



Awareness about Pulmonary Rehabilitation during COVID-19 Pandemics

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Abstract

Introduction: Given the significant likelihood of respiratory, physical, and psychological impairment during Covid-19, a large percentage of patients should be referred to a rehabilitation program. Even among patients with chronic respiratory disorders, awareness of pulmonary rehabilitation is limited. We believe that during the pandemic, people's knowledge of pulmonary rehabilitation grew. The purpose of this study is to determine patient awareness of pulmonary rehabilitation and provide information about pulmonary rehabilitation.

Methods: Outpatients from the Physical Medicine and Rehabilitation clinic who agreed to participate were included in the study. The patients were divided into two groups: those previously infected with Covid-19 and those who were not. Multiple choice questions were used to assess knowledge of specific topics about pulmonary rehabilitation. Both groups' pulmonary rehabilitation awareness was assessed and compared. Patients who had a past infection with Covid-19 were also asked additional questions about the course of the disease. The patients who requested to learn more were informed about pulmonary rehabilitation.

Results: Considering the total of patients participating in the study in terms of pulmonary rehabilitation awareness, 66.8% of the patients had an average awareness level. In terms of awareness levels, there was no statistically significant difference between the two groups.

Discussion and Conclusion: Awareness allows patients to develop stronger self-management abilities, which helps to reduce the severity of the disease, avoid hospitalizations, and enhance health-related quality of life. As a result, patients' awareness of the benefits of pulmonary rehabilitation should be raised.

Keywords: Covid-19; Pandemia; Pulmonary Rehabilitation.

SARS-CoV-2 is a novel coronavirus that infects humans and was recognized as Covid-19 by the World Health Organization (WHO) on February 11, 2020. In humans, this new coronavirus is frequently linked to a mild to severe respiratory illness. It causes an acute and fatal illness with a mortality rate of 2%^[1-4].

Dry cough, fever, and dyspnea are the most prevalent clinical symptoms of Covid-19 in the majority of patients.

Other symptoms include a sore throat, headache, myalgia, fatigue, and diarrhea in some patients^[5,6].

Covid-19 is a highly contagious respiratory tract disease that can cause respiratory, physical, and psychological problems in patients. As a result, pulmonary rehabilitation is essential for both admitted and discharged Covid-19 patients^[7].

The American Thoracic Society European Respiratory Society defines pulmonary rehabilitation as a thorough

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treatment based on a thorough patient assessment followed by patient-tailored therapies such as exercise training, education, and behavior change, all aimed at improving the physical condition of people with respiratory disease^[8].

In Covid-19, the goal of pulmonary rehabilitation is to alleviate dyspnea symptoms, lessen anxiety, reduce complications, minimize impairment, maintain function, and improve quality of life. When appropriate and safe, pulmonary rehabilitation should be undertaken during the acute management of Covid-19, and may involve nutrition, postural control training, airway clearing techniques, oxygen supplementation, breathing exercises, stretching, manual therapy, and physical activity^[9].

Patients must comprehend their illness and therapy in order to be more engaged in self-management programs and to use action plans effectively. As a result, hospitalization is avoided and health-related quality of life is improved^[10,11].

Even among patients with chronic respiratory disorders, awareness of pulmonary rehabilitation is limited. We believe that during the pandemic, people's knowledge of pulmonary rehabilitation grew. The current study aims to assess the awareness amongst patients about pulmonary rehabilitation.

Materials and Methods

Approval was obtained from the Institutional Ethics Committee (Ethics Committee date/approval number: 18.01.2021/HNEAH-KAEK 2021/20). The study was conducted in accordance with the principles outlined in the Helsinki Declaration. Outpatients from the Physical Medicine and Rehabilitation clinic who agreed to participate were included in the study. The patients were divided into two groups: those previously infected with Covid-19 and those who were not. To prevent the spread of infection during the pandemic, the questionnaire was not given to the patients. Instead, all the questions were asked by a doctor and marked in the questionnaire.

The demographic characteristics of the patients were recorded. The chronic illnesses and the medications were thoroughly evaluated. The status of exercising regularly in daily life, the types of exercises, eating habits, nutritional supplementations, and their smoking-alcohol usage were all investigated.

Patients who had previously had a Covid-19 infection were also asked additional questions about the disease course (symptoms, hospitalization requirement, lung involvement, oxygen need) and the presence of remaining complaints following infection.

