Availability and use of antibiotics in the Dormaa Municipal District of the Bono Region in Ghana

Jennifer Bonnah
Food and Drugs Authority, Accra, Ghana

Clare I.R. Chandler
(Mentor) London School of Hygiene and
Tropical Medicine, London, UK

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I, Jennifer Bonnah hereby declare that this report is based on research duly conducted in the Dormaa Central Municipality of the Bono Region of Ghana towards my Fleming Fellowship programme. This work has neither been previously published by any other person, nor has the material been presented for the award of any certificate in any other institution. All published work from which references were taken have been duly acknowledged to the best of my knowledge.

The rise observed in antimicrobial resistance over the past decades has been linked to the dramatic increase in use of antibiotics in humans and animals. Few studies have prospectively examined the availability and use of antibiotics in humans and animals at the residential level in Ghana. This study was conducted to gather data on the availability and use of antibiotics among residents in a suburban municipality in Ghana. Data from such studies may aid policy makers to devise strategies to help consumers to minimise inappropriate use of antibiotics at the community level.

This study is a cross-sectional study during which the study team assessed the availability and use of antibiotics in humans at the community level in the Dormaa municipality of the Bono Region in Ghana. Structured questionnaires and the Drug Bag' method were employed to quantify antibiotic types available at the community level, frequently used antibiotics in the community as well as the disease conditions these antibiotics are used to treat. A total of 100 households, 6 retail community pharmacy outlets and 11 out-patient health facilities were visited. Questionnaires were administered to participants in the pharmacies and out-patient facilities whilst the 'Drug Bag' method was combined with questionnaires to gather data in the households.

The study results revealed that the top four antibiotics used by respondents in the households in the communities surveyed often without prescription were Amoxicillin Capsules, Metronidazole Tablets, Phenoxymethylpenicillin Tablets and Tetracycline Capsules. These antibiotics are normally obtained from Over-the-Counter Medicines Sellers facilities and peddlers although such outlets are not permitted by law to stock and dispense these antibiotics. The top three disease conditions given by respondents in the study communities for which antibiotics are used are gastrointestinal diseases, followed by fever with body pains and cough and cold conditions. Antibiotics known and used by respondents in the community was compared with the WHO AWaRe classification tool. The study revealed that 50% and 47% respectively of antibiotics known and used by respondents fell within the "Access" list while 11% and 8% respectively of antibiotics known and used by respondents fell within the "Watch" list. None of the antibiotics in the "Reserve" list was known to or had been used by respondents. The research found that 85% of households had used antibiotics three months prior to the study in the vicinity.

The study has revealed common antibiotic use among residents in the Dormaa municipality, including for diseases which are preventable. This paper therefore suggests that preventive approaches including improving access to water and sanitation facilities may improve infection prevention and control, leading to decreased incidence of infections such as gastrointestinal disturbances and a decrease in the perceived need for frequent antibiotic use. Awareness creation is also key in sensitising communities about the dangers of excessive use of antibiotics, including the emergence of AMR.

AMR:	Antibiotic Resistance
AMU	Antimicrobial Use
CHAG:	Christian Health Association of Ghana
CHPS Centre	Community Health Planning Services Centre
EML	Essential Medicines List
FDA	Food and Drugs Authority
GHS	Ghana Health Service
GNDP	Ghana National Drugs Programme
INRUD	International Network for the Rational Use of Drugs
LMICs	Low- Middle Income Countries
LSHTM	London School of Hygiene and Tropical Medicine
MCAs	Medicine Counter Assistants
MOH	Ministry of Health
NAP	National Action Plan
OTC:	Over-the-Counter Medicine
OTCMs	Over-The-Counter Medicine Sellers
P	Pharmacist-Initiated Medicine
POM	Prescription-only Medicine
WHO	World Health Organisation

1.1 Introduction

Antimicrobial Resistance (AMR) is the ability of disease-causing micro-organisms to counteract the effects of antimicrobial agents administered so that they are not killed and their growth is not stopped. Infections with resistant organisms are difficult to treat and invariably become very costly [1]. The emergence of antimicrobial resistance has become a serious issue across the globe resulting in life-threatening infections as organisms continue to develop resistance against commonly used and affordable antimicrobial agents [2]. The phenomenon is considered a 'One Health' issue because it permeates infection treatment in humans, animals, poultry, fish as well as the environment [3]. Disposal of antimicrobial agents can end up in water bodies that are sources of drinking water, plants that we consume and in the air we breathe culminating in a vicious cycle of passive antibiotic consumption [4].

Antimicrobial resistant-microbes are found in human beings, animals, food, and the environment (in water, soil and air). They can spread between people and animals, including from food of animal origin and from person to person [3]. Poor infection control, inadequate sanitary conditions and inappropriate food-handling encourage the spread of antimicrobial resistance [5]. Antibiotic resistance is present in every country and patients with infections caused by drug-resistant bacteria are at increased risk of worse clinical outcomes and death. Such patients consume more healthcare resources than patients infected with non-resistant strains of the same bacteria (2). It is estimated that infections due to antimicrobial resistance is responsible for up to 50,000 deaths annually in the US and Europe. Additionally, an estimated 10 million people could die from the effects of antimicrobial resistance worldwide [6].

1.2 Justification for Study

Antibiotic use has been identified as a very important cause of increasing microbial resistance to antibiotics [7][8]. In many low and middle income countries, whilst there is increasing data from hospital settings and some summary data from sales and imports, there is lack of information about the types and quantities of antibiotics being used in communities. This picture is mirrored in Ghana. Most researches that have been conducted into the use of antibiotics are point prevalence studies which are conducted with in-patients in selected hospitals. Few studies have been conducted into the use of antibiotics in the community and by out-patients. Gaps therefore exist in the viability of data from studies on use of antibiotics in the community. The proposed study therefore seeks to investigate the use of antibiotics in the selected community. The study also seeks to unearth the drivers of the use of antibiotics at the community level so that appropriate interventions can be designed to promote rational dispensing and use of antimicrobial agents.

1.3 General Objective

To quantify the frequency of antibiotic use by antibiotic type in the study population.

1.4 Specific Objectives

To determine the classes of antibiotics available for use in the community
To determine the classes of antibiotics frequently used in the community
To assess the proportion of households using antibiotics within a specific time frame

Antimicrobials had an impressive use in clinical practice in the treatment of infections when discovered. This meant infections such as pneumonia, tuberculosis, gonorrhoea among others could be treated effectively and the risk of patients losing their lives due to infections was decreased [9]. Clinical practice also depends on antimicrobial prophylaxis against opportunistic infections which is estimated to affect 10% of hospitalized patients annually [10]. This is a major concern because a resistant infection may kill or impose huge costs on individuals and society. According to WHO, the increasing prevalence of antimicrobial resistance has become a critical healthcare issue across the world [11].

In low-middle income countries, the threat of AMR is worsened by poor hygiene practices as well as inadequate or non-existent healthcare systems and infrastructure [5]. Treatment of infections with counterfeit as well as sub-standard antimicrobial agents also leads to sub-therapeutic levels of antimicrobials being used for treatment of infections which can also leads to resistance as well as increase in morbidity and mortality. Increase in resistance culminates to increased financial burden especially on LMICs [8]. According to the European Medicines Agency, EMA, the cost for treatment of resistant bacterial infections is about 1.5 billion Euros per year [12]. A review presented by WHO stated that the evaluation of the burden of AMR mainly relies on point prevalence studies conducted at single centres, or as retrospective cohort studies or as case-control studies conducted in high income countries [2]. The review indicated that complications resulting from resistant bacterial infections mostly are reported for hospitalized patients.

Monitoring the use of antibiotics and exploring factors that promote inappropriate use is key to designing relevant interventions that can help in reducing the rate of development of resistance to antimicrobial agents [13]. Studies have shown that antibiotics are among the commonest prescribed medicines in Africa [14]. Although some research has been conducted into the use of antimicrobial agents at the hospital level through point prevalence studies, not much has been done on use at the community level. Resistance monitoring is required to track changes in microbial populations, detect early resistant strains and support the prompt notification and investigation of outbreaks [10].

The WHO and INRUD [15] have developed standardized indicators for monitoring rational drug use and these indicators have been used widely to assess the quality of prescribing in health delivery systems [16]. Research has shown that the estimated consumption of antibiotics is about seventy billion doses per year with penicillins being the most consumed antibiotic class by volume. Second to the penicillins in terms of volume of consumption is the Cephalosporins followed by Macrolides, Flouroquinolones, Trimethoprim and Tetracyclines respectively [17]. However, according to a health metrics study in 2013 by the Institute for Health and Metrics Evaluation, Ghana is undergoing an epidemiologic transition through for which there is a reduction in infectious diseases as against an increase in communicable diseases [18].

Medicinal products for human and animal use in Ghana including antibiotics are registered by the Food and Drugs Authority (FDA) of Ghana. Medicinal product samples are analysed and approved for use before it becomes available to end users. Registered products are deemed to be of the required quality, having passed FDA regulatory requirements. [19] FDA also maintains a list of registered medicines on its website which is updated monthly. FDA has central and regional visibility but does not have district offices and this affects post market surveillance.

The Pharmacy Council of Ghana is responsible for securing the highest level of pharmaceutical care and is expected to ensure competent pharmaceutical care providers practice within agreed standards and are accessible to the whole population[20]. In addition, the Pharmacy Council

collaborates with related local agencies and international pharmaceutical organizations to enhance effectiveness and contribute to rational drug use in humans. Although these organisations are doing their best, policies that guide the use and control of antimicrobials in both humans and animals have not been enforced to the letter [20].

Limited studies on antimicrobial use have been conducted by the Ministry of Health of Ghana and the Ghana National Drugs Programme (GNDP). These studies made use of the WHO drug use indicators. Although retail pharmacy outlets and Over-the-Counter Medicine Sellers (OTCMS) play a very key role in the management of diseases including microbial infections in the Ghanaian community settings, a lot of gaps still exist with respect to studies conducted into the use of antimicrobial agents in the community. The proposed research is therefore needed to provide some data on use of antibiotics at the community level [21]

3.1 Study Population

Dormaa Municipal district was chosen for the study in line with the study objectives under the One Health umbrella (human and animal use aspects). The main occupation of the study population is farming and the area is also noted for rearing of poultry and livestock which makes it convenient for the study. This report presents data from the survey with residents about the use of antibiotics for themselves and their families. A separate report documents findings from farms.

3.2 Study Setting

Dormaa Central Municipal covers an area of 570 square kilometres with Dormaa Ahenkro as its capital. The total human population according to the 2010 census is 112,111 inhabitants with 52.9% being males and 47.1% being females. Majority of the inhabitants (61%) live in the rural areas. The main occupation of inhabitants in the municipality is predominantly farming. Of the employed population, 60.8% are farmers who engage in crop cultivation, poultry farming, livestock rearing and fish farming [22].This compares with the national average in Ghana as farming is a major occupation employing more than 60% of the population and contributes about 54% to gross domestic product [22]. The municipality shares a land border to the west with la Cote d'Ivoire. Due to porous borders, there are occasional influx of unregistered pharmaceuticals products including antibiotics through unapproved routes.

