

Descriptive Analysis of Tuberculosis Surveillance Data in the Bantama Sub Metropolis, Kumasi, Ghana - 2016-2020

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Abstract: *Introduction:* Tuberculosis (TB) is an ancient bacterial disease characterized by coughs, fever and other symptoms. Globally, the disease affected about 10 million people in 2019, with about 1.4 million dying. It is transmitted through air and, mainly affects the lungs. Ghana recorded 44,000 cases in 2019 with 15,000 deaths. This study analyzed the cases registered from 2016-2020 in the Bantama Sub-metropolis, Kumasi by person, place and time and treatment outcomes. *Methods:* A descriptive cross-sectional design was used. A case was defined as any person registered for treatment, irrespective of diagnostic method. Secondary data was obtained manually from the TB register and entered into an excel sheet and analyzed descriptively using pivot table. ArcGIS version 13 was used to produce a map. Stata version 14 was used for multivariate analysis. Results were presented in tables and chart showing rates and frequencies. *Results:* A total of 537 TB cases, aged between 5 and 82 years, were recorded from 2016 to 2020. About 67.4% (362/537) were males. The cases detected per year were 121, 123, 98, 126, and 69 from 2016-2020 respectively. Less than 1% (0.74%, 4/537) were less than 15 years. The mean age was 42.2 (SD±15.1). Up to 36.3% (195/537) of the cases resided in the Kumasi Metropolis. Treatment success decreased from 81.8% (99/121) in 2016 to 72.5% (50/69) in 2020. Treatment success for 2018 was 93.9%, while the rest of the years fell below the 90% target. Case fatality rate among females was 15.6% (27/175) and 11.6% (42/362) among males. Also, mortality among cases resident in Kumasi was 11.3% (22/195) compared to 13.7% (47/342) among those outside Kumasi. Treatment success among cases without HIV co-infection (93%) was higher than those with co-infection (63%), p-value 0.001, CI. *Conclusions:* TB case detection in Bantama was stable from 2016 to 2019 but dipped in 2020. Majority of the cases were males. About two-thirds of the cases registered resided outside Kumasi. The treatment success rate was lower than the 90% target, except for 2018. Case fatality rates were higher among females, cases residing outside Kumasi and smear negative case. Regular home visits should be intensified by Community Health Officers to improve treatment success. HIV co-infection could negatively affect treatment outcomes.

Keywords: Analysis, Tuberculosis Surveillance, Bantama, Kumasi

1. Introduction

1.1. Background

Tuberculosis is a chronic disease caused by bacteria that

mainly affect the respiratory system and may also affect other parts of the body. It is highly contagious and characterized by cough, fever, night sweats, weight loss and

other symptoms [1]. The disease is transmitted from person to person mainly through air, but occasionally through consumption of infected meat or unpasteurized milk. Averagely, one infected person could transmit the bacteria to up to 15 persons in a year, if not put on treatment [2].

Globally, an estimated 10 million persons were diagnosed with Tuberculosis in 2019, with children below 15 years accounting for 12% [2]. Total of 1.4 million persons out of this number died of Tuberculosis in the same year. Of this number of deaths, 208,000 were HIV positive. Developing countries account for about 95% of the global Tuberculosis burden. The WHO Africa region is burdened with 25% of the cases [2].

In Ghana, more than 44,000 tuberculosis cases were recorded in 2019, out of which 15,000 died [3]. According to Osei et al., Tuberculosis case detection in Ghana was low, though stable over a five year period (2013-2017) [4].

All facilities, both private and public, are mandated to detect Tuberculosis cases through both active and passive surveillance in Ghana. All person attending health facilities are to be screened for Tuberculosis. All suspected cases are sent for laboratory testing using either microscopy or *gene xpert*, at no cost to the patient.

1.2. Public Health Importance

Globally Tuberculosis incidence continues to fall at about 2% per year, giving a cumulative reduction of 9% from 2015 to 2019, despite the global target of 20% reduction by end of 2020.

According to WHO, an estimated 60 million lives would be saved through Tuberculosis case detection and treatment. The United Nations targets to end the global Tuberculosis epidemic by 2030, as part of the Sustainable Development Goals (SDGs) [2].

