ORIGINAL RESEARCH

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Seasonal Influenza and Pneumococcal Vaccination Rates Among Patients with Cancer in COVID-19 Pandemic: A Cross-Sectional Study

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ABSTRACT Objective: Influenza and pneumococcal vaccination rates were not in the expected levels before the coronavirus disease-2019 (COVID-19) pandemic among patients with cancer. However, pandemic conditions may have changed the attitude of patients. In this study, we aimed to assess current influenza and pneumococcal vaccination rates of patients with cancer and changing attitudes toward vaccination in these patients. **Material and Methods:** This cross-sectional study was conducted in a tertiary cancer center in Turkey. A self-administered questionnaire consisting of 20 items was used. **Results:** A total of 309 patients completed the questionnaires. Most patients did not get a flu shot and pneumococcal vaccine before the COVID-19 pandemic (74.1% for flu shot and 84.1% for pneumococcal vaccine). Moreover, 144 patients (46.6%) stated that they were considering to get a flu shot, and 133 (43%) were considering to get a pneumococcal vaccine because of the COVID-19 pandemic. Only 35 patients (11.3%) got a flu shot, and 56 (18.1%) got a pneumococcal vaccine during the COVID-19 pandemic. **Conclusion:** Vaccination rates for seasonal influenza and pneumococcal infections were low in patients with cancer before the COVID-19 pandemic. Although the number of patients who want to be vaccinated against seasonal influenza and pneumococcal infections increased in the COVID-19 pandemic, the number of patients vaccinated with these vaccines is still low.

Keywords: Influenza; pneumococcal infection; vaccination; cancer patients; COVID-19

Patients with cancer are more vulnerable to seasonal influenza and pneumococcal infections than the overall population. Furthermore, the mortality rate is higher in the patients receiving active cancer treatment.[1-4] Influenza and pneumococcal vaccines are protective even in patients with cancer undergoing chemotherapy. Both are recommended by the Center for Disease Control and Prevention in this patient group.[5] Despite recommendations by the medical societies and an increased mortality rate from influenza and invasive pneumococcal infections among patients with cancer, vaccination rates for these infections are low in the patients.[6,7] The reasons for these low vaccination rates have not yet been elucidated. Some authors suggested that insufficient information to patients can be a reason for low vaccination rates.[8] In addition, concerns regarding the effect of vaccination on immunocompromised patients could affect the decision to take vaccines.[6]

The protective effect of seasonal influenza and pneumococcal vaccines on coronavirus disease-2019 (COVID-19) was discussed during the pandemic.[9,10]

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However, people against the vaccine (named anti-vaxxers) claimed that influenza vaccination might increase the risk of death from COVID-19.[11] Conflicting results regarding the effect of influenza and pneumococcal vaccination on COVID-19 may affect the attitude of patients with cancer toward vaccination. To date, no data exist regarding the vaccination rates and attitudes of patients with cancer toward seasonal influenza and pneumococcal vaccination during the COVID-19 pandemic.

In this study, we aimed to assess current influenza and pneumococcal vaccination rates of patients with cancer and their attitudes toward vaccination in this pandemic era.

MATERIAL AND METHODS

PARTICIPANTS

This cross-sectional study was conducted in a tertiary cancer center in Turkey.

We included all adult (older than 18 years) patients with cancer with a solid tumor admitted to the tertiary cancer center between 15.11.2020 and 30.11.2020. To ensure a homogeneous patient population, patients with hematological malignancies (i.e., lymphoma, leukemia, and multiple myeloma) and receiving immunotherapy were excluded from this study.

MEASURES

A self-administered questionnaire consisting of 20 items was used (Supplementary). It was divided into 2 parts. In the first part, there were questions regarding the sociodemographic aspects of patients. In the second part, patients' influenza and pneumococcal vaccination status, attitudes toward influenza and pneumococcal vaccination in the pandemic, and considerations regarding the protective effect of these vaccines on COVID-19 were assessed.

STATISTICAL ANALYSIS

Descriptive analyses were presented using mean±standard deviation or median with interquartile range (IQR) for continuous variables and percentages for categorical variables. McNemar's test was performed to compa re the two related categorical variables. A p value less than 0.05 was considered statistically significant. All statistical analyses were performed using IBM SPSS Statistics version 27.0 (Armonk, NY: IBM Corp).

