

ORIGINAL ARTICLE

Drug adherence to anti-tubercular treatment during COVID-19 lockdown in Haldwani block of Nainital district

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Abstract

Background: India saw one of the stringent lockdowns during the COVID-19 pandemic. In the wake of this period, the normal functioning of medical services was affected. People were reluctant to seek medical attention and notification of Tuberculosis dipped. The aim of the study was to estimate the proportion of non-adherence to anti-tubercular treatment and to identify the factors affecting the non-adherence to treatment. **Methods:** A retrospective community-based study was conducted among 284 tuberculosis patients. They were interviewed using a pre-designed questionnaire consisting of WHO dimensions of non-adherence and lockdown related questions. **Results:** The proportion of non-adherence to treatment was found to be 5.3%. Factors like chronic diseases, depression, without knowledge on how the disease is transmitted and that medication can be discontinued once the symptoms subsided, alcohol consumption, and trouble accessing medicine were found to be the determining factors in non-adherence to the treatment. **Conclusions:** Non-adherence to anti-tuberculosis treatment in our study was low but the various dimensions of adherence along with lockdown related factors had significant impact on it. To further minimize non-adherence during emergency like the lockdown due to COVID-19 pandemic, corrective measures must be explored and implemented.

Keywords

Tuberculosis; Adherence; Non-Adherence; COVID-19; Lockdown

Introduction

Following COVID-19 pandemic, the Indian government implemented one of the strictest lockdowns on the 25th of March 2020 sparing essential services like hospitals and other related medical establishments. (1,2) This restriction imposed might discourage patients from getting their anti-tubercular drugs refilled. As of 2018, India accounted for 27% of the global burden of Tuberculosis.(3) It is a known fact that anti-TB drugs when

used inappropriately leads to multidrug resistance and is a hindrance on the road to ending TB in India.(3,4) Globally, an estimated 10.0 million (range, 8.9–11.0 million) people were diagnosed with TB in 2019 of which the South-East Asia region contributed 44% and India contributed maximum (26%) to global tuberculosis burden. In the same year, about 0.5 million people developed rifampicin-resistant TB (RR-TB), of which 78% had multidrug-resistant TB (MDRTB). India (27%) has the largest share of the global burden of drug resistant TB.(5)

India witnessed the worst impact due to COVID-19 pandemic.(6) The containment measures and fear of contracting COVID-19 have changed health-seeking behaviour, reduced accessibility, and availability of health services in general. Health systems structures and health-care workers diversion and reprioritization to the COVID-19 response has doubled the impact because of under-resourced health system. The net effect of disruption to tuberculosis services will result in delay in diagnosis or non-diagnosis of tuberculosis and in disruption to treatment causing increased morbidity, mortality, transmission of tuberculosis and drug resistance levels.(7) Preliminary evidence showed that with the onset of COVID-19 cases in India, a large drop of about 25–30% was seen in reporting number of people diagnosed with TB (between January and June 2020) as compared to the same 6-month period in 2019.(5)

Non-adherence/noncompliance to the treatment protocol results in treatment failure, recurrent tuberculosis, severe form of tuberculosis like MDR tuberculosis, XDR tuberculosis etc. which in turns leads to more prolonged & expensive therapy.(8) Different studies in India have shown variable adherence to DOTS therapy (45%- 93%).(9–12)

Studies have shown that factors that were significantly associated with non-adherence were smoking during treatment, travel-related cost factors, cultural and gender influences, category of treatment, drug ingestion problems, treatment under direct Observation in continuation phase, Knowledge that Drug should be taken under observation, Knowledge that disease is curable with treatment, economic influences, medicine stock-outs, patient–provider interactions and provider attitudes.(12–14)

Aims & Objectives

1. To estimate the proportion of non-adherence to anti-tubercular treatment.
2. To identify the factors affecting the non-adherence to treatment protocol.

Material & Methods

Study type: Retrospective community-based study.

Study population: Adult tuberculosis patients registered in Haldwani tuberculosis unit of Nainital district during Dec 2019-Feb 2020.

Study area: Haldwani, tuberculosis unit of Nainital district

Study duration: The data collection period was from July-September 2021.

Sample size: A total of 284 participants were interviewed during the study. (Figure 1)

Inclusion criteria: The study included participants aged 18 years and above who gave informed verbal consent.

