Research



Magnitude and trends of tuberculosis in Dodoma Region, Tanzania, 2018-2021

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ABSTRACT

Introduction: The majority of tuberculosis infections and fatalities occur in Sub-Saharan Africa. Globally, it affects 9 million people and kills 1 million people each year. Tanzania's 32% reduction in TB incidence and 52% reduction in TB deaths from 2015 to 2021 place it among the few high-burden countries to surpass the End TB strategy milestones. Treatment availability, access to and use of healthcare facilities, delays in diagnosis, and in seeking treatment all influence how frequently tuberculosis cases are reported. This study investigated the trends and magnitude of tuberculosis in Dodoma Region, Tanzania from January 2018 to December 2021. Methods: A crosssectional study was conducted which involved a descriptive data analysis from 2018 to 2021 in Dodoma Region, Tanzania. The Electronic Tuberculosis and Leprosy System (ETL) was used to extract and evaluate the National TB and Leprosy Program (NTLP) database's tuberculosis surveillance data from 2018 to 2021. Trend and magnitude analysis for tuberculosis were performed using a Microsoft Excel worksheet and STATA software. We used frequencies and proportions to represent the results after analysis. P values ŏ0.05 were considered significant. Results: A total of 17,549 tuberculosis (TB) patients were reviewed and included in the analysis, of which 57.6% were male, 26.4% had extra pulmonary TB (EPTB), 98.7% were new cases, and 14.8% were HIV positive. In 2020, there were 192 prevalence rates of all forms of TB per 100,000 population, but the prevalence had not decreased significantly by 2021 (P= 0.170). Similarly, the new cases detection rate for all forms of tuberculosis was 190 per 100,000 population in 2020, although the proportion had not declined considerably by 2021 (P=0.176). Over the investigated periods, the magnitude of TB has generally reduced. The Pulmonary TB percentage is high. Conclusion: In the Dodoma Region, there was no significant change in the prevalence and case detection rate of tuberculosis. The frequency of pulmonary TB was high. The present study's treatment success rate was lower than the NTLP target. We recommend increasing the bacteriological diagnosis to contain PTB patients and further study to identify the causes of the low treatment success rate.

KEYWORDS: Tuberculosis, Prevalence, Pulmonary TB, Dodoma

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Introduction

Tuberculosis (TB) is an infectious illness caused by bacteria (*Mycobacterium tuberculosis*) that mostly affects the lungs but can potentially affect other organs [1]. Tuberculosis is both treatable and preventable [1]. Tuberculosis is transmitted from person to person through the air. When persons with lung tuberculosis cough, sneeze, or spit, the TB germs are released into the air. Only a few of these germs must be inhaled for a person to get sick [1].

Globally, tuberculosis is a serious public health concern that affects 9 million people and kills 1.3 million people, with Sub-Saharan Africa accounting for the bulk of cases and fatalities [2]. Between the years 2000 and 2021, it is believed that approximately 74 million individuals were able to continue living due to the timely detection and subsequent treatment of tuberculosis cases [1].

In 2020, the 30 countries with the highest rates of tuberculosis were responsible for 86% of new infections [1]. India had the highest number of cases, followed by China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh, and South Africa [1]. The disease affected millions of males, females, and children worldwide, showing that tuberculosis is a global issue that affects people of all ages [1].

In 2021,1.6 million people died from tuberculosis (including 187,000 HIV patients). TB is the thirteenth largest cause of mortality worldwide and the second leading infectious killer after COVID-19 (followed by HIV and AIDS). It is estimated that 10.6 million people fell ill with TB globally in 2021. There are six million males, 3.4 million women, and 1.2 million children. One of the United Nations Sustainable Development Goals (SDGs) aims to end the TB epidemic by 2030 [1].

Tanzania is now one of six TB high-burden nations that have completed the end TB 2020 incidence goals, with a 52% reduction in TB mortality from 55,000 in 2014 to 26,800 in 2020 [3]. In 2020, Dodoma was one of the regions that contributed to most of the cases recorded in Tanzania [3]. However, it is unfortunate that there is a lack of reliable information regarding the extent and trends of TB disease in Dodoma.

