physicians and nurses, to diabetic patients, may be beneficial in vaccination. Health authorities must be more attentive to initiatives and campaigns to counteract adverse media effects and provide correct information to the community, particularly individual patients.

The patient's high response rate and perception level may be considered the strength of the present study, thus providing valuable information for future national immunization strategies. Another significant feature is the inclusion of elderly (over 80 years of age) vaccinated patients with a regular follow-up for 14-15 years. The reasons for a higher vaccination rate among women may be attributable to more often hospital visits and a higher degree of willingness to vaccinate. The significantly high rate of tetanus vaccination among males may be credited to the routine vaccination procedure after injuries, which men are more likely to sustain.

The authors urge the physicians to be aware of their shortcomings before blaming the patients. The authors deliberate that awareness among physicians must be raised first to do the same for their patients. In this study, 13.3% of patients disclosed the lack of recommendation for vaccination by their physicians. Besides, increasing awareness depends strictly on other sources' engagement, including health managers, media, and allied health care personnel. Nonetheless, the authors thank the Ministry of Health and diabetes associations' keen efforts for several years, because of which positive progress has already been achieved in adult vaccinations.

Limitations

Since the study was conducted in a tertiary health institution of the Kartal District in İstanbul, it may not reflect the country's actual vaccination rate. The majority of diabetic patients seen in other provinces, outpatient clinics, and family health centers are likely to have low vaccination rates. Another limitation of this study is the lack of integration of vaccination records into a national data network. Furthermore, patients who reported that they were unaware of why they had not received vaccination should have been further questioned, which may have hinted to other factors affecting vaccinations. Many patients might have been anxious about their responses to be negatively evaluated by the physician if they disclosed the effect of social media and cultural misbeliefs and may have perhaps misinformed.

Conclusion

The level of awareness regarding vaccinations is still a severe problem throughout the world, leading to low vaccination rates, as demonstrated in this study. Low vaccine awareness can be a significant reason for low vaccination rates. Studies on vaccine awareness are essential to determine the current state of the problem so that necessary steps can be planned and initiated to raise awareness among individuals.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and/or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Arzu Cennet Işık, Seydahmet Akın; Design: Arzu Cennet Işık, Seydahmet Akın, Nazire Aladağ; Control/Supervision: Seydahmet Akın, Ersin Engin Şimşek; Data Collection and/or Processing: Arzu Cennet Işık, Seydahmet Akın; Analysis and/or Interpretation: Seydahmet Akın; Literature Review: Arzu Cennet Işık; Writing the Article: Arzu Cennet Işık, Seydahmet Akın, Nazire Aladağ; Critical Review: Seydahmet Akın, Ersin Engin Şimşek; References and Fundings: Arzu Cennet Işık, Seydahmet Akın; Materials: Arzu Cennet Işık, Seydahmet Akın, Nazire Aladağ.

