Global Journal of Medicine & Public Health

Public perceptions on the use of antibiotics at a market place in Kumasi, Ghana: A cross-sectional study

Geeta Hitch[1], Cynthia A Danquah[2], Alex Owusu-Ofori [3], Thomas Agyarko-Poku [4], Andrea Manfrin[5], Ellis Owusu-Dabo [6], Kwame O Buabeng [3]*

ABSTRACT

Background

Ghana launched its National Action Plan (NAP) to curb the spread of antimicrobial resistance (AMR) in 2017. The current study was designed to gather data on public perception concerning antibiotic use by surveying a population at Kejetia market in Kumasi with the aim of informing the design and implementation of public health campaigns linked to the NAP in Ghana.

Methods

A cross-sectional study was conducted at the Kejetia market in Kumasi, Ghana between November 2017 and January 2018. Participants were adults over 18 years of age and data were gathered via a questionnaire regarding participants' perceptions on the acquisition, use and disposal of antibiotics.

Results

The number of participants was 302, of which nearly 60% were female. Statistically significant associations were identified between gender and level of education ($p<0.05$, Fisher's exact test). Amoxicillin and metronidazole were the most commonly used antibiotics. Females were three times more likely to use these agents for diarrhoea than males, and more likely to purchase them from non-pharmacy outlets and market pedlars.

Conclusion

This study shows access to, and the misuse of, antibiotics without prescriptions amongst the surveyed population. Antibiotics were used more by females and by people with a lower level of education. This research highlights antibiotic misuse within a target population that needs addressing by implementation of the NAP.

Keywords: Perceptions, Antibiotics, Resistance, Self-treatment, Ghana, Market

GJMEDPH 2020; Vol. 9, issue 1

[1] School of Life Sciences/Pharmacy, University of Sussex, Falmer, Brighton BN1 9RH, United Kingdom

[2] Department of Pharmacology, Faculty of Pharmacy and Pharmaceutical Sciences (FPPS), College of Health Sciences (CHS), Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana

[3] Department of Clinical Microbiology, School of Medical Sciences, College of Health Sciences (CHS), Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana

[4] Department of Pharmacy Practice, Faculty of Pharmacy and Pharmaceutical Sciences (FPPS), College of Health Sciences (CHS), Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana

[5] School of Pharmacy and Biomedical Sciences, Maudland Building, University of Central Lancashire, MB069, United Kingdom

[6] School of Public Health, CHS, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana

***Corresponding Author**
Geeta Hitch, School of Life Sciences /Pharmacy, University of Sussex, Falmer, Brighton BN1 9RH, United Kingdom
g.hitch@sussex.ac.uk

Conflict of Interest—none

Funding— This work was conducted by Geeta Hitch, University of Sussex, through the Harry Kroto Research Fellowship

INTRODUCTION

In February 2018, WHO published a report on antimicrobial resistance (AMR), which highlighted that its emergence and spread is made worse by the acquisition and use of antibiotics without a prescription.[1] It also emphasized the issues of overprescribing of antibiotics by healthcare professionals and their overuse by the public in countries without standard treatment guidelines. Other factors may also contribute to the inappropriate use of antibiotics. These include socioeconomic status, cultural background and the level of instruction on their use.[2,3] The use of antibiotics has risen sharply over the recent years. The Centre for Disease Dynamics, Economics and Policy (CDDEP) has shown that the global use of

antibiotics rose by more than 30% between 2000 and 2010.[4] This is particularly evident in developing countries due to the inadequate enforcement of laws to limit the non-prescription sale of antibiotic medications.[2,5] These problems are further compounded by a rise in infectious diseases, together with poor access to medical care in many countries. Infections such as pneumonia, tuberculosis, gonorrhoea, and salmonellosis are becoming harder to treat as the antibiotics available become less effective.[6] AMR is a major issue because it also leads to longer hospital stays, higher medical costs and increased mortality. In response to this major problem, WHO issued a Global Action Plan on AMR which has five strategic objectives:[7]

1) To improve awareness and understanding of AMR.
2) To strengthen surveillance and research.
3) To reduce the incidence of infection.
4) To optimize use of antimicrobial medicines.
5) To ensure sustainable investment in countering AMR.

Like many low middle-income countries (LMICs), Ghana faces a rapidly-developing problem of AMR and as such has developed its first comprehensive policy and National Action Plan (NAP) to curb the spread of AMR[8] in line with WHO objectives.[7]

Whilst studies on AMR in Ghanaian hospitals show a high prevalence of drug resistance, there is a dearth of literature on the use of antimicrobial agents within the community.[9-13] A point prevalence study showed that metronidazole and amoxiclav were the two most prescribed antibiotics to treat various infections at a major teaching hospital in Kumasi.[9] A recent cross-sectional study on patients with urinary tract infections at a healthcare facility identified *Escherichia coli (E.coli)* and *Klebsiella* species which displayed resistance to piperacillin, co-amoxiclav and nalidixic acid with extended spectrum beta lactamase resistant genes harbouring multidrug resistance in *E.coli.*[10] Another study in the Brong Ahafo region of Ghana showed that poor prescribing practices amongst nurses and physicians was attributed to gaps in their knowledge of what constituted optimal prescribing practices.[11] Yevutsey et al. (2017) identified the absence of a National Antimicrobial Policy regarding antibiotic use in humans and animals as well as weak enforcement of existing regulations and non-adherence to practice standards resulting in indiscriminate use by the general public.[12] Indeed, a study by Ameko et al. showed that, in patients who had self-medicated previously with antibiotics, 33.3% of the *Staphylococcus aureus* isolates from their urine samples exhibited resistance to co-amoxiclav and nearly 67% showed resistance to gentamicin, in comparison to those who did not self-medicate.[13] Whilst drugs are accessible by the general public from various retail outlets in Ghana, there is little literature on the use of antibiotics in the community.

