

# The Impact of COVID-19 Pandemic on Tuberculosis Patient Treatment Adherence

*by* Tintin Sukartini

---

**Submission date:** 26-Jul-2022 02:39PM (UTC+0800)

**Submission ID:** 1875352791

**File name:** OVID-19\_Pandemic\_on\_Tuberculosis\_Patient\_Treatment\_Adherence.pdf (476.17K)

**Word count:** 3996

**Character count:** 21932

## LITERATURE REVIEW

# The Impact of COVID-19 Pandemic on Tuberculosis Patient Treatment Adherence

Natalia Christin Tiara Revita<sup>1</sup>, Tintin Sukartini<sup>1\*</sup>, Makhfudli<sup>1</sup>, Joel Rey Ugsang Acob<sup>2</sup>,  
Hasanudin<sup>1</sup>, Handira Nadhifatul Aini<sup>1</sup>

<sup>1</sup>Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia.

<sup>2</sup>Faculty of Nursing, Visayas State University, Baybay, Philippines.

## ARTICLE INFO

## Article history:

Received 27 October 2021

Received in revised form 18 May 2022

Accepted 27 May 2022

Available online 31 May 2022

## Keywords:

COVID-19,

Infectious disease,

Stress,

Treatment adherence,

Tuberculosis.

## ABSTRACT

Coronavirus disease 2019 (COVID-19) pandemic caused a lack of attention to treatment of tuberculosis (TB). TB patients who do not adhere to treatment during a pandemic can cause various health problems in various countries. COVID-19 pandemic adversely affects TB patients such as increasing psychological stress, triggering non-adherence to treatment, affecting quality of life, and even increasing the number of deaths of TB patients. The increasing number of deaths and decreasing success of TB treatment during the pandemic are serious problems that must be addressed immediately. Various efforts were made to overcome the barriers for TB treatment during pandemics. Health workers can provide health education and rehabilitation programs in another media such as tele-health. Digital media can provide health information about TB, improve medication adherence, emphasize the benefits of medication adherence, and motivate patients to undergo treatment.

## INTRODUCTION

The 2019 Coronavirus Disease (COVID-19) and tuberculosis (TB) can affect the respiratory system, especially the lungs, such as coughing, fever, and difficulty breathing.<sup>1</sup> COVID-19 and TB have similar transmission, through airborne, but COVID-19 transmission is faster and difficult to control than TB.<sup>2</sup> People diagnosed with TB and COVID-19 may have a poorer prognosis and have a higher risk of death. The current COVID-19 pandemic may pose obstacles to TB prevention and control.<sup>3</sup> Lack of attention in the treatment of TB patients and lack of medication adherence during the pandemic can lead to various problems including the increasing number of deaths of TB patients in various countries.

TB detection is reduced by 25% as TB health services are hampered during COVID-19 pandemic in many countries. World Health Organization (WHO) estimated that between 2020 and 2025 there will be an additional 1.4 million TB deaths as a direct result of COVID-19 pandemic.<sup>4</sup> They also estimated that about 1/3

of people living with TB are currently undiagnosed, untreated, and unreported. COVID-19 pandemic has led to an increase in the number of people who are not diagnosed with TB and is a major source of transmission leading to high morbidity and mortality.<sup>5</sup> TB cases during COVID-19 pandemic are estimated to have an increased incidence of death.<sup>6</sup> TB patient deaths is estimated to increase between 2020 and 2035. The estimated increase in the number of deaths occurs in various countries such as 4.65% in India, 7.64% in Indonesia, 2.09% in Kenya, and 8.68% in Pakistan. This estimated increase in TB incidence and mortality are associated with the impact of COVID-19 on TB surveillance and treatment.<sup>6</sup>

The success rate of TB treatment has decreased by 69% during COVID-19 pandemic. Some of the reasons for this decline occurred due to the closure of healthcare facilities and laboratories, sick health workers, and limited healthcare facilities during the pandemic.<sup>7</sup> Other barriers to TB treatment during COVID-19 pandemic are challenges in accessing healthcare facilities, stigma in the community, and lack of information, motivation, or support.<sup>8</sup> Access to healthcare facilities may decrease

