

ORIGINAL ARTICLE

Impact of newer initiatives on treatment compliance and outcome in tuberculosis patients of rural Delhi and rural Ghaziabad – a comparative study

Deepika Agrawal¹, Anupama Singh², Gajendra K Gupta³, Ashish Gaur⁴, A Revanth Kumar⁵

¹Professor, Department of Community Medicine, Santosh Medical College, Ghaziabad, Uttar Pradesh; ²Assistant Professor, Department of Community Medicine, Santosh Medical College, Ghaziabad, Uttar Pradesh; ³Professor, Department of Community Medicine, Santosh Medical College, Ghaziabad, Uttar Pradesh; ⁴Statistician, Department of Community Medicine, Santosh Medical College, Ghaziabad, Uttar Pradesh; ⁵Assistant Professor, Department of Community Medicine, Santosh Medical College, Ghaziabad, Uttar Pradesh.

Abstract	Introduction	Methodology	Results	Conclusion	References	Citation	Tables / Figures
--------------------------	------------------------------	-----------------------------	-------------------------	----------------------------	----------------------------	--------------------------	----------------------------------

Corresponding Author

Dr Deepika Agrawal, Professor and Head, Dept of Community Medicine, Santosh Medical College, Ghaziabad, Uttar Pradesh - 201009.
E Mail ID: deepikasudhanshu@gmail.com



Citation

Agrawal D, Singh A, Gupta GK, Gaur A, Kumar AR. Impact of newer initiatives on treatment compliance and outcome in tuberculosis patients of rural Delhi and rural Ghaziabad – a comparative study. Indian J Comm Health. 2021;33(1):47-55. <https://doi.org/10.47203/IJCH.2021.v33i01.007>

Source of Funding: Nil Conflict of Interest: None declared

Article Cycle

Received: 03/02/2021; Revision: 24/02/2021; Accepted: 05/03/2021; Published: 31/03/2021

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

Abstract

Background: India has the highest burden of Tuberculosis in the world, having about one-fourth of the total global incident cases of the disease in 2017. The RNTCP program started many newer initiatives in 2015 to improve compliance and treatment outcomes, reduce the incidence of resistance and control the TB-HIV co-infection. **Objectives:** To assess the improvement in patient compliance, to find out and compare the improvement in nutritional status of the patients after initiation of treatment and Direct Benefit Transfer and to compare the treatment outcomes of the enrolled subjects in the two areas. **Material and Method:** Data was collected from the DOTS centers under CHC, Muradnagar and TB and Chest Hospital Karawal Nagar, between January 2019 to September 2019. Details of the enrolled patients were taken from the centers and these patients were contacted individually. Of the registered patients, 59 patients from Muradnagar, Ghaziabad and 70 from Karawal Nagar, Delhi had completed treatment at the time of data collection and they were further evaluated for different parameters. **Results:** 62% of the registered patients at DOTS centre, Muradnagar, had completed treatment, 35.1% were cured, 1.7% died during treatment while only 1.2% of the patients did not show good compliance. 54% of the registered patients at DOTS centre of Karawalnagar, East Delhi, had completed treatment, 25.5% were cured, 2.7% of the patients had died during treatment while only 2.7% of the total patients did not show good compliance. More number of patients registered at Ghaziabad had either completed the treatment or were cured (97.1%) as compared to Delhi (79.5%). The mean gain in weight was 5.39 kg and 5.04 kg for Ghaziabad and Delhi respectively. This gain in weight had no relationship with Direct Benefit Transfer.

Keywords

Compliance; Tuberculosis

Introduction

India has the highest burden of Tuberculosis in the world, having about one-fourth of the total global incident cases of the disease in 2017. (1) As per Global TB Report 2017, 33% of global TB deaths in HIV negative people occurred in India alone. (2) The Incidence rate of TB in India is 211/lakh/year against the global rate of 176/lakh/year. More than 80% of the cases in India, are in the age group 15-54 years which is the most productive age. (3) Out of these, two-third cases are males and the rest females. More than fifty percent of females are affected before the age of thirty-four years, which is alarming. (4) One third of female infertility cases are also attributed to TB. It has been observed that it is a major cause of mortality among reproductive age females.

