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Influence of knowledge, access to information, and health seeking behavior on antibiotic self-medication in Thailand

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ABSTRACT

Antibiotic self-medication (ASM) significantly contributes to antimicrobial resistance (AMR), a pressing global health concern. However, the impact of knowledge, health information access, and health-seeking behavior on ASM in Thailand is poorly understood. This study aimed to evaluate these influences using data from the 2021 health and welfare survey conducted by Thailand's National Statistical Office. A generalized linear mixed model was applied to assess associations. Variables with a p-value <0.25 in bivariate analysis were further analyzed in a multivariable model, with adjusted odds ratios (AOR), 95% confidence intervals (CI), and p-values reported. Among 26,030 participants, 2.79% (95% CI: 2.59%-2.99%) engaged in ASM. Low knowledge of antibiotic use was strongly linked to ASM (AOR=4.30, 95% CI: 2.61-7.08), as was moderate knowledge (AOR=2.47, 95% CI: 1.49-4.09). Lack of antibiotic-related information significantly increased ASM (AOR=3.86, 95% CI: 3.03-4.92). Recent health-seeking behaviors, including over-the-counter medication (AOR=3.54, 95% CI: 2.02-6.21) and avoiding public and private hospitals, were also major contributors. Medication and transportation expenses were additional significant factors. Enhancing access to health information, knowledge, and healthcare services could reduce ASM in Thailand.

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1. INTRODUCTION

Antibiotics are commonly used in the treatment of infectious diseases, either orally or intravenously [1]. Antibiotic self-medication (ASM) is defined as the treatment of self-recognized disorders or symptoms using antibiotics without prior consultation with a qualified health professional [2]. A major consequence of ASM is antimicrobial resistance in bacterial infections, leading to longer hospitalization periods and higher costs of antibiotic treatment [3], [4]. Additionally, ASM can contribute to delays in the diagnosis and treatment of communicable diseases, such as pulmonary tuberculosis [5].

ASM was prevalent worldwide [6]. Global ASM prevalence, excluding the Asian continent, has been reported to range from 12.1% to 93.9% in previous studies [7]. In Asia, ASM prevalence has also been estimated at 7.3% to 85.59% [8]. A study conducted in metropolitan Thailand, 88.2% of the working-age population practiced self-medication, primarily using NSAIDs (34.8%) and antibiotics (30.2%) for minor illnesses, with many experiencing incomplete recovery, some requiring hospital care, and showing misunderstandings about antibiotic use [9].

Several previous literatures demonstrated contributed factors to ASM. Living in a rural area, sex, and age have been observed to be the related factors to ASM [10], [11]. A higher education has also been

associated with ASM [10], [12], [13]. Monthly income has been shown to affect ASM behavior [11], [14]. Previous qualitative studies have revealed the several reasons for engaging in ASM, such as it being easier than accessing to healthcare services, the need to pay for health services, and it being less time-consuming [15].

While prior studies have identified general contributing factors, such as rural living, income, and education, the association between ASM and healthcare access costs, like transportation and service fees, remains unclear. Additionally, previous research results on these factors have been inconclusive. This study offers a more precise assessment of these influences on ASM, highlighting the role of low and moderate antibiotic knowledge, lack of information, and recent health-seeking behaviors. By emphasizing the importance of healthcare access and education, this research aims to inform policies that can better control ASM.

2. METHOD

2.1. Study design and population

This cross-sectional study was employed using data from the Health and Welfare Survey 2021, which was extracted from the National Statistic Office. The survey was conducted among the Thai population across 77 provinces in Thailand. The population included individuals aged 15 years and over who were enrolled in the study [16]. The inclusion criteria encompassed all individuals under the survey who had consumed the antibiotics in the preceding month. Data from individuals with several missing values were excluded from the study.

2.2. Outcome and covariates definition

ASM was defined as individuals who had taken antibiotics within one month before the interview and obtained antibiotics from leftover supplies, drugstores, or grocery stores. The number of underlying diseases was categorized into three groups: no underlying disease, one underlying disease, and more than one underlying disease. Occupation type was defined based on the interviewee's occupation and classified into three groups: unemployed, private business employee, and public or private officer.

Health-seeking behavior was defined as the actions taken by interviewees when they fell ill, including visits to public and private hospitals, primary care units (PCUs), or purchasing medications. Transportation expenses were defined as essential payments for traveling to healthcare facilities. Health services expenses were defined as expenses incurred by patients for healthcare services without reimbursement. Understanding of antibiotic usage was assessed through a series of six questions, with scores ranging from 0 to 6 points. A cumulative score of 0 to 2 points reflected insufficient knowledge, 3 to 4 points suggested a moderate level of knowledge, and 5 to 6 points indicated a strong grasp of the subject. Attitudes regarding antibiotic usage were gauged using five questions, and scored between 5 and 25 points. A score below 11.67 was indicative of a negative attitude, while a score surpassing 18.34 demonstrated a positive outlook. Scores within these ranges were considered to represent a moderate attitude.