\*Corresponding author: [tintin-s@fkn.unair.ac.id](mailto:tintin-s@fkn.unair.ac.id)



due to limited health workers and material resources, and social stigma in TB patients. The stigma of disease transmission in TB patients has been exacerbated by COVID-19 pandemic.<sup>5</sup> Regional quarantine can also cause problems for TB patients seeking healthcare facilities and may result in delays in diagnosis and treatment.<sup>9</sup> These obstacles cause TB patients to be prone to stress. The stress experienced by TB patients will affect them in undergoing treatment, therefore it can result in non-adherence to treatment and the risk of death.<sup>10</sup>

Various efforts were made to overcome the barriers for TB treatment during the pandemic. Health workers can provide health education and rehabilitation programs in another media such as tele-health. Digital media can provide health information about TB, help improve and emphasize the benefits of medication adherence, and motivate patients to undergo treatment.<sup>8</sup> This literature review discussed the effects of COVID-19 pandemic on adherence of TB treatment.

### Lung Tuberculosis in the Era of COVID-19 Pandemic

TB is a disease which attacks the lungs caused by *Mycobacterium tuberculosis*. It is spread through the air when a person with pulmonary TB coughs, sneezes, or spits. A person who inhales some of the germs from a TB patient can immediately become infected with TB. Every year, 10 million people are diagnosed with TB. Despite being a preventable and curable disease, 1.5 million people die from TB every year, making it the world's top infectious killer.<sup>11</sup> However, COVID-19 had a record of high death toll surpassing the death toll of TB patients in early April 2020.<sup>3,12</sup>

COVID-19 is an infectious disease caused by SARS-CoV-2, a member of the beta family *Coronaviridae*, which also includes SARS-CoV-1 and MERS-CoV (Middle East respiratory syn-coronavirus).<sup>13</sup> COVID-19 virus can spread from an infected person's mouth or nose in small liquid particles when they cough, sneeze, speak, or breathe. These particles range from larger respiratory droplets to smaller aerosols.<sup>14</sup> The world has been forced to adapt to a new disease called COVID-19 which has become a pandemic and infected more than 200 million people with a death rate of over 4.6 million people worldwide since December 2019.<sup>15</sup> Patients with chronic diseases such as TB have higher risk of death during COVID-19 pandemic.<sup>3</sup> WHO continues to monitor the prevention and care of TB patients during the COVID-19 pandemic. Health services need to be involved in providing effective and fast services against COVID-19 while ensuring that health services for TB patients are also maintained.<sup>16</sup>

### Impact of COVID-19 on TB Treatment

Compliance patient adherence to treatment can be observed from various factors, such as from individual patients, health facility providers, and community. Health workers are expected to help each other in overcoming the non-compliance of TB treatment. Healthcare workers should provide health education to solve patients' medical problems, develop short-term treatment regimens, give motivational support, counseling session, social and family support for patients, and raise patient's awareness about the disease.<sup>17</sup> Poor adherence can lead to prolonged infectious disease, drug resistance, relapse, and death.<sup>18</sup>

COVID-19 pandemic is placing enormous pressure on healthcare services around the world. Some suggested solutions, such as social distancing and quarantine in some areas, can help contain the spread of the virus. However, such solutions may also affect special patient populations such as patients with chronic illnesses that limit access to healthcare facilities for routine care and treatment.<sup>19</sup> Some of the impacts of COVID-19 pandemic on TB patients are triggering non-adherence to treatment and even increasing the number of deaths of TB patients.

