

ORIGINAL RESEARCH

Medicine Science 2020;9(1):60-6

Factors influencing influenza and pneumococcal immunization rates of COPD patients in Bolu, Turkey**Manolya Ballar, Tuncer Tug, Mehmet Kayhan, Suat Konuk***Bolu Abant Izzet Baysal University, Department of Chest Diseases, Bolu, Turkey*Received 06 November 2019; Accepted 04 December 2019
Available online 24.02.2020 with doi:10.5455/medscience.2019.08.9135

Copyright © 2020 by authors and Medicine Science Publishing Inc.

Abstract

The aim of this study was finding out the rates of pneumococcal and influenza vaccination, the factors influencing vaccination, and non-vaccination in COPD patients. The study was conducted with 104 COPD patients diagnosed by a pulmonologist. The diagnosis was made according to the GOLD 2019 document via an FEV1/FVC ratio below 70%. The patients were inquired about getting vaccinated for influenza in the last year and pneumococci in the last five years. The patients were then grouped according to their vaccination status and inquired about their perception of the necessity of vaccination. The study revealed a significant association between COPD levels and the awareness of the necessity of annual influenza vaccination ($p=0.019$). However, there was no significant association between COPD levels and being vaccinated for influenza in the last year ($p=0.434$). There was no significant association between COPD levels and pneumococcal vaccination in the last five years or the awareness for the necessity of the vaccine ($p=0.0559$ and $p=0.495$). 22.2% of the patients who were vaccinated for pneumonia were also vaccinated for influenza and 98.7% of the patients who were not vaccinated for pneumonia were also not vaccinated for influenza in the last year. 85.7% of the patients who got an influenza vaccine in the last year also knew the necessity of getting annually vaccinated ($p<0.001$). Every patient who has gotten the pneumonia vaccine in the last five years knew the necessity of getting a pneumonia vaccine as well ($p<0.001$). This study shows that most patients who got the influenza vaccine in the last year also knew the necessity of getting an influenza vaccine every year. Furthermore, all the patients who got the pneumococcal vaccine in the last five years knew the necessity of getting the pneumococcal vaccine. Most patients who were not vaccinated for pneumonia in the last 5 years were not vaccinated for influenza either.

Keywords: COPD, vaccine, pneumococcus, influenza**Introduction**

Chronic obstructive pulmonary disease (COPD) is a common chronic disease and a significant cause of mortality and morbidity in the whole world. Exacerbations are an important determinant for deterioration and mortality among COPD patients, and reducing exacerbations is one of the primary goals of treatment [1]. The most commonly shown viruses in acute exacerbations are; rhinovirus, RSV and influenza. The most frequently isolated virus in the first week of exacerbation is the human rhinovirus [2]. The most common cause of secondary bacterial infection after an influenza infection is pneumococci [3]. In addition to the pharmacological treatment of stable COPD, international guidelines recommend vaccination with 23PPA and 13KPA is recommended in patients 65 years and older. 23PPA is recommended in young COPD cases in the presence of co-morbidities including chronic heart diseases [1].

influenza vaccination for all patients. Additionally, pneumococcal This study aimed to determine the frequency of influenza and pneumococcal vaccination in COPD patients and the factors affecting the vaccination rates; thus, raising awareness among physicians for the steps to be taken to solve the underlying causes of non-vaccination behavior.

Material and Methods

This study was a single-center cross-sectional study carried out at The Bolu Abant Izzet Baysal University, Training and Research Hospital, Chest Diseases Service, data were collected between 15.02.2019-15.04.2019. The study was approved by the Bolu Abant Izzet Baysal University Clinical Researches Ethics Committee with the protocol number 2019/33. Patients who decided to participate in the study signed an informed consent form. 104 COPD patients diagnosed by pulmonologists were included in the study. All patients were diagnosed according to the GOLD criteria of FEV1/FVC $<70\%$ of what is expected. There were no exclusion or inclusion criteria beyond that. The form used

*Corresponding Author: Suat Konuk , Bolu Abant Izzet Baysal University, Department of Chest Diseases, Bolu 14030, Turkey
E-mail: suatkonukk@windowslive.com

for data collection was composed of 13 questions and was based on recent literature. The questions were about socio-economical characteristics, knowledge and behaviors about vaccination.