Exclusion criteria: Participant's age < 18 years & those who declined to participate were excluded from study.

Strategy for collection: The data was collected using a pre-designed schedule consisting of WHO dimensions of

non-adherence and lock down related questions. (11,13,15,16) The interview questions were filled in a Google form. Majority of data was collected using telephonic interview (97.5%) whereas data from some participants was also collected by home visits who address was verified & present in Haldwani block.

The interview schedule was designed using literature search and necessary permission was obtained from District TB Office, Nainital. The data of tuberculosis patients registered in Haldwani Tuberculosis Unit during Dec 2019-Feb 2020 was obtained.

Before starting of data collection, the field investigators were trained on objectives of study, using the interview schedule questions & also about using Google form on 2 separate sessions and their queries were resolved. Review meetings with the field investigators taken monthly to assess the progress of data collection and to solve any queries related to it.

Working definition:

Non-adherent: The participants who stopped treatment prematurely/ who were lost to follow up were considered as non-adherent.

Adherent: The participants who completed their full course of treatment within stipulated time were considered as adherent.

Ethical approval: It was obtained from the Institutional Ethics Committee, Govt. Medical College, Haldwani. Ref No. 626/GMC/IEC/2021/Reg596 IEC/R-09/07/2021 dated 13/07/2021

Consent: Informed verbal consent was taken from each study participant. The nature & consequence of the study was explained & strict confidentiality was assured.

Data analysis: The data was entered and analyzed using SPSS ver. 16. For descriptive analysis, frequency, percentages, mean (SD) were calculated whereas for testing association chi square test, Fisher exact test, Multiple logistic regression were used. P value <0.05 was taken as significant.

Results

The proportion of non-adherence among study population was found to be 5.3% (95% CI, 3.0- 8.6). (Figure 2) Majority of the study participants' current TU was Haldwani (78.2%) followed by Motahaldu (10.2%).

The mean (SD) age of study participants was 37.24 (16.16) years. Roughly two-third of study participants were of age group 18- 39 years (62.3%) followed by 40- 59 years (25%) while 12.7% were 60 years & above. Approximately three-fifth of study participants were males (57.7%) followed by females (42.3%).

Association of non-adherence with factors related to socio- economic dimension: Patients belonging to 18-39 years age group and 40-59 years age group had higher odds of non-adherence ((AOR=2; 95% CI= 0.1, 27.5), (AOR=1.5; 95% CI= 0.1, 19.6) respectively) in comparison to age group 60 years & above. Females had lower odds

of non-adherence (AOR=0.5; 95% CI= 0.1, 5.1) than males. Patients belonging to rural area had higher odds of non-adherence (AOR=5.4; 95% CI= 1, 28.6) as compared to urban area. Homemaker patients, job, labourers, self-employed etc. had higher odds of non-adherence (AOR=12.2; 95% CI= 0.1, 1230.2), (AOR=6.3; 95% CI= 0.1, 375.6), (AOR=4.9; 95% CI= 0.1, 408.7), (AOR=4.2; 95% CI= 0.1, 219.2), respectively than patients non-working. Patients belonging to lower class had higher odds of non-adherence (AOR=1.5; 95% CI= 0.1, 33.1), whereas others have similar odds of non-adherence than patients belonging to upper class. Patients without family support and social support had higher odds of non-adherence (AOR=29.2; 95% CI= 0.3, 2907.8), (AOR=4.2; 95% CI= 0.4, 49.0) than with family support and social support respectively. Patients who told distance of DOTS centre far and felt treatment is costly had higher odds of non-adherence (AOR=1.5; 95% CI= 0.2, 13.7), (AOR=1.7; 95% CI= 0.4, 7.5) than patients who do not told distance of DOTS centre far and did not felt treatment costly respectively whereas odds of non-adherence were similar irrespective of difficulty of travel/ transport. ([Table 1](#))

Association of non-adherence with factors related to health care dimension: Patients who told too much time consumed for taking medicine; who were not told about the affect stopping midway by doctor; who were not satisfied with health service had higher odds of non-adherence ((AOR=1.3; 95% CI=0.4, 3.9), (AOR=1.3; 95% CI=0.4, 3.8), (AOR=5.0; 95% CI=0.5, 52.5) respectively). ([Table 2](#))