### Non-Adherence

Patients with chronic diseases such as TB require proper disease management and follow-up for successful treatment. If TB patients do not get proper treatment management, it can increase the risk of failure in treatment, especially in the era of COVID-19 pandemic.<sup>20</sup> The results showed that COVID-19 pandemic had an impact on decreasing the rate of diagnosis, decreasing treatment adherence of TB patients, and increasing the incidence of TB. It is estimated that if COVID-19 pandemic is assumed to last only 2 years, the long-term effects will last longer, a decade or more since the start of COVID-19 pandemic. In addition, in the absence of further intervention, the peak TB incidence caused by COVID-19 pandemic will not only result in new TB cases but also an increase in TB-related deaths worldwide.<sup>6</sup> The estimated number of TB deaths between 2020 and 2035 is 4.65% in India, 7.64% in Indonesia, 2.09% in Kenya, and 8.68% in Pakistan. The total number of deaths in the four countries is estimated at over 1.29 million people.<sup>6</sup>

Several policies from healthcare facilities issuing advice on administering TB drugs to outpatients can affect patient's medication adherence. Policies such as patients should be given TB drugs for 1 to 2 months during the pandemic, to reduce patient visits and reduce the risk of disease transmission can lead to a lack of control over medication adherence.<sup>27</sup> Health workers

are unable to provide intense motivation for treatment and monitoring the patient's health condition is also reduced.<sup>21</sup> TB patients experience recurrent TB for not complying with the treatment and experience worsening conditions and even death.<sup>10</sup> Treatment adherence is the key to ensuring a high success rate at the end of treatment and controlling TB.<sup>28</sup> Intensive counseling and monitoring of treatment are needed in overcoming patient non-adherence in undergoing TB treatment.<sup>29</sup>

#### Number of Deaths Rising

COVID-19 treatment will have an impact on TB services and treatment. Several factors which affect TB treatment during pandemic are lack of health workers due to handling the pandemic, health services that focus on dealing with COVID-19 pandemic, stigma and fear of COVID-19 infection in health services. These factors will contribute to the delay in diagnosis and treatment of TB patients.<sup>3</sup> Delay in TB diagnosis and treatment are even expected to persist for up to 1.5 years after the pandemic.<sup>6</sup> Studies suggest that the impact of a late diagnosis of TB can increase mortality by up to 20% in the next 5 years.<sup>7</sup>

The decrease in healthcare services other than pandemic diseases has a negative impact on chronic diseases such as TB. TB patients get difficulty to monitor their health condition, hence patients who need regular care and follow-up are unreachable.<sup>20</sup> TB requires early detection and intense treatment to optimize the treatment.<sup>6</sup> Delay in diagnosis and treatment of TB can increase the risk of transmission, increase drug resistance, and increase mortality.<sup>1</sup> Delay in diagnosis and treatment of TB can increase the risk of transmission and death.<sup>3</sup> Some TB patients during COVID-19 pandemic stopped rehabilitation activities, got limited outpatient activities, avoided access to healthcare facilities even though they had severe symptoms that further aggravated their disease condition.<sup>23</sup>

#### **Impact of COVID-19 on Patient's Psychology**

TB is a chronic disease that not only affects the patient's physical condition but also the patient's psychology. COVID-19 pandemic can increase the patient's stress level and reduce the quality of life in TB patients.<sup>24</sup>

#### Stress

TB patients can recover with a long duration of treatment for at least 6 months. The long treatment can cause psychological stress in the patient. A study stated that the majority of respondents experienced moderate stress levels in the intensive phase of 62.5% and the

advanced phase of 75.86%.<sup>20</sup> Stress in TB patients not only caused by the duration of treatment but also drug side effects.<sup>21</sup> Some patients experience side effects in the beginning of TB treatment. Gastritis is one of the common side effects of anti-TB drugs. The patients will experience excessive stress and decide to stop taking medication because they do not know the drug side effect clearly.<sup>22</sup>

Various other factors that influence the stress response internally and externally include age, gender, personality, cognitive function, family situation, and physical and social environment.<sup>20</sup> Lack of activity and social interaction make the stress level of TB patients higher.<sup>23</sup> Lack of social activities and interactions among TB patients is due to negative stigma in society that causes prolonged stress to patients. Negative stigma begins from family and friend. Sometimes patients get harsh words and people who are close with patient avoid them as they are an infectious agent. Emotional weakness can adversely affect the patient's psychology, hence patients become susceptible to secondary infections. Patients who repeatedly get questions about treatment and the effects of treatment by relatives also contribute to the cause of stress. Even after recovering, patients are still being avoided by relatives and are kept away from social gatherings by community members.<sup>24</sup>