Though the Govt of India started its National Tuberculosis Control Program in the year 1962, it was not able to make a mark. The reasons identified were- managerial weakness, inadequate funding, over-reliance on X-ray for diagnosis, frequent interrupted supplies of drugs, and low rates of treatment completion.(5) Its loopholes led to the upgradation and revision of the program to Revised National Tuberculosis Control Program in 1996. The main strategy adopted in this program was DOTS (Directly Observed Treatment Short course), ensuring regular supply of drugs and comprehensive services, commitment from top leadership, adoption of smear microscopy in a decentralized manner. (5) The objectives of RNTCP were to achieve at least 85% cure rate among the new smear positive cases initiated on treatment and a case detection rate of at least 70%. We were able to achieve the objectives of this program, but it was observed that despite it, the burden of the disease did not decrease. In fact, there were more cases of drug resistant Tuberculosis. According to Drug Resistance Surveillance Survey carried out by RNTCP, prevalence of MDR TB was about 2.84% in new cases and 11.6% in retreatment cases.(6) Reasons cited for the emergence of drug resistance were- genetic mutation of the bacilli due to inadequate or poorly administered treatment regimen,(7) and co-infection with HIV.(1) The Prevention of Drug Resistance guidelines of RNTCP state that using drugs to which bacteria is sensitive after sensitivity testing at the outset and ensuring that the treatment is complete, adequate and regular, are the key to control of Drug Resistant Tuberculosis.

Taking cognizance of these facts, the RNTCP program started many newer initiatives in 2015 in order to improve compliance and treatment outcomes, reduce the incidence of resistance and control the TB-HIV co-infection. Some of the major initiatives are as follows-

- 69 C& DST laboratories were established and certified for conducting drug sensitivity testing in identified tuberculosis patients.
- 147 DR TB centers were established in India by 2017 designated as Nodal DR TB Centres, at the rate of 1 centre for 10 million population.
- The treatment regimen has been revised to daily regimen instead of alternate day regimen in 2016 in a phased manner.
- Digitalization through e-Nikshay, TB surveillance using case based, web based IT system to collect, maintain and manage data systematically. The information contains all the details of any case right from confirmation of diagnosis to treatment outcome along with details of DOTS provider, referrals if any and SMS alerts to patients and concerned program officers, electronic pill boxes, SMS reminders etc. (8)
- Direct Benefit Transfer smart cards for giving incentives to the stake holders, including nutritional support to patients.
- Conditional Access of newer drugs- Bedaquiline and Delamanid.

At the beginning of 2020, the central government renamed the RNTCP as the National Tuberculosis Elimination Program (NTEP). In a letter to all the State Chief Secretaries of states and UTs, the commitment is emphasized for the Union government for achieving the sustainable development goal of ending TB by 2025, five years ahead of the global targets.(9) There is a need to assess the impact of newer initiatives taken under RNTCP for identifying further improvements required to achieve the goal of ending TB by 2025. No such study was done in this region to assess the same.

Aims & Objectives

1. To assess the improvement in patient compliance by recording the proportion of patients initiated on therapy who complete the treatment in the two areas.
2. To find out and compare the improvement in nutritional status of the patients after initiation of treatment and Direct Benefit Transfer.

3. To compare the treatment outcomes of the enrolled subjects in the two areas.
4. To explore the factors influencing treatment compliance, outcome and improvement in nutritional status and compare the results between the two areas.

Material & Methods

Place of Study: Department of Community Medicine, Santosh Medical College, Ghaziabad

Area of study: Rural areas of East Delhi and Ghaziabad.

Duration of study: One year (August 2019-August 2020)

Sampling Technique: One CHC each from the two areas were selected by random sampling. At Ghaziabad, CHC Muradnagar was selected randomly and at East Delhi, Karawal Nagar TB and Chest Hospital was randomly selected. There were 15 DOTS centres under CHC Muradnagar and 17 under Karawal Nagar TB and Chest Hospital. All DOTS centers under these two were utilized for data collection.

Study subjects: Adult Patients suffering from Tuberculosis

Inclusion criteria: All adult TB patients enrolled in the selected DOTS center who gave consent for the study.

Exclusion criteria: Pediatric TB patients
Patients who were seriously ill and not able to give interview

Patients who were hospitalized for any reason
Patients who refused to participate

Method of data collection: Data was collected from the DOTS centers under CHC, Muradnagar and TB and Chest Hospital Karawal Nagar, for assessing the compliance and treatment outcomes of the patients enrolled between January 2019 to September 2019. Details of the enrolled patients were taken from the centers and these patients were contacted individually. Of the registered patients, 59 patients from Muradnagar, Ghaziabad and 70 from Karawal Nagar, Delhi had completed treatment at the time of data collection and they were further evaluated for different parameters.