Association of non-adherence with factors related to clinical care dimension: Patients with diabetes and depression had higher odds of non-adherence ((AOR=1.3; 95% CI=0.2, 12.1), (AOR=7.5; 95% CI=1.8, 32), respectively). ([Table 2](#))

Association of non-adherence with factors related to therapy dimension: Previously treated patients, patients perceiving treatment is too long, patients perceiving treatment should be discontinued on resolving symptoms, patients experiencing side effects had higher odds of non-adherence ((AOR=2.5; 95% CI=0.7, 9.5), (AOR=1.6; 95% CI=0.4, 6.4), (AOR=12.6; 95% CI=3.7, 42.8), (AOR=2.1; 95% CI=0.5, 8.8) respectively). ([Table 2](#))

Association of non-adherence with factors related to patient dimension: Patients who were not aware of the modes of transmission of TB, current tobacco chewers, past & present alcohol users, substance abusers, not aware of problems related to stopping of treatment, who felt stigmatized, did not perceive improvement in health status had higher odds of non-adherence ((AOR=4.6; 95% CI=1.3, 16.5), (AOR=7; 95% CI=0.5, 104.5), (AOR=4.5; 95% CI=0.9, 22.5), (AOR=3.6; 95% CI=0.4, 38.1), (AOR=1.7; 95% CI=0.3, 9.9), (AOR=1.4; 95% CI=0.4, 5.2), (AOR=1.6; 95% CI=0.4, 6), (AOR=1.7; 95% CI=0.4, 7.8), respectively). ([Table 2](#))

Association of non-adherence with lockdown related factors: Patients who missed treatment due to problem in accessing medicines and those who had fear of contracting COVID-19 in institutional settings had higher odds of non-adherence ((AOR=26.2; 95% CI=6.4, 107.8), (AOR=1.9; 95% CI=0.5, 7.7), respectively). ([Table 3](#))

Discussion

The study was conducted to obtain baseline information from the participants regarding their TB treatment compliance when the state was under lockdown due to COVID 19. We found a higher rate of TB treatment compliance (94.7%) for all participants, unlike the Ethiopian study conducted by Tadele et al., where the compliance was reported to be 75.5%.⁽¹⁷⁾ The non-compliance rate reported by Suman Lata et al. in the District Tuberculosis Unit (DTU) of Kathua district in Jammu and Kashmir and also from the Ethiopian study by Akilev et al. was reported to be 20% and 13.6% respectively which is higher as compared to what we found (5.3%).^(18,19) The difference in these results may be due to different definitions of non-compliance with TB control in different regions.

Though not significant, non-adherence to treatment was higher in our study among participants residing in rural areas, those with low socioeconomic status, no formal education, married participants, lacking family/social support, etc. which was also similar to the findings from around the world. ^(18,20–22) Even though the setting and the condition/situation of the study were different, as our study focused during the lockdown brought about by the pandemic, the findings remained the same. This shows that the socio-demographic factors of the patients play an important role in non-adherence to drugs therapy.

The distance between the patient and the DOTS centre, nor the problem with transportation had any significant difference when it came to non-adherence to treatment. Contrary to our findings, many studies reported that the compliance depended on distance from the centre and route difficulties.^(18,21,23,24) The low prevalence from our study in spite of the stringent lockdown may be due to the relaxation placed for health sector and those seeking medical help.⁽¹⁾

Anti-TB medication is required to be taken for a long duration, which is another important factor in the non-adherence of the treatment which was also corroborated by Cylia Nkechi Iweama et al.⁽²⁵⁾ The other factors were Diabetes and HIV, which are chronic diseases, such diseases also require a tenacious medication for a long duration or lifelong.⁽²²⁾ Such chronic diseases also affect the mental status of the patients which may lead to anxiety and depression thereby affecting the drug adherence of anti-tuberculosis treatment.^(26,27)

Participants with no knowledge regarding the transmission of TB had lower adherence to treatment which is consistent to the study from China by Tang et al.

unlike the study from Nigeria, where those with good knowledge had higher non-adherence rate.(23,25) The rate of non-adherence among those who discontinued treatment as and when the symptoms subsided was at 25% and similar finding was reported by Vedavathi Hanumaiah et al. In the same study, the rate of non-compliance due to side effect caused by anti-tuberculosis treatment was approximately 4-fold (30%) higher than in our study (7.9%). One possible reason for these differences may be due to the different level of knowledge of the research participants in these two studies regarding TB treatment.(21)

Alcohol consumption and addiction to drugs are well known risk factor and a barrier to medical treatment which may lead to non-adherence.(21,28) Findings from our study also reflects that alcohol consumption and drug addiction are risk factors, where the rate of non-adherence to treatment due to these factors were as high as 15% and 6.7% respectively.

