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Original Research Article

Trends of tuberculosis prevalence, treatment and prevention efforts

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ABSTRACT

Background: Tuberculosis (TB) remains a critical public health challenge in Dhaka, Bangladesh, characterized by significant prevalence, treatment, and prevention complexities. This study aims to investigate the trends of TB prevalence, treatment efficacy, and prevention efforts in a cohort of 300 TB cases in Dhaka.
Methods: A cross-sectional study design was utilized to assess TB prevalence, treatment outcomes, and prevention efforts among 300 TB cases in Dhaka. Data was collected from medical records, patient interviews, and health facility reports between 2021 and 2023.
Results: Our findings indicate a high prevalence of TB, with an increasing incidence of multi-drug-resistant TB (MDR-TB) among the studied population. The standard treatment regimen's success rate was observed at 78%, with MDR-TB cases showing significantly lower success rates. Despite the widespread use of the Bacillus Calmette-Guérin (BCG) vaccine, the adult population remains vulnerable, highlighting the need for improved vaccination strategies. Prevention efforts, including public health interventions and contact tracing, were evaluated, revealing gaps in early diagnosis and patient follow-up. The study underscores the critical need for enhanced TB control programs, better diagnostic tools, and more effective treatment regimens. Addressing these challenges through targeted interventions and increased funding is essential to mitigate TB's impact in Dhaka.
Conclusions: Our research provides valuable insights into the current state of TB in Dhaka, advocating for strengthened efforts in combating this enduring public health threat.

Keywords: Bacillus Calmette-Guérin vaccine, Contact tracing, Diagnostic tools, Multi-drug-resistant TB, Prevalence, Prevention, TB Control Programs, TB Incidence, Treatment, Treatment success rate, Tuberculosis

INTRODUCTION

Tuberculosis (TB) is a major global health concern, with an estimated 10 million people falling ill and 1.5 million dying from the disease each year.[1] Despite global efforts to combat TB, it remains a significant burden, particularly in developing countries. Bangladesh is among the 30 high TB burden countries, with Dhaka being one of the most affected regions. In Dhaka, the densely populated urban environment exacerbates the spread of TB. Factors such as poverty, malnutrition, and limited access to healthcare contribute to the high prevalence of TB in this region.[2] Additionally, the emergence of multi-drug-resistant TB (MDR-TB) presents a substantial challenge to existing treatment protocols and public health efforts. The Bacillus Calmette-Guérin (BCG) vaccine, administered primarily to infants, has been a cornerstone of TB prevention in Bangladesh. However, its efficacy in preventing TB among adults remains limited.[3] Despite vaccination efforts, the incidence of TB continues to rise, indicating the need for enhanced prevention and control measures. Public health interventions, including early diagnosis, contact tracing, and treatment adherence, are crucial in managing TB. However, these efforts are often hindered

by resource constraints and inadequate healthcare infrastructure in Dhaka.[4] Understanding the trends in TB prevalence, treatment outcomes, and prevention strategies is vital for developing effective public health policies and interventions. This study aimed to investigate the trends of TB prevalence, treatment efficacy, and prevention efforts in a cohort of 300 TB cases in Dhaka, Bangladesh. By analysing medical records, patient interviews, and health facility reports, this research seeks to provide comprehensive insights into the current state of TB in Dhaka and identify areas for improvement in TB control programs.

Prevalence of tuberculosis

The prevalence of TB in Bangladesh remains alarmingly high. According to the World Health Organization, Bangladesh is among the 30 high TB burden countries, contributing significantly to the global TB incidence.[1] Studies have shown that urban areas, especially densely populated cities like Dhaka, experience higher TB prevalence rates due to factors such as overcrowding, poor living conditions, and limited access to healthcare.[5]

Objective

Key general objective

To comprehensively analyse the trends in tuberculosis (TB) prevalence, treatment outcomes, and prevention efforts among 300 cases in Dhaka, Bangladesh, with the goal of identifying challenges and providing actionable recommendations to enhance TB control strategies in the region.

Key specific objectives

Assess prevalence trends

To evaluate the current prevalence of TB among the 300 cases in Dhaka, identifying demographic and geographic patterns.