The study was explained to them and after obtaining their verbal consent, they were interviewed through a semi-structured questionnaire. The questionnaire included personal and socio-demographic details, details of co-morbidities, history of the disease, family history of disease, treatment practices for

compliance, nutritional status details etc. The data thus collected was transferred to SPSS and analyzed.

Results

(Table 1) shows that the total number of registered patients at Ghaziabad were 422 and at Delhi were 444. Out of the total patients registered in DOTS centre at Muradnagar, Ghaziabad, 62% had completed treatment, 35.1% were cured, 1.7% died during treatment while only 1.2% of the patients did not show good compliance. Among the total patients registered at DOTS centre of Karawalnagar, East Delhi, 54% had completed treatment, 25.5% were cured, 2.7% of the patients had died during treatment while only 2.7% of the total patients did not show good compliance. 14.9% of the total registered patients at Karawalnagar DOTS centre had been transferred out due to various reasons.

(Table 2) shows the distribution of studied subjects according to their socio-demographic profile. It was observed that 74.5% of patients in Ghaziabad and 80.1% of patients in East Delhi were upto 40years of age. In Ghaziabad, 33.9% patients were educated upto middle school followed by 16.9% who were educated upto high school. Lesser number of patients were graduate or post-graduate. But in East Delhi, most of the patients were educated upto either high school or intermediate (30.0% and 28.9% respectively). Majority of the patients in both the areas were not working (66.1% and 65.7%). Ghaziabad showed more patients doing unskilled work (16.9% vs 5.7%) while East Delhi had more patients doing skilled work (25.7% vs 15.3%). It was also observed that more than half of the patients in Ghaziabad resided in Joint families (55.9%) while in East Delhi, more patients resided in nuclear families (57.1%).

(Table 3) shows the mean values of age, number of family members, total family income and per capita income of the study subjects in the two areas. It was observed that the mean age of subjects in the two areas was almost same i.e. 32.53 in Ghaziabad and 31.75 in Delhi. This also indicates that majority of the patients were young adults. The average family size indicated by the number of family members was also found to be similar in the two areas with Ghaziabad showing 6.51 and Delhi showing 5.97 as the average number of family members. The average total income of the family was found to be slightly higher in Ghaziabad (13,271) as compared to Delhi (12,442).

However, the average per capita income was slightly higher for Delhi than Ghaziabad (2089 vs 2039).

(Table 4) shows that almost 1/4th of the patients in Delhi had a positive family history of TB (22.9%) while few patients in Ghaziabad had a positive family history (6.8%). This difference was found to be statistically significant ($P= 0.0121$). Few patients in both the areas had past history of TB (3.4% in Ghaziabad and 5.7% in Delhi). Diabetes mellitus was present in 10% of the patients and hypertension was present in only 1.4% of the cases in Delhi while in Ghaziabad, proportion of patients with Diabetes mellitus and with Hypertension was similar i.e. 3.4% each. None of the study subjects had HIV co-infection.

It was observed that more than 90% of the subjects in both the areas did not smoke. Study subjects residing in Delhi showed slightly higher proportion of smoking as compared to those residing in Ghaziabad (8.6% vs 6.8%). Similarly, a higher proportion of Delhi residents consumed alcohol than Ghaziabad residents (8.6% vs 1.7%). These differences were however, not significant.

(Table 5) reflects the distribution of study subjects according to different aspects related to their diagnosis and treatment. It was seen that 100% of the study subjects in Ghaziabad had pulmonary Tuberculosis. There were 5 out of 70 study subjects (7.1%) in Delhi who had extra-pulmonary Tuberculosis and the rest 65 (92.9%) had pulmonary Tuberculosis. Most of the study subjects were undergoing treatment as per Category 1 in both the areas (98.3% and 97.1%). Majority of them got the medicine on a weekly basis in both the areas (71.2% and 84.3%). 27.1% of the study subjects in Ghaziabad got the medicines fortnightly while 14.3% of the study subjects in Delhi got the medicines once a month.

It was also observed that majority of the study subjects in Ghaziabad were returning the empty medicine packs to the DOTS provider and three-fourth of them returned the empty packs every week and the rest every fortnight; while only 44.3% of study subjects in Delhi were returning the same and all of them returned the medicine packs every week. Messages regarding treatment were received by 20.3% of study subjects in Ghaziabad and 10.0% of study subjects in Delhi.