The descriptive findings of the census data are shown as frequency, distribution, and percentages. The descriptive findings of the data indicated by the measurement are shown as mean, median, standard deviation, minimum and maximum values. When examining the difference between groups in terms of a numeric variable, in cases where parametric test assumptions were accurate, the significance test of the difference between the two means was used. When parametric test assumptions were not accurate, the Mann-Whitney U test was used. The analysis of categorical variables was examined by Chi-square test and the level of statistical significance was taken as $p < 0.05$. SPSS v.21 was used for statistical analysis.

Results

The mean age of the participants was 64. 85% were male, 75% were primary school graduates. When classified according to GOLD groups, 51% (n=52) were in group A, 26% (n=26) were in group B, 11% (n=11) were in group C, and 13% (n=13) were in group D (Table 1).

Even though 41.3% (n = 43) of the participants knew that they should be vaccinated for flu, the rate of actual vaccination was 26.9% (n = 28) in the last year. Of those who knew that they needed to get the flu vaccine, 41.9% (n = 18) reported that they got this information from a pulmonologist or assistant physician, 25.6% (n = 11) from a family physician, 7% (n = 3) from media, 4.7%

(n = 2) from a pharmacist, and 16.3% (n = 7) from their social environment. 73% (n = 76) of the participants did not receive the flu vaccine in the last year. When asked why, 67.1% (n = 51) did not get a recommendation from their physician, 1.3% (n = 1) feared the vaccination, 5.3% (n = 4) did not know where to do it, and 13.2% (n = 10) forgot.

7.8% (n = 8) of participants knew that they should receive pneumonia vaccination and 6.8% (n = 7) received pneumococcal vaccination in the last five years. Of those who knew that they needed to get the pneumococcal vaccine, 50% (n = 4) reported that they got this information from a pulmonologist or assistant physician, 12.5% (n = 1) from a family physician, 12.5% (n=1) from an auxiliary health personnel, and 12.5% (n=1) from a pharmacist. 93.2% (n = 96) of the participants did not receive pneumococcal vaccine in the last five years. When asked why, 87.5% (n = 84) did not get a recommendation from their physician and 6.3% (n = 6) did not know where to do it.

There was no statistically significant relationship between GOLD groups and vaccination in the last year ($p = 0.434$). The highest vaccination rate was in group C with 45.5%, while the lowest rate was in group A with 21.2%. The GOLD groups did not affect the status of influenza vaccination. Yet, there was a statistically significant relationship between the GOLD groups and the awareness for an annual vaccination ($p = 0.019$). When we look at the rates in groups, 81.8% of group C stated that they knew the necessity of a flu vaccine every year. This rate was found to be considerably higher than in other groups (Table 2).

Table 1. Demographic characteristics

Age	Mean $\pm$ Std. Deviation	Min - Max	
	64.173 $\pm$ 11.22	30 – 84	
		Number	Percentage
Sex	Female	16	15.4
	Male	88	84.6
	Illiterate	6	5.9
	Literate	4	3.9
Education	Primary school	76	74.5
	Middle school	6	5.9
	High school	9	8.8
	University	1	1.0
Tobacco use *	Non-smoker	18	18.0
	Active user	26	26.0
	Past user	56	56.0
GOLD groups	A	52	51.0
	B	26	25.5
	C	11	10.8
	D	13	12.7

*Those who had no past smoking experience were classified as “non-smokers”, current users were classified as “active users”, those who had previously used but were not currently smoking classified as “past users”

Table 2. Relationship between demographic characteristics and flu vaccination awareness