2.3. Data processing and management

The data were extracted from health and welfare survey 2021. Pairwise deletion was performed for missing values management. This procedure was conducted using Microsoft Excel 2007. Statistical analysis. Prevalence of ASM was calculated by determining the proportion of ASM among the entire population. Categorical variables were described in terms of frequency and percentage, while continuous variables were reported as mean and standard deviation (SD), as appropriate.

Generalized linear mixed model (GLMM) with binomial family was utilized to quantify the interplay between socioeconomic and health seeking behavioral factors, and ASM. Region was designed as random effect variables. The bivariate analysis results were revealed as crude odds ratio (COR), 95% CI, and p-value. Variables with p-value less than 0.05 from the bivariate analysis were then subjected to further multivariable analysis. The final results were shown as adjusted odds ratio (AOR), 95% CI, and p-value. All of statistical procedures were implemented in STATA version 18 (copyright of Khon Kaen University).

2.4. Ethical approval

Ethical clearance is a letter or document stating that a study has met the ethical rules of research. Ethical approval to conduct this study was granted by the Ethics Review Committee for Research Involving Human Research Subjects, Khon Kaen University. The approval number is HE662146 which was issued on June 19, 2023.

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. ASM prevalence

Among the 26,030 participants included in the study, 1,835 reported antibiotic consumption within the past month, with 727 of them identified as ASM users. The prevalence of ASM was calculated to be 2.79% (95% CI: 2.59%-2.99%) as shown in Table 1. Drug stores were the primary source of antibiotics for ASM users, accounting for 94.09% of cases. Additionally, grocery stores were observed to be a source of antibiotics for ASM users, representing 5.64% as shown in Table 1.

Table 1. ASM prevalence (n=26,030)

Characteristics	Number	Percentage	95%CI
Antibiotics user			
ASM	727	2.79	2.59-2.99
Non-ASM	1,108	4.26	4.01-4.50
Non-antibiotics users	24,195	92.95	92.63-93.26
Sources of antibiotics among ASM user (n=727)			
Drug store	684	94.09	
Grocery store	41	5.63	
Leftover antibiotics	2	0.28	

3.1.2. Personal and socioeconomic characteristics of the surveyed participants

More than half of the participants were male and resided in urban areas. The average age was 52.44 years. The majority of them had completed primary school education and were married. Private business employment and unemployment were the predominant observed statuses among participants, at 43.57% and 30.04% respectively. Universal health coverage was the primary health insurance reported among participants. The majority of participants had a monthly household income exceeding 10,000 baht. Underlying diseases were reported among 8,648 participants (33.22%), with 3,993 participants having more than one underlying disease as shown in Table 2.

3.1.3. Participants' health-seeking behavior

Of the 6,911 participants who reported on their illness treatment, 559 people (8.09%) didn't exhibit any health-seeking behavior. Among them, 40.51% visited public hospitals, while 23.69% visited primary care units when they fell ill. Purchasing medication accounted for 18.91% of the participants, while 11.04% visited private hospitals and clinics. Nearly all of them (91.67%) sought treatment from a physician, with modern medicine being the most common treatment option (99.30%) among participants. Herbal remedy treatment was reported by 3.63% of participants as shown in Table 2.

Non-healthcare access was observed among 1,869 people (27.04%). The main reasons for non-visitation included having mild illness (61.85%) and longer waiting times for services (17.49%). A small percentage of people (6.52%) couldn't visit during official hours, while 2.19% cited longer distances between home and health facilities as the barrier. Additionally, 53.01% of participants followed up on their underlying diseases only once, while 10.45% followed up more than once.

3.1.4. Knowledge and attitude regarding antibiotics use, including sources of information regarding antibiotics use and its resistance

More than three-quarters of the people (75.16%) knew that they should stop using antibiotics in accordance with health professionals' advice, while 30.52% of them understood that antibiotics can't kill viruses. Correct knowledge about antibiotics not being used for common cold treatment was found in 7,011 participants (34.71%). Nearly all of them (87.92%) knew that inappropriate antibiotic use contributes to antimicrobial resistance (AMR) infections. Around 60% of them knew that frequent antibiotic use induces adverse drug reactions, such as diarrhea. Only 43.08% of them correctly knew that antibiotics and anti-inflammatory drugs are different. The average knowledge score among surveyed participants was 2.58, with a standard deviation of 1.49. Low knowledge regarding antibiotic use accounted for 48.67% as shown in Table 3.

The majority of people (62.49%) agreed that they should consume antibiotics prescribed by a physician, while 45.40% disagreed that they should keep leftover antibiotics for further illness treatment. Many people agreed that they should be concerned about AMR infections (72.19%), and the majority of them (68.15%) also agreed that they should worry about AMR affecting individuals and family health statuses. Moreover, a large number of people (71.32%) agreed that they have a lower risk of AMR infections when they use antibiotics appropriately. The average attitude score was 19.03, with a standard deviation of 3.22. Poor attitude regarding antibiotic use was reported among 583 participants (2.30%) as shown in Table 4.