(Table 6) gives the distribution of study subjects according to receipt of Direct Benefit Transfer amount in their accounts. It was seen that 28.6% of

the subjects residing in Delhi were receiving direct benefit transfer. However, only 5.17% of study subjects in Ghaziabad were receiving the same. It was also observed that 15.7% of the subjects in Delhi were getting an amount of >500 Rs while 1.77% of the subjects in Ghaziabad were getting >500 Rs.

The mean weight of the subjects in Delhi was found to be slightly higher than those of Ghaziabad (47 vs 44.75 kg). Same was true for the mean weights measured at the end of the treatment (52.04 vs 50.14). However, the mean gain in weight of the study subjects in the two areas was almost same (5.39 and 5.04 in Ghaziabad and Delhi respectively).

(Table 7) shows the distribution of mean initial and final weights of the study subjects in Ghaziabad and Delhi in relation to Direct Benefit Transfer. The mean final weights of the study subjects in both the areas showed an improvement on the mean initial weights irrespective of the provision of Direct Benefit Transfer. The improvement in mean weight was found to be significant among those receiving DBT in Delhi and also among those who were not getting any DBT in the two study areas.

(Table 8). Though the difference in the mean weight of those study subjects who were receiving DBT (Direct Benefit Transfer) in Ghaziabad was more than their counterparts in Delhi but this difference was not significant. The change in weight among those not receiving DBT among study subjects of the two areas, was also not found to be significant.

Discussion

Out of the total patients registered in DOTS centre at Muradnagar, Ghaziabad (422), 62% had completed treatment, 35.1% were cured, 1.7% died during treatment while only 1.2% of the patients did not show good compliance. Among the total patients registered at DOTS centre of Karawalnagar, East Delhi (444), 54% had completed treatment, 25.5% were cured, 2.7% of the patients had died during treatment while only 2.7% of the total patients did not show good compliance. In a study by Suparna Bagchi et al (10) in Mumbai conducted in 2003, non-compliance to TB treatment was found to be 16%. In another study done in Tripura by Rituparna Das et al (11) in 2015, non-compliance was found to be 15.5%. So, it can be said that the compliance had improved among the patients after the implementation of newer initiatives and this was not affected by the area of residence.

As for the treatment outcomes in the two areas, more number of patients registered at Ghaziabad had either completed the treatment or were cured (97.1%) as compared to Delhi (79.5%). This may be because of transfer of patients from Delhi as Delhi is a place where migratory population is abundant. Mortality due to TB was found to be similar in Ghaziabad and Delhi (1.7% and 2.7% respectively). Majority of the TB patients were young i.e. upto 40 years old, very few of them were graduates or postgraduates, almost three-fifth of the study subjects were not working for livelihood and the study subjects were almost equally distributed into nuclear or joint families, with the average number of family members ranging between 5-7. In the study done by Srikanta Kanungo et al(12) in Aligarh in 2013, the maximum number of cases (43.4%) was in the age group of 15-30 years, 36.4% of the patients were found to be at the illiterate, 24.2% of the study population was comprised of unskilled workers, while 19.8% of the study population were unemployed. Professionals constituted only 3.6% of the study population, and 5.8% had retired from their jobs. Similar findings were observed by Subha Sankha Kundu et al(13) in their study in West Bengal in relation to age of the patients. In another study done by Natasha S. Hochberg et al(14) in Southern India between 2014-16, the mean age of TB patients was found to be 45 years and the mean family size was 4 which is similar to our findings. So, as evident from the observations, TB is affecting the young population more leading to loss of earning members due to increased morbidity. No difference was found in these parameters in the two areas suggesting that these factors were independent of the area of residence of the subjects.

The mean per capita income was found to be Rs 2039 in Ghaziabad and 2089 in Delhi, thereby showing that the patients generally belonged to Class 4 as per Modified BG Prasad Scale of year 2020. So, no difference was observed in the socio-economic status of the patients residing in Ghaziabad or Delhi. It was found that 16 and 4 study subjects residing in Delhi had a positive family history and past-history of TB respectively while only 4 and 2 study subjects in Ghaziabad had a positive family history and past-history of TB. More study subjects in Delhi were found to have Diabetes mellitus along with TB (10%) as compared to the study subjects in Ghaziabad (3.4%). Hypertension in the TB patients was also found in few subjects in the two areas (1.4% in Delhi

and 3.4% in Ghaziabad). However, none of the interviewed subjects had an HIV co-infection. Subha Sankha Kundu et al (13) in their hospital based study in West Bengal done from 2014-18, found that 43% of the study subjects were suffering from Diabetes and 2% had HIV. In the study by Natasha S. Hochberg et al (14) in Southern India between 2014-16, 35.2% of the study subjects had Diabetes mellitus. In a hospital based study done in northeast India by Prasanta Bhattacharya et al (15) in 2016-17, comorbidities were present in 53.17% of the patients, of which diabetes mellitus (DM) (26.58%) and hypertension (17.34%) were the most common. In our study, the proportion of comorbidities was very less compared to above studies. This may be because our study was based in rural settings while others were hospital based studies.