Households connected to the national grid and having access to electricity comprise 59.2% of the population. There are three main sources of water in the municipality with 54.5% of the population relying on bore-holes, 9.1% using public standpipes, 10.8% using water from protected wells [22]. The municipality has 2 hospitals, 3 health centres and 11 CPHS Compounds. It is also served by 6 retail pharmacies which are mainly located in the district capital and its environs and 56 OTCMs mostly located in the rural areas. According to the Ghana Maternal Health Survey in the Bono Region in which the Municipality is situated, 28% of women in the rural areas deliver at home compared to 9% in the urban areas with 20% of women having complications during child-birth [23]. In 2014, the Region in which the Municipality is located was rated the second best out of ten Regions in addressing mortality of infants and children under five years of age. [24]

MAP OF DOMAA CENTRAL MUNICIPAL
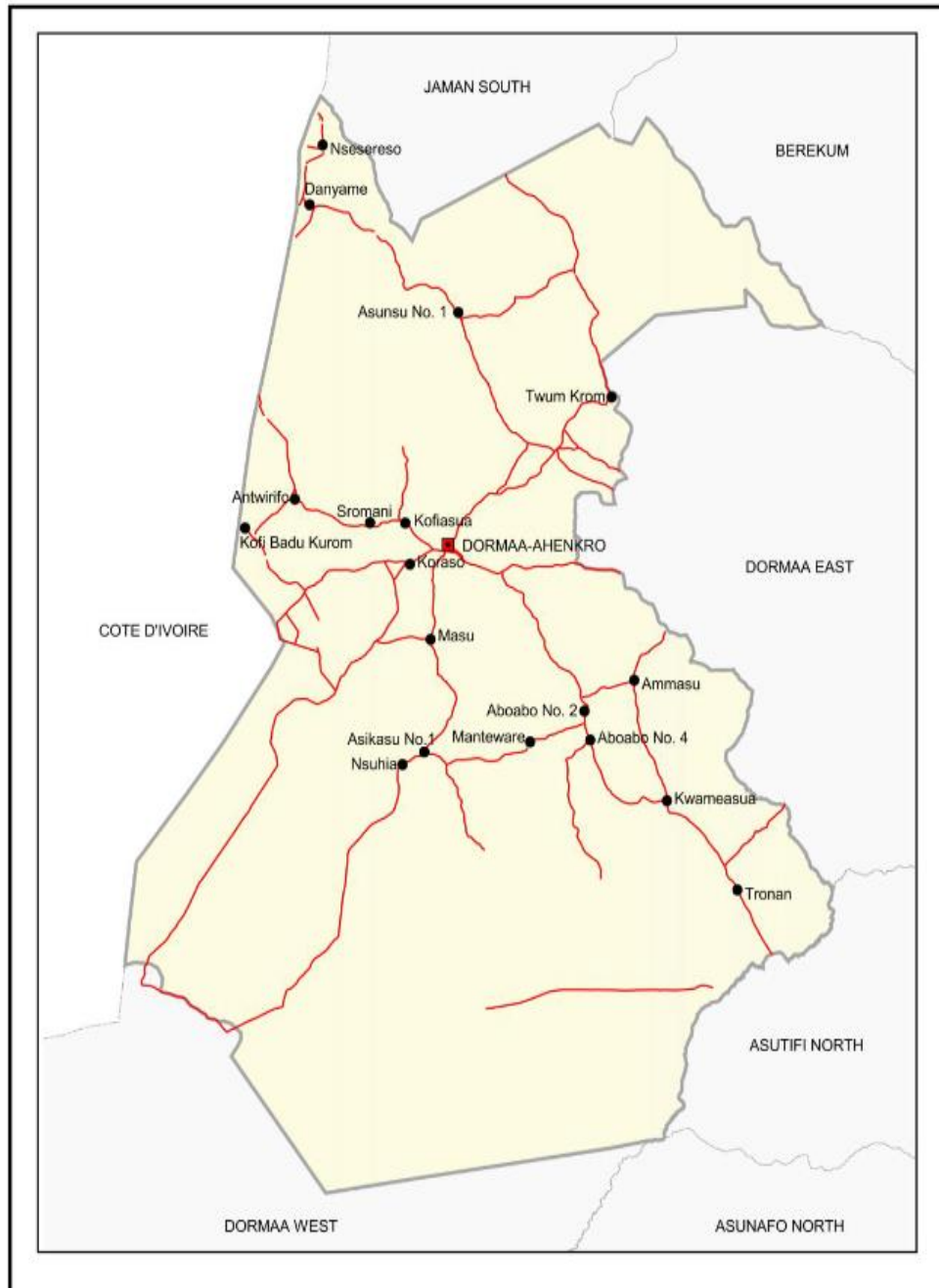
Figure 1: A map of the study area, Dormaa Central Municipality

3.3 Study Design

The study is a cross-sectional descriptive study combining quantitative and qualitative methods. We administered a structured questionnaire to each of the study population groups within the selected sub-urban community based on the inclusion criteria set in the study protocol in the following settings:

a. Antibiotic sales outlets- Retail Pharmacies

b. Over-the-Counter Medicine Sellers (OTCMS) Outlets

c. Community Health Planning Service Centres (CHPS) Centres

d. Household members in the community
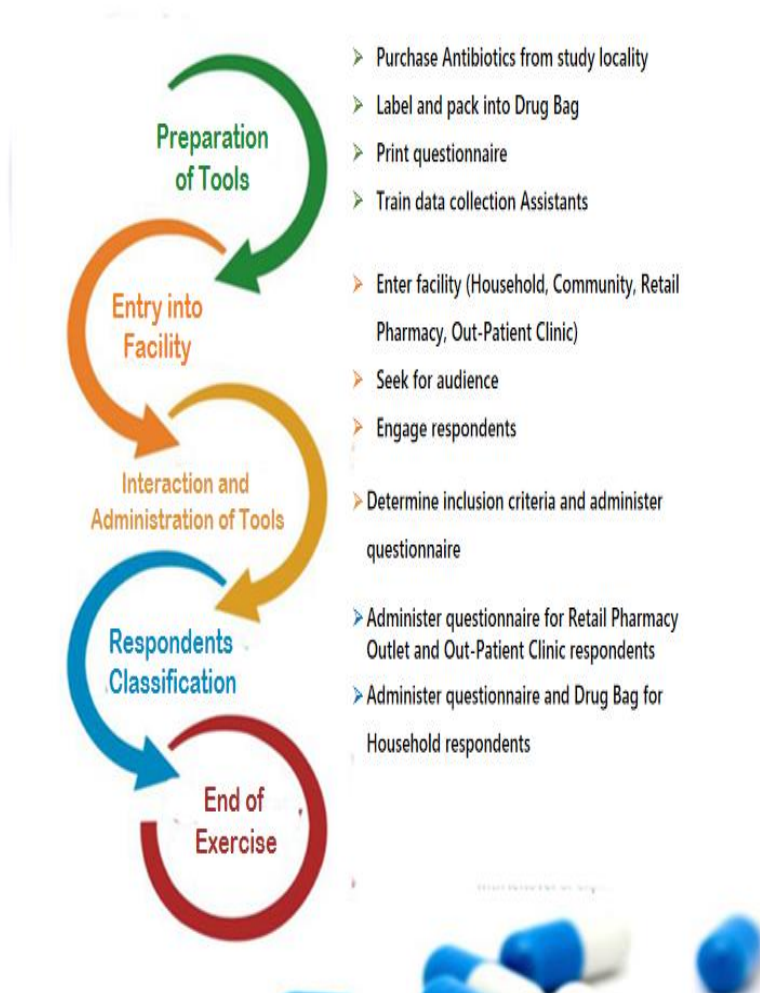
Figure 2: A summary of the method for preparation and conducting the survey

3.4 Survey in Pharmacies, Out-Patient Clinics and OTCMs

Out of the eight private Retail Community Pharmacies earmarked for the survey, six which were operating at the time of the survey as well as eleven Out-Patient Clinics were visited during the study and questionnaires were administered to responsible persons met in the facilities. The district has 56 OTCMs. Since these outlets are not permitted by law to stock and dispense antibiotics with the exception of Co-trimoxazole, we purchased antibiotics under-cover until saturation point where it was realised that the same or similar brands of antibiotics were being found in the OTCMs. In all, twenty (20) OTCMs were surveyed.

3.5 Household survey:

Using the "Drug Bag" method, [25], we visited selected households and members who met the inclusion criteria were interviewed. A total of one hundred (100) households were visited during the survey. The number of households sampled was determined using survey system as follows;
• Estimated number of households in study community
• Point estimate of 65%
• Confidence interval of 95%.
• Allowable error of ± 10%.

3.6 Study Inclusion and Exclusion Criteria

Male and female adults of age eighteen years and above, of sound mind and are able to give consent were included in the household survey. Similarly, adult male and female staff of age eighteen years and above, of sound mind and were able to give consent were considered for the Retail Pharmacy outlets and Out-Patient Clinics survey. Temporary staff such as National Service Persons, students on attachment training and interns working in Pharmacies were excluded in the survey as these personnel are under training and may not have the requisite experience and knowledge to provide accurate answers. They also do not have the authority to act on their own accord or on behalf of the facility owners and the Superintendent Pharmacists.

