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Factors Influencing Adherence to Anti-Tb Drugs in Sunyani Municipality, Ghana; A Cross-Sectional Study

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ABSTRACT

Background: A large portion of the global population has been infected with *Mycobacterium tuberculosis*, but most eliminate it without developing tuberculosis. About 50 % of TB patients fail to adhere to treatment, leading to incomplete therapy, drug resistance, prolonged infectiousness, relapse, and death. Nonadherence contributes to multidrug-resistant TB.

Objective: This study identified factors that influence adherence to anti-TB drugs in the Sunyani Municipality.

Methodology: A quantitative, descriptive cross-sectional design was used. The study population included TB patients aged ≥ 18 years who had been on treatment for at least one month across three selected hospitals. Data were collected from 157 participants using an interviewer-led structured questionnaire, with adherence measured via the 8-item Morisky Medication Adherence Scale. Data were entered into Excel, cleaned, and analyzed in Stata 15. Descriptive and inferential statistics were performed, using Chi-square and Fisher's exact tests to identify associations, and logistic regression to determine the strength of significant factors. Statistical significance was set at $p \leq 0.05$.

Results: Majority of respondents were male (65.6 %). Adherence to anti-TB drugs was 53.5 %. Bivariate analysis found associations between adherence and gender (p=0.020), social support (p=0.030), primary caregiver (p=0.002), beliefs about TB (p=0.013), knowledge about TB (p=0.003), and accessibility to healthcare facilities (p=0.001). In multiple logistic regression, gender and healthcare facility access were independently associated with adherence (aOR=2.19, p=0.039 and aOR=4.07, p=0.030, respectively). Males had 2.19 times higher odds of adherence than females. Participants with ready access to a healthcare facility had 4.07 times higher odds of adherence than those without.

Conclusion: Adherence to anti-TB drugs was relatively low at 53.5 %. Male gender and ready access to healthcare facilities significantly predicted better adherence. Interventions to improve adherence in the Sunyani Municipality should be strengthened, with further research needed to explain the gender disparity in adherence behavior.

Keywords: Tuberculosis, Treatment adherence, Ghana, Medication adherence, anti-TB Drugs.

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Facteurs influençant l'observance thérapeutique des médicaments antituberculeux dans la municipalité de Sunyani, au Ghana : une étude transversale

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RÉSUMÉ

Contexte : Une grande partie de la population mondiale a été infectée par *Mycobacterium tuberculosis*, mais la plupart des personnes l'éliminent sans développer de tuberculose. Environ 50 % des patients atteints de tuberculose n'adhèrent pas au traitement, ce qui entraîne une thérapie incomplète, une résistance aux médicaments, une contagiosité prolongée, des rechutes et des décès. La non-observance du traitement contribue à l'émergence de la tuberculose multirésistante.

Objectif : Cette étude a identifié les facteurs qui influencent l'observance des traitements antituberculeux dans la municipalité de Sunyani.

Méthodologie : Une étude transversale quantitative et descriptive a été menée. La population étudiée comprenait des patients atteints de tuberculose âgés de ≥ 18 ans ou plus, sous traitement depuis au moins un mois, répartis dans trois hôpitaux sélectionnés. Les données ont été recueillies auprès de 157 participants à l'aide d'un questionnaire structuré administré par un enquêteur. L'observance thérapeutique a été mesurée grâce à l'échelle d'observance médicamenteuse de Morisky à 8 items. Des analyses statistiques descriptives et inférentielles ont été réalisées, à l'aide des tests du chi carré et le test exact de Fisher pour identifier les associations, et une régression logistique pour déterminer la force des facteurs significatifs. Le seuil de signification statistique a été fixé à $p \leq 0,05$.

Résultats : La majorité des répondants étaient des hommes (65,6 %). L'observance du traitement avec les médicaments antituberculeux était de 53,5 %. L'analyse bivariée a révélé des associations entre l'observance et le sexe ($p = 0,020$), le soutien social ($p = 0,030$), la présence d'un aidant principal ($p = 0,002$), les croyances relatives à la tuberculose ($p = 0,013$), les connaissances sur la tuberculose ($p = 0,003$) et l'accès aux soins dans les établissements de santé ($p = 0,001$). Dans le cadre d'une régression logistique multiple, le sexe et l'accès aux soins dans les établissements de santé étaient indépendamment associés à l'observance (aOR = 2,19, $p = 0,039$ et aOR = 4,07, $p = 0,030$, respectivement). Les hommes avaient 2,19 fois plus de chances d'observer leur traitement que les femmes. Les participants ayant facilement accès à un établissement de santé avaient 4,07 fois plus de chances d'observer leur traitement que ceux qui n'y avaient pas accès.

Conclusion : l'observance thérapeutique des médicaments antituberculeux était relativement faible (53,5 %). Le sexe masculin et un accès facile aux soins dans les établissements de santé prédisaient significativement une meilleure observance. Les interventions visant à améliorer l'observance dans la municipalité de Sunyani devraient être renforcées, et des recherches supplémentaires sont nécessaires pour expliquer les disparités entre les sexes dans le comportement d'observance.

Mots-clés : Tuberculose, observance thérapeutique, Ghana, adhésion au traitement médicamenteux, Médicaments antituberculeux.