1.3. Problem Statement

TB is estimated to be the number 4 cause of death in Ghana, among communicable, maternal, neonatal & nutritional diseases [3]. Bonsu et al., reported 356 bacteriologically confirmed tuberculosis cases per 100,000 population in Ghana [5].

Data from the Kumasi Metropolis indicates that Tuberculosis cases recorded in 2020 was 63 per 100,000 population, down from 65.5 per 100,000 population a year earlier [6].

The Bantama Submetro performs a type of active surveillance, especially at the Suntreso Hospital, where all patients are actively asked of cough history irrespective of presenting complains. Eligible patients are then asked to produce sputum sample for testing at the Komfo Anokye Teaching Hospital.

This study seeks to descriptively analyze the data for Tuberculosis surveillance for the Bantama Submetro for the period 2016 to 2020. This would enable us to identify the contributions of the sub metropolis towards the global fight and make recommendations for improvements.

1.4. Justification

Tuberculosis affects the entire population. One of the major interventions to curb the spread is effective case detection and case holding for effective treatment. Sustainable Development goal 3.3 targets to end the global Tuberculosis epidemic by 2030. With free Tuberculosis medication and testing, data on outcomes need to be analyzed periodically [2].

This study would therefore produce results that could be useful for health worker sensitization, public health education and policy decisions.

1.5. General Objectives

To describe the TB case detection pattern and treatment outcomes in the Bantama Submetro.

1.6. Specific Objectives

- 1) To describe the district of residence of registered TB cases at the Bantama Submetropolis.
- 2) To identify the trend of TB case detection.
- 3) To describe the treatment outcomes for TB cases.

2. Methods

2.1. Study Design

A descriptive cross-sectional design was used for this study. Secondary data from 2016 to 2020 was extracted manually from the facility TB register and entered into an excel software and analyzed descriptively.

2.2. Study Area

Bantama is one of the traditional sub metropolis under Kumasi Metropolis which is the capital of Ashanti region of Ghana, and the second largest city in Ghana. It lies about 300km from the national capital, Accra. Bantama lies in the central part of Kumasi with an estimated population of 342,419 based on the 2010 population census. It has been subdivided into 5 sub units, including Abrepo Ohwim, Ahodwo Danyame, Adiembra Santase, Patase Suntreso and Batama Bohyen [7].

It shares boundaries with Suame, Kwadaso, Asokwa Municipalities, and Atwima Kwanwoma and Atwima Nwabiagya North and South Districts. Bantama has 30 health facilities, including 14 hospitals. The Suntreso Hospital, the only state owned, serves as the only Tuberculosis treatment centre for the entire jurisdiction [6].

2.3. Study Population

All registered Tuberculosis cases entered in the tuberculosis register from 2016 to 2020 for Suntreso hospital was used. Routinely, cases that meet the TB suspect case definition are sent for testing using the highly sensitive *gene xpert* test, using sputum samples. Cases that could not produce sputum are referred for x-ray. Patients' x-ray is

reviewed by clinicians and those who are suggestive of TB are referred to the TB treatment centre for registration and treatment initiation. The National TB Control programme periodically performs quality assurance on the test equipment and procedures to ensure the test results are standardized.

2.4. Data Collection Tool

Data from the institutional TB register for Suntreso Government hospital was used. An excel template was designed, in order to capture the case-based details of all cases from the register.

2.5. Data Collection and Analysis

Data was extracted from the register manually, unto the excel template, designed purposely for this study. The data was cleaned and validated for errors and validity. Excel pivot tables was used to analyze the data into frequencies and proportions, whiles ArchGIS was used to produce a map. Stata version 14 was used for the multivariate analysis after exporting the excel data. Results are presented by tables and a graph. The variables collected included age, sex, method of diagnosis, residence, HIV status and treatment outcome.

Method of diagnosis include smear positive or bacteriologically confirmed, which is defined as a pulmonary TB case with a positive smear or *gene xpert* results before treatment. Smear negative TB is a pulmonary TB case which has classical symptoms of the disease but in the absence of a laboratory confirmation. Extra Pulmonary TB includes one that affects parts of the body other than the lungs. Extra

pulmonary and smear negative cases are considered non-bacteriologically confirmed.

