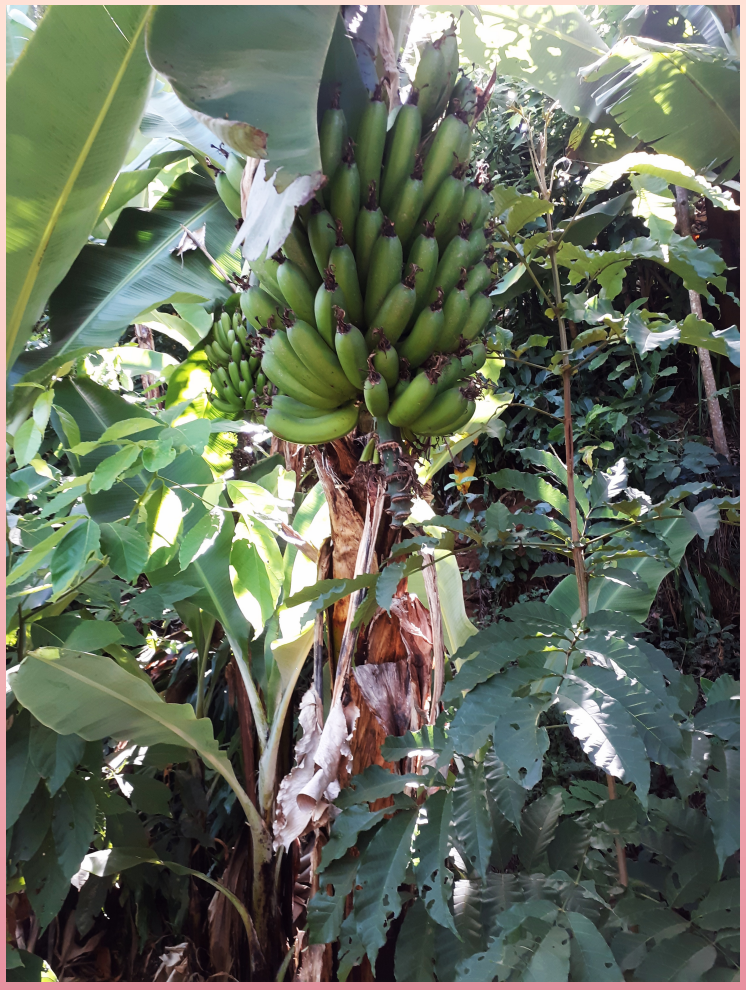
Mothers' Experience of Antibiotic Treatment to Children with Respiratory Tract Infections in Moshi, Tanzania

Cecilia Rosenlind

Degree Project in Medicine



UNIVERSITY OF GOTHENBURG

SAHLGRENSKA ACADEMY

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Programme in Medicine

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Abstract

Degree Project, Programme in Medicine

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Introduction: Antibiotic resistance is a serious threat to global health, leading to prolonged illnesses, increased mortality and higher medical expenses. Inappropriate antibiotic use is accelerating antibiotic resistance development. Previous studies have shown that antibiotics are used irrationally in many countries, including Tanzania.

Aim: To assess mothers' experience of antibiotic treatment to children with respiratory tract infections.

Methods: A cross-sectional study was conducted during March and April in 2019 at Reproductive and Child Health Clinic at the referral hospital Kilimanjaro Christian Medical Centre in Moshi, Tanzania. The study population was 182 mothers of children under five years of age. A questionnaire was used for data collection.

Results: More than half of the mothers (65%) said that the child had received antibiotics in the past year. The most common symptoms the child had the last time he or she received antibiotics were cough (87%), fever (70%), and stuffy/runny nose (70%). Approximately half of the children (46%) had rapid/difficult breathing, i.e. signs associated with pneumonia. The

great majority (92%) received a prescription from a doctor/nurse, and 87% completed the last antibiotic treatment. Around one fourth of the mothers (27%) had antibiotic stocks at home.

Conclusion: The results suggest that most mothers intend to use antibiotics rationally. Nevertheless, there seems to be a high level of antibiotic use and some children might receive antibiotics for non-bacterial conditions, such as common colds. Measures have to be taken to increase knowledge about antibiotic resistance and to ensure rational antibiotic use.

Key words: Antibiotics, antibiotic resistance, antibiotic use, Tanzania

Introduction

Antibiotics are medicines that are used to treat bacterial infections. *Antibiotic resistance* occurs when bacteria develop the ability to resist the effects of an antibiotic to which they used to be sensitive. According to the World Health Organization (WHO), antibiotic resistance is one of the major threats to global health, leading to longer illnesses, prolonged hospital stays, increased mortality, lack of protection for people undergoing surgery and higher medical expenses (1). Furthermore, antibiotic-resistant bacteria can spread from person to person (2). The problem of antibiotic resistance is constantly growing and there are poor prospects for the development of new types of antibiotics in the near future (3).

Global action plan

The WHO has developed a global action plan on antimicrobial resistance (1). *Antimicrobial resistance* is a broader term than antibiotic resistance, since it also includes resistance to medicines used to treat diseases caused by viruses, fungi and parasites. One of the objectives of the action plan is to improve the use of antibiotics among humans and animals. High antibiotic use is accelerating antibiotic resistance development. This is explained by the fact that antibiotics kill antibiotic-sensitive bacteria, allowing antibiotic resistant bacteria to reproduce (4, 5). Therefore, antibiotics should only be used when patients truly need them. Unfortunately, antibiotic prescriptions are seldom based on definitive diagnoses (6). In many countries, use of antibiotics is poorly regulated and it is often possible to buy antibiotics directly over the counter (7). Furthermore, a large proportion of antibiotic overuse is related to

animal production, where many healthy animals receive antibiotics as growth promoters and prophylaxis against infections (8).

National action plans

In the East African country Tanzania, a national action plan on antimicrobial resistance was published in 2017 (9). Several reports had shown that antibiotic resistance was a serious problem across the country and that there were high levels of incorrect antibiotic use in the human as well as the animal sector (10, 11). As a result, the Ministry of Health Community Development created a plan in line with the WHO global action plan on antimicrobial resistance (9). The national action plan addresses actions such as optimizing the use of antibiotics, preventing infections and raising awareness of antibiotic resistance. It also promotes surveillance of antibiotic resistance and antibiotic consumption in the country. Another objective of the national action plan is to support investment in new medicines, vaccinations and diagnostic equipment. These actions are needed in order to slow down antibiotic resistance development and limit the spread of antibiotic-resistant bacteria in Tanzania.

According to a report from the Global Antibiotic Resistance Partnership (GARP) Working Group in Tanzania, the aim is to reduce antibiotic use without jeopardizing animal or human health (10). One of the GARP Working Group's priorities is to rationalize antibiotic use in the society by reducing inadequate antibiotic use and increasing access to antibiotics in areas where needed. On one hand, antibiotics are essential medicines and access to antibiotics is

crucial to save lives. On the other hand, antibiotics have to be used correctly to prevent further resistance development. The GARP Working Group states: “We need to reach a balance where on one hand antibiotics are optimally available versus limiting unwarranted use on the other hand” (10, p. 4).

Antibiotic treatment of respiratory tract infections

It can be a challenge to know when it is appropriate to give antibiotics to children with respiratory tract infections. Children with bacterial pneumonia should be treated with antibiotics (12). Without proper antibiotic treatment, bacterial pneumonia can lead to death. Signs of bacterial pneumonia in children under five years old are fast breathing and/or chest indrawing (13). General danger signs, such as the child not being able to drink, persistent vomiting, convulsions, lethargic or unconscious, stridor or severe malnutrition, indicate severe pneumonia or very severe disease (13). However, children with cough or cold who do not have any signs of pneumonia most likely suffer from viral infection and should not receive antibiotic treatment (14).

Other examples of respiratory tract infections are acute bronchitis, croup (acute laryngo-tracheobronchitis), acute pharyngotonsillitis and acute laryngitis. Acute bronchitis, croup and acute laryngitis are caused by viruses and do not require antibiotic treatment (15). Pharyngotonsillitis is caused by viruses or bacteria, and only bacterial pharyngotonsillitis should be treated with antibiotics. Sings of bacterial pharyngotonsillitis are enlarged, tender cervical lymph nodes and a scarlet-like rash, or fever >38, severe laryngeal pain and absence

of cough and rhinitis (16). In Tanzania, respiratory tract infection diagnoses are mainly based on symptoms and clinical signs.

Another important infection affecting the respiratory system is tuberculosis (TB). It can be difficult to detect TB in children, since they often show atypical symptoms and it is hard to collect sputum from children (15). The diagnosis in children is based on several findings, such as clinical signs, history of contact with a TB-positive person, X-ray etc (15). TB is treated with several different medicines, including antibiotics (17).

Antibiotic misuse in Tanzania

Misuse of antibiotics is a major health problem in many countries, including Tanzania. A study carried out at hospitals in Moshi, Tanzania, showed that 80% of children with acute watery diarrhoea and 69% of children with common cold received antibiotics incorrectly (18). According to WHO guidelines, antibiotics should not be used in the treatment of acute watery diarrhoea and common cold (13, 19). Additionally, a majority of the children (79%) at the hospitals in Moshi were given inappropriate dosage (too high or too low dose according to the weight of the child) (18). These are alarming findings, since the development of antibiotic resistance is promoted by overuse of antibiotics, inadequate dosage and use of antibiotics in treatment of non-bacterial infections (4, 18).

Another study revealed that antibiotics were available in many unauthorized pharmacies in Moshi, Tanzania (20). The study was carried out at 14 part I pharmacies (pharmacies allowed to sell prescription-only medicines) and 15 part II pharmacies (pharmacies allowed to sell medicines for minor conditions, but no prescription-only medicines such as systemic antibiotics). Researchers went to the part II pharmacies and asked for an antibiotic named ciprofloxacin without showing a prescription. In contrast to drug sale guidelines, it was possible to buy ciprofloxacin without a prescription in all 15 part II pharmacies (20). These results suggest that there is an unregulated availability of antibiotics in Moshi, Tanzania. Furthermore, a study conducted at pharmacies in eight districts in Tanzania showed that only 51% of the antibiotics sold were relevant (21).

Antibiotic misuse in other countries

Other African countries are also struggling with antibiotic misuse. In southeastern Nigeria, it was found that the prevalence of unprescribed antibiotics in children under five years old in the management of upper respiratory tract infections was 76% (22). The misuse of antibiotics was more common in older children and among mothers with higher education. Moreover, a South African study showed that antibiotics were prescribed in more than half of the cases of acute bronchitis, even though guidelines say that acute bronchitis should not be treated with antibiotics (23). On the other hand, there is evidence of underuse of antibiotics in neighbouring countries. A study of children with fast-breathing pneumonia in rural Malawi showed that 9% had not been given antibiotics (24). The children with pneumonia who did not receive antibiotics had worse clinical outcomes than the ones who got the correct antibiotic treatment.

