Acta Medica Alanya

RESEARCH ARTICLE

ARAŞTIRMA

Acta Medica Alanya

2022;6(3): 263-270

DOI: 10.30565/medalanya.1165897

Influenza and pneumonia knowledge level and vaccination status of pneumoconiosis patients

Pnömokonyoz Hastalarının İnfluenza ve Pnömoni Konusunda Bilgi Düzeyi ve Aşılı Olma Durumları

Yusuf Samir Hasanlı[1*], Meral Türk[2], Emin Erdem[3]

1. Ege University Faculty of Medicine, Department of Internal Diseases, Department of Occupational Diseases, Izmir, Türkiye
2. Ege University Faculty of Medicine, Department of Public Health, Department of Occupational Diseases, Izmir, Türkiye
3. Ege University Faculty of Medicine, Department of Chest Diseases, Department of Occupational Diseases, Izmir, Türkiye

ABSTRACT

Aims: In pneumoconiosis, which is a chronic lung disease, frequent seasonal flu and pneumonia worsen the course of the disease. Therefore, it is important that patients have seasonal flu and pneumococcal vaccines. The study aims to measure the knowledge level of patients with pneumoconiosis about influenza and pneumonia and to determine their vaccination status.
Methods: We reached 73 patients with pneumoconiosis and had them fill out a 26-question questionnaire that evaluated their information about influenza and pneumonia and their vaccination status. The study was designed as descriptive, cross-sectional. We also examined the sociodemographic, socio-economic characteristics and working conditions of the patients.
Results: The mean age of 73 patients, one of whom was female, was 46.4±7.8 years. They started working life in middle adolescence. Most of them are primary school graduates and they estimated their income was not sufficient. One-third of the patients were hesitant about vaccination in general. Some had not heard of the seasonal flu and pneumonia vaccine. Thirty-four patients (46.6%) said that they heard about the vaccines from the TV or the internet, not from the healthcare professionals. After the diagnosis of pneumoconiosis, influenza and pneumonia vaccination rates were very low (14 patients/19.2% and 16 patients/21.9%, respectively). One-third of the patients were unaware that pneumonia was a lung disease. When we asked, "Why haven't you been vaccinated against pneumonia?" the answer "I just got this information" came to the fore (39 patients/53.5%). Most patients (42/57 patients) who were not vaccinated against pneumonia after being diagnosed with pneumoconiosis were not aware that pneumonia could be prevented by vaccination (p<0.001). However, most of those who have been vaccinated said that they had this knowledge before (15/16 patients).
Conclusion: Patients with pneumoconiosis need regular information and advice about influenza and pneumococcal vaccines.

Key-words: Pneumoconiosis, influenza, pneumonia, vaccine, pneumococcal vaccine.

ÖZ

Amaç: Kronik bir akciğer hastalığı olan pnömokonyozda sık sık influenza ve pnömoniye yakalanmak hastalığın seyrini kötüleştirir. Bu sebepten hastaların influenza ve pnömokok aşılarını olması önem arz eder. Çalışmanın amacı pnömokonyozlu hastaların influenza ve pnömoni hakkında bilgi düzeylerini ölçmek ve aşılı olma durumlarını belirlemektir.
Yöntem: Yetmiş üç pnömokonyoz tanılı hastaya ulaşarak mevsimsel grip ve pnömoni hakkında bilgileri ve aşılı olma durumlarını değerlendiren 26 soruluk anket bilgi formu doldurmalarını sağladık. Çalışma tanımlayıcı, kesitsel olarak tasarlandı. Hastaların sosyodemografik, sosyoekonomik özelliklerini, çalışma şartlarını da inceledik.
Bulgular: Biri kadın 73 hastanın yaş ortalaması 46,4±7,8 yıl idi. Hastalar çalışmaya orta ergenlik döneminden itibaren başlamış. Çoğu ilkokul mezunu ve gelir durumlarının yeterli olmadığını düşünüyorlardı. Hastaların üçte biri genel olarak aşı konusunda tereddütte idi. Grip ve zatürre aşısını duymayanlar vardı. Otuz dört hasta (%46,6) aşıları bizzat sağlıkçılardan değil, TV veya internetten duyduğunu söyledi. Pnömokonyoz teşhisi sonrası grip ve zatürre aşısı olma oranları çok düşüktü (sırasıyla, 14 hasta/%19,2 ve 16 hasta/%21,9). Hastaların üçte biri zatürrenin akciğer hastalığı olduğu, 41 hasta (%56,2) ise pnömokonyozun zatürre riskini artırdığı bilgisine sahip değildi. "Neden zatürre aşısı olmadınız?" diye sorduğumuzda ise "Bu bilgiye henüz yeni ulaştım" cevabı ön plana çıktı (39 hasta/%53,5). Pnömokonyoz teşhisi aldıktan sonra zatürre aşısı olmayan hastaların büyük çoğunluğu (42/57 hasta) zatürrenin aşıyla önlenebileceği bilgisine sahip değildi. Diğer taraftan aşıyı olanların çoğu önceden bu bilgiye sahip olduklarını söyledi (15/16 hasta) (p<0.001).
Sonuç: Pnömokonyozlu hastaların influenza ve pnömokok aşıları hakkında düzenli bilgi ve tavsiyeye ihtiyacı vardır.