Table 2. Socioeconomic characteristics of the participants (n=26,030)

Characteristics	Number (n)	Percentage (%)
Personal and socioeconomic		
Gender		
Female	14,933	42.63
Male	11,097	57.37
Residency area		
Urban	14,494	55.68
Rural	11,536	44.32
Age (years)		
Mean (SD)	52.44 (15.62)	
Median (Min: Max)	53 (15: 98)	
Personal and socioeconomic		
Marital status		
Single	3,884	14.92
Married	16,718	64.23
Widow	3,747	14.39
Divorce	1,681	6.46
Occupation (n = 25,522)		
Unemployed	7,667	30.04
Private business employee	11,579	45.37
Private or public officer	6,276	24.59
Educational attainment (n=25, 954)		
Kindergarten or lower	5,360	20.65
Primary school	9,640	37.14
Junior secondary school	3,257	12.55
Senior secondary school	3,552	13.69
Diploma	1,039	4.00
Bachelor's degree or above	3,106	11.97
Monthly household income (n=16,904)		
<5,000 baht	2,341	13.85
5,000-10,000 baht	5,223	30.90
>10,000 baht	9,340	55.25
Health insurance		
Universal health coverage	26,023	99.97
Non-universal health coverage	7	0.03
Chronic Disease		
No chronic disease	17,382	66.78
One chronic disease	4,655	17.88
More than one chronic disease	3,993	15.34
Health seeking behaviors (n=6,911)		
Public hospitals visit (n=6,909)		
Yes	2,799	40.51
No	4,110	59.49
PCU visit		
Yes	1,637	23.69
No	5,274	76.31
Private hospital/clinic visit		
Yes	572	8.28
No	6,339	91.72
Buying the drugs		
Yes	1,307	18.91
No	5,604	81.09
Health care providers (n=5,008)		
Physician		
Yes	4,591	91.67
No	417	8.33
Thai traditional medical professions		
Yes	14	0.28
No	4,994	99.72
Nurse		
Yes	149	2.98
No	4,859	97.02
Public health officer		
Yes	233	4.65
No	4,775	95.35
Treatment options*,**		
Modern medicine	4,973	99.30
Herbal remedy	182	3.63
Other alternative medicine	95	1.89
Transportation expense (n=26,009)		
Paid	9,408	36.17
Not paid	16,601	63.83
Health service expense (n=25, 998)		
Paid	3,677	14.14
Not paid	22,321	85.86

*Reported among 5,008 participants
**Multiple responses

Table 3. Knowledge regarding antibiotics use among entire participants (n=26,030)

Correct knowledge	Number (n)	Percentage (%)
1. I should stop using antibiotics according to the advice of medical personnel. (n=24,893)	18,710	75.16
2. Antibiotics can't kill viruses. (n=19,935)	6,084	30.52
3. Antibiotics can't cure the common cold. (n=20,200)	7,011	34.71
4. Unnecessary use of antibiotics can render treatment ineffective or lead to AMR. (n=20,607)	18,118	87.92
5. Frequent use of antibiotics can cause side effects, such as diarrhea. (n=15,829)	9,471	59.83
6. Antibiotics and anti-inflammatory drugs are different types of medication. (n=18,254)	7,891	43.08
Knowledge score		
Mean (SD)	2.58 (1.49)	
Median (Min: Max)	3 (0: 6)	
Level of knowledge		
High	2,978	11.44
Average	10,385	39.89
Low	12,667	48.67

Table 4. Attitude regarding antibiotics use among entire participants (n=26,030)

Question	Level of agreement (%)				
	Strongly disagree	Disagree	Borderline	Agree	Strongly agree
1. I should only take antibiotics prescribed by a physician (n=25,496)	226 (0.89)	496 (1.94)	1,020 (4.00)	15,932 (62.49)	7,822 (30.68)
2. I should save leftover antibiotics for future illness (n=24,700)	4,325 (17.51)	11,213 (45.40)	2,077 (8.41)	6,220 (25.18)	865 (3.50)
3. Antibiotics resistance is a problem that I should concern about (n=24,957)	106 (0.42)	541 (2.17)	2,250 (9.02)	18,017 (72.19)	4,043 (16.20)
4. I concern about the potential adverse effects of antibiotics resistance on my health and that of my family. (n=24,875)	143 (0.57)	1,086 (4.37)	3,194 (12.84)	16,953 (68.15)	3,499 (14.07)
5. Using antibiotics correctly ensures that I'm not at risk of developing antibiotic resistance. (n=24,454)	132 (0.54)	978 (4.00)	2,089 (8.54)	17,639 (72.13)	3,616 (14.79)
Attitude score					
Mean (SD)	19.03 (3.22)				
Median (Min: Max)	19 (4: 25)				
Attitude level	n (%)				
High	15,570 (61.12)				
Average	9,319 (36.58)				
Low	587 (2.30)				

Receiving information regarding antibiotic use and AMR was reported by 26.46% of surveyed participants. Most antibiotic users obtained this information from physicians (47.56%) and pharmacists (43.20%). Nurses also provided this information to some extent. A few people received this information from newspapers/posters (7.69%) and from friends and family members (12.46%).