Multiple choice questions were used to assess knowledge of specific topics about pulmonary rehabilitation. These questions were composed from the knowledge about physical exercises, breathing exercises, relaxation techniques, positioning, and secretion removal techniques. The patients were asked to respond with a yes, no, or don't know response to each statement. To prevent forcing the patient to guess the answer, the 'don't know' option was provided. A total of 9 questions were included about the awareness of pulmonary rehabilitation. If 33% of the replies in the completed questionnaire were correct, the magnitude of awareness was determined to be "below average." While 33-66% of correct replies were deemed "normal," and >66% were deemed "above average"^[12]. Pulmonary rehabilitation awareness level was compared between the two groups: those previously infected with Covid-19 and those who were not.

Patients were asked if they had previously been informed about pulmonary rehabilitation and if they wanted to be informed about it. A brochure on pulmonary rehabilitation was also given to patients who wanted to receive further information.

Statistical Analysis

Statistical analyses were performed with the IBM SPSS (Statistics Package for Social Sciences for Windows, Version 21.0, Armonk, NY, IBM Corp.) package program. The Kolmogorov-Smirnov and Shapiro-Wilks tests were used to determine whether the variables were suitable for a normal distribution. While evaluating the study data, Student's t-test was used for the comparison of normally distributed variables between two groups, in addition to descriptive statistical methods (mean, standard deviation, frequency) in comparison of quantitative data. To compare qualitative data, the Pearson Chi-square test, Fisher's Exact Chi-square test, Fisher-Freeman-Halton Exact Chi-square test, and Continuity (Yates) Correction were utilized. Bonferroni post hoc correction method was used for multiple comparisons between groups. Data were considered statistically significant if $p < 0.05$.

Results

The study enlisted the participation of 292 patients. 185 of them had never had Covid-19 before, whereas 107 had the disease. A total of 224 female patients (76.7%) and 68 male patients (23.3%) participated in this study. The mean age of the patients was 46.44 ± 12.77 . In terms of general demographic variables, there was no significant difference between the groups ($p = 0.24$) (Table 1). The group who had Covid-19 previously was dubbed the Covid-19 group,

Table 1. Demographic characteristics of patients

	Infected with COVID-19 infection previously				p
	Yes		No		
	n	%	n	%	
Age (mean±SD) (years)	45.29±11.94		47.10±13.22		¹ 0.244
Gender					
Female	88	82.2	136	73.5	² 0.120
Male	19	17.8	49	26.5	
BMI (mean±SD) (kg/m ²)	28.46±5.75		27.15±4.83		¹ 0.039*
Education					
Literate and below	4	3.7	4	2.1	³ 0.125
Elementary School	51	47.6	64	34.6	
Middle School	8	7.4	18	9.7	
High School	24	35.3	44	23.8	
University or above	20	22.4	55	29.7	
Smoking status					
Yes	14	13	57	30.8	² 0.001*
No	93	87	128	69.2	
Chronic disease					
Yes	64	59.8	91	49.2	³ 0.080
No	43	40.2	94	50.8	

*p<0.05. ¹: Student t test; ²: Continuity (yates) correction; ³: Chi-square test. BMI: Body mass index; SD: Standard deviation.

Table 2. Evaluation of the disease process and post-COVID-19 symptoms of patients who have had COVID-19 infection

	n	%		n	%
Hospitalization			Post-covid symptom		
Yes	12	11.2	Yes	54	50.5
No	95	8.8	No	53	49.5
Disease course			Remaining symptoms (n=54)		
Asymptomatic	5	4.7	Get tired quickly	29	53.7
Mild	39	36.4	Difficulty using stairs	17	31.5
Moderate	37	34.6	Dorsalgia	10	18.5
Severe	18	16.8	Shortening in walking distance	9	16.7
Extremely severe	8	7.5	Lassitude	7	13.0
ICU hospitalization			Shortness of Breath	5	9.3
Yes	0	0	Loss of smell	4	7.4
Lung Involvement			Forgetfulness	4	7.4
Yes	20	18.7	Panic Attack	3	5.6
No	41	38.3	Muscle Pain	3	5.6
Don't know	46	43	Shoulder pain	2	3.7
Oxygen Demand			Loss of taste	2	3.7
Yes	13	12.1	Chest pain	2	3.7
No	92	86	Other symptoms	7	13
Don't know	2	1.9			

ICU: Intensive care unit.