COVID-19 pandemic increases stress level of patients. Patients with chronic diseases such as TB may have a higher risk of the threat of COVID-19 pandemic. Chronic illness makes patients more susceptible to infection and experience difficulties in medication management, which can put some patients under stress during the pandemic. Stress and anxiety are normal reactions during crisis situations. The negative impact of COVID-19 outbreak may affect the clinical outcomes of patients with chronic conditions and psychological stress.<sup>19</sup>

One of the supporting factors that must be considered is psychological stress management. Good management of psychological stress will enable TB patients to undergo treatment.<sup>10</sup> Family support, socio-economics factors, support from doctors and nurses, availability of access to healthcare services, social stigma, psychological pressure, and knowledge about the success factors of TB treatment are needed to overcome the psychological problems of patients.<sup>10,20</sup> Proper management must be immediately established by governments, health workers and other stakeholders to prevent the psychological impact of pandemics. Developing advanced healthcare technologies that assist healthcare professionals is paramount to continue routine appointments.<sup>26</sup>

### Quality of Life

Quality of life in TB patients includes complex elements, such as disease conditions, economic conditions, stigma in family life, work environment, and social activities.<sup>30</sup> In addition to drug management, TB patients require treatment such as pulmonary rehabilitation and socio-economic support. A study explained that quality of life was also influenced by treatment adherence for TB patients. Quality of life of TB patients will decrease if TB treatment is less than optimal, especially during pandemics.<sup>2</sup>

### **Strategy to Overcome the Negative Impact of COVID-19 in TB**

#### Health Education

Knowledge is one of the domains of behavior formation in TB treatment. It can increase the success of treatment and prevent disease recurrence.<sup>10</sup> Most of the patients do not have good knowledge about the causative factors, mode of transmission, or duration of treatment.<sup>18</sup> Most TB patients also complain the side effects of treatment, which become the main reason for missing treatment. Some patients feel that the duration of treatment is very long and worry that there will be damage to internal organs if they continue to take the drugs for a long time. Some patients are also unaware of the consequences of non-adherence to treatment.<sup>17</sup>

The most common reason for TB patients discontinuing treatment because they feel recovered from TB. Some patients did not know the standard duration of treatment and the consequences if TB patients stopped treatment. Some other reasons are patients lose their jobs when they were diagnosed with TB, weak body condition at work, or unable to find daily work due to long term treatment. Lack of knowledge, loss of income, negative community stigma, lack of social support, drug side effects, and long duration of treatment are barriers to medication adherence. Comprehensive health education at healthcare service for patients, family members, and the community is needed to address medication adherence in TB patients.<sup>18</sup>

Health workers can provide information to patients about COVID-19 and TB in order to protect patients from COVID-19 infection while continuing TB treatment.<sup>3</sup> Counseling and motivation are also needed for patients to overcome the disease. Health workers can provide information regarding side effects of treatment, community stigma, duration of treatment, and the importance of medication adherence.<sup>1</sup> Psychosocial counseling includes understanding the patient's psychosocial problems and providing stress management coping skills. Healthcare workers can provide psychosocial counseling and coping strategies for patients regarding how to cope with stress and feelings of

loneliness. Counseling can be a recommendation to start social activities and relationships with relatives and train patients to think positively and avoid negative thoughts. TB treatment should not only consist of TB drug therapy but also include psychosocial support for patients. Therefore, appropriate psychosocial education is needed for TB patients, especially when facing COVID-19 pandemic.<sup>1</sup>

#### Rehabilitation

Rehabilitation is important to treat TB sequelae. After completion of anti-TB treatment, patients often experience various health problems, such as difficulty in doing physical exercise or even performing activities of daily lives, which results in a decrease of quality of life. These health problems can be solved by rehabilitation program. Some patients got advantages from pulmonary rehabilitation program.<sup>12</sup> During COVID-19 pandemic, patients are restricted from hospital visits and rehabilitation activities, which results in patients experience various health problems.

