International Journal of Community Medicine and Public Health
Hlaing T et al. Int J Community Med Public Health. 2022 Apr;9(4):1592-1604
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20220826

Original Research Article

Prevalence and possible causes of antibiotic self-medication among rural dwellers and volunteer health workers in Nattalin Township, Bago region, Myanmar

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Received: 27 February 2022
Accepted: 16 March 2022

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ABSTRACT

Background: In Myanmar, the emergence of antibiotic-resistant strains is increased, but its exact causes remain unrecognized. This cross-sectional study examined the prevalence and possible causes of antibiotic self-medication (ASM) among rural dwellers and volunteer health workers (VHWs).
Methods: 445 adult rural dwellers from 24 villages and all the 133 registered VHWs within Nattalin Township were examined for illnesses, types and sources of antibiotics, knowledge, perception and possible causes for ASM practices within the last six months. The significant causes of ASM were determined by 95% CI resulting from bivariate and multivariate analysis.
Results: The ASM proportions of rural dwellers and VHWs were 14.2% and 84.2%. The top three most frequent illnesses for ASM were sore throat-(28.6%), respiratory symptoms-(15.8%) and diarrhoea-(17.9%) among rural dwellers and the common cold-(30.4%), sore throat-(25.0%) and respiratory symptoms-(20.6%) among VHWs. In ASM of rural dwellers and VHWs, amoxicillin-(46.0% and 67.9%) was used for the most frequency followed by cefixime-(33.3% and 29.5%), ampicillin-(22.2% and 8.9%) and penicillin-V-(6.3% and 10.7%). For ASM practice, convenience-(54.0% and 65.2%), their prior experiences-(60.3% and 49.1%) and cost reduction advantages-(31.7% and 25.0%), and for the availability of antibiotics, community pharmacies-(88.9% and 78.6%) were mentioned among rural dwellers and VHWs respectively. Among rural dwellers and VHWs, ASM was significantly associated with knowledge-(AOR: 0.5, 95% CI-0.2, 0.9, AOR: 0.2, 95% CI-0.05, 0.8) and keeping antibiotics-(AOR: 64, 95% CI-14, 292, AOR: 45, 95% CI-5.1, 395).
Conclusions: Through multisectoral approaches, it is necessary to promote awareness of the consequences of irrational antibiotic use, enforce national drug laws, and regular inspections on community pharmacies, and provide easy access to public health infrastructures.

Keywords: Antibiotic self-medication, Prevalence, Possible causes, Rural dwellers, Volunteer health workers

INTRODUCTION

Improper antibiotic self-medication (ASM) has been majorly contributing to the growth of antibiotic resistance that is recognized as a dangerously great threat to global health. The evolutionary development of a new strain of antibiotic-resistant infections can significantly be dangerous to the community especially children and the poor. Of all global sepsis newborn deaths per year, about 30% were due to resistant bacteria.[1] Among the poor, the accumulation of difficult-to-treat illness, greater economic burden, direful disability, and higher mortality were significantly noted due to the requirements of more medical expenses, and longer treatment-duration of

antibiotics resistance.[1,2] In some regions of the world, there are 60% and above of the population with the asymptomatic condition are capable of transmitting the multidrug-resistant infection to others.[1] ASM for prophylaxis is common to occur among communities in many developing countries.[3,4] Most of the people from low- and middle-income countries have been keeping antibiotics at their homes and these practices potentiate to self-medicate.[5] Many studies revealed when antibiotics were kept at home and intentions to take self-medication were coexistent, ASM was more likely to occur.[6-8] Due to antibiotic resistance, the common air-borne diseases such as pneumonia, tuberculosis, vector-borne diseases such as malaria, sexually transmitted diseases such as gonorrhoea, and food-borne diseases such as gastroenteritis and cholera, etc. are becoming more difficult to cure.[1]

South-East Asia region (SEAR) is mentioned for the highest number of deaths from antimicrobial resistance.[1] Many rural or hard-to-reach communities have low access to standardized healthcare infrastructures and qualified medical practitioners in this region. This is the major contribution to ASM.[9] In the general public of SEAR, 86% have self-medicated by the use of one or more antibiotics.[10] At community levels of some Asian countries, the prevalence of ASM was reported by 23.6% in Bhutan, 26.69% in Bangladesh, 39.4% in India, 45% in Indonesia, 46.9% in Korea, and 37.7% in Thailand respectively.[11-16] In SEAR, regarding antibiotics resistance, there is no systematic surveillance system and strong government intervention. Consequently, it is very difficult to quantify the magnitude of the diseases, deaths, and costs relating to antibiotic resistance.[17,18]

In Myanmar, the emergence of antibiotic-resistant strains is increased, but its exact causes remain unrecognized. As resulted from National Health Laboratory in 2016, *Escherichia coli* had low susceptibility to cotrimoxazole (34%), ceftriaxone (32%), ciprofloxacin (32%), ceftazidime (31%), amoxicillin (29%), norfloxacin (29%), cefotaxime (27%), tetracycline (17%) and ampicillin (8%).[19] The susceptibility of *Klebsiella* species to antibiotics ranged from 40% (cotrimoxazole (40%), tetracycline (39%), ceftazidime (38%), cefotaxime (36%) and amoxicillin (34%)) to 28% (cefuroxime). Ciprofloxacin was not suitable for *Pseudomonas aeruginosa.* Penicillin G could not be used for the treatment of *Staphylococcus* species. Ciprofloxacin, cotrimoxazole, ceftazidime, ceftriaxone and cefotaxime were less effective for treating *Acinetobacter* species. For the species of *Pseudomonas, Acinetobacter,* and *Enterobacteriaceae*, the proportions of resistance to carbapenem were 27%, 21%, and 14% respectively. The efficacy of methicillin was 40% for treating *Staphylococcus aureus* and the efficacy of vancomycin for *Enterococcus* species was 30%. With 4.2%, Myanmar bagged the second spot among countries of World Health Organization (WHO) South-East Asia region in MDR-TB prevalence. Although these conditions may be due to multifactorial causations, two considerable reasons are the unawareness of the professionals themselves and the community about antibiotics resistance and its consequences, and weak enforcement of drug laws and regulations.

