academicJournals

Vol. 11(25), pp. 1018-1026, 7 July, 2017
DOI: 10.5897/AJMR2017.8583
Article Number: C39733765079
ISSN 1996-0808

http://www.academicjournals.org/AJMR

African Journal of Microbiology Research

Full Length Research Paper

Community knowledge and attitudes on antibiotic use in Moshi Urban, Northern Tanzania: Findings from a cross sectional study

Goodluck Mbwambo[1], Basiliana Emidi[1,2], Maseke R. Mgabo[1,3], Geofrey Nimrod Sigalla[1,4] and Debora C. Kajeguka[1]*

[1]Kilimanjaro Christian Medical University College, P.O. Box 2240, Moshi, Tanzania.
[2]National Institute for Medical Research, Headquarters, P.O. Box 9653, Dar es Salaam, Tanzania.
[3]Institute of Rural Development Planning, P.O. Box 138, Dodoma, Tanzania.
[4]Evangelical Lutheran Church in Tanzania, P.O. Box 3033, Arusha, Tanzania.

Received 8 May, 2017; Accepted 29 June, 2017

There is increasing and spread of antibacterial resistance to antibiotics worldwide. The level of knowledge and attitudes of the community regarding the use of antibiotics in Tanzania is unknown. The present study identified determinants of knowledge and attitudes regarding antibiotics use in Moshi Urban district, Northern Tanzania. A cross-sectional study was conducted from April to June 2016 among community members whereby information was collected by using questionnaires on a sample of 292 randomly selected respondents. Descriptive statistics and logistic regression analysis were used in data analysis to assess factors associated with knowledge and attitude towards antibiotic use. Out of 292 respondents, 183 (62.7%) had good knowledge regarding antibiotics use while those with adequate attitude were 255 (87.3%). Respondents with no formal education, primary and secondary education had lower odds of having good knowledge regarding antibiotics use as compared to those with higher education degree (OR=0.04, 95%CI: 0.002-0.79), (OR=0.38, 95% CI: 0.14-0.97), and (OR=0.42, 95% CI: 0.16-1.06), respectively. Respondents with good knowledge regarding antibiotics use had higher odds of having adequate attitude towards antibiotic use (OR=3.16, 95% CI: 1.49-6.70). It was concluded that knowledge and attitude regarding antibiotic use is fair. Therefore, these findings are important in strategizing targeted antibiotic awareness campaigns among population.

Key words: Community, knowledge, practices, antibiotic, Tanzania.

INTRODUCTION

Antibiotic resistance is a growing global problem of public health importance (WHO, 2014). In 2014, World Health Organization (WHO) reported that in many countries where there is a high rate of antimicrobial resistance,

*Corresponding author: E-mail: dkajeguka@gmail.com.

common infections are documented in communities and health facilities. Despite these alarming reports, there is a global consensus that the prevalence of antimicrobial resistance is under reported and therefore continuous surveillance is instituted in many countries, Tanzania included (WHO, 2015). The WHO Global action on antimicrobial resistance plan recognizes the role of societies in causing antibiotic resistance. Included in the list of possible causes of antibiotic resistance are the acts of inappropriate use of medicines that include failure to complete treatment, skipping of doses, re-use of leftover medicines, and overuse of antibiotics (Hemo et al., 2009). The root cause is the lack of knowledge on appropriate use of antibiotic that may collectively promote selection and dissemination of antibiotic resistant bacterial strains.

The two main dispensing points for medicines in Tanzania are either the pharmacies (which are located in health facilities) and/or the drug-specific retailers. The former, usually operate under prescription-only policy and institutes strict control in the dispensing of medication including antibiotics. Medicines are more available to communities in the drug-specific retailers through the prescription-only and over-the-counter dispensing mechanisms (Battersby et al., 2003). The Tanzania Food, Drugs and Cosmetics Act (TFDA, 2003) has done recommendable efforts through the Tanzania's accredited drug dispensing outlet (ADDO) program in training dispensers followed by regulation to achieve quality standards (Alba et al., 2010; Rutta et al., 2015), and registered over 3,500 functioning ADDOs in 2013 (HSSP-IV, 2015).

However, current and previous studies have indicated that infringement of policies although reduced, are still very common (Chalker et al., 2015; Goodman et al., 2007). A recent community based study on antimicrobial use among 1,200 household done by Chalker et al. (2015) indicated that ADDOs were the more convenient source of medicines by most community members but such sourcing was associated with poor ADDOs dispensing practices and over use or incomplete dosages of antimicrobials in response to incorrect public demand (Chalker et al., 2015). Inappropriate antimicrobial selling was common, for example, more than one-third of requests by investigators who presented as "mystery shoppers" with acute respiratory infection were approved and also, 85% of prescription-only antimicrobials were sold just on verbal requisition. In these circumstances, the role of consumers as final regulators for the antibiotic use becomes a priority.

