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Factors affecting antibiotics consumption among the elderly population in Thailand

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ABSTRACT

Background: The consumption of antibiotic among the elderly population has raised concerns in Thailand due to its correlation with antimicrobial resistance (AMR) infections. Moreover, it is also related to adverse drug reactions resulting from impaired drug excretion and elimination. Contributing factors to antibiotic consumption in the elderly population are insufficiently understood in Thailand.

Objectives: The purposes of this study were to determine the prevalence of antibiotic consumption behaviour among the elderly population and to identify associated factors.

Methods: A cross-sectional study was conducted using survey data from the National Statistic Office, which included only elderly individuals. Bivariate analysis with a generalized linear mixed model (GLMM) was performed to screen for significant independent variables with a significance level below 0.05. All significant variables were included in the multivariable analysis, which revealed adjusted odds ratios (AOR) and 95% confidence intervals (CI).

Results: Of 9,104 elderly people, the prevalence of antibiotic consumption was found to be 7.77% (95% CI: 7.21% - 8.31%). The multivariable GLMM analysis demonstrated that being free from underlying diseases (AOR= 2.16, 95% CI: 1.63-2.88, p-value < 0.001), having transportation expenses (AOR = 2.11, 95% CI:1.49-2.99, p-value < 0.001), experiencing pain and discomfort symptoms (AOR =1.66, 95%CI: 1.27-2.16, p-value < 0.001), having anxiety and depression (AOR = 1.66, 95%CI: 1.27-2.16, p-value = 0.012), having moderate to poor level of knowledge (AOR = 2.42 95% CI: 1.55-3.78 and (AOR=2.71, 95% CI:1.75-4.21), and not receiving information regarding antibiotic use and its resistance (AOR = 5.12, 95%CI: 4.12-6.36, p-value < 0.001) were the major contributing factors to antibiotic consumption behaviours in the elderly population.

Conclusion: The prevalence of antibiotic consumption in the elderly population may contribute to emergence of AMR infections and increased mortality rates. Implementing clinical practice guidelines and health education programs is essential to control antibiotic prescriptions and discourage self-medication in Thailand.

Keywords: Antibiotic, Elderly, Transportation expense

1. Introduction

Thailand has been reported as an aging society [1]. Projections indicate that the proportion of the elderly population will exceed 30% by 2040 [1]. Elderly individuals undergo physical changes due to aging, which complicates the diagnosis of infectious diseases, making it challenging due to unclear clinical manifestations. Notably, the absence of fever is a significant characteristic of early-stage infectious diseases in the elderly, further complicating the diagnosis [2-4]. Consequently, oral antibiotics have emerged as a primary treatment option for infectious diseases in this demographic.

Antibiotic consumption among older adults poses risks of antimicrobial resistance (AMR) [5], as well as antibiotics overdose and adverse drug reactions due to impaired drug excretion and elimination [6]. Moreover, elderly individuals with chronic diseases often experience polypharmacy, increasing the likelihood of drug interactions when antibiotics are consumed [7]. The prevalence of antibiotic consumption among the elderly varies globally. For example, in Spain, the prevalence was reported to be 4.64% in 2006 and has seen a slight increase until 2017 [8]. Antibiotic prescription rates among the elderly in Hungary and Sweden were also reported as 649.8 prescriptions per 1,000 inhabitants per year and 545 prescriptions per 1,000 inhabitants per year, respectively [9]. Similarly, high prescription rates were observed among older adults in the United States [10], with Italy reporting a prevalence of antibiotic use at 39.1% [11].

Multiple hospital visits increase the probability of obtaining antibiotics, especially among the elderly with chronic diseases [12, 13]. Attitudes and knowledge regarding antibiotic use have also been associated with antibiotic consumption among the Thai elderly population [14]. However, studies on factors related to antibiotic consumption among the elderly are insufficient in Thailand. Exploring the factors related to antibiotic consumption in the elderly is useful for providing specific health education programs. The findings of this study can help regulate antibiotic use among the elderly. Therefore, the purposes of this study are to identify the prevalence of antibiotic consumption and its associated factors among the Thai elderly population.

2. Methods

2.1 Study Area

This study utilized secondary data obtained from a national survey conducted in Thailand in 2021.