Currently, Myanmar has been supported by WHO for combatting antibiotic resistance problems and has developed national sustainable development plan (2018-2030). Additionally, national action plan for antibiotics resistance has been implemented under the WHO technical supports across the MoHS-WHO collaborative work-plan. In this plan, strengthening the evidence base through research is an essential strategy.[20] However, there was no previous research regarding ASM among the rural public and VHWs while many countries have conducted various studies regarding ASM among the general public, village health workers, healthcare workers, and special settings. Myanmar still needs evidence from worthwhile attempts studying ASM and related characteristics to set reliable strategies capable of preventing unreasonable use of antibiotics among the general public. The main aim of this study was to determine ASM prevalence and to find out the possible factors contributing to ASM among rural communities and VHWs. Besides, this quantitative approach identified the names of antibiotics they kept at their home, locations of non-prescribed antibiotics they bought, and their knowledge and attitude towards the usage of non-prescribed antibiotics. Additionally, this study intended to provide a robust reference for the community-focused educational interventions for preventing irrational antibiotic use and antibiotics-related health risks.

METHODS

This cross-sectional study was conducted in Nattalin Township, Bago region, and began with the date on 10 February 2020 and ended with the date on 10 December 2021. This quantitative study intended to reveal the proportions and characteristics of ASM in two settings: rural dwellers and VHWs. To justify the required sample size, the sampling frame and reference prevalence of ASM were separately executed for each setting.

Calculating the required sample size of rural dwellers based on the ASM prevalence (37.7%) resulted from a study by Sirijoti et al in the general public of Thailand.[16] Further, the ASM prevalence (86%) in the WHO South-East Asia region was used as reference prevalence for manipulating a required sample of registered VHWs.[10] In determining the appropriate sample size for both settings at a 95% confidence interval, the formula (given below) developed by Daniel was used and the non-response rate (10%) was considered to prevent unacceptable response rate.[21]

$$n = z^2pq/d^2$$

As study participants, the rural dwellers were to live in rural areas, be 18-years-old and above, and have normal personalities. Besides, they were not to be profession

relating to medicine for preventing excessive professionals differences. The VHWs were to be registered and functioning volunteers and not to be outside the study area or during the study period. In defining ASM, the study participants had to self-treat themselves on their self-diagnosed illnesses with the use of any antibiotics. This study collected ASM information within six months before the study to mitigate the possible recall bias.

For the sample selection of the rural dwellers, the researchers firstly executed to list villages in the closest proximity to the rural health center (RHC) or the longest distance from an RHC in the study township. After proofing these two lists of villages, each list included 43 villages. Of these 86 villages, a total of 24 villages (twelve villages from each list) were culled by administering a simple random sampling procedure. After that, a systematic simple random sampling procedure was applied to select 18-19 households from each village selected. Additionally, to be questioned through face-to-face interviews with semi-structured questionnaires, an adult resident in each household selected was chosen by lottery method for covering a quality assessment sample when a selected household had more than one eligible dweller during the study period. Accordingly, 445 adult rural dwellers could be assigned. For a sample of VHWs, the township register of VHWs was based and 135 out of all registered VHWs were recruited accordingly. In the sample population of both settings for statistical analysis, more rural dwellers and fewer VHWs could be recruited if compared with the predetermined samples of 402 rural dwellers and 201 VHWs.

The researchers applied Epi-data version-4.6.0.6 to make a computerized data entry. The statistical package for the social sciences (SPSS) version-25 was applied to report the background characteristics of the participants, their ASM practices, common illnesses, antibiotics, and reasons for ASM according to the frequencies, percentages, 95% CI and standard deviations (SD) and to calculate the proportions of particular knowledge and perception towards ASM according to the frequencies and percentages. The significant associations between ASM and background characteristics and overall knowledge and perception scores were determined by crude and adjusted odd ratios with 95% CI resulting from bivariate and multivariate analysis.

RESULTS

Sociodemographic characteristics and prevalence of antibiotic self-medication

The self-medication related findings among rural dwellers and VHWs were independently analyzed and presented (Table 1). Among 445 rural dwellers, (60.4%) were (13-17) age-ranged, (53.5%) were male, (58.9%) were married, (61.6%) were middle passed education, (51.9%) had more than 210,000 MMK per month and (40.8%) kept antibiotics at home. The mean age (SD) of rural dwellers was (35.1±13.3) years with a minimum age of (18) years and a maximum of (70) years. The mean distance from the nearest health facility (SD) for rural dwellers was (4.8±5.0) miles with a minimum distance of (0) mile and a maximum of (35) miles. Among 133 volunteers, (81.2%) were (18-24) age-ranged, (78.2%) were females, (76.7%) were married, (56.4%) were middle passed education, (85.0%) had more than 210,000 MMK per month and (54.9%) kept antibiotics at home. The mean age (SD) of volunteers was (45.9±10.3) years with a minimum age of (19) years and maximum age of (65) years. The mean service years (SD) of volunteers was (11.6±6.2) years with a minimum service of (3) years and maximum of (36) years. The mean distance from the nearest health facility (SD) for volunteers was (6.1±5.5) miles with a minimum distance of (1) mile and a maximum of (30) miles.