INTRODUCTION

Tuberculosis (TB) remains a major public health issue, ranking above HIV/AIDs as a leading cause of death from a single infectious agent until the coronavirus (COVID-19) pandemic.[1] About a quarter of the global population is estimated to have been infected with Mycobacterium tuberculosis, but most people will not go on to develop tuberculosis and some will eliminate the infection.[1] Globally in 2024, approximately 10.7 million people got infected with tuberculosis. Also, the tuberculosis incidence rate (new cases per 100,000 population per year) was 131 and case fatality rate of 11.5 %.[1]

An estimate of 95.0 % of cases of tuberculosis are found in developing countries which have limited resources in the world as shown in studies.[2,3] West Africa is significantly affected by this trend because of lack of development and poverty which keep on driving the spread of TB.[2] WHO African region contributed to 25.0% of the estimated number of incident cases of tuberculosis worldwide in 2024.[1]

The estimated annual incidence of tuberculosis in Ghana in 2018 was 120 per 100,000 population.[4] In the second national TB survey done in Ghana, prevalence rate of tuberculosis was found to be 290 per 100,000 population which is about three times higher than the World Health Organization (WHO) estimate of 92 per 100,000.[4] The estimated national prevalence of tuberculosis in Ghana in 2021 was 126 per 100,000 population.[5] Ghana is regarded as one of the countries with 100-299 incident cases per 100,000 population in 2024.[1]

Anti-TB drug adherence by patients with tuberculosis is one of the crucial ways of preventing drug resistance tuberculosis. Successful treatment of TB involves the patient taking the anti TB drugs for a least six months uninterrupted.[6] However, about fifty percent of people with tuberculosis do not finish treatment and this results in drug resistance, prolonged infectiousness, relapse and death.[7]

Adherence to anti-TB drugs is essential for effective tuberculosis control and management.[8] A lot of factors have been associated with adherence to anti-TB medicines/drugs which includes patient-related factors, socioeconomic factors and health service-related factors.[6,8]

Tuberculosis is one of the significant public health problems in Ghana.[5] Drug-resistant TB continues to be a problem in Ghana with marked regional differences which poses as a public health challenge.[9] It has been found that, an estimate of 33.0 % of cases of tuberculosis in Ghana are detected and that 1.7 % of new cases of TB and 17.0 % of retreatment cases have multi-drug resistant tuberculosis.[10] A study by Nkansah *et al*. (2026)[9] in Ghana reported overall prevalence of Drug-Resistant TB to be 17.4 % with higher resistance at the southern sites than the north. Similarly, a study reported overall prevalence of Drug-resistant TB as 13.8 % in 2022 across four regions in Ghana with Central region recording the highest prevalence of 27.8 %.[11] Nonadherence to anti-TB medicines have been found to be one of the factors that causes development of multi-drug resistant tuberculosis.[9,10]

In Ghana, adherence rates to anti-TB drugs vary across regions, with studies reporting rates of 81.6 % in Ketu North District, 63.0 % in Suhum Kraboa Coaltar District and 76.8 % in Kumasi Metropolis in Ashanti Region.[6,12,13] It can be inferred that, a significant number of patients do not adhere to treatment, and this can results in multi-drug resistant TB and ultimately leads to increase in morbidity and mortality, long duration of treatment, increased treatment cost and can affect patients' ability to contribute to the financial burden of the family. In the Sunyani municipality in the Bono region, much remains to be done to assess factors that influence adherence to anti-tuberculosis medicines. This study therefore aims to identify factors that influence adherence to anti-TB drugs in Sunyani Municipality.

METHODS

Study design and type

A quantitative, descriptive cross-sectional study design was used to assess factors influencing adherence to anti-TB drugs in Sunyani municipality. The study included consenting patients with a confirmed diagnosis of tuberculosis who were receiving anti-tuberculosis treatment at the time of data collection and had been on treatment for at least one month.

Study site description

This study was conducted in the Sunyani municipality of the Bono region, Ghana. It involved three facilities. The facilities were the Sunyani Teaching Hospital, Sunyani Municipal Hospital and Seventh Day Adventist (S.D.A.) Hospital, Sunyani. These facilities were selected for the study because they are the primary healthcare facilities providing tuberculosis diagnosis and treatment services within the municipality and manage the highest volume of tuberculosis cases. The Sunyani Municipality is one of

Ghana's 261 administrative metropolitan, municipal, and district assemblies.

There are 34 health facilities in Sunyani municipality, including 1 teaching hospital, 1 municipal hospital, 12 health centres, 18 Community-based Health Planning and Services (CHPS) compounds and 3 private hospitals. Of these, three facilities were used in the study. These were Sunyani Teaching hospital, Sunyani Municipal hospital and S.D.A. hospital. The Sunyani teaching hospital is the main referral hospital in the municipality. It is a 350-bed capacity hospital that provides a wide range of medical services, including outpatient and inpatient care, surgery, obstetrics and gynaecology, public health, rehabilitation, laboratory services, imaging, allied surgery, specialized care in various areas, and paediatrics. The Sunyani municipal hospital provides primary and secondary health care services to the people of the municipality. The municipal hospital has about 96 bed capacity. The S.D.A hospital is a Christian-based hospital that is operated by the Ghana Adventist Health services and has about 98 bed capacity. The hospital offers wide range of services, including; outpatient department, family planning, emergency ward, maternity ward, scan centre, pharmacy, birth and death registry, mortuary, disease control and child weighing and care.

Study population

The study population was patients with TB receiving anti-TB drugs above 18 years who have their names captured in the TB registers in the three selected hospitals at the time of data collection.

Inclusion criteria

The study included consenting adults (?18 years) with a confirmed diagnosis of tuberculosis who had been receiving anti-tuberculosis treatment for at least one month at any of the three selected hospitals in the municipality.

Exclusion criteria

Patients with tuberculosis and on treatment who did not agree to participate in the study and TB patients who are characterized as being severely ill by the clinician who may not be able to respond to the questionnaire were excluded from the study.

