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Original Research

Knowledge, Attitudes, and Behaviors Regarding Antibiotic Use for Children Under 5 Years Old Among Mothers in Rural Northern Vietnam

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Abstract

Background: The use of antibiotics in children is influenced by the knowledge, attitudes, and behaviors of caregivers, especially mothers. **Objective:** This study aimed to assess the knowledge, attitudes, and practices regarding antibiotic use for children among mothers with children under 5 years old in rural areas of northern Vietnam. **Methods:** This research utilized a cross-sectional descriptive design with a self-administered questionnaire targeting mothers with children under 5 years old in two communes in Hai Duong province and two communes in Hung Yen province. Data collection was conducted from March to April 2023. Chi-square tests and multivariable regression analyses were employed to explore the relationship between the demographic characteristics of mothers and their knowledge, attitudes, and antibiotic use behaviors. **Results:** The majority of mothers exhibited inadequate knowledge (86.2%), inappropriate attitudes (73.8%), and incorrect antibiotic use behavior (73%). Mothers with university-level education or higher had better knowledge (OR = 4.98; 95% CI: 2.58-9.64) and more correct behaviors (OR = 2.32; 95% CI: 1.31-4.13) in antibiotic use. Mothers with an income higher than 20 million VND exhibited more appropriate attitudes (OR = 5.74; 95% CI: 2.76-11.93) and more correct behaviors (OR = 6.33; 95% CI: 3.18-12.61) regarding antibiotic use. **Conclusion:** The majority of mothers possess incorrect knowledge, improper attitudes, and irrational antibiotic use behaviors. This calls for continuous interventions and collaborations between healthcare professionals and the community, particularly parents, to enhance the understanding of rational antibiotic use.

Keywords: knowledge, attitudes, behaviors, antibiotics; children; rural; mothers; Vietnam

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INTRODUCTION

Presently, antibiotic resistance is manifesting globally, profoundly affecting the treatment of infectious diseases. In just the last 30 years, antibiotic resistance is predicted to be one of the leading causes of mortality worldwide, particularly in low- and middle-income countries.[1] Vietnam is notably impacted by high rates of antibiotic resistance, partly attributed to unnecessary antibiotic use.[2,3] In hospitals, approximately one-third of the annual antibiotic consumption in Vietnam is deemed unnecessary, with potentially higher rates observed in the community, primary healthcare facilities, private pharmacies, and informal sellers catering to local markets.[2]

Antibiotic resistance can affect anyone, of all age groups, and is especially pertinent in children.[4,5] Children are susceptible to acute infections, many of which originate from viruses, making antibiotic treatment redundant. However, parents frequently request physicians to prescribe antibiotics for their children, anticipating a rapid recovery.[6] This underscores that antibiotic use in children relies on the caregivers' knowledge, attitudes, and practices, especially mothers, as children cannot autonomously decide on antibiotic consumption.[7,8]

Studies from various countries indicate that between 22% to 70% of parents possess misconceptions, inappropriate attitudes, and behaviors concerning the role and proper use of antibiotics for children.[8-10] In Vietnam, self-administration of antibiotics for children without a doctor's consultation and

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prescription is prevalent. Previous research indicated that 78% of antibiotics for human use were distributed at 60,000 private drugstores, with approximately 90% dispensed without prescriptions.[11] A cross-sectional study in Northern Vietnam found that 75% of children under 5 received antibiotics for acute respiratory infections in the preceding month, primarily purchased over-the-counter.[12] A 2006 survey at the Pediatrics Department of Bach Mai Hospital, a major hospital in Vietnam, revealed that 63% of pediatric patients had taken antibiotics before admission, with 29.3% consuming antibiotics without a doctor's prescription.[13] Additionally, parents' knowledge, attitudes, and practices regarding antibiotic use for children <5 years old are influenced by variables such as parents' age, educational level, income, and trust in physicians.[14-16] However, to our best knowledge, this association has not been explored in the rural areas of northern Vietnam. Therefore, this study was conducted aiming to understand the knowledge, attitudes, practices, and associated factors of mothers with children under 5 regarding antibiotic use in rural northern Vietnam.