The prevalence of reported ASM within the last six months was determined in this study. Out of 133 VHWs recruited in the study, 112 (84.2%; 95% CI: 78.0%, 90.4%) practiced ASM. In addition, ASM practice was also reported by 63 (14.2%, 95% CI: 11.0%, 17.4%) out of 445 participated rural dwellers.

Most frequent illnesses and frequently used antibiotics for self-medication

The top three most frequent illnesses for ASM were sore throat-(28.6%), respiratory symptoms-(15.8%) and diarrhoea-(17.9%) among rural dwellers and the common cold-(30.4%), sore throat-(25.0%) and respiratory symptoms-(20.6%) among VHWs. In ASM of rural dwellers and VHWs, amoxicillin-(46.0% and 67.9%) was used for the most frequency followed by cefixime-(33.3% and 29.5%), ampicillin-(22.2% and 8.9%) and penicillin-V-(6.3% and 10.7%) correspondingly (Table 4).

Reasons and antibiotics kept at home for antibiotic self-medication

This study discovered a variety of reasons for ASM and types of antibiotics kept at home (Table 5). The rural dwellers and VHWs frequently cited their convenience to practice (54.0% and 65.2%), their prior experience with ASM (60.3% and 49.1%) and cost reduction advantage (31.7% and 25.0%) as individual reasons for their ASM practice. Amoxicillin (91.7% and 100%), cefixime (45.8% and 75.0%) ampicillin (5.6% and 4.2%) and penicillin-V (9.7% and 4.2%) were the antibiotics kept at home by VHWs and rural dwellers that were found to be similar to the antibiotics they had used for self-medications.

Characteristics of antibiotic self-medication

The most common characters of ASM among rural dwellers and VHWs were that antibiotics selection criteria were based on types of medicines (68.3% and 49.1%), community pharmacies were their main source of antibiotics (88.9% and 78.6%), the dosage of antibiotics was exercised by previous knowledge (30.2% and 63.4%),

the dosage of the antibiotic was frequently changed when the conditions were improved (70.2% and 68.3%), the type of antibiotic was often changed when the former medicines did not work (51.4% and 56.6%) and ASM practice was oral only (96.8% and 83.3%) separately (Table 3).

Knowledge and perception relating to antibiotic self-medication

The denotation and impacts of ASM, antibiotics resistance and the rational use of antibiotics were investigated to determine knowledge and perception about ASM among study populations. Among rural dwellers and VHWs, the statistical analysis demonstrated the positive response proportions for highlighted knowledge questions like "ASM needs prescription" (50.4% and 40.4%), "drug resistance is a disadvantage" (16.9% and 33.8%), "antibiotics are needed for bacterial infections" (67.4% and 78.4%), and "antibiotics are needed for viral infections" (87.4% and 78.4%). Yet, 55.5% of rural dwellers were rated as having good knowledge of ASM whereas the rest (45.5%) was categorized as having poor knowledge. Not much differently, 57.1% of VHWs were categorized that their knowledge of ASM was good, while the remaining 42.9% was rated as having poor knowledge.

Furthermore, the rural dwellers and VHWs positively responded to highlighted perception questions such as "ASM should be practiced for minor ailments" (33.2% and 14.3%), "ASM can lead to drug resistance" (73.0% and 66.1%), "antibiotics are needed for bacterial infections" (87.4% and 88.4%), and "antibiotics are needed for viral infections" (17.4% and 28.4%). On that account, the analytic result indicated that (34.4%) and (65.6%) of rural dwellers had good and poor perceptions towards ASM and only (17.3%) of VHWs were rated as having good perception related to ASM while the remaining (82.7%) was graded as having poor perception respectively (Table 2).

Significant factors of antibiotic self-medication

A logistic regression analysis was used to identify the determinants of ASM practice among study populations (Table 6). Neither of age, gender, marital status, education, family members and family income had any real association with ASM not only among rural dwellers but also among VHWs. Though the distance between the nearest health facility and their residences had no effect on ASM practice among rural dwellers, there was a 4 times greater likelihood of practicing ASM among VHWs whose residence was within 5 miles of the nearest health facility when compared to the comparison group. The rural dwellers who kept antibiotics at home were approximately 64 times more likely than their counterparts to practice ASM. Similarly, the VHWs who kept antibiotics at home were approximately 45 times more likely to self-medicate with antibiotics than those who did not. The rural dwellers who were rated as having good knowledge of ASM had a 50% lower likelihood of ASM than their counterparts. Correspondingly, the VHWs with good knowledge had an 80% lower chance of ASM than those with poor knowledge. Obviously, for every ASM practice among rural dwellers who had a positive perception of that practice, there were five ASM practices among those who had a negative perception. Nonetheless, there was no significant difference in ASM practice between VHWs rated as having good and poor perceptions.

Table 1: Background characteristics of rural dwellers and voluntary health workers and prevalence of antibiotic self-medication.