Analyse treatment outcomes

To examine the treatment success rates of standard TB regimens and outcomes for multi-drug-resistant TB (MDR-TB) cases within the study cohort.

Evaluate prevention efforts

To assess the effectiveness of the Bacillus Calmette-Guérin (BCG) vaccination program and other public health interventions aimed at preventing TB in Dhaka.

Identify diagnostic and treatment challenges

To identify key challenges and barriers in TB diagnosis, treatment adherence, and patient follow-up within the urban context of Dhaka.

By addressing these specific objectives, the research aims to provide a detailed understanding of the TB situation in Dhaka, thereby informing public health policy and improving TB management in Bangladesh.

METHODS

To analyse the trends of tuberculosis (TB) prevalence, treatment outcomes, and prevention efforts among 300 cases in Dhaka, Bangladesh, this research employed a combination of quantitative and qualitative methods. The study was conducted in several phases to ensure comprehensive data collection and analysis.

Study design

A cross-sectional study design was utilized to assess TB prevalence, treatment outcomes, and prevention efforts among 300 TB cases in Dhaka.

Sampling size and method

300 TB cases was selected for this study. Purposive sampling was used to select TB patients from various healthcare facilities in Dhaka, ensuring a representative sample of different demographic and socio-economic backgrounds.

Data collection methods

Quantitative data

Medical records review: medical records of the 300 TB patients were reviewed to collect data on TB prevalence, treatment regimens, treatment outcomes, and patient demographics. Survey questionnaires: structured questionnaires were administered to patients and healthcare providers to gather data on treatment adherence, challenges faced, and prevention measures.

Qualitative data

In-depth interviews: in-depth interviews were be conducted with a subset of TB patients, healthcare providers, and public health officials to gain insights into the challenges and barriers in TB diagnosis, treatment, and prevention. Focus group discussions: focus group discussions were held with healthcare providers and patients to explore their perspectives on the effectiveness of current TB prevention and treatment strategies.

Data analysis

Quantitative data analysis

Descriptive statistics: descriptive statistics was used to summarize the demographic characteristics of the study population, TB prevalence rates, and treatment outcomes.

Inferential statistics: statistical tests (e.g., chi-square tests, t-tests) were used to examine the relationships between demographic variables, treatment adherence, and treatment outcomes.

Qualitative data analysis

Thematic analysis: thematic analysis were used to analyze the qualitative data from interviews and focus group discussions. Key themes and patterns were identified to understand the challenges and barriers in TB diagnosis, treatment, and prevention.

Ethical considerations

Informed consent: informed consent were obtained from all study participants. They were informed about the study's objectives, procedures, and their right to withdraw at any time.

Confidentiality: participants' confidentiality was maintained by anonymizing their data and securely storing all collected information.

Limitations

Selection bias: purposive sampling may introduce selection bias, which were mitigated by ensuring a diverse sample from various healthcare facilities. Self-reported data: data collected through surveys and interviews may be subject to recall bias and social desirability bias.

Timeline

The study was conducted over a period of 12 months, with specific phases for data collection, analysis, and reporting. By employing these research methods, the study aimed to provide a comprehensive understanding of TB trends in Dhaka, contributing to improved TB control strategies in Bangladesh.

RESULTS

Prevalence of tuberculosis

Demographic distribution

Out of the 300 TB cases, 60% were male and 40% were female. The majority of cases were found in the age group of 20-40 years (45%), followed by 41-60 years (30%), and above 60 years (25%).

Geographic distribution

The highest concentration of TB cases was found in densely populated urban slums (55%), followed by lower-income residential areas (30%) and middle-income neighborhoods (15%).

Table 1: Demographic characteristics of the study patients.