We conducted this study to address the significant public health challenge posed by tuberculosis (TB) in the Dodoma Region of Tanzania, where TB remains prevalent due to limited healthcare access and high HIV co-infection rates. The study aimed to fill the knowledge gap on TB trends and patient characteristics from January 2018 to December 2021. By understanding these trends, we hope to support the National TB and Leprosy Program (NTLP) in developing more effective interventions, ultimately improving health outcomes for those affected by TB in the region. The findings will help identify areas of concern, such as high pulmonary TB prevalence and treatment challenges, enabling the NTLP to prioritize resources and improve strategies like active case finding, contact tracing, health education, and rehabilitation services. This, in turn, will contribute to global TB control efforts. The study described the characteristics of TB cases and the trends in the magnitude of TB in the Dodoma Region, Tanzania, from January 2018 to December 2021.

Methods

Study setting and study population

Tanzania has 31 administrative regions and a total of 8,446 health facilities, with 4,013 being Direct Observed Treatment Centers for managing tuberculosis patients and ensuring proper medication intake. Additionally, there are 1,202 diagnostic centers in the country equipped with gene experts, microscopes, and chest X-rays. In 2019, the prevalence of multidrug-resistant tuberculosis among new patients was 0.97%, and among retreatment patients was 13% [4]. The Dodoma Region is one of the 31 administrative regions in the country. Functioning as its capital, the city of Dodoma is located in the heart of Tanzania. This region is surrounded by the Singida area to the west, the Manyara Region to the north, the Iringa Region to the south, and the Morogoro Region to the east. According to the latest national census conducted in 2022, the population of the Dodoma Region was recorded at 3,085,625 individuals [5]. In the 2012 national census, a total of 2,083,588 individuals were recorded. According to population estimates from the National Bureau of Statistics in 2018, Dodoma had a population of 2,312,141 in 2017, with 1,126,309 being men and 1,185,833 being women [3]. The population grows

by an average of 2.1 percent every year. This study covered all 7 districts in the Dodoma Region. From 2018 to 2021, the National Tuberculosis and Leprosy Programme (NTLP) submitted all TB patient data in Dodoma from health centers that provide direct observed tuberculosis therapy.

Inclusion criteria

All TB patients registered on treatment in the NTLP database between January 2018 and December 2021 were included.

Exclusion Criteria

There were no exclusion criteria. All the tuberculosis patients were eligible to participate in the study.

Study design

This cross-sectional study was conducted using secondary data from the National Tuberculosis and Leprosy Program (NTLP) database. The study covered all 7 districts in the Dodoma Region, Tanzania, and included all tuberculosis (TB) patients registered for treatment in the NTLP database between January 2018 and December 2021. The study aimed to describe the characteristics of TB cases and trends in the magnitude of TB in the region during this period. The sampling method included all 17,549 TB cases recorded in the database from January 2018 to December 2021.

Sampling method

All 17,549 TB cases on secondary data from January 2018 to December 2021, as indicated by NTLP data from all 7 districts in Dodoma, were included.

TB Case Definition

Pulmonary tuberculosis (PTB) refers to any bacteriologically confirmed or clinically diagnosed case of TB involving the lung parenchyma or the tracheobronchial tree [6].

Extra-pulmonary tuberculosis (EPTB) refers to any bacteriologically confirmed or clinically diagnosed case of TB involving organs other than the lungs,

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e.g. pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, meninges [<u>6</u>].

Definition of Indicators

All forms of TB: All types of tuberculosis i.e. pulmonary tuberculosis and extra pulmonary tuberculosis [<u>6</u>].

Cured: A pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who was smear- or culture-negative in the last month of treatment and on at least one previous occasion [<u>6</u>].

Treatment completed: A TB patient who completed treatment without evidence of failure but with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are unavailable [<u>6</u>].

Treatment failed: A TB patient whose sputum smear or culture is positive at month 5 or later during treatment $[\underline{6}]$.

Died: A TB patient who dies for any reason before starting or during treatment [<u>6</u>].

Treatment success: The sum of cured and treatment completed [<u>6</u>].

Data abstraction procedure

Data was accessed from the NTLP database, and information was documented on a case-based system using the existing Electronic Tuberculosis and Leprosy System (ETL). This computerized system serves as a monitoring tool for the performance of several NTLP program metrics. Data flow starts at the primary health facility, where a TB patient is identified and recorded in the TB register. Notification is then sent to the District TB and Leprosy Coordinator, who registers the patient in the electronic TB register and transfers the information to the TB register. This data is then reflected at both the Regional and National levels. Data from the ETL system was extracted in the form of an Excel sheet. Variables that were analyzed were sex, age groups, patient categories, methods of detection, classification of tuberculosis,

HIV status, treatment outcomes, and tuberculosis results for the trend of tuberculosis cases in Dodoma Districts from January 2018 to December 2021.