Anahtar Kelimeler: Pnömokonyoz, influenza, pnömoni, aşı, pnömokok aşısı.

Received: 23.08.2022 Accepted: 06.11.2022 Published (Online): 31,12,2022

*Corresponding Author: Yusuf Samir Hasanlı, Ege University Faculty of Medicine Public Health Building. Department of Occupational Diseases. 35100 Izmir, Türkiye. Phone:05075352238 dryusufsmrh@gmail.com

ORCID : 0000-0001-6514-6789

To cited: Hasanli YS, Turk M, Erdem E. Influenza and Pneumonia Knowledge Level and Vaccination Status of Pneumoconiosis Patients. Acta Med. Alanya 2022;6(3):263-270 doi: 10.30565/medalanya.1165897

INTRODUCTION

Pneumoconiosis is defined as an irreversible chronic interstitial lung disease characterized by accumulating inorganic dust in the lungs and the fibrotic tissue response in the lungs, to the accumulated dust. This disease, which is widespread globally, is a public health problem. Respiratory and heart failure resulting from chronic inflammation and fibrosis in the lung tissue is the main cause of mortality. Concomitant infections (upper and lower respiratory tract infections, tuberculosis) contribute to the acceleration of this process. Pneumoconiosis is in the class of occupational chronic interstitial lung diseases, but these patients may develop concomitant emphysema or chronic obstructive pulmonary disease (COPD) [1,2]. Coal workers' pneumoconiosis is also associated with an increased risk of COPD. In a study conducted in China, they showed that the prevalence of COPD in pneumoconiosis increased up to 40% [3]. Unfortunately, there is no effective treatment for pneumoconiosis. Some measures are critical to slow down the course of the disease: quitting smoking, avoiding dust in the work and home environment, screening and treatment of latent tuberculosis, pulmonary rehabilitation, as well as getting influenza and pneumococcal vaccines, as in every chronic lung disease, are the most important of these measures [4].

Influenza is an acute viral respiratory infection that causes significant morbidity and mortality worldwide. Three types of influenza (A, B, and C), a seasonal RNA virus, cause illness in humans. Influenza A is the type most responsible for causing pandemics due to its high susceptibility to antigenic variation [5]. The influenza virus is highly contagious and infects 5% to 15% of the world's population each year. It causes significant morbidity and mortality, especially in immunocompromised and at-risk individuals, and invites the development of bacterial superinfections. It evolves constantly, mutating rapidly and unpredictably, producing new viruses that can evade the humoral immunity produced by current influenza virus vaccines [6]. Pneumonia, a lower respiratory tract infection, is responsible for high morbidity and mortality, and is the cause of approximately 75% of antibiotic use worldwide. Pneumococci are the most common bacteria in lower respiratory tract infections. Risk factors for invasive pneumococcal infections (pneumonia, meningitis) are well defined. Sickle-cell anemia, diabetes mellitus, chronic heart, kidney, lung and liver diseases, alcohol abuse, cancers and immunosuppressive diseases, are associated with an increased frequency of pneumococcal infections [7]. Infectious exacerbations and pneumonia occur frequently in the follow-up of chronic lung diseases (such as COPD, asthma, bronchiectasis, interstitial lung diseases), which are among the priority public health problems. Depending on these, physician/emergency applications, hospitalization or intensive care support are required. In various studies, the risk of developing pneumonia was 7 to 10 times higher, the risk of developing pneumococcal pneumonia 3 times, and the risk of hospitalization was 3 to 9 times higher in patients with chronic lung disease, compared to healthy individuals [8].