#### Tele-Health Service

Health workers can use virtual services and digital technologies such as video and text messages to avoid delays in TB diagnosis and treatment due to COVID-19 pandemic. Virtual services and digital technology have the aim of providing TB patients with treatment adherence support, health workers can also monitor the health of TB patients, conduct counseling, and follow-up consultations.<sup>3</sup> Therapy using video demonstration media can also support medication adherence and help TB patients complete treatment during the pandemic.<sup>27</sup>

A study explained that video demonstration media significantly reduced non-adherence by 4 days per 2-week period. Moreover, it could save the patient's time, saving money, and increase satisfaction.<sup>13</sup> The use of tele-health services during COVID-19 pandemic also prevent transmission and focus on healthcare services.<sup>25</sup> The use of digital health technology should be intensified to support patients, improve communication, counselling, care, and provide health education. In accordance with WHO recommendations, technology such as treatment monitoring, educational facilities, and therapy supported by video can help patients complete TB treatment.<sup>4</sup>

### **SUMMARY**

COVID-9 and TB can affect the respiratory system, especially the lungs, such as coughing, fever, and difficulty breathing. COVID-19 and TB have similar transmission, through airborne, but COVID-19

transmission is faster and difficult to control than TB. COVID-19 pandemic has an impact on controlling TB. TB patients experience psychological stress, lack of medication adherence, decreased quality of life, to increase the number of deaths. Various efforts were made to overcome the problem of TB patients during the pandemic. The provision of health education and medical rehabilitation is performed in various media such as tele-health services. Technological services such as treatment monitoring, educational facilities, and therapy supported by video can help patients to complete TB treatment.

#### Acknowledgments

We would like to extend our sincere gratitude to the Head of Master Program in Nursing, Universitas Airlangga, and the Dean of the Faculty of Nursing, Universitas Airlangga for the supports in the preparation of this study.

#### Conflict of Interest

The author stated there is no conflict of interest in this study.

#### Funding

This study does not receive any funding.

#### Author's Contributions

Conceiving the study: NCTR, TS, M, JRUA. Designing the experiments: NCTR. Gathering, analyzing, interpreting data, making tables and figures, writing the manuscript: NCTR, HNA, H. Reviewing: TS, M, JRUA. All authors contributed to revise the manuscript and approved the final version.