Data analysis

To provide a comprehensive analysis, data was cleaned by MS Excel to reduce errors before being exported and analyzed using STATA Version 15.1. We used a demographic table to summarize information such as sex, age groups, patient categories, methods of detection, classification of tuberculosis, HIV status, treatment outcomes, and tuberculosis results for the trend of tuberculosis cases in Dodoma Districts from January 2018 to December 2021. Frequency distributions, percentages, pie charts, and bar graphs were used to present the data. The chi-square test for trend was used to determine if there is a statistically significant trend across ordered groups or categories and a p-value of ?0.05 was considered significant.

Ethical considerations

The study analyzed existing secondary data gathered through regular medical and public health surveillance, eliminating the need for formal ethical approval. Permission to access and utilize the data from the national TB program was granted by the Program Manager of the National Tuberculosis and Leprosy Program within the Ministry of Health. To protect patient privacy, personal identifying information was encrypted for confidentiality purposes.

Results

Description of demographic characteristics of tuberculosis

A total of 17,549 tuberculosis cases were notified in the year 2018 and 2021. The disease was found to be common among male patients 10,112 (57.6%) as compared to females. The most affected age group was between the ages of 15-50 years and 7,300 (41.6). The majority of the notified cases were new patients 17,329 (98.7%) and were classified as having pulmonary TB 12,902 (73.5%). Among patients expected to have completed treatment for all types of Tuberculosis who started treatment in respective years, a total of 11,952 (68.1%) successfully completed treatment. Moreover, assessments conducted have shown that referrals of 9,624 (54.8%) cases were self-reported and 5,936 (33.8%) were from communities. The demographic and epidemiological features of TB patients in Dodoma, Tanzania (N=17,549) from 2018 to 2021 are shown in <u>Table 1</u>.

Over the last four years, there has been a consistent and gradual rise in numbers starting from 2018. This upward trend reached its highest point in 2020 and gradually declined. Figure 1 displays the trend of tuberculosis cases reported in the Dodoma Region from 2018 to 2021.

The age-sex distribution of the tuberculosis cases reported between 2018 and 2021 reveals that male patients made up the majority of cases with 4,331 (60%) of them being older than 50 (Figure 2). Additionally, females made up the majority of cases among all patients who had completed treatments 5,415 (73.25%).

The district with the greatest number of cases, Dodoma Municipal Council, reported 5,272 (30.04%), while Chemba District Council, which had the fewest cases 598 (3.41%). Figure 3 shows the district's distribution of tuberculosis cases in Dodoma, Tanzania, from 2018 to 2021. While the Kondoa Town Council was found to have a higher attack rate of 39 per 10,000 population compared to the Chemba District Council which had an attack rate of 6 per 10,000, these details are shown in Figure 4.

Clinically diagnosed and bacteriologically proven TB case trends are nearly identical, with a dramatic uptick starting in 2019 for bacteriologically confirmed cases and in 2020 for the clinically diagnosed patients, respectively. Among TB cases recorded, 54.8% were self-reported, whereas 33.8% were reported by communities. Figure 5 represents the pattern of clinically and bacteriologically confirmed TB patients.

Trends in TB notifications, magnitude, and treatment outcomes

The region had an average prevalence and case detection rate of 168 and 166 per 100,000 people, respectively, for all forms of TB. There was a minor

decrease in the prevalence and case detection rate of all forms of TB in 2018, as compared to the year 2020 (P = 0.170).

Throughout the study periods, the success rate of treatment was above 60%, except in 2021 and the trend in the percentage of people who were cured of TB decreased from 25.7% in 2018 to 16.6% in 2021. On average, the rates of cure and treatment success were 25.9% and 59.1%, respectively. In this study, the average death rate was 1%. Despite its irregularities, the death rate generally decreased over the study years.

Table 2 provides a comprehensive overview of the trends observed in tuberculosis (TB) notifications, as well as the magnitude and treatment outcomes of TB patients registered in Dodoma, between the periods of January 2018 to December 2021.

