

Pneumococcal and influenza vaccination rates among patients with cardiovascular disease

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ABSTRACT

Introduction: Influenza virus infections and pneumococcal pneumonia are associated with significant increases in hospitalization and mortality rates in patients with cardiovascular diseases (CVD). In Turkey, pneumococcal and flu vaccines are recommended for patients with chronic heart disease, adults aged 65 and older and adults who are at risk of pneumonia.

Material and Method: This study was conducted between July 2019 and December 2019 among 240 CVD patients. The survey consisted of 29 questions aimed at evaluating the sociodemographic characteristics of the patients, the history of influenza and pneumococcal vaccines, and their knowledge and attitudes towards vaccines.

Results: Vaccination rates were low in CVD patients. Last year, only 10% of the participants had been previously vaccinated with the pneumococcal vaccine and 27.75% with the influenza vaccine. While the percentage of vaccination influenza vaccine among university graduates was significantly higher than all other groups, this high was not detected for pneumococcal vaccine.

Eighty percent of the participants visited their family physicians regularly in the previous year, while only 61.6% received information about the vaccination from the doctor or nurse. Influenza vaccine (39.2%) was recommended at a higher rate than pneumococcal pneumonia (12.1%) by the physicians or nurses of the participants during the visits. ($p < 0.05$)

Conclusion: Our results suggest that training programs on adult vaccination are needed for both healthcare professionals and patients at risk to achieve higher vaccination rates.

Keywords: Cardiovascular disease, influenza vaccine, pneumococcal vaccine, survey

INTRODUCTION

Background and Significance

Pneumococcal pneumonia and influenza are associated with excess mortality and morbidity in the elderly and are associated with acute myocardial infarction risk (1-2). While community-acquired pneumonia is associated with up to eightfold increases in the risk of myocardial infarction. Influenza virus infections are also associated with considerable increases in cardiovascular hospitalizations and mortality (3-4). Pneumococcal vaccination is recommended for at-risk populations, including cardiovascular diseases (CVD's) in the USA in 2015 and Europe in 2016 (5-6). In Turkey, pneumococcal and influenza vaccinations are recommended for adults >65 years of age and adults at risk of pneumonia, including patients with chronic heart disease (7). Despite the above recommendations, a large proportion of at-risk adults, are thought to be non-immunized.

Purpose

There is little information regarding cardiovascular patients' knowledge, attitudes, and behaviors with cardiovascular disease concerning pneumococcal and influenza vaccinations. The survey was conducted to evaluate the pneumococcal and influenza vaccine coverage among cardiovascular disease patients, their knowledge, and the factors influencing pneumococcal and influenza vaccinations.

MATERIAL AND METHOD

The study was carried out with the permission of the Selçuk University Faculty of Medicine Clinical Researches Ethics Committee (Date: 12.06.2019, Decision No: 2019/142). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

The questionnaire was prepared by the researchers based on previous literature (8). The questionnaire consisted of 29 questions aiming to assess patients' sociodemographic characteristics, influenza and pneumococcal vaccine history, and their knowledge and attitudes concerning the vaccines.

Participants were consecutive 240 adult patients (120 women and 120 men) who presented to the Department of Cardiology Outpatient Clinic who previously had a diagnosis of CVD. Patients with heart failure and cardiomyopathies, atherosclerotic heart disease, heart valve diseases, cyanotic congenital heart disease, pulmonary hypertension who were recommended to be vaccinated according to the expert opinion of Turkish Society of Cardiology were included in the study (9). The patients were examined in two different groups as those with coronary artery disease (CAD) and other cardiovascular diseases (non-CAD) recommended for vaccination. Heart failure was evaluated in the non-CAD group, regardless of etiology. Patients who were unable to conduct a face-to-face questionnaire and patients who refused to participate in the study were not included in the survey. Diagnoses of CVD, coronary artery disease (CAD), chronic diseases, and vaccination history were based on the participants' statements.

Statistical Analysis

The statistical power analysis tool "G*Power version 3.1" was used to calculate the sample size. Based on the

preliminary study results, 240 participants were needed for the study based on $\beta=86$ power, $\alpha=0.05$ margin of error and $d=0.25$ effect size.