		Awareness about annual flu vaccination		
		Yes	No	p
Age		65.69 ± 12.51	63.09 ± 10.19	0.142
		67 [30 - 84]	64 [34 - 80]	
Sex	Female	5 (31.3)	11 (68.8)	0.373
	Male	38 (11.6)	50 (56.8)	
	Illiterate	1 (16.7)	5 (83.3)	
	Literate	3 (7.0)	1 (25.0)	
Education	Primary school	28 (36.8)	48 (63.2)	
	Middle school	4 (66.7)	2 (33.3)	*
	High school	6 (66.7)	3 (33.3)	
	University	0 (0.0)	1 (100.0)	
Tobacco use *	Non-smoker	3 (16.7)	15 (83.3)	
	Active user	12 (46.1)	14 (53.8)	0.068
	Past user	26 (46.4)	30 (53.6)	
	A	17 (32.7)	35 (67.3)	
GOLD groups	B	12 (46.2)	14 (53.8)	0.019
	C	9 (81.8)	2 (18.2)	
	D	4 (30.8)	9 (69.2)	

*Those who had no past smoking experience were classified as “non-smokers”, current users were classified as “active users”, those who had previously used but were not currently smoking classified as “past users”

There was no statistically significant relationship between GOLD groups and pneumonia vaccination status in the last five years ($p = 0.559$). When we look at the rates in different groups, it is shown that 10% of group C was vaccinated for influenza annually and also for pneumonia in the last 5 years. This rate was higher than in other groups, but the difference was not statistically significant. There was no statistically significant relationship between GOLD groups and pneumonia vaccination awareness ($p=0.495$). Strikingly 100% ($n=13$) of group D patients were unaware of the need for a pneumonia vaccination (Table 3).

There was no statistically significant relationship between GOLD groups and pneumonia vaccination status in the last five years ($p = 0.559$). When we look at the rates in different groups, it is shown that 10% of group C was vaccinated for influenza annually and also for pneumonia in the last 5 years. This rate was higher than in other groups, but the difference was not statistically significant. There was no statistically significant relationship between GOLD groups

and pneumonia vaccination awareness ($p=0.495$). Strikingly 100% ($n=13$) of group D patients were unaware of the need for a pneumonia vaccination (Table 3).

There was a statistically significant relationship between the influenza vaccination status in the last year and the knowledge that the vaccine should be administered every year ($p = <0.001$). While 85.7% of those who have had the flu vaccine in the last year knew that they should have it every year, only 25.0% of those who have not had the flu vaccine in the last year knew that they should have it every year. Similarly, there was a statistically significant relationship between pneumococcal vaccination status in the last five years and the knowledge that the vaccine should be administered every five years ($p<0.001$). All of those who have had pneumonia vaccination in the last five years knew that they should get this vaccine, while only 1.0% of those who have not had pneumonia vaccination in the last five years knew about the necessity of the vaccine.

Table 3. Relationship between demographic characteristics and pneumonia vaccination awareness

		Awareness about annual flu vaccination		
		Yes	No	p
Age		69.62 ± 7.99	63.65 ± 11.40	0.222
Sex	Female	1 (6.3)	11 (93.8)	0.805
	Male	7 (8.0)	50 (92.0)	
	Illiterate	0 (0.0)	6 (100.0)	
	Literate	0 (0.0)	4 (100.0)	
Education	Primary school	5 (6.6)	71 (93.4)	*
	Middle school	1 (20.0)	4 (80.0)	
	High school	2 (22.2)	7 (77.8)	
	University	0 (0.0)	1 (100.0)	
Tobacco use *	Non-smoker	1 (5.6)	17 (94.4)	0.478
	Active user	1 (3.8)	25 (96.2)	
	Past user	6 (10.9)	49 (89.1)	
	A	5 (9.6)	47 (90.4)	
GOLD groups	B	2 (7.7)	24 (92.3)	0.495
	C	1 (10.0)	9 (90.0)	
	D	0 (0.0)	13 (100.0)	

* Inter-group evaluation could not be done because the data was concentrated in one category.