#### REFERENCES

- Kant S, Tyagi R. The Impact of COVID-19 on Tuberculosis: Challenges and Opportunities. *Ther Adv Infect Dis* 2021; 8: 1–7.
- Duarte R, Aguiar A, Pinto M, et al. Different Disease, Same Challenges: Social Determinants of Tuberculosis and COVID-19. *Pulmonology* 2021; 27: 338–344.
- Fei H, Yinyin X, Hui C, et al. The Lancet Regional Health - Western Pacific The Impact of the COVID-19 Epidemic on Tuberculosis Control in China. *Lancet Reg Heal - West Pacific* 2020; 3: 100032.
- World Health Organization. Tuberculosis and COVID-19: Considerations for Tuberculosis Care. *World Heal Organ* 2020; 1–11.
- Irfani TH, Siburian R, Nabila R, et al. Tuberculosis and Coronavirus Disease 2019 (COVID-19) From a Clinical Perspective: A Systematic Review. *Medeni Med J* 2020; 35: 338–343.
- Tovar M, Joaquín Sanz AA, Moreno Y. A Significant Increase in Tuberculosis Diagnosis is Required to Mitigate the Impact of COVID-19 on Its Future Burden. *Medrxiv*.
- Malik AA, Safdar N, Chandir S, et al. Tuberculosis Control and Care in the Era of COVID-19. *Health Policy Plan* 2020; 35: 1130–1132.
- Yoeli E, Rathouser J, Bhanot SP, et al. Digital Health Support in Treatment for Tuberculosis. *N Engl J Med* 2019; 381: 986–987.
- Gupta A, Singla R, Caminero JA, et al. Impact of COVID-19 on Tuberculosis Services in India. *Int J Tuberc Lung Dis* 2020; 24: 637–639.
- Putra KWR, Toonsiri C. Factors Related to the Successful Treatment of Tuberculosis: A Literature Review. *Belitung Nurs J* 2019; 5: 136–146.
- World Health Organization. Tuberculosis. *WHO*.
- Silva DR, Mello FC de Q, D'ambrosio L, et al. Tuberculosis and COVID-19, the New Cursed Duet: What Differs between Brazil and Europe? *J Bras Pneumol* 2021; 47: 1–8.
- Visca D, Ong CWM, Tiberi S, et al. Tuberculosis and COVID-19 Interaction: A Review of Biological, Clinical and Public Health Effects. *Pulmonology* 2021; 27: 151–165.
- World Health Organization. Coronavirus.
- Syafa'ah I. Non-Invasive Ventilation in COVID-19 Related Respiratory Failure. *J Respirasi* 2021; 7: 139.
- World Health Organization. Coronavirus Disease (COVID-19): Tuberculosis. *WHO*.
- R. G. G, D'souza MJ, A. Adherence to Anti-Tuberculosis Treatment among Patients in Urban Field Practice Area of Medical College, Davangere, Karnataka: A Qualitative Study. *Int J Community Med Public Heal* 2019; 6: 2555.
- Gebreweld FH, Kifle MM, Gebremicheal FE, et al. Factors Influencing Adherence to Tuberculosis Treatment in Asmara, Eritrea: A Qualitative Study. *J Heal Popul Nutr* 2018; 37: 1–9.
- Kretchy IA, Asiedu-Danso M, Kretchy JP. Medication Management and Adherence during the COVID-19 Pandemic: Perspectives and Experiences from Low- and Middle-Income Countries. *Res Soc Adm Pharm* 2021; 17: 2023–2026.
- Fekadu G, Bekele F, Tolossa T, et al. Impact of COVID-19 Pandemic on Chronic Diseases Care Follow-Up and Current Perspectives in Low Resource Settings: A Narrative Review. *Int J Physiol Pathophysiol Pharmacol* 2021; 13: 86–93.
- Jain VK, Iyengar KP, Samy DA, et al. Tuberculosis in the Era of COVID-19 in India. *Diabetes Metab Syndr Clin Res Rev* 2020; 14: 1439–1443.
- Sarinoglu RC, Sili U, Eryuksel E, et al. Tuberculosis and COVID-19: An Overlapping Situation during Pandemic. *J Infect Dev Ctries* 2020; 14: 721–725.
- Kaur R, Singh T, Singh SM, et al. Effect of Psychiatric Co-Morbidity on Adherence to Anti Tubercular Treatment: A Cross Sectional Study from North India. *Int J Community Med Public Heal* 2021; 8: 1325.

24. Visca D, Tiberi S, Pontali E, *et al.* Tuberculosis in the Time of COVID-19: Quality of Life and Digital Innovation. *Eur Respir J*; 56. Epub ahead of print 2020. DOI: 10.1183/13993003.01998-2020.
25. Febi AR, Manu MK, Mohapatra AK, *et al.* Psychological Stress and Health-Related Quality of Life among Tuberculosis Patients: A Prospective Cohort Study. *ERJ Open Res* 2021; 7: 00251–02021.
26. Putu N, Purnama W, Kurnia A, *et al.* Comparison of Stress Level and Coping Strategy between Therapeutic Phases in Newly Diagnosed Tuberculosis. 9. Epub ahead of print 2020. DOI: 10.11591/ijphs.v9i2.20410.
27. Fuadiati LL, Dewi EI, Hadi E. Hubungan Mekanisme Koping dengan Stres Pasien TB Paru di Rumah Sakit Paru Jember. *Pustaka Kesehatan* 2019; 7: 71.
28. Maharjan B, Gopali RS, Ishikawa N, *et al.* Psychosocial and Nutritional Counselling Intervention for Tuberculosis Patient Improves Patient's Stress and Treatment Adherence: A Case Study from Nepal. *Int J Heal Syst Implement Res* 2018; 2: 35–40.
29. Khairnar DR, Markad S. Socio-Psychological Effects on Tuberculosis Patients from Maharashtra, India. *J Assoc Physicians India* 2021; 69: 64–68.
30. Putra MM, Sari NPWP. Model Theory of Planned Behavior to Improve Adherence to Treatment and the Quality of Life in Tuberculosis Patients. *J Ners* 2020; 15: 167.

