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Effects of the COVID-19 Pandemic on Patients with Tuberculosis

Sonay Gökçeoğlu,[1] Emine Beyaz[2]

[1]Sanliurfa Provice Health Directorate, Sanliurfa, Türkiye
[2]Department of Nursing, Mus Alparslan University, Health Sciences Faculty, Mus, Türkiye

ABSTRACT

Objective: People with tuberculosis (TB) are highly vulnerable to the coronavirus pandemic due to pre-existing lung damage, leading to a higher risk of complications from Coronavirus Disease 2019 (COVID-19). This study aims to examine the effects of the COVID-19 pandemic on patients with tuberculosis.

Materials and Methods: A descriptive study was conducted with 101 TB patients between January and October 2021. Data analysis was performed using descriptive statistics (numbers, percentages), Fisher's Exact Test, Pearson's Chi-Squared Test, and multiple logistic regression.

Results: Among the TB patients, 42.6% were negatively affected during the pandemic, while 57.4% were not affected. A total of 43.6% of patients received all COVID-19 vaccines. Factors including education level above primary school (65.9%), income level equal to or higher than expenses (71.4%), mask usage (61.5%), and a history of relapse or returning from treatment (100.0%) were significantly impacted by the pandemic. Logistic regression analysis revealed that mask usage increased the likelihood of being adversely affected by 3.0 times, while having an income equal to or greater than expenditures increased it by 4.5 times ($p<0.05$).

Conclusion: With the positive influence of education, the demand for hospital and health services access increased among tuberculosis patients who experienced an improvement in their economic situation. However, even those who regularly used masks made mistakes in their usage. Consequently, these groups have been adversely affected during the COVID-19 pandemic.

Keywords: COVID-19, epidemiology, health care, pandemics, tuberculosis.

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Address for correspondence:
Sonay Gökçeoğlu.
Sanliurfa Provice Health Directorate, Sanliurfa, Türkiye
Phone: +90 414 318 70 00
E-mail:
sonay.gokceoglu@gmail.com

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INTRODUCTION

The Coronavirus Disease 2019 (COVID-19) is a respiratory illness caused by the Severe Acute Respiratory System Coronavirus 2, a novel coronavirus that spread rapidly due to its high contagiousness, leading to a global crisis.[1] The severe clinical manifestations of the disease have resulted in many deaths. Worldwide, more than 500,000 people died from COVID-19 in the first six months of the pandemic.[2] Countries had to impose restrictions to reduce the damage caused by the pandemic, which led to anxiety, fear about the future, economic catastrophes, and, most significantly, a global health crisis.[3] The health systems of various countries have struggled with the heavy burden brought by the virus. Access to health services has become a significant challenge for many people,

with some unable to receive any healthcare. Patients with acute and chronic diseases other than COVID-19 have been hesitant to visit hospitals due to concerns about crowding and the risk of transmission. Consequently, hospital admissions for medical conditions other than COVID-19 decreased rapidly during the pandemic. This situation particularly impacted patients with respiratory diseases, with those suffering from tuberculosis (TB) being the most affected.[4,5]

Although TB presents a mortality risk, it is preventable and treatable. Effective TB control programmes can significantly manage the disease. The United Nations' Sustainable Development Goals aim to eradicate TB by the end of 2030. In a similar vein, the World Health Organization (WHO) has set a target to reduce TB incidence and death rates by 95%, aspiring for the disease's eradication by 2035. However, the COVID-19 pandemic has negatively impacted TB control programmes, hindering the achievement of these goals.[6] The lung damage caused by COVID-19 infection increases the risk of death among patients with TB, making them more vulnerable to the development of complications. Approximately 1.2 million deaths due to TB occur annually.[7] The WHO estimates that the number of deaths due to TB will increase between 2020 and 2025, owing to the pandemic.[8] Countries have faced challenges in managing TB cases during the pandemic. As of 2020, the numbers of new TB cases detected in many countries have decreased for several potential reasons. Many patients have avoided hospital visits due to the pandemic; additionally, compliance with social distancing and mask use may have prevented TB transmission, thereby reducing case numbers. Apart from new diagnoses, health services may have experienced difficulties with TB treatment and follow-up.[1,9]

This study was conducted to examine how patients with TB in a Şanlıurfa, Türkiye were affected by the COVID-19 pandemic in terms of TB diagnosis, treatment, and follow-up.