Discussion

Currently, the GOLD document states that both influenza and pneumococcal vaccines should be administered to patients with COPD, and the annual flu vaccination is recommended for all patients regardless of the COPD groups [1]. Viruses are thought to be responsible for 25-30% of COPD exacerbations caused by infection [5]. Influenza virus infections lead to exacerbations in this group of patients, facilitating the development of pneumonia and secondary bacterial infection, increasing morbidity and mortality, and it is thought that 8-10% of acute exacerbations are due to influenza virus.

In our study, only 26.9% of the participants had the flu vaccine in the last year, and this rate is quite low considering the severity of a condition such as COPD. The reason for the low rate of vaccination may be; that the beneficial effects of vaccines in disease management are not known by the participants, the average age of the patient population is high, the level of education of patients is low, clinicians or health workers do not inform the patients and their relatives about the vaccination and there may be some obstacles arising from access to the vaccine. In similar studies conducted in Turkey, the frequency of influenza vaccination was shown to be 35-40% [5-7]. In a study conducted in the UK “The Health Improvement Network (THIN)” database, vaccination

rates in 60 years or older COPD patients were shown to be less than 30% before 1995 and the rate increased to over 70% in 2005. [8] In a study conducted in the USA in 2005, vaccination rates in the general population over 65 years of age were 63.7%. [9] The reasons for the difference to our country may be influenced by many factors such as the educational status of the patients, health policies of the countries, the severity and duration of the disease, the history of frequent consultations, and the attitudes of physicians about the vaccination of their patients.

In a study conducted with 95 patients by Özol et al., 40% of the patients had been vaccinated at least once in the last 5 years and the influenza vaccination rate was similar in those above and below the age of 65, but influenza vaccination rates were higher in university graduates. [10] In our study, when the distribution of participants according to educational level is examined, primary school graduates make up the majority with 74.5%. The fact that the study center is in a rural area and the population is predominantly elderly may explain the low level of education. The overall level of literacy is linked to health literacy, but it does not guarantee a high level of health literacy. Although studies have found that people with low literacy levels have difficulty understanding their health, individuals with high levels of literacy may have low levels of health literacy as well [11].

67.1% of the participants who did not get the flu vaccine stated that the reason for it was a lack of recommendation by their physician, while 13.2% forgot to get vaccinated. In our study, the rate of non-vaccination due to physician attitude was very high. In a study conducted by Balbay et al., the pneumococcal vaccine was not recommended to any patient by family physicians, whereas the flu vaccine was recommended at a rate of 16.4% [12]. In a study conducted in Germany, it was found that the most important factor determining the vaccination was physicians' advice [13]. In a study conducted by Szcus et al. to evaluate the coverage of influenza vaccines during two consecutive influenza seasons (2002/2003-2003/2004) in six European countries, family physicians were found to be the most potent factors in immunizing individuals against influenza. Additional information about vaccine efficacy and tolerance increased the odds of vaccination in the general public [14]. In a study conducted in the USA, it was found that 27% of patients who initially refused to be vaccinated, accepted the vaccine on the recommendation of a physician [15]. In the study of Erer et al., the majority of the patients who were aware of the vaccine but were not vaccinated stated that the reason for non-vaccination was a lack of recommendation [5]. In our country, immunization information is given less frequently to patients compared to other developed countries. The increased workload in our country, prolonged working hours with intensive outpatient clinics and insufficient time to examine patients are a possible cause of this difference.

Although there is no statistically significant effect on exacerbations by pneumococcal vaccination, influenza and pneumococcal infections are the most common causes of acute exacerbations of COPD [17,18]. Both influenza and pneumococcal vaccination have been reported to reduce the incidence of lower respiratory tract infections. Vaccination is, therefore, a cost-effective, economical and life-saving approach. Evidence suggests that pneumococcal and influenza vaccines may prevent community-acquired pneumonia and acute exacerbations in COPD patients and that early pneumococcal vaccination in COPD may help maintain stable health status [1].