The community plays an important role in antibiotic resistance; either worsening or improving the condition and its is necessary to understand their antibiotic use knowledge and attitude and if any educational needs exist (Napolitano et al., 2013). The report on situation analysis and recommendation of antibiotic use and resistance in Tanzania recognizes community to be responsible for antibiotic resistance through irrational use but also as an important pillar if used as an opportunity for interventions to avert the situation (GARP-Tanzania, 2015). If the community could have correct knowledge, right attitude and good practice in antibiotic use, they could make it possible for reduction and even prevention of antibiotic resistance. Several factors that are associated with public knowledge regarding antibiotics use have been reported to be demographic characteristics, including gender (Barah and Gonçalves, 2010; Chang et al., 2012; You et al., 2008), age (Barah and Gonçalves, 2010), education level (Barah and Gonçalves, 2010; You et al., 2008), family income (Barah and Gonçalves, 2010; You et al., 2008) and place of residence (Mouhieddine et al., 2015). Moreover, social demographic characteristics and culture has been linked with practices towards antibiotics (Touboul-Lundgren et al., 2015), thus referred to as possible explanations of persistent differences in antibiotic consumption between countries. Appropriate knowledge can improve behaviors and thus influence culture on antibiotic use (Touboul-Lundgren et al., 2015).

However, there is little evidence on the level of community knowledge and attitude regarding antibiotics use in Tanzania. Such information is important in designing future interventions needed to improve rational antibiotic use and ultimately restrain the dissemination of antibiotic resistance. Therefore, the aim of the study was to identify determinants of knowledge and attitudes regarding antibiotics use in Moshi Urban district, Northern Tanzania.

METHODOLOGY

Study settings, design, population sample and sampling

This was a cross sectional community based study. The study was conducted from April to June 2016. The study was conducted in Moshi urban district in Kilimanjaro region, which is located in Northern Tanzania. Moshi Urban is one of the 7 districts forming Kilimanjaro region. Moshi urban has a population of 184,292 people with annual population growth of 2.8% (PHC, 2013). Pharmacies and ADDOs are easily accessible within the area. The ADDOs convenient location with no waiting queue makes it easier for the community to have greater access to antibiotics outside health care centers.

For sample size calculation, the knowledge should be 76% (Auta et al., 2013) in the population. This has been assumed from literature review: $N = [Z^2 P(1-P)]/(d^2)$; N is the required sample, Z is the confidence level at 95% (1.96), P is the prevalence of 0.76, d = Margin of error at 5% (0.05). Non-response correction = 10%. Therefore, N = 273 + 10% of 273 = 300.

A multistage cluster sampling was employed. Moshi municipal council has 21 wards. Six wards were randomly selected. In each ward two villages were then randomly selected to obtain 12 villages. In each village, a total of 25 households were selected randomly using rotary method. From each household, an adult individual (the head of the household or in his/her absence the next responsible person) was contacted and given an explanation about the purposes of the research. A total of 292 respondents agreed to be interviewed. The response rate was 97.3%. Participants' aged 15 to 70 years were included considering that those in the age

group make their own decision in caring for their health, including seeking medical care and antibiotics use. Females 174 (59.6%) were more than men 118 (40.4%).

Data collection methods

Questionnaire development and structure

Selected household were visited and face-to-face interview was conducted using a structured questionnaire as previously described (Auta et al., 2013; Azeem et al., 2014; Pereko et al., 2015) with few modification. The questionnaires were divided into three parts. Part 1: recorded the respondent's socio-demographic characteristics such as age, sex, occupation, level of education, income per month and residence. Part 2, comprised nine questions that provided information about respondent's knowledge on antibiotics and antibiotics use. It included the following guestions: "aspirin is antibiotic", "piriton is antibiotic", "ampicillin is antibiotic", "paracetamol is antibiotic", "antibiotics are used to stop fever", "antibiotic are used to relieve pain", "antibiotics can cure all infections", "antibiotic can kill bacteria" and "antibiotic can kill viruses". Part 3 assessed attitudes and practice of respondents towards antibiotics use. Respondent was asked: "If my family member is sick", "I usually share my antibiotics with them", "I can stop taking a full dose of antibiotics if your symptoms are improving", "it is good to keep leftover antibiotics at home in case of future need", "it would be good to purchase antibiotics in pharmacies without prescription", "unnecessary use of antibiotics makes them ineffective", "when I visit a doctor sick enough with cold I usually expect an antibiotic", "when I have a fever I should always take an antibiotic to feel better", and "when I have cold, I should always take an antibiotic to feel better".

The antibiotic knowledge score was calculated as a discrete variable by summing the respondent's number of correct responses. Nine questions were asked, which were used to measure knowledge. One point was awarded for each correct response (Yes or No, for correct question), and zero for each wrong or uncertain response, with a maximum obtainable correct score of nine for each respondent. The knowledge score was categorized into two levels indicated by poor (0-4) and good (5-9).

The attitude and practice scores were calculated as a discrete variable by summing the participant's number of appropriate responses to 8 statements. One point was awarded for each appropriate response (Agree or Disagree, for correct statement); and zero was awarded to each wrong answer. The attitude and practices score was categorized into two levels indicated by not adequate (0-3) and adequate (4-8). The method used for knowledge score and attitudes was adopted from Awad and Aboud (2015).

Pre-testing of the questionnaire

The questionnaire was pretested for readability and ease of understanding among 10 community members. Their data was not used in the study. Face and content validation of the measuring instrument was done by analyzing the data obtained from the community members and corrections was done where appropriate. The pretested questionnaire was administered to community member.