Discussion

The findings of this study indicate that a large proportion of the patients included in the analysis were male, belonged to an older age group, selfreported their condition, were newly diagnosed cases, had tested negative for HIV, and successfully completed their tuberculosis treatment. Interestingly, when comparing the data from 2018 to 2021, there was no significant difference observed in the point prevalence and new case detection rate (NCDR), although both showed a slight decrease. This suggests that the overall burden of TB has generally decreased over the period investigated. Notably, the percentage of patients with Pulmonary TB remains considerably high.

This study found that there was a decrease in the percentage of newly diagnosed TB cases reported in 2020 in the Dodoma Region compared to the previous year. In 2019, there was a 32.7% increase in newly diagnosed cases, whereas in 2020, this increase dropped to 16.2%. Based on the NTLP 2020 report, the COVID-19 pandemic has had a noticeable effect on TB disruptions, particularly in terms of the decrease in the percentage of newly diagnosed TB cases reported in 2020 compared to the previous year [4]. In 2019, there was an 8.3% increase in newly diagnosed cases, whereas in 2020, this increase dropped to 4.2%. This decline can be

attributed to the significant increases observed between 2017 and 2019, and the subsequent decrease in the rate of increase compared to previous years[4]. Early analysis has revealed that the notification of DS TB and DRT (drug-resistant TB) cases has been impacted by the pandemic. However, community-based activities, such as community referrals, have remained relatively unaffected. This highlights the important role played by community-based initiatives in responding to the outbreak and ensuring that TB cases are identified and managed effectively based on the NTLP 2020 report [4,7].

The higher prevalence of TB disease observed among males in this study is consistent with results from other parts of the world [8-11]. There could be several reasons why men are more likely to be affected by tuberculosis (TB). One possible explanation is that men may be more exposed to certain risk factors such as alcohol and smoking. Research has shown that, in general, men tend to smoke more than women[11]. This finding is consistent with a study conducted in Nigeria, which also found a higher prevalence of TB among males. The study suggested that men may have more exposure to the outside world, particularly in rural areas, which could increase their risk of coming into contact with individuals infected with TB [12]. This contradicts another study that found more cases of TB among women than men. This may suggest that men are less likely to seek medical care, even when they have symptoms of TB. Overall, these findings highlight the importance of considering gender differences when addressing TB prevention and treatment [13].

In Dodoma, Tanzania, there appears to be a high prevalence of tuberculosis among individuals over 50 years of age as well as those aged 15 to 50 years. The reason for this higher proportion of tuberculosis among the elderly population could potentially be attributed to weakened immune systems. On the other hand, for individuals aged 15 to 50, their engagement in physically demanding laborer jobs and daily activities may contribute to their increased vulnerability to tuberculosis. Factors such as productivity, socioeconomic status, and job descriptions could potentially expose this younger population to tuberculosis. A study conducted in Kenya also revealed that tuberculosis primarily affects young adults during their most productive years, with the age group of 15 to 44 years bearing the highest burden [14]. These findings align with the commonly held belief that tuberculosis is a disease that primarily affects adults, particularly males who carry a greater burden [13].

The study revealed that the prevalence rates of pulmonary tuberculosis (PTB), extra-pulmonary tuberculosis (EPTB), and the co-occurrence of both types of tuberculosis were 73.5%, 26.4%, and 0.1%, respectively. Interestingly, these findings differ significantly from a similar study conducted in the northwest region of the country, where the rates were 19.3%, 51.3%, and 28.5% for PTB, EPTB, and both types, respectively [4-12]. Furthermore, the results also deviate from research conducted in the western regions of Ethiopia, where the rates were reported as 21.5%, 44.4%, and 34% [13-15]. These disparities highlight the regional variations in tuberculosis prevalence within a country. It is important to note that these findings challenge the previously reported conclusions drawn from other studies conducted in Ethiopia, suggesting the need for further research and investigation into the factors contributing to these differences.

In this study, it was observed that the occurrence of HIV among the participants was determined to be 14.7%. This percentage, on the one hand, is consistent with the findings from previous research conducted in Ethiopia, Iran, and Malaysia, where the recorded rates ranged from 3% to 17% [16-24]. On the other hand, the rates of our findings were notably lower in comparison to those reported in other previous studies conducted in Ethiopia, where the frequency ranged from 20% to 26% [25-27]. This lower rate of TB-HIV co-infection in our study may be attributed to the higher proportion of patients from urban areas, where the prevalence of HIV is known to be lower.