MATERIALS AND METHODS

Study Design

This descriptive study was conducted between January and October 2021 in all tuberculosis dispensaries in Şanlıurfa. During the study period, 110 patients were followed up in all dispensaries. Nine TB patients refused to participate in the study. The aim was to record all 110 tuberculosis patients followed in dispensaries; however, the study was conducted with 101 patients who agreed to participate. No sample was selected for the study, and no exclusion criteria were applied.

Data Collection

Data were collected through telephone interviews conducted by a single researcher using a structured questionnaire, and from dispensary records. Patients were asked about their sociodemographic characteristics, TB diagnosis, treatment, and follow-up, as well as whether they were negatively affected by the pandemic. A translator was used for individuals who did not speak Turkish.

Ethical Concerns

The study was approved by the Harran University Faculty of Medicine's Non-Interventional Research Ethics Committee (29.03.2021-07). Written permission was obtained from the Ministry of Health, and verbal informed consent was secured from all participants. The researchers covered all study costs.

Study Variables

The dependent variable was the impact of the pandemic on TB diagnosis, treatment, and follow-up. The independent variables included age, gender, marital status, Syrian refugee status, educational level, employment status, income level, place of residence, number of rooms in the residence, number of people living in the residence, presence of chronic diseases, cigarette/alcohol consumption, mask use, type of TB, case type, treatment/follow-up type, regularity of drug use, receipt of financial aid, and COVID-19 vaccination status.

Definitions

Patients who experienced difficulty in receiving healthcare or who received delayed care due to COVID-19-related factors in the TB diagnosis, treatment, and/or follow-up phase were defined as being negatively affected by the pandemic. In the analysis, the cut-off point for the age variable was set at 18. While the child age group constitutes 26.5% of the entire population in Türkiye, this level is 44.9% in Sanliurfa.[10] The high number of children in crowded families in the research area suggests that the child population may be significantly affected by tuberculosis transmission. Studies indicate that familial tuberculosis contact increases in large families, and that individuals under the age of 18 are also at risk of exposure.[11,12] Therefore, this study aimed to more clearly reveal the characteristics of tuberculosis and the impact of the pandemic on the group aged 17 years and younger. In the study, those who had received two doses of a messenger Ribonucleic Acid (mRNA) vaccine, two or three doses of an inactive vaccine, or two doses of inactive vaccine plus a single dose of an mRNA vaccine were considered fully vaccinated.[13]

Statistical Analysis

Descriptive statistics (numbers, percentages), Fisher's exact test, and Pearson's chi-squared tests were used for univariate data analysis. Multiple logistic regression analysis was performed with variables found to be significant in univariate analyses (education status, income status, case type, consistent mask use). The data were analyzed using the Statistical Package for the Social Sciences (SPSS) 20.0. Statistical significance was set at $p<0.05$.

Table 1. Distribution of sociodemographic variables according to pandemic effect status