Differences in antibiotic use between different socio-economic groups

Previous research indicates that there is a difference in antibiotic use between different socio-economic groups. A study conducted in Tanzania revealed that level of public understanding of antimicrobials and their use increased with wealth status and education (25). People in wealthier households were five times more likely to have a higher knowledge of antimicrobials compared to those from poorer households. Moreover, those with completed primary education were three times more likely to have more knowledge than those with no or incomplete primary education. These data suggest that people with higher socio-economic status are more aware of when to use antibiotics compared to those with lower socio-economic status.

Underuse of antibiotics has been associated with lower socio-economic status. For instance, a study about healthcare for children in rural southern Tanzania showed that poorer parents were less likely to know the danger signs of pneumonia and less likely to bring their children to a healthcare facility, compared to wealthier parents (26). Additionally, children with poorer parents did not receive antibiotics for pneumonia as often as children with wealthier parents. These results suggest that children from lower socio-economic households in Tanzania do not get antibiotic treatment when they truly need it. This goes against the WHO Constitution, which states that everyone has right to the highest attainable standard of health regardless of ethnicity, religion, political belief or socio-economic status (27).

Antibiotic resistance in Tanzania

Just like in the rest of the world, antibiotic resistance is already a widespread problem in Tanzania. According to a study on pneumococcal carriage in healthy children in Moshi, Tanzania, pneumococcal isolates that were susceptible to penicillin using the standard dosing regimen decreased from 69% in 2013 to 47% in 2015 (28). This is worrying considering pneumococci are the most common cause of pneumonia and pneumonia continues to be the biggest killer worldwide of children under five years old (13). Nevertheless, susceptibility to amoxicillin and ceftriaxone among the isolated pneumococci was high, and penicillin can still be used for the treatment of the majority of pneumococcal infections in Tanzania (28). However, penicillin has to be given in higher doses and it is not first line treatment for more critical pneumococcal infections (28).

Several other studies have shown that antibiotic resistance is common in Tanzania. For instance, a study carried out on *Escherichia coli*-bacteria from drinking water in northern Tanzania revealed that 47% of the bacteria were resistant to one or more antibiotics (29). Another study from regional hospitals in Dar es Salaam showed that 35% of the patients were colonized with *Staphylococcus aureus* and that 25% out of them were carriers of methicillin-resistant *S. aureus* (MRSA) (30). Furthermore, it has been found that around 34% of the children in Dar es Salaam carry ESBL-producing bacteria (31). In other words, antibiotic resistance is already an established health problem in Tanzania.

Healthcare system and health status in Tanzania

The Tanzanian healthcare system has the structure of a pyramid (32). Primary healthcare services represent the basis of the pyramid, and include dispensaries and health centres. Dispensaries offer preventive and curative outpatient services, whereas health centres also admit patients and sometimes provide surgery. Next, council hospitals offer health care to referred patients and provide medical as well as basic surgical services. Thereafter, regional referral hospitals have specialist medical care, and, finally, zonal and national hospitals provide the most complex medical care. Medicines are provided through public and Faith Based Organizations' health facilities, private pharmacies and Accredited Drug Dispensing Outlets (32).

On the whole, health status in Tanzania is gradually improving. Life expectancy is increasing and the country has effectively reduced under-five and infant mortality (32). The total HIV prevalence has not changed, but an increasing number of HIV-patients are receiving treatment. Unfortunately, maternal and neonatal mortality have not declined as much as planned, and in many rural areas people are still living far away from health services. Additionally, people with lower socio-economic status are generally having poorer health status compared to wealthier people. Non-communicable diseases such as type two diabetes and cardiovascular diseases are slowly increasing among adults. Life expectancy at birth in Tanzania was 63 years for females and 60 years for men in 2012 (32). In 2015, child mortality was 81 per 1,000, with pneumonia, diarrhoea and malaria being major causes of death. Tuberculosis was another common disease among children as well as adults in Tanzania, and

there were many undetected cases. Data from 2014 showed that there were only 0.25 doctors per 10,000 inhabitants (32). In summary, health status in Tanzania is steadily getting better, but there is still a lot of room for improvement when it comes to access to quality healthcare services.

Moshi Municipality in the Kilimanjaro Region

The present study was carried out in Moshi, a municipality in the Kilimanjaro Region of Tanzania. Moshi Municipal had slightly more than 184,000 inhabitants in 2012 (33). The average household size was 3.9 persons, adult literacy rate was 98% and the enrolment rate in primary school was 95%. The most common occupations in Moshi Municipal were service worker and shop/stall sales worker. There is no rural component in Moshi Municipal. However, the rest of the Kilimanjaro Region is mainly rural, with 76% living in rural areas (33). The Kilimanjaro Region had a population of 1.6 million in 2012. Looking at the whole Kilimanjaro region, the literacy rate was lower compared to Moshi Municipal, and the main occupation was farming. However, the average household size and the enrolment rate to primary school were similar to the ones in Moshi Municipal (4.2 and 95%, respectively). Primary education was the most common level of education in The Kilimanjaro Region, with 81% of the population aged five years and above having primary school as the highest level of education. Only a few percent (2.4%) had studied at university level. The region had a young age structure and only 7% were aged 65 years and above (33).

Although some studies have examined the use of antibiotics in Tanzania, little is known about the antibiotic treatment of respiratory tract infections among young Tanzanian children. Furthermore, few studies have been done on how antibiotic consumption differs between people from different socio-economic classes.

Aim

The aim of the study was to assess mothers' experience of antibiotic treatment to children with respiratory tract infections in Moshi, Tanzania. Firstly, the study investigated whether antibiotics were used adequately to children below five years old with respiratory tract infections in Moshi, or if there was evidence of overuse or underuse, according to the mothers' own experiences. Secondly, mothers' strategies to provide their children with antibiotics were identified. Thirdly, the study examined if there were any differences in antibiotic consumption between children of highly educated mothers compared to children of mothers with lower education.

Material and Methods

A cross-sectional observational study was conducted during March and April in 2019 at the Reproductive and Child Health Clinic (RCHC) at Kilimanjaro Christian Medical Centre (KCMC) in Moshi, Tanzania. KCMC is a large referral hospital covering more than 15 million people in northern Tanzania. The study population was mothers of children under five years of age. Inclusion criteria were mothers attending the clinic for routine care such as vaccination of the child, antenatal care, postnatal care or family planning, mothers seeking

healthcare and mothers accompanying a relative or friend. The children were one month to five years of age. Exclusion criteria were mothers <18 years, and mothers unable to participate due to physical or psychical disabilities. If the mother had brought one child below five years to the clinic, that child was selected for data collection. If she had brought more than one child below five years, data was collected on the youngest child. Furthermore, if the mother had not brought any children to the clinic and had more than one child under five at home, the youngest child was selected for data collection.

The mothers were selected through convenience sampling. A nurse and a research assistant went from person to person in the waiting room at the RCHC. They gave brief information about the study and asked if the women fulfilled the inclusion criteria. Women who showed interest in participating and fulfilled the inclusion criteria received more detailed information. Written consent was obtained before they were enrolled in the study.

During the period of data collection, the total attendance at the RCHC was at least 963 women (total attendance numbers were counted on 13 out of 15 study days). Two hundred and seven of the women spoken to were eligible for participation. Out of these, 182 participated in the interview and were included in the analyses of the data. A flow chart of the recruitment procedure is shown in Figure 1. It was not possible to collect the exact number of eligible women. However, the vast majority of the women attending the clinic were asked if they fulfilled the inclusion criteria. The women usually spent many hours in the waiting room, which meant that the nurse or research assistant had time to talk to them about the study.

Many of the women did not fulfil the inclusion criteria since they were expecting the first child and consequently did not have a child between one month and five years of age.

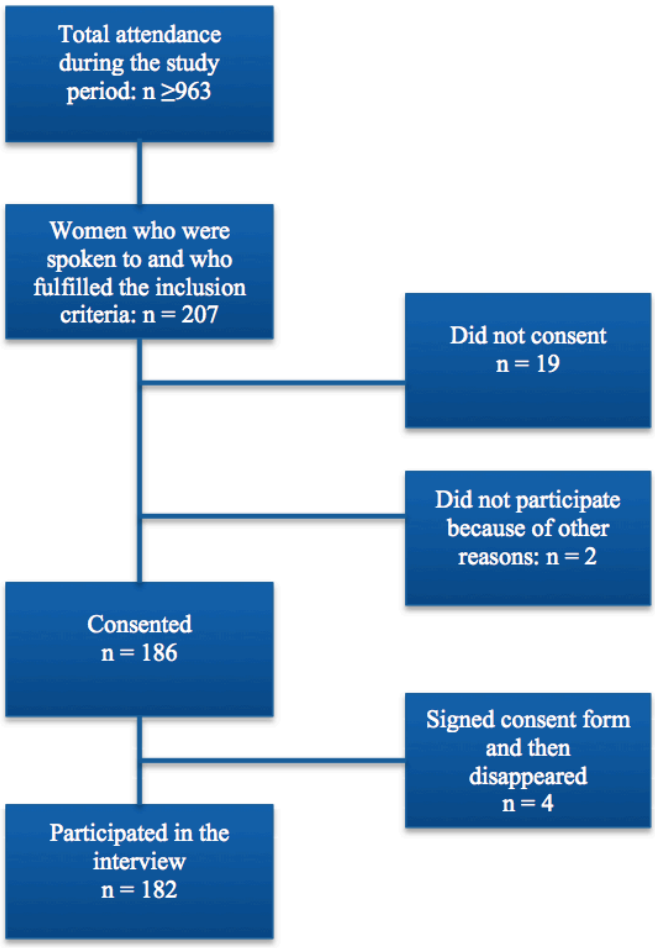

Figure 1. A flowchart of the recruitement procedure at the Reproductive and Child Health Clinic.

A questionnaire based on the WHO multi-country public awareness survey on antibiotic resistance was used with some modifications (34) (see appendix 1). The questions were in both English and Swahili. By assistance of a nurse and a research assistant, two Swedish medical students asked the questions to the mother and filled in the answers. The questionnaire was tested on six mothers of children under five years at the RCHC at KCMC before the sampling begun. Additionally, the questionnaire was back-translated from Swahili to English, and some sentences were adjusted.