Strategic objective 1 of the Ghana NAP is to improve awareness and understanding of AMR through effective communication, education and training. This involves continuous education to promote the responsible use of antimicrobials amongst the public by developing materials for targeted groups in a stratified public health education campaign.

It is important, therefore, to determine the public's perceptions about antibiotics and how they use these drugs. Marketplaces in many African countries are central to the livelihoods of many people and form both a social hub as well as a base for trading. Kejetia Central Market in Kumasi, Ghana is one such urban market with more than 10,000 market-stall vendors and 5,000 street vendors.[14] The aim of this study was to determine the perceptions on antibiotics and antibiotic use by the population in the market. We hoped that this study would highlight some of the problems associated with antimicrobial use, to inform the government's NAP and to provide data to support its future attempts at raising public awareness of AMR and appropriate antibiotic use.

METHOD AND MATERIALS

Study area and period

The study was conducted between November 2017 and January 2018 at the Kejetia Central Market in Kumasi, Ghana, which is one of the largest in West Africa. Thirty million people live in Ghana and 1.5 million in Kumasi, which is the second largest city in the country.

Research instrument

An online literature review of similar studies was conducted to identify potential items for our questionnaire. The questionnaire was designed by adapting items from previously validated surveys.[15-17] The research team customized the content, tailoring it appropriately for use in the local population. The questionnaire was initially written in English and then translated into Ewe and Akan, which are the most widely spoken languages in Kumasi. It was then piloted with 36 members of the public as suggested by Perneger *et al.*[18] The questionnaire was divided into the following domains and comprised 20 questions in total: demographic (4 questions), acquisition (5 questions), use (6 questions), disposal of antibiotics (2 questions) and questions in an 'other' category (3 questions). Any other related comments made by the participants were also collected in writing at the end of the questionnaire.

Study population

Inclusion Criteria

Participants were adults 18 years of age or above, and conversant in one or more than one of the following languages: English, Ewe and Akan.

Exclusion Criteria

Participants under 18 years of age.

Sample size

An *a priori* calculation was conducted using the chi square test and contingency table. To obtain a 95% power with an alpha of 0.05, a degree of freedom (DF) of 5, an effect size (Cohen d) of 0.3 and X^2=11.1, a sample size of 220 participants was required. The sample size calculation was conducted using G Power Version 3.1.9.3.

Sampling technique

This was a cross-sectional study. The participants were selected by using a systematic random sampling technique using calculated K-value (total expected participants (10,000) during the study period divided by the number of actual participants (220 calculated by a priori calculation)). The Kth value was 45.5 and, therefore, every 46th person was included in the study.

Data collection, consent and anonymity

Data collection for the pilot study was carried out in November 2017 by two members of the research team. Five postgraduate students were then trained in using the questionnaire to collect a larger sample size. Data collection was continued, and reached the required sample size in January 2018. Face-to-face interviews were conducted in order to collect verbal responses to the questions. The participants' verbal consent to participate in the study and for the results to be disseminated was recorded. No names and addresses were recorded during the course of the interview to ensure anonymity; participants were recorded numerically.

Statistical analysis

Information on the baseline characteristics of the participants was calculated using descriptive statistics and the data were presented as frequencies and percentages. Categorical variables such as gender, age and the influence of the level of education on the different medications used were tested using chi square (X^2) for independent variables and Fisher's exact test p-value was used for 2x2 cross-tabulation. Cramer's V test was used to determine the strengths of associations after X^2 was determined. (The value of Cramer's V varied from 0 and 1 where 0 means no association and 1 complete association). Twenty-one statements were analyzed using gender as a dichotomous variable calculating the unadjusted odds ratio (OR) at 95% confidence interval (95% CI) with X^2 used to estimate univariate association. The level of statistical significance was set at $p<0.05$. The study data were analyzed using SPSS version 24.

Ethical consideration

Ethical approval (number CHRPE/RC/Oct/2017) was obtained from the Committee for Human Research Ethics and Publications, School of Medical Sciences, KNUST and Komfo-Anokye Teaching Hospital.

Data confidentiality and storage

All information collected during the course of the study was anonymized and kept in a password protected file by the principal investigator (GH) and stored securely at the University of Sussex (UK).

RESULTS

Population demographics

There were 302 participants in this study. Of these, 59.6% (n=180) were female and 40.1% (n=121) male with one gender unidentified. The highest number of participants were between the ages of 25–44 years (51.7%; n=156). Whilst the smallest group (1.7%, n=5) were those over 65 years of age (Table 1). The percentage of participants with NHIS insurance was 71.5%, with female participants significantly higher than males (p=0.001, Fisher's exact test). More than 24% of the participants did not have NHIS insurance.

Table 1 Demographic characteristics of participants

Demographic characteristics	N	%
Gender		
Male	121.0	40.1
Female	180.0	59.9
Missing data	1.0	0.3
Age		
18-24	79.0	26.2
25-44	156.0	51.7
45-64	62.0	20.5
65+	5.0	1.7
Employment data		
Male employed	112.0	37.1
Female employed	163.0	53.9
Total employed	276.0	91.1
Missing data	1.0	0.3
NHIS insurance		
Male with insurance	74	24.5
Female with insurance	142	47.0
Total with insurance	216	71.5
Total without insurance	83	24.4

Association between gender, age and use of antibiotics

More than 97% (n=294) participants in the study population stated that they had used antibiotics during the preceding 12 months. Of these, 47.7% (n=174) were female and 27.8% (n=120) were male with (n=1 missing data) (p<0.001, Fisher's exact test). Females in the age range 25–44 years of age had taken the most antibiotics in the preceding 12 months, whilst respondents of both genders in the 65 years and over group had taken the least.