For outcome of treatment, cured means a case which was initially bacteriologically confirmed but has a negative laboratory result at the end of the treatment. A completed case is one which was diagnosed without a bacteriological confirmation who has finished the treatment and signs and symptoms had disappeared, a bacteriologically confirmed case without a negative laboratory result but without clinical disease at the end of treatment. Cured and completed cases are put together to estimate treatment success. Loss to follow up is one who was not available for evaluation at the end of year after been put on treatment.

2.6. Ethical Consideration

Permission was sought from the Metropolitan Health Directorate and the Suntreso Hospital TB unit. No data on client identity such as names was collected from the TB register.

3. Results

3.1. Monthly Trend of TB Case Detection

A total of 537 TB cases were registered at the Suntreso Government Hospital from 2016 to 2020. An average of 9 cases per month was recorded, with a minimum of one case each for June and July 2020, as shown in Figure 1.

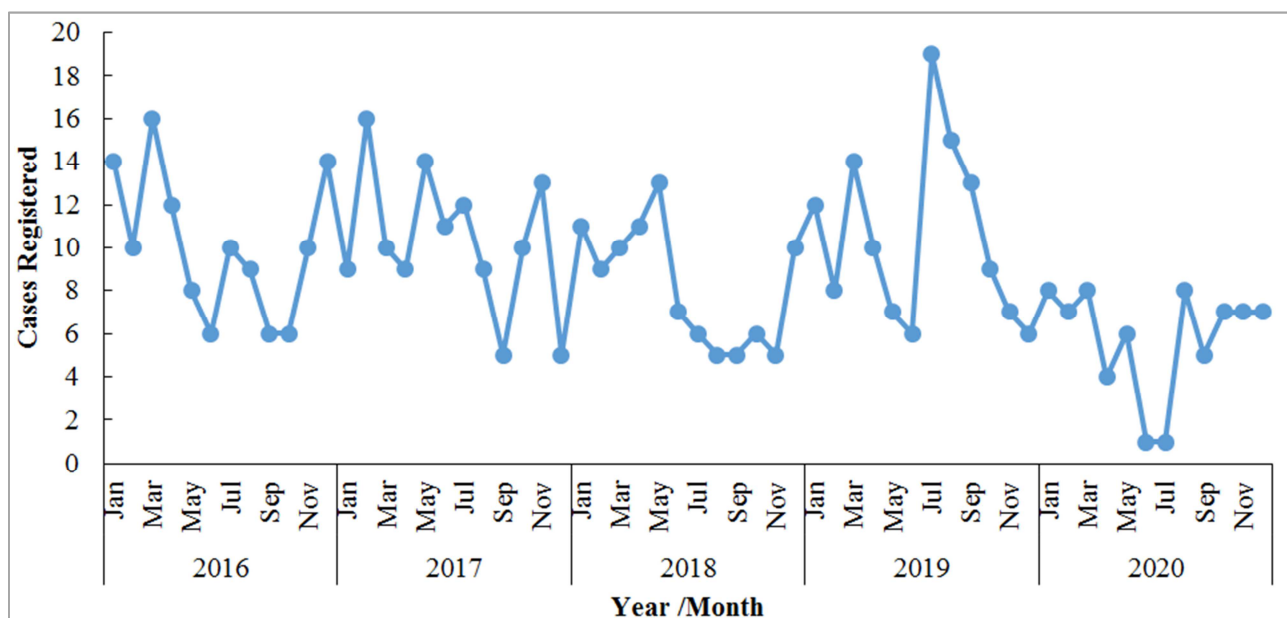


Figure 1. Number of TB Cases detected per month at Bantama Sub Metro, Kumasi- 2016-2020.

3.2. Socio-Demographic Distribution of Cases

3.2.1. TB Case Distribution by Age & Sex

During the period under review, 4 paediatric TB cases (under 15years) were registered and put on treatment. There were more 67.4% (362/537) male TB cases than females.

