

Prevalence of Pulmonary Tuberculosis and Associated Factors in Prisons of Benishangul Gumuz Region, Western Ethiopia

Authors: *Mulatu Agajie*¹, *Haimanot Disassa*,² *Muluken Birhanu*³,
*Muluwas Amentie*⁴

Corresponding author: agajiemulatu@gmail.com

¹Department of Public Health, College of Health Science, Assosa University, Assosa, Ethiopia

²Department of Animal Science, College of Agriculture, Assosa University, Assosa, Ethiopia

³Department of Nursing, College of Health Science, Assosa University, Assosa, Ethiopia

⁴Department of Nursing, College of Health Science, Assosa University, Assosa, Ethiopia

Abstract

Background: Tuberculosis (TB) is one of the major health problems in Ethiopia. Congregate settings like prisons are the most important conducive environment for the transmission of tuberculosis (TB), but they are often given less attention. **Objective:** This study was done to assess point prevalence and associated factors of pulmonary tuberculosis in Benishangul Gumuz Region prisons. **Methods:** A cross-sectional study was conducted from February to April 2018 in three zonal prisons of Benishangul Gumuz Region. PTB symptom screening according to WHO criteria was done to all prisoners residing in the prisons during the data collection period. One morning sputum was obtained from 84 eligible prisoners and tested for mycobacterium tuberculosis using gene expert. **Results:** The prevalence of pulmonary tuberculosis among the total prisoners was 0.24% (8/3395) and among those with cough duration of more than two weeks was 9.5% (8/84). One newly diagnosed case in Kamash prison was found to be drug resistant TB. Predictors identified for PTB were cough for more than four weeks duration and body mass index less than 18.5 kg/m² were significantly associated with odds of being cases of pulmonary tuberculosis. **Conclusions:** The finding of this study showed that tuberculosis among prisoners having cough of two or more week's duration in Benishangul Gumuz Region prisons was found to be high. Rifampicin resistant TB was also identified in one of the prison which is a public health crisis and a global health security risk carrying grave consequences for those affected. In order to reduce the burden of TB in prisons regular screening of the prisoners and routine screening of newly introduced prisoners should be in place.

Keywords: prevalence, associated factors, pulmonary tuberculosis, prison.

Introduction

Tuberculosis (TB) remains a major threat to human beings, with the majority of cases occurring in the developing world. Tuberculosis (TB) is one of the most prevalent human infection and is the second leading cause of deaths from infectious diseases worldwide. In 2015, there were an estimated 10.4 million incident TB cases and 1.4 million TB deaths worldwide (1).

Mostly prisons are conducive environments for the transmission of TB because of poor ventilation, overcrowding, poor nutrition, and limited access to health care. One case of pulmonary TB in prison can infect many others prisoners efficiently.

Although the number of TB deaths fell by 22% between 2000 and 2015, TB remained a major cause of morbidity and mortality in many countries and a significant public health problem worldwide. The global incidence of TB was estimated to be 142 cases per 100,000 in 2015. Ninety-five percent of these cases and 98% of TB deaths occur in developing countries, affecting mostly (75 percent) persons in the economically productive age group (15–50 years) (2). The vast majority (90%) of people who are infected with the TB organism do not develop active TB disease. Once infected, a person stays infected for many years, probably for life. People with active pulmonary TB are the source of TB infection. These people shed TB bacilli in the community. The route of transmission of TB bacilli is airborne through droplets produced by TB patients when they cough or sneeze (3).

The risk of infection, and the development of subsequent disease, depend on factors associated with the bacteria (viability, transmissibility, virulence, the size of infecting dose), the host (strength of immune system, genetic susceptibility, length and intensity of exposure, previous exposure) and the host-bacteria interaction (site of involvement, severity of disease) (4).

Overcrowding, poor ventilation due to inadequate infrastructure (lack of windows) or covering of windows by prisoners (to block cold air from entering the room in cold climates or by hanging of clothes on bars), and prolonged confinement inside cells are all factors conducive of transmission of airborne diseases. Furthermore, many prisoners are heavy smokers, adding to the unhealthy atmosphere in overcrowded cells, and standards of hygiene are often poor. Living together in cramped quarters, with little or no ventilation, is another major factor for contracting TB (5).

TB spreads in poor, crowded and poorly ventilated settings, and the most vulnerable groups are migrants, prisoners, minorities, refugees who face risks, discrimination & barriers to care HIV, prison, women, diabetes, alcohol, drug use and smoking are associated with TB (6).