Vaccination continues to be the most effective and economical way to prevent many infections and their complications, especially influenza and pneumonia. There are currently three types of seasonal flu vaccines licensed for use in humans: inactivated, live attenuated and recombinant hemagglutinin influenza vaccines [9]. Since 2012, an additional B strain has been added to the traditionally used trivalent (two A and one B strains) inactivated influenza vaccine, and a quadrivalent inactivated vaccine has been developed. This vaccine is recommended for all individuals at risk of influenza, such as those under the age of two, over the age of 65, organ transplant recipients, pregnant women, as well as those suffering from chronic heart, neurological, kidney and lung diseases [10]. The pneumococcal vaccine, which has been in use since 1983, has significantly reduced the burden of pneumonia in both pediatric and elderly populations. The pneumococcal vaccine is divided into two, as whole cell vaccine and subunit vaccine. The whole cell vaccine includes live attenuated vaccine and inactivated vaccine, while the subunit vaccine includes the polysaccharide vaccine, conjugate vaccine and protein-based vaccine. Commercially available pneumococcal vaccines are subunit vaccines. Among them, the most commonly used vaccines are pneumococcal polysaccharide 23 (PPV23) and

pneumococcal conjugate 13 (PCV13) vaccines. Considering that not every vaccine provides full protection, it is worth mentioning that studies are being conducted on new vaccines [11].

We know that influenza and pneumonia affect the quality of life of pneumoconiosis patients. There are many ways to encourage patients to get vaccinated and one of these is education. With this study, we aimed to measure the knowledge level of patients with pneumoconiosis about influenza and pneumonia, and to determine their vaccination status.

MATERIAL AND METHODS

Data source and study population

The study was conducted through the data obtained from the electronic health records of the patients with pneumoconiosis, who applied to the Ege University Medical Faculty Hospital Occupational Diseases polyclinic, between November, 2015-December, 2021, and the information questionnaire filled by the patients. Sociodemographic and socioeconomic characteristics of the patients, information on working conditions and ILO (International Labour Organization) Pneumoconiosis Radiograph results, were obtained from the outpatient clinic records. The opacities observed in the PA chest X-ray were evaluated by two B readers by comparing them with the standard ILO radiographs in terms of size, shape, and extent, if any, in terms of pleural plaques and additional pathologies. With the Information Questionnaire, the knowledge level of the patients about influenza, pneumonia and their vaccination status, was evaluated using various questions, numbering a total of twenty-six questions. The study complied with the Declaration of Helsinki, and was approved by Ege University Rectorate Faculty of Medicine Dean's Medical Research Ethics Committee (Approval Decision: 21-12.1T/18; Date: 20.12.2021).

Statistical Analysis

The IBM SPSS Statistics 24 program was used in the analysis of the data. Categorical variables were expressed in cross-tables and numerical variables in mean, median, standard deviation, minimum and maximum. In the comparison of independent categorical variables, the Chi-square test was used. P value of <0.05 was considered statistically significant.

RESULTS

Only one of the 73 patients included in the study was female and the mean age was 46.4±7.8 years. The patients started working in mid-adolescence and experienced dust exposure for a long period, on average 18.7±8.1 years. The mean duration of follow-up for pneumoconiosis was 4.1±3.2 years, and cigarette consumption was calculated as 13.3±11.6 pack-years (Table 1).

Table 1. Numerical sociodemographic characteristics of the patients.

Variables	Mean	Standard deviation	Min.	Max.
Age (year)	46.4	7.8	26	72
Pneumoconiosis disease duration (years)	4.1	3.2	1	28
Exposure time (years)	18.7	8.1	3	42
Age of employment (years)	17.4	4.2	10	25
Smoking (packyear)	13.3	11.6	1	60

When we look at the other sociodemographic characteristics, we observed that almost half of the patients (48%) did not attend school beyond secondary school. More than 90% of the patients were married and living with their family. When pneumoconiosis was diagnosed, most of them were working in the glass-earth-ceramic and mining industry (87.7%). Another remarkable point was that more than half of the patients had income at or below the minimum wage (52%). Considering that smoking is an important additional risk factor for the progression of pneumoconiosis (in the presence of silica dust), it was satisfying to note that 13 patients (17.8%) had never smoked and 25 patients (34.2%) had quit smoking. Active alcohol consumption was 13.7% (10 patients). We obtained the ILO (International Labour Organization) pneumoconiosis classification from the electronic health records and found that most patients were in category I (42 patients/57.5%). while eleven patients (15.1%) were in category III. Among the accompanying chronic diseases, hypertension, diabetes mellitus and cardiopulmonary diseases were the most common. Occupational hearing loss and musculoskeletal system diseases were more prominent among occupational diseases (Table 2).

