ORIGINAL ARTICLE
Bali Medical Journal (*Bali MedJ*) 2025, Volume 14, Number 3 : 732-740
P-ISSN.2089-1180, E-ISSN: 2302-2914

Factors associated with self-medication using antibiotics among adults in Saudi Arabia: a cross-sectional study

Anas Ali Alhur[1*], Wejdan Mohammed Alharbi[2], Lama Altwalah[3], Jomanah Alghuwainem[4], Hala Algahtni[5], Sara Shabana[6], Seham Mufarreh[7], Shahad Alshahrani[8], Rawan Fayhan[9], Taif Almutairi[10], Mohammed Althomali[11], Raghad Almathkouri[12], Seham Alsuhaymi[13], Abdullah Alqahtani[14], Mohammed Alharbi[15]

[1]Department of Health Informatics, College of Public Health and Health Informatics, University of Hail, Hail, Saudi Arabia
[2]Department of Clinical Pharmacy, College of Pharmacy, Qassim University, Qassim, Saudi Arabia
[3]Community Pharmacy, United Pharmaceutical Company, Hail, Saudi Arabia
[4]Department of Clinical Pharmacy, College of Pharmacy, King Khalid University, Abha, Saudi Arabia
[5]Department of Clinical Pharmacy (PharmD), College of Pharmacy, Taif University, Taif, Saudi Arabia
[6]Department of Clinical Pharmacy, College of Pharmacy, Umm Al-Qura University, Makkah, Saudi Arabia
[7]Department of Clinical Pharmacy, College of Pharmacy, Al Baha University, Al Baha, Saudi Arabia
[8]Pharmaceutical Care Department, IV Pharmacist, Armed Forces Hospital, Southern Region, Khamis Mushait, Saudi Arabia
[9]Department of Pharmacy, College of Pharmacy, Shaqra University, Shaqra, Saudi Arabia
[10]Physical Therapy Department, Alwatani Alshamil Center, Jeddah, Saudi Arabia
[11]Department of Clinical Pharmacy, College of Pharmacy, Taif University, Taif, Saudi Arabia
[12]Department of Clinical Pharmacy, Ghodaf Medical Company, Taif, Saudi Arabia
[13]Department of Pharmacy, College of Pharmacy, Umm Al-Qura University, Makkah, Saudi Arabia
[14]Emergency Department, King Fahd Military Medical Complex, Dhahran, Saudi Arabia
[15]Department of Clinical Pharmacy, Dr. Sulaiman Al Habib Medical Company, Riyadh, Saudi Arabia

*Corresponding to:
Anas Ali Alhur; Department of Health Informatics, College of Public Health and Health Informatics, University of Hail, Hail, Saudi Arabia;
anas.ali.alhur@gmail.com

Received: 2025-09-12
Accepted: 2025-11-27
Published: 2025-12-28

ABSTRACT

Introduction: Self-medication with antibiotics is a common community practice that contributes to inappropriate use and antimicrobial resistance. Despite regulatory policies in Saudi Arabia restricting non-prescription antibiotic sales, community-level access remains relatively easy, and misuse continues to be reported. This study aimed to estimate the prevalence of antibiotic self-medication among adults in Saudi Arabia and identify associated demographic, behavioral, and perceptual predictors.

Methods: A cross-sectional online survey was conducted among adults aged ≥18 years or older residing in Saudi Arabia. A structured questionnaire assessed sociodemographic characteristics, healthcare access, antibiotic knowledge, perceptions, and self-medication behavior. Descriptive statistics summarized sample characteristics. Bivariate analyses (χ^2, t-test, point-biserial correlation) examined crude associations, and multivariable logistic regression identified independent predictors. Internal reliability was assessed using Cronbach's alpha, and model diagnostics included variance inflation factors (VIF), Hosmer–Lemeshow goodness-of-fit, and Nagelkerke R^2.

Results: A total of 523 respondents participated; 42.1% reported using antibiotics without a prescription in the past 12 months. Individuals who self-medicated had significantly lower antibiotic knowledge scores than non-users (mean 1.74 vs. 2.28; $p < 0.001$). After adjustment, higher knowledge remained protective (aOR = 0.73, 95% CI 0.58–0.91), while perceiving antibiotics as easy to obtain increased the odds nearly twofold (aOR = 1.89, 95% CI 1.20–2.97). Support for stricter regulations was associated with lower odds of self-medication (aOR = 0.58, 95% CI 0.36–0.92). Model diagnostics showed no multicollinearity (all VIF < 2.0) and acceptable model fit (Hosmer–Lemeshow $p = 0.47$). Findings were consistent across gender and education subgroups.

