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RESEARCH ARTICLE

Prevalence and Determinants of Antibiotic Use by the Elderly in Marrakech, Morocco

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Abstract: Antibiotics are essential for the prevention and treatment of bacterial infections; however, their inappropriate use among elderly populations poses serious risks, including the emergence of multidrug-resistant organisms. Antimicrobial resistance has become a critical global public health challenge, with irrational antibiotic use being one of its primary drivers. In Morocco, data on antibiotic use among older adults remain scarce, particularly regarding the determinants of irrational use in this vulnerable group, a gap that hinders the development of targeted health policies. This cross-sectional study aimed to assess the prevalence of antibiotic use among elderly individuals in Marrakech and to identify the key determinants of irrational use. Participants were recruited from primary healthcare centers and pharmacies in the city of Marrakech using stratified sampling. A total of 180 elderly individuals with prior awareness of antibiotics were enrolled, of whom 144 completed questionnaires were included in the final analysis. Logistic regression was performed to identify factors associated with antibiotic use patterns. Among respondents, 62.5% had used antibiotics in the 12 months preceding the survey, and only 46.8% had adhered to their prescribed antibiotic course. Self-medication was reported in 36.7% of cases, with leftover medicines (20%) and over-the-counter pharmacy purchases (16.7%) as the primary sources. Respiratory infections were the most common indication for antibiotic use (30%). Multivariable logistic regression revealed that urban origin was associated with better antibiotic knowledge, female sex with better practice, and rural origin, nuclear family structure, and higher educational level with more appropriate antibiotic-related behaviour. These findings highlight significant gaps in antibiotic knowledge and adherence among the elderly in Marrakech. Strengthened public health education and stricter regulation of antibiotic dispensing are urgently needed to curb irrational antibiotic use in this population.

Keywords: Antibiotic use, Self-medication, Antimicrobial resistance, Elderly population, Irrational drug use, Marrakech, Morocco, Primary healthcare

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Introduction

Antibiotics are essential for combating and preventing infections caused by microorganisms (Coates et al., 2020). Between 2000 and 2015, global antibiotic use rose by 39% (Klein et al., 2018). his overconsumption is especially notable among older adults, who use roughly 50% more antibiotics per person than younger adults (Portero de la Cruz & Cebrino,

2020). The elderly population grew from one million in 1970 to 4.5 million in 2022, an average annual increase of 2.8%, a rate higher than the overall population growth in Morocco, which is 1.7%. By 2050, this number is projected to reach 10 million (HCP, 2022). Because of several factors including immune senescence, deterioration of skin integrity, degenerative changes in bones and cartilage, and diminished respiratory function, older adults face a heightened risk of infectious diseases (Chakhtoura et al., 2017). Such infections represent one of the leading causes of hospitalization and death in this population (Ittisanyakorn et al., 2019).

In older adults, inappropriate antibiotic use poses considerable risks and can lead to serious adverse outcomes. These include harmful drug interactions, age-related side effects or disease-related metabolic changes, as well as increased vulnerability to multidrug-resistant organisms and Clostridium difficile infections (Beckett et al., 2015) (Lessa et al., 2015) (Corsonello et al., 2015). Moreover, the rise of antibiotic resistance among pathogenic bacteria poses a major global public health challenge (Munita & Arias, 2016). This issue is particularly critical in older adults, where multidrug-resistant organisms contribute to higher morbidity, mortality, and healthcare costs (Nelson et al., 2022). The elderly are more susceptible to infections, and bacterial resistance tends to increase with age (Sahuquillo-Arce et al., 2011). Urinary tract infections represent the second most frequent reason for prescribing antibiotics, following respiratory infections (Foxman, 2010). In older adults, diagnosing these infections is challenging due to the frequent occurrence of atypical clinical presentations (Gavazzi & Krause, 2002). Diagnostic uncertainty often results in the excessive use of antibiotics, which subsequently contributes to the rise of antimicrobial resistance (Bell et al., 2014) (Costelloe et al., 2010).