References

1. Mahmood SS, Levy D, Vasan RS, Wang TJ. The Framingham Heart Study and the epidemiology of cardiovascular disease: a historical perspective. *Lancet*. 2014;383:999-1008. [Crossref] [PubMed] [PMC]
2. Casqueiro J, Casqueiro J, Alves C. Infections in patients with diabetes mellitus: a review of pathogenesis. *Indian J Endocrinol Metab*. 2012;16 Suppl 1:S27-S36. [Crossref] [PubMed] [PMC]
3. Delamaire M, Maugendre D, Moreno M, Le Goff MC, Allannic H, Genetet B. Impaired leucocyte functions in diabetic patients. *Diabet Med*. 1997;14:29-34. [Crossref] [PubMed]
4. Wang IK, Lin CL, Chang YC, Lin PC, Liang CC, Liu YL, Chang CT, Yen TH, Huang CC, Sung FC. Effectiveness of influenza vaccination in elderly diabetic patients: a retrospective cohort study. *Vaccine*. 2013;31:718-724. [Crossref] [PubMed]
5. Giannattasio A, Squeglia V, Lo Vecchio A, Russo MT, Barbarino A, Carlomagno R, Guarino A. Pneumococcal and influenza vaccination rates and their determinants in children with chronic medical conditions. *Ital J Pediatr*. 2010;36:28. [Crossref] [PubMed] [PMC]
6. Bouter KP, Diepersloot RJ, van Romunde LK, Uitslager R, Masurel N, Hoekstra JB, Erkelens DW. Effect of epidemic influenza on ketoacidosis, pneumonia and death in diabetes mellitus: a hospital register survey of 1976-1979 in The Netherlands. *Diabetes Res Clin Pract*. 1991;12:61-68. [Crossref] [PubMed]
7. Türkiye Diyabet Vakfı, Türk Diyabet Cemiyeti, Türkiye Endokrinoloji ve Metabolizma Derneği, Diyabet Hemşireliği Derneği. *Diyabetik Birey Aşılama Rehberi*. [Link]
8. Williams WW, Lu PJ, O'Halloran A, Kim DK, Grohskopf LA, Pilishvili T, Skoff TH, Nelson NP, Harpaz R, Markowitz LE, Rodriguez-Lainz A, Fiebelkorn AP. Surveillance of vaccination coverage among adult populations - United States, 2015. *MMWR Surveill Summ* 2017;66:1-28. [Crossref] [PMC]
9. Krasselt M, Ivanov JP, Baerwald C, Seifert O. Low vaccination rates among patients with rheumatoid arthritis in a German outpatient clinic. *Rheumatol Int*. 2017;37:229-237. [Crossref] [PubMed]
10. EuroStat. 44% of elderly people vaccinated against influenza. 2019. (Date of Access: 31.03.2020) [Link]
11. Quach S, Hamid JS, Pereira JA, Heidebrecht CL, Deeks SL, Crowcroft NS, Quan SD, Brien S, Kwong JC; Public Health Agency of Canada/Canadian Institutes of Health Research Influenza Research Network Vaccine Coverage Theme Group. Influenza vaccination coverage across ethnic groups in Canada. *CMAJ*. 2012;184:1673-1681. [Crossref] [PubMed] [PMC]
12. Dower J, Donald M, Begum N, Vlack S, Ozolins I. Patterns and determinants of influenza and pneumococcal immunisation among adults with chronic disease living in Queensland, Australia. *Vaccine*. 2011;29:3031-3037. [Crossref] [PubMed]
13. Arslan İE, Altınova A, Baloş Törüner F, Yalçın MM, Özkan Ç, Müjde NÇ, Arslan AM. Diyabetik hastaların hepatit-B, influenza ve pnömokok aşısı farkındalıkları. *Gazi Med J*. 2016;27:115-117. [Link]
14. Satman I, Akalin S, Cakir B, Altinel S; diaVAX Study Group. The effect of physicians' awareness on influenza and pneumococcal vaccination rates and correlates of vaccination in patients with diabetes in Turkey: an epidemiological Study "diaVAX". *Hum Vaccin Immunother*. 2013;9:2618-2626. [Crossref] [PubMed] [PMC]

15. Sahin S, Tasar PT, Guclu YA, Sengul HS, Bozkurt N, Garip A, Duman S, Akcicek F. Vaccinations rates in the elderly with diabetes mellitus. *Adv Aging Res.* 2014;3:293-296. [[Crossref](#)]
16. Ünal S, Durusu Tanrıöver M, Taş E, Güner İ, Çetin ÖY, Sayar İ. Aile hekimlerine eğitim verilmesi ve aşılama hedeflerinin belirlenmesinin pnömokok aşılama oranları üzerine etkileri. *Flora.* 2015;20:10-15.
17. Ciblak MA; Grip Platformu. Influenza vaccination in Turkey: prevalence of risk groups, current vaccination status, factors influencing vaccine uptake and steps taken to increase vaccination rate. *Vaccine.* 2013;31:518-523. [[Crossref](#)] [[PubMed](#)]
18. Nicholson KG, Wood JM, Zambon M. Influenza. *Lancet.* 2003;362:1733-1745. [[Crossref](#)] [[PubMed](#)]
19. Collins JP, Campbell AP, Openo K, Farley MM, Cummings CN, Hill M, Schaffner W, Lindegren ML, Thomas A, Billing L, Bennett N, Bargsten M, Lynfield R, Eckel S, Ryan P, Yousey-Hindes K, Herlihy R, Kirley PD, Garg S, Anderson EJ. Outcomes of immunocompromised adults hospitalized with laboratory-confirmed influenza in the United States, 2011-2015. *Clin Infect Dis.* 2020;70:2121-2130. [[Crossref](#)] [[PubMed](#)] [[PMC](#)]
20. LaVela SL, Smith B, Weaver FM, Legro MW, Goldstein B, Nichol K. Attitudes and practices regarding influenza vaccination among healthcare workers providing services to individuals with spinal cord injuries and disorders. *Infect Control Hosp Epidemiol.* 2004;25:933-940. [[Crossref](#)] [[PubMed](#)]
21. Jimenez-Trujillo I, López-de Andrés A, Hernández-Barrera V, Carrasco-Garrido P, Santos-Sancho JM, Jiménez-García R. Influenza vaccination coverage rates among diabetes sufferers, predictors of adherence and time trends from 2003 to 2010 in Spain. *Hum Vaccin Immunother.* 2013;9:1326-1332. [[Crossref](#)] [[PubMed](#)] [[PMC](#)]