In our study, 93.2% of the patients did not receive the pneumonia vaccine in the last 5 years. 77.8% of those who had the flu vaccine did not receive the pneumococcal vaccine and the underlying causes should be addressed. This may be because influenza can remain on the agenda by making outbreaks every year and maintaining its popularity in the media, while pneumococcal infections remain in the background affecting at-risk populations and stay unheard of by the general public. In the study of Balbay et al., the rate of patients who had received the pneumococcal vaccine in the last five years was found to be similar to our study with 8.2% [12]. The results of Erer et al.'s study in Izmir were similar, the influenza vaccination rate was 40% and the pneumococcal vaccination rate was 10%. The pneumococcal vaccination rate was higher in women and those with higher educational level [5]. In a study conducted with 178 patients in the Catalonia region of Spain, the ratio of pneumococcal vaccination was reported to be 84.2%, which is considerably higher than in our country [19]. In two different studies conducted in Spain and Sweden, the proportion of patients receiving both vaccines was found to be 62.5% and 78%, respectively, and is still very high compared to our country [19,20].

87.5% of those who have not received the pneumonia vaccine in the last 5 years have not been vaccinated because the physician did not recommend it. Other reasons include the family physician saying that the vaccine is not needed and the patient's belief that the vaccine will not help. As can be seen from these results, the most important factor in pneumococcal vaccination is the physician's advice. In the study of Balbay et al., 27.9% of the patients were offered influenza vaccination by a pulmonologist or an assistant physician, whereas pneumococcal vaccine was recommended only to 4.9% and their family physician recommended none of the patients a pneumococcal vaccine [12]. Despite the availability of effective pneumococcal vaccines and recommendations from national health authorities, vaccine coverage is low in many countries. These levels are 70% in the United Kingdom, 76% in Spain, 36% in Ireland, 15-30% in Norway, 15% in Germany and 5% in France [21]. The reason for low vaccine coverage may be the perception levels and low vaccine awareness of elderly patients.

In a phone survey conducted between November 2015 and February 2016 on individuals over 50 years of age with more than 9000 participants, pneumonia and vaccine awareness was measured. It was found that 85% of the participants trusted vaccines, 27% avoided vaccines (for safety reasons), and 29% thought that they did not need them because they were not at risk. Also, respondents stated that they followed their physicians' recommendations (92%) and preferred to receive additional medical information from their physicians. In general, awareness of pneumococcal vaccine was found to be low and the most common cause for non-vaccination (55%) was shown to be a lack of recommendation from their physician [22]. The inclusion of pneumococcal vaccination in the early treatment of COPD may improve the long-term natural course of the disease. Since patients trust their physicians as their main source of health information, physicians need to make more effective efforts to inform their at-risk patients about the dangers of pneumonia and the benefits of pneumococcal vaccination [21].

There was no statistically significant relationship between influenza or pneumonia vaccination and age, sex, smoking, or COPD severity. Since in our study, almost all patients were primary school graduates, no statistical evaluation was made in terms of education level. A statistically significant correlation was found between the awareness of influenza vaccine and COPD severity. This may be since in advanced disease stages, health institutions are more frequently referred to and the outcome of the disease is felt more vividly. In international publications examining the factors affecting the vaccination rates in COPD patients, it was shown that vaccine acceptance and vaccination rates decrease in patients with milder disease severity [23,24]. Influenza vaccination rates have been shown to be higher in older patients, patients with a higher number of physician visits, and patients with poor overall health [25]. In the study conducted by Bülbül et al., the rate of pneumococcal vaccination increased by 4.1 fold in patients with advanced-stage COPD [26]. In a multicenter study of 5135 patients by Özlü et al., influenza vaccination rates were found to be significantly higher in patients with advanced age, higher education, severe COPD and comorbid diseases, as well as smokers and urban residents. The lifetime vaccination rate for pneumococci was 13.3%, and similarly to influenza, pneumococcal vaccination rates were significantly higher in smokers who quit smoking, in patients with higher education, in patients with comorbidities, and

in urban residents, regardless of COPD group. Also significantly higher pneumococcal vaccination rates were found in female patients [16]. Similarly, a study conducted abroad reported that the most important determinants of pneumococcal vaccination were female gender, advanced age, and the severity of COPD [27]. In our study, the reason that the sociodemographic characteristics did not affect vaccination may be due to the low number of participants. To determine the factors affecting vaccination in COPD, larger sample sizes will need to be studied.