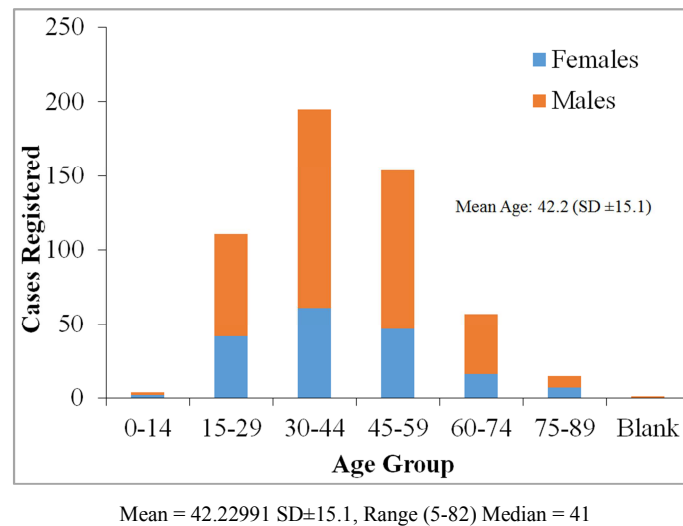


Figure 2. TB cases in Bantama Submetro per sex and Age Group, 2016-2020.

3.2.2. Distribution by TB Cases by District of Residence

Kumasi Metropolis and Kwadaso Municipality contributed most (more than 100) cases compared with other districts.

The cases resided mostly in districts sharing boundaries with Kumasi, but with few distant districts, as shown in figure 3.

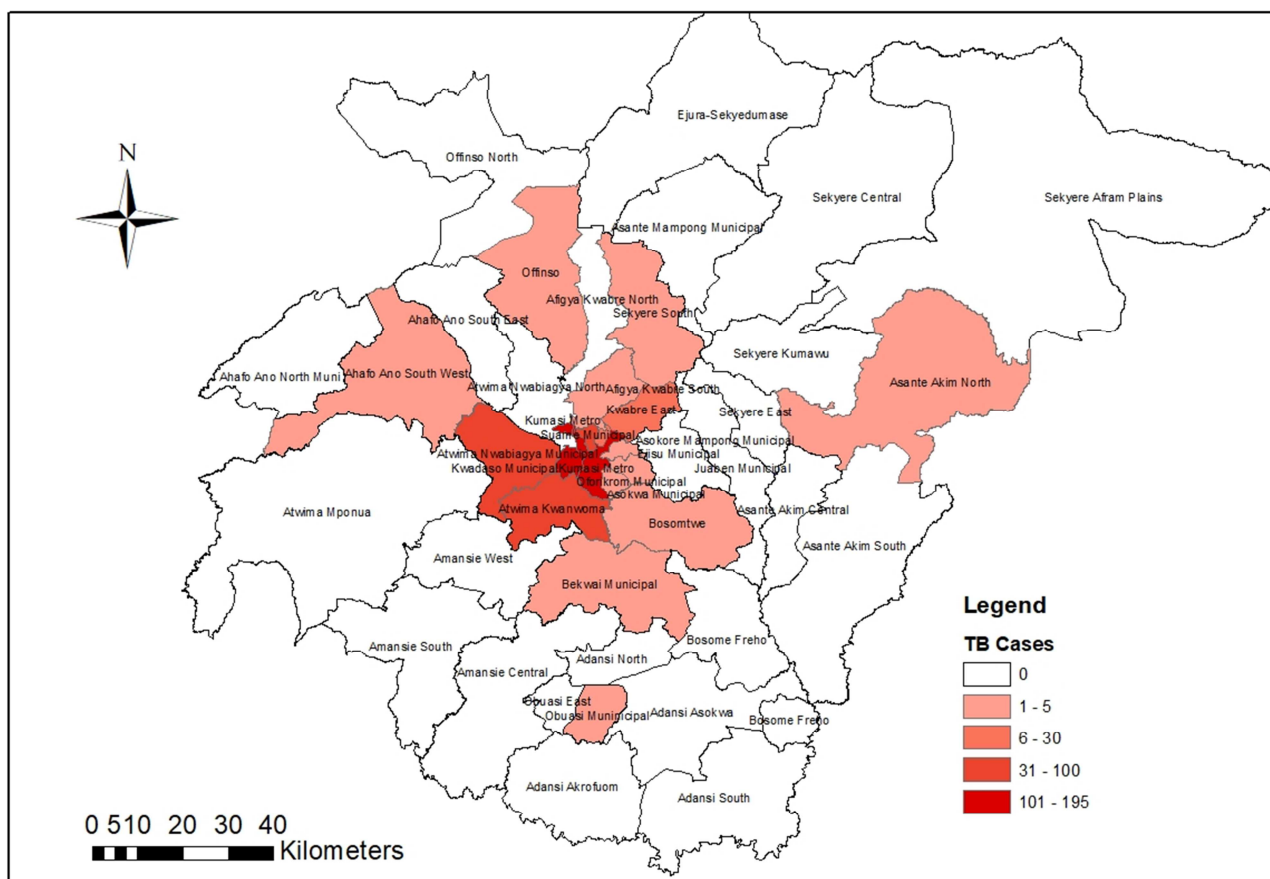


Figure 3. Residence of registered TB Cases from Bantama, 2016-2020.