In response to this issue, numerous studies have investigated the impact of socio-demographic and clinical factors on the global rise in antibiotic consumption, aiming to implement timely measures to promote the rational use of these medications (Masiero et al., 2010) (Bruyndonckx et al., 2014) (Ardoino et al., 2019). However, research specifically examining antibiotic use among community-dwelling older adults remains limited, as most studies have focused on the general population or hospitalized patients. To our knowledge, no study has been specifically conducted in Morocco, to assess the prevalence and analyze the determinants of antibiotic use by the elderly, a population particularly vulnerable to infections and bacterial resistance. Indeed, the aim of this study is to assess the prevalence of antibiotic use among the elderly in our country and identify the determinants associated with this use, with a view to promoting the rational use of these drugs by this population.

Materials and Methods

Study Design

This cross-sectional study was conducted from September to December 2021 with the aim of determining the prevalence and analyzing the risk factors of antibiotic use in the elderly population of the city of Marrakech. Morocco.

Sampling Methods

We used a stratified sampling method, dividing the population into homogeneous groups based on criteria such as age, sex, and place of residence. Quotas were then set for each category. Health centers and pharmacies were randomly selected in each district from a pre-established list of these facilities. After selecting the establishments, participants were randomly chosen in each stratum of independent samples. A questionnaire was sent to those who agreed to take part in the study. Before their inclusion, the researchers explained the aims of the study and obtained their verbal consent.

Questionnaire Design

This cross-sectional study was carried out among older adults living in the city of Marrakech. Data were gathered using a self-administered questionnaire, and for participants who were illiterate, individual interviews were conducted to ensure complete data collection. The questionnaire was designed following a review of the relevant literature from similar studies (Mahmood et al., 2008) (Sien & Omar, 2018). It was pre-tested on a sample of 20 participants randomly selected at the survey site but not included in the main study. This pilot test evaluated the clarity and comprehensibility of the questions and confirmed their relevance and appropriateness. Participants received an explanation of the study objectives and were informed that their anonymity and data confidentiality would be maintained. Oral consent was obtained prior to administering the questionnaire. The questionnaire comprised five sections. The first collected sociodemographic and economic information about older adults. The second addressed antibiotic use, while the third assessed participants' knowledge of antibiotics. The fourth explored their attitudes toward antibiotic use, and the fifth examined their related behaviors.

For the knowledge, attitude, and behavior sections, a scoring system was applied. Each correct response was given 1 point, whereas incorrect or uncertain responses received 0 points. The points for each question were summed for each participant to obtain a total score for each domain. Based on these totals, an overall median score was calculated for each domain. Participants scoring at or below the median were classified as having insufficient knowledge, attitudes, or behaviors, while those with scores above the median were considered to have a good level in these areas.

Data Analysis

Data from the questionnaires were entered, analyzed and stored using SPSS software. Descriptive statistics were applied to examine the prevalence of antibiotic use, the sociodemographic characteristics of participants, and their knowledge, attitudes, and behaviors related to antibiotic use. Associations between categorical variables were tested using the chi-square test. Variables with a p-value ≤ 0.2 were included in a multivariate logistic regression model for further analysis (Vallin et al., 2016). This model helped identify risk factors associated with antibiotic use among older adults. The statistical significance threshold (α) was set at 0.05 for all analyses.

Results

A total of 144 questionnaires were collected out of the 180 initially distributed, giving a response rate of 80%.

Socio-Demographic Characteristics Of Participants

A total of 144 questionnaires were collected and included in the analysis. The majority of older adults (53.5%) were between 70 and 79 years old, while 46.5% were between 60 and 69 years old. Men represented 52.1% of the sample and women 47.9%. Regarding educational level, 29.2% of participants were illiterate, 29.2% had completed primary education, 22.9% had completed middle school, 8.3% had secondary education, and 10.4% had a university degree. In terms of origin, 14.6% of respondents were from urban areas, whereas 85.4% came from rural areas. Concerning marital status, 87.5% were married and 12.5% divorced. With respect to family structure, 58.3% came from nuclear families, 33.3% from extended families, and 8.4% from composite families. Finally, 66.7% reported having health insurance coverage.