Table 3. Awareness of groups about 'pulmonary rehabilitation' during pandemic

	COVID-19 infection				p1	p2
	Yes		No			
	n	%	n	%		
Is COVID 19 a treatable disease?						
Yes	49	45.8 [†]	118	63.8 [†]	0.011*	0.017
No	19	17.8	22	11.9		0.987
Don't know	39	36.4	45	24.3		0.165
Is medication the only treatment used in COVID-19?						
Yes	39	36.4	67	36.2	0.338*	1.000
No	37	34.6	51	27.6		1.000
Don't know	31	29.0	67	36.2		1.000
Do all exercises increases the covid-19 symptoms?						
Yes	17	15.9	27	14.6		1.000
No	66	61.7	100	54.1	0.26*	1.000
Don't know	24	22.4	58	31.4		0.613
Do you know breathing exercises?						
Yes	22	20.6	35	18.9		1.000
No	82	76.6	117	63.2	0.001*	0.108
Don't know	3	2.8 [†]	33	17.8 [†]		0.001
Do you know relaxation techniques?						
Yes	10	9.3	19	10.3		1.000
No	53	49.5	102	55.1	0.538*	1.000
Don't know	44	41.1	64	34.6		1.000
Do position adjustments relieves breathlessness?						
Yes	77	72.0	144	77.8		1.000
No	15	14.0 [†]	8	4.3 [†]	0.011*	0.018
Don't know	15	14.0	33	17.8		1.000
Do position adjustments help to cough out?						
Yes	66	61.7	112	60.5		1.000
No	17	15.9	21	11.4	0.382*	1.000
Don't know	24	22.4	52	28.1		1.000
Do you know secretion removal techniques?						
Yes	9	8.4	16	8.6		1.000
No	59	55.1	90	48.6	0.543*	1.000
Don't know	39	36.4	79	42.7		1.000
Do you think smoking causes serious disease in COVID-19?						
Yes	95	88.8	169	91.4		1.000
No	7	6.5	9	4.9	0.742**	1.000
Don't know	5	4.7	7	3.8		1.000

Stats: n (%), p*: Pearson Chi-Squared Test; p**: Fisher's Exact Test; p1: inter-group comparison; p2: inter-group comparison on the basis of answers.

whereas the group without it was dubbed the healthy group.

In terms of the rate of chronic disease, there was no statistical difference between the two groups ($p=0.08$). Also, we could not find a statistically significant difference when we divided chronic diseases as pulmonary disease, rheumatologic diseases, neurologic diseases, psychiatric disease, and metabolic disorders like thyroid disease and

diabetes mellitus ($p>0.05$) (Table 1).

A total of 38% of the patients stated that they took nutritional supplements during the pandemic. Among the nutritional supports, the most preferred one was vitamin D (56.8%), but there were respectively vitamin C (31.5%), multivitamin (18%), a variety of herbal products (18%) and vitamin B12 (17.1%). 92.8% of the patients were using

nutritional support on their own decision without the doctor's recommendation. The rate of receiving vitamin B12 supplementation was statistically significantly higher in the group who had previously had Covid-19 infection (30%), compared to those who did not have Covid-19 infection (9.9%) ($p=0.015$). There is no statistically significant difference between the rates of using other nutritional support between people who have and haven't had Covid-19 infections.

Patients who have had a past infection with Covid-19 exercise at a rate of 24.3%, which is statistically considerably lower than patients who have not had the infection (36.8%) ($p=0.028$).

In the Covid-19 group, the 10 most common symptoms in in-group assessments were muscle pain, fatigue, weight loss, taste loss, cough, fever, dyspnea, headache, back pain, and nausea. The course of disease and post-Covid-19 symptoms were summarized in Table 2.

Considering the total of patients participating in the study in terms of pulmonary rehabilitation awareness, 21.2% of the patients had below-average awareness level, 66.8% of the patients had an average awareness level and 12% of the patients had above-average awareness level. There was no difference between the two groups in terms of awareness level (Table 3).

When the pulmonary rehabilitation components were evaluated one by one on a question basis, there is no difference between both groups except for a few questions. These questions were whether the disease was treatable, the knowledge of breathing exercises, and the effect of positioning on dyspnea. Patients who have had Covid-19 were more likely to believe it was a treatable disease ($p=0.017$). Those who gave the answer "I don't know" to the question "Do you know breathing exercises" were significantly higher in the group of those who did not have Covid-19 ($p=0.001$). On the other hand, the percentage of people in the Covid-19 group who stated that changing their position to sit or lie down might not help their dyspnea was noticeably higher ($p=0.018$) (Table 3).