3.3. HIV Status of TB Cases and Outcome of Treatment

HIV prevalence was 19.9% (107/537) during the period under review. Out of 107 TB cases who were also HIV

positive, 24.3% (26/107) of them died by end of the treatment of 6 months, as seen in Table 1. Of the 69 TB cases that died, 62.3% (43/69) of them were not HIV positive.

Twenty-six out of 107 (24.3%) of HIV positive cases died as compared to 10% (43/430) of those who were not HIV

positive.

Table 1. HIV status of TB cases registered in Bantama Submetro, compared to treatment outcome- 2016-2020.

HIV Status	Treatment Outcome						Grand Total
	Completed	Cured	Died	Failure	Loss to follow up	Not Evaluated	
Negative	148	224	43	0	7	8	430
Positive	44	36	26	1	0	0	107
Total	192	260	69	1	7	8	537

3.4. Annual TB Treatment Outcomes 2016-2020

Apart from 2018, percentage of patients with successful treatment outcomes had consistently been below the 90%.

Table 2. Annual TB Treatment success rate for Bantama Submetro, 2016-2020.

Year	Total	Treatment Success		Died	Failure	Loss to follow up	Not evaluated	Treatment Success Rate (%)
		Completed	Cured					
2016	121	47	52	18	1	3	0	81.8
2017	123	49	57	15	0	2	0	86.1
2018	98	45	47	5	0	1	0	93.9
2019	126	33	72	20	0	1	0	83.3
2020	69	18	32	11	0	0	8	72.5
Total	537	192	260	69	1	7	8*	84.2

*Still on Treatment at time of data collection

3.5. TB Case Fatality by Sex and District of Residence

Mortality rate among Female cases were higher 15.4% (27/175) than males.

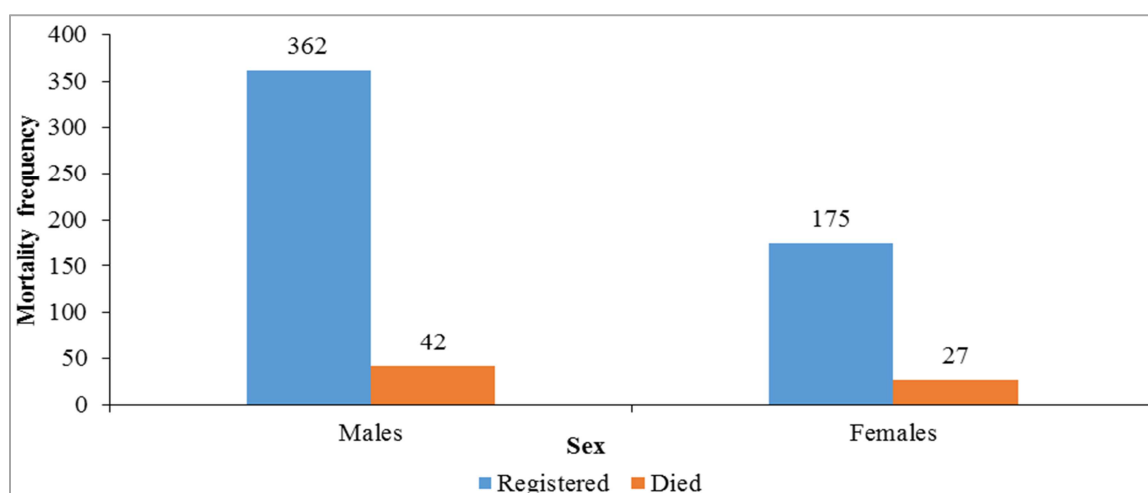


Figure 4. Mortality rates compared among Male and Female TB cases from Bantama, 2016-2020.