ETHICAL CONSIDERATIONS AND CONFIDENTIALITY

The local ethical committee approved this study. In addition, this study was conducted in accordance with the "Declaration of Helsinki."(Ankara University Faculty of Medicine, Date: 23.10.2020, Number: İ8-550-20)No information regarding the identity of patients was collected during the study.

RESULTS

A total of 309 patients completed the questionnaires. The median age of patients was 57 years (IQR: 48-66 years). Moreover, 141 patients (45.6%) were males. A majority of included patients were undergoing chemotherapy (67.3%). In addition, 134 patients (43.4%) had at least one comorbidity. Baseline characteristics of all patients are shown in Table 1.

PATIENTS' VACCINATION STATUS FOR SEASONAL INFLUENZA AND PNEUMOCOCCAL INFECTIONS BEFORE COVID-19 PANDEMIC

A majority of patients (74.1%) did not get a flu shot before the COVID-19 pandemic. Moreover, 37 patients (12%) got a flu shot annually. Similar to seasonal influenza, most patients (84.1%) did not get a pneumococcal vaccine before the COVID-19 pandemic. Among 49 patients (15.8%) who got a pneumococcal vaccine, 7 got a 13-valent vaccine, 5 got a 23-valent vaccine, and 4 got both 13-and 23-valent vaccines. The remaining patients did not know the pneumococcal vaccine type. The patients' vaccination rates are shown in Figure 1 and Figure 2.

PATIENTS' ATTITUDES TOWARD SEASONAL INFLUENZA AND PNEUMOCOCCAL VACCINATIONS IN THE COVID-19 PANDEMIC

A total of 144 patients (46.6%) stated that they were considering to get a flu shot because of the COVID-19 pandemic. Moreover, 78 patients (25.2%) were neutral for the seasonal flu vaccine, and 87 patients (28.2%) stated that they did not want to get a flu shot in the COVID-19 pandemic. In addition, 133 patients (43%) stated that they were considering to get a pneumococcal vaccine because of the COVID-19 pandemic.

TABLE 1: Baseline characteristics of patients.

	n=309	%
Median age, IQR	57 (48-66)	
Sex		
Female	165	53.4
Male	141	45.6
Missing	3	1
Undergoing chemotherapy		
Yes	208	67.3
No	101	32.7
Undergoing radiotherapy		
Yes	33	10.7
No	276	89.3
Smoking status		
None	201	65
Ex-smoker	80	25.9
Current	28	9.1
Comorbidities		
Hypertension	78	25.2
Diabetes	66	21.4
CVD	38	12.3
Chronic renal disease	22	7.1
COPD	16	5.2
Heart failure	13	4.2
Connective tissue disease	3	1
Cirrhosis	2	0.6
Level of education		
Primary school	177	57.3
High school	68	22
University	48	15.5
Master's or doctoral degree	14	4.5
Missing	2	0.6

IQR: Interquartile range; CVD: Cardiovascular disease; COPD: Chronic obstructive pulmonary disease.

Furthermore, 70 patients (22.7%) were neutral for pneumococcal vaccination, and 106 patients (34.3%) stated that they did not want to get a pneumococcal vaccine in the COVID-19 pandemic. The rates of patients considering to get seasonal influenza and pneumococcal vaccination because of the COVID-19 pandemic were higher than that before the pandemic. The difference was statistically significant in both groups ($p<0.001$). Patients' attitudes toward seasonal influenza and pneumococcal vaccination are shown in Figure 1 and Figure 2.

PATIENTS' VIEW OF PROTECTIVE EFFECT OF SEASONAL INFLUENZA AND PNEUMOCOCCAL VACCINATIONS ON INFLUENZA, INVASIVE PNEUMOCOCCAL INFECTION, AND COVID-19

A total of 219 (70.9%) patients believed in the protective effect of flu shots on seasonal influenza. In addition, 203 patients (65.7%) thought that the pneumococcal vaccine had a protective effect on invasive pneumococcal infections. However, 61 (19.7%) and 54 (17.5%) patients did not believe in the protective effects of the flu and pneumococcal vaccines, respectively. However, 85 (27.5%) patients believed in the protective effect of the flu shot and pneumococcal vaccine against COVID-19. Patients' view of the protective effect of the flu shot and pneumococcal vaccine is shown in Figure 3.