The percentage of people who reported they got information about pulmonary rehabilitation was low (12%) and the number of people who requested to learn more about pulmonary rehabilitation was high (76.7%). There was no statistically significant difference between groups in terms of both questions ($p=0.903$, $p=0.065$).

Discussion

The majority of patients with Covid-19 present with mild-to-moderate symptoms and recover spontaneously.

About 30% of the patients develop dyspnea, and these patients who develop hypoxemia and pneumonia generally require hospitalization^[13].

Besides the respiratory tract, other system involvement can also be seen in Covid-19. Neurological involvement may cause physical and cognitive impairment. Inadequate food intake may occur in individuals with gastrointestinal involvement due to symptoms such as nausea, vomiting, and diarrhea. As a result, excessive inflammation, immobility, and malnutrition can cause sarcopenia^[14].

Therefore, pulmonary rehabilitation is crucial in the follow-up and treatment of Covid-19. In the studies with COPD patients, it is seen that patients' disease awareness may be enhanced with education and it allows patients to develop stronger self-management abilities. The end result becomes a reduction in the severity of the disease, a decline in hospitalizations, and an enhancement in health-related quality of life^[11,15]. Since Covid-19 is a disease transmitted through droplets, the management of the pulmonary rehabilitation process differs from other diseases, and the patient takes charge in the rehabilitation program more effectively. In other words, the knowledge of the patients in this area is very important. In this study, awareness of pulmonary rehabilitation associated with Covid-19 was evaluated, and general awareness was found at an average level in 66.8% of the patients. While the awareness of 21.2% of the patients was below average, 12% have also been shown to have above-average awareness.

There are many studies in the literature on general awareness of Covid-19. However, the questionnaires in these studies are about the general characteristics of the disease such as symptoms, transmission routes, ways of prevention, disease course, treatment approaches, and the awareness rates on these issues are well above the rates in this study^[16-23].

In a meta-analysis on Covid-19 knowledge-attitude-practice, it was shown that 75% of patients answered questions about symptoms, transmission route, individuals at risk, incubation and isolation times, virus fatality, treatment, and prevention methods^[24].

A survey was also conducted in Türkiye with 1070 patients in 2020, showing that the rate of correct answers to the questions regarding the general awareness of Covid-19 varied between 72.9%-96.4%. The questions with low correct response rates are mostly related to Covid-19 treatment and vaccination^[25].

Due to factors such as the prevalence of Covid-19 all over the world, the rapid increase in the number of patients, the declaration of a pandemic by the WHO, and the higher

incidence of fatalities in the early period of the disease, the information on the subjects mentioned in these studies has become easily accessible everywhere and even started to appear in daily media frequently. Taking into consideration this situation, the results in Covid-19 awareness studies are quite predictable. However, when the treatment methods, especially a specific area such as pulmonary rehabilitation, are in question, it is not extraordinary to see lower awareness rates.

Thus, similar to this study, in a study conducted with 282 patients with chronic obstructive pulmonary disease, the disease awareness rate was 47.84%, while pulmonary rehabilitation awareness was only 25.14%^[12].

In this study, contrary to expectations in terms of pulmonary rehabilitation awareness, no difference was found between those who had Covid-19 and those who did not. This situation may be related to the course of the disease in the individuals participating in the study who had Covid-19. Because although the symptoms of dyspnea were detected in 25.2% of these patients, 75.7% of the patients had the disease asymptomatic or with mild-moderate symptoms. Only 18.7% of the patients had lung involvement, 11.2% of the patients required inpatient treatment, 12.1% of the patients needed oxygen supplementation, and there were no patients requiring intensive care follow-up. Therefore, the need for pulmonary rehabilitation may have been limited in this patient group, most of whom had mild disease and did not experience dyspnea. Even so, more than half of the individuals who had Covid-19 reported that they had ongoing complaints after the disease. Considering that complaints related to the respiratory system such as rapid fatigue, difficulty in using stairs, back pain, shortened walking distance, dyspnea, chest pain, sweating, and expectoration are frequently reported, the rate of seeking and acquiring information related to pulmonary rehabilitation is expected to be higher in this group.