Sampling technique and sample size

The total population of patients receiving anti-TB drugs who were receiving treatment at the time and had their names captured in the 2023-2024 facility-based registers in the Sunyani municipality were enrolled on the study upon consent to participate in the study. Hence, complete enumeration was attempted. A total of 157 participants out of 172 consented to participate in the study. The data was collected within a six-week period; 19/02/24 to 29/03/24.

Measure of adherence and coding instructions for 8-MMAS

The 8-item Morisky Medication Adherence Scale was used in measuring adherence. It involves eight structured questions. The response to the questions were 'Yes' and 'No'. 'Yes' was coded 0 and 'No' was coded 1 generally. But for question e, 'Yes' was coded 1 and 'No' was coded 0. For question h, the following codes were assigned. 'Never/rarely' = 1, 'Once in a while'=0.75, 'Sometime'=0.50, 'Usually'=0.25 and 'All of the time'=0
A total score of <6= low adherence, a score from 6 but less than 8 = medium adherence and high adherence=8.[14,15,16]

Adherence level was further dichotomized into two; non-adherence and adherence. A total score of less than 6 (low adherence) was classified as non-adherence and total score of 6 to 8 (medium and high adherence) was classified as adherence based on the original cut-off recommendations.[14]

Measure of knowledge about tuberculosis

Knowledge about TB was measured based on ten (10) questions. Knowledge about TB scores were derived from the corresponding set of items in Tables 2a. The response to the questions were 'Yes' or 'No' as required. 'Yes' was coded '1' and 'No' as '0' but for question 6, 'Yes' was coded '0' and 'No' as '1'. For question (4) 'by touching' and 'not sure' was coded '0' and 'air droplet' was coded '1'. For question (7), '6 months=1' and '9months and > 9months = 0'. For question (9), 'for at least 3 symptoms=1, > 3 symptoms but greater than 0= 0.5, and 0 symptoms =0. A score of less than five (5) was considered low knowledge level and 5 or more was considered high knowledge level. This was adapted from a study by Nirmal et al. (2021).[17]

Measure of awareness about TB

Awareness of TB was measured using five (5) questions. The questions were derived from the corresponding set of items in Table 2b. The response to the questions were 'Yes' and 'No' with 'yes' assigned 1 and 'No' 0. A score of less than 2.5 was considered low awareness and 2.5 or more was considered high awareness. This was adapted from the following studies: Nirmal *et al*. (2021), Dorji *et*

al. (2020) and Kwakye (2019).[17,18,19]

Data collection tool and technique

Trained research assistants collected the data by administering data collection instrument (questionnaire) which was pretested. The research assistants were people who had at least acquired a higher national diploma (HND), capable of speaking in Twi and English. They were trained on how to collect the requisite data from the study population. Five (5) patients with TB from STH were used in pretesting the questionnaire to help do away with ambiguous and repeated questions. No changes were made to the questionnaire after pretesting. These people were not part of the main study. The questionnaire was developed based on the objectives of the study. It had four sections for tuberculosis patients. The first section was the socio-demographic and economic factors of study participants (including age, gender, educational level, occupation, income level, social support etc.), second section was patient related factors (including knowledge about TB, awareness of TB, beliefs about TB, side effects of anti-TB drugs), third section was the health service-related factors (including access to healthcare facility, counselling and education, relationship with healthcare providers, distance and time covered to collect anti-TB drugs) and the last section was on measurement of adherence to anti-TB drugs.

The study conducted was explained into detail to the patients and upon their consent indicated in signing of the informed consent, became participants of the study. It was an interviewer-administered structured questionnaires. The questionnaire was adapted from previous studies and extensive literature review on factors influencing adherence to anti-TB drugs to suit this current study.[14,15,16,17,18,19,20] The interviews were conducted in either Twi or English depending on the language the patient was fluent in. The interviews were conducted with a six-week period.

Data analysis

For the data gathered to be analysed, it was initially coded and entered into excel, was then cleaned and finally migrated into Stata 15.0 for statistical analysis. Descriptive and Inferential statistics, specifically, Chi-square tests and Fisher's exact (for distributions with cell count less than 5) were used to identify association between adherence to anti-TB drugs and the independent variables. Simple logistic regression analyses were carried out on independent variables that were found to be associated with adherence to anti-TB drugs to determine the magnitude of the association. This threshold-based approach was adopted as a pragmatic screening strategy in similar adherence studies to reduce the risk of overfitting given the sample size.[21,22] Finally, variables meeting the predetermined selection criteria were entered into a multivariable logistic regression model to identify independent predictors of adherence to anti-TB drugs. Both crude odds ratios (COR) and adjusted odds ratios (AOR), together with their 95 % confidence intervals, were estimated and reported. Statistical significance was set at a p-value of less than 0.05. Assumptions of the logistic regression model, including absence of multicollinearity among predictors, were not formally assessed and are acknowledge as a limitation.

Ethical consideration

Ethical approval was obtained from the Ghana Health Service Ethics Review Committee (GHS-ERC: 024/12/23). Written informed consent was obtained from all participants. Confidentiality was maintained through anonymization of data, and participants were informed of their right to withdraw at any time without penalty. Written approval was obtained from the institutions involved.

RESULTS

Socio-demographic and economic characteristics of participants

The total number of participants for the study was 157. Table 1 below illustrates the results from socio-demographic and economic characteristics of participants. Majority of respondents were males constituting 65.6 % (103). The average age of respondents was 38.59 years (Standard deviation (sd) = ± 12.78). Majority of participants had some level of formal education (87.3 %). The proportion of participants who were self-employed was 40.1%. The respondents who felt stigmatized by family member or friends formed 36.3% (57) of all respondents. Majority of participants had social support with their TB treatment (75.2 %) and 54.6 % of the social support came from family members.