Figure 1, on the following page, shows the age and gender association with antibiotic use, showing percentage of males and females who had taken amoxicillin or metronidazole or both during the preceding 12 months. The vertical axis shows the gender in different age ranges. The horizontal axis shows the use of amoxicillin, metronidazole or both by the percentage of participants within different age ranges: 18–24, 25–44, 45–64 and above 65.

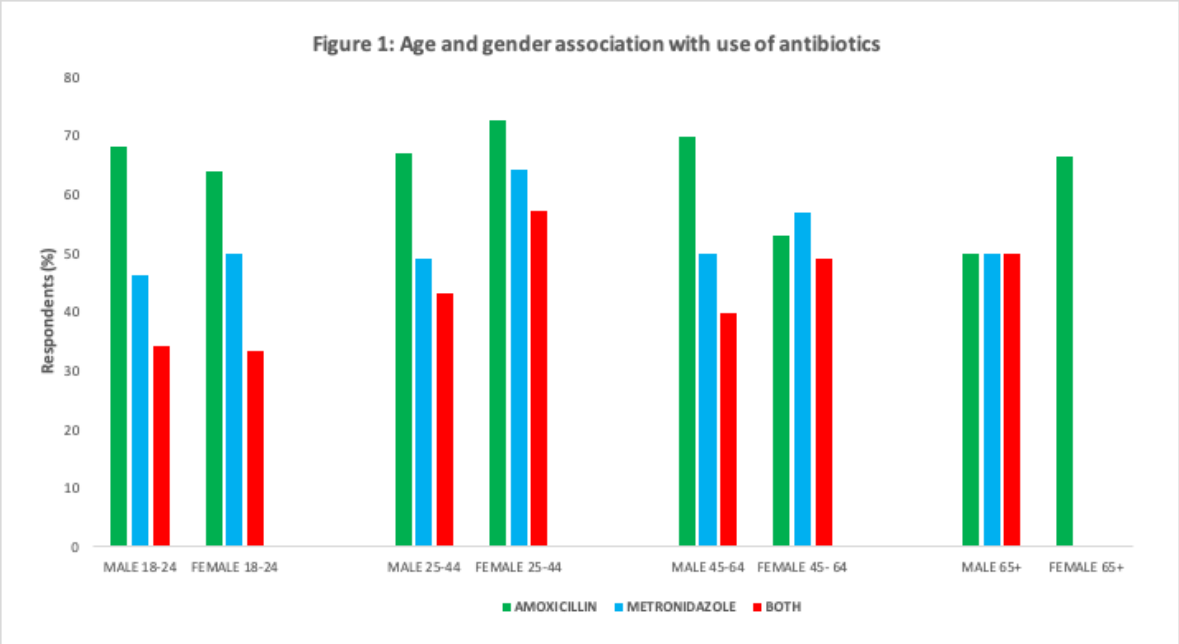

Fig 1 Association between gender, age and use of antibiotics

Use of antibiotics to treat various conditions

Figure 2, below, shows that the most common uses of antibiotics were for the treatment of diarrhoea and skin infections, such as boils and sores. With regard to the treatment of diarrhoea, the proportion of participants in each age group using antibiotics for this purpose was very similar. However, use was three times higher in females (OR=3.2, 95% CI 1.8-5.5, p<0.001). Figure 2 shows the use of antibiotics by the participants for the treatment of various conditions, as a percentage of the total number of participants within the different age ranges.

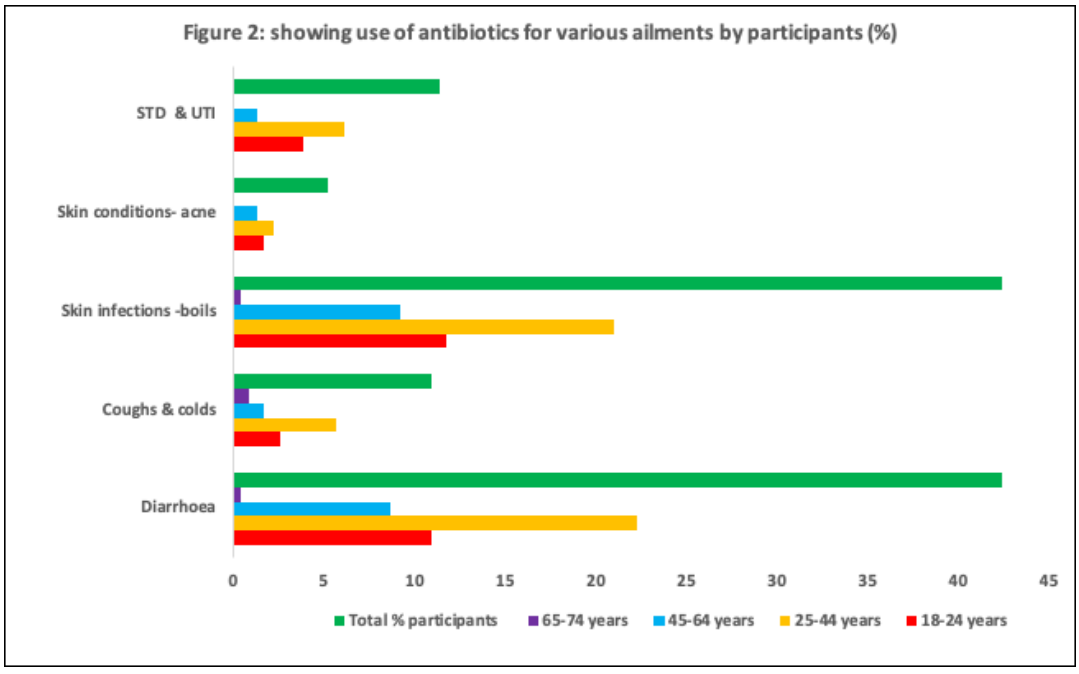

Fig 2 Antibiotics for various ailments by participants (%)

Association between gender, age and highest level of education obtained by the participants

Table 2 shows the education status of participants surveyed. Primary education is defined as being 6–11 years of age. Secondary education is 12–18 years of age and includes those who may have left school within this range. Post-secondary education begins at 19 years of age and includes teacher training, apprenticeships, polytechnic and university level higher education. The results show the numbers of participants in each category together with the missing data, which represents those who did not indicate their education status when surveyed.