Conclusion: Self-medication with antibiotics remains widespread among adults in Saudi Arabia. Knowledge, accessibility perceptions, and regulatory attitudes are key determinants of misuse. Strengthening public awareness, improving enforcement of prescription-only policies, and supporting community-based antimicrobial stewardship may help reduce inappropriate antibiotic use.

Keywords: antibiotics; antimicrobial resistance; cross-sectional study; Saudi Arabia; self-medication.
Cite This Article: Alhur, A.A., Alharbi, W.M.A., Altwalah, L., Alghuwainem, J., Algahtni, H., Shabana, S., Mufarreh, S., Alshahrani, S., Fayhan, R., Almutairi, T., Althomali, M., Almathkouri, R., Alsuhaymi, S., Alqahtani, A., Alharbi, M. 2025. Factors associated with self-medication using antibiotics among adults in Saudi Arabia: a cross-sectional study. *Bali Medical Journal* 14(3) :732-740. DOI: 10.15562/bmj.v14i3.5795

INTRODUCTION

Antibiotic resistance has emerged as one of the most serious public health issues worldwide, placing increasing pressure on healthcare systems and limiting the effectiveness of widely used treatments. A major contributor to this problem is the inappropriate use of antibiotics, particularly when individuals take them without medical guidance or a prescription.[1–5] Self-medication with antibiotics (SMA) often occurs when people rely on previous personal experiences, recommendations from family members, or leftover medications at home.[4–6] Although this approach may appear convenient, it exposes individuals to risks such as using antibiotics for non-bacterial illnesses, taking incorrect dosages, or discontinuing treatment prematurely, all of which contribute to antimicrobial resistance.[5,6]

International studies consistently report that SMA is a common practice, especially in communities where antibiotics remain readily accessible without stringent regulation.[7–10] In many Middle Eastern countries, including Saudi Arabia, social norms favor self-care, and

misconceptions about antibiotics persist. For example, many individuals mistakenly believe that antibiotics are effective for viral infections such as colds or influenza, a trend documented in regional and local studies.[11,12] These practices continue despite accumulating evidence linking inappropriate antibiotic use to rising resistance patterns.

In Saudi Arabia, SMA remains widespread despite the Ministry of Health policies banning the sale of antibiotics without a prescription.[13,14] Several investigations from different regions of the country, including Riyadh, Dammam, Medina, and Al-Baha, report SMA prevalence ranging between 30% and 60%.[4,10,15] These studies highlight recurring themes: limited public knowledge about appropriate antibiotic use, previous personal success with antibiotics, easy access to antibiotics from community pharmacies, and social influence from friends or relatives.[13,14,16,17] Recent findings by Morsy[18] and Malli et al.[14] indicate that even university and healthcare students engage in SMA, suggesting that increased educational attainment alone may not be sufficient to prevent misuse.

While existing evidence outlines the scope of SMA in Saudi Arabia, many studies have focused on specific groups or basic descriptive patterns. There is limited research that examines how antibiotic knowledge, perceptions of accessibility, and attitudes toward regulation collectively influence SMA among the broader adult population. Previous Saudi studies rarely incorporate multivariable approaches or explore indirect relationships, such as whether the perception of easy access mediates the effect of knowledge on antibiotic use.

With antimicrobial resistance continuing to rise nationally and globally, and with community-level misuse still prevalent in Saudi Arabia despite regulatory actions, further investigation is urgently needed. Understanding how knowledge, access, and regulatory perceptions contribute to SMA can support national strategies aimed at promoting responsible antibiotic use. Therefore, this study aims to assess the prevalence of SMA among adults in Saudi Arabia and to identify the key factors associated with this practice through a combination of descriptive, bivariate, multivariable, and exploratory mediation analyses.

METHODS

Study Design and Setting

This study used a cross-sectional survey design to explore factors associated with self-medication with antibiotics among adults in Saudi Arabia. Data were collected between May and August 2025 through an online questionnaire. The digital format allowed participants from various regions of the Kingdom to access the survey easily and anonymously.

Study Population and Sampling

The target population consisted of Saudi adults aged 18 years and above living in Saudi Arabia during the study period. Individuals employed in clinical, pharmacy, or health-related fields were excluded to avoid bias related to professional antibiotic knowledge. Convenience sampling was used due to the online distribution method, which is commonly applied in community-based public health studies.

To ensure adequate statistical power, the sample size was calculated using Cochran's formula, assuming a 50% expected prevalence of self-medication, a 5% margin of error, and a 95% confidence level. The minimum required sample was 384 participants; however, 523 adults completed the survey, increasing the precision of the estimates.