Table 1: Socio-demographic and economic characteristics of participants

Variable	Frequency (N)	Percentage (%)
Age (mean ±SD)	38.59 years ± 12.78	
Gender		
Female	54	34.4
Male	103	65.6
Marital status		
Married	85	54.2
Single	60	38.2
Divorced	9	5.7
Widowed	3	1.9
Religion		
Christian	69	44.0
Muslim	77	49.0
Traditionalist	11	7.0
Educational level		
No formal education	20	12.7
Primary	4	2.6
Junior high school (JHS)	30	19.1
Senior high school (SHS)	45	28.7
Technical/vocational	22	14.0
Tertiary	36	22.9
Occupation		
Self-employed	63	40.1
Public sector	23	14.7
Private sector	29	18.5
Unemployed	28	17.8
Student/apprentice	14	8.9
Income level (Ghana cedis)		
100-1000	82	52.2
1001-2000	38	24.2
2001-3500	24	15.3
3501-5000	11	7.0
5001-7000	0	0.0
7001-10000	2	1.3
>10000	0	0.0
Financial assistance from other people in support of your TB care		
Yes	84	53.5
No	73	46.5
Feeling stigmatized by family members or friends		
Yes	57	36.3
No	100	63.7
Social support		
Yes	118	75.2
No	39	24.8
Social support from..		
Family member	65	54.6
Spouse	36	30.3
Friend	17	14.3
Other	1	0.8

Characteristics of patient-related factors of participants
Majority of respondents had a primary caregiver (77.1%). One hundred and forty-six (93.0%) of participants had high knowledge level about TB. Majority of participants were aware of TB (have heard of TB and know of its existence as a disease) [133 (84.7 %)]. Majority of respondents experienced side effects of their anti-TB drugs (71.3). Tables 2a-2d below illustrate the patient-related characteristics of participants, covering knowledge, awareness, beliefs, and side effects/comorbidity, respectively. Figure 1 below depicts common symptoms of active TB infection as cited by respondents.

Table 2a: Knowledge about TB

Knowledge about TB	Frequency (Percentage)	
	Yes	No
Do you know of TB?	123 (78.3)	34 (21.7)
Is tuberculosis caused by bacteria?	119 (75.8)	38 (24.2)
Can TB be transmitted from one person to another?	139 (88.5)	18 (11.5)
How is TB transmitted from one person to another?		
Air droplets	135 (86.0)	
By touching	2 (1.3)	
Not sure	20 (12.7)	
Does covering the mouth and nose while coughing and sneezing help to reduce the spread of tuberculosis?	134 (85.4)	23(14.6)
Can tuberculosis be prevented by not sharing the utensils with an infected person?	48 (30.8)	108(69.2)
Can TB be cured with appropriate treatment?	152 (97.4)	4(2.6)
Are there vaccines available to prevent TB?	60 (38.2)	97 (61.8)
How long is the treatment of tuberculosis?		
6 months	139 (88.5)	
9 months	11(7.0)	
>9 months	7 (4.5)	

Table 2b: Awareness of TB

Awareness of TB	Frequency (Percentage)	
	Yes	No
Do you know of tuberculosis?	123 (78.3)	34 (21.7)
Can TB be transmitted from one person to another?	139 (88.5)	18 (11.5)
Is TB a bacterial infection that primarily affects the lungs?	106 (67.5)	51(32.5)
Do you know that TB can be effectively treated with antibiotics?	117 (74.5)	40 (25.5)
Have you heard about the signs and symptoms of TB; such as coughing for more than 2 weeks, weight loss and night sweats?	125 (79.6)	32 (20.4)

Table 2c: Beliefs about TB

Beliefs about TB	Frequency (Percentage)	
	Yes	No
Do you believe that TB is a serious health concern in Sunyani municipality?	57 (36.3)	100 (63.7)
Do you have any cultural or traditional beliefs related to TB, its causes or its treatment?	57 (36.3)	100 (63.7)
Does these beliefs affect you in anyway, especially in taking the TB drugs?	35 (22.4)	121 (77.6)

Table 2d: Side effects of anti-TB drugs

Side effects of anti-TB drugs and comorbidity	Frequency (Percentage)	
	Yes	No
Do you experience any side effects from your anti-TB medications?	112 (71.3)	45 (28.7)
Do you have any other health condition?	57 (36.3)	100 (63.7)