METHODS

Study Design and Participants

This study employed a cross-sectional descriptive design utilizing a self-administered questionnaire. The target population consisted of mothers with children under the age of 5 from four rural communes, specifically two communes (Tan Ky and Dai Hop) in Tu Ky district, Hai Duong province, and two communes (Dong Ket and Lien Khe) in Khoai Chau district, Hung Yen province. Both Hai Duong and Hung Yen provinces are located in the heart of the Red River Delta. Hai Duong spans a natural area of 1668.3 km^2, and its average population in 2021 is approximately 1.9 million, of which 1.3 million reside in rural areas. Hung Yen covers a natural area of 930.2 km^2, with a 2021 population of around 1.2 million, approximately 1 million of whom live in rural settings. Regarding healthcare in 2021, Hai Duong was equipped with 6255 patient beds and 1839 doctors, while Hung Yen had 3880 patient beds and 1172 doctors.[17]

Sampling and Data Collection

A convenience sampling method was applied. For the two communes in Hai Duong, based on the childbirth monitoring list satisfying the research criteria from the commune health stations, these participants were directly approached at their residences through printed survey forms. Meanwhile, in the two communes in Hung Yen, online forms created using Google Forms were dispatched to mothers with children under 5 years of age. They were invited to participate in the study via Zalo group chats (a prevalent chat application in Vietnam) associated with kindergartens where their children were enrolled. Participation was voluntary, and identifiable information was not collected. Consenting participants were requested to complete the survey within 20 minutes. Data collection occurred from March to April 2023.

Data Collection Instrument

A questionnaire was conceptualized for self-administration in both print and online forms, drawing upon previous research.[18-21] The instrument underwent a pretest involving 20 mothers and was critically reviewed by three experts in the field of pharmacy practice. Subsequent revisions were made to the language and phrasing to enhance clarity and comprehension for respondents.

The questionnaire comprised two sections. The first section aimed to assess mothers' knowledge, attitudes, and practices related to antibiotic use. It included 6 questions to gauge knowledge, 5 for attitudes, and 10 for addressing practices. Responses were solicited using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Each response was then scored, awarding 1 point for correct answers and 0 for incorrect ones. For statements that were inherently correct, participant selections of 4 (agree) and 5 (strongly agree) were considered correct, with all other responses marked as incorrect. Conversely, for statements inherently incorrect, responses of 1 (strongly disagree) and 2 (disagree) were deemed correct, while the remainder were classified as incorrect. The scores for general knowledge, attitude, and practices were derived from the sum of individual items within each category. A threshold of 80% was set to delineate adequate knowledge, appropriate attitudes, and correct practices. Therefore, mothers scoring 4.8 or above for knowledge, 4 or above for attitude, and 8 or higher for practices were recognized as having accurate knowledge, suitable attitudes, and appropriate practices.

Data analysis

Data were processed and analyzed using SPSS software version 20.0. Descriptive statistics were employed to present frequency distributions and percentages for categorical variables. Relationships between mothers' demographic characteristics and their knowledge, attitudes, and antibiotic use behaviors were examined using the Chi-squared test (χ^2) and multivariate regression analysis. A significance level of $\alpha = 0.05$ (95% confidence interval) was adopted for this study.

RESULTS

A total of 790 mothers participated in the survey. The majority of them were between 25 and 35 years old (75.7%). Almost half of the participants had completed secondary education or less (48.5%), were industrial workers (48.7%), and had an income ranging from 5 to 10 million VND (45.9%).

A significant proportion of mothers in the study exhibited misconceptions regarding the therapeutic role of antibiotics (Table 1). Most believed that antibiotics are necessary for treating conditions like flu (62.8%) and sore throat (58.7%) in children. Over half of the mothers agreed that pharmacists had successfully treated their children on multiple occasions (58.4%) and expressed satisfaction with the advice provided by pharmacists when purchasing antibiotics without a prescription (55.7%). Approximately 40% of surveyed mothers agreed that they should keep a stock of antibiotics at home for use when necessary (41.3%) and would save leftover antibiotics for future use if their children contracted similar illnesses (39.7%). Similarly, nearly 40% of mothers believed it's appropriate

to discontinue antibiotic use as soon as the child's condition improves (50.6%) and to reduce the antibiotic dosage when the child begins to recover (48.9%) (Table 2). Overall, the majority of mothers demonstrated incorrect knowledge (86.2%), inappropriate attitudes (73.8%), and irrational practices (73%) related to antibiotic use (Table 3).

