Impact of COVID-19 Pandemic on Tuberculosis Treatment Outcomes at a Tuberculosis Unit in Southern India: A Retrospective Observational Study

ANWITH HULUVADI SHIVALINGAIAH[1], PRANAV AYYAPPAN[2], DIVYARAJAN VINITHA KIRUFFI[3], MADHUSUDAN MURALIDHAR[4]

ABSTRACT

Introduction: The Coronavirus Disease-2019 (COVID-19) pandemic significantly affected both existing and undiagnosed Tuberculosis (TB) patients worldwide. The impact of the pandemic on the treatment outcomes of these patients in India remains unclear.

Aim: To assess the difference in TB treatment outcomes before and during the COVID-19 pandemic in an economically disadvantaged urban area in Southern India.

Materials and Methods: A retrospective observational study was conducted at a TB Unit in South Bangalore, Southern India, serving a population of 2,50,000 from January 2022 to December 2022. Purposive sampling was employed to select 516 patients who had registered for TB treatment during the years 2019 and 2020. The socio-demographic details and TB profiles of the patients were collected and tabulated. Treatment outcomes were classified according to World Health Organisation (WHO) definitions after a case record analysis. Data were entered into Microsoft Excel 2018 and analysed using Open Epi software. Descriptive statistics, such as mean and standard deviation, were used to report socio-demographic profiles, and the Chi-square test was utilised to evaluate the differences in treatment outcomes. A p-value <0.05 was considered statistically significant.

Results: The study included a total of 516 subjects. There were fewer cases registered in 2020 (n=202), especially after the first quarter, compared to the number registered in 2019 (n=314). The majority of the cases during both years were new instances of microbiologically confirmed pulmonary TB with no co-morbidities. Treatment success rates were 85.35% in 2019 and 88.61% in 2020, which was not statistically significant.

Conclusion: There was a noticeable reduction in the number of cases registered during 2020, indicating that the COVID-19 pandemic had a definite effect on TB case notification. However, treatment success rates increased during the COVID-19 pandemic. This increase in the treatment success rate from 85.35% to 88.61% could be attributed to the decrease in the number of registered cases during the pandemic. The study thus found no significant impact on TB treatment success rate due to the COVID-19 pandemic.

Keywords: Coronavirus disease, Therapy, Tuberculosis outcome assessment

INTRODUCTION

The TB, a disease known since ancient times, continues to be endemic in many South Asian countries and remains one of the leading causes of mortality in modern India [1,2]. The Indian government initially developed the National Tuberculosis Programme (NTP) in 1962 and established district TB centres to address the country's TB burden. Since then, India's approach to combating TB has evolved, embracing both contemporary developments and international principles [3]. Following the implementation of the WHO-recommended Directly Observed Therapy Short course (DOTS) regimen, the programme was renamed the Revised National Tuberculosis Control Programme (RNTCP) in 1993 [4]. More recently, in an effort to eliminate TB by 2025, India's TB programme has integrated the goals of the "End TB Strategy", endorsed by the WHO Assembly in May 2014 [5]. On March 11, 2020, the WHO declared COVID-19 a public health emergency of international concern [6]. India reported its first COVID-19 case on January 30, 2020; eight weeks later, the country's total number of cases had surpassed 1,000 [7]. The COVID-19 pandemic has posed a global health crisis, stretching health programmes to their limits, and affecting even established public health initiatives such as Tuberculosis Control Programmes [8]. These national programmes have been actively involved in ensuring a rapid and effective response to COVID-19 while also maintaining essential TB services [9].

The pandemic has significantly impacted the delivery of services intended to tackle India's TB burden, including diagnosis, surveillance, and management, thereby spelling 'double trouble' for the country's health system [10,11]. Although India aims to eliminate TB by 2025, the current political and financial focus on COVID-19 could necessitate a reorientation of this goal, potentially creating adverse effects for existing and undiagnosed TB patients [12-14]. While reviews and modelling studies predicted a noticeable decline in TB case notification, testing, and treatment coverage, few field studies have documented these effects. Furthermore, changes in treatment outcomes reported in these studies were less pronounced, and data in this regard were sparse [15,16].

In this context, the present study was undertaken to determine the impact of the COVID-19 pandemic on TB case detection and treatment outcomes in an economically disadvantaged urban area in Southern India.

MATERIALS AND METHODS

A retrospective observational study was conducted at a TB Unit in South Bangalore, Southern India, from January 2022 to December 2022, covering a population of 2,50,000. The study was conducted after obtaining clearance from the Institutional Review Board, Approval No. KIMS/IEC/A004/M/2022.

Inclusion criteria: All TB cases aged over 18 years registered for treatment from January 2019 to December 2020 at the study site were included in the study.