Associated factors of ASM behavior from bivariate analysis. The prevalence of ASM in urban areas was 2.99%, which was higher than that in rural areas (2.55%); however, statistical significance was not observed (p-value=0.218). The prevalence among males and females was similar (p-value=0.435). The prevalence of ASM among different levels of education and marital status was also similar. The prevalence of ASM among younger people was greater than among the elderly (OR=1.23 (95% CI: 1.05-1.44)).

ASM prevalence among private business employees and public/private officers was 2.85% and 3.22%, respectively, which was greater than the prevalence in the unemployed group (2.31%) and showed statistical significance (p-value=0.0064). Prevalence among different levels of household income was similar, with no statistical significance. The odds of being ASM users among people without underlying diseases were similar to those with underlying diseases (p-value=0.430).

People who didn't visit public hospitals when they fell ill had odds of being ASM users 5.22 times higher than those who did visit, with statistical significance (OR=3.85-7.08). ASM prevalence among participants who didn't visit primary care units (PCUs) was 6.56%, which was greater than among the other groups (p-value<0.001). The proportion of ASM among those who did not visit private hospitals was greater than among those who did, with statistical significance (OR=1.99 (95% CI: 1.24-3.20)). The majority of people who bought drugs when they fell ill were ASM users, showing statistical significance (OR=9.40 (95% CI: 7.56-11.69)). The ASM proportion among physicians as healthcare providers was significantly greater than among other healthcare providers (p-value=0.042) as shown in Table 5.

Table 5. Factors associated with ASM among entire participants from bivariate analysis (n=26,030)

Factors	Total sample	ASM		OR	95% CI	p-value
	n	n	(%)			
Socioeconomic factors						
Residency area						0.218
Rural	11,536	294	2.55	1		
Urban	14,494	433	2.99	1.10	0.94 – 1.28	
Gender						0.435
Female	11,097	301	2.71	1		
Male	14,933	426	2.85	1.06	0.91 – 1.23	
Age group						0.010
≥60 years	9,014	222	2.44	1		
<60	16,926	505	2.98	1.23	1.05 – 1.44	
Marital status						0.863
Married	16,718	460	2.75	1		
Not married	9,312	267	2.86	1.01	0.86 – 1.18	
Educational attainment (n=25,954)						0.129
No formal education	5,360	134	2.50	1.		
Primary school	9,640	271	2.81	1.13	0.91 – 1.39	
Secondary school	6,809	217	3.19	1.26	1.01 – 1.58	
Diploma	1,039	27	2.60	1.01	0.66 – 1.53	
Bachelor degree or above	3,106	134	2.51	0.95	0.71 – 1.27	
Occupation (n=25,552)						0.0064
Unemployed	7,667	177	2.31	1		
Public or private officers	6,276	202	3.22	1.37	1.12 – 1.69	
Private business employee	11,579	330	2.85	1.26	1.05 – 1.52	
Monthly household income (n=16,904)						0.208
<5,000 THB	2,341	58	2.48	1		
5,000-10,000 THB	5,223	167	3.20	1.30	0.96 – 1.76	
>10,000 THB	9,340	282	3.02	1.17	0.87 – 1.57	
Having chronic diseases						0.431
No	17,382	493	2.84	1.06	0.91 – 1.24	
Yes	8,648	234	2.71	1		
Health seeking behavioral factors						
Public hospitals visit (n=6,909)						<0.001
Yes	2,799	49	1.75	1		
No	4,110	350	8.52	5.22	3.85 – 7.08	
PCU visit						<0.001
Yes	1,637	53	3.24	1		
No	5,274	346	6.56	2.01	1.48 – 2.70	
Private hospital/clinic visit						0.004
Yes	572	19	3.32	1		
No	6,339	380	5.99	1.99	1.24 – 3.20	
Buying the drugs						<0.001
No	5,604	141	2.52	1		
Yes	1,307	258	19.74	9.40	7.56 – 11.69	
Transportation expense (n = 26,009)						<0.001
Not paid	16,601	315	1.90	1		
Paid	9,408	412	4.38	2.37	2.04 – 2.75	
Health services expense (n = 25,998)						<0.001
Not paid	22,321	401	1.80	1		
Paid	3,677	326	8.87	5.39	4.63 – 6.28	
Knowledge and attitude regarding antibiotics use factors						
Knowledge regarding antibiotics use						<0.001
High	2,978	38	1.28	1		
Average	10,385	212	2.04	1.74	1.22 – 2.46	
Low	12,667	477	3.77	3.26	2.33 – 4.56	
Attitude regarding antibiotics use (n = 25,476)						0.0018
High	15,570	397	2.55	1		
Average	9,319	303	3.25	1.29	1.11 – 1.50	
Low	587	22	3.75	1.51	0.97 – 2.34	
Receiving information regarding antibiotics use (n = 24,347)						<0.001
Yes	17,905	309	1.73	1		
No	6,442	379	5.88	3.55	3.04 – 4.14	