Background characteristics	Respondents, n (%)		ASM prevalence	
	Rural dwellers (n=445)	VHWs (n=133)	Rural dwellers (n=445)	VHWs (n=133)
Age group (in years)				
37 and younger	269 (60.4)	25 (18.8)	35 (13.0)	25 (100.0)
38 and above	176 (39.6)	108 (81.2)	28 (15.9)	87 (80.6)
Gender				
Male	238 (53.5)	29 (21.8)	26 (10.9)	26 (89.7)
Female	207 (46.5)	104 (78.2)	37 (17.9)	86 (82.7)
Marital status				
Single	165 (37.1)	31 (23.3)	20 (12.1)	27 (87.1)
Married	262 (58.9)	102 (76.7)	41 (15.6)	85 (83.3)
Widow/widower	16 (3.6)		2 (12.5)	
Separate/divorce	2 (0.4)			
Education				
Illiterates	5 (1.1)			
Can read and write	18 (4.0)	3 (2.3)	3 (16.7)	3 (100)
Primary passed	70 (15.7)	39 (29.3)	10 (14.3)	29 (74.4)
Middle passed	274 (61.6)	75 (56.4)	42 (15.3)	65 (86.7)
High passed	60 (13.5)	13 (9.8)	5 (8.3)	12 (92.3)

Continued.

Background characteristics	Respondents, n (%)		ASM prevalence	
	Rural dwellers (n=445)	VHWs (n=133)	Rural dwellers (n=445)	VHWs (n=133)
Graduates	18 (4.0)	3 (2.3)	3 (16.7)	3 (100)
Occupation				
Dependent	46 (10.3)		6 (13.0)	
No current job	39 (8.8)		5 (12.8)	
Trader	45 (10.1)		8 (17.8)	
Hard workers	34 (7.6)		6 (17.6)	
Shopkeepers	80 (18.0)		10 (12.5)	
Farmers	133 (29.9)		23 (17.3)	
Government staff	13 (2.9)			
Private staff	18 (4.0)		1 (5.6)	
Students	23 (5.2)		1 (4.3)	
Others	14 (3.1)		3 (21.4)	
Family members				
<5	315 (70.8)	99 (79.4)	49 (15.6)	84 (84.8)
≥5	130 (29.2)	34 (25.6)	14 (10.8)	28 (82.4)
Family income (MMK)				
<210,000	231 (51.9)	113 (85.0)	34 (14.7)	97 (85.8)
≥210,000	214 (48.1)	20 (15.0)	29 (13.6)	15 (75.0)
Distance from the nearest health center (miles)				
≤5	376 (84.5)	80 (60.2)	62 (16.5)	71 (88.8)
>5	69 (15.5)	53 (39.8)	1 (1.4)	41 (77.4)
Regular alcohol drinking within last 6 months				
Yes	67 (15.1)	16 (12.0)	9 (13.4)	14 (87.5)
No	378 (84.9)	117 (88.0)	54 (14.3)	98 (83.3)
Keeping antibiotics at home				
Yes	26 (5.8)	73 (54.9)	24 (92.3)	72 (98.6)
No	419 (94.2)	60 (45.1)	39 (9.3)	40 (66.7)
Knowledge				
Good	247 (55.5)	76 (57.1)	16 (6.5)	61 (80.3)
Poor	198 (44.5)	57 (42.9)	47 (23.7)	51 (89.5)
Perception				
Good	153 (34.4)	23 (17.3)	3 (2.0)	22 (95.7)
Poor	292 (65.6)	110 (82.7)	60 (20.5)	80 (81.8)

Table 2: Knowledge and perception related to antibiotic self-medication among respondents.

Knowledge and perception questions	Respondents, (%)	
	Rural dwellers (n=445) *	VHWs (n=133)*
Knowledge		
ASM is taking antibiotics without any medical supervision	89.9	73.7
In ASM, diagnosis is done by the individual himself	55.7	40.6
For ASM, the prescription is necessary	50.4	40.4
ASM has disadvantages	88.8	62.4
A disadvantage of ASM is "incorrect self-diagnosis".	32.8	36.1
A disadvantage of ASM is "the risk of side effects/interactions".	18.4	9
A disadvantage of ASM is "improper/insufficient dosage and frequency"	26.5	20.3
A disadvantage of ASM is "incorrect choice of therapy"	29.4	20.3
A disadvantage of ASM is "the risk of dependence and addiction"	88.1	91.7
A disadvantage of ASM is "drug resistance"	16.9	33.8
A disadvantage of ASM is "can lead to toxicity and death"	18.2	13.5
Do you know over the counter (OTC) drugs?	38.4	53.4

Continued.

Knowledge and perception questions	Respondents, (%)	
	Rural dwellers (n=445) *	VHWs (n=133)*
OTC drugs are procured or dispensed by the pharmacist without a prescription	62.9	72.9
OTC drugs have no schedule	25.2	6.8
OTC drugs do not need a prescription	28.8	66.9
Antibiotics are also considered OTC drugs	51.9	26.3
Antibiotics are needed to take for bacterial infections	87.4	78.4
Antibiotics are needed to take for viral infections	65.7	75.3
Antibiotics are needed to treat the common cold and influenza	89.9	72.9
Antibiotics are needed to treat skin infections and wounds	79.7	78.6
Antibiotics are a must to treat diarrhoea	89	69.9
The proportion of good general knowledge	55.5	57.1
Perception		
ASM is a good/acceptable practice completely	89	67.7
ASM is entirely safe	78.7	64.7
ASM is disadvantageous	82.2	57.1
ASM should be practiced for minor ailments	33.2	14.3
ASM should be practiced for serious conditions	88.3	45.8
You should seek pharmacist guidance before taking ASM	45.2	42.9
You should seek a physician's opinion if symptoms worsen with ASM	92.2	75.2
You should suggest ASM for people without medical knowledge	73.2	51.8
You should consult the doctor for treating side effects due to ASM	90.2	69.2
You yourself should change the physician's prescription if your condition does not progress	82.3	42.1
You yourself should substitute the physician's prescription with ASM	83.4	47.3
Whenever you suffer from a similar health condition, you yourself should take antibiotics as previous doctor's prescription	75.7	42.1
ASM can lead to substantial adverse drug reactions	81.6	63.9
ASM can lead to drug resistance	73	66.1
ASM can lead to treatment failure	66.1	54.1
ASM can lead to drug-related toxicity	81.3	67.7
Antibiotics are needed to take for bacterial infections	87.4	88.4
Antibiotics are needed to take for viral infections	17.4	28.4
Antibiotics are needed to treat the common cold and influenza	18.9	22.7
Antibiotics are needed to treat skin infections and wounds	78.2	88.3
Antibiotics are a must to treat diarrhoea	8	9.9
The proportion of good general perception	34.4	17.3