All data were evaluated using SPSS 21.0 statistical package program. Number, percentage (%), and mean±standard deviation was used to evaluate the data. Chi-square test was used for categorical data. Kappa test was used to compare vaccination status and post-poll vaccination opinions. A p-value of <0.05 was considered significant.

RESULTS

A total of 240 participants were included in the study. The mean age was 65.90±11.56 years (min:31 max:93). The gender ratio was equal. The mean body mass index (BMI) was 28.58±4.59 (min: 15.40 max: 46.29).

Relation between sociodemographic characteristics and the participants' knowledge and opinion on pneumonia and influenza vaccines and their immunization levels are given in detail in **Tables 1** and **2**. The education and income levels were mainly considered as low. Participants were diagnosed with CVD for a median of 7.00 years (min: 1 max:42). 165 patients (68.75%) had a diagnosis of CAD (**Figure 1**). CAD was the leading heart disease, and majority of the participants had at least one chronic disease involving another system besides cardiovascular disease.

Table 1. Relation Between Demographic, Social and Health Status, Vaccination Status and Knowledge of Participants

All participants n=240		Vaccinated for		Knows need for vaccination	
		influenza/	pneumococcus	influenza	pneumococcus
Sex					
Female	n=120	25.8% (n=31)	10.8% (n=13)	30.8% (n=37)	10.0% (n=12)
Male	n=120	21.7% (n=26)	9.2% (n=11)	34.2% (n=41)	11.7% (n=14)
Education status					
Illiterate	n=13	0% (n=0)	7.7% (n=1)	0% (n=0)	0% (n=0)
Literate	n=49	24.5% (n=12)	10.2% (n=5)	30.6% (n=15)	6.1% (n=3)
Primary	n=110	22.7% (n=25)	11.8% (n=13)	31.8% (n=35)	12.7% (n=14)
High School	n=45	15.6% (n=7)	8.9% (n=4)	33.3% (n=15)	11.1% (n=5)
University	n=23	56.5% (n=13)*	4.3% (n=1)	56.5% (n=13)*	17.4% (n=4)
Occupation					
Housewife	n=95	20.0% (n=19)	10.5% (n=10)	26.3% (n=25)	8.4% (n=8)
Public servant	n=15	40.0% (n=6)	6.7% (n=1)	60.0% (n=9)	20.0% (n=3)
Worker	n=9	33.3% (n=3)	11.1% (n=1)	11.1% (n=1)	0.0% (n=0)
Retired	n=81	23.5% (n=19)	8.6% (n=7)	39.5% (n=32)	14.8% (n=12)
Other	n=40	25.0% (n=10)	12.5% (n=5)	27.5% (n=11)	7.5% (n=3)
Smoking habit					
Yes	n=42	21.4% (n=9)	9.5% (n=4)	35.7% (n=15)	9.5% (n=4)
No	n=198	24.2% (n=48)	10.1% (n=20)	31.8% (n=63)	11.1% (n=22)
Alcohol consumption					
Yes	n=9	11.1% (n=1)	0.0% (n=0)	33.3% (n=3)	11.1% (n=1)
No	n=231	24.2% (n=56)	10.4% (n=24)	32.5% (n=75)	10.8% (n=25)
Chronic illness other than CVD					
Yes	n=211	24.6% (n=52)	10.4% (n=22)	33.2% (n=70)	10.0% (n=21)
No	n=29	17.2% (n=5)	6.9% (n=2)	27.6% (n=8)	17.2% (n=5)

CVD: Cardiovascular Disease. *p<0.05 compared to other education status

Table 2. Vaccination and Knowledge Status of the Participants
All participants N=240