Characteristic	Status of being affected by the pandemic						
	Negatively affected		Not affected				
	n	%**	n	%**	%*	χ^2	p
Age							
17 years and younger	3	75.0	1	25.0	4.0		
18 years and older	40	41.2	57	58.8	96.0	***	0.31
Marital status							
Married	26	41.3	37	58.7	62.4		
Single	17	44.7	21	55.3	37.6	0.02	0.89
Gender							
Male	21	53.8	18	46.2	38.6		
Female	22	35.5	40	64.5	61.4	2.59	0.11
A Syrian refugee							
Yes	3	18.8	13	81.2	15.8		
No	40	47.1	45	52.9	84.2	3.33	0.06
Employment status							
Employed	12	54.5	10	45.5	21.8		
Unemployed	31	39.2	48	60.8	78.2	1.08	0.29
Education status							
Primary school or below	14	24.6	43	75.4	56.4		
Over primary school	29	65.9	15	34.1	43.6	15.71	<**0.001**
Social security							
Yes	26	48.1	28	51.9	53.5		
No	17	36.2	30	63.8	46.5	1.02	0.31
Income status							
Income is less than expenses	23	31.5	50	68.5	72.3		
Income matches expenses or more	20	71.4	8	28.6	27.7	11.61	<**0.001**
Place of residence							
City center	35	43.2	46	56.8	80.2		
Rural area	8	40.0	12	60.0	19.8	0.00	0.99
Number of rooms							
3 and fewer	8	47.1	9	52.9	16.8		
4 rooms	26	38.8	41	61.2	66.3		
5 or more rooms	9	52.9	8	47.1	16.8	1.27	0.53
Number of people living in the same house							
4 and less	24	47.1	27	52.9	50.5		
5 and more	19	38.0	31	62.0	49.5	0.51	0.47
Cigarette consumption							
Yes	16	51.6	15	48.4	30.7		
No	27	38.6	43	61.4	69.3	1.01	0.32
Alcohol consumption							
Yes	4	66.7	2	33.3	5.9		
No	39	41.1	56	58.9	94.1	***	0.39
Chronic diseases							
Yes	9	37.5	15	62.5	23.8		
No	34	44.2	43	55.8	76.2	0.11	0.73

*: Total percentage; **: Row percentage; ***: Fisher's exact test and chi-squared test.

Table 2. Distribution of TB variables according to pandemic effect status

Characteristic	Status of being affected by the pandemic						
	Negatively affected		Not affected				
	n	%**	n	%**	%*	χ^2	p
Case type							
New	39	40.2	58	59.8	96.0		
Relapses and returning from discontinued treatment	4	100.0	0	0.0	4.0	***	**0.03**
Type of TB							
Pulmonary	20	41.7	28	58.3	47.5		
Non-pulmonary and non-pulmonary+pulmonary	23	43.4	30	56.6	52.5	0.00	1.00
Drug use							
Regular	40	42.6	54	57.4	93.1		
Forgets sometimes	3	42.9	4	57.1	6.9	***	1.00
Treatment follow-up							
Medical staff visits their home	3	75.0	1	25.0	4.0		
TeleDOT	40	41.2	57	58.8	96.0	***	0.31
Financial aid							
Yes	9	42.9	12	57.1	20.8		
No	34	42.5	46	57.5	79.2	0.00	1.00

*: Total percentage; **: Row percentage; ***: Fisher's exact test and chi-squared test; TB: Tuberculosis; DOT: Directly observed treatment.

RESULTS

Among the participants, 96.0% were aged ≥18 years, 61.4% were women, 62.4% were married, and 56.4% had completed primary school or less. Overall, 78.2% were unemployed, 72.3% had low incomes, 46.5% did not receive social security benefits, and 15.8% were Syrian refugees. Additionally, 19.8% lived in rural neighborhoods, 16.8% in homes with three or fewer rooms, and 49.5% with five or more people. The rates of cigarette and alcohol consumption were 30.7% and 5.9%, respectively, and 23.8% had a chronic disease. Those with middle-school education (vs. ≤primary school) and those with matching income and expense levels ($p<0.001$) and good income levels were more negatively affected by the pandemic ($p<0.001$). Other sociodemographic variables showed no detectable influence on pandemic effect status ($p>0.05$) (Table 1).