Multivariate regression analysis revealed significant relationships between mothers' educational level, income, and their knowledge, attitudes, and practices regarding antibiotic use for children under 5 (Tables 4, 5, and 6). Mothers with university-level education or higher displayed better knowledge (OR = 4.98; 95%CI: 2.58-9.64) and more appropriate practices

Table 1. Knowledge about antibiotics and attitudes towards antibiotic use among mothers (n = 790)

Code	Items	Disagree* n (%)	Neutral n (%)	Agree** n (%)
Knowledge about antibiotics				
K1	Antibiotics should be used every time a child has a fever.	306 (38.7)	140 (17.8)	344 (43.5)
K2	Antibiotics are necessary to treat a child with a sore throat.	169 (21.4)	157 (19.9)	464 (58.7)
K3	Antibiotics are essential for treating a child with a runny nose.	292 (37.0)	139 (17.6)	359 (45.4)
K4	Antibiotics are needed to treat a child with the flu.	197 (24.9)	97 (12.3)	496 (62.8)
K5	When a child has the flu, the illness will recover faster if given antibiotics promptly.	165 (19.7)	60 (7.6)	574 (72.7)
K6	In general, antibiotics are safe for children.	207 (26.2)	170 (21.5)	413 (52.3)
Attitudes towards antibiotic use				
A1	Community pharmacists can dispense antibiotics for children without a prescription.	456 (57.7)	74 (9.4)	260 (32.9)
A2	Community pharmacists are well-trained; therefore, I highly trust their advice on antibiotic use without needing to consult a physician for the child.	94 (11.9)	564 (71.4)	132 (16.7)
A3	Using antibiotics as prescribed means following the advice of the community pharmacist.	403 (51.1)	97 (7.5)	328 (41.5)
A4	On multiple occasions, community pharmacists have provided antibiotics that aided in my child's recovery.	206 (26.1)	123 (15.6)	461 (58.4)
A5	I am very satisfied with the counsel provided by the community pharmacy staff when I personally purchase antibiotics for my child.	262 (33.2)	88 (11.1)	440 (55.7)

Note: *Participants who responded with 1-strongly disagree and 2-disagree are considered to disagree, while **those who responded with a level of 4-agree and 5-strongly agree are considered to agree.

Table 2. Mothers' self-prescribing antibiotic behaviors for their children (n = 790)

Code	Items	Disagree* n (%)	Neutral n (%)	Agree** n (%)
Mothers' experience in self-administering antibiotics for their children				
B7	I should stock up on antibiotics at home to use for my child when needed.	374 (47.3)	90 (11.4)	326 (41.3)
B8	One can use a previous prescription from the physician to purchase antibiotics when the child exhibits similar symptoms.	502 (63.5)	52 (6.6)	236 (29.9)
B9	After my child recovers, I will retain the remaining antibiotics for future use if the child contracts a similar illness.	354 (44.8)	122 (15.4)	314 (39.7)
B10	I can choose antibiotics for my child based on my own treatment experience.	570 (72.2)	82 (10.4)	138 (17.5)
Mothers' adherence to antibiotic use for their children				
B1	To avoid adverse effects, antibiotics should be discontinued as soon as the child's illness improves	299 (37.8)	91 (11.5)	400 (50.6)
B2	Forgetting to administer 1-2 doses of antibiotics to children does not impact the drug's therapeutic effectiveness.	614 (77.7)	92 (11.6)	84 (10.6)
B3	I would cease antibiotic use for my child once the illness shows signs of improvement.	481 (60.9)	116 (14.7)	193 (24.4)
B4	One can reduce the antibiotic dosage for children once their illness begins to subside.	337 (42.7)	67 (8.5)	386 (48.9)
Reasons for mothers' self-administration of antibiotics for their children				
B5	For minor illnesses in children, I might purchase antibiotics from the pharmacy without consulting a physician.	266 (33.7)	218 (27.6)	306 (38.7)
B6	When my child had a high fever for several days, I administered antibiotics without seeking a physician's advice.	463 (58.6)	114 (14.4)	213 (27.0)

Note: *Participants who responded with 1-strongly disagree and 2-disagree are considered to disagree, while **those who responded with a level of 4-agree and 5-strongly agree are considered to agree.