The questionnaire had three parts: 1) background information, 2) antibiotic knowledge and 3) antibiotic use. In the first part, the questions were about income, occupation and education, as well as living conditions and health insurance. The second part investigated the mothers' knowledge about antibiotics and antibiotic resistance (this part of the questionnaire was mainly for my fellow student's study). In the third part, there were questions about how many times the child had received antibiotics for a respiratory tract infection over the last year, how the mother got hold of antibiotics, if the child had completed the last antibiotic treatment etc. Some of the questions about antibiotic use could either be correct or incorrect according to the WHO recommendations (34). According to the WHO, adequate antibiotic use include using antibiotics when prescribed by a certified health professional, taking the full prescription, not using leftover antibiotics and not sharing antibiotics with others (34).

The sample size was calculated based on the results from a previous study. In reference 14, the awareness of antimicrobial resistance was 40% with higher formal education compared to

20% in areas with lower education. With a power of 80% and a statistical significance level of 0.05, a sample size of 161 was estimated to be able to detect a difference between the groups. With an estimated dropout frequency of 10%, the number of mothers needed to be included was found to be 172.

Ethics

Ethical approval was sought and obtained from the local ethics committee in Moshi, Tanzania (KCMUCo research ethics and review committee), see appendix 3. The study was in line with the principles of the Helsinki Declaration. Full written consent was obtained from the participants prior to the study and all collected data was anonymous in order to attain confidentiality.

Statistical methods

The collected data was analysed using the statistic program SPSS (Statistical Package for the Social Sciences) version 25. Descriptive analyses such as frequency tables were made. In order to compare different groups, binary logistic regression analyses were performed. P-values <0.05 were considered significant.

Results

Characteristics of the Study Population

The characteristics of the study population are shown in Table 1. The median age of the mothers was 31 years (range 18-46), whereas the median age of the children was 17 months (range 1-59). The main reasons for the mothers to attend the clinic were antenatal care (37%), postnatal care (24%) and immunization of the child (20%). Most of the mothers (74%) lived in an urban area and only a few had never been to school. Almost half of the participants (45%) had studied at college or university. Most of the mothers were self-employed (45%), for example running a small business, or employed (40%). Additionally, 63% said that the family had a health insurance, which indicates a higher socio-economic status.

When it came to household monthly income, the median was 400,000 Tanzanian shillings (TZs) (range 10,000-5,000,000 TZs), which corresponded to 170 US dollars (USD). The mean household monthly income was 610,000 TZs, which can be compared to national data of the Tanzania Mainland, where the mean household monthly income was 51,000 TZs in 2007 (more recent data is unavailable) (35). Thirteen percent of the mothers (n = 24) lived on less than 1.90 USD per day (= 57.95 USD/month = 133,000 TZs/month), and were thus considered to be living in extreme poverty, according to The World Bank (36).

Table 1. Characteristics of the mothers participating in the interview (n = 182).

Characteristic	***N (%)***
Reason for attending clinic	
Antenatal care	68 (37.4)
Postnatal care	44 (24.4)
Immunization of the child	37 (20.3)
Family planning	4 (2.2)
Other[I]	29 (15.9)

Best description of living area	
Urban	134 (73.6)
Rural	46 (25.3)
Do not know	2 (1.1)
Education mother	
Never been to school	3 (1.6)
Some primary school	0 (0)
Completed primary school	41 (22.5)
Secondary school	57 (31.3)
University or college	81 (44.5)
Current occupation mother	
Self-employed[2]	82 (45.1)
Employed	72 (39.6)
Unemployed	19 (10.4)
Student	7 (3.8)
Other	2 (1.0)
Health insurance in the family	114 (62.6)
Medical background mother	16 (8.8)
Gender of child	
Female	96 (52.7)
Male	86 (47.3)
Number of children in household	
1	72 (39.6)
2	57 (31.3)
≥3	43 (29.0)
Number of children under five in household	
1	144 (79.1)
2	37 (20.3)
3	1 (0.5)
Number of rooms in home	
1	7 (3.8)
2-3	82 (45.0)
4-5	53 (29.1)
≥6	40 (21.8)
Number of rooms used for sleeping	
1	36 (19.8)
2	61 (33.5)
≥3	85 (47.2)
Income categories in TZs (USD)[3]	

<200,000 (<87.1)	30 (17.8)
200,000-399,999 (87.1-169)	51 (30.2)
400,000-599,999 (170-259)	31 (18.3)
600,000-799,999 (260-349)	14 (8.3)
800,000-999,999 (350-429)	8 (4.7)
≥1,000,000 (≥430)	35 (20.7)

[1] Check-up, escorting someone, abdominal pain, lab results etc.
[2] Small business (selling clothes, tailoring, running a small shop etc), farming/livestock keeping etc.
[3] Thirteen participants did not answer the question about income.

Antibiotic Use

Sixty-five percent (n = 119) of the mothers stated that the child had received antibiotics for a respiratory tract infection in the past 12 months. The median number of times the child had taken antibiotics in the past 12 months was 2.5 times (range 1-15 times). Fifteen percent reported that the child had taken antibiotics against a respiratory tract infection in the last week, 17% in the last month and 27% in the last six months (Fig 2). Thirty-five percent said that the child had never taken antibiotics.

The mothers were asked about which symptoms the child had the last time he or she received antibiotics for a respiratory tract infection, and the results are shown in Fig 3. Common symptoms were cough (87%), fever (70%), stuffy or runny nose (70%), and sore throat (23%). Approximately half of the mothers (46%) said that the child had rapid or difficult breathing, i.e. signs associated with pneumonia, which usually demands antibiotic treatment. Only 9.3% said that the child had chest indrawings, also associated with childhood pneumonia. Other symptoms mentioned were chest pain, flu, pain when breathing, vomiting, tiredness and loss of appetite, enlarged lymph nodes, sneezing, and stomach pain.

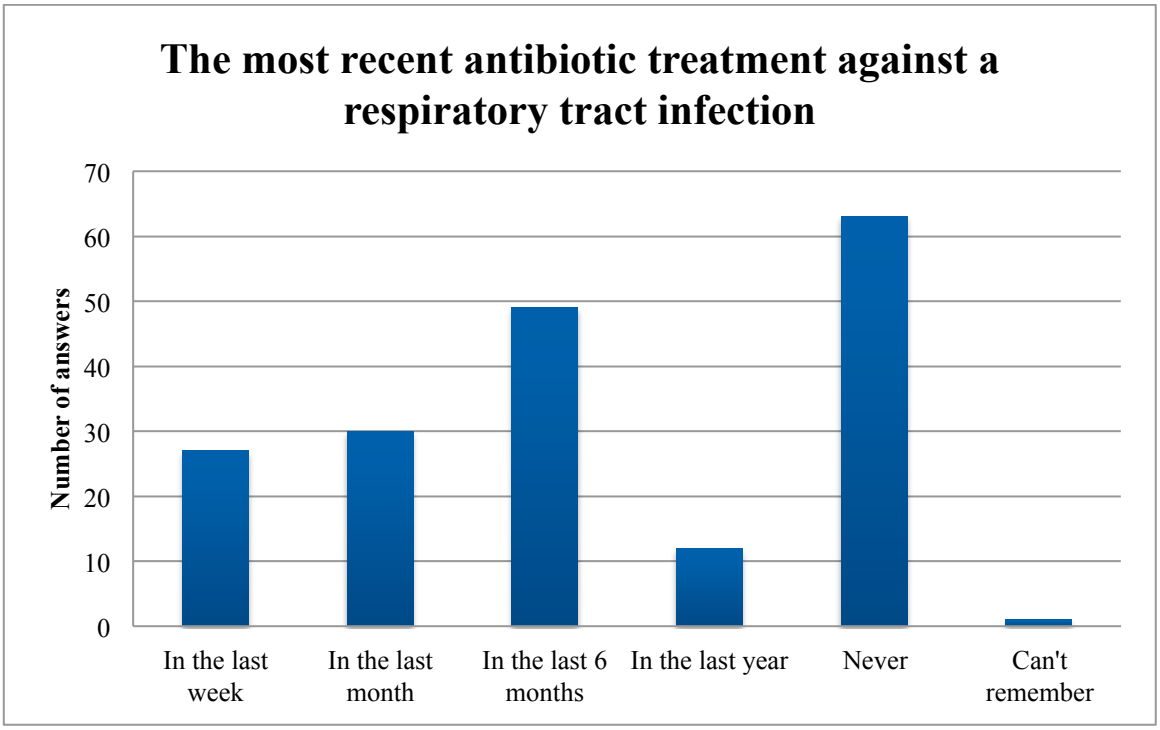

Figure 2. The most recent antibiotic treatment the child received against a respiratory tract infection (n = 182).

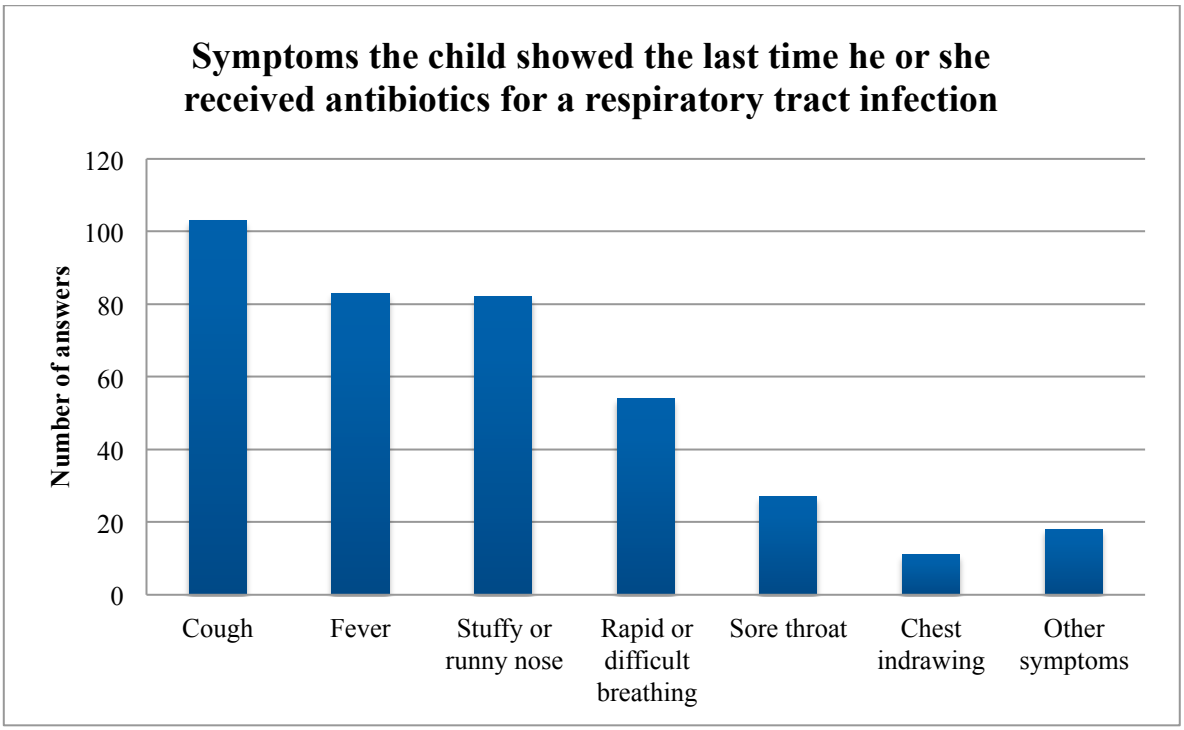

Figure 3. Symptoms the child showed the last time he or she received antibiotics for a respiratory tract infection, according to the mother (n = 118). Sixty-four mothers did not answer because the child had not been treated with antibiotics in the past 12 months.