According to our study, there was a statistically significant relationship between influenza vaccination in the last year and pneumonia vaccination in the last five years. While 22.2% of those who have received pneumonia vaccination in the last five years have also had the flu vaccine in the last year, 98.7% of those who have not had pneumonia vaccination in the last five years have not received the flu vaccine in the last year either. The flu vaccine is known by the general population and most patients with chronic diseases. Pneumococcal vaccine is not even known by at-risk patients who should receive this vaccine. However, patients who are aware of the severity of their disease know they need the pneumococcal vaccine and this awareness may have led to higher flu vaccination rates.

Vaccination is as vital as medical treatment in COPD and is effective on both morbidity and mortality. The primary determinants of the patients' vaccination behaviors are the physicians who treat them. Especially in chronic diseases such as COPD, where both the disease is severe, and the costs of care is high, primary preventive activities are very important and specialist physicians have great responsibilities. In this context, pulmonologists and even general practitioners should not only concentrate on medical treatment, but should also focus on preventive treatments, give sufficient time to vaccination awareness and convince patients about the vaccine [28].

Conclusion

In conclusion, vaccination is vital in severe and chronic diseases such as COPD. In our study, it was shown that the most important factor affecting the vaccination behavior was the physician's advice. Therefore, pulmonologists and family physicians should not only treat COPD patients medically but also should raise awareness about vaccination.

Competing interests

The authors declare that they have no competing interest.

Financial Disclosure

The authors received no financial support for this study.

Ethical approval

Bolu Abant İzzet Baysal University Clinical Researches Ethics Committee with the protocol number 2019/33