3.1.5. Multivariable analysis

The GLMM with a binomial family was employed to control for confounding effects. After adjusting for attitudes regarding antibiotic use, age, and PCU visits, the results indicated that visits to public hospitals (AOR=3.43, 95% CI: 1.91-6.16), private hospital or clinic visits (AOR=2.40, 95% CI: 1.16-4.96)), transportation expenses (AOR=1.64, 95% CI: 1.19-2.26), health services expenses (AOR=1.59, 95% CI: 1.11-2.29)), and purchasing drugs (AOR=3.54, 95% CI: 2.02-6.21) were statistically significant. The odds of

being ASM among those with low and average knowledge levels were higher than among those with high knowledge (p-value<0.001). Additionally, not receiving information regarding antibiotic use and its resistance also showed statistical significance (AOR=3.86, 95% CI: 3.03-4.92), after adjustment for other covariates as shown in Table 6.

Table 6. Factors associated with ASM among entire participants from multivariable analysis (n=6,321)

Factors	Total Sample (n)	ASM n	ASM (%)	Adj. OR	95% CI	p-value
Public hospitals visit						<0.001
Yes	2,799	49	1.75	1		
No	4,110	350	8.52	3.43	1.91-6.16	
Private hospital visit						0.017
Yes	572	19	3.32	1		
No	6,339	380	5.99	2.40	1.16-4.96	
Buying the drugs						<0.001
No	5,604	141	2.52	1		
Yes	1,307	258	19.74	3.54	2.02-6.21	
Health services expense						0.012
Not paid	22,321	401	1.80	1		
Paid	3,677	326	8.87	1.59	1.11-2.29	
Transportation expense						0.002
Not paid	16,601	315	1.90	1		
Paid	9,408	412	4.38	1.64	1.19-2.26	
Knowledge regarding antibiotics use						<0.001
High	2,978	38	1.28	1		
Average	10,385	212	2.04	2.47	1.49-4.09	
Low	12,667	477	3.77	4.30	2.61-7.08	
Receiving information regarding antibiotics use and its resistance						<0.001
Yes	17,905	309	1.73	1		
No	6,442	379	5.88	3.86	3.03-4.92	

*Adjusted for attitude regarding antibiotics use, elderly, PCU visit, and occupation

3.2. Discussion

The prevalence of ASM in the present study was 2.79%, which was lower than the reported prevalence in Sri Lanka [17]. Additionally, the ASM prevalence in the study was lower than the overall prevalence in the Southeast Asia region [8], as well as lower than previous prevalence rates reported in Thailand [9]. The prevalence was lower in several previous studies due to the Thai population's ability to access healthcare services. In this study, the coverage of universal health coverage among the total population was 99.97%. Public hospitals and PCUs were the major healthcare services utilized by the Thai population. Furthermore, the survey was conducted during the COVID-19 pandemic. The health services system in Thailand was strengthened. Healthcare workers provided good patient care, including health knowledge about infection care, which contributed to a lower ASM prevalence [18].

The ASM prevalence among people living in urban areas was similar to those in rural areas. This result differed from previous studies conducted in Ghana, which revealed Antibiotic self-medication rates are notably high at 36% among rural residents [19]. Similarly, a study conducted in Ethiopia reported a higher ASM prevalence in urban areas, which was a significant risk factor for self-medication [20].

The ASM proportions were highest among people who were unmarried (2.86%). This result was similar to a study conducted in Ethiopia, which showed a higher prevalence of self-medication among divorcees [21]. However, Demelash's study mentioned different results, indicating that being married was associated with self-medication with statistical significance [22].

People without underlying diseases were ASM users at a lower rate compared to those with underlying diseases in the present study. Previous studies in Pakistan and China [23], [24] demonstrated lower self-medication prevalence among people with chronic illnesses. Chronic illness patients typically visit healthcare facilities such as PCUs because they require multiple medications and are concerned about drug interactions [25]. Additionally, increasing numbers of underlying diseases were associated with more frequent visits to healthcare facilities [26].

ASM users were less likely to visit PCUs and public hospitals. Visiting public hospitals decreased the odds of being ASM users with statistical significance. Physicians generally prescribe antibiotics based on rational drug use (RDU) guidelines [27], which indicate that antibiotic prescriptions for upper respiratory tract infections and acute gastroenteritis should be lower than 20% [27]. Data from the Health Data Center (HDC) in 2021 revealed that almost all provinces in Thailand had achieved this indicator, reducing antibiotic

prescriptions to lower than 20% [28]. Pharmacists also provide appropriate health education on antibiotic use, which can help decrease ASM prevalence [27].