More than 90% of the study subjects had good personal habits. Few of the subjects had history of smoking tobacco (6.8% and 8.6% respectively) or consuming alcohol (1.7% and 8.6% respectively) in both Ghaziabad and Delhi. In a study done by A S Pradeepkumar et al(16) in Kerala in 2008, 75% of the TB patients were tobacco users. In the study by Natasha S. Hochberg et al(14) in Southern India between 2014-16, 19.7% of the study subjects were current smokers and 50.8% were consuming alcohol. In another study done in Belgaum in 2013 by Vinay Mahishale et al(17), tobacco users were found to be 16.8% among the total study subjects. A M Veerakumar et al(18) in their study done in Puducherry in 2013-14, found that 31.5% of the study subjects were consuming alcohol. In another study conducted in Karnataka in 2013 by P Thapa et al(19), about 20.3% (n=25) participants were found to be alcoholic. From the above studies, it is being observed that the proportion of patients consuming tobacco or alcohol are declining with times. Our findings corroborate with this observation.

It was seen that 100% of the study subjects in Ghaziabad had pulmonary Tuberculosis. There were 5 out of 70 study subjects (7.1%) in Delhi who had extra-pulmonary Tuberculosis and the rest 65 (92.9%) had pulmonary Tuberculosis. Most of the study subjects were undergoing treatment as per Category 1 in both the areas (98.3% and 97.1%). Majority of them got the medicine on a weekly basis in both the areas (71.2% and 84.3%). 27.1% of the study subjects in Ghaziabad got the medicines fortnightly while 14.3% of the study subjects in Delhi got the medicines once a month. In a hospital-based

study done in northeast India by Prasanta Bhattacharya et al¹⁵ in 2016-17, Pulmonary TB (PTB) was found in 43.94%, extra-pulmonary TB (EPTB) in 52.02%, and disseminated TB in 4.04%. This difference in the findings might be because of because of the regional difference in the occurrence of different types of TB in India.

It was also observed that majority of the study subjects in Ghaziabad were returning the empty medicine packs to the DOTS provider and three-fourth of them returned the empty packs every week and the rest every fortnight; while only 44.3% of study subjects in Delhi were returning the same and all of them returned the medicine packs every week. Messages regarding treatment were received by 20.3% of study subjects in Ghaziabad and 10.0% of study subjects in Delhi. So, it can be said that the digital platform still needs to be used to its full potential as only a fraction of the study subjects were receiving SMS alerts.

28.6% of the study subjects in Delhi had received DBT amount while only 5.17% of study subjects in Ghaziabad had received the same. This clearly shows that the latest monetary benefits stipulated in the NTEP to TB patients had not percolated down to the beneficiaries. Situation was somewhat better in Delhi but still needs improvement.

The last three tables show that almost all the study subjects showed weight gain after treatment completion. The mean gain in weight was 5.39 kg and 5.04 kg for Ghaziabad and Delhi respectively. This gain in weight had no relationship with Direct Benefit Transfer and even those who were not receiving the incentive showed improvement in weight. This indicates that DBT had no effect on the nutritional status of a TB patient in both the areas.

Conclusion

This study shows that the compliance and treatment outcomes have improved in the TB patients, with very less mortality. However, it also reflects that the newer initiatives of Direct Benefit Transfer to improve the nutritional status of the TB patients and sending SMS alerts regularly to the patients, need a thrust as only a few patients were found to be receiving the monetary benefits or the SMS alerts. The gain in weight had no relationship with Direct Benefit Transfer and even those who were not receiving the incentive showed improvement in weight. This indicates that DBT had no effect on the nutritional status of a TB patient in both the areas.

The latest monetary benefits stipulated in the NTEP to TB patients had not percolated down to the beneficiaries.