The data shows the highest level of education achieved by participants in our study. It is evident that the overall education status of females was considerably lower than males. Three times as many females received either primary school education only or no formal education compared to males. Only one female received post-secondary education compared to 21 males ($p<0.001$, Fisher's exact test). The percentage of females between 18–44 years who had primary level education was significantly higher, at more than twice that of males ($p<0.001$, Fisher's exact test). However, the number of males who had received secondary (62.5%) and post-secondary (17.5%) education between the ages of 18–44 years was higher than females (55.6% and 2.8%) respectively. The number of females who had no formal education was significantly higher at 18.4% compared to males at only 8.5% ($p<0.001$; Fisher's exact test). This suggests that opportunities for females for post-secondary education are limited.

Table 2 Education status of participants

Education status of participants					
Male age ranges (years)	**Primary**	**Secondary**	**Post-secondary**	**No formal education**	**Missing data**
18-24	6	25	7	2	1
25-44	9	39	13	6	0
45-64	3	5	0	2	1
65-74	0	0	1	0	1
Total	18	69	21	10	3
Female age ranges (years)	**Primary**	**Secondary**	**Post-secondary**	**No formal education**	**Missing data**
18-24	13	20	1	2	2
25-44	27	45	0	12	4
45-64	23	11	0	17	0
65-74	0	2	0	1	0
Total	63	78	1	32	6

Association between age, gender and level of employment

The percentage of employed people in the surveyed population was 91.1% (n=276), with a higher percentage of employed females (53.9%, n=163) than males (37.1%, n=112).

The percentage of employed participants between the ages of 18-24 years was 21.9% and between the ages of 25-44 years it was 48.7%. This was statistically significant ($p<0.003$, Fisher's exact test).

Association of the use and disposal of antibiotics with age and gender

The majority of the population (80.5%) stopped taking antibiotics once they felt better. Almost all of these (97%) said they would not return the unused antibiotics to the pharmacy to be destroyed ($p<0.001$, Fisher's exact test). Instead, they kept them either for themselves (57.9%), their family and friends (20.9%) or disposed of them with household waste (34.4%). There were no significant associations between age, gender and the use and disposal of antibiotics.

Participants' means of acquiring antibiotics

More than 83% of participants bought their antibiotics from a pharmacy, 35.4% from a retail outlet and 8.9% from market pedlars (the percentages do not add up to 100 because respondents could choose multiple options). Interestingly, the majority of participants (78.8%) occasionally used a prescription to purchase antibiotics whilst only 7% always used a prescription and 11.5% never used one. Females were less likely to buy antibiotics from the pharmacy (OR=0.4, 95% CI 0.2-0.9, p=0.020) than males, and more likely to buy from retail outlets and market pedlars. However, females were also four times more likely to return their unused antibiotics to the pharmacy (OR=4.1, 95% CI 0.5-34.6, p=0.159) compared to males, though this was not statistically significant.