The great majority of the mothers (88%, n = 104) obtained the antibiotics at a health facility the last time the child was treated with antibiotics for a respiratory tract infection. Twelve percent (n = 103) got the antibiotics from a medical store or pharmacy. As shown in Fig 4, 92% received a prescription from a doctor or nurse and 93% got advice on how to take the antibiotics. Slightly fewer (86%) said that a doctor or nurse performed a physical examination of the child (Fig 4). In most of the cases, the child completed the antibiotic treatment (Fig 4). Only a few mothers said that the child had ever received antibiotics that belong to someone else (5.1%, n = 6) or leftover antibiotics (8.5%, n = 10).

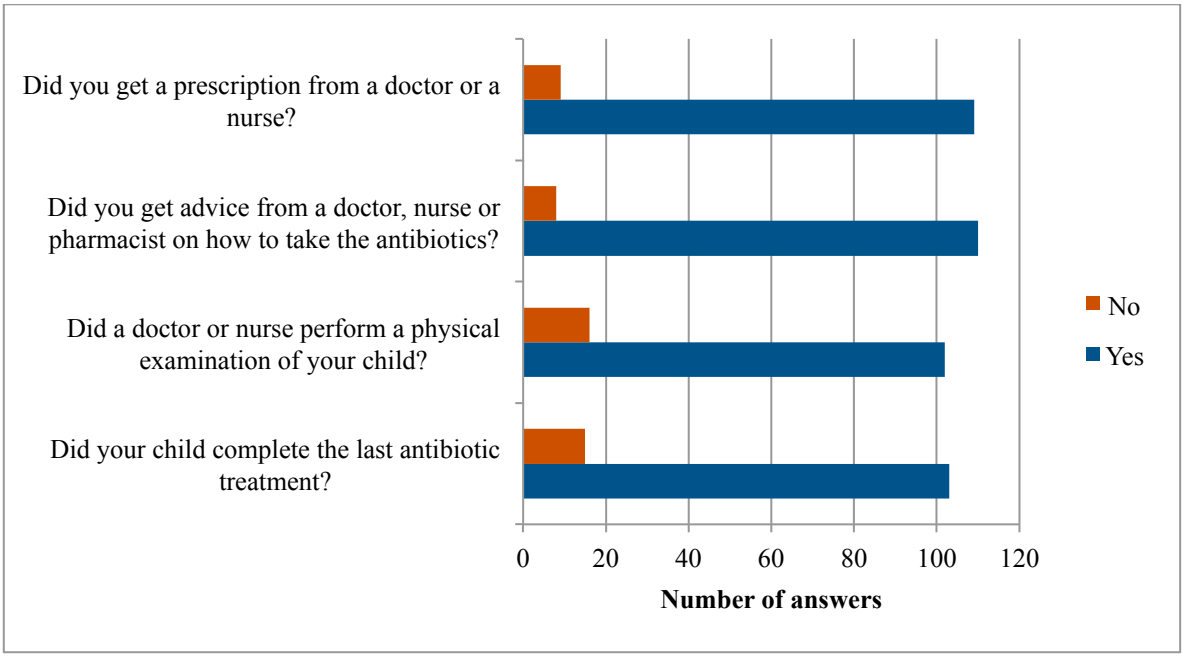

Figure 4. Information about the last time the child received antibiotics (n =118). Sixty four mothers did not answer because the child had not been treated with antibiotics in the past 12 months.

About one fourth (27%) of the mothers said that they had antibiotic stocks at home (Fig 5). Almost everyone (96%) claimed that they look at the expiration date of the antibiotic before they use it (Fig 5). Most mothers (87%) said that they would not stop the antibiotic treatment if the child were feeling better after half of the treatment (Fig 5). On the question of where the mothers would get hold of antibiotics, 95% said that they would go to a health facility to get a prescription and 12% claimed that they would go directly to a pharmacy (Fig 6). Some of the mothers sometimes went to the health facility and sometimes directly to the pharmacy.

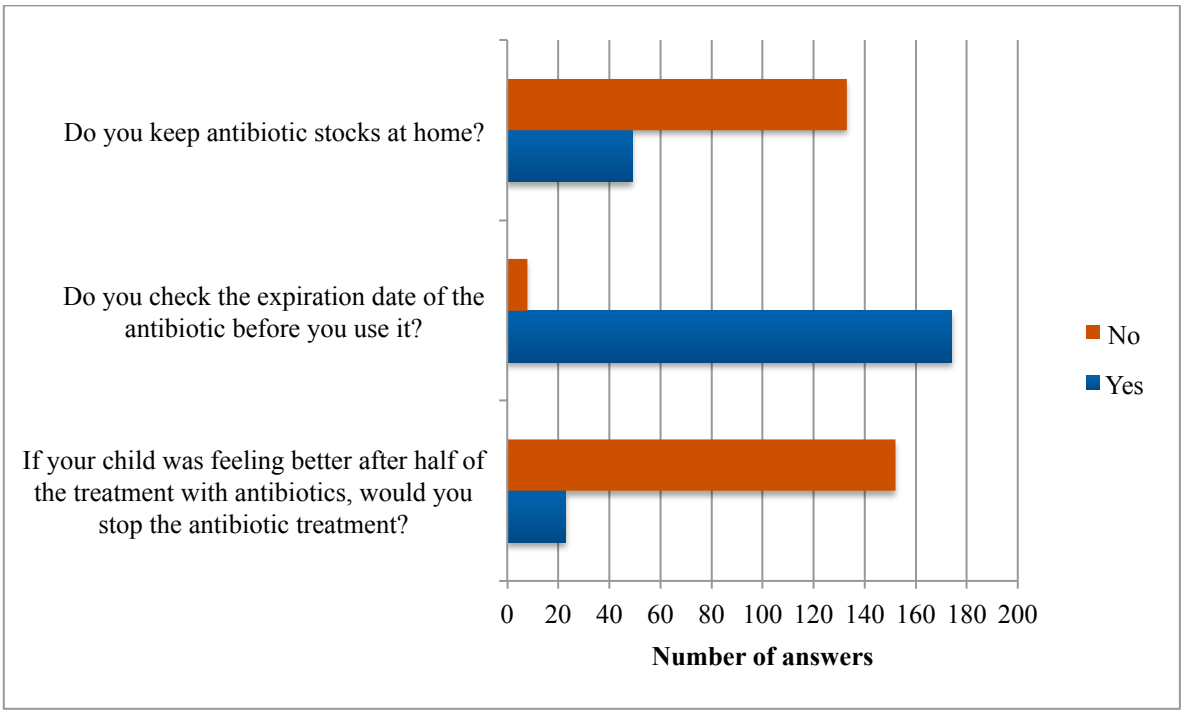

Figure 5. Information about the mothers' antibiotic use. On the first two questions, all 182 mothers answered. On the last question, 175 replied. Seven did not answer because they had never heard of a medicine called an antibiotic.

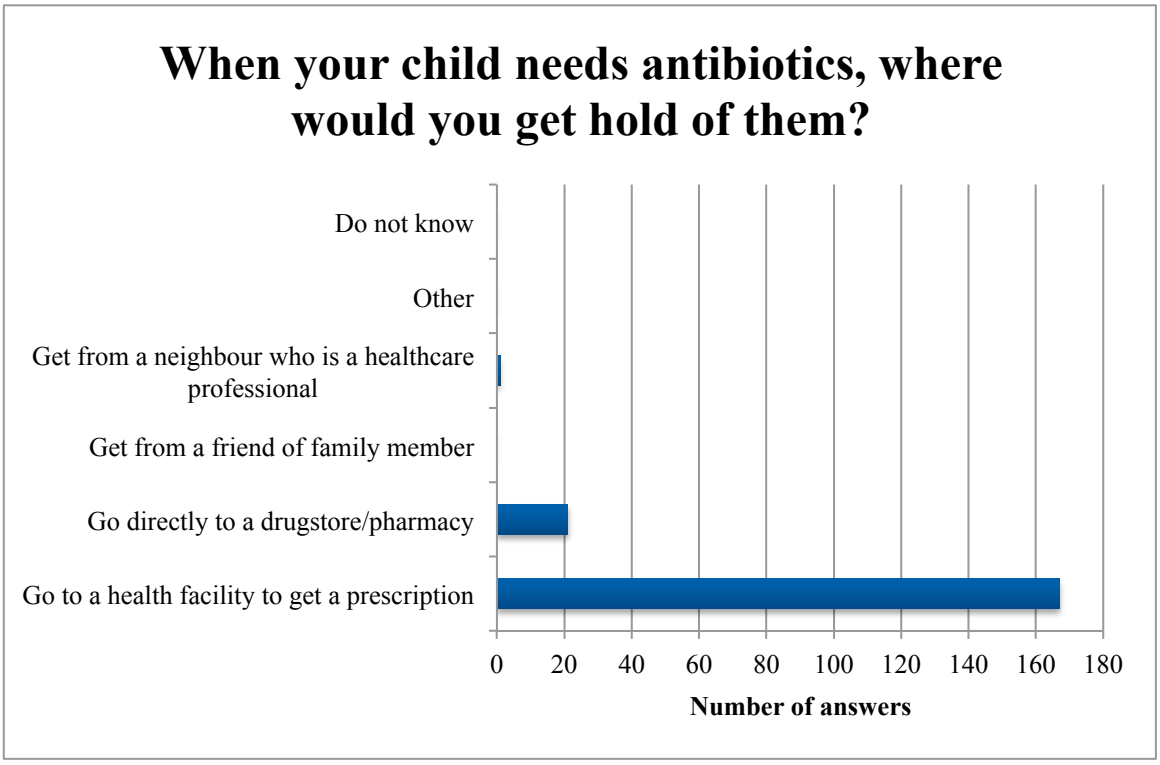

Figure 6. Where the mothers would get hold of antibiotics (n = 175). Seven mothers did not answer because they had never heard of a medicine called an antibiotic.