Figure 3: A summary of the administration of the questionnaire for household respondents using the Drug Bag method
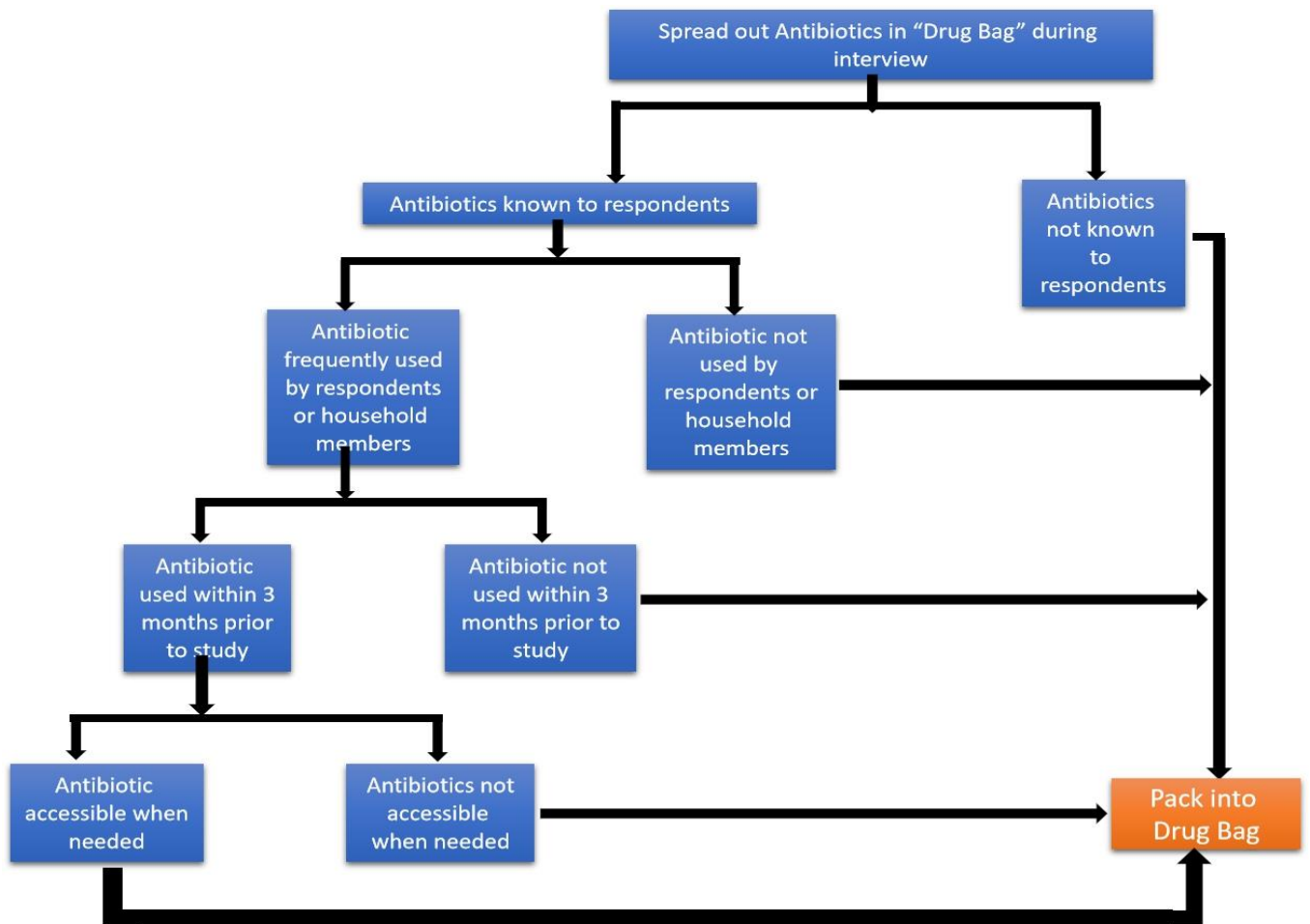
Figure 4: Study team interviewing members of households in Dormaa, March, 2020

3.7 Quality Control Measures

3.7.1 Training and recruitment of Research Assistants

The survey groups comprised two teams of three persons each. Each team consisted of the team lead and two research assistants with university degree from recognized universities and experience in data collection. The team leads were the Principal Investigator and a Co-Investigator who is a Pharmacist and also a current PhD student conducting research in AMR. We trained the research assistants on the data collection tools to ensure proper administration and accurate data collection.

3.7.2 Pre-testing and Review of Data Collection Tools:

We pre-tested the data collection tools in Koforidua, a community in the Eastern Region of Ghana which is outside the study area to ensure appropriateness of use of the tools. The questionnaires were duly revised after the pre-testing.

3.8 Ethical Issues, Data Security and Confidentiality

Ethical clearance for this study was obtained from the Institutional Review Board of Ensign College of Public Health, Akosombo, Ghana and the London School of Hygiene Observational/ Interventional Research Ethics Committee, London, UK. The research team ensured that results are not linked to individual respondents, outlets or key informants. Data collected onto paper forms are being kept under lock-and-key to ensure confidentiality and protect the identity of participants. The

importance of data integrity, confidentiality and the protection of the identity of respondents was also emphasized to the data collection assistants.

3.9 Statistical Analysis of Data

Quantitative data collected from the field was first entered into Ms. Excel, sorted, cleaned and exported into STATA (Version 15) statistical package for analysis. Preliminary analysis was performed using frequencies, charts and tables for a general overview of the data. With the aid of STATA, the data analysts performed both descriptive and inferential statistics. The descriptive method analyzed the frequencies, percentages and summary statistics whilst the inferential analysis sought to ascertain the predictability of the independent variables on the dependent variables. Univariate analysis was used to assess the association between socio-demographic characteristics of respondents and antibiotic use. Test of significance was conducted on the associated factors using Fischer's exact test with statistical significance set at p-values <0.05. This was done to assess the association between antibiotic use (dependent variable) and the independent variables (socio-demographic factors). Qualitative data arising from the questionnaires was analyzed using thematic analysis to identify and classify common ideas emerging across respondents.

This chapter presents the results of the study in line with each of the research objectives. After describing the demographic characteristics of respondents, their socio-economic and household factors, data on knowledge and use of antibiotics are presented. The analysis is based on data obtained from respondents in the one hundred (n=100) households visited during the study period spanning 24th February- 19th March, 2020.

During the survey, six retail pharmacies (n=6) and eleven out-patient clinics (n=11) situated within the district were also visited. All six retail pharmacies in the municipality as well as the District Hospital are located in the district capital, Dormaa Ahenkro. All the villages except one are served with at least one Over-the Counter Medicine Sellers' (OTCMS) facility. None of the villages has a Community Retail Pharmacy outlet. There are other private clinics located in the district capital which also offer out and in-patient services. Healthcare is accessible for many residents through the National Health Insurance Scheme which covers individuals with an annual premium payment.

4.1. Presentation of socio-demographic and socio-economic factors of respondents

4.1.1 Demographic profile of respondents

The median age of respondents from the households visited was within the age range of 40- 49 years. The various age groups presented are 18-29 years 18.0%, 30-39 years 22.0% and 40-49 years 15.0%. Respondents within the age groups of 50-59 and 60-69 years were 17.0% each. Respondents who are 70 years and above comprised 11%. Majority of respondents comprising 35% had primary school education. Respondents who have been educated up to the Middle/Junior Secondary School level constituted 24% while 13% had secondary/ tertiary level education. Respondents with no formal education was found to be 28%. This is higher than the national illiteracy average of 23.4% published by the Ghana Statistical Service [22]. In terms of occupational status of respondents, more than half (60%) were found to be farmers whereas artisans and traders comprised 26%. Females comprised 67% of respondents while males comprised 33%. This is illustrated in Table 1.

Table 1: Demographic characteristics of household respondents in the Dormaa Municipality, March, 2020

Demographic	Frequency	Percentage
Age		
18-29	18	18.0
30-39	22	22.0
40-49	15	15.0
50-59	17	17.0
60-69	17	17.0
70 and above	11	11.0
Sex		
Female	67	67.0
Male	33	33.0
Marital Status	63	63.0
Married	16	16.0
Single	8	8.0
Widow	13	13.0
No answer		
Educational level		
Primary	35	35.0
Middle/JSS	24	24.0
No formal school	28	28.0
Secondary/Tertiary school	13	13.0
Occupational status		
Artisan	12	12.0
Farmers	60	60.0
Trader	14	14.0
Others	7	7.0
Unemployed	7	7.0

4.1.2 Household Health Profile

This section presents data on the most commonly reported symptoms in the households surveyed, the places respondents sought treatment, medications used and sources of the medications. The results are presented in Figures 5 and 6 as well as Table 2.

4.1.2.1: Commonly reported symptoms in households surveyed

Respondents were asked about disease symptoms that they or any member of the household had suffered within the last three months prior to the survey. Options comprising a number of disease states on the questionnaire were read out to respondents and the symptoms described to them. Out of the total number of respondents, 20% stated that one or more members in the household complained of fever and body pains within the specified period. Another 18% responded that one or more household members had been sick of malaria and 12% of respondents said a household member suffers from high blood pressure. With other diseases such as stomach pains, cough, wounds, and runny nose, less than 10% of respondents replied that a member in the household had suffered any in the past three months prior to the survey. This is represented in Figure 5.

Figure 3: Graph of disease conditions and occurrence in households surveyed in Dormaa Municipality, March 2020
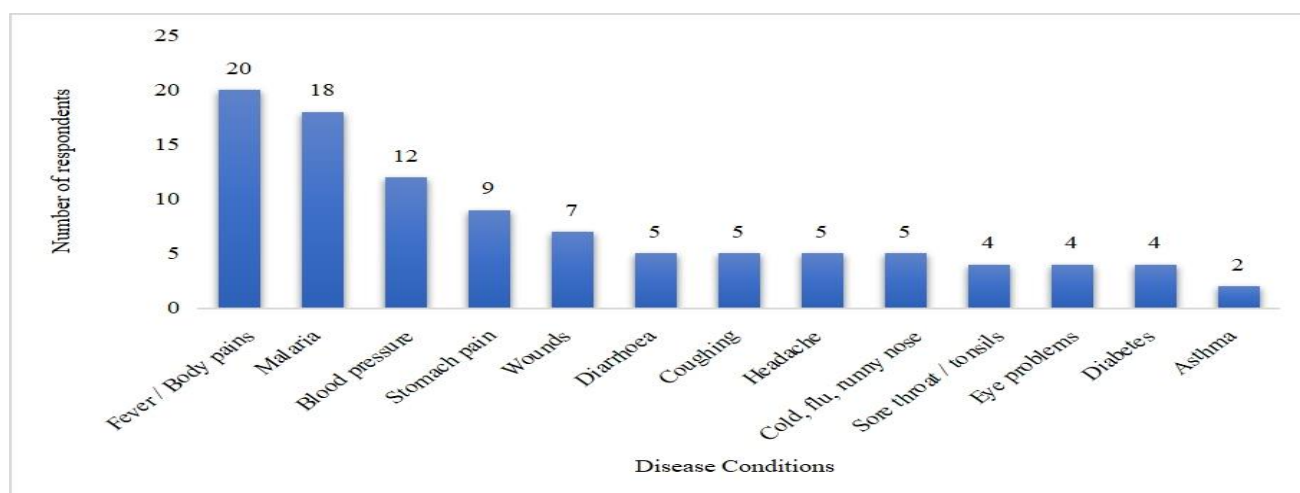
4.1.2.2: Places of care for treatment for sick members of households surveyed

The study sought to learn from respondents the first point of call when they are sick. Four out of ten respondents answered that their first point of call is the out-patient clinic/ health centre in the vicinity while 19% responded they will visit the hospital and 16% said they will visit an OTCMS. A total of 8% of respondents would visit a Pharmacy, 6% would visit the traditional/ faith healer while 11% responded that they will visit other places such as village information centre. Figure 6 below illustrates this information.