Table 3. Overall assessment of mothers' knowledge, attitude, and behavior regarding antibiotics (n = 790)

	Frequency	Percent (%)
General Knowledge Assessment		
Mothers with inadequate knowledge (< 4.8 points)	681	86.2
Mothers with adequate knowledge (≥ 4.8 points)	109	13.8
General Attitude Assessment		
Mothers with inappropriate attitudes (< 4.0 points)	583	73.8
Mothers with appropriate attitudes (≥ 4.0 points)	207	26.2
General Behavior Assessment		
Inappropriate antibiotic usage behavior (< 8.0 points)	577	73.0
Appropriate antibiotic usage behavior (≥ 8.0 points)	213	27.0

Table 4. Factors associated with mothers' knowledge of antibiotic use for children under 5 years old (n = 790)

Characteristics		Knowledge, n (%)		Univariate		Multivariate	
		Appropriate	Inappropriate	OR (95%CI)	p-value	OR (95%CI)	p-value
Age Group	20-24	1 (3.4)	28 (96.6)	1			
	25-35	80 (13.4)	518 (86.6)	4.32 (0.58-32.20)	0.153	3.82 (0.49-29.81)	0.201
	36-39	20 (18.2)	90 (81.8)	6.22 (0.79-48.50)	0.081	5.93 (0.72-48.9)	0.098
	≥ 40	8 (15.1)	45 (84.9)	4.97 (0.59-41.90)	0.140	4.48 (0.50-40.10)	0.179
Educational Level	High school or below	26 (6.8)	357 (93.2)	1			
	Intermediate	6 (18.2)	27 (81.8)	3.05 (1.10-8.05)	**0.024**	2.52 (0.92-6.91)	0.072
	College	20 (14.5)	118 (85.5)	2.32 (1.25-4.32)	**0.007**	2.43 (1.26-4.71)	**0.008**
	University or above	57 (24.2)	179 (75.8)	4.37 (2.66-7.19)	**<0.001**	4.98 (2.58-9.64)	**<0.001**
Occupation	Industrial worker	43 (11.2)	342 (88.8)	1			
	Official	44 (20.4)	172 (79.6)	2.04 (1.29-3.22)	**0.002**	0.77 (0.42-1.44)	0.424
	Homemaker	3 (9.7)	28 (90.3)	0.85 (0.25-2.92)	0.799	0.64 (0.17-2.37)	0.504
	Merchant	11 (10.2)	97 (89.8)	0.91 (0.45-1.81)	0.772	0.79 (0.37-1.68)	0.544
	Farmer	1 (3.7)	26 (96.3)	0.31 (0.04-2.31)	0.251	0.26 (0.03-2.08)	0.205
	Other	7 (30.4)	16 (69.6)	3.45 (1.36-9.94)	**0.010**	2.06 (0.72 -5.88)	0.176
Average income (million VND)	< 5	13 (17.3)	62 (82.7)	1			
	5-9	62 (17.1)	301 (82.9)	0.98 (0.51 -1.89)	0.958	0.89 (0.44-1.79)	0.747
	10-20	24 (17.6)	112 (82.4)	1.02 (0.49 -2.15)	0.954	0.73 (0.33-1.60)	0.429
	>20	10 (4.6)	206 (95.4)	0.23 (0.10-0.55)	**<0.001**	0.17 (0.67-0.42)	**<0.001**

Table 5. Factors associated with mothers' attitudes towards antibiotic use for children under 5 years old (n = 790)

Characteristics		Attitudes, n (%)		Univariate		Multivariate	
		Appropriate	Inappropriate	OR (95%CI)	p-value	OR (95%CI)	p-value
Age Group	20-24	2 (6.9)	27 (93.1)	1			
	25-35	184 (30.8)	414 (69.2)	6.00 (1.41-25.50)	**0.015**	4.25 (0.96-18.86)	0.057
	36-39	12 (10.9)	98 (89.1)	1.65 (0.35-7.84)	0.527	0.99 (0.2-5.02)	0.990
	≥ 40	9 (17.0)	44 (83.0)	2.76 (0.56 -13.75)	0.215	2.12 (403-11.16)	0.375
Educational Level	High school or below	120 (31.3)	263 (8.7)	1			
	Intermediate	5 (15.2)	28 (84.8)	0.39 (0.15-1.04)	0.060	0.56 (0.19 - 1.61)	0.280
	College	27 (19.6)	111 (80.4)	0.53 (0.33-0.86)	**0.009**	0.55 (0.19-1.61)	**0.033**
	University or above	55 (23.3)	181 (7.7)	0.67 (0.46 -0.97)	**0.032**	0.65 (0.35-1.19)	0.162