Antibiotic Use in Different Socio-economic Groups

On the whole, there were few significant differences in antibiotic use between mothers with different socio-economic status (Table 2). However, children of mothers with health insurance were more than two times more likely to have received antibiotics for a respiratory tract infection in the past year, according to the mother, than children of mothers without a health insurance (OR 2.31, CI 1.22-4.34, p = 0,01). Furthermore, children of mothers with college/university education had more likely been examined physically by a doctor or nurse before antibiotic prescription than children of mothers with lower educational level (OR 4.36, CI 1.19-16.04, p = 0,027). There were no significant differences in antibiotic use between

mothers with different occupational status, i.e. unemployed/student/other, self-employed and employed (data not shown). Neither were there any significant differences in antibiotic use related to household monthly income (data not shown).

Table 2. Comparison between mothers in relation to educational levels. N = 182 on the first and last question. N = 118 on the other questions (64 mothers did not answer because the child had not been treated with antibiotics in the past 12 months).

	Education	OR (95% CI)	*P*-value
Has your child received antibiotics for a respiratory tract infection in the past 12 months?	None/primary (ref)	1.00	
	Secondary	0.74 (0.32-1.72)	NS
	College/University	0.82 (0.37-1.82)	NS
Did you get a prescription from a doctor or nurse?	None/primary (ref)	1.00	
	Secondary	-	NS
	College/University	2.40 (0.59-9.7)	NS
Did a doctor or nurse perform a physical examination of your child?	None/primary (ref)	1.00	
	Secondary	2.91 (0.78-10.86)	NS
	College/University	4.36 (1.19-16.04)	0.027
Did your child complete the last prescribed antibiotic treatment?	None/primary (ref)	1.00	
	Secondary	0.36 (0.07-1.92)	NS
	College/University	0.46 (0.09-2.37)	NS
Do you keep antibiotic stocks at home?	None/primary (ref)	1.00	
	Secondary	1.23 (0.52-1.93)	NS
	College/University	0.82 (0.35-1.90)	NS

Table 3. Comparison between mothers in relation to family health insurance status. N = 182 on the first and last question. N = 118 on the other questions (64 mothers did not answer because the child had not been treated with antibiotics in the past 12 months).

	Family health insurance	OR (95% CI)	*P*-value
Has your child received antibiotics for a respiratory tract infection in the past 12 months?	No health insurance (ref)	1.00	
	Health insurance	2.31 (1.22-4.34)	0.01
Did you get a prescription from a doctor or nurse?	No health insurance (ref)	1.00	
	Health insurance	2.01 (0.51-8.00)	NS
Did a doctor or nurse perform a physical examination of your child?	No health insurance (ref)	1.00	
	Health insurance	2.78 (0.95-8.13)	NS

Did your child complete the last prescribed antibiotic treatment?	No health insurance (ref) Health insurance	1.00 0.55 (0.15-2.10)	 NS
Do you keep antibiotic stocks at home?	No health insurance (ref) Health insurance	1.00 0.82 (0.42-1.60)	 NS

Discussion

This study investigated mothers' experience of antibiotic treatment to children with respiratory tract infections in Moshi, Tanzania. The primary findings of the study were that more than half of the children had taken antibiotics for a respiratory tract infection within the past year and that most of the mothers received an antibiotic prescription from a doctor or nurse the last time the child was treated with antibiotics. There were few significant differences in antibiotic use between mothers from different socio-economic groups.

The results indicate that the participating mothers aimed to use antibiotics adequately when the child suffered from a respiratory tract infection. One of the main findings was that most of the participating mothers (92%) received an antibiotic prescription from a doctor or a nurse the last time the child was treated with antibiotics for a respiratory tract infection. This was quite unexpected, since previous studies from Moshi had shown that it was possible to buy antibiotics at the pharmacies without a prescription (20) and that 76% of the antibiotic purchases were without a prescription (37). The fact that a clear majority of the mothers in the present study went to see a doctor to get an antibiotic prescription suggests that the mothers had the intention of using antibiotics rationally, as consulting a doctor increases the chance of treating the right condition and getting the right type of antibiotic (34). Furthermore, 87% of

the participating mothers claimed that the child completed the last antibiotic treatment, which also implies that most of the mothers had rational antibiotic use. This number was high compared to Sudan, Egypt and China, where less than half of the survey respondents in a WHO study about antibiotic resistance said that they would complete the antibiotic treatment if they were feeling better after half of the treatment (34). A large part of the mothers in this study had college or university education, which could explain why so many knew what to do when the child was sick. Mothers of lower education might not have the same opportunities to learn about antibiotics and their use, and the results of the study would probably have been different if data was collected on mothers who had not studied at such a high level.

Nevertheless, the participating mothers might also have used antibiotics incorrectly in some ways. An interesting finding was that 27% of the participating mothers had antibiotic stocks at home, which could be a sign of irrational antibiotic use. If the mothers used antibiotic stocks to treat their children, the medication might not help or could cause side effects. Additionally, using antibiotic stocks when they are not needed contributes to antibiotic resistance development (1, 9, 10). Nevertheless, the participating mothers only reported that they had antibiotic stocks, and this does not necessarily mean that they will give them to the child. The great majority of the mothers in the present study said that they had not given leftover antibiotics or someone else's antibiotics to the child, which indicates that they did not take from the antibiotic stocks at home when the child was sick.

The results of the current study suggest that there was a relatively high antibiotic use for respiratory tract infections among the participating children. More than half of the children (65%) had received antibiotics for a respiratory tract infection in the past 12 months. Antibiotic use was high compared to Sweden, where the proportion of children treated with at least one course of antibiotics during the last year was 20% in 2015 (38). However, antibiotic use was lower compared to Bangladesh and Pakistan, where more than 98% of healthy children had received antibiotic by the age of six months (39). In a WHO study conducted in 12 different countries, 65% of the respondents said that they had taken antibiotics within the past six months (34). In other words, antibiotic use in the current study was both higher and lower compared to other countries. However, the fact that more than half of the children had taken antibiotics for a respiratory tract infection in the past 12 months and that some of them received antibiotics over ten times suggests high antibiotic use.

Some of the children in the present study might have received antibiotics for non-bacterial conditions. The most common symptoms the child showed the previous time he or she received antibiotics for a respiratory tract infection were cough, fever and stuffy or runny nose. Approximately half of the children had rapid or difficult breathing and only 9% had chest indrawing. According to WHO, rapid or difficult breathing and/or chest indrawing are signs of bacterial pneumonia, which should be treated with antibiotics (13). Only cough, fever and/or stuffy or runny nose are more likely signs of a viral infection and should probably not be treated with antibiotics (13). Since about half of the mothers did not report the symptoms the WHO considers being signs of bacterial pneumonia, there might be overuse of antibiotics. However, it can be hard for the mother to understand which symptoms the child shows. After

all, observing symptoms such as rapid breathing and chest indrawing is the doctor's assignment. Additionally, cough without rapid breathing and/or chest indrawing could be a symptom of tuberculosis, which also requires antibiotic treatment (15). Nevertheless, a previous study from Moshi showed that 69% of children with common cold received antibiotics inappropriately (18); hence it would not be surprising if some of the children in this study also were treated incorrectly with antibiotics.

On most of the questions, there were no significant differences between mothers with different educational, occupational or income status on the use of antibiotics. For instance, the proportion of mothers saying that the child had received antibiotics in the past 12 months did not differ in relation to these socio-economic factors. Nor were there any significant differences between different socio-economic groups regarding finishing the last antibiotic treatment or keeping antibiotic stocks at home. However, children of mothers with college/university education had more likely been examined physically by a doctor or nurse than children of mothers with lower educational level. Perhaps this was because clinicians felt more pressure to examine the child properly if the mother was highly educated. Another possible explanation could be that mothers with high education attend clinics with more skilled doctors and nurses. In a previous study from Moshi, educational level or employment status were not significantly associated with irrational antibiotic use (37). On the other hand, a WHO study showed that respondents with lower education were more likely to have taken antibiotics within the last six months compared to those with higher education, and that participants with lower education were less likely to complete the antibiotic treatment (34). A study carried out in southern rural Tanzania revealed that children of poorer parents were less

likely to receive antibiotic treatment for pneumonia compared to children of richer parents (26).

It may be difficult to assess household monthly income in studies from low-income settings, where people often do not have a stable monthly income. In the current study, many of the mothers were self-employed, and their household monthly income probably varied from month to month. In low-income settings, it can be preferable to use other socio economic status-measurements, such as wealth index (an index based on a household's ownership of certain assets, water access, sanitation facilities etc). Here, presence of health insurance was used as an indicator of socio-economic status of the family.

In relation to health insurance status, one significant difference in antibiotic use was detected. Interestingly, children of mothers with health insurance in the family were more likely to have received antibiotics for a respiratory tract infection in the past year than children of mothers without a health insurance. A possible explanation to this finding could be that mothers without health insurance have lower socio-economic status and therefore avoid going to health facilities and buying medicines because of the costs. This interpretation might be contradicted by the finding that no difference could be shown between mothers with different household monthly income. Nor were there any significant differences between mothers with and without health insurance when it came to getting an antibiotic prescription from a doctor or nurse – the vast majority of mothers had received a prescription in both groups. Previous

research from Moshi could not show that health insurance status had any significant influence on antibiotic use (37).

The present study implies that most of the mothers attending the RCHC at KCMC in Moshi aim to use antibiotics correctly and that almost all of them go to a health facility to get an antibiotic prescription when the child is sick. Furthermore, there seems to be few significant differences in antibiotic use between mothers with different socio-economic status. However, the results of the study do not clearly say if there is overuse or underuse of antibiotics. In order to further investigate antibiotic use, future studies could be made on doctors' antibiotic prescribing practices. On what grounds do doctors prescribe antibiotics to children with respiratory tract infections in Moshi? Are there signs of overprescription or underprescription of antibiotics? Do the doctors prescribe the appropriate type and dose of antibiotic, and for the right amount of time? Moreover, most of the mothers in this study lived in an urban area with good access to healthcare services. It would be interesting to learn more about antibiotic use in more rural parts of The Kilimanjaro Region, where mothers might not have the same opportunity to go to health facilities. Future research could also investigate antibiotic susceptibility patterns among bacterial isolates in Moshi. Are bacteria that cause respiratory tract infections still susceptible to first-line antibiotics or have they developed resistance mechanisms?