Table 2. Other sociodemographic and socioeconomic characteristics of the patients.

Features	Number (N)	Percent (%)
Gender		
Female	1	1.4
Male	72	98.6
Education		
No	1	1.4
Primary	34	46.6
Secondary	15	20.5
High	21	28.8
University	2	2.7
Marital status		
Married	70	95.9
Single or widower	3	4.1
Industry		
Glass, earth, ceramic	37	50.7
Mining	27	37
Metallurgy	5	6.8
Petrochemistry	2	2.7
Construction	2	2.7
Income status		
Less than minimum wage	25	34.2
Minimum wage	13	17.8
More than minimum wage	35	47.9
Smoking status		
Never smoked	13	17.8
Still smoking	35	47.9
Quitted smoking	25	34.2
Alcohol		
Never drank	62	84.9
Still drinking	10	13.7
Quit drinking	1	1.4
*ILO Pneumoconiosis Category		
I	42	57.5
II	20	27.4
III	11	15.1
Comorbid diseases		
No	33	45.2
Hypertension	11	15.1
Diabetes Mellitus	6	8.2
Respiratory system diseases	6	8.2
Cardiovascular diseases	5	6.8
Others	12	16.5
Co-occupational illness		
No	36	49.3
Hearing loss	23	31.5
Musculoskeletal diseases	10	13.7
Asthma, COPD	4	5.5

*ILO: International Labour Organization

All 73 patients answered the questionnaire questions entirely, which revealed that although most of the patients with pneumoconiosis (48 patients / 65.8%) believed in the effect of vaccines in general, a substantial number were unconvinced (24 patients / 32.8%). There were still patients who had not heard of seasonal flu and pneumonia vaccines (6 patients/8.2% and 19 patients/26%, respectively). Another interesting point was that almost half of the patients heard about these vaccines via television or the internet (34 patients/46.6%). More than one-third of the patients said they often had the seasonal flu (28 patients/38.4%). After the diagnosis of pneumoconiosis, influenza and pneumonia vaccination rates were very low (14 patients/19.2% and 16 patients/21.9%, respectively). Some of the vaccinated patients may have received these vaccines due to other chronic diseases. The number of patients who had pneumonia even once in their lifetime was six (8.2%). We learned that a significant part of the patients did not know that influenza and pneumonia were transmitted by respiratory tract, and moreover, they did not know that pneumonia was a lung disease (27 patients/37% and 25 patients/34.2%, respectively). More than half of the patients did not know that pneumoconiosis increases the risk of pneumonia and may cause severe pneumonia (41 patients/56.2%). Most patients said that they did not know that pneumonia could cause sepsis and meningitis (57 patients/78.1%), and almost half did not realize that pneumonia could be fatal (32 patients/43.8%). It was observed that 43 patients (58.9%) did not have the information that pneumonia could be prevented with vaccines, and that 86.3% (63 patients) did not have the information that these vaccines are free for chronic lung diseases such as pneumoconiosis. Thirty-four patients (46.6%) said that they did not know that the seasonal flu vaccine should be repeated every year, and 55 patients (75.3%) did not know that the conjugate vaccine (PCV13) should be given only once in a lifetime. When we asked, “Why didn't you get a seasonal flu shot?”, the majority of the patients said they didn't care or they just got this information (83.5%). When asked, “Why haven't you been vaccinated against pneumonia?”, the answer “I just got this information” was the majority of the responses (39 patients/53.5%) (Table 3).

Table 3. Responses of the patients to the Questionnaire Information Form questions.

Questions	Number (N)	Percent (%)
Your general attitude towards vaccines?		
I believe in its effects	48	65.8
Don't believe its effects	1	1.4
I'm undecided	24	32.8
Have you heard of the seasonal flu (influenza) vaccine?		
Yes	67	91.8
No	6	8.2
Have you heard of the pneumonia (pneumococcal) vaccine?		
Yes	54	74
No	19	26
What channel did you hear about these vaccines?		
Occupational physician	4	5.5
Family doctor	12	16.4
Occupational diseases specialist	7	9.6
TV or internet	34	46.6
I researched myself	10	13.7
I did not hear	6	8.2
Do you often get influenza (every year)?		
Yes	28	38.4
No	45	61.6
Have you had the flu vaccine after the diagnosis of pneumoconiosis?		
Yes	14	19.2
No	59	80.8
Have you had pneumonia?		
Yes	6	8.2
No	67	91.8
Have you been vaccinated for pneumonia after the diagnosis of pneumoconiosis?		
Yes	16	21.9
No	57	78.1
Did you know that seasonal flu and pneumonia are transmitted through the respiratory tract?		
Yes	46	63
No	27	37
Did you know that pneumonia is a lung disease?		
Yes	48	65.8
No	25	34.2
Do you know that pneumoconiosis increases the risk of pneumonia and pneumonia is severe in pneumoconiosis?		
Yes	32	43.8
No	41	56.2
Did you know that pneumonia causes sepsis or meningitis?		
Yes	16	21.9
No	57	78.1
Did you know that pneumonia can be deadly?		
Yes	41	56.2
No	32	43.8
Did you know that pneumonia can be prevented with a vaccine?		
Yes	30	41.1
No	43	58.9
Do you know that these vaccines are free to you?		
Yes	10	13.7
No	63	86.3