Data analysis

Data was entered into MS excel sheet, then transferred to Statistical Package for Social Sciences (SPSS) version 22.0. Descriptive statistics were used to summarize demographic characteristics variables. During Bivariate logistic regression analysis variables associated with knowledge and attitude at a level of significance $p < 0.1$ were entered into the final model of the multivariate logistic regression analysis, which was used to compute adjusted odds ratio (AOR) and 95% confidence intervals (95% CI) to assess the independent associations of these variables with outcome of interest (knowledge and attitude). Since a multistage cluster sampling technique was used in our study, a Generalized Estimating Equations (GEE) model was used in our analysis to adjust for the design effect. A $p < 0.05$ was considered significant.

RESULTS

Socio-demographic characteristics of the studied population

The characteristics of the respondents are summarized in Table 1. Out of 292 respondents included in this study, most 111 (38.0%) were from the age group 21-30 years and female were more represented 174 (59.6%) than male. Most respondents had completed at least the primary level of education 142 (48.6%), while married respondents were more represented 145 (49.7%). Most respondent had income per month of less than 240,000/= Tanzanian Shillings 223 (76.4%). Majority of respondents were engaged in business 139 (47.6). No information was gotten on the characteristics of non-respondents 8 (2.6%). Conversely, the respondents are representative of the whole population.

Respondents' knowledge regarding antibiotics use

When assessing the level of knowledge amongst the respondents, 183 (62.7%) had good knowledge while 109 (37.3%) had poor knowledge of antibiotics use. Forty-eight of respondents (40.8%) correctly answered on the question "*aspirin is not antibiotic",* Less than half of respondent 126 (43.2%) correctly answered *"piriton is not antibiotic".* One hundred sixty eight (57.5%) correctly answered the question "*ampicillin is antibiotics"* while 71 (58.6%) correctly answered the question "*paracetamol is not antibiotics*", 140 (47.9%) answered no to the question *"antibiotics are used to stop fever*". Less than half 135 (46.2%) correctly answered the question that "*antibiotic are not used to relief body pain*". More respondent 228 (78.1%) answered no to the question that "*antibiotic cannot cure all infections*". 194 (66.4%) respondent correctly answered the question that "*antibiotics can kill bacteria*", and only 102 (34.9%) responded no to the question that *"antibiotics can kill viruses"* (Figure 1).

Respondents' attitude regarding antibiotics use

A total of 255 (87.3%) respondents had adequate attitude while 37 (12.7%) had inadequate attitude regarding antibiotics use. Figure 2 presents the respondent's

Table 1. Socio-demographic characteristics of respondents (N=292).

Variable	Frequency [n (%)]
Age in years	
15- 20	42 (14.4)
21- 30	111 (38.0)
31- 40	58 (19.9)
41-50	49 (16.8)
≥51	32 (11.0)
Sex	
Male	118 (40.4)
Female	174 (59.6)
Education levels	
No formal	5 (1.7)
Primary	142 (48.6)
Secondary	112 (38.4)
Higher education degree	33 (11.3)
Marital status	
Single	135 (46.2)
Married	145 (49.7)
Divorced	4 (1.4)
Widowed	8 (2.7)
Income (In Tanzania shillings -TZs)*	
<240,000	223 (76.4)
≥240,000	69 (23.6)
Occupation	
Peasant	48 (16.4)
Employee	71 (24.3)
∞Student	34 (11.6)
Business	139 (47.6)
Ward	
Pasua	55 (18.8)
Rau	51 (17.5)
Soweto	51 (17.5)
Longuo	71 (24.3)
Majengo	47 (16.1)
Mawenzi	17 (5.8)

*1USD equivalent to 2000 Tanzanian Shillings (TZs). ∞Secondary and college students.

attitude regarding antibiotics use. The responses were as follows: forty-nine (16.8%) of responded wrongly agreed that *"if my family member is sick, I usually share my antibiotics with them".* Over half of the respondents 239 (81.8%), dis-agreed on the statement that" *I can stop taking a full dose of antibiotics if your symptoms are improving".* Over half of the respondents 212 (72.6%) dis-agreed that *"it is good to keep leftover antibiotics at home in case of future need".* Two hundred and thirty nine (81.8%) respondents disagreed that *"it would be good to purchase antibiotics in pharmacies without prescription".* Most respondents 223 (76.4%) agreed *"unnecessary use of antibiotics makes them ineffective".* One hundred and seventy two (58.9%) respondents dis-agreed on the statement that *''When I visit a doctor, sick enough with cold I usually expect an antibiotic"*. Over half of respondent 168 (57.5%) ds-agreed on the statement *"when I have a fever I should always take an antibiotic to feel better",* and 176 (60.3%) dis-agreed that *"when I have cold, I should always take an antibiotic to feel better"*.

