ARAŞTIRMA MAKALESİ / *RESEARCH ARTICLE*

Change in Pneumococcal and Influenza Vaccine Awareness in Diabetic Patients in the Last 2 Years

Diyabetik Hastalarda Son İki Yılda Değişen Pnömokok ve İnfluenza Aşı Farkındalığı

Esra Bayar[1], Zeynep Koc[2], Seydahmet Akin[2]

[1]Yeditepe University, Faculty of Medicine, Internal Medicine Department, Istanbul, Türkiye; [2]Kartal Doktor Lutfi Kırdar City Hospital, Internal Medicine Department, Istanbul, Türkiye

ABSTRACT

Aim: *Our study aimed to evaluate the influenza and pneumococcal vaccination rates in patients diagnosed with Type 1 Diabetes Mellitus (T1DM) and Type 2 Diabetes Mellitus (T2DM) and the awareness of these patients about vaccination after the coronavirus disease 2019 (COVID-19) pandemic.*

Material and Method: *Between April and May 2022, a questionnaire was applied to diabetic patients who met the criteria and applied to the internal medicine outpatient clinic at the University of Health Sciences, Kartal Dr. Lütfi Kirdar City Hospital, questioning the status of influenza and pneumococcal vaccination, and their awareness of vaccination before and after the COVID-19 pandemic; and the results were evaluated.*

Results: *A total of 195 cases, 43.6% female and 56.4% male, with a mean age of 58.53±10.73 years, were included in the study. 92.8% of the cases were T2DM; and the mean duration of diabetes mellitus was 15.11±7.64 years. 48.2% of the cases had at least one type of vaccine (83% influenza, 47.9% pneumococcal vaccine) before the pandemic. It was observed that 51.8% of the cases were not vaccinated with influenza and pneumococcal vaccines. Among the reasons why these patients were not vaccinated, the most common reason was that the doctor did not give information about vaccination (44.6%). 70.3% of the cases who had not been vaccinated before decided to have both vaccinations after the COVID-19 pandemic.*

Conclusion: *In our study, it was determined that the pneumococcal and influenza vaccination rates of diabetic patients were low before the COVID-19 pandemic, and the most important factor causing this was the inadequacy of the physician to inform the patients. Patient age, diagnosis of T2DM, duration of diabetes mellitus, and presence of additional disease were positively associated with vaccination. According to the data, the COVID-19 pandemic has positively affected the approach to vaccination of diabetic patients who have not been vaccinated before.*

Keywords: *awareness; diabetes mellitus; influenza vaccine; pneumococcal vaccine*

ÖZET

Amaç: *Çalışmamızda Tip 1 Diabetes Mellitus (T1DM) ve Tip 2 Diabetes Mellitus (T2DM) hastalarında influenza ve pnömokok aşılanma durumu ve COVID-19 pandemisi sonrasında bu hastaların aşı konusundaki farkındalıklarının değerlendirilmesi amaçlanmıştır.*

Materyal ve Metot: *Nisan-Mayıs 2022 tarihleri arasında Sağlık Bilimleri Üniversitesi Kartal Dr. Lütfi Kırdar Şehir Hastanesi Diyabet Polikliniği'ne başvuran diyabetik hastalara yönelik influenza ve pnömokok aşıları hakkındaki bilgi düzeyleri ile COVID-19 pandemisi öncesi ve sonrası aşılanma durumlarını sorgulayan anket uygulanmış olup sonuçları değerlendirilmiştir.*

Bulgular: *Çalışmaya yaş ortalaması 58,53±10,73 yıl olan, %43,6'sı kadın, %56,4'ü erkek toplam 195 olgu alındı. Olguların %7,2'sinin T1DM ve %92,8'inin T2DM olduğu, diyabet sürelerinin ise ortalama 15,11±7,64 yıl olduğu görüldü. Olguların %48,2'sinin pandemi öncesi en az bir tip aşı (%83 influenza veya %47,9 pnömokok aşısı) yaptırdığı, ancak %51,8'sinin ise influenza ve pnömokok aşılarını yaptırmadığı saptandı. Aşı olmama nedenleri arasında ilk sırada doktorun aşıları tavsiye etmemesi (%44,6) olduğu görüldü. Daha önce aşı yaptırmayan olguların %70,3'ünün COVID-19 pandemisi sonrası her iki aşıyı da yaptırmaya karar verdiği çalışmamızda saptandı.*