Occupation	Industrial worker	111 (28.8)	274 (71.2)	1			
	Official	45 (20.8)	171 (79.2)	0.65 (0.44-0.97)	**0.033**	0.78 (0.43-1.5)	0.484
	Homemaker	6 (19.4)	25 (80.6)	0.59 (0.24-1.48)	0.264	0.73 (0.27-1.98)	0.531
	Merchant	37 (34.3)	71 (65.7)	1.29 (0.82-2.03)	0.277	1.09 (0.64-1.85)	0.749
	Farmer	5 (18.5)	22 (81.5)	0.56 (0.21-1.52)	0.255	0.61 (0.20-1.85)	0.387
	Other	3 (13.0)	20 (87.0)	0.37 (0.11-1.27)	0.114	0.44 (0.12-1.65)	0.223
Average income (million VND)	< 5	11 (14.7)	64 (85.3)	1			
	5-9	49 (13.5)	314 (86.5)	0.91 (0.45 -1.84)	0.790	0.91 (0.44-1.88)	0.788
	10-20	46 (33.8)	90 (66.2)	2.97 (1.43-6.18)	**0.004**	3.17 (1.48-6.78)	**0.003**
	>20	101 (46.8)	115 (53.2)	5.11 (2.56-10.22)	**<0.001**	5.74 (2.76 -11.93)	**<0.001**

Table 6. Factors associated with mothers' behaviors in antibiotic use for children under 5 years old (n = 790)

Characteristics		**Behavior, n (%)**		**Univariate**		**Multivariate**	
		Appropriate	**Inappropriate**	**OR (95%CI)**	**p-value**	**OR (95%CI)**	**p-value**
Age Group	20-24	2 (6.9)	27 (93.1)	1			
	25-35	148 (24.7)	450 (75.3)	4.44 (1.04-18.89)	**0.044**	2.02 (0.45-8.98)	0.356
	36-39	48 (43.6)	62 (56.4)	10.45 (2.37-4.14)	**0.002**	4.18 (0.89-19.59)	0.070
	≥ 40	15 (28.3)	38 (71.7)	5.33 (1.13-25.25)	**0.035**	3.16 (0.63-15.93)	0.160
Educational Level	High school or below	86 (22.5)	297 (77.5)	1			
	Intermediate	8 (24.2)	25 (75.8)	1.105 (0.48-2.54)	0.810	1.95 (0.79-4.81)	0.145
	College	39 (28.3)	99 (71.7)	1.36 (0.88-2.12)	0.170	1.24 (0.72-2.13)	0.434
	University or above	80 (33.9)	156 (66.1)	1.77 (1.23-2.54)	**0.002**	2.32 (1.31-4.13)	**0.004**
Occupation	Industrial worker	92 (23.9)	293 (76.1)	1			
	Official	66 (30.6)	150 (69.4)	1.40 (0.97-2.03)	0.076	0.61 (0.341-1.10)	0.102
	Homemaker	5 (16.1)	26 (83.9)	0.61 (0.23 -1.64)	0.329	0.83 (0.29-2.36)	0.725
	Merchant	39 (31.6)	69 (63.9)	1.80 (1.14 -2.84)	**0.012**	0.96 (0.56 -1.66)	0.895
	Farmer	6 (22.2)	21 (77.8)	0.91 (0.36 -2.32)	0.844	0.99 (0.36-2.71)	0.977
	Other	5 (21.7)	18 (78.3)	0.89 (0.32 -2.45)	0.810	0.57 (0.18-1.86)	0.351
Average income (million VND)	< 5	13 (17.3)	62 (82.7)	1			
	5-9	51 (14.0)	312 (86.0)	0.78 (0.40-1.52)	0.460	0.79 (0.4-1.57)	0.500
	10-20	25 (18.4)	111 (81.6)	1.07 (0.51-2.25)	0.850	0.97 (0.45-2.09)	0.944
	>20	124 (57.4)	92 (42.0)	6.43 (3.34-12.39)	**<0.001**	6.33 (3.18-12.61)	**<0.001**

(OR = 2.32; 95%CI: 1.31-4.13) in antibiotic use compared to those with secondary education or lower. Mothers with an income higher than 20 million VND exhibited more favorable attitudes (OR = 5.74; 95%CI: 2.76-11.93) and more correct practices (OR = 6.33; 95%CI: 3.18-12.61) regarding antibiotic use compared to those with incomes under 5 million VND.