*Only positive responses are mentioned in percentage

Table 3: Characteristics of antibiotics self-medication within last 6 months among respondents.

Characteristics of ASM	Respondents, n (%)	
	Rural dwellers (n=63)	VHWs (n=112)
Frequency*		
Once	53 (84.1)	67 (50.4)
More than once	10 (15.9)	45 (49.6)
Antibiotics selection criteria*		
Types of medicines	43 (68.3)	55 (49.1)
Brand of medicines	18 (28.6)	17 (15.2)
Price of medicines	8 (12.7)	17 (15.2)
Indications for use	7 (11.1)	25 (22.3)
Adverse reactions	0 (0.0)	6 (5.4)

Continued.

Characteristics of ASM	Respondents, n (%)	
	Rural dwellers (n=63)	VHWs (n=112)
Source of antibiotics*		
Community pharmacies	56 (88.9)	88 (78.6)
Traditional medicine practitioners	2 (3.2)	12 (10.7)
Leftover from the previous prescription	0 (0.0)	2 (1.9)
Online shopping/e-pharmacies	1 (1.6)	3 (2.7)
Knowing the dosage of antibiotics*		
Checking the package insert	6 (9.5)	12 (10.7)
Consulting a doctor	1 (1.6)	3 (2.7)
Consulting a pharmacist	18 (28.6)	6 (5.4)
Consulting family members/ friends	19 (30.2)	10 (8.9)
Newspapers/magazines/books/T	6 (9.5)	0 (0.0)
Internet	5 (7.9)	7 (6.3)
Previous experience	19 (30.2)	71 (63.4)
Guessing by myself	5 (7.9)	10 (8.9)
Reasons for changing antibiotics dosage*		
Improving conditions	33 (70.2)	69 (68.3)
Worsening conditions	9 (19.1)	29 (19.8)
To reduce adverse reactions	7 (14.9)	7 (6.9)
Drug insufficient for complete treatment	3 (6.4)	2 (2.0)
Reasons for changing antibiotics types*		
The former medicines did not work	18 (51.4)	56 (56.6)
The former medicines ran out	12 (34.3)	37 (37.4)
The latter one was cheaper	3 (8.6)	8 (8.1)
To reduce adverse reactions	0	4 (4.0)
Normally stop taking antibiotics*		
After a few days regardless of the outcome	18 (28.6)	31 (27.7)
After symptoms disappeared	15 (23.8)	34 (30.4)
A few days after the recovery	16 (25.4)	23 (20.5)
After medicines ran out	15 (23.8)	10 (8.9)
At the completion of the course	5 (7.9)	22 (19.6)
After consulting a doctor/pharmacist	0 (0.0)	3 (2.7)
When adverse reactions occurred		
Consulted family members/friends	0 (0.0)	1 (0.9)
Practiced self-medication antibiotics are		
Injectable only	2 (3.2)	4 (3.6)
Oral only	61 (96.8)	93 (83.0)
Both	0 (0.0)	15 (13.4)

Multiple response questions*

Table 4: Most frequent illnesses and frequently used antibiotics for self-medications.

Characteristics of ASM	Respondents, n (%)	
	Rural dwellers (n=63)	VHWs (n=112)
Most frequent illnesses*		
Cold, cough and fever (common cold, flu)	7 (11.1)	34 (30.4)
Sore throat	18 (28.6)	28 (25.0)
Respiratory symptoms (cough, dyspnea)	10 (15.8)	23 (20.6)
Diarrhoea	12 (17.9)	20 (17.9)
Dysentery	1 (1.6)	7 (6.3)
Toothache	1 (1.6)	5 (4.5)
Skin infection or wound	3 (4.8)	4 (3.6)

Continued.

Characteristics of ASM	Respondents, n (%)	
	Rural dwellers (n=63)	VHWs (n=112)
Urinary tract problems	0 (0.0)	4 (3.6)
Acne	1 (1.6)	3 (2.7)
Burning	1 (1.6)	1 (0.9)
Enteric fever	2 (3.2)	1 (0.9)
Other GIT problems (abdominal pain, indigestion, constipation, nausea, vomiting, and gastritis)	3 (4.8)	0 (0.0)
Eye and ear related symptoms	0 (0.0)	1 (0.9)
Frequently used antibiotics*		
Amoxicillin	29 (46.0)	76 (67.9)
Cefixime	21 (33.3)	33 (29.5)
Ampicillin	14 (22.2)	10 (8.9)
Penicillin-V	4 (6.3)	12 (10.7)
Tetracycline	5 (7.9)	8 (7.1)
Ampicillin + cloxacillin	2 (3.2)	7 (6.3)
Erythromycin	0 (0.0)	6 (5.4)
Ciprofloxacin	0 (0.0)	6 (5.4)
Chloramphenicol	1 (1.6)	6 (5.4)
Amoxicillin and clavulanic	0 (0.0)	3 (2.7)
Cotrimoxazole	1(1.6)	2 (1.8)
Ofloxacin	0 (0.0)	1 (0.9)
Azithromycin	0 (0.0)	1 (0.9)
Rifampicin	0 (0.0)	1 (0.9)
Cephalexin	1 (1.6)	0 (0.0)
Kanamycin (injection)	0 (0.0)	4 (3.6)
Others	18 (28.6)	36 (32.1)