2.2 Study Design

The cross-sectional study was conducted using data from the Health and Welfare Survey 2021, which was extracted from the National Statistics Office. The national survey included the elderly population, with the inclusion criteria being all older adults aged 60 and over who participated in the survey. Data from individuals with unclear information were excluded from the study.

2.3 Sample size and sampling

The sample size was estimated using a formula recommended for cross-sectional studies [15]. The power of the study was set at 80%. The previous percentage of antibiotic consumption among elderly individuals with severe disabilities was 21.39%, while the percentage among elderly individuals without disabilities was 34.49% [8]. The ratio of exposed to unexposed groups was 1. Although the sample size was estimated at 366, all 9,104 elderly participants were enrolled in the study.

2.4 Data Collection

The data were extracted from the Health and Welfare Survey 2021. Pairwise deletion was utilized to manage missing values. This procedure was conducted using Microsoft Excel 2007.

Antibiotic consumption was defined as the use of oral antibiotics within a one-month period. Various aspects of elderly physical and mental health, activities of daily living, anxiety and depression levels, pain and discomfort, and ability to work were assessed. Additionally, health-seeking behaviours among the elderly, such as visits to public hospitals and self-purchase of medications were determined. Transportation and health services expenditures were reported as either expended or not expended.

Knowledge regarding antibiotic use was assessed using six questions, with the knowledge score ranging from 0 to 6 marks. A total score of 0 to 2 marks indicated poor knowledge, 3 to 4 marks indicated moderate knowledge, and 5 to 6 marks indicated good knowledge. Attitudes regarding antibiotic use were assessed through five questions, with the attitude score ranging from 5 to 25 marks. A score below 11.67 was defined as a poor attitude, while a score above 18.34 was defined as good attitude. Scores falling between these ranges were defined as moderate attitudes.

2.5 Data Analysis

The prevalence of antibiotic use was calculated as the proportion of antibiotic use

among total population. All categorical variables were described as frequency and percentage. Continuous variables were reported as mean and standard deviation (SD), as appropriate. The Generalized Linear Mixed Model (GLMM) with a binomial family was employed to quantify the relationship between covariates and antibiotic use. This analysis is appropriate to control the clustering effect. Region was designated as a random effect variable. Results of the bivariate analysis were presented as crude odds ratios (OR), 95% confidence intervals (CI), and p-values. Variables with p-values less than 0.05 from the bivariate analysis were included and adjusted in further multivariable analysis. The results were presented as adjusted odds ratios (AOR), 95% CI, and p-values. All statistical procedures were conducted using STATA version 18 (copyrighted by Khon Kaen University).

2.6 Ethical Clearance

Ethical approval to conduct this study was obtained from the Ethics Review Committee for Research Involving Human Research Subjects, Khon Kaen University. The approval number is HE662146, granted on 19 June 2023.

3. Results

3.1 Socioeconomic characteristic of elderly population

Most of the elderly participants were male and resided in urban areas. Employment was reported among 3,792 participants (42.57%). Less than half of them reported a monthly household income exceeding 10,000 baht. The majority of elderly participants had at least a primary school education and approximately 60% were married. All participants utilized universal health coverage as their health insurance. Underlying diseases were reported among 5,392 elderly participants (59.23%) (Table 1).

Most of the elderly participants were male and lived in urban areas. Employment was reported among 3,792 participants (42.57%). Less than half of them reported a monthly household income exceeding 10,000 baht. The majority of elderly participants had at least a primary school education, and around 60% of them were married. All participants utilized universal health coverage as their health insurance. Underlying diseases were reported among 5,392 elderly participants (59.23%) (Table 1).

Table 1: Baseline characteristics of the elderly participants (n=9,104)