One of the main concerns regarding TB control programs is the problem of treatment failure, which refers to cases where the treatment administered to TB patients is not effective in curing the disease. In our extensive research on this topic, we discovered that there 0.1% of TB patients encountered treatment failure. This statistic is remarkably low when compared to data obtained from various other countries, including Nigeria, Egypt, Niger, and Ethiopia, where the proportion of treatment failure ranged from 3% to 8% [18, 23, 28-31]. Our

findings align with several studies conducted across different regions of Ethiopia, all of which have documented the proportion of treatment failure ranging from 0.1% to 0.8%. This consistent pattern observed in multiple research goings-on strengthens the validity and reliability of our results [19, 23, 26-32]. The exceptionally low TB treatment failure rate of 0.1% in the Dodoma Region may be due to rigorous patient follow-up, proactive re-engagement of lost patients, robust support systems, well-trained healthcare providers, adequate resources, and active community engagement.

According to the findings of the current study, the mortality rate linked to tuberculosis (TB) was determined to be 1.0%. This figure stands out as significantly lower when compared to the rates documented in various studies carried out in Ethiopia, which have ranged from 3% to 5% [18, 22, 27, 28, 30, 32, 33]. However, it is important to note that some studies have reported higher proportions of TB-associated deaths, ranging from 5.6% in Debre Tabor and Egypt to 17.7% in Gondar [20, 21, 23, 29, 34, 35]. The coordinated efforts in the execution of TB/HIV collaboration activities in Tanzania may be the cause [28].

The study's average prevalence rate for all forms of TB was 168/100,000 people. Compared to the most recent national TB prevalence reports from Ethiopia (240/100,000), Kenya (426/100,000), and Uganda (253/100,000) [$\underline{6}$, 22, 23], this figure is low. After 2020, the prevalence rate of all forms of TB exhibited a gradual increase, reaching a prevalence rate of 177/100,000 people in 2021, as shown in Table 2. In the research region, the detection rate of all forms of TB has also shown a similar slight increase trend after 2020.

Finally, our research has limitations. One of the significant limitations of the study was the reliance on secondary data, as it failed to include crucial variables that could have greatly impacted the findings. For instance, important socio-economic factors like education status and occupation were missing from the dataset. This omission hindered the comprehensive understanding of the research topic and limited the scope of the study. Secondly, because this study assessed the TB trend using data from the National database, it excluded cases that were not reported or diagnosed. Due to the aforementioned limitations, it is crucial to consider

the findings of the current study as they hold great importance and relevance in capturing the attention of the general public. Consequently, it is imperative to take into account the limitations mentioned above when interpreting the results of the study.

Conclusion

In the Dodoma Region, the overall prevalence and the detection rate for tuberculosis infections are declining. The region has been meeting national indicator targets, such as the percentage of pediatric cases and the percentage of community involvement. The proportion of pulmonary tuberculosis is high. The current study's treatment success rate is lower than the NTLP target. It is also necessary to do more studies to determine the causes of the poor treatment success rate in order to assess the effectiveness of Direct Observed Treatments (DOTS) programs, which are crucial for addressing systemic issues before the prevalence and percentage of resistant isolates increase. Additionally, NTLP to ensure that all patients diagnosed with TB are being confirmed bacteriologically as well as NTLP should think about health education, routine evaluation of TB suspects, and those suspects to be referred to a primary health facility for bacteriological diagnosis, and start anti-TB treatment.

What is known about this topic

- The majority of tuberculosis (TB) infections and fatalities occur in Sub-Saharan Africa
- After COVID-19, TB is the second most infectious killer
- In 2020, Dodoma was the second region in Tanzania that reported the highest number of TB cases

What this study adds

- Dodoma region has met national indicator targets such as the proportion of pediatric cases as well as the percentage of community engagement
- This data analysis will aid in identifying trends, the burden, and the distribution of TB, as well as evaluating the efficiency of DOTS programs on treatment success rates

• The findings of this study have the potential to greatly enhance the overall health of both the study area community and the entire country by presenting novel information regarding the magnitude and trends of tuberculosis (TB). This valuable data can aid in the development of effective strategies and interventions to combat TB and ultimately improve the well-being of individuals within these populations

Competing interests

The authors declare no competing interests.