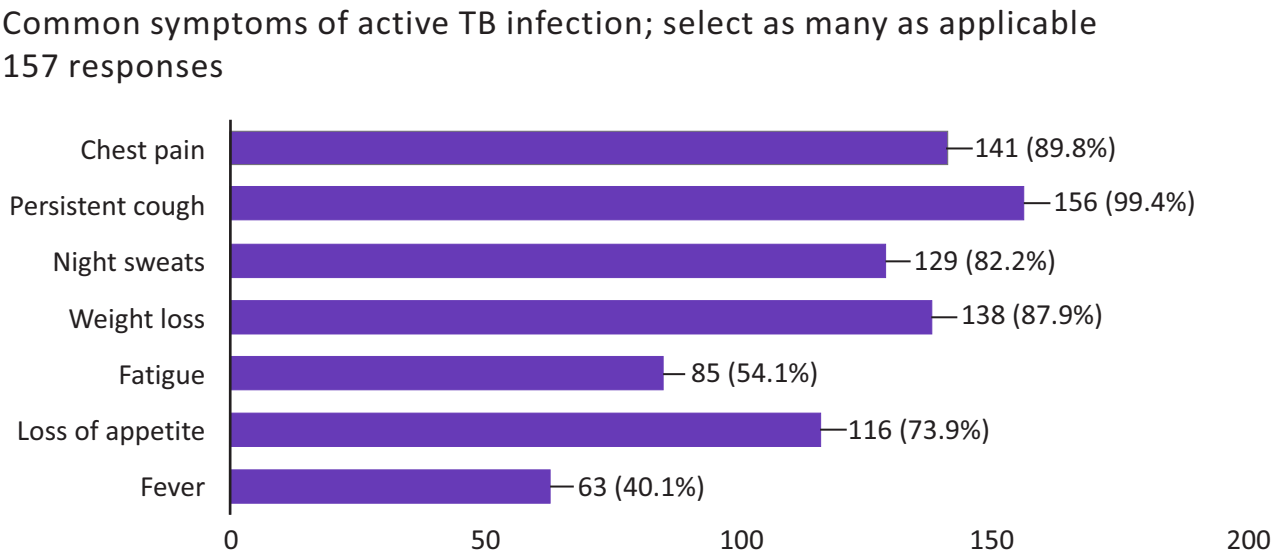


Figure 1: Common symptoms of active TB infection

Characteristics of health service-related factors of participants

Fifty (31.9 %) of the respondents travel a distance of 11-20 Km to the treatment centre to collect their medications. Fifty (31.8 %) of participants missed appointments or medication doses because the healthcare facility was too far away or difficult to reach. Generally, 145 (92.4 %) were adequately counselled and educated. The overall staff attitude at the various centres were satisfactory (98.7 %). Majority of participants (96.2 %) felt that their healthcare provider was supportive and understanding of your personal circumstances, such as work or family commitments, in relation to their TB treatment. Majority of participants (98.1 %) had good relationship with their healthcare providers. Table 3 below depicts the health service-related factors of participants.

Table 3: Characteristics of health service-related factors of participants

Accessibility of healthcare facility	**Frequency (percentage %)**	
	Yes	**No**
Have you ever missed appointments or medication doses because the healthcare facility was too away or difficulty to reach?	50 (31.8)	107 (68.2)
Have you considered relocating or changing your residence to be closer to the healthcare facility for the convenience of accessing TB treatment?	5 (3.2)	152 (96.8)
Have you encountered any financial constraints, such as out-of-pocket expenses or fees related to your TB treatment that affect your ability to access healthcare services?	80 (51.0)	77 (49.0)
How satisfied are you with the overall accessibility of healthcare services with respect to TB treatment in your community?		
Satisfied	135 (86.0)	
Not Satisfied	22 (14.0)	
What mode of transportation do you primarily use to travel to the healthcare facility for your anti-TB drugs?		
Walking	22 (14.0)	
Bicycle	5 (3.2)	
Public transport	124 (79.0)	
Personal vehicle	6 (3.8)	
Counselling and education		
Were you given instructions on how to take your medication?	152 (97.4)	4 (2.6)
Did you understand the instructions given?	152 (97.4)	4 (2.6)
Were you provided with a source for further clarification if you needed one?	111 (71.2)	45 (28.8)
Have you been informed about the common side effects of the anti-TB drugs and how to manage or report them?	77 (49.0)	80 (51.0)
Did your healthcare provider discuss the importance of adhering to the full course of anti-TB drugs and the consequences of non-adherence?'	134 (85.4)	23 (14.6)
Relationship with healthcare providers		
How would you rate the attitude of staff who attended to you at the health facility?		
Satisfactory	155 (98.7)	
Not satisfactory	2 (1.3)	
Do you feel comfortable discussing your concerns and questions about your TB treatment with your healthcare provider?	148 (94.3)	9 (5.7)
Do you feel that your healthcare provider is supportive and understanding of your personal circumstances, such as work or family commitments, in relation to your TB treatment?	150 (96.2)	6 (3.8)
How satisfied are you with the communication between you and your healthcare provider regarding your TB treatment?		
Satisfied	152 (96.8)	
Not satisfied	5 (3.2)	

Adherence level

The proportion of respondents who had low adherence was 46.5 % (a Morisky score of < 6), 15.9 % of participants had medium adherence (a score of 6 but < 8) and the proportion of high adherence was 37.6 % (score = 8).

Adherence level was divided into two; non-adherence (Morisky score < 6) and adherence (Morisky score of 6-8 i.e medium + high adherence). The proportion of respondents who were adherent to their anti-TB drugs was 53.5 % whiles 46.5 % were not adherent. The pie chart (fig. 2) below depicts the levels of adherence among study participants.