Characteristics	Number (n)	Percentage (%)
Sociodemographic		
Gender		
Female	3,791	41.64
Male	5,313	58.36
Location		
Urban	4,961	54.49
Rural	4143	45.51
Marital status		
Single	488	5.36
Married	5,300	58.22
Widow	2,934	32.23
Divorce	382	4.19
Occupation (n = 8,907)		
Unemployed	5,115	56.62
Employed	3,792	42.38
Education level (n = 9,102)		
Lower than primary school	3,645	40.05
Primary school or above	5,457	59.95
Monthly household income (n = 6,706)		
<5,000 baht	1,615	24.08
5,000 – 10,000 baht	2,177	32.46
>10,000 baht	2,914	43.46
Health insurance		
Universal health coverage	9,104	100
Non-universal health coverage	0	0
Having underlying diseases		
Yes	5,392	59.23
No	3,712	40.77
Types of health seeking behaviours		
Public hospitals visit (n = 3,799)		
Yes	1,730	54.46
No	2,069	45.54
PCU visit		
Yes	1,059	27.86
No	2,742	72.14
Private hospital/clinic visit		
Yes	243	6.39
No	3,558	93.61
Self-purchase of medications		
Yes	496	13.05
No	3,305	86.95
Transportation expense (n = 9,093)		
Paid	4,873	53.59
Not paid	4,220	46.41
Health service expense (n= 9,090)		
Paid	7,833	86.17
Not paid	1,257	13.83
Health care providers (n = 3,032)		
Physician		
Yes	2,767	91.26
No	265	8.74
Thai traditional medical professions		
Yes	4	0.14

Characteristics	Number (n)	Percentage (%)
No	4,994	99.86
Nurse		
Yes	100	3.30
No	2,932	96.70
Public health officer		
Yes	151	4.98
No	2,881	95.02
Health status		
Problems of walking and movement		
Yes	3,730	40.97
No	5,374	59.03
Problem of daily activity living		
Yes	1,205	13.24
No	7,899	86.76
Pain and discomfort symptoms		
Yes	3,772	41.43
No	5,332	58.57
Anxiety and depression		
Yes	1,296	14.24
No	7,808	85.76
Problem of ability to work		
Yes	2,143	23.54
No	6,961	76.46
Knowledge and attitude regarding antibiotics use		
Knowledge regarding antibiotics use		
Poor	5,045	55.41
Moderate	3,260	35.81
Well	799	8.78
Attitude regarding antibiotics use (n = 8,807)		
Poor	275	3.12
Moderate	3,318	37.67
Well	5,214	59.21
Receiving information regarding antibiotics use and its resistance (n = 8,362)		
Yes	6,149	73.54
No	2,213	26.46

3.2 Prevalence of antibiotics consumption behaviour among elderly people

Among the 9,104 elderly individuals included in the study, 707 reported antibiotic consumption. The prevalence of antibiotic consumption among the elderly was 7.77% (95% CI: 7.21% - 8.31%) (Table 1). Sources of antibiotics included public hospitals (38.33%), drug stores (28.28%), and primary care units (24.18%) (Table 2).

Table 2: Prevalence of antibiotics consumption behavior among elderly people (n=9,104)

Outcome	Number (n)	Percentage (%)	95%CI
Antibiotics consumption			
Yes	707	7.77	7.21-8.31
No	8,397	92.23	91.68-92.78
Source of antibiotics			
Public Hospital	271	38.33	

Outcome	Number (n)	Percentage (%)	95%CI
Primary care unit	170	24.05	
Private hospital or clinic	40	5.66	
Drug store	200	28.28	
Grocery store	21	2.98	
Leftover antibiotics	1	0.14	
Unspecified source	4	0.56	

*95CI = 95% confidence interval

3.3 Contributed factors to antibiotics consumption behaviour among elderly by bivariate analysis

The proportions of antibiotics consumption among elderly people living in urban and rural areas were similar (54.49% vs 45.51%) and were not statistically significant (p-value = 0.109). The prevalence of antibiotic consumption among other socioeconomic statuses was nearly the same. However, elderly people with underlying diseases reported a higher antibiotic consumption rate than those in other groups, and this difference was statistically significant (OR =1.63,95% CI:1.38 - 1.93, p-value< 0.001).

Antibiotic consumption prevalence among elderly individuals experiencing problems with walking and movement was 10.83% higher than those without problems, with statistical significance (OR=2.01, 95% CI:1.71-2.34, p-value <0.001). Similarly, antibiotic consumption prevalence was higher among those with impaired daily activities of daily living (OR= 2.59, 95% CI:2.17-3.10, p-value <0.001)). Work-related problems among the elderly also contributed to antibiotic consumption patterns (OR=2.23, 95% CI: 1.90-2.62, p-value < 0.001). Moreover, pain and discomfort symptoms among elderly individuals revealed a higher rate of antibiotic consumption (OR=2.65, 95% CI:2.26-3.11, p-value < 0.001). The prevalence among elderly individuals with anxiety and depression was twice as great as those without symptoms, with statistical significance (OR=2.13, 95% CI:1.77-2.56, p-value < 0.001).