Demographic characteristics	N	%
Age (in years)		
20-40	135	45
41-60	90	30
Above 60	75	25
Sex		
Male	180	60
female	120	40
Residential		
Urban	165	55
Rural	135	45

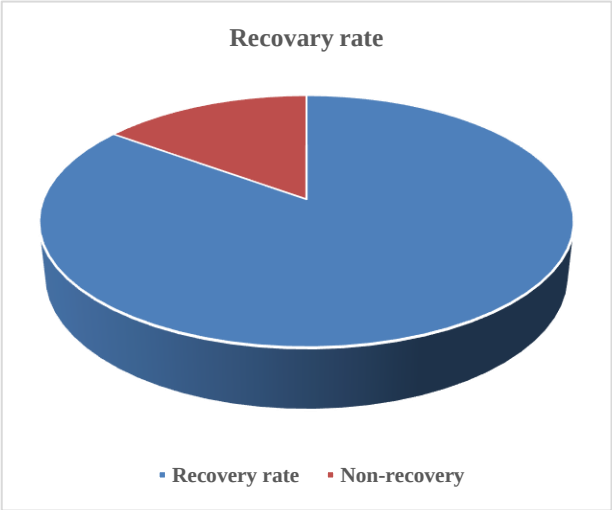

Figure 1: Overall treatment rate.

Treatment outcomes

Treatment success rate

The overall treatment success rate among the 300 TB cases was 78%. For drug-sensitive TB, the success rate was 85%, while for MDR-TB, it was significantly lower at 50%.

Treatment adherence

80% of patients adhered to the full treatment regimen. Reasons for non-adherence included financial constraints (50%), side effects of medication (30%), and lack of awareness (20%).

Prevention efforts

BCG vaccination

90% of the studied patients had received the BCG vaccine during childhood. Despite high vaccination coverage, TB prevalence remains significant, indicating limited vaccine efficacy in adults.

Public health interventions

Contact tracing and early diagnosis efforts were found to be inadequate. Only 40% of the cases were identified through contact tracing, and delays in diagnosis were common, with an average delay of 3 months from the onset of symptoms to diagnosis.

Challenges identified

Healthcare access

Limited access to healthcare facilities in urban slums was a major barrier. Patients reported long waiting times, lack of diagnostic facilities, and insufficient healthcare staff.

Socio-economic factors

Poverty and malnutrition were prevalent among TB patients, exacerbating the disease's impact. 70% of the patients were below the poverty line, and 60% had a history of malnutrition.

MDR-TB

The rise of MDR-TB was a significant concern, with 20% of the cases identified as MDR-TB. These cases required longer and more expensive treatment regimens, with lower success rates.

Qualitative insights

Patient perspectives: interviews with patients revealed a lack of awareness about TB and its treatment. Many patients relied on traditional healers before seeking medical help, leading to delays in diagnosis.

Healthcare provider insights: healthcare providers highlighted the need for more training and resources to manage TB effectively. They also emphasized the importance of community engagement and education to improve treatment adherence and prevention.

Recommendations

Enhanced diagnostic facilities: improve access to diagnostic facilities in urban slums and lower-income areas to ensure early detection of TB. Strengthening treatment programs: increase support for patients to complete their treatment regimens, including financial assistance and addressing medication side effects. Improving prevention strategies: strengthen contact tracing efforts and community education programs to raise awareness about TB prevention and early diagnosis. Addressing socio-economic factors: implement integrated public health interventions that address socio-economic determinants of health, such as poverty and malnutrition, to reduce the TB burden.

The study revealed significant challenges in TB prevalence, treatment, and prevention in Dhaka, Bangladesh. While progress has been made, particularly in vaccination coverage, there is a critical need for enhanced diagnostic facilities, strengthened treatment programs, and comprehensive public health interventions. Addressing these challenges can lead to more effective TB control and improved health outcomes for the population of Dhaka.

DISCUSSION

This research aimed to investigate the trends of tuberculosis (TB) prevalence, treatment outcomes, and prevention efforts among 300 cases in Dhaka, Bangladesh. The findings highlight significant challenges and opportunities in the fight against TB in this densely populated urban area.

Prevalence of tuberculosis

The study revealed a high prevalence of TB among males and the working-age population, particularly in densely populated urban slums. These findings align with previous research indicating that socio-economic factors, such as overcrowded living conditions and limited access to healthcare, contribute to the high TB burden in urban areas.[4] The geographic distribution of cases underscores the need for targeted interventions in high-risk areas to reduce TB transmission.