Exclusion criteria: Subjects under the age of 18 were excluded from the study.

Purposive sampling was employed to recruit 516 patients registered for TB treatment. Socio-demographic details of all subjects were collected from their treatment cards in person and through the NIKSHAY portal. Any additional information required was collected via telephone calls and patient interviews after obtaining verbal consent. Details of the patient's TB profiles, such as the type of TB, prior treatment for TB, diagnostic tests used, and information on co-morbidities, including Human Immunodeficiency Virus (HIV) status and the presence of diabetes mellitus, were collected from the patients' treatment cards. After performing a case record analysis of the enrolled cases, treatment outcomes were classified according to WHO Criteria, i.e., cured, lost to follow-up, not evaluated, treatment completed, death, and treatment failure [17]. The treatment success rate was calculated using the appropriate formula:

$$\text{Treatment Success Rate} = \frac{\text{subjects who completed treatment} + \text{subjects cured}}{\text{Total number of subjects}}$$

STATISTICAL ANALYSIS

Data were entered into Microsoft Excel 2018 and analysed using Open Epi software. Descriptive statistics such as mean and standard deviation were used to report socio-demographic profiles, and the Chi-square test was used to determine the difference in treatment outcomes. A p-value <0.05 was considered statistically significant.

RESULTS

The present study involved a total of 516 subjects, with 314 (60.85%) registered during the pre-COVID-19 era (2019) and 202 (39.15%) during the COVID-19 pandemic (2020). The mean±SD age of the subjects was 35.78±16.58 years in 2019 and 36.31±16.43 years in 2020. Of the 314 subjects in 2019, 139 (44.27%) were females and 175 (55.73%) were males . In 2020, among the 202 subjects, 95 (47.03%) were females and 107 (52.97%) were males. A total of 257 (81.85%) cases in 2019 and 163 (80.69%) cases diagnosed during 2020 were new cases [Table/Fig-1]. Additionally, the majority of the subjects, 183 (58.28%) in 2019 and 112 (55.45%) in 2020, had microbiologically confirmed pulmonary TB with no co-morbidities [Table/Fig-2].
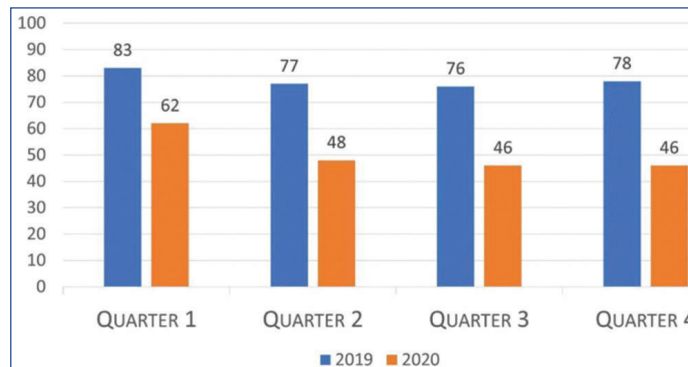
Type of patient	Year 2019 (Pre-COVID-19) n=314, n (%)	Year 2020 (COVID-19) n=202, n (%)
New	257 (81.85)	163 (80.69)
Relapse/recurrent	32 (10.19)	12 (5.94)
Treatment after failure	2 (0.64)	1 (0.50)
Treatment after loss to follow-up	0	1 (0.50)
Others	23 (7.32)	25 (12.37)

[Table/Fig-1]: Patient registered.

During the first quarter of 2020, a total of 62 cases were registered, while the number of registered cases dropped to 48, 46, and 46 in the second, third, and fourth quarters, respectively [Table/Fig-3]. The treatment outcome showed that 144 (45.86%) were cured in 2019, while in 2020, 93 (46.04%) were cured [Table/Fig-4]. The treatment success rates were 85.35% in 2019 and 88.61% in 2020. There was no statistically significant difference in treatment success between the two years (p-value >0.05) [Table/Fig-5].

Profile	Classification	Year 2019 (Pre-COVID-19) n=314, n (%)	Year 2020 (COVID-19) n=202, n (%)
Anatomical site	Pulmonary	183 (58.28)	112 (55.45)
	Extra-pulmonary	131 (41.72)	90 (44.55)
Case definition	Bacteriologically confirmed	196 (62.42)	120 (59.41)
	Clinically diagnosed	118 (37.58)	82 (40.59)
HIV status	Positive	7 (2.23)	2 (0.99)
	Negative	288 (91.72)	199 (98.51)
	Unknown	19 (6.05)	1 (0.50)
Diabetes Mellitus	Present	46 (14.65)	35 (17.33)
	Absent	240 (76.43)	166 (82.18)
	Unknown	28 (8.92)	1 (0.49)

[Table/Fig-2]: Tuberculosis (TB) profile.