Multiple response questions*

Table 5. Reasons and antibiotics kept at home for antibiotics self-medications.

Characteristics of ASM	Respondents, n (%)	
	Rural dwellers (n=63)	VHWs (n=112)
Reasons for antibiotic self-medication*		
Pre-experience	38 (60.3)	55 (49.1)
Convenience	34 (54.0)	73 (65.2)
Cost reduction	20 (31.7)	28 (25.0)
Knowledge of the diseases	6 (9.5)	5 (4.5)
Advice from friends	4 (6.3)	5 (4.5)
Old prescription	3 (4.8)	4 (3.6)
Knowledge of the medicines	5 (7.9)	1 (0.9)
Unknown the consequences of self-medication	3 (4.8)	4 (3.6)
Advertisement	4 (6.3)	0 (0.0)
Internet	2 (3.2)	2 (1.8)
Lack of trust in prescribing doctor	0 (0.0)	1 (0.9)
No time to seek medical care of physicians	0 (0.0)	2 (1.8)
Lack of near health facilities	2 (3.2)	1 (0.9)
Too much distance to go to physician clinic	0 (0.0)	1 (0.9)
Recommended by pharmacists	1 (1.6)	0 (0.0)
Considering the symptoms as minor or not necessary to consult a doctor	1 (1.6)	0 (0.0)
Avoiding crowd and waiting time at OPD	0 (0.0)	2 (1.8)
Others	0 (0.0)	1 (0.9)

Continued.

Characteristics of ASM	Respondents, n (%)	
	Rural dwellers (n=63)	VHWs (n=112)
Antibiotics kept at home*		
Amoxicillin	25 (100.0)	66 (91.7)
Cefixime	18 (75.0)	33 (45.8)
Penicillin-V	1 (4.2)	7 (9.7)
Ampicillin	1 (4.2)	4 (5.6)
Ampicillin + cloxacillin	0 (0.0)	6 (8.3)
Chloramphenicol	0 (0.0)	4 (5.6)
Erythromycin	0 (0.0)	3 (4.2)
Cephalexin	0 (0.0)	2 (2.8)
Ciprofloxacin	0 (0.0)	2 (2.8)
Cloxacillin	0 (0.0)	1 (1.4)
Cotrimoxazole	0 (0.0)	1 (1.4)
Kenamycin (injection)	0 (0.0)	4 (5.6)
Azithromycin	1 (4.2)	0 (0.0)
Tetracycyline	0 (0.0)	1 (1.4)
Others	0 (0.0)	5 (6.9)

Multiple response questions*

Table 6: Multiple logistic regression analysis to identify the determinants of antibiotics self-medication among participants in the study area.

Influencing factors	Rural dwellers (n=445)		VHW (n=133)	
	Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
Age group (in years)				
37 and younger	0.8 (0.5, 1.4)		1.2 (1.1, 1.4) *	
38 and above	1		1	
Gender				
Male	0.6 (0.3, 0.9) *		1.8 (0.5, 6.6) *	
Female	1		1	
Marital status				
Single	0.8 (0.4, 1.3)		1.4 (0.4, 4.4)	
Married and others	1		1	
Education				
Below high school	1.5 (0.7, 3.4)		0.3 (0.04, 2.6)	
High school and above	1		1	
Family members				
<5	1.5 (0.8, 2.8)		1.2 (0.4, 3.4)	
≥5	1		1	
Family income (MMK)				
<21,000	1.1 (0.6, 1.9)		2.0 (0.6, 6.3)	
≥21,000	1		1	
Distance from health center (miles)				
≤5	13.4 (1.8, 98.5)**		2.3 (0.9, 5.9)	4.0 (1.1, 14.4)*
>5	1		1	1
Keeping antibiotics at home				
Yes	36 (4.7, 278) ***	64 (14, 292) ***	117 (27, 513) ***	45 (5.1, 395) **
No	1	1	1	1
Knowledge				
Good	0.5 (0.2, 1.3)	0.5 (0.2, 0.99) *	0.2 (0.1, 0.4) ***	0.2 (0.05, 0.8) *
Poor	1	1	1	1
Perception				
Good	(0.6, 38.4)	0.2 (0.05 ,0.7) *	0.1 (0.02 ,0.3) ***	
Poor	1	1	1	

(Nagelkerke R2=0.484, Hosmer and Lemeshow p value=0 .223) for VHWs; (Nagelkerke R2=0.414, Hosmer and Lemeshow p value=0.539) for rural dwellers; ***p<0.001, **p<0.01, *p<0.05