Manolya Ballar, ORCID: 0000-0002-7790-1398

Tuncer Tug, ORCID: 0000-0003-2622-5104

Mehmet Kayhan, ORCID: 0000-0001-7493-5165

Suat Konuk, ORCID: 0000-0002-8240-4775

References

- Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2019.
- Zwaans WA, Mallia P, van Winden ME, et al. The relevance of respiratory viral infections in the exacerbations of chronic obstructive pulmonary disease—a systematic review. *J Clin Virol.* 2014;61:181-8.
- Song JY, Nahm MH, Cheong HJ, et al. Impact of preceding flu-like illness on the serotype distribution of pneumococcal pneumonia. *PLoS One.* 2014;9:e93477.
- Donner CF. Infectious exacerbations of chronic bronchitis. *Monaldi Arch Chest Dis.* 1999;54:43-8.
- Erer OF, Karadeniz G, Gazibaba D ve ark. Kronik obstrüktif akciğer hastalığında aşılanma; gerçekten yaptırıyor muyuz? *İzmir Göğüs Hastanesi Dergisi.* 2013;25:31-40.
- Uçar N, Akpınar S, Yıldız M, Şipit T.KOAH'lı Olgularda influenza ve pnömokok aşısı olma sıklığı. *Solunum Hastalıkları.* 2015;25:1-4
- Özsu S, Uçar E, Arslan Y ve ark. KOAH hastalarında influenza ve pnömokok aşılanma sıklığı. *Solunum.* 2011;13:21-5.
- Schembri S, Morant S, Winter JH, et al. Influenza but not pneumococcal vaccination protects against all-cause mortality in patients with COPD: *Thorax.* 2009;64:567-72.
- CDC. Influenza and pneumococcal vaccination coverage among persons aged >65 Years United States, 2004-2005. *Morb Mortal Wkly Rep.* 2006;55:1065-8.
- CDC. Influenza and pneumococcal vaccination coverage among persons aged >65 Years United States, 2004-2005. *Morb Mortal Wkly Rep.* 2006;55:1065-8.
- Egbert N, Nanna KM. Health Literacy: Challenges and Strategies. *OJIN.* 2009;14:1-9.
- Balbay EG, Tanrıverdi E, Alaşan F, ve ark. Düzce ilinde kronik obstrüktif akciğer hastalığı tanılı hastaların aşılanma sıklığı. *Düzce Üniversitesi Sağlık Bilimleri Enstitüsü Dergisi.* 2013;3:15-17.
- Schoefer Y, Schaberg T, Raspe H, et al. Determinants of influenza and pneumococcal vaccination in patients with chronic lung diseases. *J Infect.* 2007;55:347-52.
- Szucs TD, Muller D. Influenza vaccination coverage rates in five European countries—a population-based cross-sectional analysis of two consecutive influenza seasons. *Vaccine.* 2005;23:5055-63.
- Schwartz KL, Neale AV, Northrup J, et al. Racial similarities to standardized offer of influenza vaccination: a metronet study. *J Gen Intern Med.* 2006;21:346-51.
- Özlü T, Bülbül Y, Alataş F, et al. Türk Toraks Derneği erişkinlerde toplumda gelişen pnömoni tanısı ve tedavi yaklaşımı raporu. *Türk Toraks Dergisi.* 2009;10:5-9 (article in Turkish)
- Walters JA, Smith S, Poole P, vd. Kronik obstrüktif akciğer hastalığı olan hastalarda pnömokok enfeksiyonunu önlemek için enjekte edilebilir aşılarda. *Cochrane Database Syst Rev.* 2010;11:CD001390.
- Sethi S, Murphy T. Patogenezinde enfeksiyon ve kronik obstrüktif akciğer hastalığının seyri. *N Engl J Med.* 2008;359:2355-65.
- Jimenez-Garcia R, Arinez-Fernandez MC, Hernandez-Barrera V, Garcia-Carballo MM, Miguel AG, Carrasco-Garrido P. Compliance with influenza and pneumococcal vaccination among patients with chronic obstructive pulmonary disease consulting their medical practitioners in Catalonia, Spain. *J Infect.* 2007;54:65-74.
- Christenson B, Lundbergh P. Comparison between cohorts vaccinated and unvaccinated against influenza and pneumococcal infection. *Epidemiol Infect.* 2002;129:515-24.
- Froes F, Roche N, Blasi Francesco. Pneumococcal vaccination and chronic

- respiratory diseases. *Int J Chron Obstruct Pulmon Dis*. 2017;12:3457–68.
22. Ipsos PneuVUE: a new view into pneumonia among older adults. 2016
23. Bovier PA, Chamot E, Bouvier GM, Loutan L. Importance of patients' perceptions and general practitioners' recommendations in understanding missed opportunities for immunisations in Swiss adults. *Vaccine*. 2001;19:4760-7.
24. Kamal KM, Madhavan SS, Amonkar MM. Determinants of adult influenza and pneumonia immunization rates. *J Am Pharm Assoc*. 2003;43:403-11.
25. Jimenez- Garcia R, Arinez-Fernandez MC, Garcia-Carballo M, et al. Influenza vaccination coverage and related factors among Spanish patients with chronic obstructive pulmonary diseases. *Vaccine*. 2005;23:3679-86.
26. Bülbül Y, Öztuna F, Gülsoy F, Özlü T. Doğu Karadeniz Bölgesinde Kronik Obstrüktif Akciğer Hastalığı; hastalık özellikleri ve İnfluenza-Pnömonok aşılama sıklığı. *Türkiye Klinikleri J Med Sci*. 2010;30:24-9.
27. Ariñez-Fernandez MC, Carrasco-Garrido P, Garcia-Carballo M, Hernández-Barrera V, de Miguel AG, Jiménez-García R, et al. Determinants of pneumococcal vaccination among patients with chronic obstructive pulmonary disease in Spain. *Hum Vaccin*. 2006;2:99–104.
28. Filipe Froes, 1 Nicolas Roche , 2 ve Francesco Blasi 3, Pneumococcal vaccination and chronic respiratory diseases. *Int J Chron Obstruct Pulmon Dis*. 2017;12:3457–68.