Death rate among cases resident in the Kumasi metropolis 11.3% (22/195) was slightly below the rate among those who resided outside Kumasi Metropolis (13.74%) (47/342).

Table 3. Treatment outcomes compared among TB cases Kumasi Residents and Non-Residents.

Residence	No Registered	Treatment Outcome						Indicators	
		Completed	Cured	Died	failure	Loss to follow up	Not evaluated	Treatment Success rate	Death rate
Kumasi Metropolis	195	72	94	22	1	6	0	85.12	11.3
Out of Kumasi Metropolis	342	120	166	47	0	1	8	83.62	13.74
Total	537	192	260	69	1	7	8	84.17	12.85

3.6. Mortality Rates Per Method of Diagnosis

From Table 4, mortality rate among bacteriologically confirmed (smear positive) cases was lowest 9.9% (31/312) compared to the other methods of diagnosis.

Table 4. Treatment outcomes of TB cases compared to method of Diagnosis.

Type of Case	Treatment Outcome						Grand Total	Death Rate
	Completed	Cured	Died	failure	Loss to follow up	Not evaluated		
Extra Pulmonary	34	1	7	0	0	0	42	16.60
Smear Positive (+ Gene Xpert)	22	248	31	1	4	6	312	9.90
Smear Negative	136	11	31	0	3	2	183	16.90
Grand Total	192	260	69	1	7	8	537	12.90

Table 5. Treatment outcomes compared to HIV status, District of Residence and Type of TB.

Characteristics		Treatment Outcome		P-value	95% Confidence Interval
		Treatment Success (%)	Adverse Outcome (%)		
HIV Status	HIV Positive	80 (61)	50 (39)	0.001	Ref
	HIV Negative	372 (93)	27 (7)		-0.208, -0.623
Type of TB	Smear Positive + Gene Xpert	270 (88)	36 (12)	0.057	ref
	Smear Negative + EPTB	182 (97)	4 (3)		-0.89, 0.001

* 8 cases were excluded for none evaluation of outcomes due to incomplete data

From Table 5, it can be observed that 93% HIV negative patients who were diagnosed and put on TB treatment had successful outcomes for TB (Cured, Completed) compared to 61% of those who were HIV positive. The difference was statistically significant. Also, cases that were bacteriologically diagnosed were seen to have successful outcomes than those with smear negative or extra-pulmonary cases.

4. Discussions, Limitation, Conclusions and Recommendations

4.1. Discussions

Overall, the trend of case detection was fairly stable over the period, but with a reduction in 2020. The number of cases per month was an average of 9, for the period under review. On annual basis, most cases were above 100 except in 2018 and 2020. The sharp reduction in cases in 2020 can be attributable to the creation of the Kwadaso Municipality, which now has its own TB treatment centre. Cumulatively, Kwadaso contributed the highest number of cases (21.8%), apart from the Kumasi Metropolis. Cases resident in Kwadaso most likely would now be treated at their new treatment centre. This reduction in 2020 could also be attributable to the COVID 19 pandemic, which hit the world in 2020. Bantama was the hardest hit with COVID 19 in Ashanti [6]. This reduction was similar to what was reported globally, where a 21% reduction in 2020 was attributed to the pandemic [8].

The mean age of 42.2 years (SD \pm 15.1) was lower than what pertained in Sene East district of Bono East, where the mean age was 48.5 (SD \pm 17.8) [9]. Unlike the study in Volta Region of Ghana where children under 15 accounted for 4.3% of TB cases from 2013 to 2017 from 10 districts, this study found a much lower, 0.74% burden among same aged children [10].

Males constituted 67.4% of all cases, very close to what was reported from Accra as 65% [11]. This was higher than the finding of Osei et al. from the Volta region which was 62.5%, and what was reported from Liberia (58%) and Nigeria (53.3%) but lower than Sene East where males

constituted 74.4% [9, 10, 12, 13]. Even though males were the majority, mortality rate among them was lower (11.6%) compared to females (15.4%). This contrasts the study by Osei et al., where mortality rate was higher among males (13.8%) compared with females (12.9%) [4]. TB disease is also known to progress rapidly in females, compared to males [14].

Just about a third of all cases were resident in the Kumasi Metropolis, where Bantama is located. Majority of the cases came from outside the jurisdiction to seek care. This could be attributable to the central location of the treatment centre. This could have dire consequences on case holding and treatment outcomes. Home visits and monthly revisits for review could be greatly hindered by cost and time.