Of the participants, 96.0% were new TB patients and 47.5% developed pulmonary TB. Among those receiving TB treatment, 96.0% underwent telehealth-based directly observed treatment (TeleDOT) and 4% were followed with home visits by health personnel. A total of 6.9% occasionally forgot to take their medication. Of the patients followed in TB dispensaries, 20.8% received financial aid. Patients who relapsed or dropped out of treatment were more affected by the pandemic than new patients ($p=0.03$). Other features of TB had no influence on patients' pandemic effect status ($p>0.05$) (Table 2).

Table 3. Symptoms present at the time of hospital admission

Symptoms	(n=101)	%
Cough	34	33.7
Back pain/chest pain	11	10.9
Weight loss	1	1.0
Stomach ache	7	6.9
Fatigue/no appetite	6	5.9
Mass	24	23.8
Bloody sputum	10	9.9
Shortness of breath	4	4.0
Night sweats/fever	4	4.0

Of the TB cases, 51.5% were diagnosed at a university hospital, 32.7% at a state or research hospital, 8.9% at a TB dispensary, and 6.9% at a private hospital. The most common symptom upon admission to a health institution was coughing (Table 3).

Table 4. Distribution of COVID-19 variables according to pandemic effect status

Characteristic	Status of being affected by the pandemic						
	Negatively affected		Not affected				
	n	%**	n	%**	%*	χ^2	p
Constant mask use							
Yes	24	61.5	15	38.5	38.6		
No	19	30.6	43	69.4	61.4	8.12	**0.004**
COVID-19 history							
Yes	6	54.5	5	45.5	10.9		
No	37	41.1	53	58.9	89.1	***	0.52
Vaccinated against COVID-19							
Incomplete	22	38.6	35	61.4	56.4		
Complete	15	47.7	23	52.3	43.6	0.51	0.47

*: Total percentage; **: Row percentage; ***: Fisher's exact test and chi-squared test.

Table 5. Logistic regression model of the factors determining the state of being affected by the pandemic

Variables	B	Standard error	P	OR	95% confidence interval
Constant mask use (yes)	1.1	0.4	0.017	3.0	1.1–7.7
Income status (income matches expenses or is more)	1.5	0.5	0.003	4.5	1.6–12.6

B: Regression coefficient; OR: Odds ratio.

Postponement of any clinical appointment due to the pandemic was reported in 7.9% of cases. Overall, 42.6% of patients reported adverse effects on their TB diagnosis, treatment, or follow-up; however, 57.4% were not affected. A total of 43.6% of patients were fully vaccinated. Tuberculosis patients who consistently wore masks were adversely affected by the pandemic during follow-up and treatment (p=0.004). Of the patients, 38.6% consistently used masks outdoors; among them, 46.2% used the same mask for extended periods, 46.1% changed masks daily, and 7.7% changed them throughout the day (Table 4). Additionally, 30.8% of those who consistently wore masks did not wash their hands, and 17.9% did not cover their mouth and nose completely.

Mask usage varied with literacy levels: 13.9% for illiterate patients and 37.5% for literate patients. The mask usage level of illiterate patients was lower than that of other patients (p=0.001).

Multiple logistic regression analysis was conducted using variables such as educational status, income status, case type, and mask use, which were significant in univariate analyses. The analysis revealed that mask use negatively impacted the status of being affected by the pandemic 3.0 times, and having an income equal to or higher than expenditures increased the impact by 4.5 times (Table 5).

DISCUSSION

The COVID-19 pandemic has led to significant global developments, with the functioning of health systems and access to health services being crucial at the national level. Living conditions and access to health services are particularly important for patients with TB, who are among the groups at high risk for COVID-19-related complications. COVID-19 has significantly impacted the treatment and follow-up of many patients with TB.[3]