In general, it was observed that the record keeping of the data was completely digitalized in Delhi while it was still manual in Ghaziabad.

There is a need to look into the benefits of DBT again as this study does not reveal an improved nutritional status even after initiation of financial support to the patients.

Limitation of the study

This study was limited by fewer number of patients and lesser resources. There is a need for a larger survey covering majority of TB patients so as to know the actual benefits of the newer initiatives undertaken regarding treatment of TB in India by National Tuberculosis Elimination Programme (RNTCP previously).

Relevance of the study

This study shows that after the newer initiatives, there is an improvement in the outcomes of the registered patients. However, the role of financial assistance to the patients in improving their nutritional status was found to be questionable.

Authors Contribution

DA: designed the study. AS, GKG & ARK: helped in data collection and gave valuable inputs in improving the quality of data and the study. AG: did the data entry and the statistical analysis of the study.

Acknowledgement

We acknowledge the contribution of Mr Rajesh Kumar, Medico-Social Worker in the Department of Community Medicine for actively carrying out the survey along with interns posted in the department.

References

1. WHO (2018). Global Tuberculosis Report 2018. <https://apps.who.int/iris/bitstream/handle/10665/274453/9789241565646-eng.pdf?sequence=1&isAllowed=y> [accessed on 20 mar 2021]
2. WHO (2017). Global Tuberculosis Report 2017. https://www.who.int/tb/publications/global_report/gtbr2017_main_text.pdf [accessed on 20 Mar 2021]
3. Govt of India (2008), TB India 2008, RNTCP Status Report, I am stopping TB, Ministry of Health and Family Welfare, New Delhi <http://tbcindia.nic.in/showfile.php?lid=2920> [accessed on 20 Mar 2021]
4. Govt of India (2010), TB India 2010, RNTCP Status Report, Central TB Division, Ministry of Health and Family Welfare, New Delhi <http://tbcindia.nic.in/showfile.php?lid=2922> [accessed on 20 Mar 2021]

5. Govt of India (2012), TB India 2012, RNTCP Status Report, Central TB Division, Ministry of Health and Family Welfare, New Delhi <http://tbcindia.nic.in/showfile.php?lid=3141> [accessed on 20 Mar 2021]

6. RNTCP 2018, TB India 2018, Ministry of Health and Family Welfare, New Delhi <http://tbcindia.nic.in/showfile.php?lid=3314> [accessed on 20 Mar 2021]

7. Govt of India (2012), Guidelines on Programmatic Management of Drug Resistant TB in India, Ministry of Health and Family Welfare, New Delhi <https://tbcindia.gov.in/WriteReadData/1892s/8320929355/Guidelines%20for%20PMDT%20in%20India%20-%20May%202012.pdf> [accessed on 20 Mar 2021]

8. Govt of India (2014), TB India 2014, RNTCP Status Report, Central TB Division, DGHS, Ministry of Health and Family Welfare, New Delhi <https://tbcindia.gov.in/showfile.php?lid=3142> [accessed on 20 Mar 2021]

9. RNTCP - National Tuberculosis Elimination Program (NTEP), National Strategic Plan (NSP). <https://tbfacts.org/rntcp/> [accessed on 20 Mar 2021]

10. Suparna Bagchi, Guirish Ambe, Nalini Sathiakumar. Determinants of Poor Adherence to Anti-Tuberculosis Treatment in Mumbai, India. *Int J Prev Med.* 2010; 1(4): 223–32[[PubMed](#)]

11. 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 Apr;62(2):74-9. doi: 10.1016/j.ijtb.2015.04.005. Epub 2015 Jun 12. PMID: 26117475.[[PubMed](#)]

12. Srikanta Kanungo, Zulfia Khan, Mohammad Athar Ansari, Ali Jafar Abedi. Role of sociodemographic factors in tuberculosis treatment outcome: A prospective study in Aligarh, Uttar Pradesh. *Annals of Tropical Medicine and Public Health* 2015;8(3):55-9

13. Subha Sankha Kundu, Rajib Sikder, Rituraj Dey, Kunal Kanti Majumdar, Gautam Joardar. Study of socio-demographic [Tuberculosis treatment compliance...] | Agrawal D et al and treatment profile and other epidemiological correlates of clients attending revised national tuberculosis control programme clinic in a tertiary hospital of West Bengal, India. *Int J Community Med Public Health.* 2020 ;7(2):742-47