# The Impact of COVID-19 Pandemic on Tuberculosis Patient Treatment Adherence

## ORIGINALITY REPORT

14%

SIMILARITY INDEX

13%

INTERNET SOURCES

11%

PUBLICATIONS

0%

STUDENT PAPERS

## PRIMARY SOURCES

1	<a href="http://jhpn.biomedcentral.com">jhpn.biomedcentral.com</a> Internet Source	1%
2	<a href="http://lume.ufrgs.br">lume.ufrgs.br</a> Internet Source	1%
3	<a href="http://en.zaums.ac.ir">en.zaums.ac.ir</a> Internet Source	1%
4	<a href="https://pdfs.semanticscholar.org">pdfs.semanticscholar.org</a> Internet Source	1%
5	Mario Tovar, Alberto Aleta, Joaquín Sanz, Yamir Moreno. "A significant increase in Tuberculosis diagnosis is required to mitigate the impact of COVID-19 on its future burden", Cold Spring Harbor Laboratory, 2021 Publication	1%
6	<a href="http://www.ncbi.nlm.nih.gov">www.ncbi.nlm.nih.gov</a> Internet Source	1%
7	<a href="http://www.northern-scot.co.uk">www.northern-scot.co.uk</a> Internet Source	1%



8	<a href="http://ijphs.iaescore.com">ijphs.iaescore.com</a> Internet Source	1 %
9	Pooja Singh, Jasmine Samal, Sheeba Zarin, Ravikrishnan Elangovan, Seyed E. Hasnain, Nasreen Z. Ehtesham. "Chapter 24 Breaking the Transmission of TB: A Roadmap to Bridge the Gaps in Controlling TB in Endemic Settings", Springer Science and Business Media LLC, 2019 Publication	1 %
10	<a href="http://erj.ersjournals.com">erj.ersjournals.com</a> Internet Source	1 %
11	D. Visca, C.W.M. Ong, S. Tiberi, R. Centis et al. "Tuberculosis and COVID-19 interaction: A review of biological, clinical and public health effects", Pulmonology, 2021 Publication	1 %
12	<a href="http://www.downtoearth.org.in">www.downtoearth.org.in</a> Internet Source	1 %
13	<a href="http://www.frontiersin.org">www.frontiersin.org</a> Internet Source	1 %
14	<a href="http://banglajol.info">banglajol.info</a> Internet Source	<1 %
15	<a href="http://www.dovepress.com">www.dovepress.com</a> Internet Source	<1 %

[repository.upenn.edu](http://repository.upenn.edu)

16

Internet Source

<1 %

17

Kanika Patra, Sovona Batabyal, Kashmiri Mandal, Dhriti Ghose, Joy Sarkar.

<1 %

"Tuberculosis and COVID-19: A combined global threat to human civilization", *Clinical Epidemiology and Global Health*, 2022

Publication

18

"Mycobacterium Tuberculosis: Molecular Infection Biology, Pathogenesis, Diagnostics and New Interventions", Springer Science and Business Media LLC, 2019

<1 %

Publication

Exclude quotes  Off

Exclude matches  < 10 words

Exclude bibliography  On

# The Impact of COVID-19 Pandemic on Tuberculosis Patient Treatment Adherence

---

GRADEMARK REPORT

---

FINAL GRADE

**/1000**

GENERAL COMMENTS

**Instructor**

---

PAGE 1

---

PAGE 2

---

PAGE 3

---

PAGE 4

---

PAGE 5

---

PAGE 6

---