The prevalence of risk factors for TB among adults of 30 high TB burden countries was attributed to HIV (0.9%), under nutrition (12%), diabetes (8.5%), alcohol misuse (4%), smoking (19%) and indoor air pollution (53%) respectively. HIV positive people were 21 times higher risk of developing TB disease (1).

Ethiopia is one of the 30 high-burden countries and based on the Global TB report 2017, there were an estimated 177 per 100,000 population's incident cases of TB in Ethiopia. According to the same report the prevalence of TB was estimated to be 224 per 100,000 populations (7).

The present study aimed at determining the prevalence of TB and associated risk factors in the Benishangul Gumuz Region prisons. To the Knowledge of investigators, no study has been conducted assessing these parameters in the region. The aim of this study was to assess the prevalence of pulmonary tuberculosis in Benishangul Gumuz Region prisons, Western Ethiopia.

Significance of the Study

This study is expected to give information on the prevalence of PTB and associated risk factors in prisons of Benishangul Gumuz Region. The result from this study will be important for decision makers, for planners, for health care providers and other

stakeholders to make an intervention in reducing the transmission and controlling the disease. It will also serve as the base line data for further research for researchers who are interested in prisons of the Region.

General objective

To assess the prevalence pulmonary TB and associated factors in Prisons of Benishangul Gumuz Region Western Ethiopia, 2018

Operational Definitions

Confirmed TB patient: cases confirmed sputum smear positive by gene Xpert or a PTB patient on anti-TB treatment.

Presumptive Pulmonary TB: a person with sign of coughing for two or more weeks but negative to bacteriological tests (i.e. negative for sputum smears).

Materials and Methods

Study area and period

The study was conducted from February to April, 2018 in three zonal prisons of Benishangul-Gumuz Region. The region is located in the western part of the country bordering Sudan in west, Gambella in south, Oromiya in East, and Amhara in North. The capital of the Region, Assosa, is 660kms from Addis Ababa. Administratively the region has three zones, namely Assosa, Kamashi and Metekel. By the year 2017/18, the Region has estimated total population of the 1,066,001. There are two governmental general hospitals and 34 health centers providing tuberculosis treatment in the Region. There are three prisons in the region by 2017/18. There were a total of 3395 (Metekel (1650), Assosa (1231) and Kamash (514) prisoners found the three zones.

Study design

Cross-sectional study design was employed to determine point prevalence of smear positive pulmonary TB and identify associated factors in the prisons.

Source population

All prisoners found within three prisons of the region were the source population.

Study/sampled population

Prisoners who had productive cough for two or more weeks and pulmonary TB cases who were on treatment during data collection period were our study population.

Sample size determination

All prisoners were massively screened for TB and from 150 TB suspects who had productive cough for

two or more weeks sputum were collected directly sent for gene expert test because there AFB examination were not available during data collection. And also three pulmonary TB cases that were on treatment during the data collection period were included in the study.

Sampling procedure

Mass screening was used to identify pulmonary tuberculosis suspects and nurses working in the prisons registered all patients who had cough. After complete registration all prisoners who satisfied the inclusion criteria were included in the study.