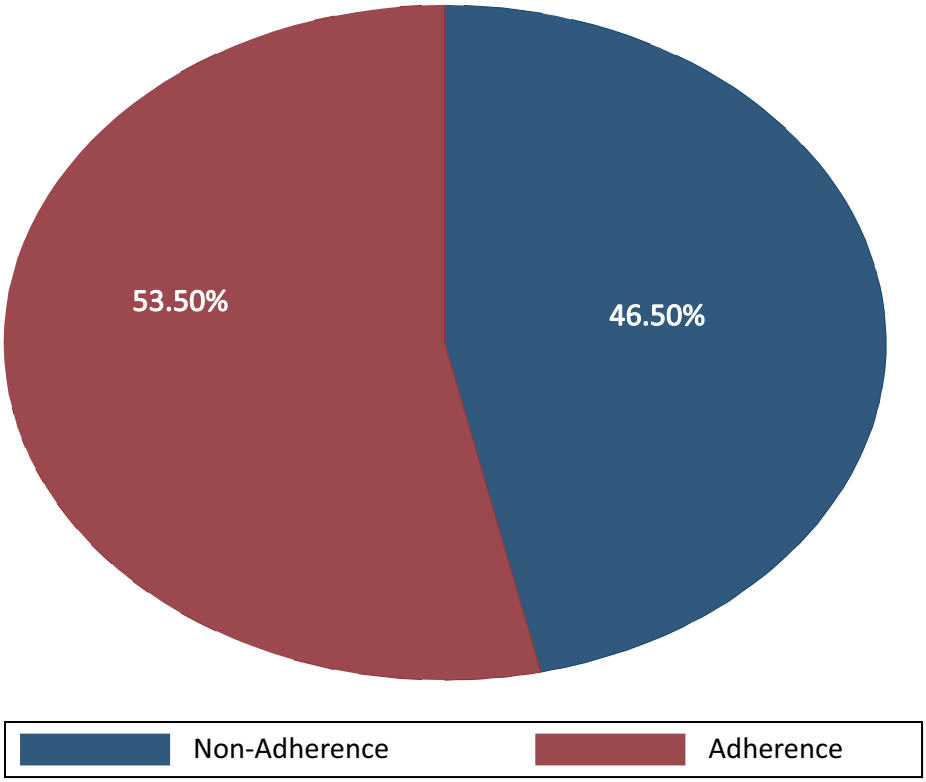


Figure 2: Level of adherence

Bivariate analysis of factors associated with adherence to anti-TB drugs.

The results from bivariate analysis using Chi square test indicated that, gender was significantly associated with adherence to anti-TB with a p-value of 0.020 and 60.2 % of males were adherent to their anti-TB drugs compared to females (40.7 %). For respondents who had social support, 58.5 % were adherent to their anti-TB drugs. Accessibility to the health facility was found to be statistically significant (p = 0.001). Having a primary care giver was significantly associated with adherence to anti-TB drugs (p = 0.002). Traditional beliefs about TB was also associated with adherence to anti-TB drugs with p-value of 0.013 which was statistically significant. Knowledge about TB was significantly associated with adherence to anti-TB drugs. The results of the bivariate analysis are shown in table 4

Table 4: Results of bivariate analysis of factors associated with adherence to anti-TB drugs

Variable	Adherence level		Total (N) (%)	p-value
	Non-adherence (*n*) (%)	Adherence (*n*) (%)		
Gender				
Male	41 (39.8)	62 (60.2)	103(100.0)	0.020
Female	32 (59.3)	22 (40.7)	54 (100.0)	
Age (years)				
18-28	20 (45.5)	24 (54.5)	44 (100.0)	0.828
29-39	17 (41.5)	24 (58.5)	41(100.0)	
40-50	23 (53.5)	20 (46.5)	43(100.0)	
51-61	10 (47.6)	11 (52.4)	21(100.0)	
62+	3 (37.5)	5 (62.5)	8(100.0)	
Age				
>40years	37 (43.5)	48 (56.5)	85 (100.0)	0.418
40 or more years	36 (50.0)	36 (50.0)	72(100.0)	
Marital status*				
Single	28 (46.7)	32 (53.3)	60(100.0)	0.959
Married	39 (45.9)	46 (54.1)	85(100.0)	
Divorced	4 (44.4)	5 (55.6)	9(100.0)	
Widowed	2 (66.7)	1 (33.3)	3(100.0)	
Religion				
Christian	30 (43.5)	39 (56.5)	69(100.0)	0.775
Muslim	38 (49.4)	39 (50.6)	77(100.0)	
Traditionalist	5 (45.5)	6 (54.5)	11(100.0)	
Educational level				
No formal education	9 (45.0)	11 (55.0)	20(100.0)	0.928
Primary	2 (50.0)	2 (50.0)	4(100.0)	
JHS	14 (46.7)	16 (53.3)	30(100.0)	
SHS	23 (51.1)	22 (48.9)	45(100.0)	
Technical/vocational	11 (50.0)	11 (50.0)	22(100.0)	
Tertiary	14 (38.9)	22 (61.1)	36(100.0)	
Occupation*				
Self-employed	24 (38.1)	39 (61.9)	63(100.0)	0.245
Public sector	11 (47.8)	12 (52.2)	23(100.0)	
Private sector	14 (48.3)	15 (51.7)	29(100.0)	
Unemployed	14 (50.0)	14 (50.0)	28(100.0)	
Student/apprentice	10 (71.4)	4 (28.6)	14(100.0)	
Income level (GHS)*				
100-1000	42 (51.2)	40 (48.8)	82(100.0)	0.377
1001-2000	16 (42.1)	22 (57.9)	38(100.0)	
2001-3500	9 (37.5)	15 (62.5)	24(100.0)	
3501-5000	4 (36.4)	7 (63.6)	11(100.0)	
> 7001-10000	2 (100.0)	0 (0.0)	2(100.0)	
	0	0	0	
Financial assistance				
Yes	43 (51.2)	41 (48.8)	84(100.0)	0.206
No	30 (41.1)	43 (58.9)	73(100.0)	