Development and Validation of the Questionnaire

The questionnaire was developed based on previous research examining antibiotic use, self-medication practices, and antimicrobial resistance in Saudi Arabia and other Middle Eastern countries. It included four main sections, 1) consent statement: confirming voluntary, anonymous participation, 2) sociodemographic information: including age, gender, marital status, education, employment, income, chronic disease status, and health insurance coverage, 3) health behaviors and antibiotic knowledge: covering physician visits, beliefs about antibiotic effectiveness, awareness of resistance development, and attitudes toward using leftover antibiotics, and 4) self-medication practices: including use of antibiotics without a prescription, frequency, reasons, conditions treated, sources, and perceptions of accessibility. The survey was available in Arabic and English. Three experts in public health and pharmacy practice reviewed the questionnaire for clarity and content validity. A pilot test with 25 adults was conducted to assess comprehension and reliability. Minor adjustments were made based on feedback, and pilot responses were excluded from the final analysis.

Ethical Approval and Consent

The study received formal approval from the Ministry of Health Institutional Review Board. Ethical Approval Number: H-2025-1735 (Central IRB – Ministry of Health, Saudi Arabia). Electronic informed consent was obtained from each participant before accessing the questionnaire. Participation was voluntary, anonymous, and no identifying data were collected.

Data Collection Procedures

The survey was distributed through widely used social media platforms, including WhatsApp, Twitter, and Telegram, to reach adults across different age groups and regions. Participants were encouraged to answer independently and honestly. The data collection system prevented multiple submissions from the same device to reduce duplication. Several steps were taken to minimize potential bias throughout the study. Anonymity and neutral question wording helped reduce information and social desirability bias. Recall bias was minimized by limiting antibiotic-use questions to the previous 12 months. Measurement bias was reduced through expert review, translation validation, and pilot testing. During analysis, multicollinearity between predictors was assessed using variance inflation factors.

Statistical Analysis

Data were exported from Google Forms into Microsoft Excel and then analyzed using IBM SPSS Statistics version 29. Descriptive statistics, frequencies, percentages, means, and standard

deviations were calculated for all relevant variables. Bivariate associations were examined using χ^2 tests for categorical variables, Independent-samples t-tests for continuous variables, and point-biserial correlation where appropriate. A multivariable binary logistic regression model was then constructed to identify independent predictors of antibiotic self-medication. Only complete cases were included in the model. Knowledge scores and perception variables were entered as predictors along with relevant demographic covariates. Model diagnostics included the Hosmer–Lemeshow goodness-of-fit test, variance inflation factors to assess collinearity, and Nagelkerke R^2 to evaluate explanatory power. Internal consistency for knowledge and perception items was assessed using Cronbach's alpha.

RESULTS

A total of 523 respondents completed the survey. As shown in Table 1, most participants were aged 25–34 years (38.6%), followed by those aged 18–24 years (24.5%). Females represented 59.5% of the sample. Slightly more than half of the participants were single (54.1%), while 43.2% were married.

Regarding education, 62.0% held a bachelor's degree, and 21.4% had postgraduate qualifications. Over half of respondents were employed (55.6%). Monthly household income was fairly distributed across income categories, with 32.0% earning 10000–14999 SAR and 27.3% earning ≥ 15 000 SAR. Chronic disease was reported by 23.3% of participants, and two-thirds (66.5%) had medical insurance coverage.

As shown in Table 2, the majority of respondents (74.4%) visited a physician at least once in the previous 12 months, whereas 8.8% reported no medical visits. Knowledge of antibiotic use and resistance varied considerably. Only 36.7% correctly recognized that antibiotics are not effective against viral infections such as colds or influenza. Most participants (75.9%) understood that incomplete antibiotic courses can contribute to antimicrobial resistance. Similarly, 59.8% correctly disagreed that using leftover antibiotics is safe if symptoms are similar. Overall, while awareness of antibiotic resistance was relatively high, misconceptions about antibiotic indications remained common.

Of the total respondents, 42.1 % reported that they had used antibiotics without a medical prescription, while 57.9 % indicated that they had never done so (Figure 1). This finding suggests that nearly two out of every five adults in the sample engaged in non-prescribed antibiotic use, highlighting the continued challenge of antibiotic misuse in the community.

Table 1. Sociodemographic and health characteristics of respondents (N = 523)

Variables	Category	n	%
Age (years)	18–24	128	24.5
	25–34	202	38.6
	35–44	102	19.5
	≥ 45	91	17.4
Gender	Male	212	40.5
	Female	311	59.5
Marital status	Single	283	54.1
	Married	226	43.2
	Other	14	2.7
Education level	High school or below	87	16.6
	Bachelor's degree	324	62.0
	Postgraduate degree	112	21.4
Employment status	Employed	291	55.6
	Unemployed/Student/ Homemaker	232	44.4
Monthly household income (SAR)	< 5000	79	15.1
	5000–9999	134	25.6
	10000–14999	167	32.0
	≥ 15000	143	27.3
Chronic disease	Yes	122	23.3
	No	401	76.7
Medical insurance coverage	Yes	348	66.5
	No	175	33.5

Note: Percentages are rounded to one decimal.