Factors associated with knowledge of antibiotics use

In univariate logistic regression analysis variables such as age, gender, marital status, occupation and education qualified for multivariate logistic regression analysis. Here only results for multivariate logistic regression and GEE analyses are presented. Respondents who had no formal education, primary and secondary education had lower odds of having good knowledge of antibiotics use compared to respondents who had higher education degree (OR=0.04, 95% CI: 0.002-0.79), (OR=0.38, 95% CI: 0.14-0.97), and (OR=0.42, 95% CI: 0.16-1.06), respectively. Other variables such as age, gender marital status and occupation were not statistically significant. After adjusting for potential cluster effect of wards, the results of the GEE model indicated that gender, marital status and education remained significant predictor for knowledge (Table 2).

Factors associated with attitude of antibiotic use

The multivariate logistic regression analysis revealed that two independent variables have a significant influence on the respondents' overall attitude towards use of antibiotics. Respondents who were students (secondary and college) had reduced odds of having adequate attitude than those who engaged in business (OR=0.16, 95%CI: 0.03-0.92). Respondents with good knowledge regarding antibiotics had higher odds of having adequate attitude towards antibiotic use (OR=3.16, 95%CI: 1.49-6.70). After adjusting for potential cluster effect of wards, the results of the GEE model indicated that gender, occupation, education and knowledge remained significant predictor for attitude (Table 3).

DISCUSSION

It was believed that this was the first baseline study of its kind to comprehensively determine knowledge, attitudes

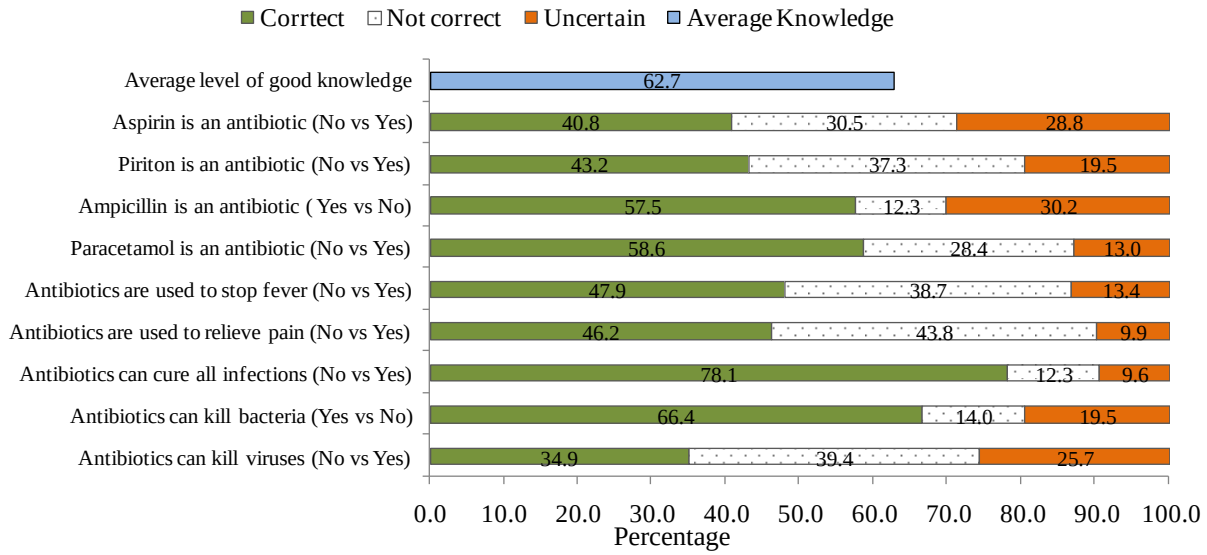

Figure 1. Respondents' knowledge regarding Antibiotics use.

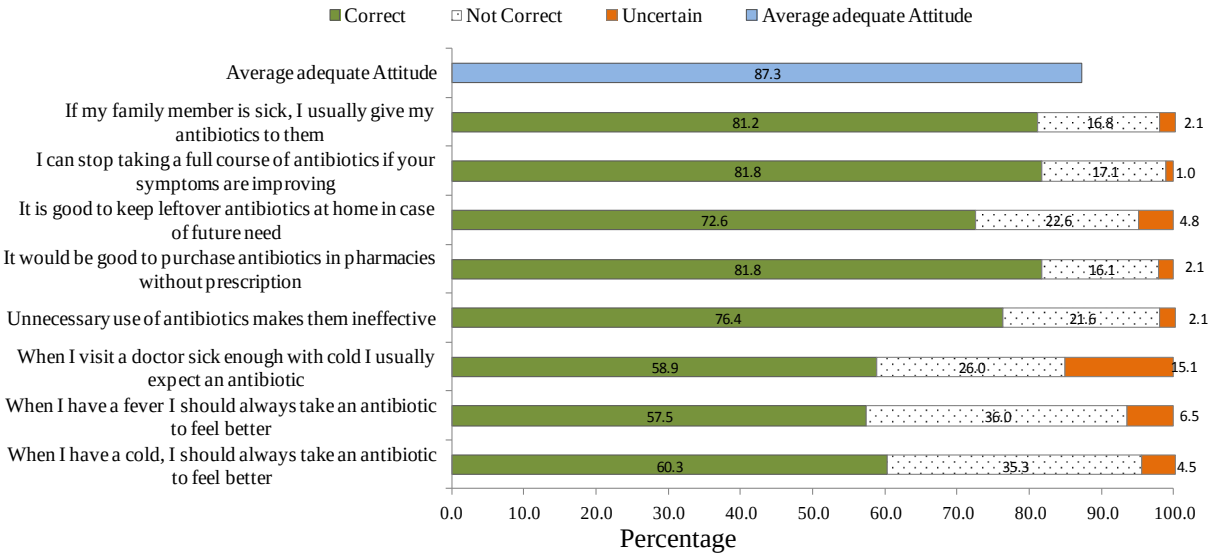

Figure 2. Respondents' attitude regarding Antibiotics use.