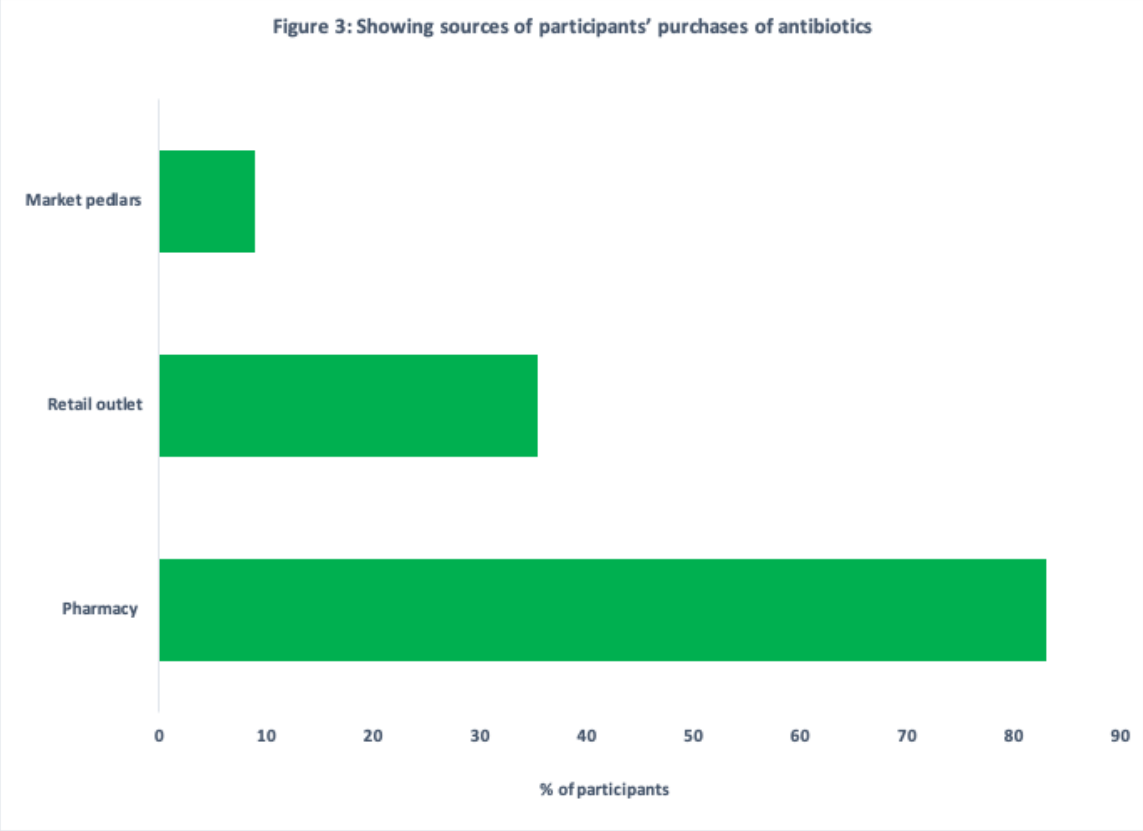

Fig 3 Source of participants' purchase of antibiotics

Figure 3 shows the sources of antibiotics reported and the percentage of participants who purchased antibiotics from each source. Around 83.1% declared that they had never felt unwell from taking antibiotics. Around 89.7% said that pharmacists were willing to sell them antibiotics without a prescription and 57.0% stated that if they were not able to buy antibiotics without a prescription from their pharmacy, they would go to their doctor to get a prescription; 30.3% said they would try another pharmacy or a retail outlet and only 9.1% said they would forego obtaining the medicine.

Use of traditional medicines by participants

Figure 4 (next page) shows the use of traditional medicines by age range. Around two-thirds of the participants (65.2%, n=197) confirmed that they used traditional medicines for treating infections. Of these, 34.1% (n=103) were in the 25–44 age range group, of whom 39.1% were female. Amongst the remedies used were Adutwumwaa Bitters (4.6%), Taabea Herbal Mixture (36.5%), Madame Catherine (4.6%), Time Herbal Mixture (11.7%) and Kooko (3.0%). More than half of the participants (56.4%) also used decoctions of homemade remedies.

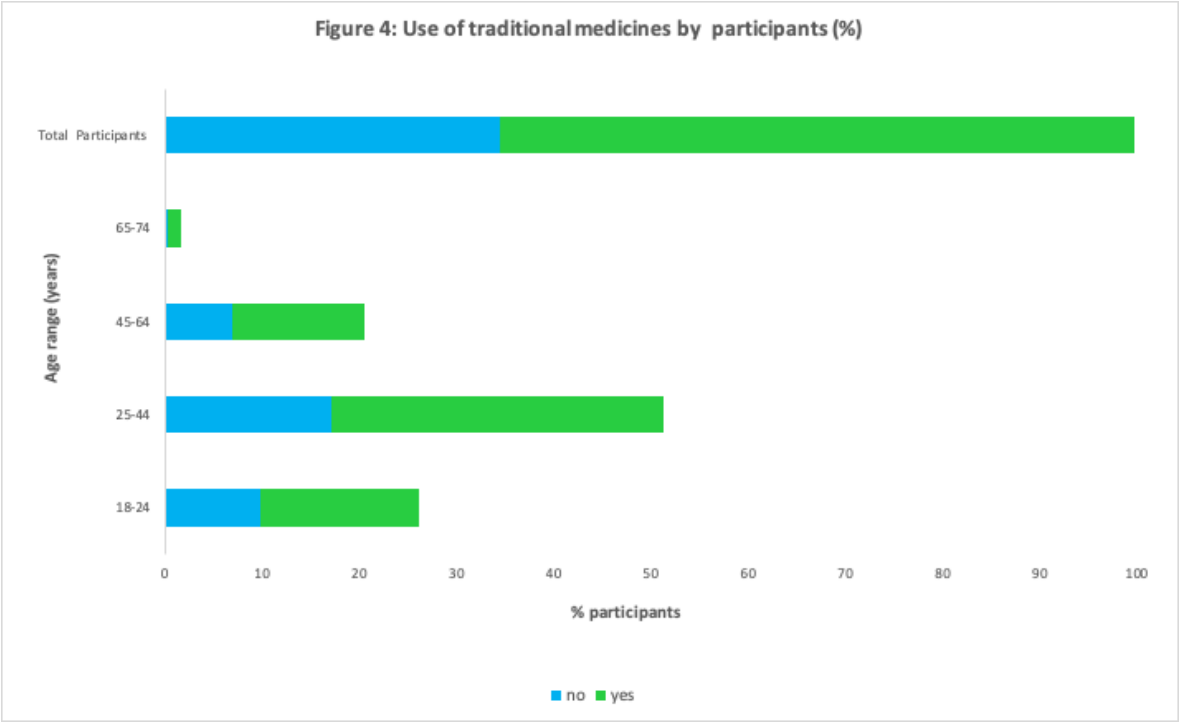

Fig 4 Use of traditional medicines by participants (%)

Media use by the participants, to listen to news and music

Data on media used by the participants, particularly to listen to news, was collected in order to determine potentially suitable media through which to reach a rural target audience with public health campaigns. For listening to news and music, most participants used the radio (85.8%, n=289) whilst at work, and television (59.3%, n=179) when at home; cell phones (22.2%, n=67); and the internet (20.5%, n=62). The percentages did not add up to 100 because respondents could choose multiple options. Few participants used cell phones (22.2%) and internet (20.5%) for entertainment. This may be due to either the costs involved, or problems with internet providers and Wi-Fi.

Participants' comments on access to antibiotics

More than 36% (n=110) of participants provided comments on their worries about not having access to antibiotics; some of these are shown below. These were especially interesting as 57.9% of participants said they were not worried if they were not able to buy antibiotics from pharmacies without a prescription. Participants who obtained their antibiotics from sources other than a prescriber did not understand why they had to go to the doctor and had the following views:

"*Because I have been buying from them already.*" [Participant number 209]

"*It is not something serious so I do not see the reason why I should go for a prescription.*" [Participant number 070]

Participants who were in pain or wanted to keep the antibiotics as a 'rescue agent' had the following views:

"*Because I have waist pain.*" [Participant number 031]

"*Because it is my first aid.*" [Participant number 269]

"*I am sick and I need the medication.*" [Participant number 287]

Participants who did not want to go to the hospital or to their general practitioner had the following views:

"*Cannot go to the hospital.*" [Participant number 266]