Less likely, the second reason for this finding may be the higher rate of smoking in the Covid-19-free group. Individuals who have a smoking habit may have done more research on this issue and learned more about pulmonary rehabilitation, worrying that the disease progress may be more severe if they have Covid-19 disease. A possible third reason for this situation may be the prevalence of the disease. The news that enlightens the society about the Covid-19 disease and its treatment, starting from 2020, has appeared frequently both in the press and in social media. This news may have informed

the society about pulmonary rehabilitation even if they did not get Covid-19 disease.

It is possible to classify the methods that can be applied within the scope of pulmonary rehabilitation as respiratory support and active mobilization incentive strategies. Respiratory support should include positions to reduce dyspnea, relaxation, breathing and airway clearance techniques besides respiratory muscle strength training. Active mobilization recommendations vary according to the severity and stage of the disease, but in-bed mobility exercises, active-assist/active range of motion exercises for upper and lower extremities, activities of daily living training, transfer training, pre-walk exercises, and ambulation training may be included^[14,26-28].

As with the whole world, Covid-19 pulmonary rehabilitation guides for physicians have been published by relevant associations in our country. In fact, detailed brochures with the headings 'Covid-19 home exercise recommendations', 'Covid-19 stay physically active', 'Covid-19 exercise sheet', and 'Rehabilitation and self-management after Covid-19 related illness' prepared for patients have also been published by the rehabilitation association^[14,27-29].

However, although 57.2% of the patients in this study thought that Covid-19 is a treatable disease, the answer to the question of whether the only treatment method is medication was yes in 36.3% of the patients, no in 30.1% of the patients, and don't know in 33.6% of the patients. This result shows that at least 69.9% of the patients do not consider pulmonary rehabilitation among the treatment options in this field. While it is seen that the patient's awareness about the respiratory support part of pulmonary rehabilitation such as breathing, relaxation, or airway cleaning techniques is quite limited, they have higher rates of awareness about body positions that reduce dyspnea or facilitate coughing. The difference in the question about the effect of positioning on dyspnea is unexpected, but it is probably related to the mild course of the disease in the individuals participating in the study. Regarding active mobilization, most of the patients (56.8%) are aware that all physical exercises will not increase dyspnea. When these findings are evaluated, it is seen that the efforts to inform the society about pulmonary rehabilitation in Covid-19 patients are insufficient, especially for the more specific respiratory support part. Considering that the education level in the study is at secondary school or below for nearly half of the patients (46.4%), and that these people's internet use would be more limited, it can be understood that the brochures published only on the

internet and on the websites of rehabilitation associations are difficult to reach. As a matter of fact, only 12% of the patients stated that they have received information about pulmonary rehabilitation. It is obvious that briefing in this field should be shared in communication areas where it can be delivered to large masses.

All patients are recommended to quit smoking within the scope of pulmonary rehabilitation^[14,27]. 90.4% of our patients think that Covid-19 will have a more severe course in smokers. While the rate of smoking was 24.3% as a result of the survey, this rate was significantly lower in the Covid-19 group. However, since the relationship between smoking cessation and Covid-19 was not questioned in the questionnaire, it is not possible to comment on this subject, which is one of the important limitations of the study.

Dietary habits, which are an important parameter that can affect the patient's mobilization and muscle mass, should also be considered in pulmonary rehabilitation. In general, it is recommended to follow a diet rich in mainly fresh fruits and vegetables, whole grains, low-fat dairy products, and healthy fats, and to limit the intake of sugary drinks and processed foods high in calories and salt^[30].

Although the data on nutritional supplements are controversial, various vitamin and mineral supplements are recommended to support the immune system, especially in the elderly and those with systemic diseases^[31,32].

In our patients, the use of vitamin D, vitamin C, and vitamin B12, which are among the most popular recommendations, is seen at very high rates. What is interesting is that 92.8% of individuals use this supplementation without a doctor's recommendation. This result again reveals the inadequacy of patient information. Nutritional characteristics such as daily energy or protein intake, which may affect pulmonary rehabilitation practices, were not evaluated in the questionnaire. This is another limitation of the study.

This study is valuable in that it is the first study to evaluate awareness of pulmonary rehabilitation practices in Covid-19. The small number of individuals included, the fact that they are mostly women, and individuals who have had Covid-19 generally have a mild illness may call into doubt in terms of reflecting the general public awareness with these results. However, the fact that a homogeneous population based on the education level of patients is also among the strengths of the study. In addition, the lack of difference between the two groups in terms of all these demographic characteristics made it possible to compare individuals who had Covid-19 with those who did not objectively. It seems possible to develop new strategies

to increase the awareness of society about Covid-19 and pulmonary rehabilitation with further studies designed considering these limitations.