Sonuç: *COVID-19 pandemisi öncesinde diyabetik hastaların pnömokok ve infuenza aşılarını yeterli oranda yaptırmadıkları ve buna neden olan en önemli faktörün hekim bilgilendirmesinin yetersizliği olduğu saptandı. Hasta yaşı, T2DM tanısı, diyabet süresi ve ek hastalık varlığı aşı yaptırma ile pozitif yönde ilişkili bulundu. Covid 19 daha önce aşı yaptırmayan diyabetik hastaların aşı konusundaki yaklaşımını olumlu yönde etkilemiştir.*

Anahtar kelimeler: *diabetes mellitus; farkındalık; influenza aşısı; pnömokok aşısı*

İletişim/Contact: *Esra Bayar, Yeditepe University, Faculty of Medicine, Internal Medicine Departmant, Istanbul, Türkiye* • ***Tel:*** *+90 505 937 66 11* • ***E-mail:*** *ilessa_esra@hotmail.com* • ***Geliş/Received:*** *23.10.2022* • ***Kabul/Accepted:*** *05.12.2023*

ORCID: *Esra Bayar, 0000-0001-9136-7980 • Zeynep Koç, 0000-0002-1393-4561 • Seydahmet Akın, 0000-0002-2557-3812*

Introduction

Type 1 Diabetes Mellitus (T1DM) and Type 2 Diabetes Mellitus (T2DM) have become important health problems all over the world in recent years, and their incidence is increasing rapidly due to the change in lifestyle[1]. Diabetes Mellitus (DM) is one of the important causes of morbidity and mortality; prolonged hyperglycemia macrovascular and microvascular complications cause degradation in leukocyte functions in the long term in diabetic patients. Along with immune dysregulation, sensitivity to infections occurs, and pneumococcal pneumonia, which is an acquired phagocytic system defect, is observed more frequently in diabetic patients than in the general population[2–5]. The progression of DM with hypoglycemia-hyperglycemia attacks and failure to reach glycemic targets constitute the basis of the development of pneumonia. Pneumonia is one of the important causes of hospitalization and mortality in diabetic patients[6,7]. Vaccines are biological agents that protect against preventable infections by modulating the immune system. Vaccination in diseases with a high risk of infection, such as DM, is one of the most effective and safe preventive health services that reduce morbidity and mortality against infectious diseases. Turkish Infectious Diseases and Clinical Microbiology Specialization Association[8], American Diabetes Association[9], Diabetes Canada Clinical Practice Guidelines[10], Royal Australian College of General Practitioners[11], Turkish Endocrinology and Metabolism Association[12], Turkish Diabetes Foundation[13], Centers for Disease Control and Prevention[14], which are national and international associations; recommend that diabetic patients be vaccinated against influenza and pneumococcus (Fig. 1)[6,9–14].

The World Health Organization (WHO) defined vaccine hesitancy as a behavior influenced by many factors, including complacency (do not perceive a need for a vaccine, do not value the vaccine) and issues of confidence in the vaccine or provider[15]. Vaccine-hesitant individuals are a group who hold various degrees of indecision about vaccines or vaccination in general. Vaccine-hesitant individuals may accept all vaccines but remain concerned about vaccines; some individuals may not accept all vaccines, and some may refuse some vaccines but accept others[15].

In December 2019, a cluster of patients presented with pneumonia caused by an unknown pathogen in China, and the disease caused by the virus was named coronavirus disease 2019 by the WHO[15]. COVID-19 presents a range of clinical manifestations, from mild flu-like symptoms to life-threatening clinical conditions[16]. The spread of the COVID-19 epidemic to many countries and the increase in the number of deaths due to the disease have affected people deeply. The availability of vaccines is important to minimize new infectious diseases, so it is crucial to vaccinate people.