Table 1: Socio-demographic characteristics of participants

Variable		Frequency	Percentage
Age	60-69	67	46.5
	70-79	77	53.5
Gender	Men	75	52.1
	Woman	69	47.9
Level of Education	Illiterate	42	29.2
	Primary	42	29.2
	College	33	22.9
	Secondary	12	8.3
	University	15	10.4
Place of Birth	Urban	21	14.6
	Rural	123	85.4
Marital Status	Married	126	87.5
	Divorce	18	12.5
Family Structure	Nuclear	84	58.3
	Extended	48	33.3
	Compound	12	8.4
Social Security	Yes	96	66.7
	No	48	33.3

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Table 2: Use of antibiotics by the elderly

Variable		Frequency	Percentage
Antibiotics use	Yes	90	62.5
	No	54	37.5
Number of times	< 2 times	63	70
	2 - 4 times	21	23.3
	>5 times	6	6.7
Source of use	On medical prescription	57	63.3
	Over-the-counter, at the pharmacy	15	16.7
	Rest of the drug	18	20
Type of antibiotics used	Amoxicillin	9	10.35
	Flucloxacillin	12	13.79
	Benzylpenicillin	15	17.24
	Clarithromycin	9	10.35
	Amoxicillin clavulanic acid	33	37.93
	Cephalosporin	3	3.44
	Ciprofloxacin	6	6.90
Reasons for taking antibiotics	Respiratory diseases	27	30
	Otorhinolaryngology infections	27	30
	Fever and pain	3	3.3
	Urinary pathologies	24	26.7
	Digestive infection	6	6.7
	Infection of the skin or a wound	3	3.3
Side-effects	Yes	57	67.9
	No	27	32.1
Type of side effects	Diarrhea	42	73.7
	Abdominal pain	12	21
	Vertigo	3	5.3

Prevalence of Antibiotic Use

Overall, 62.5% of elderly participants reported using antibiotics in the 12 months prior to the survey. Prescription antibiotics accounted for 63.3% of use, while self-medication was observed in 36.7% of cases. The main sources of self-medication were leftover medications (20%) and antibiotics obtained without a prescription from pharmacies (16.7%). Respiratory infections were the leading indication for antibiotic use (30%), followed by otorhinolaryngological infections (30%) and urinary tract infections (26.7%). Amoxicillin-clavulanic acid was the most frequently used antibiotic (37.9%), followed by benzylpenicillin (17.2%) and clarithromycin (10.3%). Ciprofloxacin (6.9%) and cephalosporins (3.4%) were less commonly used. Adverse effects were reported by 67.9% of users, with diarrhea being the most common (73.7%) (Table 2).

Older People's Knowledge of Antibiotic Use

A total of 64.6% of elderly people had good knowledge of antibiotics. Gaps in knowledge about the appropriate use of antibiotics were identified. Despite believing that antibiotics are effective against bacteria (78.3%), the majority (75%) also believe that antibiotics are effective against viruses, and against all germs (81.3%), in the case of colds and coughs (75%) and (58.3%) in the case of fever and pain. 48% did not know that antibiotics cause allergic reactions, 47.9% of older people did not know that antibiotics cause side effects.