Stigmatized				
Yes	30 (52.6)	27 (47.4)	57(100.0)	0.245
No	43 (43.0)	57 (57.0)	100(100.0)	
Social support				
Yes	49 (41.5)	69 (58.5)	118(100.0)	0.030
No	24 (61.5)	15 (38.5)	39(100.0)	
Distance				
1-10km	11 (44.0)	14 (56.0)	25(100.0)	
11-20km	29 (58.0)	21 (42.0)	50(100.0)	0.250
21-30km	17 (38.6)	27 (61.4)	44(100.0)	
>30km	16 (42.1)	22 (57.9)	38(100.0)	
Duration of travel				
6-10mins	5 (29.4)	12 (70.6)	17(100.0)	
11-15mins	18 (62.1)	11 (37.9)	29(100.0)	0.273
16-20mins	14 (42.4)	19 (57.6)	33(100.0)	
21-25mins	7 (36.8)	12 (63.2)	19(100.0)	
26-30mins	10 (55.6)	8 (44.4)	18(100.0)	
>30mins	19 (47.5)	21 (52.5)	40(100.0)	
Accessibility*				
Readily accessible	56 (41.2)	80 (58.8)	136(100.0)	
Not readily accessible	17 (80.9)	4 (19.10)	21(100.0)	0.001
Counselling and education*				
Adequate	64 (44.1)	81 (55.9)	145(100.0)	0.067
Not adequate	9 (75.0)	3 (25.0)	12(100.0)	
Relationship with HCP*				
Good	73 (47.4)	81 (52.6)	154(100.0)	0.249
Not good	0 (0.0)	3 (100.0)	3(100.0)	
Primary caregiver				
Yes	48 (39.7)	73 (60.3)	121(100.0)	0.002
No	25 (69.4)	11 (30.6)	36(100.0)	
Beliefs about TB				
Yes	34 (59.6)	23 (40.4)	57(100.0)	0.013
No	39 (39.0)	61 (61.0)	100(100.0)	
Side effects				
Yes	51 (45.5)	61 (54.5)	112(100.0)	0.703
No	22 (48.9)	23 (51.1)	45(100.0)	
Comorbidity				
Yes	29 (50.9)	28 (49.1)	57(100.0)	0.406
No	44 (44.0)	56 (56.0)	100(100.0)	
Knowledge level*				
Low knowledge	10 (90.9)	1 (9.10)	11(100.0)	0.003
High knowledge	63 (43.1)	83 (56.9)	146(100.0)	
Awareness level				
Low awareness	15 (62.5)	9 (37.5)	24(100.0)	0.088
High awareness	58 (43.6)	75 (56.4)	133(100.0)	

Multiple (multivariable) logistic regression

The multivariable logistic regression model included 157 observations. The Hosmer-Lemeshow goodness-of-fit test indicated that the model fit the data well (X2=3.31, df=5, p = 0.653). After adjusting for other factors, gender (aOR = 2.19, 95% CI: 1.04-4.63, p = 0.039) and accessibility to healthcare facility (aOR = 4.07, 95 % CI: 1.15-14.43, p=0.030) remained independently associated with adherence. Males had 2.19 times higher odds of adherence compared to females, while participants with ready access to healthcare facilities had 4.07 times higher odds of adherence. The results of the multiple logistic regression analysis are displayed in table 5

Table 5: Results of simple and multiple logistic regression analysis of significant factors associated with adherence to anti-TB drugs

Variable	Crude odds ratio (cOR)	95% CI	p-value	Adjusted odds ratio (aOR)	95% CI	p-value
Gender						
Male	2.20	1.12-4.30	0.021	2.19	1.04-4.64	0.039
Female	1			1		
Social support						
Yes	2.25	1.07-4.73	0.032	1.38	0.58-3.28	0.471
No	1			1		
Primary caregiver						
Yes	3.46	1.56-7.67	0.002	2.22	0.89-5.51	0.085
No	1			1		
Beliefs about TB						
Yes	1			1		
No	2.31	1.19-4.49	0.013	1.70	0.80-3.60	0.167
Knowledge about TB						
Low knowledge	1			1		
High knowledge	13.17	1.64-105.62	0.015	9.16	0.99-84.87	0.051
Accessibility						
Readily accessible	6.07	1.94-19.01	0.002	4.07	1.15-14.43	0.030
Not readily accessible	1			1		
Counselling and education						
Adequate	3.80	0.99-14.60	0.052	3.36	0.78-14.54	0.104
Not adequate	1			1		

DISCUSSION

This study assessed factors influencing adherence to anti-TB drugs among patients in Sunyani Municipality, Ghana. Adherence to anti-TB drugs is very crucial in achieving desirable outcomes in the management of tuberculosis. From the study, adherence to anti-TB drugs was relatively low (53.5 %). A similar result was found by Bea *et al*. (2021)[23] in a study done in South Korea where adherence to TB treatment was 56.5 %. This was similar to the rate of adherence found by Danso *et al*. (2015)[12] in a study done in Suhum, Ghana (63.0 %). It is lower than the adherence rate (81.6 %) recorded in a study by Dogah *et al*. (2021)[6] in Ketu North district of Volta region of Ghana, 76.8 % by Garbrah *et al*. (2024)[13] in Kumasi metropolis and the 66.4 % by Fang *et al*. (2019)[24] in China. A little less than half (46.5 %) of respondents were non-adherent to anti-TB drugs. It has been found that, nearly half (50.0 %) of TB patients do not complete their treatment resulting in non-adherence to therapy.[7,25] Almost half (46.5 %) of respondent were not adherent to

their anti-TB drugs which correspond to the statement by Sazali *et al*. (2023).[25]

The success rate of treatment recommended by WHO for all diagnosed cases of TB is at least 85.0-90.0 %.[26] And it has been found that, the level of adherence needed to ensure control of TB should be more than 90.0 %.[27] With non-adherence rate being 46.5 %, there is increased risk of spread of TB, increased risk of treatment failure, prolonged infectiousness, higher risk of relapse of disease and drug resistance, increased healthcare cost, and increased morbidity and mortality.[24,27,28,29] This can ultimately lead to development of multi-drug-resistant tuberculosis as non-adherence to therapy have been associated with development of MDR. This can potentially result in increased morbidity and mortality. It is therefore crucial that, measures such as effective DOT implementation, ready access to healthcare facilities, adherence counselling, etc. should be put in place to improve adherence levels.

From the bivariate analysis, socioeconomic factors that were shown to influence adherence to anti-TB drugs were gender and social support. This is comparable to other studies. Social support was found to influence adherence to anti-TB drugs in a study done in Ethiopia.[30] In this study, majority of participants had social support with more than half of the support coming from family members. Hence, having social support as someone to rely on to help you remember and take your anti-TB drugs might help TB patients to take their drugs as prescribed. This support can be from family members, spouse, friends, etc. However, social support was not independently associated with adherence to anti-TB drugs in this study. After adjusting for other variables in multiple logistic regression analysis, it was found not be statistically associated with adherence to anti-TB drugs.