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References

1. Chan JF, Yuan S, Kok KH, To KK, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: A study of a family cluster. *Lancet* 2020;395:514–23. [\[CrossRef\]](#)
2. Perlman S. Another decade, Another coronavirus. *N Engl J Med* 2020;382:760–2. [\[CrossRef\]](#)
3. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med* 2020;382:727–33. [\[CrossRef\]](#)
4. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;395:497–506. [\[CrossRef\]](#)
5. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. *Lancet* 2020;395:507–13. [\[CrossRef\]](#)
6. Hui DS, I Azhar E, Madani TA, Ntoumi F, Kock R, Dar O, et al. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health - The latest 2019 novel coronavirus outbreak in Wuhan, China. *Int J Infect Dis* 2020;91:264–6. [\[CrossRef\]](#)
7. Yang LL, Yang T. Pulmonary rehabilitation for patients with coronavirus disease 2019 (COVID-19). *Chronic Dis Transl Med* 2020;6:79–86. [\[CrossRef\]](#)
8. Spruit MA, Singh SJ, Garvey C, ZuWallack R, Nici L, Rochester C, et al. An official American Thoracic Society/European Respiratory Society statement: Key concepts and advances in pulmonary rehabilitation. *Am J Respir Crit Care Med* 2013;188:e13–64.
9. Zhao HM, Xie YX, Wang C. Recommendations for respiratory rehabilitation in adults with coronavirus disease 2019. *Chin Med J (Engl)* 2020;133:1595–602. [\[CrossRef\]](#)
10. Omachi TA, Katz PP, Yelin EH, Iribarren C, Knight SJ, Blanc PD, et al. The COPD helplessness index: A new tool to measure factors