Stigmatization towards tuberculosis and those suffering from TB is an old issue which discourages the patient to come forward for the treatment or may also lead to early stoppage of the treatment. Ironically, our study observed that the rate of non-compliance was higher (6.4%) among those who believed that TB disease was a social stigma. The reason for this non-compliance may be due to lack of awareness among the general public in some pockets of areas, this creates a sense of fear or stigmatization towards the disease and the person with the disease which ultimately brings about the patient to hide his/her condition and affect the treatment.

Our study found that participants who missed treatment due to problems accessing nearby health facilities for anti-tuberculosis drugs had a higher prevalence of non-compliance. The reasons stated were the geographical location where the patients were stranded due to the lockdown and some reasoned that they fear contracting COVID-19.

Conclusion

Amid the restriction imposed during the pandemic, the non-adherence rate to anti-tubercular drug in our study was low at 5.3%. Chronic diseases, depression, ignorant of how the disease is transmitted and that medication can be discontinued once the symptoms subside, alcohol consumption, and trouble accessing medicines during the lockdown were found to be the major factors in determining the non-adherence to the treatment.

Recommendation

Although the proportion of non-adherence was very low but the various WHO dimensions of adherence as well as lockdown related factors had significant impact on non-adherence. To further minimise non-adherence during emergency situation such as lockdown due to COVID-19 pandemic, corrective measures must be explored and implemented.

Secondly, a large-scale qualitative study consisting of in-depth interviews is required to get a clearer insight of reasons that led to low prevalence of non-adherence which can be used as an example to deal with these types of situations if they arise in future, and it can also use to frame policies for other states also to tackle the problem of non-adherence.

Limitation of the study

The operational definition used for non-adherence in this study was different from other studies as other studies have used missing single dose/ missing dose for 1 week etc. for defining non-adherence that may have affected the estimate of non-adherence in this study which is different/ lower from other studies. The study design was a retrospective study where telephonic interview was mostly taken; therefore, it might have subjected to the recall bias. Using of google forms, and bias may have crept up for understanding the question.

Relevance of the study

This study was conducted in context of lockdown due to COVID-19, and might be helpful in further perspective and prospective scenario if lockdown/community movement restriction follows due to any other reason, and the findings of the study might be helpful to increase the compliance of tubercular patients for continuing the treatment.

Authors Contribution

MM, GP, MB, SA, SCB, PS made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; drafting the article, revising it critically for important intellectual content; and final approval of the version to be published.

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References

1. Guidelines on the measures to be taken by Ministries/ Departments of Government of India, State/Union Territory Governments and State/ Union Territory Authorities for containment of COVID-19 Epidemic in the Country | COVID-19 Inter-Ministerial Notification [Internet]. 2020. [cited 2022 Dec 15]. Available from: <https://covid19.india.gov.in/document/mha-order-covid-19/>
2. Government of India issues Orders prescribing lockdown for containment of COVID-19 Epidemic in the country [Internet]. 2020 [cited 2022 Dec 15]. Available from: <https://pib.gov.in/PressReleasePage.aspx?PRID=1607997>
3. Global tuberculosis report 2019 [Internet]. WHO. 2019 [cited 2022 Dec 15]. p. 2. Available from: <https://www.who.int/publications/i/item/9789241565714>
4. Tuberculosis [Internet]. WHO. [cited 2022 Dec 15]. Available from: https://www.who.int/health-topics/tuberculosis#tab=tab_1