and practice regarding antibiotic use among community members in Moshi urban area. The information gathered from this study gives highlights of the areas that need attention regarding health promotion as well as knowledge and practices that require to be imparted to community for enhancing fight against antibiotic resistance in Tanzania. Additionally, the present study includes opinions so that we have an initial point of view when dealing with health in a comprehensive approach.

In this study, it was found that 62.7% of the study respondents had good knowledge of antibiotics use. Our findings were relatively lower compared to the study conducted in Hong Kong which reported adequate knowledge of 77% (You et al., 2008). Similar to what was documented in our study are the findings in Nigeria which reported a low level of knowledge regarding antibiotic use of 30.5% (Auta et al., 2013). In knowledge specific questions, more than 60% of the study population agreed that antibiotics are effective against bacteria, which is relatively the same with previously reported study in Namibia (Pereko et al., 2015) and lower than a study conducted in Kuwait (Awad and Aboud, 2015). It was found out that 87.3% of respondents had adequate attitude regarding the use of antibiotics. This is higher than what was found in a study conducted in Hong Kong that reported adequate attitude of 72% (You et al., 2008). In assessing respondents attitudes towards antibiotic use, 35.3% of respondents in this study agreed with the

Table 2. Factors associated with good knowledge on antibiotic use (N=292).

Variable	Good [n (%)]	Poor [n (%)]	Crude OR (95%CI)	P value	AOR ** (95%CI)	P value	GEE*** OR (95%CI)	P value
Age (years)								
15-20	28 (66.7)	14 (33.3)	0.66 (0.23-1.85)	0.42	0.84 (0.28-2.50)	0.76	0.84 (0.31-2.24)	0.73
21-30	64 (57.7)	47 (42.3)	0.45 (0.18-1.09)	0.08	0.59 (0.23-1.54)	0.28	0.59 (0.31-1.13)	0.11
31-40	37 (63.8)	21 (36.2)	0.58 (0.22-1.53)	0.21	0.65 (0.23-1.80)	0.41	0.65 (0.39-1.08)	0.10
41-50	30 (61.2)	19 (38.8)	0.52 (0.19-1.41)	0.23	0.67 (0.23-1.92)	0.46	0.67 (0.33-1.34)	0.26
≥51	24 (75.0)	8 (25.0)	1	-	1	-	1	-
Gender								
Male	68 (57.6)	50 (42.4)	0.69 (0.43-1.12)	0.10	0.63 (0.38-1.07)	0.09	0.63 (0.45-0.89)	0.009
Female	115 (66.1)	59 (33.9)	1	-	-	-	1	-
Marital status								
Single	69 (51.1)	66 (48.9)	0.14 (0.01-1.24)	0.07	0.14 (0.01-1.57)	0.11	0.14 (0.02-0.85)	0.03
Married	104 (71.7)	41 (28.3)	0.34 (0.04-3.03)	0.36	0.30 (0.02- 3.38)	0.33	0.30 (0.05-1.82)	0.19
Divorced	3 (75.0)	1 (25.0)	0.42 (0.20-9.36)	0.54	0.30 (0.01-8.30)	0.48	0.30 (0.01-6.70)	0.45
Widowed	7 (87.5)	1 (12.5)	1	-	1	-	1	-
Income (TZs)*								
<240,000	141 (63.2)	82 (36.8)	1.10 (0.63-1.92)	0.71	-	-	-	-
>240,001	42 (60.9)	27 (39.1)	1					
Occupation								
Peasant	35 (72.9)	13 (27.1)	1.51 (0.73-3.12)	0.22	2.06 (0.68-6.19)	0.19	2.06 (0.71-5.97)	0.18
Employee	43 (60.6)	28 (39.4)	0.86 (0.47-1.55)	0.60	1.63 (0.64-4.11)	0.29	1.63 (0.76-3.47)	0.20
∞ Student	16 (47.1)	18 (52.9)	0.49 (0.23-1.06)	0.07	1.76 (0.72-4.29)	0.21	1.76 (0.84-3.66)	0.12
Business	89 (64.0)	50 (36.0)	1	-	1	-	1	-
Education level								
No formal	1 (20.0)	4 (80.0)	0.09(0.09-0.95)	0.04	0.04 (0.002-0.79)	0.03	0.04 (0.005-0.34)	0.003
Primary	92 (64.8)	50 (35.2)	0.69(0.29-1.59)	0.32	0.38 (0.14-0.97)	0.04	0.38 (0.21-0.67)	0.001
Secondary	66 (58.9)	46 (41.1)	0.53(0.22-1.26)	0.14	0.42 (0.16-1.06)	0.05	0.42 (0.26-0.69)	0.001
Higher education degree	24 (72.7)	9 (27.3)	1	-	1	-	1	-

*TZs: Tanzania shilling. **OR have been adjusted for age, gender, marital status, Occupation and education. ***Generalized estimating equations model has been adjusted for the cluster effect of wards to knowledge. ∞Secondary and college student.