- affecting patient self-management. *Chest* 2010;137:823–30.
11. Effing T, Monninkhof EM, van der Valk PD, van der Palen J, van Herwaarden CL, Partidge MR, et al. Self-management education for patients with chronic obstructive pulmonary disease. *Cochrane Database Syst Rev* 2007;CD002990. [CrossRef]
 12. Thakrar R, Alaparathi GK, Kumar SK, Vaishali K, Zulfeequer CP, Aanad R. Awareness in patients with COPD about the disease and pulmonary rehabilitation: A survey. *Lung India* 2014;31:134–8. [CrossRef]
 13. Salian VS, Wright JA, Vedell PT, Nair S, Li C, Kandimalla M, et al. COVID-19 transmission, current treatment, and future therapeutic strategies. *Mol Pharm* 2021;18:754–71. [CrossRef]
 14. Bargı G, Candemir Çaylı İ, Yılmaz Durmaz D, Durutürk N, Ercan ŞN, Ergün P, et al. Covid-19 pandemi sürecinde pulmoner rehabilitasyon türk toraks derneği uzlaşısı raporu. Available at: https://www.toraks.org.tr/site/sf/books/2021/05/d6de4362e66f0d0ccdf533b062d808bb_2b2b25f5b01b0f853ab5b305a88c0c67.pdf. [Article in Turkish] Accessed Mar 16, 2024.
 15. Hernandez P, Balter M, Bourbeau J, Hodder R. Living with chronic obstructive pulmonary disease: A survey of patients' knowledge and attitudes. *Respir Med* 2009;103:1004–12. [CrossRef]
 16. Liem A, Wang C, Dong C, Lam AIF, Latkin CA, Hall BJ. Knowledge and awareness of COVID-19 among Indonesian migrant workers in the Greater China Region. *Public Health* 2021;197:28–35. [CrossRef]
 17. Kanellopoulou A, Koskeridis F, Markozannes G, Bouras E, Soutziou C, Chaliasos K, et al. Awareness, knowledge and trust in the Greek authorities towards COVID-19 pandemic: Results from the Epirus Health Study cohort. *BMC Public Health* 2021;21:1125. [CrossRef]
 18. Siddiqui AA, Alshammary F, Amin J, Rathore HA, Hassan I, Ilyas M, et al. Knowledge and practice regarding prevention of COVID-19 among the Saudi Arabian population. *Work* 2020;66:767–75. [CrossRef]
 19. Jahan A, Mohamed M, Alabani E, Amaziq A, Elarriesh, Alagelli F, et al. Awareness, knowledge, attitudes, and behaviors related to COVID-19 in Libya: A nation-wide online survey. *Pan Afr Med J* 2021;40:156.
 20. Teo CL, Chee ML, Koh KH, Tseng RMWW, Majithia S, Thakur S, et al. COVID-19 awareness, knowledge and perception towards digital health in an urban multi-ethnic Asian population. *Sci Rep* 2021;11:10795. [CrossRef]
 21. Zhong BL, Luo W, Li HM, Zang QQ, Liu XG, Li WT, et al. Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: A quick online cross-sectional survey. *Int J Biol Sci* 2020;16:1745–52. [CrossRef]
 22. Saeed BQ, Elbarazi I, Barakat M, Adrees AO, Fahady KS. COVID-19 health awareness among the United Arab Emirates population. *PLoS One* 2021;16:e0255408. [CrossRef]
 23. Bazaid AS, Aldarhami A, Binsaleh NK, Sherwani S, Althomali OW. Knowledge and practice of personal protective measures during the COVID-19 pandemic: A cross-sectional study in Saudi Arabia. *PLoS One* 2020;15:e0243695. [CrossRef]
 24. Siddiquea BN, Shetty A, Bhattacharya O, Afroz A, Billah B. Global epidemiology of COVID-19 knowledge, attitude and practice: A systematic review and meta-analysis. *BMJ Open* 2021;11:e051447. [CrossRef]
 25. Ayhan Başer D, Çevik M, Gümüştakim Ş, Başara E. Assessment of individuals' attitude, knowledge and anxiety towards COVID-19 at the first period of the outbreak in Turkey: A web-based cross-sectional survey. *Int J Clin Pract* 2020;74:e13622. [CrossRef]
 26. Felten-Barentsz KM, van Oorsouw R, Klooster E, Koenders N, Driehuis F, Hulzebos E, et al. Recommendations for hospital-based physical therapists managing patients with COVID-19. *Phys Ther* 2020;100:1444–57. [CrossRef]
 27. Türkiye fiziksel tıp ve rehabilitasyon uzman hekimleri derneği ve türkiye fiziksel tıp ve rehabilitasyon derneği adına, türkiye fiziksel tıp ve rehabilitasyon uzman hekimleri derneği. kardiyopulmoner rehabilitasyon çalışma grubu. SARS-COV-2 (covid-19) Sonrası pulmoner rehabilitasyon prensipleri: Akut ve subakut sürecin yönetimi için rehber. Available at: <https://www.tftr.org.tr/covid19/files/doc01.pdf>. Accessed Mar 16, 2024.
 28. Kurtaiş Aytür Y, Füsün Köseoğlu B, Özyemişi Taşkıran Ö, Kutay Ordu Gökkaya N, Ünsal Delialioğlu S, Sonel Tur B, et al. Pulmonary rehabilitation principles in SARS-COV-2 infection (COVID-19): The revised guideline for the acute, subacute, and post-COVID-19 rehabilitation. *Turk J Phys Med Rehabil* 2021;67:129–45. [CrossRef]
 29. Kurtaiş Aytür Y, Köseoğlu BF, Özyemişi Taşkıran Ö, Ordu-Gökkaya NK, Ünsal Delialioğlu S, Sonel Tur B, et al. Pulmonary rehabilitation principles in SARS-COV-2 infection (COVID-19): A guideline for the acute and subacute rehabilitation. *Turk J Phys Med Rehabil* 2020;66:104–20. [CrossRef]
 30. de Faria Coelho-Ravagnani C, Corgosinho FC, Sanches FFZ, Prado CMM, Laviano A, Mota JF. Dietary recommendations during the COVID-19 pandemic. *Nutr Rev* 2021;79:382–93. [CrossRef]
 31. Shakoor H, Feehan J, Al Dhaheri AS, Ali HI, Platat C, Ismail LC, et al. Immune-boosting role of vitamins D, C, E, zinc, selenium and omega-3 fatty acids: Could they help against COVID-19? *Maturitas* 2021;143:1–9. [CrossRef]
 32. Tan CW, Ho LP, Kalimuddin S, Cherng BPZ, Teh YE, Thien SY, et al. Cohort study to evaluate the effect of vitamin D, magnesium, and vitamin B12 in combination on progression to severe outcomes in older patients with coronavirus (COVID-19). *Nutrition* 2020;79-80:111017. [CrossRef]