Authors' contributions

All of the authors listed in this study made substantial contributions, and their individual contributions are outlined as follows: Ali Said was responsible for conceptualizing and designing the study, conducting literature searches, reviewing data, analyzing findings, and drafting the manuscript. Hussein Mwanga and Ally Hussein played integral roles in critically reviewing the study concept, design, literature, data analysis, and manuscript drafting. Riziki Kisonga, Robert Balama, and Emmanuel Nkiligi all made significant contributions by critically reviewing and editing the manuscript. The paper has been reviewed and approved by all authors.

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Table and figures

<u>**Table 1**</u>: Demographic and Clinical Characteristics of Tuberculosis Patients in Dodoma, Tanzania, from 2018 to 2021 (N=17,549)

<u>**Table 2**</u>: Trend in TB notifications, magnitude, and treatment outcomes among tuberculosis patients registered in Dodoma Region, Tanzania, from January 2018 to December 2021

Figure 1:Trend of Tuberculosis cases notified in Dodoma Region from the year 2018 to 2021

Figure 2: Age and sex breakdown of TB cases reported in Dodoma, Tanzania, between 2018 and 2021

Figure 3:Districts distribution of TB cases from 2018 to 2021, Dodoma, Tanzania

Figure 4:Distribution of tuberculosis attack rates in Dodoma Districts in Tanzania from 2018 to 2021

Figure 5: The pattern of clinically and bacteriologically confirmed cases of tuberculosis in Dodoma, Tanzania, between 2018 and 2021

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2021 (N=17,549)			
Variables	Erec are on ore	D responding $(0/)$	
variables	Frequency	Proportion (%)	
Sex			
Female	7437	42.4	
Male	10112	57.6	
Age			
0-14	3017	17.2	
15-50	7300	41.6	
≥51	7232	41.2	
Classification of TB			
Pulmonary	12902	73.5	
Extra Pulmonary	4630	26.4	
Both	12	0.1	
Referrals			
Self	9624	54.8	
Community	5936	33.8	
Others	865	4.9	
Care and Treatment Centre (CTC)	831	4.7	
In Patient Department (IPD)	202	1.2	
Reproductive Child Health Services (RCHS)	75	0.4	
Voluntary Counselling and Testing (VCT)	16	0.1	
History of treatment			
New	17329	98.7	
Relapse	153	0.9	
Treatment after lost to follow up patient	39	0.2	
Other	20	0.1	
Treatment after failure patient	8	0.1	
HIV Status			
Negative	14846	84.6	
Positive	2589	14.7	
Not Reported	114	0.7	
Treatment Outcome			
Completed treatment	11952	68.1	
Cured	5270	30.0	
Died	179	1.0	
Lost to follow-up	12	0.1	
Treatment failed	15	0.1	
Not Reported	121	0.7	

Table 1: Demographic and Clinical Characteristics of Tuberculosis Patients in Dodoma, Tanzania, from 2018 to2021 (N=17,549)

Table 2: Trend in TB notifications, magnitude and treatment outcomes among tuberculosis patients registered in Dodoma Region, Tanzania, from January 2018 to December 2021									
Year	Population Estimate	Registered cases at the end of the year	Prevalence rate per 100,000 population	New cases detected	New cases detection rate per 100,000 population	Treatment Success Rate (%)	Cure Rate (%)	Deaths Number (Rate%)	
2018	2,492,989	3,318	133	3,274	131	71.6	25.7	44 (1.3)	
2019	2,568,514	4,361	170	4,324	168	68.4	29.2	52 (1.2)	
2020	2,647,410	5,082	192	5,024	190	66.9	31.9	43 (0.9)	
2021	2,729,668	4,822	177	4,741	174	29.5	16.6	28 (0.6)	
			P=0.170		P=0.176	P=0.150	P=0.409	P=0.090	



Figure 1: Trend of Tuberculosis cases notified in Dodoma Region from the year 2018 to 2021



Figure 2: Age and sex breakdown of TB cases reported in Dodoma, Tanzania, between 2018 and 2021



Figure 3: Districts distribution of TB cases from 2018 to 2021, Dodoma, Tanzania



Figure 4: Distribution of tuberculosis attack rates in Dodoma Districts in Tanzania from 2018 to 2021



Figure 5: The pattern of clinically and bacteriologically confirmed cases of tuberculosis in Dodoma, Tanzania, between 2018 and 2021