Table 3: Participants' knowledge, attitudes and behavior

Variable	Yes N (%)	No N (%)
Participants' knowledge of antibiotics		
Antibiotics are effective:		
Against bacteria	108 (78.3)	30 (21.7)
Against viral infections	108 (75)	36 (25)
Against all germs	117 (81.3)	27 (18.8)
For colds and coughs	108 (75)	36 (25)
In case of pain and fever	84 (58.3)	60 (41.7)
Antibiotics can cause an allergic reaction	75 (52)	69 (48)
Antibiotics cause side effects	75 (52.1)	69 (47.9)
Overuse of antibiotics renders them ineffective	66 (45.8)	77 (54.2)
Attitudes of participants		
When I get a cold - I'll be taking antibiotics to help me get better faster	57 (44.2)	73 (55.8)
- I expect my doctors to prescribe antibiotics if I suffer from cold symptoms	69 (53.5)	60 (46.5)
- I should stop taking an antibiotic when I start to feel better	3 (2.3)	127 (97.7)
When a family member is ill, I have to give them antibiotics	69 (47.9)	75 (52.1)
I will use the remaining antibiotics to treat respiratory infections	87 (60.4)	57 (39.6)
It is normal to stop taking an antibiotic when symptoms improve	81 (56.3)	63 (43.8)
Taking fewer antibiotics than prescribed is healthier than following the prescribed course of treatment	87 (60.4)	57 (39.6)
When do you think, you should stop taking an ATB?		
- When you feel better	60 (43.5)	
- When you take the antibiotic as prescribed	42 (30.4)	
- When the box is finished	15 (10.9)	
- In the event of a side effect	18 (13)	
Respondent behavior		
Have you completed the last course of antibiotics as prescribed?	66 (46.8)	75 (53.2)
Did you use an antibiotic initially used for an infection that subsequently returned?	57 (39.6)	87 (60.4)
Did you use an antibiotic initially prescribed for another illness?	75 (52.1)	69 (47.9)
Have you given someone else an antibiotic that was not prescribed for them?	45 (31.3)	99 (68.8)
I usually keep antibiotics at home in case of emergency	66 (45.8)	78 (54.2)
I'm going to take antibiotics according to the instructions	99 (71.7)	39 (28.3)
I check the expiry date of antibiotics before taking them	114 (80.9)	27 (19.1)

Attitudes of Older People

Overall, the majority of elderly people (77.1%) were categorized as having inappropriate attitudes towards antibiotics. A significant proportion of respondents displayed incorrect attitudes towards the use of these drugs, with 60.4% believing that taking less antibiotics than prescribed is more beneficial than following the recommended course. In addition, 56.3% thought it was acceptable to stop taking an antibiotic when symptoms improved. A considerable percentage of older people (44.2%) think they will take antibiotics if they have a cold to speed up recovery, and 53.5% expect their doctors to prescribe antibiotics if they have cold symptoms. Only 30.4% of older people think they should take their treatment as prescribed.

Behaviours of Older People

Approximately 45.8% of participants adopted behaviors deemed appropriate. However, 53.2% did not complete treatment as prescribed. In addition, more than half the respondents (45.8%) admitted to keeping antibiotics at home for emergency

situations, and 31.3% shared these medicines with sick relatives. In terms of following instructions, 71.7% of participants will take antibiotics according to label instructions, and 80.9% regularly checked the expiry date of antibiotics before use. 52.1% used an antibiotic originally prescribed for another illness. In addition, 39.6% have used an antibiotic initially prescribed for an infection that returned later (Table 2).

Table 4: Risk factors associated with knowledge, attitudes and behavior

Level of knowledge about antibiotics [a]		B	Sig.	Exp(B)	95%CI
High	Constant	0.67	0.35		
	Urban origin	1.49	0.03	4.46	1.13-17.64
	Rural origin	0[b]			
	Illiterate	-0.59	0.44	0.55	0.12-2.52
	Primary	-1.22	0.10	0.29	0.06-1.26
	College	-0.24	0.75	0.78	0.17-3.62
	Secondary	0.03	0.97	1.03	0.15-6.76
	University	0[b]			
	Social coverage: Yes	0.54	0.21	1.73	0.73-4.07
	Social coverage: No	0[b]			
Level of attitudes [a]					
High	Constant	-18.95	0,000		
	Age: 60-69	0.04	0.95	1.04	0.26-4.01
	Age:70-79	0[b]			
	Men	-1.60	0.00	0.20	0.07-0.54
	Women	0[b]			
	Social coverage: Yes	0.72	0.30	2.06	0.51-8.23
	Social coverage: No	0[b]			
Level of behavior [a]					
High	Constant	-2.99	0.009		
	Nuclear family structure	1.91	0.01	6.80	1.38-33.48
	Composed family structure	1.27	0.14	3.58	0.63-20.21
	Extended family structure	0[b]			
	Social coverage: Yes	-0.05	0.911	0.94	0.36-2.48
	Social coverage: No	0[b]			
	Illiterate	-1.78	0.01	0.16	0.03-0.73
	Primary	0.73	0.28	2.08	0.53-8.06
	College	0.75	0.28	2.12	0.52-8.49
	Secondary	0.90	0.34	2.46	0.38-15.72
	University	0[b]			
	Urban origin	-1.65	0.009	0.19	0.05-0.66
	Rural origin	0[b]			