DISCUSSION

To address the antimicrobial resistance crisis in Myanmar, it is necessary to speed up the surveillance of antibiotic use among different settings, awareness promotion of antibiotic resistance, and do research that determines the occurrence of antimicrobial-resistant species and antibiotic consumption rates. In Myanmar, the VHWs have been trained and recruited since the 1980s to link the communities to the local health department to the health system by providing primary healthcare services. The recruitment of the VHWs is an effective economical way in delivering basic maternal and child healthcare services, preventive and partial curative services for communicable diseases, promoting services for health literacy, environmental and occupational health, and immunization activities.[22] However, many VHWs try to practice extra curative healthcare activities apart from their primary duties because of the community demands and they come to treat their families, communities, and themselves with a wide range of antibiotics.[23] In this regard, this study is conducted to estimate ASM prevalence among VHWs, the types of antibiotics they self-medicated, and the identification of the related factors. Also, a Sweden study concluded that the general public was more likely to self-treat than healthcare professionals because they were less compressive about negative consequences following self-treatment.[25] Moreover, a previous Myanmar study by Khin-Soe-Lin et al pointed out that the less knowledge about the dangers of ASM, the more someone self-treat with antibiotics.[24] Regarding their conclusions, this study wanted to point out challenges or opportunities to draft antibiotics self-prescribed among rural communities as well as to oversee the associated factors.

Prevalence of antibiotic self-medication amongst rural dwellers

To oversee the ASM prevalence and its related factors among rural dwellers, all targeted and eligible rural dwellers (445, 100%) participated in this study. This high completion rate was because of the interest of the participants, the explanatory skills of the researchers about the importance of the study objectives, and appropriate data collection time, however not influenced by high incentive pay and personal relationships.

With regards to ASM among rural dwellers, this investigation showed a prevalence of 14.2%. Here, any comparable study was not available in Myanmar. Previously in Myanmar, an old study showed that nearly 98% of rural health-decision makers had a history of self-medication and another cross-sectional study reported the self-medication prevalence of 89.2% among the labour force[27], but the prevalence did not concern the prevalence of ASM and they did not mention which antibiotics were taken for self-treatment.[26,27] The prevalence of ASM resulting from this study is comparable to 15.1%, 15.2%, and 16.7% reported among rural communities in Malaysia, Spain, and India respectively.[28-30] This study proved that the rural dwellers in Myanmar were less likely to self-treat themselves with antibiotics than the rural population from the rural settings of other countries: Sindh of Pakistan (81.3%), Taif city of Saudi Arabia (80.6%), Niger state of Nigeria (82.2%), but more likely to practice ASM than rural dwellers of Yogyakarta City from Indonesia (7.3%), and Szeged district from Hungary (7.8%).[31-35]

Prevalence of antibiotic self-medication amongst VHWs

To estimate the prevalence of ASM amongst VHWs, this study obtained valid responses from 133 out of the total registered VHWs in the study area. The return rate of this study was 98.7%. This acceptable participation rate was achieved because the township public health department from the study area yearly updates the list of the functioning or non-functioning VHWs. Besides, all supervisors from the study area helped the researchers' contact the VHWs and the VHWs themselves were active to participate in the study.

This finding demonstrated that the ASM prevalence in the VHWs was 84.2%, which is considered high. No comparable study has been found in Myanmar as well as other countries, investigating ASM practices and related factors amongst VHWs. It is not possible to discuss this prevalence is high or low among similar settings. However, a study by Sihavong et al mentioned that 3% of the village health workers self-medicated themselves on sexually transmitted infections.[36] When comparing this prevalence, our ASM prevalence among VHWs was much higher and this incomparable difference may be due to the differences in the outcome focus of the studies.

Antibiotics used for self-medication amongst rural dwellers

This study listed more than 10 types of antibiotics the rural dwellers self-treated and showed that amoxicillin followed by cefixime, ampicillin, tetracycline and penicillin-V were the 5 most common antibiotics. Here, amoxicillin and cefixime were also mentioned and these antibiotics were less efficacious in killing some bacteria in Myanmar. Similar antibiotics that the rural dwellers used for their self-medication were also revealed from the studies of India, Greece, Pakistan, and Nigeria.[31,33,37,38] However, the most commonly used antibiotics are different and amoxicillin followed by metronidazole, tetracycline and ciprofloxacin in an Indian study, amoxicillin followed by amoxicillin/clavulanic acid, cefaclor and cefuroxime in a Greece study, amoxicillin/clavulanic acid followed by ciprofloxacin, metronidazole and doxycycline in a Pakistan study, and ampicillin/cloxacillin followed by ampicillin, co-trimoxazole, metronidazole, tetracycline and amoxicillin in a Nigerian study.[31,33,37,38]

Antibiotics used for self-medication amongst VHWs

This study reported that there were 21 types of antibiotics used for self-medication among VHWs. Of which,

amoxicillin, cefixime, penicillin-V, ampicillin, and cloxacillin were mentioned to be the most self-treated antibiotics. Many antibiotics the VHWs self-treated were included in the drug group resistant to *Escherichia coli* and *Klebsiella* species in Myanmar.[19] According to the duration of recruitment of the VHWs in the Myanmar health system, the high prevalence of ASM among them, and the antibiotic types they self-treated, the ASM practice of the VHWs may be one possible cause of the emergence of the drug resistance to *Escherichia coli* and *Klebsiella* species. However, a recent Myanmar study reported that these similar antibiotics were frequently taken for self-prescription among basic health staff without consulting a medical doctor.[24] Because of the similarity of the most frequently self-medicated antibiotics resulting from these two Myanmar studies and the antibiotics resistant to some bacteria in Myanmar, we also consider the more the antibiotics are used for self-medication, the more the antibiotics become resistant.