Mild illness was a major reason for not accessing public hospitals and PCUs in our study. A previous study in Thailand [29] explored barriers to accessing healthcare facilities and found that many interviewees did not seek medical care for mild illnesses because they believed they would recover on their own. They often waited until their condition did not improve or until severe complications arose before seeking medical care. People with mild illnesses tend to self-treat, including using ASM, rather than seeking healthcare visits [30]. Transportation expenses were associated with ASM in the multivariable analysis. Longer distances to healthcare facilities increased the odds of self-medication [30]. Travel time from home to healthcare institutions was also a predictor of self-medication [31]. Additionally, longer distances between home and healthcare facilities were observed as a reason for not accessing public hospitals and PCUs in this study.

Health services expenses were observed to be a contributing factor to ASM with statistical significance (AdjOR=1.59, 95%CI: 1.11-2.29). Antibiotics are sold globally, especially in high-income countries [32]. Cephalosporin and amoxicillin were the major antibiotics distributed to customers visiting drug stores [33]. Appropriate health knowledge is typically associated with good health behaviors. A study on dental knowledge and oral health outcomes in Japan demonstrated that good dental health knowledge was associated with good oral health [34]. Another study determined the interplay between cardiovascular risk knowledge and lifestyle modifications, showing an association among these factors [35]. Health-seeking behaviors are also influenced by proper health knowledge in previous literature [36].

The source of information regarding antibiotic use was a contributing factor to ASM (p-value<0.001). The source of information was correlated with proper knowledge. Sources such as media and the internet are good interventions to promote appropriate antibiotic use behavior. Additionally, receiving good health information is associated with good health behaviors [37].

The study's strengths include its endeavor to pinpoint the factors contributing to ASM, a subject that has been rarely explored in Thailand. It focuses particularly on aspects like transportation and health services costs, which are pivotal for policy formulation. Nonetheless, the study utilized secondary survey data, which could potentially contain missing information and exhibit lower data reliability compared to primary surveys.

4. CONCLUSION

ASM behavior is a worldwide problem that requires proper health policies to control and mitigate. Several health-seeking behaviors and knowledge regarding antibiotic use are major contributing factors to ASM. Supporting public transportation to health facilities and implementing regular health education programs are important strategies to reduce ASM prevalence in Thailand.

Some misconceptions and misunderstandings about antibiotic use were reported. Poor knowledge was also associated with being an ASM user while receiving information regarding antibiotic use can help prevent ASM behavior. Implementing education programs through the media is a potential strategy to control ASM behavior in Thailand. Policymakers should consider supporting transportation expenses or providing free public transportation to healthcare services. Healthcare workers in public hospitals should routinely monitor antibiotic prescription rates and provide health education at pharmacy units to mitigate ASM behavior. Moreover, individuals with mild illnesses should be guided on appropriate self-treatment, and antibiotics should only be prescribed by physicians. Public hospitals should promote extended outpatient department (OPD) hours for those unable to visit during regular hours. A combination of media and health education programs on antibiotic use should be implemented by public health officers at the community level. Such programs can enhance knowledge about antibiotic use and help community members avoid ASM.

REFERENCES

[1] G. Kapoor, S. Saigal, and A. Elongavan, "Action and resistance mechanisms of antibiotics: A guide for clinicians," *Journal of Anaesthesiology Clinical Pharmacology*, vol. 33, no. 3, 2017, doi: 10.4103/joacp.JOACP_349_15.

[2] M. Touat *et al.*, "Costs and outcomes of 1-year post-discharge care trajectories of patients admitted with infection due to antibiotic-resistant bacteria," *Journal of Infection*, vol. 82, no. 3, pp. 339–345, Mar. 2021, doi: 10.1016/j.jinf.2021.02.001.

[3] A. Najmi, F. Karimi, V. Kunhikatta, M. Varma, and S. Nair, "Resistance trend, antibiotic utilization and mortality in patients with E. coli Bacteraemia," *Open Access Macedonian Journal of Medical Sciences*, vol. 7, no. 7, pp. 1119–1123, Apr. 2019, doi: 10.3889/oamjms.2019.223.

[4] H. Uematsu, K. Yamashita, S. Kunisawa, K. Fushimi, and Y. Imanaka, "Estimating the disease burden of methicillin-resistant Staphylococcus aureus in Japan: Retrospective database study of Japanese hospitals," *Plos One*, vol. 12, no. 6, Jun. 2017, doi: 10.1371/journal.pone.0179767.

[5] S. Imai, N. Inoue, and H. Nagai, "Economic and clinical burden from carbapenem-resistant bacterial infections and factors contributing: a retrospective study using electronic medical records in Japan," *BMC Infectious Diseases*, vol. 22, no. 1, Dec. 2022, doi: 10.1186/s12879-022-07548-3.