The antibiotic consumption prevalence among elderly individuals who did not visit public hospitals was somewhat higher than that of those who did, but without statistical significance (p-value=0.09). The prevalence among those who visited private hospitals or clinics was similar. Elderly individuals who visited primary care units had a similar likelihood of antibiotic consumption behaviour as those who did not visit. Antibiotic consumption prevalence was higher among elderly individuals who purchased drugs (OR =1.41, 95% CI:1.09-

1.83, p-value =0.009). Additionally, the prevalence of antibiotic consumption was similar in elderly individuals who met physicians and those who did not (p-value = 0.824). The odds of antibiotic consumption behaviour among elderly individuals who had transportation expenses were 2.90 times greater than those without expenses (OR=2.90, 95% CI:2.45-3.42, p-value <0.001). Moreover, elderly individuals who had to pay for health services demonstrated higher odds of antibiotic consumption behaviour with statistical significance (OR=2.30, 95% CI:1.92 – 2.77, p-value <0.001).

The prevalence rates of antibiotic consumption among elderly individuals in each level of knowledge differed with statistical significance (p-value=0.005), whereas the antibiotic consumption prevalence rates in each level of attitude regarding antibiotic use were similar (p-value =0.445). Elderly individuals who had never received any information regarding antibiotic use and its resistance demonstrated a higher prevalence of antibiotic consumption with statistical significance (OR=5.14, 95% CI: 4.35-6.08, p-value<0.001) (Table 3).

Table 3: Bivariate analysis of related factors to antibiotics consumption (n = 9,104)

Factors	Number of sample	Antibiotics consumption n	(%)	COR	95% CI	p-value
Socioeconomic factors						
Location						0.109
Urban	4,961	368	7.42	1		
Rural	4,143	339	8.18	1.13	0.97 – 1.32	
Sex						0.491
Female	3,791	286	7.54	1		
Male	5,313	421	7.92	1.06	0.90 – 1.23	
Marital status						0.989
Not married	3,804	294	7.73	1		
Married	5,300	413	7.79	0.99	0.85 – 1.16	
Educational level (n = 9,102)						0.339
Lower than primary school	3,645	276	7.57	1		
Primary school or above	5,457	431	7.90	1.08	0.92 – 1.26	
Occupation (n = 8,907)						0.873
Unemployed	5,155	396	7.68	1		
Employed	3,792	311	7.88	1.01	0.86 – 1.18	
Monthly household income (n = 6,706)						0.655
>5,000 THB	5,091	405	7.96	1		
<5,000 THB	1,615	133	8.24	1.04	0.85 – 1.29	
Having underlying disease						<0.001
No	3,712	222	5.98	1		
Yes	5,392	485	8.99	1.63	1.38 – 1.93	

Factors	Number of sample	Antibiotics consumption n	(%)	COR	95% CI	p-value
Elderly health statuses factors						
Problem of walking and movement						<0.001
No	5,374	303	5.64	1		
Yes	3,730	404	10.83	2.01	1.71 – 2.34	
Problem of daily activity living						<0.001
No	7,899	516	6.52	1		
Yes	1,205	191	15.85	2.59	2.17 – 3.10	
Problem of working						<0.001
No	6,961	428	6.15	1		
Yes	2,143	279	13.02	2.23	1.90 – 2.62	
Pain and discomfort symptoms						<0.001
No	5,332	258	4.84	1		
Yes	3,772	449	11.90	2.65	2.26 – 3.11	
Anxiety and depression						<0.001
No	7,808	532	6.81	1		
Yes	1,296	175	13.50	2.13	1.77 – 2.56	
Health seeking behavioural factors						
Public hospitals visit (n = 3,799)						0.097
Yes	1,730	206	11.91	1		
No	2,069	288	13.92	1.17	0.97 – 1.42	
PCU visit (n = 3,801)						0.397
No	2,742	346	12.62	1		
Yes	1,059	148	13.98	1.09	0.88 – 1.34	
Private hospital/clinic visit (n = 3,801)						0.407
No	3,558	458	12.87	1		
Yes	243	36	14.81	1.16	0.81 – 1.68	
Self-purchase of medications (n = 3,801)						0.009
No	3,305	412	12.87	1		
Yes	496	82	16.53	1.41	1.09 – 1.83	
Physician as a healthcare provider (n = 3,801)						0.824
No	265	33	12.45	1		
Yes	2,767	357	12.90	1.04	0.71 – 1.52	
Transportation expense (n = 9,093)						<0.001
Not paid	4,873	216	4.43	1		
Paid	4,220	490	11.61	2.90	2.45 – 3.42	
Health services expense (n = 9,090)						<0.001
Not paid	7,833	529	6.75	1		
Paid	1,257	175	13.92	2.30	1.92 – 2.77	
Knowledge and attitude regarding antibiotics use factors						
Knowledge regarding antibiotics use						0.005
Well	799	38	4.76	1		
Moderate	3,260	272	8.34	1.77	1.25 – 2.52	
Poor	5,045	397	7.87	1.65	1.17 – 2.33	
Attitude regarding antibiotics use (n = 8,807)						0.445