Strengths and Weaknesses

One of the strengths of the study was that a lot of work was put into the questionnaire. It was tested on employees at the Community Health Department, a pilot study at the RCHC was performed, and a back-translation was made. Thanks to this, the questionnaire could be refined and adapted to the study population. The study included 182 mothers, which was more than the estimated sample size. Furthermore, it was good from an ethical point of view that the study did not take time from mothers or children who were seeking healthcare because of some acute illness. Another strength was that a nurse and a research assistant helped translating the interviews. Even though there might have been some misunderstandings, the translators made effective communication possible. If the mothers had just filled in the questionnaire without help from the translators, they would not have been able to ask the medical students about the meaning of the questions when they were insecure.

The study had some weaknesses. For instance, the participants might not have been representative for the Kilimanjaro region. Almost half of the mothers had been to college or university. This was a considerably higher proportion compared to the whole Kilimanjaro Region, where only 2.4% of the population aged five years and above had university level (33). Most of the participants also had a higher household monthly income compared to the average Tanzanian person (35). Furthermore, the mothers in this study lived within reasonable distance to Moshi, which meant that they had relatively good access to healthcare (dispensaries, health centres, and KCMC). If the study had been carried out in more rural parts of the country, the mothers might not have been able to go to see a doctor or nurse to get an antibiotic prescription to the same extent. In addition, this study only reached mothers who

went for routine care at KCMC. Some mothers in Moshi might not go to the hospital for routine check-ups and these mothers might also be less inclined to go to a health facility to get an antibiotic prescription when the child is sick.

Another weakness was that the study was based on information from the mothers. They might have forgotten details about the last time the child received antibiotics. Perhaps they thought that the child had received antibiotics when it was in fact some other medicine. Also, there is a risk that the mothers answered what they thought was expected. For instance, almost every mother claimed to check the expiration date of the antibiotic – was this actually the case or did the mothers say what they thought was most appropriate answer? Additionally, convenience sampling was used in order to select participants. This method was easy, quick and cost-effective. However, the sample might not have been representative of the target population. Random sampling would have been preferable, but was not possible due to lack of resources.

Conclusions and Implications

The results of this study suggest that the majority of mothers attending the RCHC at KCMC in Moshi, Tanzania intend to use antibiotics rationally when the child suffers from a respiratory tract infection. However, there seems to be high levels of antibiotic use and some children might receive antibiotics for conditions that do not require antibiotic treatment. Measures have to be taken to ensure rational use of antibiotics. Both health workers and the public should regularly receive information about sustainable antibiotic use and the issue of

antibiotic resistance. For instance, posters could help raise awareness of antibiotic resistance at the RCHC. Doctors' antibiotic prescribing practices should be monitored and regulated at KCMC and other health facilities in Moshi. Furthermore, the need for antibiotics could be reduced by vaccinations, good hygiene and other preventive measures against infections. Steps have to be taken in all parts of society to prevent and control the spread of antibiotic resistance.

Populärvetenskaplig sammanfattning

Mödrars erfarenheter av antibiotikabehandling till barn med luftvägsinfektioner i Moshi, Tanzania

Antibiotika är läkemedel som används för att behandla infektioner orsakade av bakterier. *Antibiotikaresistens* innebär att bakterier utvecklar förmåga att stå emot effekten av antibiotika, vilket leder till att antibiotikabehandlingen inte längre fungerar. Konsekvenserna är ökad dödlighet, längre vårdtider och högre vårdkostnader. Enligt Världshälsoorganisationen (WHO) är antibiotikaresistens ett växande hälsoproblem över hela världen. Felaktig och överdriven användning av antibiotika påskyndar utvecklingen av antibiotikaresistens. Tidigare studier från Tanzania har visat att antibiotika ofta används felaktigt vid behandling av luftvägsinfektioner. Det är inte ovanligt att antibiotika köps direkt på apotek utan recept från läkare eller att antibiotika används för behandling av icke-bakterieorsakade tillstånd såsom vanliga förkylningar. Syftet med den här studien var att undersöka mödrars erfarenhet av antibiotikaanvändning till barn med luftvägsinfektioner i Moshi, Tanzania.

Studien utfördes på sjukhuset Kilimanjaro Christian Medical Centre i Moshi, Tanzania, under mars och april år 2019. Med hjälp av ett frågeformulär intervjuades 182 mödrar som kom för rutinbesök såsom mödravårdskontroll eller vaccination av barnet. Resultaten visade att 65% av mödrarna uppgav att barnet hade fått antibiotika för en luftvägsinfektion inom senaste året, en del fler än tio gånger. Majoriteten (92%) hade fått ett recept på antibiotika från en läkare. De vanligaste symtomen som barnet hade den senaste gången han eller hon fick antibiotika

var hosta (87%), feber (70%) och nästäppa/rinnande näsa (70%). I de allra flesta fall (87%) hade barnet fullföljt antibiotikakuren. Ungefär en fjärdedel av mödrarna sa att de hade lager av antibiotika hemma.

Resultaten antyder att de flesta mödrar avser att använda antibiotika korrekt genom att bland annat uppsöka läkare för att få recept på antibiotika. Det verkar dock som att användningen av antibiotika för luftvägsinfektioner hos barn är hög och att läkare ibland förskriver antibiotika trots att det inte är nödvändigt, t.ex. mot vanliga förkylningar. Den här forskningen kan användas till att ge en uppfattning om hur antibiotika används i Moshi, Tanzania, och belysa vikten av korrekt antibiotikaanvändning. För att förhindra vidare utveckling av antibiotikaresistens är det centralt att antibiotika används på rätt sätt och bara när det behövs.

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Appendices

Appendix 1: Participant Questionnaire

PARTICIPANT QUESTIONNAIRE

DODOSO LA MSHIRIKI

BACKGROUND INFORMATION **STUDY ID NUMBER:.....**

TAARIFAZAAWALI

1.	**REASON FOR ATTENDING THE CLINIC** *JINA LA KITUO CHA AFYA*		
2.	**DATA COLLECTION DATE** *TAREHE YA KUCHUKULIWA TAKWIMU*	YYYY/MM/DD:	
3.	**NAME OF VILLAGE/STREET /WARD AND THE DISTRICT WHERE YOU LIVE** *JINA LA KIJIJI/MTAA NA KATA UNAPOISHI*	Go straight to question number 5.	
4.	**WHICH OF THESE BEST DESCRIBES WHERE YOU LIVE?** *NI YAPI KATI YA YAFUATAYO YANAELEZEA VEMA UNAPOISHI?*	A) Urban B) Rural	*A) Mjini* *B) Vijijini*
5.	**MOTHER DATE OF BIRTH** *TAREHE ALIYOZALIWA MAMA*	YYYY/MM/DD:	
6.	**AGE OF MOTHER IN YEARS** *UMRI WA MAMA KWA MIAKA*		
7.	**EDUCATION MOTHER** *ELIMU YA MAMA*	A) Never been to school B) Some primary school C) Completed primary school D) Secondary school E) College or University	*A) Hajawahi kwenda shule* *B) Hakumaliza shule ya msingi* *C) Amemaliza shule ya msingi* *D) Elimu ya Sekondari* *E) Chuo au Chuo Kikuu*
8.	**CURRENT OCCUPATION MOTHER** *KAZI YA MAMA KWA SASA*	A) Employed B) Self-employed, specify…… C) Unemployed D) Student E) Other	*A) Nimeajiriwa* *B) Nimejiajiri, ainisha:.....* *C) Sina ajira* *D) Mwanafunzi* *E) Nyingineyo*
9.	**DO YOU HAVE A MEDICAL BACKGROUND?** *JE, WEWE NI MTUMISHI WA AFYA?*	A) Yes B) No	*A) Ndio* *B) Hapana*
10.	**CHILD DATE OF BIRTH** *TAREHE ALIYOZALIWA MTOTO*	YYYY/MM/DD:	

IF THE MOTHER HAS BROUGHT TO THE CLINIC MORE THAN ONE CHILD BETWEEN ONE MONTH AND FIVE YEARS OLD, REFER TO THE YOUNGEST CHILD.
KAMA MAMA AMELETA MTOTO ZAIDI YA MMOJA, TAFADHALI ZUNGUMZIA KUHUSU MTOTO ALIE MDOGO KWA UMRI

11. AGE OF THE CHILD *UMRI WA MTOTO*		
12. GENDER OF THE CHILD *JINSIA YA MTOTO*	A) Female B) Male	*A) Mwanamke* *B) Mwanaume*
13. HOUSEHOLD/FAMILY MONTHLY INCOME *KIPATO CHA KAYA KWA MWEZI*		
14. HOW MANY CHILDREN DO YOU HAVE? *UNA WATOTO WANGAPI?*		
15. HOW MANY CHILDREN IN THE HOUSEHOLD ARE UNDER FIVE YEARS OLD? *NI WATOTO WANGAPI KWENYE KAYA YAKO WANA UMRI CHINI YA MIAKA MITANO?*		
16. HOW MANY ROOMS ARE THERE IN YOUR HOME? *NYUMBA YAKO INA VYUMBA VINGAPI KWA UJUMLA?*		
17. HOW MANY ROOMS ARE USED FOR SLEEPING? *VYUMBA VINGAPI VINATUMIKA KWA KULALA?*		
18. DOES YOUR FAMILY HAVE A HEALTH INSURANCE? *JE, KAYA AU FAMILIA YAKO INA BIMA YA AFYA?*	A) Yes B) No	*A) Ndio* *B) Hapana*

ANTIBIOTIC KNOWLEDGE
UELEWA KUHUSU DAWA ZA ANTIBIOTIC

19. HAVE YOU EVER HEARD OF A MEDICINE CALLED AN ANTIBIOTIC? *JE, UMEWAHI KUSIKIA AINA YA DAWA INAYOITWA ANTIBIOTIKI?*	A) Yes B) No If No, go to question 26	*A) Ndio* *B) Hapana*
20. AGAINST WHICH ORGANISMS ARE ANTIBIOTIC USED? *ANTIBIOTIKI ZINATUMIKA KUUWA/KUSHAMBULIA WADUDU GANI?*	A) Virus B) Bacteria C) Fungi D) Any microbes E) Do not know	*A) Virusi* *B) Kimela cha bakteria* *C) Fangasi* *D) Kimelelea chochote kile* E) *Sijui*