Figure 4: Bar chart of places where care is sought as a first action among the households surveyed in Dormaa Municipality, March 2020
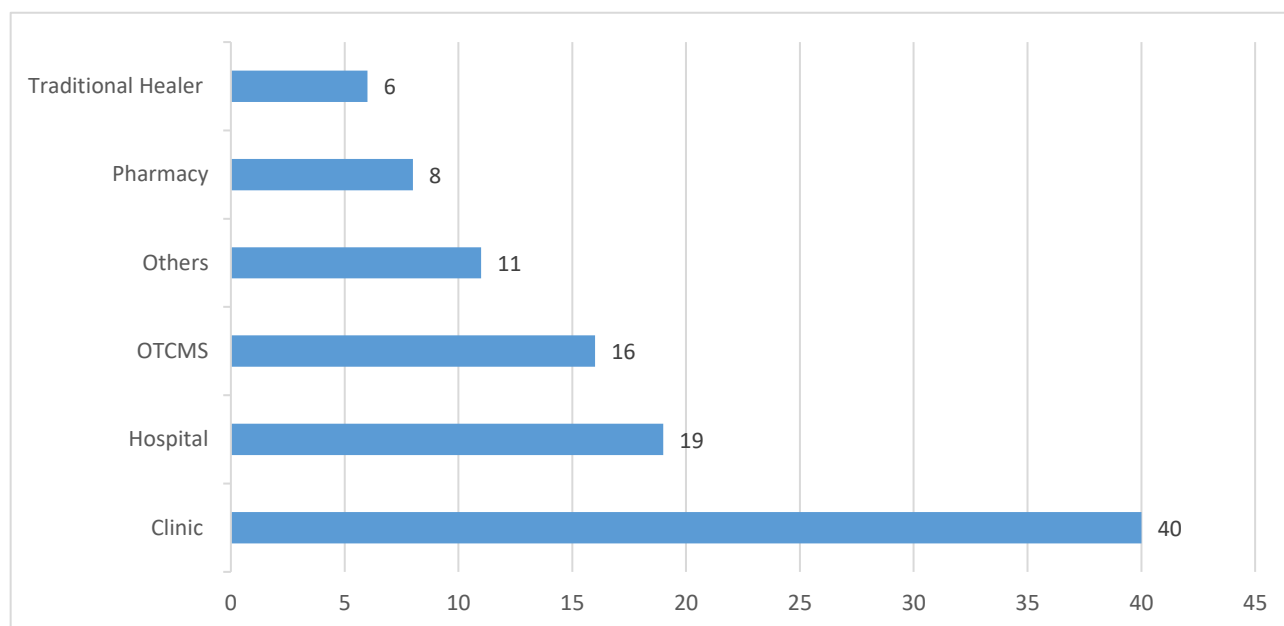
4.1.2.3: Types of Medications used at the household level

Respondents were asked the types of medications they or members of the household received when they visited a healthcare facility in the last three months prior to the study. Classes of medicines listed on the questionnaire were mentioned or described to respondents after which they were able to mention the medication they or a member in the household received. Some respondents had empty or leftover blisters, bottles and cartons of the medication they had used within the specified time frame which they showed to the interviewers. Based on the responses received, interviewers classified the medications. The data showed that 39% of the respondents or members in their household received antibiotics based on symptoms presented at healthcare facilities, 24% received anti-malarials, 42% received painkillers and 20% received anti-hypertensive medicines. Others such oral rehydration salts, HIV as well as cough and cold medicines were administered in less than 5% of cases while 15% of respondents received herbal medication.

Table 2: Medication used to treat persons at the household level based on symptoms presented to facilities within the last three months prior to the survey in Dormaa Municipality, March 2020

Classes of Medication	Yes (% use)
Anti-malarials	24 (24.0)
Painkillers / antipyretics	42 (42.0)
BP / hypertension	20 (20.0)
ORS	3 (3.0)
Antibiotics	39 (39.0)
HIV medicines	1 (1.0)
Cough/ Cold medicines	4 (4.0)
Herbal medicines	15 (15.0)

4.1.2.4 Sources of medication in the households surveyed

The data for this section is presented in Table 3 below. Among the most patronised places for healthcare services by respondents are Public Clinics/ Health Centres, 35.0%. this is followed by OTCMS, 33.0% and Retail Pharmacies, 11%. Fewer than 10% of respondents visited private clinics or private hospitals. A total of 2% of respondents admitted they do consult peddlers for their medication while 1% admitted to getting medication from local information centres where local herbal companies advertise their medication.

Table 3: Sources of medication in the households surveyed in Dormaa Municipality, 2020

Sources	Yes (%)
Friend or neighbour	2 (2.0)
Traditional/faith healer	5 (5.0)
Informal drug vendor	2 (2.0)
Retail Pharmacy	11 (11.0)
OTCMS	33 (33.0)
Public clinic	35 (35.0)
Public hospital	7 (7.0)
Private health facility	6 (6.0)
Information centre	1 (1.0)

4.2 Knowledge on and frequency of antibiotic use among the study population

This study investigated respondents' knowledge and frequency of use of the various types of antibiotics as well as barriers to accessing antibiotics in the study area.

4.2.1 Respondents' recognition and frequency of use of the types of Antibiotics available in dispensing outlets and healthcare facilities in their locality

In order to assess which types of antibiotics are available in dispensing outlets and health facilities in the locality, the 'Drug Bag' method was used for this survey. With this method, physical samples of different brands of antibiotics were obtained from retail pharmacies, OTCMS and medicine peddlers within the study vicinity and put into a 'Drug Bag'. During the interview, the medicines in the Drug Bag was spread out and respondents were tasked to sort-pile the antibiotics they are familiar with. The first five antibiotics well known to respondents in descending order is Amoxycillin capsules, Metronidazole tablets, Phenoxymethylpenicillin tablets, Tetracycline capsules and Chloramphenicol capsules.

Respondents were then asked to sort-pile antibiotics they or members of their household have used within the last three months prior to the study from the pile of medicines known to them. The percentage of respondents who selected antibiotics in order of most frequently used to least frequently used within the specified time frame is as follows: Amoxicillin Capsules 49%, Metronidazole Tablets 29%, Phenoxymethylpenicillin Tablets 28%, and Tetracycline Capsules 24% and Chloramphenicol capsules, 3%. other antibiotics were selected by 3% or less respondents.

Antibiotics selected in the sort-pile exercise were compared with the WHO AWaRe (Access, Watch, Reserve) classification list. The AWaRe classification is a tool developed by WHO to assist in the stewardship of antibiotics at the local, national and global levels to decrease the incidence of AMR. Antibiotics in the "**Access**" class are recommended as essential first or second choice treatment options. Those falling in the "**Watch**" class have higher resistance potential and are thus targeted for a limited number of specific infectious syndromes. The "**Reserved**" list comprise antibiotics that must be set aside for suspected or confirmed cases of multi-drug-resistant infections. The summary of results of respondents' knowledge on antibiotics as well as antibiotics selected as frequently used in comparison with the WHO AWaRe list is presented in Table 4. The data shows that Penicillins are widely known and used among respondents while Cefuroxime is the only Cephalosporin known and used by respondents. The second and third generation Cephalosporins are not known to respondents. Of the 38 antibiotics listed by WHO on the AWaRe Classification list, none of the antibiotics classified as "**Reserved**" was known to or had been used by any of the participants. Only 11% of participants recognised antibiotics in the "**Watch**"list and 8% had used antibiotics in this list in the last three months prior to the study. With respect to antibiotics in the "**Access**" list, 50% recognised antibiotics in this list whist 47% had used antibiotics in this list within three months prior to the study.

Table 4: Respondents' knowledge and frequency of use of Antibiotics in Dormaa Municipality in comparison with WHO AWaRe list, March 2020

No.	Medicines	% of Respondents' Knowledge of Antibiotics	% of Frequently used Antibiotics	WHO AWaRe Class of Antibiotics
1.	Amoxicillin (Capsules)	68	49	Access
2.	Metronidazole (Tablets)	64	29	Access
3.	Phenoxymethylpenicillin (Tablets)	47	28	Access
4.	Tetracycline (Capsules)	41	24	Access
5.	Cloxacillin (Capsules)	23	2	Access
6.	Flucloxacillin (Capsules)	21	2	Access
7.	Chloramphenicol (Capsules)	19	3	Access
8.	Ampicillin (Capsules)	16	2	Access
9.	Chloramphenicol (Eye/Ear)	10	3	Access
10.	Gentamicin (Eye/Ear)	8	3	Access
11.	Amoxicillin (Suspension)	5	1	Access
12.	Metronidazole (Suspension)	3	5	Access
13.	Doxycycline (Capsules)	3	1	Access
14.	Cefuroxime (Tablets)	2	2	Watch
15.	Flucloxacillin / Ampicillin (Capsules)	2	1	Access
16.	Ciprofloxacin (Tablets)	2	0	Watch
17.	Amoxicillin / clavulanic acid (Tablets)	2	0	Access
18.	Clindamycin (Tablets)	2	0	Access
19.	Levofloxacin (Tablets)	2	0	Watch
20.	Cotrimoxazole (Tablets)	1	1	
21.	Cotrimoxazole (Suspension)	1	1	
22.	Tetracycline (Eye)	1	1	Access
23.	Azithromycin (Tablets)	1	0	Watch
24.	Clindamycin (Injectable)	1	0	Access
25.	Benzathene Penicillin (Injectable)	0	0	Access
26.	Benzylpenicillin (Injectable)	0	0	Access
27.	Cefalexin (Tablets)	0	0	Access
28.	Cefixime (Tablets)	0	0	Watch
29.	Ceftriaxone (Injectable)	0	0	Watch
30.	Chloramphenicol (Injectable)	0	0	Access
31.	Clarithromycin (Tablets)	0	0	Watch
32.	Cloxacillin (Suspension)	0	0	Access
33.	Erythromycin (Tablets)	0	0	Watch
34.	Erythromycin (Suspension)	0	0	Watch
35.	Gentamicin (Injectable)	0	0	Access
36.	Norfloxacin / Metronidazole (Tablets)	0	0	Watch
37.	Ofloxacin / ornidazole (Tablets)	0	0	Watch
38.	Ciprofloxacin (Eye)	0	0	Access