a The reference category is: Poor

b This parameter is set to 0 because it is redundant

Risk Factors Associated With Elderly People's Knowledge

Multivariate analysis revealed a significant association between the place of birth of the elderly and their level of knowledge about antibiotics. Elderly people of urban origin have a good knowledge of antibiotics (OR = 4.46; CI = 1.13-17.64).

Risk Factors Associated With Attitudes

Multivariate analysis revealed a significant negative association between positive attitudes and male gender. Men had inappropriate attitudes compared with women (OR = 0.20; CI = 0.07-0.54).

Risk Factors Associated With Behavior

Multivariate analysis showed a significant association between good behavior in the elderly and family structure (OR = 6.80; CI = 1.38-33.48). Elderly people living in nuclear structures behaved better than those living in compound and complex structures. A significant and negative association between good behavior and low level of education (OR = 0.16; CI = 0.03-0.73), with illiterate elderly people displaying inappropriate behavior compared with those with higher levels of education. A significant and negative association between good behavior and origin (OR = 0.19; CI = 0.05-0.66). Elderly people of urban origin have displaying inappropriate behavior compared with those with rural origin.

Discussion

Overuse of antibiotics is a major factor in the development of resistant organisms (Costelloe et al., 2010). This study highlights a concerning level of antibiotic overuse in older adults, with 62.5% of cases and a prescription rate of 63.3%, significantly higher than reported in other studies (33.6%) (Galland et al., 2015). Frequent antibiotic prescribing for elderly patients is common practice (Yoshikawa, 2002), and research indicates a 30% increase in prescriptions for this population between 2000 and 2010 (Lee et al., 2014). Additionally, more than 46% of antibiotics prescribed for non-bacterial respiratory infections are considered unnecessary (Pulia et al., 2020).

This excessive prescribing fosters the emergence of highly resistant pathogens in older adults, including methicillin-resistant Staphylococcus aureus (MRSA), penicillin-resistant Streptococcus pneumoniae, vancomycin-resistant enterococci, and multidrug-resistant Gram-negative bacilli (Yoshikawa, 2002). Mortality directly attributable to Staphylococcus aureus bacteremia in the elderly is more than twice that of other age groups, with MRSA infections carrying a particularly poor prognosis compared with methicillin-susceptible strains (McClelland et al., 1999). Antimicrobial prescribing in older adults presents unique challenges due to polypharmacy and age-related physiological changes, such as renal insufficiency, which heighten the risk of adverse effects, functional impairment, and drug interactions (Pulia et al., 2020)

Beyond age-related factors, the atypical clinical presentation of infections in older adults often complicates diagnosis. Moreover, many elderly individuals have underlying cognitive impairments that limit their ability to communicate specific symptoms and the progression of their illness, hindering accurate diagnosis (Rasheedy, 2021). This frequently results in inappropriate antibiotic use (Lee et al., 2014). At the same time, older adults are more likely to harbor multidrug-resistant bacteria (McClelland et al., 1999). This increased colonization can be attributed to several factors, including undernutrition, prolonged use of indwelling urinary catheters, excessive catheterization, extended periods of bed rest, and insufficient implementation of preventive measures in care facilities (Beckett et al., 2015).

Other studies indicate that previous prescribing patterns predispose to future antibiotic use (Daneman et al., 2017). Research also suggests that insufficient knowledge about antibiotic resistance among physicians and nurses contributes to inappropriate prescribing practices (Fleming et al., 2015) (Russell & Gallen, 2003).