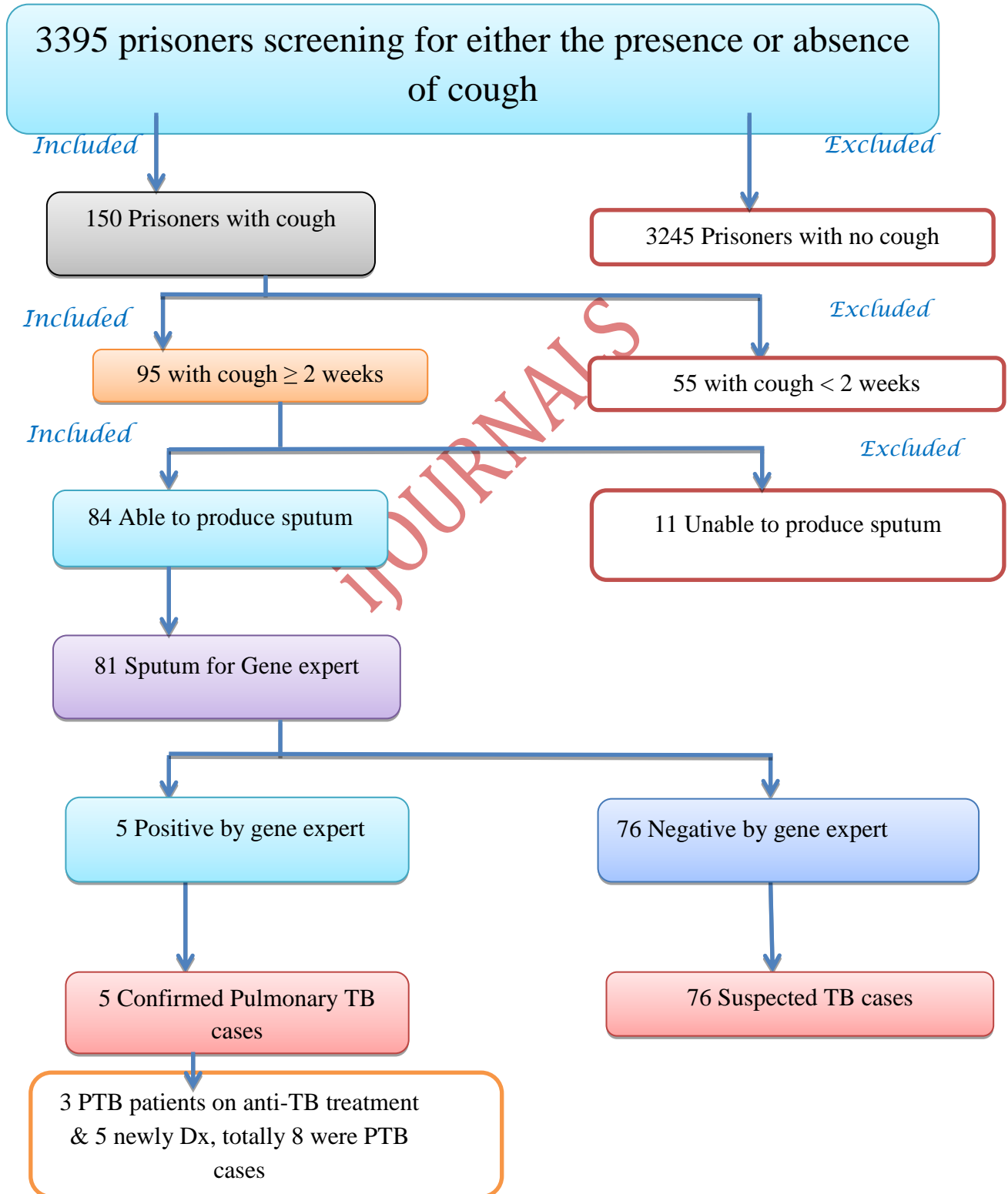


Figure 1: Sampling procedure of PTB among prisoners in BenishangulGumuzRegion, 2018.

Eligibility criteria**Inclusion criteria**

Prisoners greater than or equal to 18 years old who were, willing to participate, and who had ≥ 2 weeks duration of cough and could produce sputum were included in the study. PTB patients, who were taking anti-TB treatment during the study period, were also included.

Exclusion criteria

Prisoners who were critically ill and unable to provide information and those prisoners who were extra pulmonary TB cases were excluded. Additionally, prisoners who had cough for more than two weeks but unable to produce sputum and new prisoners with duration of less than two weeks stay in the prisons were also excluded from the study.

Study variables**Dependent variables**

Pulmonary TB

Independent variables

Socio-demography characteristics

Prison history and condition

Morbidity history and health Status

Data collectors

Trained nurses and laboratory technicians collected sputum and did sputum testing. Eligible samples were exported to Pawe and Assosa general hospitals for gene expert testing.

Data collection process and handling

A pretested structured interview questionnaire was used to collect socio-demographic, persons related associated factors, morbidity history and other relevant data of the study participants. To identify mycobacterium from sputum, 3-5ml of one early morning purulent sputum specimens were collected using coded and clean plastic containers by laboratory personnel according to WHO guidelines. Then the samples were transported using ice box every other days after collection from three sites to Assosa General Hospital and Pawe General Hospital for gene expert. A trained laboratory technologist did Gene expert.

Data management and analysis

Data collected through questionnaire and laboratory results were checked for its completeness and then entered in to SPSS window version 20.00 software for analysis. For continuous variables means and standard deviations were computed while crude and adjusted odds ratio with its 95% CI was used to see the statistical association between the dependent and independent variables. To identify independently associated factors, multiple logistic regression models

were used. Variables having P value ($P \leq 0.2$) in bivariate analysis were taken into multivariate analysis to manage confounder variables. Significant association was declared at P value ≤ 0.05 .

Data quality control

Data quality was maintained using different strategies; the questionnaire that has been adopted from similar studies of published journal was made suitable for this particular study and used. Data collectors who could hear and speak the respective local languages of the study sites were used. Pre-testing of the questionnaire and providing training for data collectors and supervisors was also done. Intensive supervision was undertaken during data collection for checking the completeness of the filled questionnaire.