[Table/Fig-3]: Quarter wise case notification.

Treatment outcome	Year 2019 (Pre-COVID-19) n=314, n (%)	Year 2020 (COVID-19) n=202, n (%)
Cured	144 (45.86)	93 (46.04)
Died	14 (4.46)	10 (4.95)
Lost to follow-up	9 (2.86)	4 (1.98)
Not evaluated	10 (3.19)	1 (0.50)
Treatment completed	124 (39.49)	86 (42.57)
Treatment failed	13 (4.14)	8 (3.96)

[Table/Fig-4]: Treatment outcomes based on WHO classification.

Treatment success		Year 2019 (Pre-COVID-19) n=314, n (%)	Year 2020 (COVID-19) n=202, n (%)	
	Yes	268 (85.35)	179 (88.61)	=0.866 p>0.05
	No	46 (14.65)	23 (11.39)	

[Table/Fig-5]: Treatment success rates.

DISCUSSION

In the present study, a total of 516 TB patients were included as study subjects. During 2020, there was a reduction in the number of TB patients registered for treatment compared to 2019, yet treatment success rates improved in 2020. TB remains a significant public health issue and a leading cause of mortality in India, despite the availability of highly effective anti-TB drugs and easy access to treatment. The Government of India has exerted considerable efforts to control TB, with the ultimate goal of eliminating it by 2025. However, recent literature published during the pandemic suggests that the current political and economic focus on COVID-19 could divert attention from these priorities [4,14]. Published literature indicates that the COVID-19 pandemic has affected various national health programs in India, including the National Tuberculosis Elimination Programme, which provides services for TB prevention, control, and treatment [8-10].

The present study documented a decrease in the number of TB patients enrolling for treatment from the second quarter of 2020,

subsequent to the declaration of the COVID-19 pandemic. This trend aligns with findings from Global TB reports, TB India reports, and other reviews [10,12,18,19]. Moreover, patients registered during the COVID-19 pandemic (2020) had a treatment success rate of 88.61%, higher than the rate for the state of Karnataka, where the study site is located, which stood at 81% for the same period. This pattern was observed even before the pandemic; the study site reported a treatment success rate of 85.35%, compared to the state's 80% [1,3].

This study is among the few efforts to compile data on the impact of COVID-19 on TB case notifications in the field. It provides a quantifiable indication of the anticipated decline in case notifications, as suggested by reviews and modelling studies. Furthermore, the findings from this study could act as a stimulus for future research that seeks to understand the specific weaknesses within the TB program and identify areas for optimisation.

Limitation(s)

As the present study was conducted at a single TB unit, the results cannot be generalised. Therefore, multicentric studies with a larger population are recommended.

CONCLUSION(S)

The reduction in the number of cases registered during 2020, particularly after the second quarter, indicates that the COVID-19 pandemic has had a definitive effect on TB case notifications. Although treatment success rates increased in 2020 compared to 2019, the decrease in the total number of cases reported during the pandemic may have contributed to this increase. Therefore, it is clear that the COVID-19 pandemic has affected TB patients at the study site. Consequently, active case finding, treatment initiation, and case follow-up require heightened attention.

Acknowledgement

Authors would like to acknowledge the Indian Council of Medical Research (ICMR) for accepting the study as part of the Short Term Studentship programme 2022, District Tuberculosis Officer-BBMP, Bengaluru and associated personnel, and the staff of the Kempegowda Institute of Medical Sciences, Bengaluru, Karnataka, India.

REFERENCES

[1] Government of India. India TB report 2022 [Internet]. National Tuberculosis Division. [Cited 2022 Aug 30]. Available from: https://tbcindia.gov.in.

[2] Shivalingaiah AH, Ramegowda C, Masthi NRR. A study on co-morbidities and treatment outcome based on updated definitions among tuberculosis patients registered at a tuberculosis unit, Bangalore. Int J Community Med Public Health. 2017;4:1071-74. Doi: http://dx.doi.org/10.18203/2394-6040.ijcmph20171326.

[3] Gupta A, Chopra V. Evolution of newer regimens in TB from RNTCP to NTEP. Indian J Tuberc. 2020;67(4S):S107-10. Doi: 10.1016/j.ijtb.2020.10.007.

[4] Khanna A, Saha R, Ahmad N. National TB elimination programme-What has changed. Indian J Med Microbiol. 2023;42:103-07. Doi: 10.1016/j.ijmmb.2022.10.008.