4.2.2 Conditions that necessitate the use of antibiotics by respondents in the study area

Respondents were asked to provide information on the common conditions for which they purchase antibiotics to treat by themselves. As described in Figure 7, 44% of respondents purchased antibiotics to treat gastrointestinal disorders, 30% used antibiotics for fever and body pains, while 10% of respondents bought antibiotics for cough and cold conditions. Between 1% and 6% of respondents purchased antibiotics for wound treatment, appetite stimulation, post-natal recovery and malaria among other conditions. The top four antibiotics used are Amoxicillin capsules, Metronidazole tablets, Phenoxymethylpenicillin tablets and Tetracycline capsules.
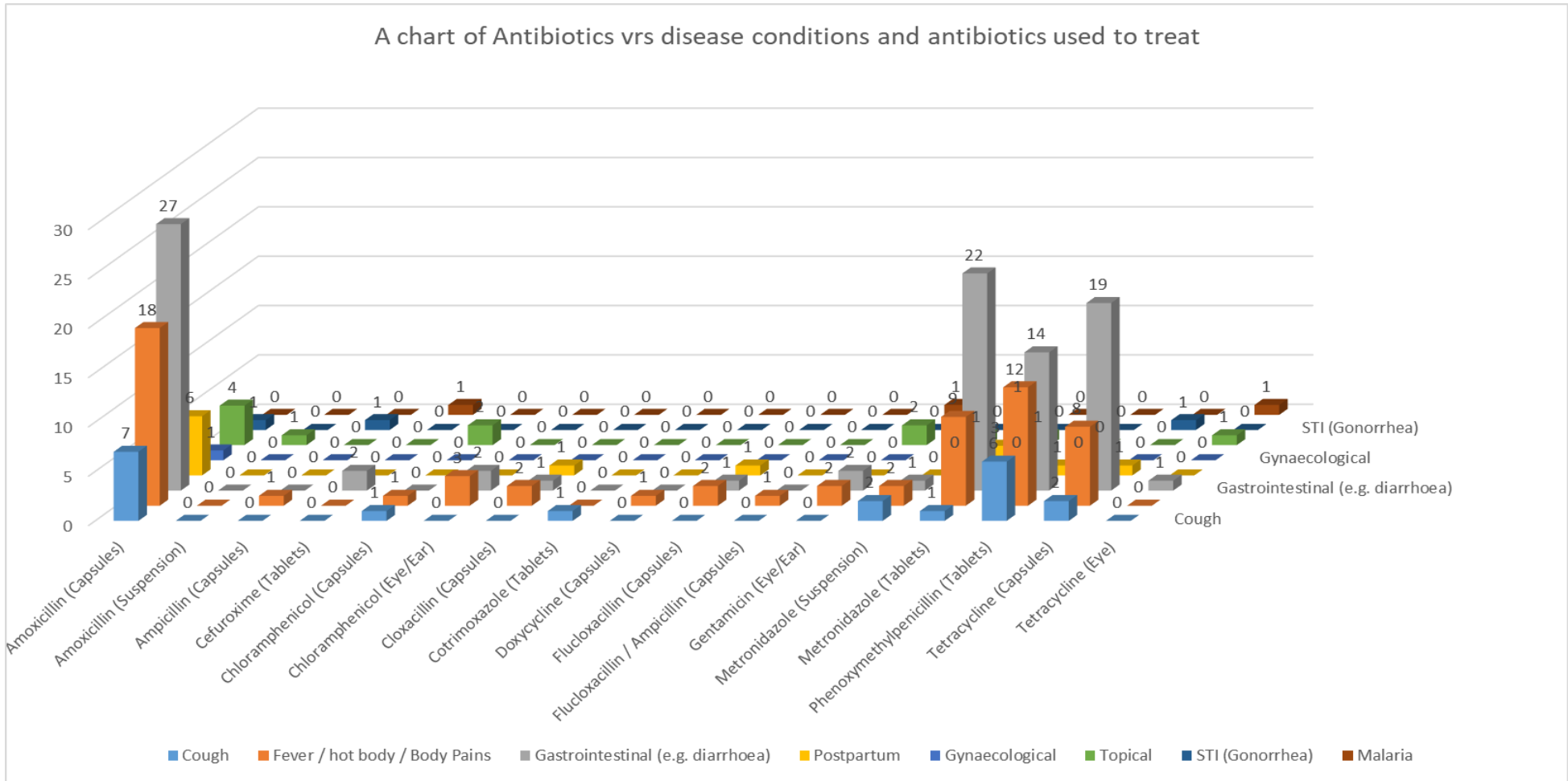
Figure 5: A chart of disease conditions and antibiotics used by respondents for treatment in Dormaa Municipality, March, 2020

4.2.3 Challenges associated with access to Antibiotics in the study area

The study sought to examine barriers to accessing antibiotics by the respondents. Respondents were therefore asked to indicate whether they have had issues accessing antibiotics during the last three months prior to the study. Of the antibiotics used by respondents, about 88% said they were able to access antibiotics for treatment of ailments at the time they needed the medicines. This shows that antibiotics known and used by respondents are readily available even without prescription.

4.3 Antibiotic use and associated factors among the households surveyed

This section presents the analysis on the use of antibiotic as well as the associated factors among the households visited during the study. The proportion of respondents having used antibiotics frequently in their household in the last three months prior to the study was 85% (95% CI: 76-91%) with only 15% (CI:09-24%) found not to have used antibiotics three months prior to the study period.

Table 5: Proportion of frequent antibiotic use in the last three months prior to survey and confidence interval in Dormaa Municipality, March 2020

Antibiotics use	Proportion	Std. Err.	[95% Conf.
No	15%	.0358	09-24%
Yes	85%	.0358	76-91%

The distribution of demographic profile for frequent use of antibiotic shows that in terms of age group, frequent antibiotic use was higher among respondents in the age group 30-39 years (24.7%) with a p-value of 0.357. This is followed by respondents between the age group of 50-59 years (18.8%). Also, antibiotic use was higher among females (68.2%) compared to males (31.8%). Similarly, those married used more antibiotics (62.4%) than those who are not married, divorced or separated (37.7%).

Table 6: Distribution of frequent antibiotic use among the various demographic groups in Dormaa Municipal three months prior to the survey, March 2020

Variables	Use (N=85)	Do not use (N=15)	P-value
Age			
18-29	14 (16.5)	4 (26.7)	0.357
30-39	21 (24.7)	1 (6.7)	
40-49	11 (12.9)	4 (26.7)	
50-59	16 (18.8)	1 (6.7)	
60-69	14 (16.5)	3 (20.0)	
70-above	9 (10.6)	2 (13.3)	
Sex			
Female	58 (68.2)	9(60.0)	0.560
Male	27 (31.8)	6 (40.0)	
Marital Status			
Married	53 (62.4)	10(66.7)	0.496
Not married	32 (37.7)	5 (33.3)	
Educational level			
No formal education	24 (28.2)	4 (26.7)	
Primary	27 (31.8)	8 (53.3)	0.378
Middle/JSS	22 (25.9)	2 (13.3)	
Secondary/Tertiary	12 (14.1)	1 (6.8)	
Occupational status			
Artisan			
Farmers	10 (11.8)	2 (13.3)	0.470
Trader	49 (57.7)	11 (73.3)	
Others	14 (7.1)	0 (0.0)	
Unemployed	6 (7.1)	1 (6.7)	
	6 (7.1)	1 (6.7)	

4.4 Results from the Community Pharmacies surveyed during study

A total of six community retail pharmacies located in the study area were surveyed by administering questionnaires. This section of the study sought to probe the types of antibiotics being stocked in pharmacies in the study area, personnel in the pharmacies who dispense antibiotics and whether these persons dispense antibiotics at the levels at which they should be dispensed such as Pharmacist-initiated (P) or Prescription-only Medicine (POM). The study also sought from respondents in the pharmacies if in their opinion, antibiotics are misused in the communities. The study team was able to visit six out of the eight retail pharmacies earmarked in the Municipality. One retail pharmacy had been converted into a wholesale facility and one was closed for renovation at the time of the survey visit.

4.4.1 Classes of Antibiotics found in Community Pharmacies surveyed

The study sought to know the classes of antibiotics available and are in stock in the pharmacies visited. All pharmacies were stocking Tetracyclines at the time of visit. Respondents in three pharmacies (50% of the sample) said they stocked Beta-lactams, Flouroquinolones, Cephalosporins and Macrolides while one pharmacy (representing 16.6%) indicated that they stock other antibiotics such as Aminoglycosides. All antibiotics being stocked in the retail pharmacies surveyed are legally permitted as per the Ghana Public Health Act of 2012, Act 851 and the Ghana Health Regulatory Bodies Act of 2011, Act 829 [19] [20].The survey team also purchased oral antibiotics undercover from OTCMs that are legally not permitted to stock and dispense antibiotics. Antibiotics purchased from OTCMS are Tetracyclines, Penicillins Beta-lactams, Flouroquinolones, and Metronidazole.

Figure 8: A graph of the classes of Antibiotics being stocked in Community Pharmacies at the time of visit in Dormaa Municipal, March 2020
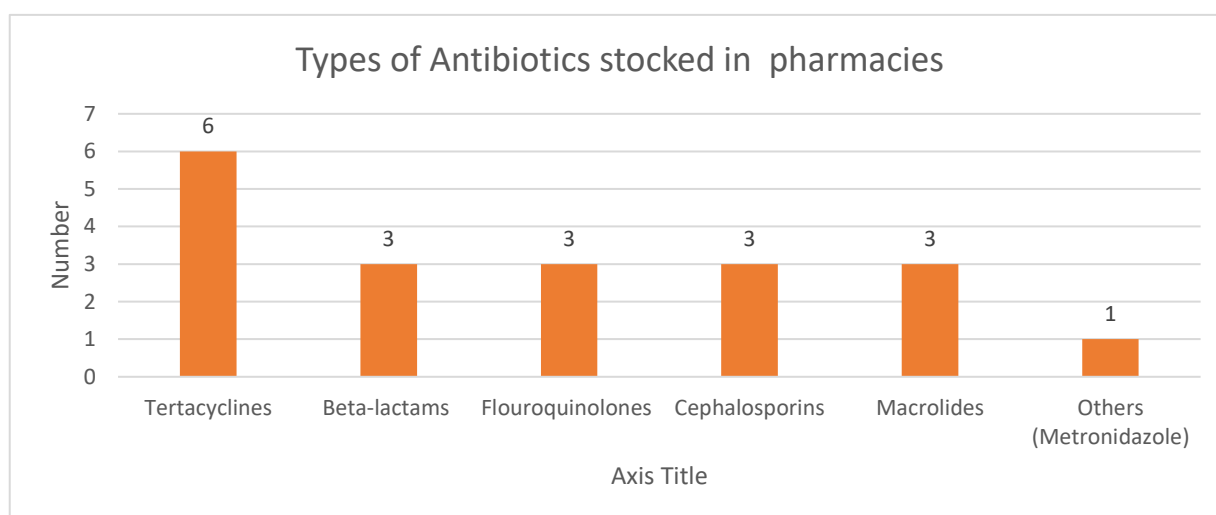
4.4.2 Perception of misuse of antibiotics in the Dormaa Municipality by Pharmacists and Pharmacy Staff

Respondents in the Community Pharmacies were asked to indicate whether they perceive that residents in the Dormaa Municipality misuse antibiotics. All six respondents representing 100% responded positively stating that antibiotic misuse persists in the municipality. Respondents were concerned that patients use Penicillins, Tetracyclines and Metronidazole which are normally bought over-the counter without prescription. According to some of the respondents, some patients do not complete the course of their prescribed antibiotics and give the left-over to other patients. Some also pointed to the illegal availability of antibiotics in OTCMS and peddlers as a major cause of misuse as patients do not normally buy a full course and some of the ailments they present such as common cold and nausea do not require antibiotics to treat.

4.5 Results from Out-Patient Clinics/ Health Centres surveyed during study

In the study protocol, it was expected that eight out-patient clinics and health centres in the municipality would be visited for the survey, based on the Ghana Statistical Service information obtained on the number of out-patient health facilities in the Municipality. Eleven facilities were however visited as three new facilities had been added by the time of the research study. Eight of the facilities belong to the Ghana Health Service (GHS) while three facilities belong to the Christian Health Association of Ghana (CHAG). All facilities visited offer out-patient care. This section presents results from the facilities where data was collected on the educational level of personnel present in the facilities and their views on the level of antibiotic use in the municipality.