		n	%
Dib you receive an influenza vaccination last year?	Yes	57	23.8
Are you vaccinated regularly for influenza every year?	Yes	54	22.5
How many influenza vaccines have you received in your life?			
	1	33	3.8
	2	30	12.5
	3	15	6.2
	4	54	22.5
	never	108	45
Do you know that heart patients should receive an influenza vaccine?	Yes	78	32.5
Has a doctor or nurse previously suggested you should be vaccinated for influenza?	Yes	94	39.2
Did you ever receive a pneumococcal vaccine?	Yes	24	10
Do you know that heart patients should receive the pneumococcus vaccine?	Yes	26	10.8
Has a doctor or nurse previously suggested you should be vaccinated for pneumonia?	Yes	29	12.1
Have you ever been diagnosed with pneumonia?	Yes	44	18.3
Were you hospitalized for pneumonia?	Yes	28	11.7
If you were vaccinated for pneumonia, which vaccine was it?			
	Polysaccharide	5	2
	Conjugated	0	0
	I don't know	19	8
	I haven't been vaccinated	216	90
Why are you not vaccinated for influenza? (more than one answer)			
	I don't trust it	13	5.4
	I don't believe in its protection.	53	22.1
	I don't need it	35	14.6
	It is expensive	1	0.4
	I didn't know I needed it	84	35
	I received the influenza vaccine	57	23.8
	I don't trust	11	4.6
		n	%
Why are you not vaccinated for pneumonia? (more than one answer)			
	I don't believe in its protection.	11	4.6
	It is expensive	35	14.6
	I didn't know I needed it	159	66.2
	I received the pneumonia vaccine	24	10.0
Are you considering getting an influenza vaccine this year	Yes	168	70.0
Are you considering getting a pneumonia vaccine this year?	Yes	151	62.9
Have you visited your family doctor in the last year?	Yes	192	80.0
From what source did you obtain information about vaccines			
	Doctor	124	51.6
	A nurse or other healthcare worker	24	10.0
	Internet or media	23	9.6
	Friends and environment	24	10.0
	I didn't need information	45	18.8

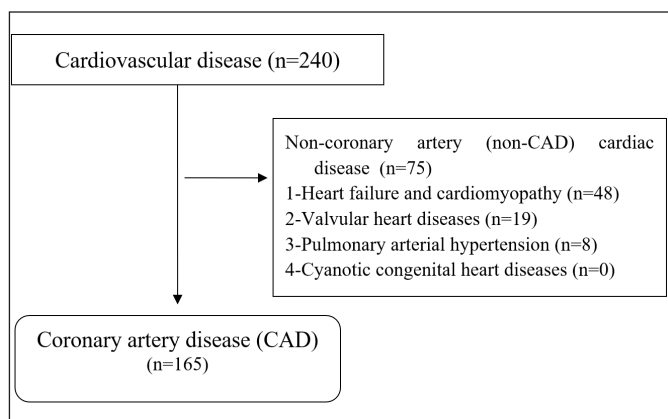


Figure 1. Cardiovascular Disease

Vaccination rates were low in CVD patients. Only 10% of the participants had been vaccinated ever before with pneumococcal vaccine and 27.75% with influenza vaccine last year.

There was no significant difference in vaccination status and knowledge levels when patients were classified and compared in two groups according to under and over 65 years of age, gender, and with or without a family physician examination in the previous year (p>0.05). Likewise, when the patients were grouped according to their profession, income, smoking and alcohol habits, and chronic diseases, there was no significant difference in vaccination status and knowledge levels (p>0.05).

Education status was of importance for influenza vaccine (Table 1). The percentage of university graduates who were vaccinated was significantly higher than all other groups, while illiterate participants had the least percentage (p<0.05). There was no significant difference between the other three groups (p>0.05). Similarly, higher percentage of university graduates know that they should receive the influenza vaccine than other groups (p<0.05). There was no significant difference between the other three groups (p>0.05). No relation was found between education level and pneumococcal vaccination. There was no significant difference regarding the participants' education level and the percent of participants who previously received pneumococcal vaccination (p>0.05). Similarly, there was no significant difference in education level and the percentage of participants who said they knew cardiovascular disease patients should be vaccinated against pneumococcal pneumonia (p>0.05). There was no significant difference between participants with heart failure and others in influenza and pneumococcal vaccination and information levels (p>0.05).

When asked if they would get vaccinated after the survey, significant number of participants who were not immunized with influenza or pneumococcal vaccine said they would consider getting vaccinated in the following days (p<0.05) (Table 3).

Comparison of CAD patients with non-coronary artery (non-CAD) cardiac disease patients are presented in Table 5. Greater percentage of participants with CAD had received the influenza vaccine in the last year and were vaccinated for pneumococcal disease and knew they should receive influenza vaccine. Also, significantly more CAD patients were informed by their doctors or nurses that they should receive an influenza vaccine (p<0.05).