Results**Socio-demographic characteristics**

During the study period there were a total of 3395 (1650 in Metekel, 1231 in Assosa and 514 in Inkamash) prisoners resided in the three zonal prisons of Benishangul Gumuz Region. After a massive screening of the whole prisoners for having of cough of two or more week's duration, 84 prisoners were included in the current study. As to the sex of the participants, 83(99.8%) of them were male and majority (32.1%) of them were between age 18 and 24 with the mean age of 34.4 and $SD \pm 14.6$. Among the study participants 72.6% were remarried, 44% were Muslims, 41.7% were unable to read and write, 73.8% were farmers, 60.7% were rural residents and 47.6% were Gumuz. Smoking was reported by 47(56%) prisoners, chewing by 21(25%) and alcohol consumption was reported by 68(81%). Only 26(31%) of the prisoners had an evidence of BCG scar. Among study participants for whom body mass index (BMI) was measured, 66(78.6%) had BMI between 18.5 and 24.9 kg/m^2 and 13(15.5%) had a BMI lower than 18.5 kg/m^2 . Of all participants, 8.3% and 4.8% of them had history of ever been diagnosed for TB and history of hospitalization respectively (Table 1).

Table 1: Socio-demographic and other behavioral characteristics of prisoners in Benishangul Gumuz Region prisons, 2018.

Variables	Level	No	%
Age	18-24	27	32.1
	25-34	19	22.6
	35-44	17	20.2
	>=45	21	25.0
Gender	Male	83	99.8
	Female	1	0.2
Marital status before	Single	17	20.2
	Married	61	72.6
	Divorced	3	3.6
	Widowed	3	3.6
Religion	Muslim	37	44.0
	Orthodox	22	26.2
	Protestant	21	25.0
	None	4	4.8
Education	Uable to read & write	35	41.7
	Able to read & write	3	3.6
	Primary (1-8)	30	35.7
	Secondary (9-12)	12	14.3
	College (10+ or 12+)	4	4.8

Results of Gene Expert

During February–April 2018, a total of 3395 prisoners resided in the three zonal prisons of Benishangul Gumuz Region and all undergone PTB symptom screening. Among total screened 84 of them fulfilled the inclusion criteria and included in the study. Of these, five were newly diagnosed with active pulmonary tuberculosis and three were already diagnosed for PTB and placed on anti tuberculosis treatment during their stay in the prison. The prevalence of smear positive tuberculosis among the total prisoners was 0.24% (8/3395) and among those with cough duration of more than two weeks was 9.5% (8/84). Of all cases, 1 (1.2%) was from Metekel prison, 3 (3.6%) from Assosa prison and 4 (4.8%) from Kamash prison. One newly diagnosed case in Kamash prison was found to be multi drug resistant TB. Taking three already existing and the five newly diagnosed TB cases in to consideration, the overall point prevalence of pulmonary tuberculosis in these three prisons was (8/3395) 236 per 100,000 prisoners. Even though there was great variability among prisons, the highest PTB prevalence was observed in Kamash prison with 4.8%.

Prison related characteristics

As to the condition and history of prisons, 31 (36.9%) of prisoners had support from their families or relatives, few 6 (7.1%) had history of stay in another prison and 63 (75%) stayed in current prison for less than two years. As of contact history, 62 (73.8%) had

history of contact with known TB patient in the same cell. The number of prisoners who shared eating and drinking materials with other persons were 54 (64.3%). Most of the study population, 69 (82%), were reported to live in a cell that had windows which almost all were always opened. Eighty three of them were spending their time every day outside of the cell (Table

Variables	Level	PTB		Total
		Neg *	Pos*	
Get support from family or relative	Yes	28	3	3
	No	48	5	5
Length of stay in prison	<2 years	57	6	6
	>=2 years	19	2	2
Stayed in another prison	No	71	7	7
	Yes	5	1	6
Lived with known TB patients in the same cell	No	58	4	6
	Yes	18	4	2
Availability of window in your cell in the prison	No	11	4	1
	Yes	65	4	6
Sharred eating and drinking materials in the prison	Yes	49	5	5
	No	27	3	3
Frequency of spending out side the cell	Every day	76	7	8
	Some times	0	1	1
Sleeping condition in the prison	Mattress on floor	15	3	1
	Carpet on floor	43	4	4
	Bed	18	1	1
Site of the prison	Metekel	27	1	2
	Assosa	20	3	2
	Kamash	29	4	3

2).

Table 2: Socio-demographic and other behavioral

characteristics of prisoners in BenishangulGumuz Region prisons, 2018.

Table 2: Prison related characteristics for prisoners in BenishangulGumuz Region, 2018.