Our study aims to determine the frequency of pneumococcal and influenza vaccination in the diabetic population in Kartal/Istanbul, to find out why non-vaccinated diabetic patients are not vaccinated, and to evaluate the impact of the Covid-19 pandemic on the views of these patients about vaccination.

Material and Method

Diabetes Mellitus patients admitted to Kartal Dr. Lütfi Kirdar City Hospital Department of Internal Medicine between April and May 2022 were included in this cross-sectional study. One hundred ninety-five patients over 18 years of age who gave informed consent for data collection and had a diagnosis of T1DM and T2DM for at least one year were included in the study. Patients under 18 years of age, patients with secondary diabetes mellitus, pregnant women, active malignancy, and severe neurological and psychiatric disorders were excluded from the study.

Figure 1. *Vaccine recommendations in national and international guidelines*

Guide Name	Recommended Vaccines
American Diabetes Association, Guidelines for Standards of Medical Care in Diabetes	Influenza, Pneumococcus, Hepatitis B
Canada, Guide to Clinical Practice in Diabetes Management and Prevention	Influenza, Pneumococcus, Hepatitis B, Herpes Zoster
Australia, General Practice Guidelines for the Management of Type 2 Diabetes	Influenza, Pneumococcus, Diphtheria-Tetanus-Pertussis (DTP)
TEMD (Turkish Society of Endocrinology and Metabolism), Diagnosis and Treatment Guidelines for Diabetes Mellitus and Its Complications	Influenza, Pneumococcus, Hepatitis B
TÜRKDİAB (Turkish Diabetes Foundation), Diabetes Diagnosis and Treatment Guidelines	Influenza, Pneumococcus, Hepatitis B
EKMUD (Turkish Infectious Diseases and Clinical Microbiology Specialization Association), Adult Immunization Guidelines	Influenza, Pneumococcus, Hepatitis B, Herpes Zoster
ACIP (Advisory Committee on Immunization Practices)	Influenza, Pneumococcus, Hepatitis B, Herpes zoster, Diphtheria-Tetanus-Pertussis (DTP)

A questionnaire was applied using the interview method, which questioned the demographic characteristics of the patients as well as their comorbidities, influenza, and pneumococcal vaccination status in the previous years. If the patients were against vaccination, the reason for this was discussed. In addition, it was questioned whether there was a change in patients' awareness of influenza and pneumococcal vaccines after the COVID-19 pandemic.

For statistical analysis, the Shapiro-Wilk test, Student's t-test, Mann-Whitney U test, Pearson chi-square test, and Fisher's exact test were used together with the NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program. The statistical significance level was accepted as a P value of less than 0.05.

The Ethics Committee of Dr. Lütfi Kirdar Kartal City Hospital approved the study (30 March 2022, no 2022/514/222/4). All the procedures conformed to the ethical standards of the Declaration of Helsinki.

Results

The study was conducted with a total of 195 cases, 43.6% (n=85) female and 56.4% (n=110) male, with a mean age of 59 years. Of the cases participating in the study, 92.8% were diagnosed with T2DM and 7.2% with T1DM, and the mean duration of DM was 15.11±7.64 years.

Regarding educational status, most cases were primary school graduates (49.8%), while the rate of university graduates was the lowest with 7.7%. There was at least one additional disease in 94.4% (n=184) of the cases included in the study. Hyperlipidemia (80.4%), hypertension (77.2%), and coronary artery disease (27.7%) constituted the majority of cases with comorbidities (Table 1).