5. Global tuberculosis report 2020 [Internet]. WHO. [cited 2022 Dec 15]. Available from: <https://www.who.int/publications/i/item/9789240013131>
6. SEAR Covid-19 Dashboard [Internet]. WHO. [cited 2022 Dec 15]. Available from: <https://who.maps.arcgis.com/apps/dashboards/73d1d3251de3435cbc0bc586230cc3ef>
7. Bhatia V, Mandal PP, Satyanarayana S, Aditama TY, Sharma M. Mitigating the impact of the COVID-19 pandemic on progress towards ending tuberculosis in the WHO South-East Asia Region. *WHO South-East Asia J Public Heal.* 2020;9(2):95.
8. Park K. *Park's Textbook of Preventive & Social Medicine.* 25th ed. M/s Banarsidas Bhanot; 2019:188-189.
9. Mittal C, Gupta SC. Noncompliance to DOTS: How it can be Decreased. *Indian J Community Med.* 2011;36(1):27.
10. Gopi PG, Vasantha M, Muniyandi M, Chandrasekaran V, Balasubramanian R, Narayanan PR. Risk factors for non-adherence to directly observed treatment (DOT) in a rural tuberculosis unit, South India. *Indian J Tuberc.* 2007;54(2):66–70.
11. Bagchi S, Ambe G, Sathiakumar N. Determinants of poor adherence to anti-tuberculosis treatment in Mumbai, India. *Int J Prev Med.* 2010;1(4):223–32.
12. Sinha TS. DOTS Compliance by Tuberculosis Patients in District Raipur (Chhattisgarh). *Online J Heal Allied Sci.* 2010;9(3):3–12.
13. Das R, Baidya S, Das JC, Kumar S. A study of adherence to DOTS regimen among pulmonary tuberculosis patients in West Tripura District. *Indian J Tuberc.* 2015;62(2):74–9.
14. Shiotani R, Hennink M. Socio-cultural influences on adherence to tuberculosis treatment in rural India. *Glob Public Health.* 2014;9(10):1239–51.
15. Shivapujimath R, Rao AP, Nilima AR, Shilpa DM. A cross-sectional study to assess the stigma associated with tuberculosis among tuberculosis patients in Udupi district, Karnataka. *Indian J Tuberc.* 2017;64(4):323–6.
16. Adherence to long-term therapies : evidence for action. World Health Organization; 2003: 196.
17. Woimo TT, Yimer WK, Bati T, Gesesew HA. The prevalence and factors associated for anti-tuberculosis treatment non-adherence among pulmonary tuberculosis patients in public health care facilities in South Ethiopia: a cross-sectional study. *BMC Public Health.* 2017;17(1):269.
18. Lata S, Khajuria V, Sawhney V, Kumari K. Evaluation of non-adherence to antitubercular drugs among tuberculosis patients: a prospective study. *Int J Curr Pharm Res.* 2021;13(2):26–28.
19. Adane AA, Alene KA, Koye DN, Zeleke BM. Non-Adherence to Anti-Tuberculosis Treatment and Determinant Factors among Patients with Tuberculosis in Northwest Ethiopia. *Wilkinson RJ, editor. PLoS One.* 2013;8(11):e78791.
20. Nezenega ZS, Perimal-Lewis L, Maeder AJ. Factors Influencing Patient Adherence to Tuberculosis Treatment in Ethiopia: A Literature Review. *Int J Environ Res Public Health.* 2020;17(15):5626.
21. Hanumaiah V, Ranganath DD, Kakkuppi N. Assessment of adherence to anti tuberculosis medication for successful implementation of revised national tuberculosis programme at a tertiary care hospital, Shimoga: a cross-sectional observational study. *Int J Basic Clin Pharmacol.* 2019;8(11):2361.
22. Batte C, Namusobya MS, Kirabo R, Mukisa J, Adakun S, Katamba A. Prevalence and factors associated with non-adherence to multi-drug resistant tuberculosis (MDR-TB) treatment at Mulago National Referral Hospital, Kampala, Uganda. *Afr Health Sci.* 2021;21(1):238–47.
23. Tang Y, Zhao M, Wang Y, Gong Y, Yin X, Zhao A, et al. Non-adherence to anti-tuberculosis treatment among internal migrants with pulmonary tuberculosis in Shenzhen, China: a cross-sectional study. *BMC Public Health.* 2015;15(1):474.
24. Herrero MB, Ramos S, Arrossi S. Determinants of non adherence to tuberculosis treatment in Argentina: barriers related to access to treatment. *Rev Bras Epidemiol.* 2015;18(2):287–98.
25. Iweama CN, Agbaje OS, Umoke PCI, Igbokwe CC, Ozoemena EL, Omaka-Amari NL, et al. Nonadherence to tuberculosis treatment and associated factors among patients using directly observed treatment short-course in north-west Nigeria: A cross-sectional study. *SAGE Open Med.* 2021;9:205031212198949.
26. Koyanagi A, Vancampfort D, Carvalho AF, DeVylder JE, Haro JM, Pizzol D, et al. Depression comorbid with tuberculosis and its impact on health status: cross-sectional analysis of community-based data from 48 low- and middle-income countries. *BMC Med.* 2017;15(1):209.
27. Ducat L, Philipson LH, Anderson BJ. The Mental Health Comorbidities of Diabetes. *JAMA.* 2014;312(7):691.
28. Nguipdop-Djomo P, Rodrigues LC, Smith PG, Abubakar I, Mangtani P. Drug misuse, tobacco smoking, alcohol and other social determinants of tuberculosis in UK-born adults in England: a community-based case-control study. *Sci Rep.* 2020;27;10(1):5639.