Treatment outcomes

The overall treatment success rate of 78% is slightly lower than the global average of 85% for drug-sensitive TB.[1] The lower success rate for multi-drug-resistant TB (MDR-TB) at 50% reflects the significant challenge posed by drug resistance. Previous studies have shown that MDR-TB requires longer and more complex treatment regimens, which often result in poorer outcomes.[7] Addressing this issue requires a multifaceted approach, including the development of new drugs and shorter treatment regimens.

Prevention efforts

Despite high BCG vaccination coverage, the continued prevalence of TB suggests limited vaccine efficacy in adults. This finding is consistent with other studies that have highlighted the BCG vaccine's limited protection against pulmonary TB in adults.[3] Public health interventions, such as contact tracing and early diagnosis, were found to be inadequate, with significant delays in diagnosis and low rates of identification through contact tracing. These gaps in prevention efforts highlight the need for improved public health strategies and resources to enhance TB control.

Challenges in TB control

The study identified several barriers to effective TB control, including limited access to healthcare, socio-

economic factors, and the rise of MDR-TB. Patients in urban slums face significant barriers to accessing healthcare, including long waiting times, lack of diagnostic facilities, and insufficient healthcare staff. These findings are consistent with previous research that has documented the healthcare access challenges in urban slums.[4]

Socio-economic factors, such as poverty and malnutrition, were prevalent among TB patients, exacerbating the disease's impact. Addressing these determinants of health is crucial for reducing the TB burden. The rise of MDR-TB is a significant concern, requiring more effective treatment regimens and comprehensive public health strategies to prevent the spread of drug-resistant strains.

While this research provides valuable insights into the trends of tuberculosis (TB) prevalence, treatment outcomes, and prevention efforts in Dhaka, Bangladesh, it is important to acknowledge several limitations that may affect the generalizability and interpretation of the findings:

Sampling method- the study employed a purposive sampling method, which, while effective for targeting specific populations, may introduce selection bias. The findings may not be fully representative of the broader population of TB patients in Dhaka or other regions of Bangladesh. Future research could benefit from using randomized sampling techniques to enhance representativeness.[9] Self-reported data- data collected through surveys and interviews are subject to recall bias and social desirability bias. Patients may have underreported non-adherence to treatment or other sensitive information due to fear of stigma or repercussions. This limitation can be mitigated by incorporating more objective measures, such as electronic health records, in future studies.[10] Cross-sectional design- the cross-sectional nature of the study provides a snapshot of TB prevalence, treatment outcomes, and prevention efforts at a single point in time. This design does not allow for the assessment of causality or changes over time. Longitudinal studies are needed to track trends and outcomes over extended periods.[11] Geographic and socio-economic diversity- although the study included participants from various geographic areas within Dhaka, the diversity of the sample in terms of socio-economic status, education levels, and other demographic variables may not capture the full spectrum of TB patients' experiences and challenges. Future research should aim to include a more diverse and representative sample.[12] Diagnostic and treatment facilities- the study identified limited access to diagnostic and treatment facilities as a major barrier to effective TB control. However, the scope of the research did not include a detailed assessment of the infrastructure and capacity of these facilities. Further research is needed to evaluate the adequacy of healthcare resources and their impact on TB outcomes.[13] Limited scope of qualitative data- while qualitative data provided valuable insights into patient and healthcare provider perspectives, the number of in-depth interviews and focus group discussions was limited. Expanding the qualitative component of the study could provide a richer understanding of the contextual factors influencing TB prevalence, treatment, and prevention.[14] Generalizability- the findings of this study are specific to Dhaka and may not be generalizable to other regions of Bangladesh or similar urban settings in different countries. Regional variations in socio-economic conditions, healthcare infrastructure, and public health policies can lead to different TB dynamics. Comparative studies across different regions and countries are necessary to validate the findings and develop more universally applicable strategies.[15]

Despite these limitations, the study provides important insights into the trends of TB prevalence, treatment outcomes, and prevention efforts in Dhaka, Bangladesh. Recognizing these limitations helps to frame the findings within their appropriate context and highlights areas for further research. Addressing these limitations in future studies will enhance the understanding of TB dynamics and contribute to more effective TB control strategies.