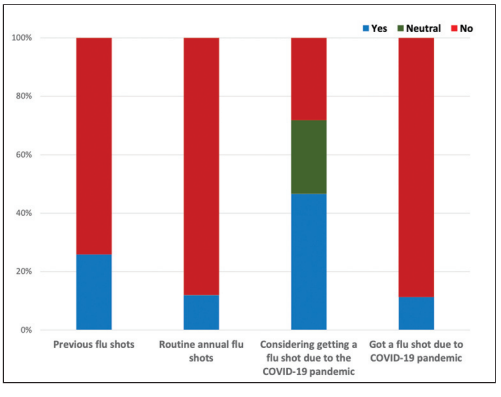

FIGURE 1: Influenza vaccination status and attitudes of cancer patients.
COVID-19: Coronavirus disease-2019.

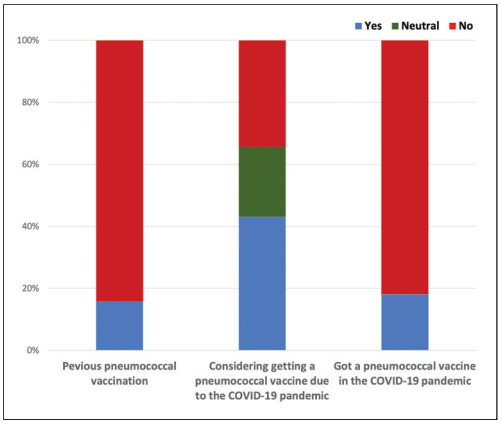

FIGURE 2: Pneumococcal vaccination status and attitudes of cancer patients.
COVID-19: Coronavirus disease-2019.

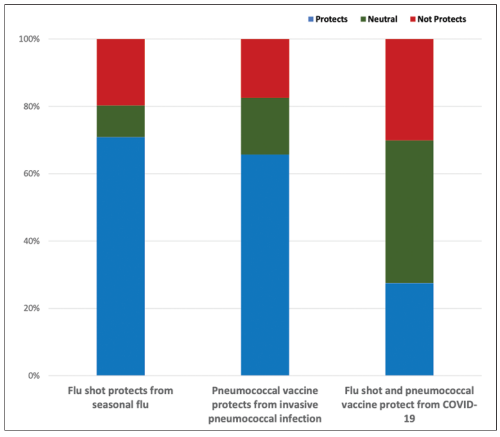

FIGURE 3: Patients' view of the protective effect of vaccines from seasonal influenza, invasiv pneumococcal infection, and COVID-19.
COVID-19: Coronavirus disease-2019.

PATIENTS' VACCINATION STATUS FOR SEASONAL INFLUENZA AND PNEUMOCOCCAL INFECTIONS IN THE COVID-19 PANDEMIC

A total of 35 patients (11.3%) got a flu shot and 56 (18.1%) got a pneumococcal vaccine in the COVID-19 pandemic. Patients' vaccination status for seasonal flu and pneumococcal infections is shown in Figure 1 and Figure 2. A recommendation for seasonal influenza and pneumococcal vaccination was made to 98 (21.57%) and 85 (27.5%) patients, respectively, from a family practitioner or an oncologist. However, no recommendation was made to 118 (38.2%) and 147 (47.5%) patients for a flu shot and pneumococcal vaccination, respectively. All resources for vaccine recommendations are shown in Figure 4.

DISCUSSION

To the best of our knowledge, this was the first study to assess the status and attitudes of patients with cancer toward seasonal influenza and pneumococcal vaccination during the COVID-19 pandemic.

We revealed that seasonal influenza and pneumococcal vaccination rates were approximately 15-25% before the pandemic; however, approximately half of the patients considered vaccination because of the COVID-19 pandemic. Despite considering vaccination because of the pandemic, vaccination rates were still low in patients with cancer during this pandemic era.