Tables

TABLE 1. ASSOCIATION OF NON- ADHERENCE WITH FACTORS RELATED TO SOCIO- ECONOMIC DIMENSION

Factors	Adherent	Non- adherent	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	
Age (p=0.772)	18-39 years	167 (94.4)	10 (5.6)	2.1 (0.3- 16.9)	2.0 (0.1- 27.5)
	40- 59 years	67 (94.4)	4 (5.6)	2.1 (0.2- 19.4)	1.5 (0.1- 19.6)
	60 years & above	35 (97.2)	1 (2.8)	1	1
Sex (p=0.791)	Female	113 (94.2)	7 (5.8)	1.2 (0.4- 3.4)	0.5 (0.1- 5.1)
	Male	156 (95.1)	8 (4.9)	1	1
Area of residence (p=0.440)	Rural	132 (93.6)	9 (6.4)	1.6 (0.5- 4.5)	5.4 (1.0- 28.6)
	Urban	137 (95.8)	6 (4.2)	1	1
Occupation (p=0.874)	Job (govt./ private)	62 (95.4)	3 (4.6)	1.3 (0.1- 12.7)	6.3 (0.1- 375.6)
	Home maker	68 (91.9)	6 (8.1)	2.3 (0.3- 20.0)	12.2 (0.1- 1230.2)
	Student	33 (97.1)	1 (2.9)	0.8 (0.1- 13.2)	1.5 (0.0- 120.5)
	Self employed	57 (95.0)	3 (5.0)	1.4 (0.1- 13.8)	4.2 (0.1- 219.2)
	Labourers	23 (95.8)	1 (4.2)	1.1 (0.1- 19.1)	4.9 (0.1- 408.7)
	Not employed/ Not working	26 (96.3)	1 (3.7)	1	1
Socio-economic class (p=0.748)	Upper class	31 (96.9)	1 (3.1)	1	1
	Upper middle class	55 (96.5)	2 (3.5)	1.1 (0.1- 12.9)	1.0 (0.1- 16.5)
	Middle class	66 (95.7)	3 (4.3)	1.4 (0.1- 14.1)	1.0 (0.1- 14.0)
	Lower middle class	98 (93.3)	7 (6.7)	2.2 (0.3- 18.7)	1.1 (0.1- 15.4)
	Lower class	19 (90.5)	2 (9.5)	3.3 (0.3- 38.5)	1.5 (0.1- 33.1)
Family support (p=0.196)	No	3 (75.0)	1 (25.0)	6.3 (0.6- 64.8)	29.2 (0.3- 2907.8)
	Yes	266 (95.0)	14 (5.0)	1	1
Social support (p=.076)	No	7 (77.8)	2 (22.2)	5.8 (1.1- 30.5)	4.2 (0.4- 49.0)

Factors	Adherent	Non- adherent	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	
Distance of DOTS centre is far away (p=0.795)	Yes	262 (95.3)	13 (4.7)	1	1
	No	138 (95.2)	7 (4.8)	1	1
Travel/ transport difficult (p=0.794)	Yes	131 (94.2)	8 (5.8)	1.2 (0.4- 3.4)	1.5 (0.2- 13.7)
	No	154 (95.1)	8 (4.9)	1	1
Did you feel treatment is costly (p=0.472)	Yes	115 (94.3)	7 (5.7)	1.2 (0.4- 3.3)	1.0 (0.1- 8.9)
	No	230 (95.0)	12 (5.0)	1	1
	Yes	39 (92.9)	3 (7.1)	1.5 (0.4- 5.5)	1.7 (0.4- 7.5)