Table 3. Factors associated with adequate attitude toward antibiotic use (N=292).

Variable	Adequate [n (%)]	Not adequate [n (%)]	Crude OR (95%CI)	P value	AOR* (95%CI)	P value	GEE** OR (95%CI)	P value
Age (years)								
15-20	36 (85.7)	6 (14.3)	0.85 (0.22-3.33)	0.82	-	-	-	-
21-30	95 (85.6)	16 (14.4)	0.84 (0.26-2.74)	0.71	-	-	-	-
31-40	52 (89.7)	6 (10.3)	1.23 (0.32-4.75)	0.76	-	-	-	-
41-50	44 (89.8)	5 (10.2)	1.25 (0.31-5.08)	0.70	-	-	-	-
≥51	28 (87.5)	4 (12.5)	1	-	-	-	-	-
Gender								
Male	99 (83.9)	19 (16.1)	0.60 (0.30-1.20)	0.10	0.64 (0.30 -1.36)	0.27	0.66 (0.47-0.92)	0.01
Female	156 (89.7)	18 (10.3)	1	-	1	-	1	-
Marital status								
Single	115 (85.2)	20 (14.8)	0.82 (0.96-7.04)	0.81	-	-	-	-
Married	130 (89.7)	15 (10.3)	1.23 (0.14-10.76)	0.84	-	-	-	-
Divorced	3 (75.0)	1 (25.0)	0.42 (0.02-9.36)	0.50	-	-	-	-
Widowed	7 (87.5)	1 (12.5)	1	-	-	-	-	-
Income (TZs)								
<240,000/=	194 (87.0)	29 (13.0)	0.87 (0.38-2.02	0.70	-	-	-	-
> 240,001	61 (88.4)	8 (11.6)	1	-	-	-	-	-
Occupation								
Peasant	46 (95.8)	2 (4.2)	0.34 (0.06-1.68)	0.11	0.45 (0.08-2.36)	0.70	0.44 (0.20-0.97)	<0.001
Employee	63 (88.7)	8 (11.3)	0.31 (0.06-1.40)	0.12	0.37 (0.08-1.74	0.23	0.16 (0.06-0.42)	0.18
[∞]Student	24 (70.6)	10 (29.4)	0.10 (0.02-0.51)	0.006	0.16 (0.03-0.92)	0.04	0.36 (0.20-0.95)	0.03
Business	122 (87.8)	17 (12.2)	1		1		1	1
Education level								
No formal	5 (100)	0 (0.0)	-	-	-		-	
Primary	128 (90.1)	14 (9.9)	2.92 (1.11-7.70)	0.03	2.07 (0.67-6.43)	0.22	2.07 (1.022-4.23)	0.04
Secondary	97 (86.6)	15 (13.4)	2.06 (0.78-5.42)	0.12	1.88 (0.64-5.52)	0.25	1.88 (0.36-9.74)	0.45
Higher education degree	25 (75.8)	8 (24.2)	1		1		1	
Knowledge								
Good	169 (92.3)	14 (7.7)	3.22 (1.58-6.58)	<0.01	3.16 (1.49- 6.70)	0.003	3.16 (1.58-6.33)	0.001
Poor	86 (78.9)	23 (21.1)	1	-	1	-	1	-

*****OR have been adjusted for gender, occupation, education and knowledge. ******Generalized estimating equations model has been adjusted for the cluster effect of wards to attitude. [∞]Secondary and college student.

statements concerning the use of antibiotics for cold, this has also been documented elsewhere (Pavydė et al., 2015; Pereko et al., 2015). Also, in demonstrating misunderstanding among the public regarding the use of antibiotics for common infections, especially respiratory tract infections (Jose et al., 2013), which are usually self-limiting and do not require antibiotic treatment (Van der Velden et al., 2013).

In the present study, it was found that 16.8% of respondents agreed to give antibiotics to their family member when they feel sick. These findings revealed that there is a tendency of patients not to complete their antibiotic doses. Moreover, there are still a percentage of Moshi residents tending to share used leftovers of antibiotics with others thus subjecting the general population to the problem of antibiotics misuse. The same scenario although higher than what was reported in our findings, was found to be a common practices and attitude of antibiotic medication sharing (Auta et al., 2013; Yu et al., 2014). About 48% of respondents would give their antibiotics to their family members if they feel they have similar illness with theirs (Auta et al., 2013). Having the knowledge, adequate attitudes and good practices on antibiotics use would result into proper consumption of antibiotics and reduce antibiotics resistance. This will also reduce unnecessary expenses in the treatment of bacterial infections.