48.2% (n=94) of the cases had been vaccinated with one or both influenza and pneumococcal vaccines before the COVID-19 pandemic. 83% (n=78) of the cases declared that they had been vaccinated with influenza; 47.9% (n=45) of the cases proclaimed that they had been vaccinated with the pneumococcal vaccine, and all of these cases stated that they would be vaccinated this year as well. When the unvaccinated group was examined, it was determined that 44.6% (n=45) of the cases were not recommended for vaccination by the doctor, 24.8% (n=25) did not believe that the vaccines were beneficial, 14.9% (n=15) were negligent, 11.9% (n=12) of them thought that the vaccines were harmful and 4% of them could not reach the vaccine. 70.3% (n=71) of the unvaccinated cases decided to get vaccinated after the COVID-19 pandemic (Table 2).

Table 1. *Distribution of sociodemographic characteristics*

Age (year)	Mean ± Standard Deviation (SD)	58.5±10.73
	Median (Min-Max)	59 (25–84)
Gender; n (%)	Woman	85 (43.6)
	Man	110 (56.4)
Education status; n (%)	Primary school and below	97 (49.8)
	Middle school	28 (14.4)
	High school	55 (28.2)
	University	15 (7.7)
		n (%)
Comorbidity	No	11 (5.6)
	Yes	184 (94.4)
	COPD	13 (7.1)
	CAD	51 (27.7)
	HT	142 (77.2)
	HL	148 (80.4)
	CKD	26 (14.1)
	CVD	5 (2.7)
	Rheumatological Disease	4 (2.2)
	Malignancy	7 (3.8)
	Hypothyroidism	13 (7.1)
	Other	17 (9.2)
Type of DM n (%)	Type 1	14 (7.2)
	Type 2	181 (92.8)
Duration of DM (year)	Mean ± SD	15.11±7.64
	Median (Min-Max)	15 (1–40)

COPD: Chronic Obstructive Pulmonary Disease; CAD: Coronary Artery Disease; HT: Hypertension; HL: Hyperlipidemia
CKD: Chronic Kidney Disease; CVD: Cerebrovascular Diseases; DM: Diabetes Mellitus

Table 2. *Situations of getting the recommended pneumococcal and influenza vaccine and barriers to vaccination*

		n (%)
Have you ever been vaccinated with one or both of the influenza and pneumococcal vaccines before the COVID-19 pandemic?	No	101 (51.8)
	Yes	94 (48.2)
Influenza (n=94)	No	16 (17.0)
	Yes	78 (83.0)
Pneumococcal (n=94)	No	49 (52.1)
	Yes	45 (47.9)
If your answer is no, why? (n=101)	Has harmful effects	12 (11.9)
	Not informed by any doctor	45 (44.6)
	Don't think it's helpful	25 (24.8)
	Lack of access to vaccine	4 (4.0)
	Negligence	15 (14.9)
Have you been vaccinated with influenza and pneumococcal vaccines post-pandemic? (n=101)	Yes	71 (70.3)
	No	30 (29.7)
If you were vaccinated with influenza and pneumococcal vaccines before the pandemic, will you be vaccinated this year?	Yes	94 (100.0)

Table 3. *Evaluation of sociodemographic characteristics by vaccination status*

		Have you been vaccinated?		p
		No (n=101)	Yes (n=94)	
Age (year)	Mean ± SD	55.23±10.92	62.07±9.36	[a]0.001**
	Median (Min-Max)	56 (26–84)	63 (25–81)	
Gender	Woman	50 (49,5)	35 (37,2)	[b]0.084
	Man	51 (50,5)	59 (62,8)	
Education status	Primary school and below	48 (47,5)	49 (52,1)	[b]0.869
	Middle school	14 (13,9)	14 (14,9)	
	High school	31 (30,7)	24 (25,5)	
	University	8 (7,9)	7 (7,4)	
Comorbidity	No	9 (8,9)	2 (2,1)	[b]0.040*
	Yes	92 (91,1)	92 (97,9)	
Duration of DM (year)	Mean ± SD	13.73±7.61	16.59±7.43	[d]0.008**
	Median (Min-Max)	14 (2–40)	16 (1–40)	
Type of DM	Type 1	11 (10,9)	3 (3,2)	[b]0.037*
	Type 2	90 (89,1)	91 (96,8)	