A study conducted in 2008 showed that the rate of seasonal influenza vaccination among patients with cancer receiving chemotherapy was 30%.[6] In another study including patients with cancer, vaccination rates against seasonal influenza and pneumococcal infection were 34.7% and 14.5%, respectively.[7,12] showed that the influenza vaccination rate was 18% in patients with cancer. A study from Turkey showed that the rate of influenza and pneumococcal vaccination was 17% and 4.2%, respectively.[13] In this study, influenza and pneumococcal vaccination rates were low in line with these previous studies.

The COVID-19 pandemic has changed the attitudes of patients with cancer toward seasonal influenza and pneumococcal vaccination. Although it is believed that vaccination against seasonal influenza and pneumococcal infections may protect from COVID-19 and its worse clinical outcomes, some controversies exist regarding the negative effect of influenza vaccination on the clinical course of COVID-19. Fortunately, a study conducted by Zein et al. showed that there was no increased risk for infection with "severe acute respiratory syndrome-coronavirus-2" and its worse clinical outcomes among the patients who got a flu vaccine.[14] Furthermore, Amato et al. showed the positive effect of influenza vaccination on the clinical course of COVID-19.[15] To date, in contrast to common beliefs, no clear evidence exists on the protective effect of pneumococcal vaccines from COVID-19. Our study confirmed the positive perception of vaccination

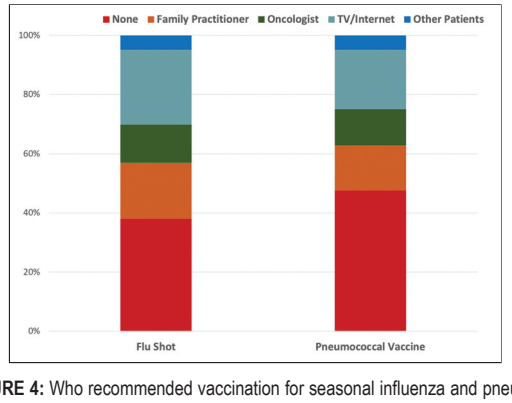

FIGURE 4: Who recommended vaccination for seasonal influenza and pneumococcal disease.?
COVID-19: Coronavirus disease-2019.

against seasonal influenza and pneumococcal infections in the community. Furthermore, approximately one out of four patients believed in the protective effect of seasonal influenza and pneumococcal vaccines from COVID-19.

Despite the positive perception of vaccination against seasonal influenza and pneumococcal infections among the patients with cancer, vaccination rates were low during the COVID-19 pandemic. The rates of vaccinated patients were almost similar to that before the pandemic. Our study showed that vaccination against seasonal influenza and pneumococcal infections was not recommended to approximately 40-50% of all patients. It may be one of the main reasons for low vaccination rates. Vinograd et al. showed that recommendations from oncologists played a crucial role in the vaccination against seasonal influenza in patients with cancer.[16] In addition, it is typically considered that a gap of at least 2 weeks should be there between the vaccination and chemotherapy schedules for ideal immune response. A majority of patients in this study were undergoing active chemotherapy. In this context, physicians may have avoided recommending vaccination against seasonal influenza and pneumococcal infections, which could be accepted as a reason for low vaccination rates. However, a study conducted by Alkan et al. showed that influenza and pneumococcal vaccination was recommended by approximately 80% of all medical oncologists.[17] Despite their well-known protective effect on seasonal influenza and pneumococcal pneumonia, approximately one out of five patients in this study, considered that seasonal influenza and pneumococcal vaccines did not have a protective effect, which may also be accepted as a reason for low vaccination rates.

This study had some limitations. First, a majority of patients in this study were undergoing chemotherapy. Physicians may avoid recommending vaccination to this group of patients. Furthermore, vaccination may be avoided in patients receiving immunotherapy. Thus, we did not include the patients receiving immunotherapy, which may lead to low vaccination rates. Second, we conducted this study in a medical oncology clinic. The vaccination rates may be different between patients with solid organ malignancies and those with hematological malignancies. Third, a small sample of patients was included because of the short patient inclusion duration at a single center. With a higher number of patients in a multicenter study, more accurate results can be obtained.