The results of this study indicate that respiratory infections were the leading cause of antibiotic prescriptions (30%), followed by otorhinolaryngological infections (30%) and urinary tract infections (26.7%). This aligns with other research showing that three types of infections, urinary tract, respiratory, and skin infection, are particularly targeted in geriatric care due to their prevalence and severity (Joly Guillou, 2016). Infections now represent a significant concern in both general and hospital medicine for older adults, reflecting the growing population affected and the specific nature of age-related pathologies (Joly Guillou, 2016). Among people aged 65 and older, infections account for approximately one-third of deaths (Yoshikawa & Norman, 2017). Compared with younger adults, urinary tract infections are 3 to 20 times more prevalent, while respiratory and skin infections are about twice as common. Incidence varies considerably depending on living arrangements, affecting 15–30% of institutionalized individuals versus less than 5% of those living independently at home. The prevalence and severity of infections in older adults are primarily influenced by reduced immunity, which is compounded by age-related factors such as decreased mucous secretion, lower gastric acidity, fragile skin, and comorbidities (Joly Guillou, 2016). Additionally, clinical signs are often atypical, complicating diagnosis (Beckett et al., 2015). Delays in diagnosis are common due to communication difficulties, atypical symptoms such as agitation or dementia, and the absence of fever (Joly Guillou, 2016).

Several strategies have been proposed to reduce antibiotic prescribing. Studies recommend strengthening education on antibiotic therapy, vaccination, and hygiene across all medical faculties, as well as making hospital-based antibiotic advice services mandatory, staffed by infectious disease specialists. The creation of regionally funded advisory centers has also been suggested to provide telephone support for outpatient physicians, alongside a regional infectious disease on-call service for healthcare facility and community-based doctors (Crémieux et al., 2020). Additionally, prescribing support could benefit from advances in artificial intelligence and clinical databases. A meta-analysis demonstrated that AI-based decision support tools significantly improved antibiotic coverage and guideline adherence, reduced overall antibiotic use and resistance, and slightly lowered mortality rates (Curtis et al., 2017).

This study found that amoxicillin/clavulanic acid was the most frequently used antibiotic (22.9%), followed by benzylpenicillin (17.27%). These results are consistent with other studies, which report that amoxicillin/clavulanic acid accounts for 27.5% of prescriptions, followed by amoxicillin alone at 23.6% (Maugat et al., 2022). Use of broad-spectrum antibiotics in older adults has increased by 68% (Lee et al., 2014).

This over-prescription may be explained by the high frequency of respiratory infections, comorbidities, and the diagnostic challenges of infections in the elderly (Ouar-Epelboin et al., 2014).

The study also showed that 67.9% of older adults experienced side effects from antibiotics, with diarrhea being the most common (73.7%). This rate is considerably higher than reported in other studies, where 5% to 49% of patients treated with antibiotics develop diarrhea. Antibiotic-associated diarrhea can range from mild, self-limiting cases to severe, life-threatening forms, with Clostridium difficile responsible for approximately 25% of cases (Eser et al., 2012).

Several studies have demonstrated that probiotics are effective in reducing the incidence and duration of antibiotic-associated diarrhea (Dietrich et al., 2014).

Additionally, self-medication was observed in 36.7% of older adults, with leftover medications (20%) and over-the-counter pharmacies (16.7%) being the main sources. Self-medication is particularly common in older adults due to multiple health issues and polypharmacy (Hussain et al., 2020). Such practices constitute a form of antibiotic overuse and inappropriate use.

Inadequate knowledge of antibiotics, misconceptions, and behaviors that do not align with recommendations all contribute to the irrational use of these drugs among older adults. The study found that 81.8% of elderly participants believed antibiotics are effective against all germs, while a majority thought they are useful for colds and coughs (58.3%), as well as for fever and pain (75%). Limited awareness of potential side effects also promotes misuse: 48% of participants were unaware that antibiotics can trigger allergic reactions, and more than half (52.1%) did not know about other possible adverse effects.

Many respondents exhibited inappropriate attitudes toward antibiotic use. For instance, 60.4% believed it is better to take a smaller dose than prescribed rather than completing the full course, and 43.5% thought it acceptable to stop taking antibiotics once symptoms improved. Furthermore, 44.2% of older adults believed antibiotics should be taken for a cold to accelerate recovery, and more than half (53.5%) expected their doctor to prescribe antibiotics for cold symptoms. Conversely, only 30.4% reported taking antibiotics exactly as prescribed, a figure notably lower than that reported in other studies (Mahmood et al., 2008).