Table 3 Continued...		
Did you know that the influenza vaccine should be given every year?		
Yes	39	53.4
No	34	46.6
*Did you know that the pneumonia vaccine should be given once in a lifetime?		
Yes	18	24.7
No	55	75.3
Why didn't you get the seasonal flu shot?		
I didn't care	32	43.8
I'm vaccinated	11	15.1
I just got this information	29	39.7
I feel healthy	1	1.4
Why didn't you get the pneumonia vaccine?		
I didn't care	16	21.9
I'm vaccinated	16	21.9
I just got this information	39	53.5
I feel health	2	2.7

*The most common vaccine in Türkiye is the conjugate vaccine (PCV13).

Most patients (42/57 patients) who were not vaccinated against pneumonia after being diagnosed with pneumoconiosis, were not aware that pneumonia could be prevented by vaccination ($p<0.001$). However, most of those who have been vaccinated said that they had this knowledge before (15/16 patients) (Table 4).

Table 4. The relationship between the knowledge that pneumonia can be prevented by vaccination and the status of being vaccinated.

		Did you know that pneumonia can be prevented with a vaccine?		
		No	Yes	Total
Have you been vaccinated for pneumonia after the diagnosis of pneumoconiosis?	No	42	15	57
	Yes	*1	15	16
	Total	43	30	73

Pearson's chi square, $p<0.001$, *Expected count > 5

DISCUSSION

We studied 73 patients with pneumoconiosis who were followed up by our department for six years. These patients had relatively low education, income and other socioeconomic status. They did not have sufficient information regarding influenza, pneumonia and their vaccines. Most of the patients did not know that these diseases are transmitted by respiratory tract, that pneumonia is a vaccine-preventable lung disease, that the vaccine is given free of charge in chronic diseases. The most important outcome was that only 19.2% of patients received influenza vaccine and 21.9% received pneumococcal vaccine after the diagnosis of pneumoconiosis. Clearly in this regard, both patients and health professionals have a great responsibility.

Pneumoconiosis is an incurable dust disease in the group of interstitial lung diseases with known cause. Silicon dioxide in exposed dust causes alveolar macrophage dysfunction. The disease is not limited to the involvement of the interstitial space, thanks to many risks such as the duration of exposure, the density of the dust and accompanying cigarette consumption. Functionally, obstructive airway disease, radiologically emphysema, bronchiectasis areas, dead spaces accompany the event. All this predisposes patients to influenza and pneumonia. Conversely, these diseases also contribute to the progression of pneumoconiosis [12,13].

There is evidence suggesting that infectious microbial agents such as viral (parainfluenza, adenovirus, cytomegalovirus), bacterial (Streptococcus pneumoniae, Haemophilus influenzae, mycobacterium) and fungi may play a role in pulmonary fibrosis. Although there are few studies detecting the presence of infectious agents in the induction and exacerbation of pulmonary fibrosis using animal models, there is insufficient data in the literature regarding the microbial induction of fibrosis in patients. Studies involving antimicrobials such as antivirals, antibiotics and antifungals show great promise for treating

pulmonary fibrosis and strengthen the relationship between microbial agents and fibrosis [14]. Known as the 2009 pandemic influenza A virus, H1N1 rapidly causes acute respiratory distress syndrome (ARDS) and bronchoalveolar pneumonia. Later, it causes pulmonary fibrosis by showing histological features including interstitial septal thickening, type II pneumonocyte hyperplasia, fibrosis and squamous metaplasia [15]. From this perspective, conclude that vaccines may be effective in preventing fibrosis and reducing the progression of pneumoconiosis.