"*Going to hospital for me is time consuming.*" [Participant number 242]

"*I will be worried because I can go back and join the queue to see a doctor.*" [Participant number 141]

Paying was seen a strong motivation to get the medication, even without prescription. Participants who gave this answer had the following views:

"*I have my money not insurance.*" [Participant number 297]

"*I have the money and in need of it.*" *(sic: antibiotic)* [Participant number 263]

"*I have the money so I will be angry.*" [Participant number 238]

Some participants understood that it was not possible to have antibiotics without a prescription and had the following views:

"*I have to understand.*" [Participant number 066]

"*I have to understand because is their work.*" [Participant number 024]

"*I have used it before so should I be refused?*" [Participant number 080]

"*I know what I want so why must he refuse to sell me a drug that is good for me?*" [Participant number 198]

Several participants expressed their anger and concerns about not having access to antibiotics and had the following views:

"*I will be very angry.*" [Participant number 243]

"*I will be very angry and worried.*" [Participant number 197]

"*Because I am sick.*" [Participant number 253]

"*What if I die?*" [Participant number 246]

"*Because I am sick and need medication.*" [Participant number 213]

DISCUSSION

The aim of this study was to determine the public's attitudes towards antibiotic use in order to inform the implementation of public health campaigns, linked to the NAP on antibiotic misuse in Ghana. Our survey was undertaken in a representative population at Kejetia market in Kumasi where responses to our questionnaire were collected from 302 participants.

Our data show that some 75% of those sampled had used antibiotics in the preceding 12-month period. In this regard our findings were in line with a similar study performed in Namibia in 2013.[19] We also found that antibiotic use was significantly higher in females than males and was greatest in the 25–44 age groups of both genders. These findings are similar to those recorded in a large-scale review of antibiotic prescribing in several European countries.[20] The reasons for this are unclear but are unlikely to be linked to prescribing practices, as very few participants (7%) in our study routinely obtained a prescription for antibiotics. It is more likely linked to prior experience of being prescribed an antibiotic and/or the use of leftover medication. Grigoryan et al (2007) came to similar conclusions in a survey of more than 14 million respondents across Europe:[21] they also found that there was a significant association between self-medication and the use of leftover antibiotics.[21] Our results show a similar trend in that 80% of respondents stated that they stopped taking antibiotics once they felt better rather than completing the course of treatment, and 97% said they would not return the remaining drugs to the pharmacy for disposal. Keeping unused antibiotics, either for themselves for future use and/or for friends and family, seems to be a common practice in several countries.[22-24] Interestingly, 70% of the participants in our study were registered with the Ghana NHIS, the majority of whom were female, a finding that corresponds well with a recent survey of the

scheme.[25] However, a review of the NHIS concluded that poor quality care in accredited health facilities potentially reduces clients' trust in the scheme and consequently decreases enrolment.[26] This might explain some of the comments made by participants in our study concerning the time they had to spend queuing at the hospital or at the local doctor's surgery, and the fact that they had to pay for their medications. It seems likely that this is also a factor in promoting self-medication amongst the population.

Amoxicillin and metronidazole were used by the majority of participants in our study and about a third had used both. These were found to be amongst the most commonly prescribed antibiotics in a survey of a healthcare facility in Ghana and the Ghana NHIS[5,9] adding further weight to the argument that prior experience of antibiotic use is a major factor in self-medication and thus adds to the development of AMR, as recognized in a survey of prescribing practice in Ghana.[11] Diarrhoea and skin infections such as boils and sores were by far the most common conditions (~40%, respectively) for which antibiotics were used, compared to coughs, colds, urinary tract infections and sexually transmitted diseases (~10%, respectively). Diarrhoea is a major public health concern in Ghana; it is one of the top six causes of mortality, killing 7,600 people in 2012[27]. Therefore, it is not surprising that it was commonly given as a reason for antibiotic use by the study participants. The inappropriate use of antibiotics has been found to be associated with the users' level of education in studies undertaken in several European populations[21,28]. The WHO has highlighted this in their definition of health literacy, which is linked to the promotion and maintenance of good health.[29] UNICEF has reported that Ghana has not achieved gender parity in education.[30] This is supported by our data, which show that antibiotic use is higher amongst females and that females have lower levels of academic achievement than males. In fact, three times as many female as male participants had no formal education, and only one had post-secondary education, compared to 21 males. It was also evident that many more females were limited to primary school education only. The Ghana NAP identifies improving the awareness and understanding of AMR through effective communication, education and training, and proposes that the subject should be included in educational curricula.[8] Our data suggest that such a programme will need to be targeted towards those at all levels of education and that gender parity in education must be achieved if the proposal is to succeed. Another area for consideration is the enforcement of legislation concerning acquisition of antibiotics without a prescription from retail outlets. Ghana's NAP advocates to improve use of antimicrobials in human care and to this end, "collaborate with law enforcement agencies and lorry station owners, drivers unions, chiefs, market queens to enforce the ban on sale of drugs at unauthorized places."[8] Our findings indicate acquisition of antibiotics from unauthorized sources: studies such as ours highlight the need for more research within market populations and for educating these populations.