In the present study, it was found that 26.0% of respondent wrongly agreed and 15.1% of respondent were uncertain on the statement that “when I visit a doctor sick enough with cold I usually expect an antibiotic”. Several reports have shown that patient’s expectation is an important factor for antibiotic prescribing and that antibiotics are more likely to be prescribed under patient pressure (Auta et al., 2013; Kumar, 2003; Ong et al., 2007). It has also been indicated that physicians would like to meet patients’ expectation even though they feel antibiotics are unnecessary (Butler et al., 1998). This highlights the need for more studies in Northern Tanzania to examine the extent of antibiotic prescriptions even in situation where antibiotics are not required.

In multivariate logistic regression analysis, the study found that students (secondary and college students) had less odds of having adequate attitude. This indicates that lack of formal education on the subject in schools can be the contributing factors (Azevedo et al., 2009). Respondents with good knowledge of antibiotics use is associated with adequate attitude, which is in agreement with previous reported findings, where good or appropriate knowledge of antibiotics was identified to be a predictor for adequate attitude towards antibiotic use (Awad and Aboud, 2015; Kim et al., 2011; Lim and Teh, 2012).

This study has some associated limitations, which may need to be taken into considered when interpreting the findings of the present study. The inherent weakness of cross sectional study design also applies in this study where we fail to assume the causal inference of factors associated with knowledge and attitude towards antibiotic use. While health programs generally provide information on rational use of medications in Tanzania, respondents from this study are not isolated from the general public where such information is delivered. To conform to the information received, they may have provided socially desirable responses that in turn increased the level of knowledge of respondents and further underestimated the strength of association between different factors associated with antibiotic use. On the other hand, the diverse nature of interventions in regard to rational use of medication and the variation in terms of geographical areas where such interventions are implemented may hinder generalization of the results of the present study to other areas in Tanzania. The cut-off used in this study was arbitrary cut offs and the use of other cut-offs could have led to different results.

Conclusion

It was concluded that knowledge and attitude regarding antibiotic use is fair. Therefore, these findings are important in strategizing targeted antibiotic awareness campaigns among population. If no action is taken to create awareness and knowledge on antibiotics, antibiotic drug resistance might develop and spread among population. Regarding this challenge, policy on drug dispensing was suggested to be adhered to.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENTS

The authors wish to thank all the interviewees for their valuable contribution to this study. This forms a part of the undergraduate studies of GM who has received a scholarship from Tanzania Loan Board to pursue his Bachelor degree in Laboratory Health sciences. Ethical clearance to conduct this study was granted from the Kilimanjaro Christian Medical University College Research and Ethics committee. Permission to conduct the study was sought from Dean of Faculty of Medicine and course coordinator and later from Moshi Municipal Director. Goodluck Mbwambo is supported by Tanzanian Government through Tanzania Loan Board.

REFERENCES

Alba SS, Hetzel MW, Goodman CC, Dillip AA, Liana JJ, Mshinda HH, Lengeler CC (2010). Improvements in access to malaria treatment in Tanzania after switch to artemisinin combination therapy and the