Factors	Number of sample	Antibiotics consumption n	(%)	COR	95% CI	p-value
Well	5,214	396	7.59	1		
Moderate	3,318	280	8.44	1.09	0.93 – 1.28	
Poor	275	20	7.27	0.90	0.56 – 1.44	
Receiving information regarding antibiotics use and its resistance (n = 8,462)						<0.001
Yes	6,249	251	4.08	1		
No	2,213	403	18.21	5.14	4.35 – 6.08	

3.4 Contributed factors to antibiotics consumption behaviour among elderly by multivariable analysis

After adjustment for self-purchase of medications, health service expenditure, impaired activity daily living, work problems, walking and movement issues, multivariable analysis showed that being free form underlying disease (AOR=2.16, 95% CI:1.63-2.88, p-value <0.001), experiencing pain and discomfort symptoms (AOR= 1.66, 95% CI:1.27-2.16, p-value <0.001), experiencing anxiety and depression (AOR=1.38, 95% CI:1.07-1.79, p-value < 0.001), and having transportation expense (AOR=2.11,95% CI:1.49-2.99, p-value < 0.001) were associated with antibiotic consumption among elderly individuals. The level of knowledge regarding antibiotic use was also associated with antibiotic consumption patterns (p-value <0.001). Elderly individuals who did not receive any information regarding antibiotic use and its resistance had higher odds of antibiotic consumption behaviour with statistical significance (AOR=5.12, 95% CI:4.12-6.36, p-value <0.001) (Table 4).

Table 4: Factors associated with antibiotics consumption among elderly people from multivariable analysis (n=3,518)

Factors	Number of sample	antibiotic consumption n	%	AOR	95% CI	p-value
Having underlying disease						<0.001
Yes	5,392	485	8.99	1		
No	3,712	222	5.98	2.16	1.63 – 2.88	
Pain and discomfort symptoms						<0.001
No	5,332	258	4.84	1		
Yes	3,772	449	11.90	1.66	1.27 – 2.16	
Anxiety and depression						0.012
No	7,808	532	6.81	1		
Yes	1,296	175	13.50	1.38	1.07 – 1.79	

Factors	Number of sample	antibiotic consumption n	%	AOR	95% CI	p-value
Total transportation expenditure						<0.001
Not paid	4,873	216	4.43	1		
Paid	4,220	490	11.61	2.11	1.49 – 2.99	
Knowledge regarding antibiotics use						<0.001
Well	799	38	4.76	1		
Moderate	3,260	272	8.34	2.42	1.55 – 3.78	
Poor	5,045	397	7.87	2.71	1.75 – 4.21	
Receiving information regarding antibiotics use and its resistance						<0.001
Yes	6,249	251	4.08	1		
No	2,213	403	18.21	5.12	4.12 – 6.36	

*Adjusted for self-purchase of medications, health service expenditure, impair activity daily living, problem of work, problem of walking and movement

4. Discussion

The prevalence of antibiotic consumption in elderly people was 7.77%, which was higher than the situation of antibiotics uses in Spain and Italy [8, 11]. The major sources of antibiotic consumption were public hospitals and PCUs. All antibiotics were prescribed by physicians in both private and public health sectors. A study in the UK showed that the majority of physicians prescribed antibiotics for elderly patients, often resorting to broad-spectrum antibiotics when the clinical signs of infection were inconclusive. They believed that early antibiotics prescription was essential for elderly patients to reduce the severity of infection and hospitalization [16].