TABLE 2. ASSOCIATION OF NON- ADHERENCE WITH FACTORS RELATED TO HEALTH CARE, CLINICAL CARE, THERAPY, AND PATIENT DIMENSIONS

Dimensions	Factors	Adherent N (%)	Non- adherent N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	
Health care dimension	Too much time consumed for taking medicine (p=0.790)					
	No	157 (95.2)	8 (4.8)	1	1	
	Yes	112 (94.1)	7 (5.9)	1.2 (0.4- 3.5)	1.3 (0.4- 3.9)	
	Did doctors mention the effects of stopping DOTS midway (p=0.602)					
	No	139 (93.9)	9 (6.1)	1.4 (0.5- 4.1)	1.3 (0.4- 3.8)	
	Yes	130 (95.6)	6 (4.4)	1	1	
	Satisfied with the health service (p=0.239)					
	Dissatisfied	4 (80.0)	1 (20.0)	4.7 (0.5- 45.2)	5.0 (0.5- 52.5)	
	Satisfied	265 (95.0)	14 (5.0)	1	1	
	Clinical care related dimension	Diabetes (p=0.732)				
No		245 (94.6)	14 (5.4)	1	1	
Yes		14 (93.3)	1 (6.7)	1.2 (0.2- 10.2)	1.3 (0.2- 12.1)	
Don't know		10 (100.0)	0 (0.0)	0	0	
HIV (p=0.868)						
No		264 (94.6)	15 (5.4)	1	1	
Yes		1 (100.0)	0 (0.0)	0	0	
Don't know		4 (100.0)	0 (0.0)	0	1.9 (0- 0)	
Depression (p=0.007) *						
No		253 (95.5)	12 (4.5)	1	1	
Yes		9 (75.0)	3 (25.0)	7.0 (1.7- 29.3)	7.5 (1.8- 32.0)	
Don't know		7 (100.0)	0 (0.0)	0	0	
Therapy dimension		DOTS category (p=0.760)				
		New	184 (95.3)	9 (4.7)	1	1
	Previously treated	84 (93.3)	6 (6.7)	1.5 (0.5- 4.2)	2.5 (0.7- 9.5)	
	MDR TB	1 (100.0)	0 (0.0)	0	0	
	Treatment is too long (p=0.594)					
	No	164 (95.3)	8 (4.7)	1	1	
	Yes	105 (93.8)	7 (6.3)	1.4 (0.5- 3.9)	1.6 (0.4- 6.4)	
	Treatment should be discontinued once symptoms resolve (p=0.001)*					
	No	251 (96.5)	9 (3.5)	1	1	
	Yes	18 (75.0)	6 (25.0)	9.3 (3.0- 29.0)	12.6 (3.7- 42.8)	
	Experienced drug ingestion problems/ side effects (p=0.336)					
	No	211 (95.5)	10 (4.5)	1	1	
	Yes	58 (92.1)	5 (7.9)	1.8 (0.6- 5.5)	2.1 (0.5- 8.8)	
	Do you think drug frequency is high (i.e., you have to consume drugs daily which is high it should be less) (p=1.00)					
	No	131 (94.9)	7 (5.1)	1	1	
	Yes	138 (94.5)	8 (5.5)	1.1 (0.4- 3.1)	0.8 (0.2- 3.8)	
Patient dimension	Do you know how tuberculosis is transmitted (p=0.019) *					
	No	39 (86.7)	6 (13.3)	3.9 (1.3- 11.7)	4.6 (1.3- 16.5)	
	Yes	230 (96.2)	9 (3.8)	1	1	
	Smoking status (p=0.471)					
	Never	211 (95.5)	10 (4.5)	1	1	
	Past	41 (93.2)	3 (6.8)	1.5 (0.4- 5.8)	0.4 (0.1- 3.1)	
	Present	17 (89.5)	2 (10.5)	2.5 (0.5- 12.2)	0.4 (0.0- 10.2)	
	Tobacco chewing (p=0.067)					
	Never	228 (95.8)	10 (4.2)	1	1	
	Past	26 (92.9)	2 (7.1)	1.8 (0.4- 8.4)	1.0 (0.1- 7.5)	
	Present	15 (83.3)	3 (16.7)	4.6 (1.1- 18.3)	7.0 (0.5- 104.5)	
	Alcohol use (p=0.021) *					
	Never	207 (96.7)	7 (3.3)	1	1	
	Past	45 (90.0)	5 (10.0)	3.3 (1.0- 10.8)	4.5 (0.9- 22.5)	
	Present	17 (85.0)	3 (15.0)	5.2 (1.2- 22.0)	3.6 (0.4- 38.1)	
	Substance abuse (p=0.664)					