4.5.1 Educational level of respondents in out-patient clinics/ health centres

Of the eleven out-patient clinics and health centres in the Dormaa Municipality that were surveyed, seven (representing 63.6%) were being run by Nurses, three (27.3%) were being run by Physician Assistants while one facility representing 9.1% was run by a Midwife. The respective heads are responsible for diagnosing patients and prescribing medications. Dispensaries in the facilities are run by Enrolled Nurses with the heads of the institutions having oversight responsibilities. As stipulated by the Essential Medicines List (EML), 2017 of the Ghana National Drugs Programme, levels of healthcare facilities are designated according to the professionals available in the facility. All out-patient facilities visited during the study fall within level M (headed by a Midwife) and level B_1 (Health centre without a Medical Doctor). Based on this classification, there are limited classes of antibiotics that should be stocked and dispensed in these facilities [21].

4.5.2 Availability of Antibiotics in Out-Patient Clinics/ Health Centres

At the time of the survey, all clinics and health centres visited were stocking antibiotics. 72.7% (8) facilities were stocking Beta-lactams which comprised mainly of Amoxicillin capsules and powder for suspension, 63.6% (7) facilities were stocking Flouroquinolones (Ciprofloxacin), 36.4% (4) facilities were stocking Tetracyclines while 9.09% (1) facility was stocking Metronidazole. These medicines when prescribed, were being dispensed by the Nurses who are in charge of the dispensaries. Although Ciprofloxacin is supposed to be dispensed at Level B_2 (Healthcare Centre with Doctor), the lower levels of care were stocking them for symptomatic treatment of Gonorrhoea. Metronidazole tablets and suspension which has also not been categorized in the EML is used for the treatment protozoal infections such as Amoebic dysentery [21]. The out-patient clinics were generally adhering to dispensing of antibiotics legally available at their level of care.

Table 7: Classes of Antibiotics available in the Out-Patient Clinics/ Health Centres visited during the study in Dormaa Municipal, March 2020

No.	Medicines	EML Level of Care	Availability in Out-Patient Clinics	WHO AWaRe List
1	Amoxicillin (Capsules)	A	Yes	Access
2	Amoxicillin (Suspension)	A	Yes	Access
3	Amoxicillin / clavulanic acid (Tablets)	B2	No	Access
4	Ampicillin (Capsules)	B1	No	Access
5	Azithromycin (Tablets)	C	No	Watch
6	Benzathene Penicillin (Injectable)	B2	No	Access
7	Benzylpenicillin (Injectable)	B1	No	Access
8	Cefalexin (Tablets)	(blank)	No	Access
9	Cefixime (Tablets)	(blank)	No	Watch
10	Ceftriaxone (Injectable)	D	No	Watch
11	Cefuroxime (Tablets)	B2	No	Watch
12	Chloramphenicol (Capsules)	C	No	Access
13	Chloramphenicol (Eye/Ear)	C	No	Access
14	Chloramphenicol (Injectable)	C	No	Access
15	Ciprofloxacin (Eye)	B2	No	Access
16	Ciprofloxacin (Tablets)	B2	Yes	Watch
17	Clarithromycin (Tablets)	C	No	Watch
18	Clindamycin (Injectable)	C	No	Access
19	Clindamycin (Tablets)	C	No	Access
20	Cloxacillin (Capsules)	B1	No	Access
21	Cloxacillin (Suspension)	B1	No	Access
22	Cotrimoxazole (Suspension)	A	No	
23	Cotrimoxazole (Tablets)	A	No	
24	Doxycycline (Capsules)	B1	No	Access
25	Erythromycin (Suspension)	B1	No	Watch
26	Erythromycin (Tablets)	B1	No	Watch
27	Flucloxacillin (Capsules)	B1	No	Access
28	Flucloxacillin / Ampicillin (Capsules)	B1	No	Access
29	Gentamicin (Eye/Ear)	C	No	Access
30	Gentamicin (Injectable)	C	No	Access
31	Levofloxacin (Tablets)	(blank)	No	Watch
32	Metronidazole (Suspension)	(blank)	Yes	Access
33	Metronidazole (Tablets)	(blank)	Yes	Access
34	Norfloxacin / metronidazole (Tablets)	(blank)	No	Watch
35	Ofloxacin / ornidazole (Tablets)	(blank)		Watch
36	Phenoxymethylpenicillin (Tablets)	B1	No	Access
37	Tetracycline (Capsules)	B1	Yes	Access
38	Tetracycline (Eye)	B1	No	Access

4.5.3 Perception of Antibiotics Misuse in Dormaa Municipality by Respondents in Out-Patient Clinics/ Health Centres

In this study, the team also sought to find out the perception of health staff of the out-patient health centres on antibiotic misuse in the municipality. This was imperative since the health centres are normally the first point of call for patients in the community and patient clerking will reveal patient medicine history and whether they have misused antibiotics. Eight out of the eleven respondents representing 72.7% indicated that they believe antibiotic misuse persists in Dormaa Municipal. According to the respondents, some patients do not finish the full course of their antibiotics and may give the left-over to relatives and friend when they complain of similar symptoms. They also stated that some patients are sometimes unable to afford the full course of prescribed antibiotics and so they buy the quantity they can afford as opposed to the full course. The other three respondents comprising 27.3% believed otherwise and did not believe that misuse of antibiotics persist.

4.6 Selected quotes from some respondents on misuse of antibiotics

- *"When my three month old daughter gets blocked nose due to cough and cold, I open one capsule of Chloramphenicol, put the contents onto a spoon, add some water and instil into her nostrils. Our neighbour taught me that." (Respondent, Aboabo No.2).*

- *"Peddlers of medicines are able to convince consumers to buy medicines even when they are not sick. The health workers are also sometimes insolent and harsh with patients.This deters patients from accessing healthcare from the clinic." Respondent, Aboabo No.2).*

- *"Drugs given at the hospital do not work that is why I purchase Chloramphenicol capsules from the OTCMS." (Respondent, Yawkrom)*

- *"Medicines issued at hospital/ clinic do not treat my symptoms, so I take Penicillin-V Tablets 4:4:2 over 24 hours. I use it even when not sick." (Respondent, Tronang)*

- *"I believe that Paracetamol causes anaemia and so I take Metronidazole Tablets for pains." (Respondent, Twumkrom)*

Antibiotic use has been identified as a major cause of microbial resistance to otherwise simple and cost-effective antibiotics for treatment of infections. Limited studies have been conducted in Ghana or other LMICs to describe frequency and types of antibiotics used by residents. Data from such studies is needed to shape policies and programmes required to minimise misuse of antibiotics and address the issue of antimicrobial resistance. In this study, conducted in a rural municipality in Ghana, we found that antibiotics are frequently used: 85 of 100 respondents reported that their households had used one or more of the antibiotics presented in the drug bag frequently in the last three months. The top four antibiotics used by respondents were Amoxicillin Capsules (49%), Metronidazole Tablets (29%), Phenoxymethylpenicillin Tablets (28%) and Tetracycline Capsules (24%). The top reason given for antibiotic use was gastrointestinal conditions (44%), followed by fever and body pains (30%) and cough and cold conditions (10%). Public health efforts need to address the reasons for residential antibiotic use.

5.1 Level of Antibiotics awareness and frequency of use among the households

This study investigated respondents' awareness and use of antibiotics in the households surveyed within a specified time frame. The top four antibiotics known to majority of respondents are Amoxicillin Capsules , Metronidazole Tablets, Phenoxymethylpenicillin Tablets, Tetracycline Capsules and Cloxacillin Capsules. The top four antibiotics frequently used by respondents is also presented as Amoxicillin Capsules, Metronidazole Tablets, Phenoxymethylpenicillin Tablets, Tetracycline Capsules. The misuse of the above listed antibiotics is a cause for concern as a study by Obeng-Nkrumah et al at a major Teaching Hospital in Ghana revealed very high prevalence of ESBL-producing Enterobacteriaceae infections with 82% and 75% isolates being resistant to Tetracycline and Chloramphenicol respectively [26]. A review by Garcia-Vello et al on antibiotic resistant patterns in Ghana in humans, animals and the environment also revealed that all articles reviewed (100%) found E. coli resistance to Amoxicillin while resistance to Tetracycline and Cefuroxime was found to be 73.6% and 34.4% respectively [27].

The results are similar to those found from studies conducted in Egypt [28][29]. We found that antibiotics well known and frequently used by respondents fell within the "Access" list of the WHO AWaRe classification for antibiotics while those falling within the "Watch" and "Reserve" category such as the 2nd, 3rd and 4th Generation Cephalosporins, Macrolides and Aminoglycosides are not well known and so not frequently used by respondents. This observation is similar to the study conducted by Mate et al which also found low knowledge on these classes of antibiotics [30]. Whist to an extent this is reassuring as self-medication with higher line antibiotics would be concerning, overuse of less expensive and easily available antibiotics in the "Access" list can still lead to resistance, ultimately requiring patients to need treatment with relatively costly antibiotics in the "Watch" and "Reserve" list. This puts strain on the resources of the healthcare system and on patients as some of these antibiotics are not covered under the health insurance system. Therefore, whilst the WHO is recommending certain antibiotics should be made 'accessible', it is important to consider ways to reduce their overuse.

5.2 Poor sanitation and antibiotic use

As a first step, investigation into gastrointestinal conditions is required, as water and sanitation conditions may be a driver of antibiotic use that may require addressing as an 'upstream' factor. The relatively high use of Metronidazole – including for gastrointestinal conditions as well as to control pain – aligns with findings from drug bag surveys in Uganda [31]. Studies have linked antibiotic use to poor hygiene and sanitation infrastructure [32] A modelling study estimated that *E.coli* resistance could be reduced by as much as 18.6% for each standard deviation improvement in an infrastructure index, largely driven by water and sanitation [33]. Improvement in the availability of water and other sanitation amenities may improve infection prevention and decrease the incidence of complaints on diseases such as gastrointestinal problems. This may lead to a decrease in the use of antibiotics in the population.

5.3 Demographic characteristics versus use of antibiotics

According to a study by Jamhour et al, there is an association between lower levels of education in a population and self-medication [34]. We observed this phenomenon in our study where respondents with secondary/tertiary education were less likely to have used antibiotics recently than those with basic or no education. Whether the causality of this relationship relates to knowledge or better life chances and therefore reduced infection risk, and consequent need to use antibiotics, is not clear. Awareness creation may play a role here, but further research is required to establish whether frequency of infection is greater amongst those who have not had opportunity to attend higher levels of education.

5.4 Healthcare Services and Sources of antibiotics in the communities surveyed

A total of 59% of respondents selected the public health system (40% for clinics and 19% for public hospitals as illustrated in Figure 6) as their first point of call when they are not feeling well and it is corroborated by the study conducted by Zwart et al in Ghana [35]. This may demonstrate that respondents have confidence in the public health system. On the other hand, 16% of respondents chose the OTCMS as their first point of call when they fell sick. Lack of pharmaceutical services and qualified health professionals especially in the rural areas may have created a gap which is being filled by the OTCMs and the non-availability of pharmacies in the rural communities might have contributed to the sale of antibiotics in OTCMs against the law. This is supported by a study conducted by Yevutsey et al, 2017 [13]. The study revealed that 35% and 33% of respondents get their medication from public clinics and OTCMs respectively as against 11% who get their medication from retail pharmacies.