[6] A. Auta *et al.*, "Global access to antibiotics without prescription in community pharmacies: A systematic review and meta-analysis," *Journal of Infection*, vol. 78, no. 1, pp. 8–18, Jan. 2019, doi: 10.1016/j.jinf.2018.07.001.
[7] E. V. Yeika, B. Ingelbeen, B. Kemah, F. S. Wirsiy, J. N. Fomengia, and M. A. B. van der Sande, "Comparative assessment of the prevalence, practices and factors associated with self-medication with antibiotics in Africa," *Tropical Medicine and International Health*, vol. 26, no. 8, pp. 862–881, Aug. 2021, doi: 10.1111/tmi.13600.
[8] G. Nepal and S. Bhatta, "Self-medication with antibiotics in WHO Southeast Asian region: a systematic review," *Cureus*, Apr. 2018, doi: 10.7759/cureus.2428.
[9] S. Chautrakarn, W. Khumros, and P. Phutrakool, "Self-medication with over-the-counter medicines among the working age population in metropolitan areas of Thailand," *Frontiers in Pharmacology*, vol. 12, Aug. 2021, doi: 10.3389/fphar.2021.726643.
[10] H. Ayana, T. Sileshi, M. H. Bule, and E. E. Chaka, "Non-prescription antibiotics use and associated factors among drug retail outlets in Ambo, Ethiopia: a cross-sectional study," *Patient Preference and Adherence*, vol. 15, pp. 2739–2747, Dec. 2021, doi: 10.2147/PPA.S337364.
[11] M. Ocan *et al.*, "Household antimicrobial self-medication: a systematic review and meta-analysis of the burden, risk factors and outcomes in developing countries," *BMC Public Health*, vol. 15, no. 1, Dec. 2015, doi: 10.1186/s12889-015-2109-3.
[12] N. Mallah, N. Orsini, A. Figueiras, and B. Takkouche, "Education level and misuse of antibiotics in the general population: a systematic review and dose–response meta-analysis," *Antimicrobial Resistance and Infection Control*, vol. 11, no. 1, Dec. 2022, doi: 10.1186/s13756-022-01063-5.
[13] A. Aslam *et al.*, "Self-medication with antibiotics: prevalence, practices and related factors among the pakistani public," *Antibiotics*, vol. 11, no. 6, Jun. 2022, doi: 10.3390/antibiotics11060795.
[14] K. Gravningen, N. Field, H. S. Blix, A. M. Asfeldt, and L. Småbrekke, "Non-prescription purchase of antibiotics during travel abroad among a general adult population in Norway: Findings from the seventh Tromsø Study," *Plos One*, vol. 15, no. 2, Feb. 2020, doi: 10.1371/journal.pone.0228792.
[15] N. T. T. Do *et al.*, "Community-based antibiotic access and use in six low-income and middle-income countries: a mixed-method approach," *The Lancet Global Health*, vol. 9, no. 5, pp. 610–619, 2021, doi: 10.1016/S2214-109X(21)00024-3.
[16] National Statistical Office Thailand, "The 2021 health and welfare survey," *2021*, 2021.
[17] D. Rathish and N. D. Wickramasinghe, "Prevalence, associated factors and reasons for antibiotic self-medication among dwellers in Anuradhapura: a community-based study," *International Journal of Clinical Pharmacy*, vol. 42, no. 4, pp. 1139–1144, Aug. 2020, doi: 10.1007/s11096-020-01065-6.
[18] B. Pinsawas *et al.*, "Home isolation and online support strategies during mild COVID-19 pandemic waves in Thailand: a scoping review," *COVID*, vol. 3, no. 7, pp. 987–998, Jun. 2023, doi: 10.3390/covid3070071.
[19] J.-P. Kretchy, S. K. Adase, and M. Gyansa-Lutterodt, "The prevalence and risks of antibiotic self-medication in residents of a rural community in Accra, Ghana," *Scientific African*, vol. 14, Nov. 2021, doi: 10.1016/j.sciaf.2021.e01006.
[20] A. D. Kassie, B. B. Bifftu, and H. S. Mekonnen, "Self-medication practice and associated factors among adult household members in Meket district, Northeast Ethiopia, 2017," *BMC Pharmacology and Toxicology*, vol. 19, no. 1, Dec. 2018, doi: 10.1186/s40360-018-0205-6.
[21] A. Tekeba, Y. Ayele, B. Negash, and T. Gashaw, "Extent of and factors associated with self-medication among clients visiting community pharmacies in the era of COVID-19: does it relieve the possible impact of the pandemic on the health-care system?," *Risk Management and Healthcare Policy*, vol. 14, pp. 4939–4951, Dec. 2021, doi: 10.2147/RMHP.S338590.
[22] Z. D. Kifle, A. B. Mekuria, D. A. Anteneh, and E. F. Enyew, "Self-medication practice and associated factors among private health sciences students in Gondar Town, North West Ethiopia. a cross-sectional study," *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, vol. 58, Jan. 2021, doi: 10.1177/00469580211005188.