14. Hochberg NS, Sarkar S, Horsburgh CR Jr, Knudsen S, Pleskunas J, Sahu S, Kubiak RW, Govindarajan S, Salgame P, Lakshminarayanan S, Sivaprakasam A, White LF, Joseph NM, Ellner JJ, Roy G. Comorbidities in pulmonary tuberculosis cases in Puducherry and Tamil Nadu, India: Opportunities for intervention. *PLoS One.* 2017 Aug 23;12(8):e0183195. doi: 10.1371/journal.pone.0183195. PMID: 28832615; PMCID: PMC5568341.[[PubMed](#)]

15. Bhattacharya P, Talukdar K, Barman B, Jamil M, Phukan P, Mobing H, War G, Nonglait PL, Murti S, Prithviraj K Sr, Sangma B. Clinical Spectrum and Medical Comorbidities in Tuberculosis: A Hospital-Based Study in Northeast India. *Cureus.* 2020 Sep 21;12(9):e10580. doi: 10.7759/cureus.10580. PMID: 33110716; PMCID: PMC7580495.[[PubMed](#)]

16. Pradeepkumar AS, Thankappan KR, Nichter M. Smoking among tuberculosis patients in Kerala, India: proactive cessation efforts are urgently needed. *Int J Tuberc Lung Dis.* 2008 Oct;12(10):1139-45. PMID: 18812043.[[PubMed](#)]

17. Mahishale V, Patil B, Lolly M, Eti A, Khan S. Prevalence of Smoking and Its Impact on Treatment Outcomes in Newly Diagnosed Pulmonary Tuberculosis Patients: A Hospital-Based Prospective Study. *Chonnam Med J.* 2015;51(2):86-90. doi: 10.4068/cmj.2015.51.2.86. Epub 2015 Aug 17. PMID: 26306303; PMCID: PMC4543154.[[PubMed](#)]

18. Veerakumar AM, Sahu SK, Sarkar S, Kattimani S, Govindarajan S. Alcohol use disorders among pulmonary tuberculosis patients under RNTCP in urban Pondicherry, India. *Indian J Tuberc.* 2015;62(3):171-7. doi: 10.1016/j.ijtb.2015.07.017. Epub 2015 Oct 9. PMID: 26600330.[[PubMed](#)].

Tables

TABLE 1 DETAILS OF REGISTERED TB PATIENTS AND THEIR TREATMENT OUTCOMES IN A DOTS CENTRE EACH OF GHAZIABAD AND DELHI

Variable	Ghaziabad	Delhi
Total No. of patient Registered	422	444
No. of patients who completed the treatment	262(62)	241(54)
No. of patient who were cured	148(35.1)	113 (25.5)
No. of TB/HIV patient co-infected	2 (0.5)	4 (0.9)
No. of patient who didn't show good compliance	5 (1.2)	12 (2.7)
No. of patients who died during treatment	7 (1.7)	12 (2.7)
No. of patients transferred out	0	66 (14.9)

TABLE 2 SOCIO- DEMOGRAPHIC PROFILE OF TB PATIENTS IN THE TWO SELECTED AREAS

Variable	DISTRICT	
	Ghaziabad (n=59) Frequency (%)	Delhi (n=70) Frequency (%)
Age		
	18-30	33(55.9)
	31-40	11(18.6)
	41-50	4(6.8)

	51-60	5(8.5)	7(10)
	61-70	6(10.2)	2(2.9)
Education	Illiterate	12 (20.3)	11(15.7)
	Primary Schooling (<5th class)	6(10.2)	3(4.3)
	Middle School (5th-8th Class)	20(33.9)	9(12.9)
	High School (9th & 10th Class)	10(16.9)	21(30)
	Intermediate (11th & 12th)	5(8.5)	20(28.9)
	Graduate	5(8.5)	6(8.6)
	Post Graduate	1(1.7)	0(0.0)
Occupation of the patient	Not Working	39(66.1)	46(65.7)
	Skilled Worker	9(15.3)	18(25.7)
	Unskilled Worker	10(16.9)	4(5.7)
	Shopkeeper/Clerical	1(1.7)	2(2.9)
Type of Family	Nuclear	26(44.1)	40(57.1)
	Joint	33(55.9)	30(42.9)

TABLE 3 AVERAGE VALUES OF SOME SOCIO-DEMOGRAPHIC VARIABLES

Variable	DISTRICT	
	GHAZIABAD (n=59)	DELHI (n =70)
Age in Year	32.53 ± 16.395	31.75 ± 13.534
Number of family members	6.51 ± 2.381	5.97 ± 2.621
Total family income per Month	13271.19 ± 6496.23	12442.86 ± 5043.68
Per capita Income	2039.063	2089.732