Although the OTCMs are operating illegally by stocking antibiotics against what is stipulated by the [19]Public Health Act of 2012, Act 851, they are filling a vacuum created by the absence of retail pharmacies in the rural communities. The reasons why people seek care from the OTCMs rather than from formal health care service providers have been widely documented as in the case of malaria [36].However, further research to establish why antibiotics are purchased over the counter, and the potential social, economic and political factors for this are important here,

as has been found elsewhere [37]. it is therefore imperative upon authorities to ensure equitable distribution of quality healthcare services at all levels. This may enhance the quality of service delivery and minimise the gap in health service provision currently being filled by the OTCMs who are not allowed by law to stock and dispense these antibiotics.

5.5 Antibiotic use and associated factors among the households

The finding of an overall high antibiotic use (85%) in the study population is consistent with what has been found in Ghana through similar studies. A study in central Ghana in 2018 discovered inappropriate use of antibiotics among 86.6% of the study population [38]. In Tanzania, Kenya and Congo, studies on antibiotic use by Mshana et al recorded over 70% use among the households surveyed [39]. These findings confirm WHO's findings on self-medication including antibiotics in sub-Sahara Africa [11] A recent study by Mate et al on the percentage of non-prescribed antibiotics use however found a small proportion (20.9%) of antibiotic use in Mozambique [30].

5.6 Limitations to the study

This study is based only on self-reporting information by participants, which represents a limitation due to recall bias. All Retail Community Pharmacies are located within the district capital, Dormaa Ahenkro. This makes pharmaceutical services accessibility to the inhabitants not equitably distributed. Responses on pharmaceutical services therefore cannot be said to be representative of the study population. The views of regulatory bodies on availability, accessibility and enforcement on antibiotics was not sought during this study. The sample size is small compared to other studies. Larger studies over longer periods of time using the Drug Bag method may result in a better understanding of the complexities of antibiotics misuse in the general population. Although the Drug Bag method is very helpful in eliciting responses from participants as they are able to easily identify products that they are familiar with or have used before, it requires a lot of resources as different brands of antibiotics available in the study area may have to be purchased for the study.

This study has exposed a high proportion of misuse of antibiotics among the study population. The unavailability of professional pharmaceutical services in the rural population of the study area may have contributed to the respondents resorting to self medication and misuse of antibiotics. Inadequate regulation on the sale of antibiotics coupled with demands of the inhabitants may also have contributed to the availability of antibiotics in OTCMs in the area. The study, although small, has provided a perspective on some of the causes of antibiotics misuse in the study population. Further research is required to establish the reasons for the use of antibiotics, including potential causes of infections requiring antibiotics, and reasons that self-medication occurs rather than treatment at clinics.

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Appendix 1: Data Collection Tool For Pharmacies

DATA COLLECTION TOOL FOR PHARMACIES

Serial Number: P-0001/-   Interviewer Code: 0001

Date…………………………………

BACKGROUND INFORMATION OF THE AREA		
District	Dormaa Municipal	**Dist**
Community		**Comm**
Street address		**St_add**
Type of sales outlet	Public [ ] Privat [ ]	**Typ_outl**
Name of Sales Outlet		**Nam_outl**
Address of Sales Outlet		**Add._outl**

Name of facility owner		**Highest Qualification**	
Name of Supt. Pharmacist		Highest Qualification	
Name of Locum Pharmacist		Highest Qualification	
Name of Respondent		Highest Qualification	
Name of Dispenser		Highest Qualification	
Name of Assistant		Highest Qualification	

Demographics		**Response**	
1.	Your Age (Years)	....	**Age**
2.	Sex of respondent	1. Male [ ] 2. Female [ ]	**Sex**
3	Education	1. No formal education [ ] 2. Primary/JSS [ ] 3. Secondary/Technical/ Voc [ ] 4. Tertiary [ ]	**Edu**

(*Please kindly choose from the options given or provide answer where there there are no options given*)

Interview Section		Response	
1.	Are you the owner of this facility?	1. Yes [ ] 2. No [ ]	Fac_own
2.	If your answer to question **Que.1** is **No**, what is your position in the facility?	....	Pos_fac
3.	How many people work in this facility?	....	Wk_man
4.	How many among your workers have the following qualifications? (***Check as many as applied and write the number against***)	[ ] Pharmacist [ ] Nurse/Midwife [ ] Pharmacy technician [ ] Pharmacy assistant [ ] Other, specify	Wk_qua
5.	Who is responsible for procuring medicines for this facility?	1. The Pharmacist [ ] 2. The Administrator [ ] 3. The Pharmacy Manager [ ] 4. Other, specify......................	Who_res
6.	Where are the medicines you stock procured from?	1. Wholesale Pharmacy [ ] 2. Medical Store [ ] 3. Informal drug vendor [ ] 4. Other, specify.............	Whr_proc
7.	Do you check for the registration status of medicines you procure?	1. Yes [ ] 2. No [ ]	Reg_stat
8.	If **Yes** to question 7 above, where do you get the information from?	1. From the FDA website/manual [ ] 2. From the local FDA office [ ] 3. From the companies [ ] 4. Others, specify.............................	Whr_info
9.	What are the types of medicines at your stock? (***Choose as many as applied***)	1. Analgesics [ ] 2. Antihypertensives [ ] 3. Antidiabetics [ ] 4. Antimalarials [ ] 5. Antibiotics [ ] 6. Haematinics [ ] 7. Others, specify..................	Med_typ
10.	Do you stock antibiotics?	1. Yes [ ] 2. No [ ]	Sto_abs

11	What ranges of antibiotics do you stock? (*Choose as many as applied*)	1. Tertacyclines [ ] 2. Beta-lactams [ ] 3. Flouroquinolones [ ] 4. Cephalosporins [ ] 5. Macrolides [ ] 6. Others [ ]	Rang_abs
12.	Does anyone/ persons in this facility prescribe medicines?	1. Yes [ ] 2. No [ ]	Per_presc
13.	If your answer to **question 12** above is **Yes**, do the medicines you prescribe include antibiotics?	1. Yes [ ] 2. No [ ]	Presc_abs
14.	Are the dispensers in this facility aware of the classification of antibiotics based on which they are dispensed?	1. Yes [ ] 2. No [ ]	Awa_clas
15	If yes to **question 14** above, can you list the classification of antibiotics based on which they are dispensed?	1. 2. 3.	List_clas
16.	How are antibiotics dispensed in your outlet	1. By Pharmacist [ ] 2. By Assistants [ ] 3. Others, specify.........	Disp_abs
17.	Do your clients request for and insist on buying medicines based on the symptoms they present to the Pharmacy?	1. Yes [ ] 2. No [ ]	Clien_req
18.	If **yes** in **question 17**, does it include antibiotics?	1. Yes [ ] 2. No [ ]	Req_abs
19.	What are your sources of information?	1. BNF [ ] 2. Standard Treatment Guidelines [ ] 3. Essential Medicines List [ ] 4. On-line information [ ] 5. Other, please specify............	Inf_sour
20.	Do you think antibiotics are being abused/misused by the public?	1. Yes [ ] 2. No [ ]	Abs_abus

21.	What in your opinion are the possible causes of antibiotic abuse/misuse**?**	1. ....… 2. ....… 3. ....… 4.	Caus_abus
22.	Do you think antibiotic abuse/misuse is a problem in this district?	1. Yes [ ] 2. No [ ]	Abus_prob
23.	If your answer to **question 22** is **Yes**, how do you think antibiotic abuse/misuse can be minimised?	1. 2. 3. 4.	Min_abus
End of interview. Thank you for your participation.			

Appendix 2: Data Collection Tool For Out-Patient Clinics

DATA COLLECTION TOOL FOR OUT-PATIENT CLINICS

Serial Number: C-0001/-   Interviewer Code: 0001

Date………………………………

BACKGROUND INFORMATION OF THE AREA		
District	Dormaa Municipality	**Dist**
Community		**Comm**
Street address		**St_add**
Type of Out-Patient Clinic	Public [ ] Privat [ ]	**Typ_cli**
Name of Out-Patient Clinic		**Nam_cli**
Address of Out-Patient Clinic		**Add._cli**

Name of facility owner		Highest Qualification	
Name of Respondent in Facility		Highest Qualification	
Medical Superintendent		Highest Qualification	
Name of Midwife		Highest Qualification	
Name of Nurse		Highest Qualification	
Name of Dispenser			

Demographics		Response	
1.	Your Age (Years)	....	**Age**
2.	Sex of respondent	3. Male [ ] 4. Female [ ]	**Sex**
3	Education	5. No formal education [ ] 6. Primary/JSS [ ] 7. Secondary/Teachnical/Voc [ ] 8. Tertiary [ ]	**Edu**

(*Please kindly choose from the options given or provide answer where there there are no options given*)

Interview Section		Response	
1.	Are you the owner of this facility?	3. Yes [ ] 4. No [ ]	Fac_own
2.	If your answer to **question 1** is **No**, what is your position in the facility?		Pos_fac
3.	How many people work in this facility?		Wk_man
4.	How many among your workers have the following qualifications? (**Check as many as applied and write the number against**)	1. Nurse/Midwife [ ] 2. Pharmacy technician [ ] 3. Pharmacist [ ] 4. Pharmacy assistant [ ] 5. Other, specify	Wk_qua
5.	Who is responsible for procuring medicines for this facility?	5. The Pharmacist [ ] 6. The Administrator [ ] 7. The Medical superintendent [ ] 8. Other, specify	Who_res
6.	Where are the medicines you stock procured from?	5. Wholesale Pharmacy [ ] 6. Medical Store [ ] 7. Informal drug vendor [ ] 8. Other, specify.............	Whr_proc
7.	Do you check for the registration status of medicines you procure?	3. Yes [ ] 4. No [ ]	Reg_stat
8.	If **Yes** to question 7 above, where do you get the information from?	5. From the FDA website/manual [ ] 6. From the district or local office [ ] 7. From the companies [ ] 8. Others, specify.............................	Whr_info
9.	What are the types of medicines at your stock? (**Choose as many as applied**)	8. Analgesics [ ] 9. Antihypertensives [ ] 10. Antidiabetics [ ] 11. Antimalarials [ ] 12. Antibiotics [ ] 13. Haematinics [ ]	Med_typ

		14. Others, specify..................	
10.	Do you stock antibiotics?	3. Yes [ ] 4. No [ ]	Sto_abs
11	What ranges of antibiotics do you stock? (**Choose as many as applied**)	7. Tetracyclines [ ] 8. Beta-lactams [ ] 9. Flouroquinolones [ ] 10. Cephalosporins [ ] 11. Macrolides [ ] 12. Others	Rang_abs
12.	Does anyone/ persons in this facility prescribe medicines?	3. Yes [ ] 4. No [ ]	Per_presc
13.	If your answer to **question 12** above is **Yes**, do the medicines you prescribe include antibiotics?	3. Yes [ ] 4. No [ ]	Presc_abs
14.	Who is responsible for dispensing antibiotics in your outlet?	4. Pharmacist [ ] 5. Nurse [ ] 6. Midwife [ ] 7. Medicine counter assistant [ ] 8. Others, specify.........	Who_resp
15.	Do your clients request for medicines based on the symptoms they present to the clinic?	3. Yes [ ] 4. No [ ]	Clien_req
16.	If **yes** to **question 15**, does it include antibiotics?	3. Yes [ ] 4. No [ ]	Req_abs
17.	Do you counsel patients on the use of their medicines?	1. Yes [ ] 2. No [ ]	Coun_pat
18.	If **yes** to **question 17** above, how do you counsel patients on antibiotic use?	1. Complete their course [ ] 2. Buy another course if they feel unwell after completion of course [ ] 3. Others, specify [ ]	How_couns
19.	Do you think antibiotics are being abused/misused by the public?	3. Yes [ ] 4. No [ ]	Abs_abus

20.	What in your opinion are the possible causes of antibiotic abuse/misuse?	5. ....… 6. ....… 7. ....… 8. ....…	Caus_abus
21.	Do you think antibiotic abuse/misuse is a problem in this district?	3. Yes [ ] 4. No [ ]	
22.	If your answer to **question 21** is **Yes**, how do you think antibiotic abuse/misuse can be minimised?	5. 6. 7. 8.	Abus_prob
End of interview. Thank you for your participation.			