[23] R. Yousaf *et al.*, "Factors associated with non-adherence to anti-tuberculosis treatment among patients in Lahore, Pakistan," *International Journal of Current Research and Review*, vol. 14, no. 15, pp. 47–53, 2022, doi: 10.31782/IJCRR.2022.141508.
[24] P. Ge *et al.*, "Self-medication in Chinese residents and the related factors of whether or not they would take suggestions from medical staff as an important consideration during self-medication," *Frontiers in Public Health*, vol. 10, Dec. 2022, doi: 10.3389/fpubh.2022.1074559.
[25] M. Hermann *et al.*, "Polypharmacy and potential drug-drug interactions in home-dwelling older people-a cross-sectional study," *Journal of Multidisciplinary Healthcare*, vol. 14, pp. 589–597, Mar. 2021, doi: 10.2147/JMDH.S297423.
[26] S. Wu, S. Du, R. Feng, W. Liu, and W. Ye, "Behavioral deviations: healthcare-seeking behavior of chronic disease patients with intention to visit primary health care institutions," *BMC Health Services Research*, vol. 23, no. 1, May 2023, doi: 10.1186/s12913-023-09528-y.
[27] N. Sumpradit *et al.*, "Thailand's national strategic plan on antimicrobial resistance : progress and challenges," *Bulletin World Health Organization*, vol. 9, no. 99, pp. 661–673, 2021.
[28] C. HD, "Percentage of antibiotics prescription among upper respiratory tract patients visiting hospitals," *Office of the Permanent Secretary*, 2022. Accessed: July. 21, 2023. [Online]. Available: https://hdcservice.moph.go.th/hdc/reports/report.php?&cat_id=03b912ab9ccb4c07280a89bf05e5900e&id=d8fa7339c10c7eccd02529be81ebb8a5.
[29] K. Moonpanane, K. Pitchalard, J. Thepsaw, O. Singkhorn, and C. Potjanamart, "Healthcare service utilization of hill tribe children in underserved communities in Thailand: barriers to access," *BMC Health Services Research*, vol. 22, no. 1, Sep. 2022, doi: 10.1186/s12913-022-08494-1.
[30] S. Akter *et al.*, "Determinants of health care seeking behavior for childhood infectious diseases and malnutrition: A slum-based survey from Bangladesh," *Journal of Child Health Care*, vol. 27, no. 3, pp. 395–409, Sep. 2023, doi: 10.1177/13674935211057714.
[31] N. F. Adimassu, Z. G. Woldetsadik, and H. W. Alemu, "Proportion of ophthalmic self-medication and associated factors among adult ophthalmic patients attending Borumeda Hospital, Dessie, Northeast Ethiopia," *Journal of Ophthalmology*, pp. 1–7, Apr. 2020, doi: 10.1155/2020/6932686.
[32] S. Rahman, O. Lindahl, C. M. Morel, and A. Hollis, "Market concentration of new antibiotic sales," *The Journal of Antibiotics*, vol. 74, no. 6, pp. 421–423, Jun. 2021, doi: 10.1038/s41429-021-00414-5.
[33] D. S. Chandran and P. P. Manickavasagam, "Sale of antibiotics without prescription in stand-alone pharmacies in Tamil Nadu," *Journal of Family Medicine and Primary Care*, vol. 11, no. 9, pp. 5516–5520, Sep. 2022, doi: 10.4103/jfmpc.jfmpc_2157_21.

[34] A. Taniguchi-Tabata *et al.*, "Associations between dental knowledge, source of dental knowledge and oral health behavior in Japanese university students: A cross-sectional study," *Plos One*, vol. 12, no. 6, Jun. 2017, doi: 10.1371/journal.pone.0179298.
[35] J. L. Jackson, K. Tierney, C. J. Daniels, and K. Vannatta, "Disease knowledge, perceived risk, and health behavior engagement among adolescents and adults with congenital heart disease," *Heart and Lung*, vol. 44, no. 1, pp. 39–44, Jan. 2015, doi: 10.1016/j.hrtlng.2014.08.009.
[36] G. Nagy-Pénzes, F. Vincze, J. Sándor, and É. Bíró, "Does better health-related knowledge predict favorable health behavior in adolescents?," *International Journal of Environmental Research and Public Health*, vol. 17, no. 5, Mar. 2020, doi: 10.3390/ijerph17051680.
[37] R. N. Vereen, R. Kurtzman, and S. M. Noar, "Are social media interventions for health behavior change efficacious among populations with health disparities?: A meta-analytic review," *Health Communication*, vol. 38, no. 1, pp. 133–140, Jan. 2023, doi: 10.1080/10410236.2021.1937830.

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