An interesting finding was that over a third of the participants (34.4%) disposed of their unused antibiotics into their household waste. This is alarming since a study conducted in Kumasi[31] has shown high concentrations of ciprofloxacin in water samples from hospital effluent and metronidazole, ciprofloxacin, erythromycin, cefuroxime and sulfamethoxazole were detected in market samples of lettuces. Antibiotics such as trimethoprim and ampicillin were also detected in farm samples. The Ghana NAP recognizes this as a problem and states one of its objectives is to develop a waste management policy. Data from our study highlights that the high level of antibiotics disposed of in household waste then finds its way to rivers and on to farmlands irrigated with these waters, further enabling AMR to develop. In addition to antibiotics, 65% (n=197) of participants in our study used traditional medicines, primarily to treat malaria, which is endemic in Ghana.[32] Amongst these were various commercial products as well as homemade decoctions. Two remedies that were bought by participants were Adutwumwa Malamix and Taabea Herbal Mixture, both of which are registered products by the Ghanaian FDA and have been shown to be an effective treatment for uncomplicated malaria.[33,34] It has been estimated that around 70% of the Ghanaian

population use traditional medicines, which are accessible and affordable, and in many cases are claimed to be effective in the treatment of several ailments.[35,36] The Ghanaian NAP recognizes this and states that one of its objectives is to promote periodic testing of herbal preparations claiming anti-infective properties for the presence of orthodox antibiotic substances and to use such data to engage with commercial producers and herbal practitioners to encourage the responsible use of medicines, including antimicrobials.[8]

In conclusion, our findings from a market population in Ghana correspond well with similar studies performed elsewhere. We have shown that the inappropriate use of antibiotics is widespread, primarily amongst females of 25– 44 years of age and is associated with educational status. Public health campaigns proposed by the Ghana NAP will need to take these findings into account when instituting such campaigns and recognize the importance of reforming both the NHIS and the unregulated supply of antibiotics if they are to tackle the spread of AMR effectively.

DECLARATIONS

Acknowledgments

The authors would like to thank all the members of the public who participated in this study.

Data availability

The dataset used for the analysis with the data dictionary is available from the corresponding author Geeta Hitch at g.hitch@sussex.ac.uk upon reasonable request.

Ethics approval and consent to participate

The research was approved and consent to participate was obtained according to the Committee for Human Research Ethics and Publications of the Medical School Sciences, KNUST and Komfo-Anokye Teaching Hospital, CHRPE/RC/Oct/2017.

Funding

The research was conducted through the Harry Kroto Research Fellowship from the University of Sussex awarded to Geeta Hitch.

REFERENCES

1. WHO report on surveillance of antibiotic consumption: 2016-2018 early implementation. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.
2. Okeke IN, Lamikanra A. Edelman R. Socioeconomic and behaviour factors leading to acquired bacterial resistance to antibiotics in developing countries. Emerg Infect Dis. 1999;5(1) 18-27.https://doi.org/10.3201/eid0501.990103 PMID: 10081668.
3. Gebeyehu E, Bantie, Azage M. Inappropriate Use of Antibiotics and Its Associated Factors among Urban and Rural Communities of Bahir Dar City Administration, Northwest Ethiopia. PLoS One. 2015Sep17;10(9): e0138179. doi:10.1371/journal.pone.0138179. PMID: 26379031; PMCID: PMC4574735.
4. Center for Disease Dynamics, Economics & Policy. 2015. State of the World's Antibiotics, 2015. CDDEP: Washington, D.C. Available from https://cddep.org/publications/state_worlds_antibiotics_2015_executive_summary/[Accessed[Accessed 3 August 2020].
5. Laxminarayan R, Heymann DL. Challenges of drug resistance in the developing world. BMJ. 2012;344: pp. e1567–1567. https://doi.org/10.1136/bmj.e1567 PMID: 224910755
6. World Health Organization. Report on the Burden of Endemic Health Care- Associated Infection Worldwide. Geneva: World Health Organisation. 2011; pp.1-88.
7. WHO Library Global Action Plan on Antimicrobial Resistance. I. World Health Organization. 2015. ISBN 978 92 4 150976 3 https://www.who.int/antimicrobial-resistance/publications/global-action-plan/en/;[Accessed 3 August 2020]
8. The Antimicrobial Resistance (*AMR*) National Action Plan (*NAP*). Ministry of Health, Ghana, 2017-2021. https://www.moh.gov.gh/wp-content/uploads/2018/04/NAP_FINAL_PDF_A4_19.03.2018-SIGNED-1.pdf
9. Labi AK, Obeng-Nkrumah N, Nartey ET, Bjerrum S, Adu-Aryee NA. et.al. Antibiotic use in a tertiary healthcare facility in Ghana: a point prevalence survey. Antimicrob Resist Infect Control. 2018 Jan 26;7:15. doi: 10.1186/s13756-018-0299-z. eCollection 2018.PMID: 29423190