DISCUSSION

This study was conducted to evaluate the knowledge, attitudes, and practices regarding antibiotic use among mothers with children under 5 years old in rural communes of Hai Duong and Hung Yen provinces, Vietnam. Our findings reveal that as many as 86.2% of mothers in our cohort were misinformed about antibiotics. This rate has exceeded the results from similar studies conducted in Ukraine (over 60%),[22] Malaysia (69.1%),[23] and Peru (79%).[15] The disparity in these findings may be attributed to the geographical contexts of the surveyed mothers, who resided in agricultural communes distant from urban centers and thus had limited exposure to authoritative information on antibiotics. Moreover, they seldom sought medical consultations at hospitals before administering drugs to their children, minimizing their interactions with healthcare professionals and opportunities to receive appropriate guidance on rational antibiotic use. Parents' misconceptions about community antibiotic use are a primary factor leading to inappropriate pediatric antibiotic consumption, which subsequently exacerbates antibiotic resistance in bacteria, intensifying the overall disease burden.[18-24]

When probed about the role of antibiotics, 43.5% of mothers agreed that they should be used whenever a child develops

a fever. Furthermore, 58.7% believed antibiotics were necessary for treating a sore throat, 45.4% for a runny nose, and 62.8% for the flu. These results underscore the prevalent misconceptions among participating mothers regarding the therapeutic capabilities of antibiotics. Similar studies globally have indicated that a significant proportion of parents erroneously believe that antibiotics can cure viral infections and that they expedite recovery from common colds.[25-26] In reality, antibiotics act by inhibiting or killing bacteria and do not target viral pathogens.[27,28] Typically, upper respiratory tract infections can resolve without antibiotic intervention. A lack of understanding about antibiotics among mothers directly translates to unwarranted self-administration of these drugs to young children, an issue now recognized as a predominant global community health concern.[29-31]

The study reveals that 73.8% of participating mothers demonstrated inappropriate attitudes towards antibiotic usage. Specifically, 32.9% believed that pharmacists could dispense antibiotics for children without a prescription, and 58.4% held that pharmacists had effectively treated their children with antibiotics multiple times. In Vietnam, community pharmacies are common health consultation points, with pharmacists playing a dual role in dispensing and providing medication advice. However, according to the 2016 regulations set by Vietnam's Ministry of Health, pharmacists are prohibited from prescribing and selling antibiotics without a proper prescription.[32] Consequently, mothers relying solely on pharmacists' advice without seeking professional medical consultation can be categorized as misusing antibiotics. Pharmacists play a pivotal role in educating the public about antibiotics and need to adhere to prescription regulations to curb unwarranted antibiotic consumption.

Our study identifies that 73% of mothers exhibited inappropriate antibiotic use behaviors. Remarkably, 41.3% endorsed stockpiling antibiotics at home for potential future use in children, 17.5% felt confident choosing antibiotics for their children based on personal experience, and 38.7% believed that for mild illnesses, they could procure antibiotics from pharmacies without consulting a doctor. Relying on personal experience to medicate recurring symptoms is a key driver of antibiotic misuse.[33] Furthermore, 50.6% of mothers held the mistaken belief that to avoid antibiotic side effects, cessation should occur as soon as the child feels better. This misapprehension, likely stemming from concerns over potential risks, could lead to disease recurrence with antibiotic-resistant bacteria. In 2023, the Prime Minister of Vietnam approved a national strategy for antibiotic resistance control for the period 2023-2030. The strategy emphasizes enhancing awareness among local government, healthcare, and veterinary professionals, and the general public, with a targeted 50% correct understanding rate by 2025 and 60% by 2030.[34] Effective community management of antibiotic resistance demands a concerted effort to reshape behaviors, underscoring the importance of a comprehensive understanding of antibiotic usage, especially among parents.[26]