Although regular influenza and pneumococcal vaccination is recommended for those with chronic diseases in high-risk groups to reduce mortality and morbidity, adequate vaccination has been achieved in only few high-risk individuals worldwide. The World Health Organization (WHO) reported that the influenza vaccination rate should be at least 75% in high-risk groups. While available data shows that the influenza vaccination rate in European countries is approximately 50.3%, this rate is lower in many Asian countries [16]. Influenza virus causes pneumonia and ARDS in the lung, both by itself and along with bacteria such as Staphylococcus aureus, Streptococcus pneumoniae, in active smokers with chronic lung disease [17]. Evidence suggests that co-administration of pneumococcal and influenza vaccines in chronic lung disease may prevent community-acquired pneumonia and acute exacerbations and even that administration of pneumococcal vaccine in the early stages of COPD, may help maintain stable health status of patients. Despite the need to prevent lung infections in those with chronic lung disease and the evidence for pneumococcal vaccine efficacy, vaccine coverage and awareness remains low [18]. In a study of 2 131 patients with chronic lung disease where most had asthma and COPD, the rate of active vaccination was 46.5% for influenza and 14.6% for pneumococcus. The main reason for the low influenza and pneumococcal vaccination rates of the patients was lack of information (53.5% and 87.6%, respectively) [19]. In a retrospective cohort study by Fekete et al., vaccination rates were 23.6% for influenza and 10.8% for pneumococci, with only 6% of patients receiving both vaccines. The vaccination rate was higher for severe forms of COPD in both vaccines. Only 28.4% of the patients were informed by their physicians about the necessity of vaccination due to their chronic disease. While 36% of the patients thought that vaccination against influenza was beneficial, 26% thought that the pneumococcal vaccine was beneficial. According to 31.2% of patients, influenza virus causes only mild illness and 54% have never heard of pneumococcal bacteria [20].

We could not find many sources in the literature related to pneumonia-related mortality rates in patients with pneumoconiosis, which was the reason we mostly referred to other chronic lung diseases. Studies related to pneumonia mortality are generally all-cause epidemiological studies. Generally, decreased pulmonary function, radiographically high-grade profusion or large opacities, tuberculosis and smoking are risk factors leading to death in patients with pneumoconiosis. In the study by Jo et al., 82 pneumoconiosis patients were divided into two groups, as deceased and survivor, and they found that the deceased group had more previous pneumonia history, higher interstitial fibrosis status and longer hospital stay [21].

Study Limitation: The main limitation of our study was that it was cross-sectional. It would be useful to follow-up on patients after a period, perhaps three or six months, to see how many have been vaccinated and see how much their knowledge level has changed.

Conclusion:

In conclusion, pneumoconiosis is an incurable, irreversible chronic lung disease with interstitial involvement. As the disease progresses, massive pulmonary fibrosis occurs. The main treatment for the disease is to stay away from dust, smoking and comply with the pulmonary rehabilitation program. It is imperative to protect patients against tuberculosis and infectious pneumonia. Therefore, screening for latent tuberculosis and vaccinations such as influenza and pneumococcus should be performed. Unfortunately, pneumoconiosis, like other comorbid conditions (asthma, COPD, diabetes mellitus, patients greater than 65), does not receive enough attention in terms of vaccination. When we searched the literature, we did not find many studies directly related to

this subject. With the coronavirus (COVID-19) pandemic, we have once again witnessed how dangerous infections targeting the lungs are. As a result of this study, we observed that patients with pneumoconiosis need regular education about influenza and pneumonia. At the same time, it is necessary to constantly encourage patients to be vaccinated.

Conflict of Interest: The authors declare no conflict of interest related to this article.

Funding sources: The authors declare that this study has received no financial support.

Ethics Committee Approval: This study was approved by the Ege University Rectorate Faculty of Medicine Dean's Medical Research Ethics Committee (Approval Decision: 21-12.1T/18; Date: 20.12.2021).

ORCID and Author contribution: **Y.S.H. (0000-0001-6514-6789):** Concept and Design, Data collection, Literature search, Analysis and Interpretation, Manuscript Writing, Critical Review. **M.T. (0000-0002-1288-7097):** Concept and Design, Analysis and Interpretation, Manuscript Writing, Critical Review. **E.E. (0000-0002-7983-9217):** Concept and Design, Data collection, Literature search.

Peer-review: Externally peer reviewed.

Acknowledgement: No acknowledgement

Note: Availability of Data and Material: The Questionnaire form used and or analyzed during the current study are available from the corresponding author on reasonable request.

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