While eighty percent of participants visited their family physician regularly during the previous year only 61.6% obtained information concerning vaccination from a doctor or a nurse. During the visits higher percentage of participants were suggested by their physician or their nurse to be vaccinated for influenza (39.2%) than pneumococcus pneumonia (12.1%) (p<0.05) (Tables 1,2). Participants with CAD were informed more than non-CAD patients (Table 4).

Table 4: Comparison of coronary artery disease (CAD) patients with non-coronary artery (non-CAD) cardiac disease patients. p<0.05 = significant

All participants N = 240				
	CAD	Non-CAD	X2	p
Did you receive an influenza vaccine last year?				
Yes	27.3% (n = 45)	16.0% (n = 12)	3.812	0.039
Are you vaccinated regularly for influenza every year?				
Yes	4.8% (n = 41)	17.3% (n = 13)	1.670	0.196
Do you know that heart patients should receive an influenza vaccine?				
Yes	35.8% (n = 59)	25.3% (n = 19)	4.757	0.045
Has a doctor or nurse previously suggested you should be vaccinated?				
Yes	46.1% (n = 76)	24.0% (n = 18)	10.532	0.001
Did you ever receive a pneumococcal vaccine?				
Yes	13.3% (n = 22)	2.7% (n = 2)	6.519	0.011
Do you know that heart patients should receive the pneumococcus vaccine?				
Yes	10.9% (n = 18)	10.7% (n = 8)	0.003	0.955

DISCUSSION

This survey findings highlight the knowledge and immunization levels of our CVD patients about pneumococcal and influenza vaccines. Despite high rates of visits to family physicians and nurses, the survey results show low vaccine coverage in CVD patients at risk for bacterial and viral pneumonia. Patients with CAD have higher rates of vaccination against influenza and pneumococcal pneumonia compared to other CVD patients. The survey also displays a relation between the rate of influenza vaccination and the participants' education level.

CVD accounts for approximately 31% of all global mortality (10). Vaccination is a basic approach for the prevention of pneumonia and influenza. Immunization of patients with CVD (particularly congestive heart failure, ischemic heart disease, and stroke) with pneumococcal and influenza vaccine effectively reduces mortality (11). The influenza vaccine is also associated with a reduced risk of primary cardiac arrest and mortality (12). Despite the effectiveness of vaccination in reducing mortality in at-risk patients, vaccination coverage seems to be lower than desirable, even among CVD patients. One of the main reasons for the low rate of immunization in the elderly population and patients

Table 3. Comparison of Pre-Survey Vaccination Status with Post-Survey Tendency for Vaccination. p<0.05=significant

All participants N=240				
Are you considering getting an influenza vaccine this year?				
	Yes	No		
Did you receive an influenza vaccine last year?	Yes (n=57)	91.2% (n=52)	8.8% (n=5)	Kappa: 0.167 p<0.001
	No (n=183)	63.4% (n=116)	36.6% (n=67)	
Are you considering getting a pneumonia vaccine?				
	Yes	No		
Did you ever receive a pneumococcal vaccine?	Yes (n=24)	87.5% (n=21)	12.5% (n=3)	Kappa: 0.081 p:0.009
	No (n=216)	60.2% (n=130)	39.8% (n=86)	

with CVD may be the low awareness of primary care physicians and nurses. According to a European survey on the pneumococcal vaccine, one of the main drivers for vaccination was healthcare professionals' recommendations. The same survey showed that only 50% of the 1300 primary care physicians were aware of invasive pneumococcal disease. The researchers concluded that to increase vaccination rates, primary care physicians should be aware of patients at risk of pneumococcal infections (13). In Turkey's healthcare system every citizen is assigned to a family physician (general practitioner) and a nurse and the cost is covered by the General Health Insurance Scheme (14). Previously Korkmaz et al. (15) examined the influenza vaccination rates of 818 individuals with chronic diseases in Turkey. Their results showed that only 12.6% of all participants and 19% of participants over the age of 65 were vaccinated annually. The most common reason for not getting vaccinated was not knowing the necessity of the vaccine. The most significant source of knowledge on vaccination was their physician. Kaya et al. (16) conducted a questionnaire on the influence of regular influenza vaccination on heart failure-related hospitalization and mortality rates in patients registered to the Turkish Research Team-HF (TREAT-HF) network. Although the heart failure-related hospitalization rate was lower in vaccinated patients, their results failed to show a difference between vaccinated and non-vaccinated heart failure patients in terms of mortality. Although our results show a high rate (80%) of a visit from our participants to their family physician during the last year; the vaccination rate was low. The pneumococcus and influenza vaccine rates were 10% and 27.75%, respectively, in our study. In the study of Korkmaz et al. (15), which included patients with all chronic diseases, the influenza vaccination rate was 12.6% in all age groups. This rate was twice as high in our study, probably because heart diseases are considered riskier by physicians and patients. Likewise, the vaccination rate was higher in the Korkmaz et al. (15) study in patients over 65 years of age, considered at higher risk for mortality. Examining hospitalization and mortality rates in the heart failure cohort only, Kaya et al. (16) determined the influenza vaccination rate in high-risk patients as 40%. These results imply that vaccination rates increase in diseases with high mortality risk.