21. WHICH DISEASE OR DISEASES DO YOU KNOW THAT CAN BE TREATED BY ANTIBIOTICS? *NI MAGONJWA GANI UNAYAFAHAMU YANAYOTIBIWA KWA ANTIBIOTIKI?*		
22. DO YOU THINK THESE CONDITIONS COULD BE TREATED WITH ANTIBIOTICS? *JE, UNAFIKIRI HIZI HALI ZINAWEZA KUTIBIWA NA ANTIBIOTIKI?*	A) Bladder infection or urinary tract infection (UTI) **Yes No** B) Diarrhoea **Yes No** C) Pneumonia **Yes No** D) Cold and flu **Yes No** E) Fever **Yes No** F) Malaria **Yes No** G) Skin or wound infection **Yes No** H) Sore throat **Yes No**	*A) Bladder infection or urinary tract infection (UTI)* ***Ndio/Hapana*** *B) Diarrhoea* ***Ndio /Hapana*** *C) Pneumonia* ***Ndio/Hapana*** *D) Flu/mafua* ***Ndio/Hapana*** *E) Homa* ***Ndio/Hapana*** *F) Malaria* ***Ndio/Hapana*** *G) Infekishen ya ngozi au kidonda* ***Ndio/Hapana*** *H) Koo kuuma anapomeza* ***Ndio/Hapana***
23. WHEN YOUR CHILD NEEDS ANTIBIOTICS, HOW WOULD YOU GET HOLD OF THEM? *PINDI MTOTO WAKO ANAHITAJI DAWA YA ANTIBIOTIKI, UTAIPATAJE?*	A) Go to a health facility to get prescription B) Go directly to a drugstore/ pharmacy C) Get from a friend or a family member D) Get from a neighbour who is a health care professional E) Other, specify:……. F) Do not know	*A) Nenda Kituo cha Afya kupata.* *B) Nenda moja kwa moja duka la dawa/famasi* *C) Pata toka kwa rafiki au ndugu katika familia* *D) Pata kutoka kwa jirani ambae ni Mhudumu wa Afya* *E) Mengineo, ainisha:.....* *F) Sijui*
24. IS THERE MORE THAN ONE TYPE OF ANTIBIOTIC? *KUNADAWA ZA ANTIBIOTIKI ZAIDI YA MOJA?*	A) Yes B) No	*A) Ndio* *B) Hapana*
25. IF YOUR CHILD WAS FEELING	A) Yes	*A) Ndio*

	BETTER AFTER HALF OF THE TREATMENT WITH ANTIBIOTICS, WOULD YOU STOP THE TREATMENT? *KAMA MTOTO WAKO ANAPATA NAFUU KABLA YA KUMALIZA DOZI YA ANTIBIOTIKI, JE UTAACHA KUTUMIA HIZO ANTIBIOTIKI?*	B) No	*B) Hapana*
26.	**ANTIBIOTICS ARE MEDICINES THAT KILL OR FIGHT BACTERIA. WHICH OF THE FOLLOWING DRUGS DO YOU THINK ARE ANTIBIOTICS?** *ANTIBIOTIKI NI DAWA ZINAZOUA AU KUSHAMBULIA BAKTERIA. NI ZIPI KATI YA DAWA ZIFUATAZO NI ANTIBIOTIKI?*	A) Amoxicillin B) Co-trimoxazole (Septrin) C) Panadol/ Paracetamol D) Penicillin E) Tetracycline F) ALU G) Metronidazole (Flagyl)	*A) Amoxicillin* *B) Co-trimoxazole (Septrin)* *C) Panadol/Paracetamol* *D) Penicillin* *E) Tetracycline* *F) ALU* *G) Metronidazole (Flagyl)*
27.	**SOME MEDICINES THAT USED TO WORK IN THE PAST FOR FIGHTING INFECTIONS ARE NO LONGER WORKING. THIS PROBLEM IS CALLED DRUG RESISTANCE. HAVE YOU EVER HEARD OF THIS PROBLEM?** *BAADHI YA DAWA ZILIZOKUWA ZINATUMIKA MIAKA YA NYUMA KUPAMBANA DHIDI YA MAGONJWA AMBUKIZI HAZIFANYI TENA KAZI KWA SASA. HII SHIDA INAJULIKANA KAMA USUGU WA DAWA. JE, UMEWAHI KUSIKIAUSUGU WA DAWA?*	A) Yes B) No	*A) Ndio* *B) Hapana*
28.	**HAVE YOU EVER HEARD OF ANTIBIOTIC RESISTANCE?** *JE, UMEWAHI KUSIKIA USUGU WA DAWA ZA ANTIBIOTIKI?*	A) Yes B) No If no, go to Question 31	*A) Ndio* *B) Hapana*
29.	**WHERE DID YOU HEAR THE TERM ANTIBIOTIC RESISTANCE?** *JE, NI WAPI ULISIKIAUSUGU WA DAWA ZA ANTIBIOTIKI?*	A) Doctor or nurse B) Pharmacist C) Family member or a friend D) Media E) Specific campaign F) Other, specify: …… G) Do not remember	*A) Daktari au Muuguzu/Nesi* *B) Mfamasia* *C) Mwanafamilia au rafiki* *D) Vyombo vya habari* *E) Kampeni maalum* *F) Mengineyo, ainisha:……* *G) Sikumbuki*

30. PLEASE INDICATE WHETHER YOU THINK THE FOLLOWING STATEMENTS ARE "TRUE" OR "FALSE" *TAFADHALI ONYESHA KAMA UNAFIKIRI SENTENSI ZIFUATAZO NI KWELI AU SIO KWELI*	A) If bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause **True False**	*A) Kama vimelea vya bacteria vinakuwa sugu dhidi ya antibiotiki, inaweza kuwa ngumusana au kushindikana kutibu maambukizi yanayosababishwanav yo* ***Kweli/Sio***
	B) Antibiotic resistance is an issue that could affect my child, myself or my family **True False**	*B) Usugu wa dawa za antibiotiki ni kitu kinachoweza kumdhuru mtoto wangu, mimi mwenyewe au familia yangu* ***Kweli/Sio***
	C) Antibiotic resistance is an issue in other countries but not here **True False**	*C) Usugu wa dawa za antibiotiki ni kitu cha nchi nyingine na sio/hapa* ***Kweli/Sio***
	D) Antibiotic resistance is only a problem for people who take antibiotics regularly **True False**	*D) Usugu wa dawa za antibiotiki ni shida tu kwa wale watu wanaotumia dawa za antibiotiki mara kwa mara* ***Kweli/Sio***
	E) Bacteria which are resistant to antibiotics can be spread from person to person **True False**	*E) Vimelea vya bacteria vilivyo sugu dhidi ya dawa za antibiotiki vinaweza kusambaa kutoka mtu mmoja kwenda kwa mtu mwingine* ***Kweli/Sio***
31. HAVE YOU EVER HEARD OF RESISTANCE TO MALARIAL DRUGS OR ANTIMALARIAL RESISTANCE? *UMEWAHI KUSIKIA USUGU WA DAWA ZA MALARIA?*	A) Yes B) No	*A) Ndio* *B) Hapana*

ANTIBIOTIC USE

MATUMIZI YA DAWAZAANTIBAOTIKI

32. HAS YOUR CHILD RECEIVED ANTIBIOTICS	A) Yes B) No	*A) Ndio* *B) Hapana*

	FOR RESPIRATORY TRACT INFECTIONS IN THE PAST 12 MONTHS? *JE, MTOTO WAKO AMEWAHI KUTUMIA DAWA YA ANTIBIOTIKI KUTIBU MAGONJWA AMBUKIZI YA MFUMO WA HEWA KATIKA MIEZI 12 ILIYOPITA?*	C) Can't remember	*C) Sikumbuki*
A)	**IF YES, HOW MANY TIMES?** *KAMA NDIO, NI MARA NGAPI?*		
33.	**WHEN DID YOUR CHILD LAST TAKE ANTIBIOTICS AGAINST A RESPIRATORY TRACT INFECTION?** ***NI LINI MARA YA MWISHO MTOTO WAKO AMEPEWA DAWA YA ANTIBIOTIKI KWA AJILI YA MAAMBUKIZI YA MFUMO WA HEWA?***	A) In the last week B) In the last month C) In the last 6 months D) In the last year E) More than a year ago F) Never G) Can't remember If more than a year ago, never or can't remember, go directly to question 42.	*A) Wiki iliyopita* *B) Mwezi uliopita* *C) Miezi 6 iliyopita* *D) Mwaka uliopita* *E) Zaidi ya mwaka mmoja uliopita* *F) Hajawahi* *G) Sikumbuki*

THE FOLLOWING QUESTIONS ARE ABOUT THE LAST TIME YOUR CHILD WAS GIVEN ANTIBIOTICS
MASWALI YAFUATAYO YANAHUSU MARA YA MWISHO MTOTO WAKO ALIOPEWA DAWA YA ANTIBIOTIKI

34.	**WHICH SYMPTOMS DID YOUR CHILD HAVE THE LAST TIME HE OR SHE RECEIVED ANTIBIOTICS FOR A RESPIRATORY TRACT INFECTION?** *NI DALILI ZIPI MWANAO ALIKUWA NAZO MARA YA MWISHO ALIPOPEWA DAWA ZA ANTIBIOTIKI KWA AJILI YA MAAMBUKIZI KWENYE MFUMO WA HEWA?*	A) Fever B) Rapid or difficult breathing C) Cough D) Stuffy or runny nose E) Sore throat F) Chest indrawing G) Other symptoms, specify……	*A) Homa* *B) Kushindwa au kupumua haraka haraka* *C) Kikohozi* *D) Pua kuziba* *E) Koo kuuma anapomeza* *F) Kifua kuingia ndani* *G) Dalili nyinginezo, ainisha:……*
35.	**WHERE DID YOU GET THE ANTIBIOTICS?** *ULIPATA WAPI ANTIBIOTIKI?*	A) Medical store or pharmacy B) Health facility (dispensary, hospital etc.) C) Market D) The internet E) Family member or friend F) I had them saved up from a previous time G) Somewhere/someone else H) Can't remember	*A) Duka la dawa au famasi* *B) Kituo cha Afya (Zahanati,Hospitali, n.k.)* *C) Sokoni* *D) Mtandaoni* *E) Kwa mtu wa familia au rafiki* *F) Nilikuwa nazo za akiba toka mara ya mwisho* *G) Mahali/kwa mtu mwingine* *H) Sikumbuki*
36.	**DID YOU GET A PRESCRIPTION FROM A DOCTOR OR A NURSE?** *ULIPATA KARATASI YA KUNUNULIA DAWA KUTOKA KWA DAKTARI AU*	A) Yes B) No C) Can't remember	*A) Ndio* *B) Hapana* *C) Sikumbuki*