10. Donkor ES, Horlortu PZ, Dayie NT, Obeng-Nkrumah N, Labi AK. Community acquired urinary tract infections among adults in Accra, Ghana. Infect Drug Resist. 2019 Jul 11;12:2059-2067. doi: 10.2147/IDR.S204880. eCollection 2019.PMID: 31372013.
11. Asante K, Boamah E, Abdulai M, Buabeng K, Mahama E, Dzabeng F. et al. Knowledge of antibiotic resistance and antibiotic prescription practices among prescribers in the Brong Ahafo Region of Ghana; a cross-sectional study. BMC Health Services Research. 2017;17(1). doi: 10.1186/s12913-017-2365-2]
12. Yevutsey SK, Buabeng KO, Aikins M, Anto BP, Biritwum RB. et.al. Situational analysis of antibiotic use and resistance in Ghana: policy and regulation. BMC Public Health. 2017 Nov 23;17(1):896. doi: 10.1186/s12889-017-4910-7.PMID: 29169340
13. Ameko E, Achio S, Alhassan S. Effects of self-medication on the efficacy of four antibiotics commonly used in Ghana on clinically isolated micro-organisms. Int J Pure Appl Sci Technol. 2012;10(2):62–70.
14. Okoye V. Street Vendor Exclusion in "Modern" Market Planning: A Case Study from Kumasi, Ghana. WIEGO Resource Document No. 15. Manchester, UK: WIEGO. 2020.
15. Jifar A and Ayele Y. Assessment of Knowledge, Attitude, and Practice toward Antibiotic Use among Harar City and Its Surrounding Community, Eastern Ethiopia. Interdiscip Perspect Infect Dis. 2018;1-6. Doi: https://doi.org/10.1155/2018/8492740
16. McNulty CA, Boyle P, Nichols T, Clappison P, Davey P. J Antimicrob Chemother. The public's attitudes to and compliance with antibiotics, Journal of Antimicrobial Chemotherapy, Volume 60, Issue suppl_1, 1 August 2007, i63–i68, doi:10.1093/jac/dkm161
17. Andre M, Vernby A, Berg J, Lundborg CS. A survey of public knowledge and awareness related to antibiotic use and resistance in Sweden. J Antimicrob Chemother 2010;65.1292–1296. doi: 10.1093/jac/dkq104 PMID: 20360063)
18. Perneger T, Courvoisier D, Hudelson P. and Gayet-Ageron A. Sample size for pre-tests of questionnaires. Quality of Life Research. 2014;24(1)147-151. doi: 10.1007/s11136-014-0752-2
19. Pereko D, Lubbe M, Essack S. Public knowledge, attitudes and behaviour towards antibiotic usage in Windhoek, Namibia. Southern African Journal of Infectious Diseases. 2019;30: 4134-137. http://dx.doi.org/10.1080/23120053.2015.1107290
20. Schröder W, Sommer H, Gladstone B, Foschi F, Hellman J, Evengard, B. et al. Gender differences in antibiotic prescribing in the community: a systematic review and meta-analysis. J Antimicrob Chemo. 2016;71(7): 1800-1806. https://doi.org/10.1093/jac/dkw054
21. Grigoryan L, Burgerhof JG, Haaijer-Ruskamp FM. et al. Is self-medication with antibiotics in Europe driven by prescribed use? J Antimicrob Chemother. 2007;59(1): 152-6. https://doi.org/10.1093/jac/dkl457
22. Ramchurren K, Balakrishna Y, Mahomed S. Patients' knowledge, attitudes and practices regarding antibiotic use at a regional hospital in KwaZulu-Natal, South Africa. 2017. Southern African Journal of Infectious Diseases 2018;0(0): pp. 1–6 https://doi.org/10.1080/23120053.2018.1516393
23. Shah S, Ahmad H, Rehan R, Najeeb S, Mumtaz M, Jilani M, Rabbani M, Alam, M, Farooq S and Kadir M. Self-medication with antibiotics among non-medical university students of Karachi: a cross-sectional study. BMC Pharmacol Toxicol, 2014.15(1). DOI: 10.1186/2050-6511-15-74.
24. Belkina T, Al Warafi A, Hussein Eltom, E. et al. Antibiotic use and knowledge in the community of Yemen, Saudi Arabia, and Uzbekistan. J Infect Developing Countries. 2014;8(4):424–429. doi: 10.3855/jidc.3866.
25. Ankrah D, Hallas J, Odei J. et al. A review of the Ghana National Health Insurance Scheme claims database: possibilities and limits for drug utilization research Basic Clin Pharmacol Toxicol. 2019;124.18–27. DOI: 10.1111/bcpt.13136
26. Alhassan R, Nketiah-Amponsah E. and Arhinful D. A Review of the National Health Insurance Scheme in Ghana: What Are the Sustainability Threats and Prospects? PLOS ONE. 2016;11(11): e0165151.https://doi.org/10.1371/journal.pone.0165151
27. Country statistics and global health estimates by WHO and UN partners Global Health Observatory Updated January 2015.

https://www.who.int/gho/countries/gha.pdf?ua=1. [Accessed July 2020]
28. Salm F, Ernsting C, Kuhlmey A, Kanzler M, Gastmeier P. and Gellert P. Antibiotic use, knowledge and health literacy among the general population in Berlin, Germany and its surrounding rural areas. PLOS ONE. 2018;13(2):e0193336
29. WHO The 9th Global Conference on Health Promotion: Mandate for Health Literacy https://www.who.int/healthpromotion/health-literacy/en/ [Accessed 29 March 2020]
30. UNICEF DATA. Gender and education - UNICEF DATA. 2019. [online] Available at: https://data.unicef.org/topic/gender/gender-disparities-in-education/ [Accessed 29 March. 2020].
31. Azanu D, Styrishave B, Darko G, Weisser JJ, Abaidoo RC. Occurrence and risk assessment of antibiotics in water and lettuce in Ghana. Sci Total Environ. 2018 May 1;622-623:293-305. doi: 10.1016/j.scitotenv.2017.11.287. Epub 2017, Dec 13. PMID: 29216470.
32. WHO estimates survey. World Malaria Report 2018. https://www.who.int/malaria/publications/country-profiles/profile_gha_en.pdf [Accessed July 2020]
33. Andrews W, Tetteh ML, Mensah KO, Boadu KP, Thomford MO. et.al. Clinical Evaluation of the Safety and Effectiveness of Adutwumwaa Malamix: A Polyherbal Product for the Treatment of Uncomplicated Malaria in Ghana. Journal of Applied Pharmaceutical Science, July, 2017. Vol. 7 (07), pp. 040-045, Available online at http://www.japsonline.com DOI: 10.7324/JAPS.2017.70706 ISSN 2231-3354
34. Tetteh AW, Thomford KP, Mensah ML, Boadu KO, Thomford AK, Amposah IK. et al. Ghanaian herbal medicines for malaria: An evaluation of the clinical safety and effectiveness of "Time Herbal Mixture" in uncomplicated malaria. Phcog Res 2020;12:71-5.
35. Adusei1 C. and Agambire R. Insights into Supply Chain Management of Herbal Medicine in Ghana. Asian Journal of Advanced Research and Reports 6(3):1-11, 2019; Article no.AJARR.51678 Qualitative DOI: 10.9734/AJARR/2019/v6i330154
36. Gyasi RM, Siaw L, Mensah CM. Prevalence and pattern of traditional medical therapy utilisation in Kumasi metropolis and Sekyere south district, Ghana. Journal of Ethnopharmacology 161.2015. 38–146.