*Neg: Negative

Variables	Level	No	%
Occupation before imprisonment	Farmer	62	73.8
	Government Employee	5	6.0
	Self Employed	2	2.4
	Student	9	10.7
	Unemployed	2	2.4
	Daily Labor	3	3.6
	Others	1	1.2
Ethnicity	Berta	14	16.7
	Gumuz	40	47.6
	Oromo	10	11.9
	Amhara	14	16.7
	Agew	5	6.0
	Tigre	1	1.2
Residence before	Rural	51	60.7
	Urban	33	39.3
Smoking status	Yes	47	56.0
	No	37	44.0
Previous Chewing status	No	63	75.0
	Yes	21	25.0
Previous alcohol consumption	No	16	19.0
	Yes	68	81.0
BCG scar	Present	26	31.0
	Absent	58	69.0
BMI in kg/m ²	< 18.5(Under Weight)	13	15.5
	18.5 -24.9 (Normal)	66	78.6
	25-29.9(Over Weight)	5	6.0
Ever been diagnosed with TB	No	77	91.7
	Yes	7	8.3
Ever been hospitalized	No	80	95.2
	Yes	4	4.8
Duration of coughing	2-4 weeks	64	76.2
	>= 4 weeks	20	23.8

*Pos: Positive

Associated Factors Assessment

Almost all, except two risk factors assessed did not show a statistically significant association with the prevalence of tuberculosis among prisoners. Cough greater than four weeks and less than was the only risk factor that showed a significant association with the prevalence of tuberculosis among prisoners. Period of imprisonment had a significant association with smear positive pulmonary tuberculosis among prisoners.

Discussion

The result of this study showed that pulmonary tuberculosis in prisons of BenishangulGumuz is very high with a prevalence of 0.24% among the total prisoners and 9.5% (236 per 100,000) among prisoners with cough duration of more than two weeks. This prevalence was higher than the total TB prevalence of the general population. The result of this study is higher than the results reported from Cotdivore 2% (8), Ghana 0.9% (9), South Africa 3.5% (10), Malawi 0.7% (11), Burkinafaso 1.3% (12), Hadiya zone 1.88% (13), Wolaita zone 4.49% (14) and East Gojjam Zone 3.4% (15). The high prevalence of TB in our study might suggest that better TB control mechanism in other study areas. The possible reasons for the difference might be explained by differences in diagnostic methods used, difference in the methodologies and difference in study population. On the other hand the finding of this study is much lower than a study conducted in Pakistan 48% (16), Uganda 13.7% (17), Nigeria 23% (18), DRC 17.7% (19), North Gondar 10.4% (20), GamoGoffa zone 19.4% (21) and BedeleWoreda 21.9% (22). This low prevalence in our study might show good TB infection control system in the prison in the study area compared with these areas. High prevalence observed in this prison is in line with studies carried out in South Africa 8.8% (23), Eastern Ethiopia 8.9% (24), Ethiopia 9.2% (25) and Tigray region 9.1% (26). Lengths of cough, having malnutrition were found to be predictors of pulmonary TB in prison.

Conclusions

The prevalence of PTB among prisoners in BenishangulGumuz region prisons was high. Rifampicin resistant TB was also identified in one of the prison which is a public health crisis and a global health security risk carrying grave consequences for those affected. In this study, Lengths of cough and malnutrition were found to be predictors of pulmonary TB in prison.

Recommendation

Based on the result of this study, the following recommendations are suggested to concerned stakeholders:

The high prevalence of 9.5% observed in this prison revealed that PTB disease among prisoners is a critical health problem that should be given due attention. The high prevalence of PTB infection in prisons indicates the need of strengthening infection control practices in these settings. New prison inmates should be screened before admission into the prison and any prisoner with TB should be properly followed up to ensure completion of treatment. Screening for TB on entry into prison using sputum smear should be done routinely. Like wise isolation and treatment of those who turn out to smear positive has significant advantages to reduce the transmission of PTB in prisons. Measures targeting factors related with PTB should be given due attention.

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Acronyms and Abbreviations

AFB: Acid Fast Bacilli
AOR: Adjusted Odds Ratio
ART: Anti-Retroviral Therapy
CI: Confidence Interval
DR-TB: Drug Resistant Tuberculosis
DST: Drug Susceptibility Testing
EPTB: Extra Pulmonary Tuberculosis
ETB: Ethiopian Birr
MDR-TB: Multi-Drug Resistant Tuberculosis
NTP: National Tuberculosis Program
PI: Principal Investigator
SD: Standard Deviation
TB: Tuberculosis
WHO: World Health Organization
XDR TB: Extremely Drug Resistant Tuberculosis

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