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

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

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 Kirdar 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 did not want to be vaccinated; 1.5% reported unavailability of vaccines, and 0.4% 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

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

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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).

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 Kirdar 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 Type1 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.

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.
(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).
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).

Table 2. Characteristics of the vaccinated and unvaccinated groups.

|                      | Unvaccinated (109) | Vaccinated (140) | p  |
|----------------------|--------------------|------------------|----|
|                      | n      | %     | n     | %    |     |
| Age (year)           |        |       |        |       |     |
| <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 |
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

### Table 3. Vaccine status of males and females.

|                          | Male n | Male min-max | Female n | Female min-max | p  |
|--------------------------|--------|--------------|----------|----------------|----|
| 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%           |     |
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 Istanbul, 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 misbelieves 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.

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

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