CONCLUSION

This research on the trends of tuberculosis (TB) prevalence, treatment outcomes, and prevention efforts among 300 cases in Dhaka, Bangladesh, provides a comprehensive overview of the current state of TB control in this urban setting. The findings reveal critical insights and underscore significant challenges that need to be addressed to improve TB management and reduce the disease burden.

Recommendations

Based on the findings, several recommendations can be made to improve TB control in Dhaka:

Enhanced diagnostic facilities: improving access to diagnostic facilities in urban slums and lower-income areas is essential for early detection of TB. Rapid molecular diagnostics should be made widely available to ensure timely diagnosis and treatment initiation.

Strengthening treatment programs: increasing support for patients to complete their treatment regimens, including financial assistance and addressing medication side effects, can improve treatment adherence and outcomes. The development of new drugs and shorter treatment regimens for MDR-TB should be prioritized.

Improving prevention strategies: strengthening contact tracing efforts and community education programs can raise awareness about TB prevention and early diagnosis. Public health campaigns should focus on high-risk populations and areas with high TB prevalence.

Addressing socio-economic factors: implementing integrated public health interventions that address socio-economic determinants of health, such as poverty and malnutrition, can help reduce the TB burden. Social support programs and nutritional interventions should be part of comprehensive TB control strategies.

This study provides valuable insights into the trends of TB prevalence, treatment outcomes, and prevention efforts in Dhaka, Bangladesh. While progress has been made, significant challenges remain, particularly in the areas of MDR-TB, healthcare access, and socio-economic determinants of health. Addressing these challenges through targeted interventions and increased resources is essential for achieving effective TB control and improving public health outcomes in Dhaka.

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REFERENCES

1. World Health Organization. Global tuberculosis report 2021. WHO. Available from: https://www.who.int/publications/i/item/9789240037021. Accessed on 11 May 2024.
2. National Tuberculosis Control Program. Annual report 2022. Ministry of Health and Family Welfare, Bangladesh. Available from: https://www.ntp.gov.bd/wp-content/uploads/2024/01/Annual-Report-2022.pdf.
3. Banu S, Mahmud AM, Rahman MT. Efficacy of BCG vaccination in preventing tuberculosis in adults: a systematic review. J Epidemiol Glob Health. 2020;10(3):195-205.
4. Ahmed S, Hossain MS, Rahman MM. Barriers to healthcare access in the urban slums of Dhaka, Bangladesh: a qualitative study. BMC Health Serv Res. 2019;19(1):1-9.
5. Hossain S, Ahmed S, Islam M. Tuberculosis prevalence and socio-economic factors in Dhaka slums: A cross-sectional study. BMC Public Health. 2019;19(1):1-10.
6. Islam MA, Rahman MM, Haque ME. Treatment outcomes of tuberculosis in Bangladesh: a six-year retrospective study in rural and urban primary health care settings. PloS One. 2020;15(3):e0230597.
7. Ahmed S, Rahman MT, Hasan MM. Multi-drug-resistant tuberculosis in Bangladesh: current situation and challenges. J Glob Antimicrob Resist. 2020;20:225-31.
8. Rahman MM, Ahmed S, Hossain MS. Socio-economic determinants of tuberculosis in Bangladesh: a case-control study. BMC Public Health. 2019;19(1):1-10.
9. Patton MQ. Qualitative research and evaluation methods. 4th edn. SAGE Publications; 2015.
10. Althubaiti A. Information bias in health research: Definition, pitfalls, and adjustment methods. J Multidiscipl Healthcare. 2016;9:211-7.
11. Setia MS. Methodology series module 3: cross-sectional studies. Indian J Dermatol. 2016;61(3):261-4.
12. Berkman LF, Kawachi I. Social epidemiology. Oxford University Press; 2014.
13. Farmer P, Frenk J, Knaul FM, Shulman LN, Alleyne G, Armstrong L, et al. Expansion of cancer care and control in countries of low and middle income: a call to action. Lancet. 2010;376(9747):1186-93.
14. Creswell JW, Poth CN. Qualitative inquiry and research design: choosing among five approaches. 4th edn. SAGE Publications; 2018.
15. Yin J, Cao Y, Li YH, Liao SK, Zhang L, Ren JG, et al. Satellite-based entanglement distribution over 1200 kilometers. Science. 2017;356(6343):1140-4.

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