Inappropriate antibiotic-related behaviors were common among older adults. The study found that 53.2% did not complete their prescribed course of treatment, 45.8% kept antibiotics at home for emergencies, and 31.3% shared these medications with sick relatives. Additionally, 39.6% reported using an antibiotic initially prescribed for a previous infection that recurred.

Multivariate analysis revealed several significant associations. Knowledge about antibiotics was linked to the participants' place of birth. Gender influenced attitudes, with men exhibiting less appropriate attitudes than women. Behavior was significantly associated with family structure, educational level, and origin: older adults living in nuclear families demonstrated better behavior than those in extended or complex family structures; illiterate individuals exhibited poorer behavior than those with higher education; and older adults from urban areas behaved less appropriately than those from rural areas.

The implementation of complementary health intervention programs has proven effective, particularly among hospitalized elderly people. A study focusing on rigorous interventions demonstrated reductions in hospital readmission rates, mortality rates in elderly patients, and antibiotic expenditures (Mauro et al., 2021). This was achieved through interventions such as reducing empiric therapy, adjusting the duration of antibiotic treatment, and daily review of microbiological data to ensure appropriate prescribing (Mauro et al., 2021). Another study reported a 26% reduction in antibiotic use and a 54% decrease in cumulative daily antibiotic costs following a comprehensive, multifaceted educational program for urinary and respiratory

infections in older adults. This program included distribution of diagnostic and treatment guidelines, conferences on geriatric infectious diseases, weekly ward visits for suspected infections, and individualized advice on infection diagnosis and antibiotic therapy (Lutters et al., 2004). Awareness campaigns have also been effective in reducing inappropriate antibiotic use (Huttner et al., 2010).

In outpatient care, strategies such as clinician training, auditing, feedback, and the use of clinical decision support systems have been shown to improve prescribing behaviors and promote better antibiotic stewardship (Pulia et al., 2020).

Limitations

This study has several limitations that should be highlighted. Firstly, its cross-sectional design makes it impossible to establish a cause-and-effect relationship between the variables studied. Also, the elderly population studied is likely to have been exposed to recall bias, due to the cognitive disorders common in this age group. Some self-reported data, particularly in relation to antibiotic consumption, may therefore have been inaccurate or incomplete. It is also possible that a selection bias may have occurred, since the study mainly included autonomous elderly people, capable of answering a questionnaire. People who were hospitalized, at home, highly dependent or suffering from severe cognitive deficits were under-represented, which limits the generalizability of the results to the entire elderly population. Despite these limitations, this study provides useful, unpublished data in a little-explored context, and constitutes a valuable basis for future research, particularly of a longitudinal nature.

Conclusion

This study revealed knowledge gaps and misconceptions about the use of antibiotics, as well as inappropriate behaviors leading to irrational use of these medications among older adults. A particularly worrying observation is the over prescription of antibiotics. This phenomenon is reinforced by self-medication, where many elderly people use antibiotics inappropriately without prior medical consultation.

These results highlight the urgent need for educational programs aimed at this population to improve their knowledge on the appropriate use of antibiotics. At the same time, it is crucial to implement prescribing support tools that provide recommendations based on the most current clinical data and treatment protocols. It also appears necessary to establish stricter regulations on the distribution of antibiotics.

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Author’s Contributions

Naima Aoutil: Drafting the article, acquisition ofdata analysis, and interpretation of data.

Mohamed Cherkaoui: Analysis and interpretationof data, reviewing, and final approval.

Mohamed Bouskraoui: Conception and design,reviewing, final approval.

Ethics

Informed oral consent was obtained from all participants.

The study protocol was approved by the institutional research ethics committee of the Marrakech University Hospital (registration number: 034/2020), as well as authorization for data collection from the Regional Health Directorate. from the Marrakech-Safi region.

Competing Interest

The authors declare that they have no competing interests.

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