The educational attainment of mothers was identified as a significant factor influencing their knowledge of antibiotics and their usage behaviors for children under five years old. These findings align with global studies from countries such as Malaysia.[23] Saudi Arabia,[35] Nigeria,[36] and Bangladesh.[37] Mothers with higher educational backgrounds, i.e., at least a diploma, displayed superior knowledge and more rational antibiotic use than those with a high school education or less. One possible explanation is that individuals with lower educational levels have limited exposure to antibiotic-related information concerning its effects, side effects, and guidelines. Even when information is available on websites, magazines, or newspapers, mothers with lower education might find it challenging to comprehend or may lack access to technologies, like the Internet.[25] A plausible solution would involve disseminating informative materials emphasizing the adverse effects of self-prescribing antibiotics, coupled with locally evidence-based guidelines on antibiotic usage, to heighten community awareness.[15,26]

Income appeared to correlate with mothers' attitudes and behaviors towards antibiotic use for children under five, a trend observed in global research.[38-40] Lower-income households tend to have less access to healthcare services,[40] leading to poorer attitudes and behaviors concerning antibiotic use. Future epidemiological studies could address this by examining antibiotic use across different income demographic groups. Educational efforts should prioritize parents in lower-income brackets to dispel misconceptions and instill appropriate attitudes toward antibiotic use. Enhancing attitudes and behaviors regarding antibiotic use requires a sustained, collaborative approach among all stakeholders, including healthcare professionals and the general populace, especially caregivers such as parents.[26] However, our study identified a contrasting trend: mothers with higher incomes demonstrated inferior knowledge compared to those with lower incomes, diverging from global findings.[40,41] This discrepancy might stem from higher-income mothers' inclination to consult doctors immediately when their children fall ill, placing implicit trust in physician prescriptions without seeking antibiotic-related information independently. Another factor could be the professional pressures faced by these mothers, limiting their time for understanding the healthcare nuances of childcare. Caregivers must prioritize expanding their knowledge about antibiotics, as such understanding empowers parents to actively engage with physicians in decision-making processes concerning their children's antibiotic use. Parents can then pose questions, discuss various treatment options, and ensure their children receive safe and effective treatments. Furthermore, knowledge about antibiotics enables parents to promptly detect and report adverse reactions to physicians, mitigating unforeseen health issues arising from antibiotic consumption.

Limitations of the study

This research has several limitations. Firstly, the study focused on mothers with children under five years old in four rural communes of Hai Duong and Hung Yen provinces in Vietnam. Restricting the study population to such a specific scope might impact the generalizability of the results, making them

potentially inapplicable to the broader population of mothers in other regions. Secondly, the data collection method, which utilized convenience sampling, could introduce biases since volunteers who opted to participate might exhibit different characteristics than those who did not. Thirdly, the study's data predominantly relied on self-reported responses by mothers, gathered through self-administered surveys or online forms. Such data could be influenced by recall bias, reluctance to disclose certain information, or potential information skewness, introducing inaccuracies in the results. Lastly, the selected threshold for evaluating correct knowledge, attitudes, and behaviors might not accurately reflect the distribution in mothers' levels of knowledge and attitudes. The findings in this study set a foundation and provide essential insights for future research endeavors. Upcoming studies should consider larger-scale investigations across diverse regions, ensuring a balanced representation of both urban and rural populations, and employing random sampling techniques to ensure better representativeness.

CONCLUSION

A majority of the mothers demonstrated incorrect knowledge, inappropriate attitudes, and imprudent antibiotic usage behaviors. A significant relationship was identified between educational level and income, with the mothers' knowledge, attitudes, and behaviors towards antibiotic use for their children under five years old. These results suggest that continuous intervention measures and collaborative approaches involving all stakeholders, including healthcare professionals and the general public, especially caregivers such as parents, are essential to enhance their understanding of prudent antibiotic use. Due to the constraints in the scope of the research location and sampling methodology, the generalizability of the results to the broader population of mothers in other regions might be affected. The findings underscore the need to intensify education on the judicious use of antibiotics to prevent overuse and resistance. This poses a significant challenge in managing and controlling antibiotic misuse. The insights from this research will aid in formulating more effective educational programs and control measures, ensuring sustainable and safe antibiotic usage in the community.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

AVAILABILITY OF DATA AND MATERIAL

The data that support the findings of this study are available from the corresponding authors Duyen Thi My Huynh (i.e., upon reasonable request).

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