In Türkiye, TB treatment is provided free of charge. Despite this state support, patients undergoing TB treatment face challenges such as insufficient nutrition, inability to continue working, and living in small, crowded residences with their families.[12–15] These problems are more common in areas with many poor people and Syrian refugees.[16] Although we anticipated that people disadvantaged in terms of education and income would be more negatively affected

by the pandemic, our results showed the opposite. In this study, patients with higher educational levels and better socioeconomic conditions were more negatively impacted by the pandemic (both $p<0.05$). Educational and socioeconomic levels are additive factors that enhance individuals' capacities in regions with limited sociocultural development. People with higher educational levels are more likely to visit health institutions and receive health services.[16] Additionally, more-educated patients in our study had higher incomes. For poor families, accessing health services is often considered a luxury beyond their basic needs. Consequently, patients with better living conditions faced greater difficulties during the pandemic, as their demand for health care services increased but could not be met. The effect was intensified by educational status; those with relatively higher income levels were affected threefold by the pandemic ($p=0.017$).

TB is contagious for the first two weeks after treatment initiation. To minimize transmission, patients must isolate themselves at home during this period. However, most patients with TB in this study could not adhere to the isolation requirement due to living with multiple people. Therefore, observing the mask rule is crucial to prevent disease transmission. Mask usage not only prevents TB transmission to family members but also protects TB patients from COVID-19 exposure. Those using masks likely felt safer during the pandemic. Nonetheless, masks must be used correctly to offer protection. Using the same mask for an extended period without changing it increases the risk of transmission, rather than protecting the individual from the disease.[17] In this study, 92.3% of the patients who stated that they always used masks outdoors did so incorrectly. These individuals believed that they could protect themselves from the disease by wearing the same mask for many hours or even days.[18] Patients with less than a primary school education level used masks less frequently than those with higher education levels. However, educated patients who used masks still faced difficulties accessing health services and used the masks incorrectly. These factors led to a result that contrasts with previous reports. Specifically, the pandemic had a negative effect on TB follow-up and treatment among patients who reported regular mask usage. The study found that the risk of being adversely affected by the pandemic was 4.5 times higher in those who consistently used masks ($p=0.003$).

The fundamental TB control intervention involves early diagnosis combined with effective treatment. The WHO estimates that approximately one-third of current TB cases are characterized by delayed diagnosis and notification.[19] Delayed TB diagnosis increases the risk of progression from latent infection to active disease.[20] Additionally, many patients who discontinue treatment return to health institutions with treatment-resistant TB. People who discontinue TB treatment and relapse are likely to face significant post-COVID-19 challenges due to chronic lung damage.[21] For this population, COVID-19 testing, when in doubt, is crucial. Moreover, patients with severe lung damage who recover from COVID-19 may be at an increased risk of TB.[17,22,23] In our sample, the pandemic affected patients who relapsed and discontinued treatment more than it affected new patients ($p<0.05$).

The main limitations of our study were the small patient sample size and its descriptive nature.

CONCLUSION

A significant portion of tuberculosis patients in this study (42.6%) reported that the pandemic negatively impacted their diagnosis, treatment, and follow-up. Patients with higher socioeconomic status experienced more difficulties during the pandemic, an indirect effect of their education level. As the level of education increased, so did awareness about mask usage. However, most survey participants still used the masks incorrectly. They did not wash their hands before using the mask, failed to change it frequently, and did not cover their mouth and nose completely. Improper mask use resulted in more harm than protection. Almost all patients in this study were treated and followed up through TeleDOT. Patients who relapsed or returned to treatment were relatively more negatively affected by the pandemic.

Contribution to Literature

This study revealed that, contrary to expectations, variables such as high income and mask use, typically considered protective, actually posed a risk in terms of being affected by the pandemic. This finding is both surprising and significant, as it contrasts with existing literature.

Ethics Committee Approval: The Harran University Non-Interventional Research Ethics Committee granted approval for this study (date: 29.03.2021, number: 07).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Author Contributions: Concept – SG, EB; Design – SG, EB; Supervision – SG, EB; Resource – SG; Materials – SG; Data Collection and/or Processing – SG; Analysis and/or Interpretation – SG; Literature Search – SG, EB; Writing – SG, EB; Critical Reviews – SG, EB.

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