HIV prevalence of 19.9% among the 537 TB cases registered for the period was also close to what pertained in Accra (20.3%) Volta region (19.1%) and 22.6% [4, 10, 11].

Death rate among HIV positives was higher (24.3%) than non-HIV negatives (10%). This suggests that the chance of survival from TB among persons with co-infections with HIV is less than twice compared to non-HIV TB patients. This was similar to the finding of Osei et al., who reported 21.8% among HIV positives and 11% among non-HIV cases [4].

Death rate among cases resident in Kumasi was lower (11.3%), compared to cases that resided outside the metropolis (13.74%). This difference could be due to challenges in case holding among cases outside the metropolis. For case holding purposes, patients are to revisit the treatment centre every month for review and re-supply of drugs. Additionally, public health staff may occasionally visit them at home. These 2 important activities which helps improves outcomes are more easily carried out among cases resident in the metropolis, compared to those who reside outside.

Death rate among smear negative cases was highest (16.9%), compared to other forms of the disease (extra pulmonary-16.6%, Smear positive (9.9%). This trend could also be seen from the study in Volta region, where mortality rate among smear negative was highest (15.7%), compared to extra pulmonary and smear positive (8.4 and 11.3%

respectively) [10]. Interestingly, smear negative cases are only suggestive of TB, mainly because of absence of positive bacteriological lab results. What this meant was that there was no certainty in the diagnosis. This could account for the high mortality among this group.

Overall, a treatment success rate of 84.2% was estimated from 537 cases registered, despite 8 cases of 2020 yet to be evaluated. This fell below the global target of 90% success rate [15]. Our finding recorded a lower success rate compared to a study in Ethiopia [16]. Significantly, it can be noticed that only 2018 achieved the 90% target of treatment success during the period under review.

It was observed that there was a statistical difference in the success rate of TB cases with HIV co-morbidity and those without HIV. Just like the Ethiopian study (Alemu *et al.*, 2021) and north Central Nigeria, there was a significant difference in the success rate among TB cases with HIV co-infection and those without HIV [13, 16]. Whiles we observed a treatment success rate of 93% among HIV negative and 61% among HIV positive TB cases, 72.5% treatment success was recorded for HIV negative and 62.7% among HIV positive cases in Nigeria [13]. In Accra Ghana, treatment success among HIV positive cases was reported to be 77%, compared to 91.2% among HIV negatives [11].

Also, cases bacteriologically diagnosed were seen to have a higher success rate than those diagnosed through other means. This could be due to the fact that bacteriological diagnosis could give a more definitive result. In TB treatment, the use of X-ray and other non-bacteriological methods diagnosed cases which are referred to as suggestive of TB, meaning they were not definitive.

4.2. Limitations to the Study

Routinely collected data was used. To this extent, any limitations in the already existing data, including gaps also apply to this study. Though efforts were made to trace missing data using the TB01 folder, some data, including age and community, were not traceable.

4.3. Conclusions

The trend of TB case detection in the Bantama metro was stable from 2016 to 2019 but dipped in 2020. Majority of the cases were males, compared to females. About two thirds of the cases registered from 2016 to 2020 resided outside the Kumasi Metropolis.

Consistently, the TB treatment success rate of Bantama Submetro was lower than the target of 90%, except for 2018. Mortality rates were higher among females, cases residing outside Kumasi and smear negative cases. HIV co-morbidity could adversely affect treatment outcomes whiles bacteriological diagnosed cases were likely to have positive outcomes.

4.4. Recommendations

- 1) Efforts, including active case finding, should be made by the Bantama Submetro TB team to improve the case detection of TB.

- 2) HIV AIDS education and prevention educations should be intensified to ensure low prevalence of co-morbidities so as to improve treatment success.
- 3) The Submetro TB coordinator should regularly analyze the data to inform decisions.
- 4) Further studies should be conducted by the NACP and NTP to study the factors accounting for different treatment success among HIV positives and negatives.
- 5) Counselling should be improved before and during treatment to ensure compliance.

Public Health Action

Findings and recommendations of this study was shared with the Kumasi Metropolitan Health Directorate, as well as the Bantama Sub metropolis.

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