Appendix 3: Data Collection Tool For Households

DATA COLLECTION TOOL FOR HOUSEHOLDS

Serial Number: H-0001/-   Interviewer Code: 0001

Date…………………………

Name of Participant	
District	Dormaa Municipality
Home address of Participant/ GPS Code	
Name and address of Antibiotic Sales outlet closest to participant	
Type of Antibiotic Sales outlet closest to participant	Pharmacy [ ] OTCMS [ ]
Name and address of nearest Health Centre/ Clinic/ Hospital	

SECTION 1

Demographic and Socio-Economic Data	
Age (Years)	....
Gender:	1. Male [ ] 2. Female [ ]
Marital Status:	1. Married [ ] 2. Single [ ] 3. Divorced [ ] 4. Separated [ ] 5. Others, specify...........................
Educational level	1. Never went to school [ ] 2. Primary/ JSS [ ] 3. Secondary school [ ] 4. Diploma [ ] 5. Vocational/Technical training [ ] 6. University degree [ ] 7. Others, Specify................................
Occupation	1. Unemployed [ ] 2. Farmer [ ] 3. Trader [ ] 4. Artisan [ ] 5. Government employee [ ] 6. Private sector employee [ ] 7. Others, please specify....................

Section 2:   In-depth interview questions

Questions	Responses		
1. Has any member of the household been sick of any of the following in the last three months? (**check all those applied**)	1	Malaria	
	2	Fever / Body pains	
	3	Stomach pain	
	4	Diarrhoea	
	5	Coughing	
	6	Sore throat / tonsils	
	7	Headache	
	8	Eye problems	
	9	Cold, flu, runny nose	
	10	Asthma	
	11	Blood pressure	
	12	Diabetes	
	13	Dental/tooth pain	
	14	HIV	
	15	TB	
	16	Skin problems	
	17	Wounds	
	18	Gynaecological	
	19	Male genital problems	
	20	Urinary tract infections	
	21	Don't know	
	22	Other (please specify)	
2. Where did the person first seek treatment from?	1. Pharmacy [ ] 2. Hospital [ ] 3. Clinic [ ] 4. OTCMS [ ] 5. Traditional Healer [ ] 6. Others, please specify.................		
3. Which medicines were used to treat the person? (**Tick all that applied**)	Antimalarials		
	Painkillers / antipyretics		
	BP / hypertension		
	ORS		
	Hay fever / allergies		
	Antibiotics		
	HIV medicines		
	Cough/ Cold medicines		
	Herbal medicines		
	Don't know		
4. What are the sources of the medicines stored in the household? (**check all applied**)	1.	Other, household member	Tick
	2.	Friend or neighbour	
	3.	Traditional/faith healer	
	4.	Informal drug vendor	
	5.	Retail Pharmacy	

		6.	OTCMS	
		7.	Public clinic	
		8.	Public hospital	
		9.	Private health facility	
		10.	Other: please specify, ……………………..	
		11.	Don't know	

I would like to continue asking you about medicines. To do this, I will show you some medicines that are with me. (Present the antibiotic library to participant). Healthcare givers often call these kinds of medicine 'antibiotics. I would like to ask you to perform a simple and short exercise. The exercise is not to test your knowledge, on the medicines but to find out whether you have seen any of these before and which you have used. The reason for this exercise is that it helps to actually show you these medicines to help you remember which ones you have seen. If you are OK to continue, we will begin.

5. Which of these medicines have you seen or heard of before? Please pick out the ones that you have seen or heard of before and put them into one pile

Medicines	Yes	No
1. Amoxicillin (Capsules)		
2. Amoxicillin (Suspension)		
3. Ampicillin (Capsules)		
4. Azithromycin (Tablets)		
5. Benzathene Penicillin (Injectable)		
6. Benzylpenicillin (Injectable)		
7. Cefalexin (Tablets)		
8. Cefixime (Tablets)		
9. Ceftriaxone (Injectable)		
10. Cefuroxime (Tablets)		
11. Chloramphenicol (Capsules)		
12. Chloramphenicol (Injectable)		
13. Ciprofloxacin (Tablets)		
14. Clarithromycin (Tablets)		
15. Amoxicillin / clavulanic acid (Tablets)		
16. Clindamycin (Tablets)		
17. Clindamycin (Injectable)		
18. Cloxacillin (Capsules)		
19. Cloxacillin (Suspension)		
20. Cotrimoxazole (Tablets)		
21. Cotrimoxazole (Suspension)		
22. Doxycycline (Capsules)		
23. Erythromycin (Tablets)		
24. Erythromycin (Suspension)		
25. Flucloxacillin (Capsules)		
26. Flucloxacillin / Ampicillin (Capsules)		
27. Gentamicin (Injectable)		
28. Levofloxacin (Tablets)		
29. Metronidazole (Tablets)		
30. Metronidazole (Suspension)		
31. Norfloxacin / metronidazole (Tablets)		
32. Ofloxacin / ornidazole (Tablets)		
33. Phenoxymethylpenicillin (Tablets)		
34. Tetracycline (Capsules)		

Medicine	Yes	No
35. Chloramphenicol (Eye/Ear)		
36. Ciprofloxacin (Eye)		
37. Gentamicin (Eye/Ear)		
38. Tetracycline (Eye)		

6. I would now like you to pick out the medicines that you use frequently when someone in your household is sick. Please place them together in a pile.

Medicine	Yes	No
1. Amoxicillin (Capsules)		
2. Amoxicillin (Suspension)		
3. Ampicillin (Capsules)		
4. Azithromycin (Tablets)		
5. Benzathene Penicillin (Injectable)		
6. Benzylpenicillin (Injectable)		
7. Cefalexin (Tablets)		
8. Cefixime (Tablets)		
9. Ceftriaxone (Injectable)		
10. Cefuroxime (Tablets)		
11. Chloramphenicol (Capsules)		
12. Chloramphenicol (Injectable)		
13. Ciprofloxacin (Tablets)		
14. Clarithromycin (Tablets)		
15. Amoxicillin / clavulanic acid (Tablets)		
16. Clindamycin (Tablets)		
17. Clindamycin (Injectable)		
18. Cloxacillin (Capsules)		
19. Cloxacillin (Suspension)		
20. Cotrimoxazole (Tablets)		
21. Cotrimoxazole (Suspension)		
22. Doxycycline (Capsules)		
23. Erythromycin (Tablets)		
24. Erythromycin (Suspension)		
25. Flucloxacillin (Capsules)		
26. Flucloxacillin / Ampicillin (Capsules)		
27. Gentamicin (Injectable)		
28. Levofloxacin (Tablets)		
29. Metronidazole (Tablets)		
30. Metronidazole (Suspension)		
31. Norfloxacin / metronidazole (Tablets)		
32. Ofloxacin / ornidazole (Tablets)		
33. Phenoxymethylpenicillin (Tablets)		
34. Tetracycline (Capsules)		
35. Chloramphenicol (Eye/Ear)		
36. Ciprofloxacin (Eye)		
37. Gentamicin (Eye/Ear)		
38. Tetracycline (Eye)		

7	What do you use this medicine for? (To be asked for each frequently used antibiotic selected)	Fever / hot body/ Body pains	
		Malaria	
		Cough	
		Sore throat	
		Cold / flu / runny nose	
		Gastrointestinal (e.g. diarrhoea)	
8	How often do you use this medicine? (Asked of each frequently used antibiotic)	Every day	
		Every week	
		Every two weeks	
		Every month	
		Between 1 - 6 months	
		Between 6 - 12 months	
		Between 1 - 2 years	
		Between 2-5 years	
		Less than every 5 years	

8. For each medicine here, has there ever been a time when you have needed the medicine but could not get it? Please place them together in a pile.

Medicine	Yes	No
1. Amoxicillin (Capsules)		
2. Amoxicillin (Suspension)		
3. Ampicillin (Capsules)		
4. Azithromycin (Tablets)		
5. Benzathene Penicillin (Injectable)		
6. Benzylpenicillin (Injectable)		
7. Cefalexin (Tablets)		
8. Cefixime (Tablets)		
9. Ceftriaxone (Injectable)		
10. Cefuroxime (Tablets)		
11. Chloramphenicol (Capsules)		
12. Chloramphenicol (Injectable)		
13. Ciprofloxacin (Tablets)		
14. Clarithromycin (Tablets)		
15. Amoxicillin / clavulanic acid (Tablets)		
16. Clindamycin (Tablets)		
17. Clindamycin (Injectable)		
18. Cloxacillin (Capsules)		
19. Cloxacillin (Suspension)		
20. Cotrimoxazole (Tablets)		
21. Cotrimoxazole (Suspension)		
22. Doxycycline (Capsules)		
23. Erythromycin (Tablets)		
24. Erythromycin (Suspension)		
25. Flucloxacillin (Capsules)		
26. Flucloxacillin / Ampicillin (Capsules)		
27. Gentamicin (Injectable)		
28. Levofloxacin (Tablets)		
29. Metronidazole (Tablets)		
30. Metronidazole (Suspension)		

31. Norfloxacin / metronidazole (Tablets)	
32. Ofloxacin / ornidazole (Tablets)	
33. Phenoxymethylpenicillin (Tablets)	
34. Tetracycline (Capsules)	
35.Chloramphenicol (Eye/Ear)	
36. Ciprofloxacin (Eye)	
37. Gentamicin (Eye/Ear)	
38. Tetracycline (Eye)	

9	The last time you could not access this medicine, why could you not get the medicine? (Asked for each antibiotic in the non-access pile)	1. It is not available in the government health facility [ ] 2. It is not available in the drug shop/pharmacy [ ] 3. It is too expensive [ ] 4. Other, Specify.........................
10	Please tell me about your most recent experience using one of the antibiotics you frequently use to manage illnesses in your household? (One antibiotic should be selected from the pile of 'frequently used medicines')	• What happened that led you to use this medicine? • How did you get to know about this medicine? • Where did you get it from? • How often is this medicine needed in this household? • What would you do next time?
11.	Is there any other information you would like to add?	
End of interview. Thank you for your participation		