Gender was however, independently associated with adherence to anti-TB drugs from the multiple logistic regression analysis. A similar finding was found in a study by Dogah *et al*. (2021)[6] in Ketu North district, where males were about thrice as likely to adhere to treatment as females. In this current study, 60.2 % of males were adherent to anti-TB drugs compared to 40.7 % of females (p=0.020). After adjusting for other variables of interest, the odds for males to adhere to anti-TB drugs was 2.19 times higher than that of females (p=0.039). This means that, males are about twice more likely to adhere to anti-TB drugs than females. In contrast, gender has been found not to influence adherence to anti-TB drugs in other studies.[24,29] Also females are more likely to adhere to anti-TB drugs than males according to a study in South Africa.[31] A possible explanation for this outcome may be that, males may have greater social support to help them complete their treatment compared to females who face household responsibilities or childcare. Further studies are however required to uncover the possible reasons why males are adherent to anti-TB drugs than females.

Accessibility to healthcare facility was found to be associated with adherence to anti TB drugs in this study in the bivariate analysis (p = 0.001) with 58.8 % of participants who had ready access to healthcare facility being adherent to their anti-TB drugs compared to 19.1 % of those who did not have ready access to healthcare facility. Participants with ready access to healthcare facility were about four times more likely to adhere to anti-TB drugs than those who do not have ready access to healthcare facility after adjusting for other significant variables. Accessibility to healthcare facility was therefore independently associated with adherence to anti-TB drugs. A similar finding was made by Adisa *et al*. (2021)[26] in a study done is Southwest Nigeria. Having ready access to healthcare facility may influence adherence since the patient can easily go the healthcare facility at the requisite times to get their medications which may improve adherence.

Counselling and education have been found in other studies to significantly influence adherence to anti-TB drugs.[32] The reason being that, the more patients are counselled and educated on their medications, the more they are understand and the higher the odds of adherence to the treatment.[32] Majority of respondent in this study were adequately counselled and educated on their condition and medications. In bivariate analysis, majority of those who were adequately counselled and educated adhered to their anti-TB drugs compared to those who were not adequately counselled and educated. However, this was not statistically significant. However, looking at the proportion of participants who were adequately counselled and educated and their adherence level, the adherence level is quite low. Hence, more efforts have to be put in place to counsel TB patients and educate them on their condition and medications to help in improving adherence level. Adequate counselling and education is expected to translate to adherence, since it was not able to predict adherence independently, it may be that the counselling was not done well, hence further studies are required to look into the kind of counselling TB patients receives

about their condition and medications.

Patient-related factors that were found to be associated significantly with adherence to anti-TB drugs from bivariate analysis were primary caregiver, traditional or cultural beliefs about TB and knowledge about TB. A study done in Yemen found knowledge about TB to be statistically associated with adherence to treatment of TB which is in agreement to this study.[33] Similar findings have been found in other studies.[6,28,30] Majority of participants in the study had high knowledge about TB but the relatively low adherence rate suggests that, knowledge may not necessarily translate into practice. This suggests the need to design interventions to modify behavior rather than merely increasing knowledge. From the multiple logistic regression analysis, the odds of adhering to anti-TB drugs among respondents who had high knowledge about TB was 9.16 higher than those with low knowledge about TB. This effect was however marginal.

Other patient-related factors such as awareness of TB, other health condition (comorbidity), and side effects of anti-TB drugs were not found to be statistically associated with adherence to anti-TB drugs. This is not in agreement with a study done in Ghana where side effects of anti-TBs was significantly associated with adherence to treatment.4 A similar result was found by Ali & Prins (2020)[28] in a systematic review. In this current study, majority of participants experienced side effects of the anti-TB drugs but the nature and severity of the side effects were not exploited. A qualitative study is therefore required to explore the nature and severity of side effects of anti-TB and how they influence adherence to anti-TB drugs. A study by Bea *et al*. (2021)[23] in South Korea found out that, comorbidities such as diabetes and history of dementia was significantly associated with adherence which is in contrast to what was found in this study. Comorbidity was found to be insignificantly associated with treatment outcomes and adherence by a study conducted in Ghana which is consistent with this study.[34]

Strengths and limitations

Strengths of this study include the use of a validated adherence scale (MMAS-8), reasonable sample size, and inclusion of multiple healthcare facilities. The Hosmer-Lemeshow goodness-of-fit test was used which indicated that the model fit the data well. Limitations include the cross-sectional design, which precludes causal inferences, potential social desirability bias, and the exclusion of severely ill patients who might have different adherence patterns. Formal assessment of logistic regression assumptions, such as multicollinearity among predictors, was not conducted in this study. These limitations should be taken into consideration when interpreting findings and making generalization beyond this setting.

CONCLUSION

The level of adherence to anti-TB drugs was 53.50 %. Nearly half of participants were not adherent to anti-TB drugs. Factors found to independently influence adherence to anti-TB drugs were gender and accessibility to healthcare facility. Males are about two times likely to adhere to anti-TB drugs than females. The odds of adherence among participants with readily accessibility to healthcare facility was 4.07 times that among those who do not have readily accessibility to healthcare facility. Policy makers should ensure equitable access to healthcare facility to improve adherence. The National Tuberculosis Programme should incorporate gender considerations into TB care by identifying and addressing barriers that disproportionately affect women. Further studies are required to explain why males are more adherent to anti-TB drugs than females. Interventions to improve adherence to anti-TB drugs in the Sunyani Municipality need to be strengthened.

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