[a]Student t-Test [b]PearsonChi-Square Test [d]Mann-Whitney U Test
*p<0.05 **p<0.01

The vaccinated cases' age was statistically significantly higher than the unvaccinated cases (p=0.001; p<0,01). The distribution of gender and educational status does not show a statistically significant difference according to vaccination status (p>0,05). The vaccination rate of cases with comorbidity was statistically significantly higher than cases without comorbidity (p=0.040; p<0,05). The duration of diabetes in the vaccinated cases was statistically significantly higher than in the unvaccinated cases (p=0.008; p<0,01). When we look at the distribution of the cases, the vaccination rate of the cases with T2DM was found to be statistically significantly higher than the cases with T1DM (p=0.037; p<0,05) (Table 3).

Discussion

March 11, 2020, when the first case was seen in Türkiye, was also the day that Covid-19 was declared a "global pandemic" by the WHO. In addition, the first death from COVID-19 in Türkiye occurred on March 17, 2020. In the last two years, with the pandemic, various measures have been taken to prevent the spread of the virus in Türkiye, as in many countries in the world. One of them was the vaccination policy. Many studies have been conducted on vaccination in our country before the pandemic, and it has been observed that vaccination awareness is low throughout our country. Whether the COVID-19 pandemic, which affected the whole world and caused many deaths, raised awareness about vaccination among people was a matter of curiosity by scientists in Türkiye and worldwide. In this context, we wanted to contribute to the literature with our study to increase academic studies on vaccination awareness after the pandemic, especially in patients with chronic diseases such as DM. In this regard, we have completed the ethics committee approval phase for the scientific relevance of the research we planned to do during the preparation process of the survey on the subject. In April and May, when the number of applications to our diabetes mellitus outpatient clinic was high, we asked our survey questions to all our patients who met the criteria we determined after obtaining their written and verbal consent. No patient refused to participate in the survey during our study. According to our clinical experience, we evaluated that the data collected from our patients who applied to our clinic between April and May 2022 were safe and consistent in terms of the healthy results of our research.

Many studies show that vaccination rates for preventing adult infectious diseases remain well below the target[17]. Öncü et al.[18], in their study conducted in 2019, demonstrated that 12.53% (n=55) of 439 diabetic patients had pneumococcal vaccine and 24.6% (n=108) of them had influenza vaccine. Arslan et al.[5] showed that awareness of vaccination and vaccination rates are very low in our country compared to other countries. A study conducted in metropolitan cities in our country showed a pneumococcal vaccination rate of 0.1% in diabetic patients[17]. Another study in our country showed that only 0.9% of 2383 cases were vaccinated, and 10% of these patients were aware of the pneumococcal vaccine[20]. Our study, which included

195 patients, found that 23.07% (n=45) had pneumococcal vaccine, and 40% (n=78) had influenza vaccine. Before the pandemic, 51.2% of diabetic cases were not vaccinated; similar to the studies of Öncü et al.[18], 44.6% (n=45) of the unvaccinated group stated that their doctor did not provide information about the vaccine, and 70.3% of this group said that they would have at least one of the pneumococcal and influenza vaccines after the pandemic. Adult patients with comorbidities should be especially aware and willing to be vaccinated. One of the most common reasons for reluctance to vaccinate is the thought that vaccine protection is insufficient[21–23]. In our study, like other studies, of 101 diabetic patients who did not want to be vaccinated, 24.8% stated that they did not believe vaccines were beneficial, and 11.9% said vaccines were harmful. A study on influenza vaccines with healthcare workers observed that the vaccination rate of individuals in the community increased when health workers were informed about vaccination[19]. In addition, a study by Ünal et al., twenty-four showed that vaccination rates quadrupled within six months with a one-day training program given to family physicians. The diaVAX study published in 2013 showed that vaccination rates of 5682 diabetic patients increased from 27% to 63.3% for influenza vaccine and from 9.8% to 47.7% for pneumococcal vaccine after the training given to physicians[25].