introduction of accredited drug dispensing outlets - a provider perspective. Malar. J. 9(1):164.
Auta A, Banwat S, David S, Dangiwa DA, Ogbole E, Toranyiin AJ (2013). Antibiotics Use in Some Nigerian Communities:Knowledge and Attitudes of Consumers. Trop. J. Pharm. Res. 12(6):1087-1092.
Awad AI, Aboud EA (2015). Knowledge, Attitude and Practice towards Antibiotic Use among the Public in Kuwait. PLOS ONE 10(2):e0117910.
Azeem M, Tashani M, Barasheed O, Heron L, Hill-Cawthorne GA, Haworth E, Dwyer DE, Rashid H, Booy R (2014). Knowledge, attitude and practice (KAP) survey concerning antimicrobial use among Australian Hajj pilgrims. Infect. Disord. Drug Targets 14(2):125-132.
Azevedo MM, Pinheiro C, Yaphe J, Baltazar F (2009). Portuguese students' knowledge of antibiotics: a cross-sectional study of secondary school and university students in Braga. BMC Public Health 9:359.
Barah F, Gonçalves V (2010). Antibiotic use and knowledge in the community in Kalamoon, Syrian Arab Republic: a cross-sectional study. East. Mediterr. Health J. 16(5):516-521.
Battersby A, Goodman C, Abondo C, Mandike R (2003). Improving the Supply, Distribution and Use of Antimalarial Drugs by the Private Sector in Tanzania. Malaria Consortium.
Butler CC, Rollnick S, Pill R, Maggs-Rapport F, Stott N (1998). Understanding the culture of prescribing: qualitative study of general practitioners' and patients' perceptions of antibiotics for sore throats. BMJ 317(7159):637-642.
Chalker JC, Vialle-Valentin C, Liana J, Mbwasi R, Semali IA, Kihiyo B, Shekalaghe E, Dillip A, Kimatta S, Valimba R, Embrey M, Lieber R, Rutta E, Johnson K, Ross-Degnan D (2015). What roles do accredited drug dispensing outlets in Tanzania play in facilitating access to antimicrobials? Results of a multi-method analysis. *Antimicrobial resistance and infection control*. Antimicrob. Resist. Infect. Control 317(7159):637-642.
Chang Y, Fan MM, Fok C-M, Lok ZL, Ni M, Sin C-F, Wong K-K, Wong S-M, Yeung R, Yeung TT, Chow W-C, Lam T-H, Schooling CM (2012). Antibiotics nonadherence and knowledge in a community with the world's leading prevalence of antibiotics resistance: implications for public health intervention. Am. J. Infect. Control 40(2):113-117.
GARP-Tanzania (2015). Global antibiotic resistance Partnership: Situation Analysis and Recommendations: Antibiotic Use and Resistance in Tanzania. The GARP-Tanzania Working Group.
Goodman CA, Kachur SP, Abdulla S, Bloland P, Mills A (2007). Drug shop regulation and malaria treatment in Tanzania—why do shops break the rules, and does it matter? Health Policy Plan. 22(6):393-403.
Hemo B, Shamir-Shtein NH, Silverman BG, Tsamir J, Heymann AD, Tsehori S, Friedman NL (2009). Can a nationwide media campaign affect antibiotic use? Am. J. Manage. Care 15(8):529-534.
HSSP-IV (2015). Health Sector Strategic Plan-IV July 2015 - June 2020. Ministry of Health and Social Welfare United Republic of Tanzania. Available at: http://ehealth.go.tz/admin/rmo_materials/2.2. HSSP IV.pdf (accessed 02/08/16).
Jose J, Jimmy B, Mohammed Saif AlSabahi AG, Al Sabei GA (2013). A study assessing public knowledge, belief and behavior of antibiotic use in an Omani population. Oman Med. J. 28(5):324-330.
Kim SS, Moon S, Kim EJ (2011). Public knowledge and attitudes regarding antibiotic use in South Korea. J. Korean Acad. Nurs. 41(6):742-749.
Kumar S (2003). Why do general practitioners prescribe antibiotics for sore throat? Grounded theory interview study. BMJ 326(7381):138-138.
Lim KK, Teh CC (2012). A cross sectional study of public knowledge and attitude towards antibiotics in Putrajaya, Malaysia. South. Med. Rev. 5(2):26-33.
Mouhieddine TH, Olleik Z, Itani MM, Kawtharani S, Nassar H, Hassoun R, Houmani Z, Zein Z El, Fakih R, Mortada IK, Mohsen Y, Kanafani Z, Tamim H (2015). Assessing the Lebanese population for their knowledge, attitudes and practices of antibiotic usage. J. Infect. Public Health 8(1):20-31.
Napolitano F, Izzo MT, Giuseppe G di, Angelillo IF (2013). Public knowledge, attitudes, and experience regarding the use of antibiotics in Italy. *PLoS ONE* 8(12):e84177.
Ong S, Nakase J, Moran GJ, Karras DJ, Kuehnert MJ, Talan DA (2007). Antibiotic Use for Emergency Department Patients With Upper Respiratory Infections: Prescribing Practices, Patient Expectations, and Patient Satisfaction. Ann. Emerg. Med. 50(3):213-220.
Pavydė E, Veikutis V, Mačiulienė A, Mačiulis V, Petrikonis K, Stankevičius E (2015). Public Knowledge, Beliefs and Behavior on Antibiotic Use and Self-Medication in Lithuania. Int. J. Environ. Res. Public Health 12(6):7002-7016.
Pereko DD, Lubbe MS, Essack SY (2015). Public knowledge, attitudes and behaviour towards antibiotic usage in Windhoek, Namibia. S. Afr. J. Epidemiol. Infect. 30(4):27-29.
PHC (2013). Population and Housing Census-Tanzania. National Bureau Of Statistics: United Republic of Tanzania. Available at: www.nbs.go.tz/ (accessed 20/06/17).
Rutta E, Liana J, Embrey M, Johnson K, Kimatta S, Valimba R, Lieber R, Shekalaghe E, Sillo H (2015). Accrediting retail drug shops to strengthen Tanzania's public health system: an ADDO case study. J. Pharm. Policy Pract. 8(1):23.
TFDA (2003). The Tanzania food, drugs and cosmetics act. Available at: http://www.tic.co.tz/media/TFDA ACT.pdf (accessed 05/12/16).
Touboul-Lundgren P, Jensen S, Drai J, Lindbæk M (2015). Identification of cultural determinants of antibiotic use cited in primary care in Europe: A mixed research synthesis study of integrated design 'Culture is all around us'. BMC Public Health 15(1):908.
Van der Velden A, Duerden M, Bell J, Oxford J, Altiner A, Kozlov R, Sessa A, Pignatari A, Essack S (2013). Prescriber and Patient Responsibilities in Treatment of Acute Respiratory Tract Infections — Essential for Conservation of Antibiotics. Antibiotics 2(2):316-327.
WHO (2014). Antimicrobial resistance: Global Report on Surveillance. World Health Organiszation.
WHO (2015). Global Action Plan on Antimicrobial Resistance. World Health Organization.
You JHS, Yau B, Choi KC, Chau CTS, Huang QR, Lee SS (2008). Public knowledge, attitudes and behavior on antibiotic use: A telephone survey in Hong Kong. Infection 36(2):153-157.
Yu M, Zhao G, Lundborg CS, Zhu Y, Zhao Q, Xu B (2014). Knowledge, attitudes , and practices of parents in rural China on the use of antibiotics in children : a cross-sectional study. BMC Infect. Dis. 14(1):1-8.