Vaccination rates of our patients are well below the desired level of vaccine coverage. CVD patients who are at high risk should be endorsed by their family physician, nurse, or cardiologist to be immunized. We asked the participants if they were directly advised by their family physician or their nurse to be vaccinated against pneumococcal pneumonia and influenza. Their

healthcare workers did not inform approximately forty percent of the participants. The present immunization rate points out that even healthcare workers are not well informed concerning the hazards of influenza pneumonia and especially pneumococcal pneumonia in CVD patients.

Educating both the patients and healthcare workers, and setting targets for vaccination coverage rates effectively increases vaccination rates. There were significant increases in vaccination coverage in the elderly population after a single day education program for family physicians in Denizli Province, Turkey (17). Before the education program, the pneumococcal vaccination rate among patients >65 years of age was 11.6%. By the 8th month after the program, vaccination coverage reached 59.5% cumulatively (17). Likewise, a prospective observational study conducted during routine follow-up visits showed a significant relationship between patients' knowledge and vaccination rates for influenza and pneumococcal pneumonia. Vaccination rates were 6.44% for pneumonia and 22% for influenza in elderly patients receiving healthcare at home (18). Even the present survey resulted in a remarkable increase in the number of our participants who decided to get vaccinated this year after being aware of the benefits of immunization during the survey.

Similar to our results, low vaccination rates were reported worldwide. A survey conducted in Japan in 2013 reported a 20.9% overall vaccination rate in persons aged >65 (19). Reports from Japan point out that public subsidies and patients' knowledge about pneumococcal vaccines are important for the lower vaccination rate (19-20). National free routine vaccination programs are effective in increasing vaccination rates (20). According to General Health Insurance legislation in Turkey, both pneumococcal and influenza vaccines are provided free of charge to naïve persons >65 years of age and at-risk patients regardless of age by family physicians. Vaccine administration requires the attention of all physicians and public health organizations (21). Unless all physicians and healthcare workers, most notable cardiologists are aware of the impact of vaccination in reducing mortality in CVD patients, free vaccine programs will not be effective.

Because of the social burden of influenza and pneumococcal disease, implementing standing order programs to improve adult vaccination coverage for these diseases should be a national public health priority. It is of foremost importance to raise the vaccination rates amongst patients with CVD. Advisory Committee on Immunization Practices (ACIP) recommends implementing standing orders programs alone or combined with other effective interventions that can help improve vaccination coverage by institutional providers (5).

CONCLUSION

Although patients with CVD are at increased risk for viral and bacterial pneumonia, our survey displays low vaccine coverage in this high-risk group of patients. Our results display significant relation between healthcare workers suggestions and vaccination rates of CVD patients. We are in the opinion that education programs for both healthcare workers and at-risk patients about adult immunization, and cheaper availability or free vaccination provision will provide higher vaccination rates. Further cohort studies are warranted to provide necessary information on vaccination rates to plan an education program to promote pneumococcal and influenza vaccination among patients with CVD.

Limitations

This study is only a cross-section from Konya Province, central Turkey; still, it demonstrates the need for better education of both the healthcare workers and at-risk patients.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of the Selçuk University Faculty of Medicine Clinical Researches Ethics Committee (Date: 12.06.2019, Decision No: 2019/142).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The author has no conflicts of interest to declare.

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Author Contributions: The author declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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