The COVID-19 pandemic has been declared a public health emergency by the World Health Organization (WHO). It has greatly affected daily life worldwide, and COVID-19 vaccination is carried out in our country, as in other countries. With the development of COVID-19 vaccines, a more positive approach to other vaccines has been observed, especially in patients with severe comorbidities. In their study with 1425 cases in 2021, Kiskaç et al.[26] showed that the COVID-19 pandemic increased awareness about pneumococcal and influenza vaccines. Similarly, in our study, it was observed that the pneumococcal and influenza vaccination level was low in diabetic patients before the COVID-19 pandemic, and there was an increase in the awareness level and vaccination rate about these vaccines after the pandemic.

In community-acquired pneumonia, DM is closely associated with pleural effusion, empyema, and mortality, and the presence of DM is one of the poor prognoses[27]. A study investigating the effects of pneumonia and influenza on mortality rates in diabetic patients in the USA showed that in adults aged 24–65, regardless of age and socioeconomic status, the rate of DM in patients with pneumonia and flu is significantly higher[28]. The effectiveness of pneumonia and influenza vaccination programs causes a decrease in mortality in DM cases.

Host response to epidemic-causing agents such as Streptococcus Pneumonia and Seasonal Influenza Virus is lower in diabetic patients than non-diabetic patients. Thus, diabetic patients are more susceptible to these infectious agents than non-diabetic patients, and these patients have a more extended recovery period and a higher risk of hospitalization and mortality. Although we want to support our view with a cost-effectiveness study conducted specifically for the diabetic group between pneumonia-influenza infections and pneumonia-influenza vaccines, no cost-effectiveness study is explicitly conducted for pneumonia in diabetic cases.

Our study data showed an increase in awareness of vaccination in patients with severe comorbidities such as DM during the COVID-19 pandemic. There is increased social awareness about vaccination with the developed vaccine programs and continuous publications for COVID-19, regardless of the patients' educational status and the presence of coronavirus infections.

The most common answer given by diabetic patients in our survey's open-ended questions was that the patients were not vaccinated because the doctor did not recommend the current vaccination program. How important are oral antidiabetic and insulin treatments for DM patients? Implementing the vaccination schedule, our prophylactic approaches, and preventive medicine against preventable factors such as pneumonia-flu are just as important and cost-effective. If the importance of vaccination is emphasized to patients despite the intensity of the outpatient clinic, the rate of physician-induced non-vaccination will decrease. As for the reason for not being vaccinated, approximately one out of 4 patients answered that the vaccines were ineffective. This approach can be minimized with media and public service announcements.

Other common causes, such as 'negligence' and 'vaccinations are harmful,' can be resolved through doctor's information, media, and public service announcements if pneumococcal and influenza vaccines are not included in the essential vaccination program of the Ministry of Health. The pneumococcal vaccine was included in

the adult vaccination program in 2016 by the Ministry of Health of the Republic of Türkiye. It was included in the expanded program on the same date for DM.

Our study shows how important it is to motivate patients with comorbidities such as diabetes mellitus to get vaccinated in terms of public health and cost-effectiveness.

In conclusion, as shown by our study, the frequency of pneumococcal and influenza vaccination in diabetic patients is still not at the desired level in the Istanbul Kartal region. The most common and most important reason for the low success rate in the vaccination was the physicians' failure to inform the patients adequately. However, after the COVID-19 pandemic, there was a significant increase in the desire to be vaccinated in diabetic patients who did not want to be vaccinated before. In this study, it was determined that the most important factor in increasing the success of vaccination was that healthcare professionals informed patients more about vaccination.

Limitations of the study

Our study does not include data on physicians' vaccination awareness, which limits our study. Also, since the study was conducted in a tertiary health center in Istanbul, it may not reflect the country's vaccination rate. Patients who stated that they had been vaccinated in the past do not clearly remember how many doses of influenza vaccine were administered. Even though all those who had PCV-13 among those who had pneumococcal vaccine were registered in our unit, patient information about the PPV23 vaccine is unclear.

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