The rate of antibiotics prescription among primary care doctors was highly observed, often due to a lack of diagnostic capacity and to prevent the complication of infection [17]. Over-prescription of antibiotics in older adults also contributed to polypharmacy, resulting in drug interaction effects and a lower quality of life [18]. The specific guideline for primary care about infection in elderly and appropriate antibiotic prescription should be developed and distribute to involved physicians.

Elderly individuals without chronic diseases have higher odds of receiving antibiotics than those with chronic diseases. However, elderly individuals with chronic diseases, especially multiple chronic diseases, are at a higher risk of severe infection than elderly people without chronic disease. Sepsis, a severe complication, is difficult to detect early in elderly patients [19]. Clinical

guidelines recommend hospitalization for elderly patients with multiple chronic diseases and signs of infection to receive intravenous antibiotics instead of oral antibiotics [20-23].

Transportation expense is associated with antibiotics consumption in elderly people. Those with common colds often requested oral antibiotics from physicians because they lived far from healthcare facilities and had to spend money on transportation to visit [24].

Antibiotic use was mainly reported in people with mental illness. The gut-microbiota axis explains the pathogenesis of mental health disorders, as gut microbiota communicates with the brain via vagal nerve transmission. Alterations in neurotransmitter levels induced by vagal signals can lead to mental illness, such as major depressive disorder [25].

Expressive disorder was observed to be a contributing factor to antibiotic consumption, with statistical significance according to previous studies. Cephalosporin and penicillin were the top two most commonly prescribed antibiotics among users [26]. Childhood exposure to antibiotics for infection treatment can lead to depression and anxiety in adulthood due to alterations in gastrointestinal bacteria, which can result in the use of antibiotics as an alternative treatment for depression and anxiety [27].

Pain and discomfort are related factors to antibiotics consumption in the elderly population. Chronic pain is a common manifestation in elderly patients and can lead to serious diseases, including infection. Discomfort and pain have been observed as early signs of infection in a qualitative study in England [28, 29], with discomfort being an early sign of sepsis among elderly individuals visiting emergency departments [20].

Knowledge regarding antibiotic use has been observed as a predictor of antibiotic consumption in elderly people. Even those with proper knowledge still expected antibiotic prescriptions from physicians and were less satisfied if antibiotics were not prescribed, often seeking prescriptions from other physicians [30]. Information sources regarding antibiotic use and its resistance are important to provide knowledge to elderly people. Healthcare providers should provide this knowledge following rational drug use (RDU) guidelines [31]. While the internet and social media are good sources of information, they may be limited for elderly people with cognitive decline and impairment [32, 33].

5. Conclusion

The strengths of this study lie in its attempt to identify the factors contributing to antibiotic consumption behaviour among elderly people, a topic that is rarely quantified in Thailand. Factors such as transportation expenditure and elderly health status were investigated, providing valuable insights for policy implementation. However, the study was based on secondary survey data, which may have contained missing values and lower validity compared to primary surveys.

The prevalence of antibiotic consumption behaviour among elderly people in Thailand was found to be similar to that in other countries. Various health status and health-seeking behavioural factors were observed to be associated with antibiotic consumption among the elderly population. To address this issue and combat AMR infection, it is essential to modify and distribute health education programs and clinical practice guidelines to all relevant healthcare workers, including physicians, in Thailand. The clinical practice guidelines for infection treatment, tailored to the primary care context, should be developed by a multidisciplinary team and distributed to primary care physicians. These guidelines should include early signs and symptoms of infection, which can be easily screened in primary care settings. Furthermore, physicians should explain the reasons for not prescribing antibiotics and provide health education to elderly patients, especially those with anxiety and depression. Oral antibiotic prescriptions should be avoided in elderly patients with multiple chronic diseases. Instead, hospitalization and intravenous antibiotics are recommended for these patients. Technologies such as telemedicine can be utilized to provide knowledge about antibiotic use by health personnel, thereby enhancing health literacy regarding antibiotic consumption behaviour among the elderly population. Future research should focus on primary data collection, including qualitative interviews, to better understand antibiotic consumption behaviour among elderly people.

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