	MUUGUZI/NESI?		
37.	**DID YOU GET ADVICE FROM A DOCTOR, NURSE OR PHARMACIST ON HOW TO TAKE THE ANTIBIOTICS?** *ULIPATA USHAURI KUTOKA KWA DAKTARI AU MUUGUZI/NES?*	A) Yes B) No C) Can't remember	*A) Ndio* *B) Hapana* *C) Sikumbuki*
38.	**DID A DOCTOR OR A NURSE PERFORM A PHYSICAL EXAMINATION OF YOUR CHILD BEFORE YOU RECEIVED ANTIBIOTICS?** *JE, DAKTARI AU MUUGUZI/NESI ALIMFANYIA MTOTO WAKO UCHUNGUZI KWA KUMPIMA KABLA YA KUPEWA DAWA ZA ANTIBIOTIKI?*	A) Yes B) No C) Can't remember	*A) Ndio* *B) Hapana* *C) Sikumbuki*
39.	**DID YOUR CHILD COMPLETE THE LAST PRESCRIBED ANTIBIOTIC TREATMENT?** *JE, MTOTO WAKO ALIMALIZA DOZI YOTEALIYOANDIKIWA?*	A) Yes B) No C) Can't remember	*A) Ndio* *B) Hapana* *C) Sikumbuki*
40.	**HAS YOUR CHILD EVER RECEIVED ANTIBIOTICS THAT BELONG TO SOMEONE ELSE?** *JE, MTOTO WAKO AMEWAHI KUPEWA DAWA YA ANTIBIOTIKI ILIYOKUWA YA MTU MWINGINE?*	A) Yes B) No C) Can't remember	*A) Ndio* *B) Hapana* *C) Sikumbuki*
41.	**HAS YOUR CHILD EVER RECEIVED LEFTOVER ANTIBIOTICS?** *MTOTO WAKO AMEWAHI KUPEWA DAWA ILIYOBAKIZWA?*	A) Yes B) No C) Can't remember	*A) Ndio* *B) Hapana* *C) Sikumbuki*
42.	**DO YOU KEEP ANTIBIOTIC STOCKS AT HOME?** *JE, HUWA UNAHIFADHI DAWA ZA ANTIBIOTIKI NYUMBANI?*	A) Yes B) No C) Can't remember	*A) Ndio* *B) Hapana* *C) Sikumbuki*
43.	**DO YOU CHECK THE EXPIRE DATE OF THE ANTIBIOTIC BEFORE YOU USE IT?** *JE, HUWA UNAANGALIA TAREHE YA KUHARIBIKA YA DAWA YA ANTIBIOTIKI KABLA YA KUITUMIA?*	A) Yes B) No C) Can't remember	*A) Ndio* *B) Hapana* *C) Sikumbuki*

Appendix 2: Participant Information Sheet and Consent Form

Participant Information Sheet

UNIVERSITY OF GOTHENBURG

This Informed Consent Form is for mothers with children under five years that we are inviting to participate in research on knowledge of antibiotic resistance and experiences of antibiotic treatment to children with respiratory tract infections.

We are…… from the Kilimanjaro Christian Medical College in Moshi, Community Health Department, in collaboration with University of Gothenburg in Sweden, supervised by Dr Florida Muro (PI Sia Msuya).

Fever and respiratory tract symptoms are common in children under five years of age. Some of these conditions can be treated with medicines called antibiotics. It is important to know what antibiotics are and their use, which can be challenging for parents and health care workers.

You as a mother are invited to participate in an interview because you are the sole taker of the child, therefore your experience will inform our findings. There may not be a direct benefit to you and your child, but the results from this study will benefit the society as a whole in the future.

You and your child's participation will be kept confidential, neither you nor your child's name will be recorded. Instead, a unique identification number will be used. We appreciate if you answer all the questions honestly and to the best of your knowledge. If there is any question you do not want to answer you are free to say so. You are also free to ask any questions.

Participating in this study may take some of your time (about half an hour), however, you are free to withdraw from this study at any time, and you do not need to give a reason. If you decide to withdraw, you can inform the interviewer/study coordinator and no new information will be collected about you or your child, other than that needed to keep track of your withdraw.

Your participation in this research is entirely voluntary. You are free to participate or not to participate in this study. Your and your child's right to receive care in this facility will not be affected if you chose not to participate. You will be provided a copy of this consent form for your references.

Contact details

Local Principal investigator:

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Principal investigator:

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National Health Research Ethics Sub-Committee (NatHREC):

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Mobile: +255 758 587885
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Email: ethics@nimr.or.tz / nimrethics@gmail.com

CONSENT FORM

The purposes of this study and the study procedures, risks and benefits have been explained to me. I have been allowed to ask questions and my questions have been answered to my satisfaction. I have been told that I may contact the KCMC Ethics committee if I have questions about my rights as a research subject.

I confirm that I have read the participant information sheet/the participant information sheet has been read to me. I understand that my participation is voluntarily, and that I am free to withdraw at any time, without my legal rights being affected. I agree to take part in this study.

Name of participant…… Signature ……..

Date……..

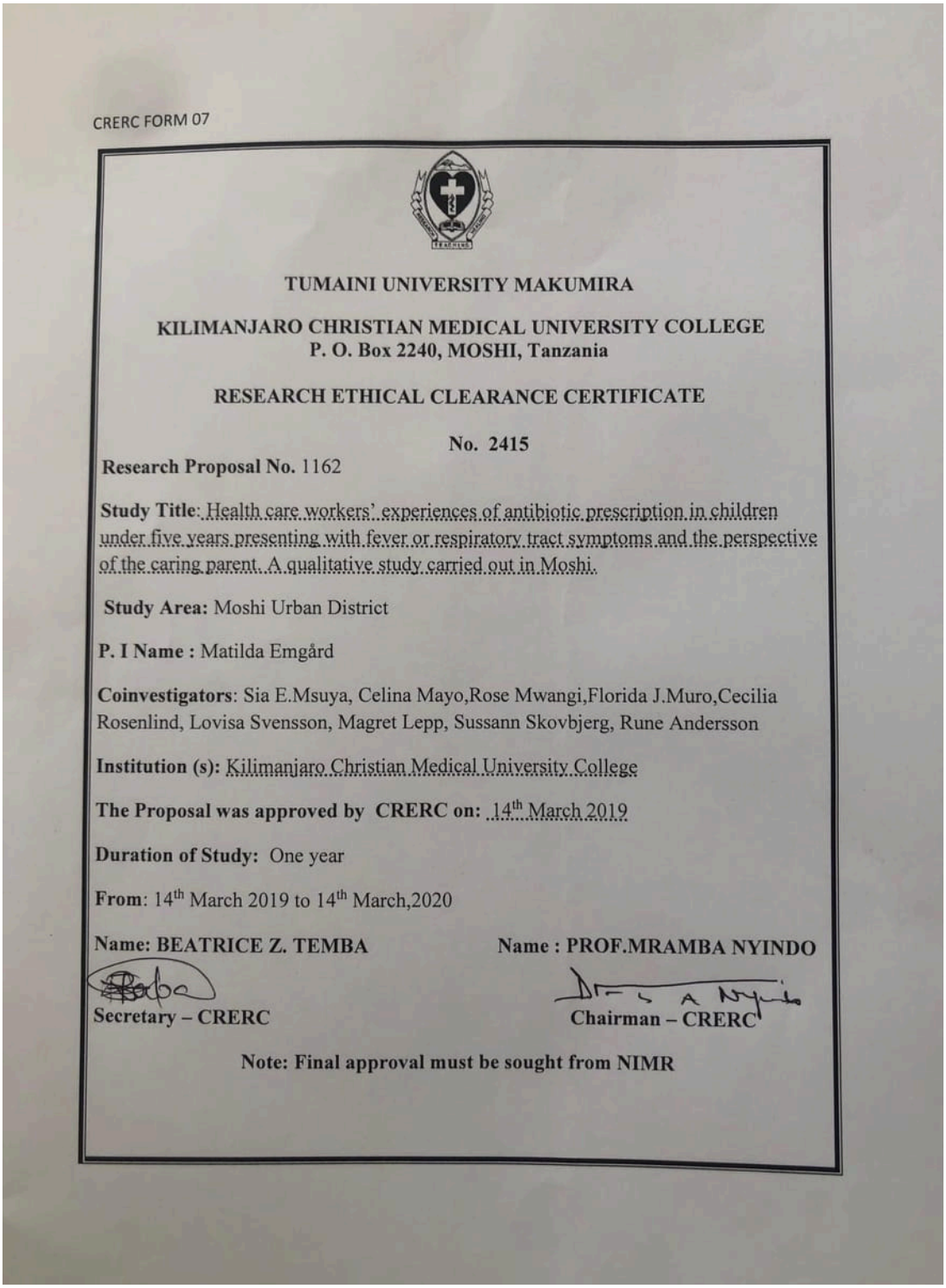
Name of researcher taking consent……..…….. Signature …….....

Date……..

Witness (if applicable)……..…..Signature……...

Date……

Appendix 3: Ethical Approval from the KCMUCo Research Ethics and Review Committee



CRERC FORM 07

TUMAINI UNIVERSITY MAKUMIRA

KILIMANJARO CHRISTIAN MEDICAL UNIVERSITY COLLEGE
P. O. Box 2240, MOSHI, Tanzania

RESEARCH ETHICAL CLEARANCE CERTIFICATE

No. 2415

Research Proposal No. 1162

Study Title: Health care workers' experiences of antibiotic prescription in children under five years presenting with fever or respiratory tract symptoms and the perspective of the caring parent. A qualitative study carried out in Moshi.

Study Area: Moshi Urban District

P. I Name : Matilda Emgård

Coinvestigators: Sia E.Msuya, Celina Mayo,Rose Mwangi,Florida J.Muro,Cecilia Rosenlind, Lovisa Svensson, Magret Lepp, Sussann Skovbjerg, Rune Andersson

Institution (s): Kilimanjaro Christian Medical University College

The Proposal was approved by CRERC on: 14th March 2019

Duration of Study: One year

From: 14th March 2019 to 14th March,2020

Name: BEATRICE Z. TEMBA — **Secretary – CRERC**

Name : PROF.MRAMBA NYINDO — **Chairman – CRERC**

Note: Final approval must be sought from NIMR