TABLE 4 PATIENTS BASED ON HISTORY OF TB, CO-MORBIDITIES AND PERSONAL HABITS

Variable		DISTRICT		P-value*
		Ghaziabad (n=59) Frequency (%)	Delhi (n=70) Frequency (%)	
Family history of TB	Yes	4(6.8)	16(22.9)	0.0121
	No	55(93.2)	54(77.1)	
Past history of TB	Yes	2(3.4)	4(5.7)	0.535
	No	57(96.6)	66(94.3)	
Non-Communicable Diseases	DM	2(3.4)	7(10.0)	0.142
	Hypertension	2(3.4)	1(1.4)	0.459
	NA	55(93.2)	62(88.6)	
HIV/AIDS	Negative	59(100)	70(100)	0.00
H/o Smoking	Yes	4(6.8)	6(8.6)	0.704
	No	55(93.2)	64(91.4)	
H/o Alcohol consumption	Yes	1(1.7)	6(8.6)	0.084
	No	58(98.3)	64(91.4)	

*z-test used for proportion comparison of the two districts.

TABLE 5 STUDY SUBJECTS ACCORDING TO DIFFERENT ASPECTS RELATED TO THEIR DIAGNOSIS AND TREATMENT

Variable		DISTRICT	
		Ghaziabad (n=59) Frequency (%)	Delhi (n=70) Frequency (%)
Diagnosis	Extra pulmonary TB	0(0)	5(7.1)
	Pulmonary TB	59(100)	65(92.9)
Category of treatment	Cat-I	58(98.3)	68(97.1)
	Cat-II	1(1.7)	2(2.9)
How frequently did you get the medicine from the DOTS centre	Fortnightly once	16(27.1)	1(1.4)
	Weekly once	42(71.2)	59(84.3)

	Month	1(1.7)	10(14.3)
Did you return the empty blister packs to the DOTS centre/provider	Yes	56(94.9)	31(44.3)
	No	3(5.1)	39(55.7)
If yes, How frequently did you return the blister packs	Fortnightly once	14(25)	0(0)
	Weekly once	42(75)	31(100)
Do you get Messages regarding your treatment on your Mobile	Yes	12(20.3)	7(10.0)
	No	47(79.7)	63(90.0)

TABLE 6 STUDY SUBJECTS ACCORDING TO DIRECT BENEFIT TRANSFER AND WEIGHT PARAMETERS

Variable		DISTRICT	
		Ghaziabad (n=59) Frequency (%)	Delhi (n=70) Frequency (%)
Direct Benefit Transfer amount	Yes	4(6.8)	20(28.6)
	No	55(93.2)	50(71.4)
DBT Amount	Rs 500	3(5.1)	9(12.9)
	Rs >500	1(1.7)	11(15.7)
	NA	55(93.2)	50(71.4)
Mean Weight in Kg's at the time of initiation of treatment		44.75 ± 11.958	47 ± 12.211
Mean Current Weight in Kg's		50.14 ± 11.452	52.04 ± 12.075
Mean Gain in weight		5.39	5.04

TABLE 7 RELATIONSHIP OF DIRECT BENEFIT TRANSFER WITH MEAN INITIAL AND MEAN FINAL WEIGHT OF STUDY SUBJECTS IN GHAZIABAD AND DELHI

Direct Benefit Transfer amount	Ghaziabad		P-Value	Direct Benefit Transfer amount	Delhi		P-value
	Initial Weight	Current Weight			Initial Weight	Current Weight	
Yes (n=4)	47.50 ± 4.51	56 ± 10.68	0.164	Yes (n=20)	44.50 ± 13.55	50.25 ± 12.45	0.000
No (n=55)	44.55 ± 12.32	49.71 ± 11.48	0.000	No (n=50)	48 ± 11.62	52.76 ± 11.97	0.000

TABLE 8 RELATIONSHIP OF GAIN IN WEIGHT AFTER TREATMENT WITH DBT IN THE STUDY SUBJECTS OF GHAZIABAD AND DELHI

Direct Benefit Transfer amount	Ghaziabad	Delhi	P-value
	Weight difference	Weight difference	
Yes	8.5 ± 9.255	5.75 ± 3.79	0.318
No	5.16 ± 5.45	4.76 ± 5.40	0.704