Illnesses and reasons for antibiotic self-medication amongst rural dwellers

This study exhibited that, among rural dwellers, pain in the throat and teeth, loose motion, mucus/blood in the diarrhoea, cold, cough, high body temperature, acute respiratory tract symptoms, and abscess were the most frequent manifestations for their ASM. These indications are comparable to those of India, Kuwait, Greece, Pakistan, Nigeria and Indonesia.[31,33,34,37-39] Here, like among VHWs, inappropriate antibiotic use is noted. Of 13 indications this study identified, common cold, influenza, toothache, abdominal pain, nausea, vomiting, and indigestion should not be initially treated with antibiotics.[40] This study revealed that the easy and legally availability of antibiotics over the counters, subsequent use of physicians' old prescriptions, and challenges of consultant fees contributed to their ASM. These contributions are similarly reported in the studies from India, Pakistan, Nigeria and Indonesia.[31,33,34,38] This finding indicates that, in Myanmar, national drug law still allows the communities and pharmacists to purchase or sell physician only-prescription medicines without showing a prescribed letter of a medical doctor, and there is no standard operating procedure for general practitioners regarding consultant fees, accountabilities and responsibilities.

Illnesses and reasons for antibiotic self-medication amongst VHWs

This study stated that the VHWs frequently used antibiotics for the common cold, influenza, sore throat, liquid stools, and cough. This practice shows a form of irrational antibiotic use because antibiotics are not necessary for the treatment of common cold, influenza and cough, and using antibiotics for these ailments would not help the patients and can harm due to their side-effects. Irrational antibiotic prescribing and use are highly associated with many serious health problems and the emergence of antibiotic-resistant infections.[40] Among VHWs we studied, their practices of ASM were based on 15 reasons, but the easy availability of antibiotics, pre-experience and monetary reasons were the main causes. These reasons might be related to weak enforcement of drug laws and regulations, lack of supervision and audit on the activities of the VHWs and high consultation fees of the medical doctors and physicians.

Knowledge and perception towards antibiotic self-medication amongst rural dwellers

Overall, of the total rural dwellers we studied, about half had a low knowledge level and about two-thirds have a poor perception towards meanings, acceptance, dangers, consequences of ASM and antibiotic resistance. This situation is mirrored by the results of the studies conducted in India, Kuwait, Greece, Pakistan, Nigeria and Indonesia.[31,33,37-39] Importantly, although many studies including this study tended to explore the knowledge of the rural population about the relationship between unnecessary use of antibiotics and antibiotic resistance, the rural dwellers could not provide acceptable or reasonable answers and misunderstood many concepts of ASM and antibiotic resistance.[31,33,38,39] This study found that most of the antibiotics they self-medicated were taken for the common cold or influenza. This finding indicates that, whenever the rural dwellers were unwell, they tried to take antibiotics without considering the indications of antibiotics, but their education levels were not enough to identify their illnesses caused by bacteria or viruses. According to the statistical evidence, knowledge and perception levels of the rural dwellers are the important determinants of ASM. Also, for combatting antibiotic resistance through national action plan, the working groups importantly need to understand and promote the knowledge gaps of the community because the community awareness of antibiotic resistance and unnecessary antibiotic use is the basis for the success of this action plan.[20]

Knowledge and perception towards antibiotic self-medication amongst VHWs

Of the total VHWs we studied, about half had insufficient knowledge about the dangers, side-effects and consequences of ASM and antibiotic resistance, and a very large percentage (more than four-fifths) had poor perception towards ASM.

This result shows that, regarding antibiotic resistance, the national strategy could not focus on knowledge development of all medical concerns and also indicates the requirement of a national information campaign for applying diverse media focus. In this study, unnecessary antibiotic use was statistically associated with low knowledge levels, keeping antibiotics at their homes, and long-distance from health center among VHWs. Accordingly, this condition can cause the antibiotics less effectiveness and more resistance.

CONCLUSION

ASM practices and unnecessary antibiotic use were found in both settings, but high proportions were more remarkable among VHWs. This study concluded that, in both settings, ASM practices were employed due to three main causes such as poor knowledge, easy availability of antibiotics and monetary reasons. To promote the awareness of the general community especially VHWs on the consequences of irrational use of antibiotics, the cooperation of the Myanmar health literacy promotion unit and technical working groups is important and they should initiate a wide range of education and information programmes through individual counselling of healthcare professionals, popular media channels, mass group education of basic healthcare professionals and distributions of information, education, communication (IEC) materials. To mitigate the easy availability of non-prescribed antibiotics, the national drug laws should be enforced and the Myanmar technical working groups should be responsible for educating community drug retail outlets on prescription-only antibiotics and taking actions on unregulated findings during inspection of community pharmacies. To outweigh the financial burden regarding consultation of a physician, the government sector should be responsible for providing easy access to public health infrastructure facilities and the Ministry of Health should be responsible for developing the standard operating procedures regarding acceptable and economical medical services of general practitioners and private clinics.

ACKNOWLEDGEMENTS

The authors are grateful to implementation research (IR) granters from the department of medical research for funding this research, directors, and assistant directors from the departments of public health of Bago region and Nattalin Township and basic health service professionals from study areas for providing in-kind support and all respondents for their active participation.

Funding: The study was funded by MOHS Research Grant (2019-2020)
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Hlaing T, Lat TW, Myint ZM. Prevalence and possible causes of antibiotic self-medication among rural dwellers and volunteer health workers in Nattalin Township, Bago region, Myanmar. Int J Community Med Public Health 2022;9:1592-604.