CONCLUSION

In conclusion, this study found that seasonal influenza and pneumococcal vaccination rates were low in patients with cancer. Although the patients were considering vaccination because of the COVID-19 pandemic, the rates were still low. The main reason for this may be the lack of recommendations for vaccination in patients with cancer. To increase vaccination rates, we should question the patients' vaccination status and recommend seasonal influenza and pneumococcal vaccination to patients with cancer in our daily practices. Moreover, we should use other methods, such as the Internet, social media, and television, to increase awareness about vaccination for seasonal influenza and pneumococcal infections in patients with cancer.

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: *Emre Yekedüz, Elif Berna Köksoy;* ***Design:*** *Emre Yekedüz, Elif Berna Köksoy, Filiz Çay Şenler, Yüksel Ürün, Güngör Utkan;* ***Control/Supervision:*** *Filiz Çay Şenler, Ahmet Demirkazık, Hakan Akbulut, Güngör Utkan, Yüksel Ürün;* ***Data Collection and/or Processing:*** *Emre Yekedüz, Satı Coşkun Yazgan, Sevinç Ballı, Ilgın Akbıyık, Ender Kalacı, Engin Eren Kavak, Bengü Dursun, Pınar Kubilay Tolunay, Mustafa Gürbüz;* ***Analysis and/or Interpretation:*** *Emre Yekedüz, Yüksel Ürün, Güngör Utkan;* ***Literature Review:*** *Emre Yekedüz, Elif Berna Köksoy;* ***Writing the Article:*** *Emre Yekedüz, Elif Berna Köksoy, Satı Coşkun Yazgan;* ***Critical Review:*** *Filiz Çay Şenler, Ahmet Demirkazık, Hakan Akbulut, Güngör Utkan, Yüksel Ürün.*

Supplementary
Pneumococcal and Influenza Vaccination Questionnaire

A. General information

1. Age (years) :

2. Gender : ○ Female ○ Male

3. Presence of current chemotherapy : ○ Yes ○ No

4. Presence of current radiotherapy : ○ Yes ○ No

5. Smoking status

○ None
○ Ex-smoker (date):
○ Yes (package/year):

6. Education level

○ Illiterate
○ Primary school
○ High school
○ University
○ Master degree or doctorate

7. Comorbidities

○ Diabetes
○ Chronic obstructive pulmonary disease
○ Hypertension
○ Cardiovascular disease
○ Heart failure
○ Chronic kidney disease
○ Other……

B. Vaccination information

8. Previous influenza vaccination

○ Yes ○ No

9. Annually influenza vaccination

○ Yes ○ No

10. Did you get an influenza vaccine due to COVID-19 pandemic?

○ Yes ○ No

11. If you have not received an influenza vaccine, do you consider getting it due to COVID-19 pandemic?

○ Yes ○ Neutral ○ No

12. Who has recommended the influenza vaccine?

○ Family physician
○ Medical oncologist
○ Internet or TV
○ Other patients

13. Your thoughts about the influenza vaccine?

○ It protects me from seasonal flu
○ It protects me from severe seasonal flu
○ It can't protect me from seasonal flu

14. Previous pneumococcal vaccination

○ Yes ○ No

15. Which type of pneumococcal vaccination did you get?

○ 13-valane ○ 23-valane ○ Both ○ Not known

16. Did you get a pneumococcal vaccine due to COVID-19 pandemic?

○ Yes ○ No

17. If you haven't received a pneumococcal vaccine, do you consider getting it due to COVID-19 pandemic?

○ Yes ○ Neutral ○ No

18. Who has recommended the pneumococcal vaccine?

○ Family physician
○ Medical oncologist
○ Internet or TV
○ Other patients

19. Your thoughts about the pneumococcal vaccine?

○ It protects me from invasive pneumococcal infections
○ It protects me from severe invasive pneumococcal infections
○ It can't protect me from invasive pneumococcal infections

20. Do you believe influenza and pneumococcal vaccines protect you from COVID-19 infection?

○ Yes ○ Neutral ○ No

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