[5] World Health Organization. The End TB Strategy 2015 [Internet]; 2015 Aug 16. [Cited 2023 Aug 15]. Available from: https://www.who.int/publications/i/item/WHO-HTM-TB-2015.19.

[6] World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19, 11 March 2020. Geneva, Switzerland: WHO; 2020 Mar 11. [Cited 2023 Aug 12]. Available from: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-COVID-19---11-march-2020.

[7] World Health Organization. India: Who coronavirus disease (COVID-19) dashboard with vaccination data. World Health Organization. [Cited 2023 Apr 27]. Available from: https://COVID-1919.who.int/region/searo/country/in.

[8] Behera D. TB control in India in the COVID-19 era. Indian J Tuberc. 2021;68(1):128-33. Doi: 10.1016/j.ijtb.2020.08.019.

[9] World Health Organisation (WHO). Tuberculosis and COVID-19 [Internet]. WHO; 2020 May 12. [Cited 2023 Jan 11]. Available from: https://www.who.int/docs/default-source/documents/tuberculosis/infonote-tb-COVID-19.pdf.

[10] Jain VK, Iyengar KP, Samy DA, Vaishya R. Tuberculosis in the era of COVID-19 in India. Diabetes Metab Syndr. 2020;14(5):1439-43. Doi: 10.1016/j.dsx.2020.07.034.

[11] Iyengar KP, Jain VK. Tuberculosis and COVID-19 in India- double trouble! Indian J Tuberc. 2020;67(4S):S175-76. Doi: 10.1016/j.ijtb.2020.07.014.

[12] Central TB Division, Ministry of Health and Family Welfare, Government of India. National Strategic Plan 2017-2025 for TB Elimination in India [Internet]. New Delhi, India: GOI, 2020. [Cited 2023 Jan 13]. Available from: https://tbcindia.gov.in/WriteReadData/National%20Strategic%20Plan%202017-25.pdf.

[13] Togun T, Kampmann B, Stoker NG, Lipman M. Anticipating the impact of the COVID-19 pandemic on TB patients and TB control programmes. Ann Clin Microbiol Antimicrob. 2020;19(1):21. https://doi.org/10.1186/s12941-020-00363-1.

[14] Hogan AB, Jewell BL, Sherrard-Smith E, Vesga JF, Watson OJ, Whittaker C, et al. Potential impact of the COVID-19 pandemic on HIV, tuberculosis, and malaria in low-income and middle-income countries: A modelling study. Lancet Glob Health. 2020;8(9):e1132-41. Doi: 10.1016/S2214-109X(20)30288-6. Erratum in: Lancet Glob Health. 2021;9(1):e23.

[15] McQuaid CF, Vassall A, Cohen T, Fiekart K, White RG. The impact of COVID-19 on TB: A review of the data. Int J Tuberc Lung Dis. 2021;25(6):436-46. Doi: 10.5588/ijtld.21.0148.

[16] Stop TB Partnership. The potential impact of the COVID-19 response on tuberculosis in high-burden countries: A modelling analysis. Stop TB Partnership 2020. [Cited 2023 Jan 21]. Available from: https://stoptb.org/assets/documents/news/Modeling%20Report_1%20May%202020_FINAL.pdf.

[17] World Health Organization. Guidance for National Tuberculosis Programs on the Management of Tuberculosis in Children. 2nd edition. Geneva: World Health Organization; 2014. Annex 2, TB case and treatment outcome definitions. [Cited 2023 Jul 23]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK214446/.

[18] World Health Organization. Global Tuberculosis report 2021 [Internet] WHO. [Cited 2023, Aug 11]. Available from: https://www.who.int/teams/global-tuberculosis-programme/tb-reports.

[19] Cilloni L, Fu H, Vesga JF, Dowdy D, Pretorius C, Ahmedov S. The potential impact of the COVID-19 pandemic on the tuberculosis epidemic a modelling analysis. E clinical Medicine. 2020;28:100603. Doi: 10.1016/j.eclinm.2020.100603.

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Community Medicine, Kempegowda Institute of Medical Sciences, Bengaluru, Karnataka, India.
2. Intern, Department of Community Medicine, Kempegowda Institute of Medical Sciences, Bengaluru, Karnataka, India.
3. Postgraduate cum Tutor, Department of Community Medicine, Kempegowda Institute of Medical Sciences, Bengaluru, Karnataka, India.
4. Scientist D (Medical), National Centre for Disease Informatics and Research, ICMR, Bengaluru, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Divyarajan Vinitha Kiruffi,
#24, 2nd Floor, 5th Cross Road, SBM Colony, Brindavan Nagar, Mathikere, Bengaluru-560054, Karnataka, India.
E-mail: vinithakiruffi@gmail.com