Dimensions	Factors	Adherent N (%)	Non-adherent N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
	Absent	241 (94.9)	13 (5.1)	1	1
	Present	28 (93.3)	2 (6.7)	1.3 (0.3- 6.2)	1.7 (0.3- 9.9)
Know problems of stopping treatment (DOTS therapy) (p=0.771)					
	No	77 (93.9)	5 (6.1)	1.2 (0.4- 3.8)	1.4 (0.4- 5.2)
	Yes	192 (95.0)	10 (5.0)	1	1
Felt stigmatised (p=0.437)					
	No	138 (95.8)	6 (4.2)	1	1
	Yes	131 (93.6)	9 (6.4)	1.6 (0.6- 4.6)	1.6 (0.4- 6.0)
Perceived change in health status (p=0.232)					
	Not improved	29 (90.6)	3 (9.4)	2.1 (0.6- 7.8)	1.7 (0.4- 7.8)
	Improved	240 (95.2)	12 (4.8)	1	1

*Statistically significant

TABLE 3. ASSOCIATION OF NON-ADHERENCE WITH LOCKDOWN RELATED FACTORS

Lockdown related factors	Adherent N (%)	Non- Adherent N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Missed treatment due to problem in access medicines (p=0.00) *				
No	261 (96.7)	9 (3.3)	1	1
Yes	8 (57.1)	6 (42.9)	21.8 (6.2- 75.9)	26.2 (6.4- 107.8)
Fear of contracting COVID-19 in institutional settings (p=0.301)				
No	129 (96.3)	5 (3.7)	1	1
Yes	140 (93.3)	10 (6.7)	1.8 (0.6- 5.5)	1.9 (0.5- 7.7)
Patients stranded in different geographic location due to lockdown (p=0.606)				
No	145 (95.4)	7 (4.6)	1	1
Yes	124 (93.9)	8 (6.1)	1.3 (0.4- 3.8)	0.4 (0.1- 1.9)

*Statistically significant

Figures

FIGURE 1 FLOW DIAGRAM SHOWING SELECTION OF PARTICIPANTS

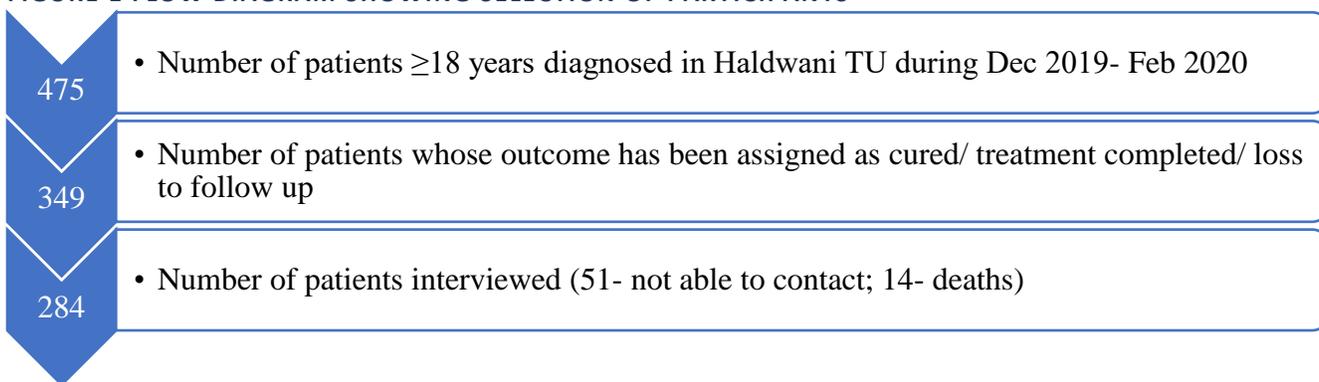


FIGURE 2 DISTRIBUTION OF STUDY PARTICIPANTS AS PER ADHERENCE TO TUBERCULOSIS TREATMENT