Table 2. Healthcare access and antibiotic knowledge (N = 523)

Item	Response	n	%
Q9. Frequency of physician visits in the past 12 months	Once or twice	214	40.9
	3–5 times	175	33.5
	> 5 times	88	16.8
	None	46	8.8
Q10. "Antibiotics are effective against viral infections."	True	331	63.3
	False (correct)	192	36.7
Q11. "Incomplete antibiotic course can lead to resistance."	True (correct)	397	75.9
	False	126	24.1
Q12. "Using leftover antibiotics is safe if symptoms are similar."	True	210	40.2
	False (correct)	313	59.8

Among those who reported self-medication, the frequency of antibiotic use varied during the previous 12 months. As shown in Figure 2, 18.4 % reported self-medicating once, 14.0 % used antibiotics two to three times, and 9.7 % used them more than three times. In contrast, 57.9 % of respondents reported no use of antibiotics without prescription during the same period. Together, these findings indicate that while antibiotic self-medication remains prevalent, repeated or habitual use is comparatively less common.

Detailed patterns of SMA are summarized in Table 3. The most common self-treated conditions were upper-respiratory complaints such as colds, sore throats, and flu (47.4%), followed by gastrointestinal problems (22.8%), urinary tract infections (18.5%), and dental or gum infections (14.9%). Community pharmacies were the principal source of antibiotics (54.3%), followed by family or friends (36.7%) and leftover medicines (25.4%). The leading motivations for self-medication included avoiding consultation costs (47.2%) and saving time (41.7%). Previous successful experiences (31.6%) and advice from relatives or friends (27.1%) also contributed substantially. These findings emphasize that SMA in Saudi Arabia is largely convenience-driven and reinforced by easy antibiotic access through pharmacies and social networks.

Participants' perceptions regarding antibiotic regulation and awareness are presented in Table 4. More than half of respondents (54.3%) either strongly agreed *or* agreed that antibiotics can be obtained too easily in Saudi Arabia, reflecting a broad public perception of weak control over antibiotic sales. About one-quarter (24.7%) remained neutral, while only a small proportion (21.0%) disagreed or strongly disagreed with this statement.

A strong majority (66.3%) supported stricter enforcement of prescription-only antibiotic sales, whereas one-third (33.7%) did not perceive additional regulation as necessary. This indicates general public approval for tighter control and monitoring of antibiotic dispensing practices. Regarding willingness to participate in educational interventions, approximately half of the respondents (50.7%) expressed readiness to attend awareness sessions about appropriate antibiotic use. However,

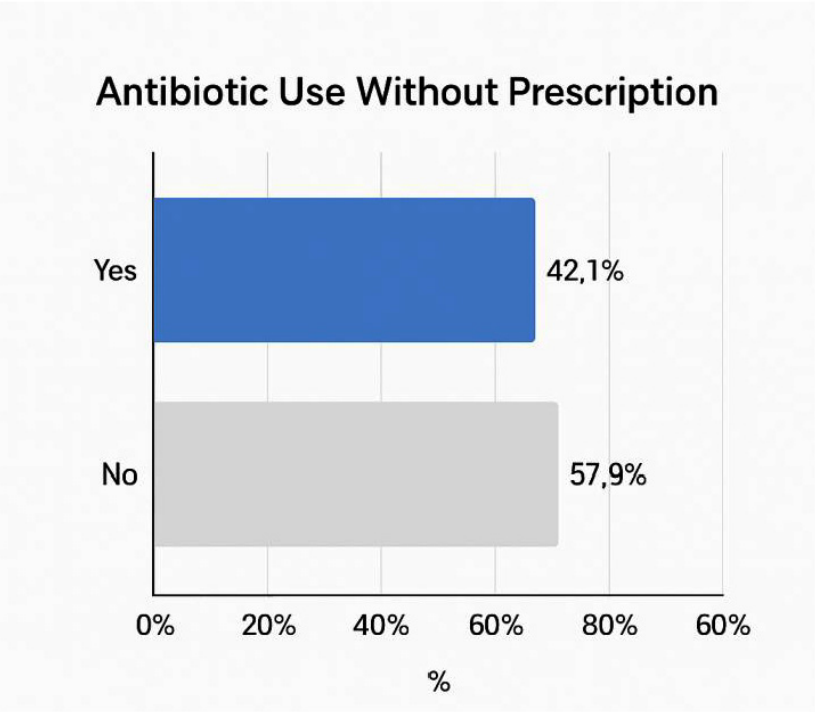

Figure 1. Distribution of self-medication with antibiotics among participants (N = 523).

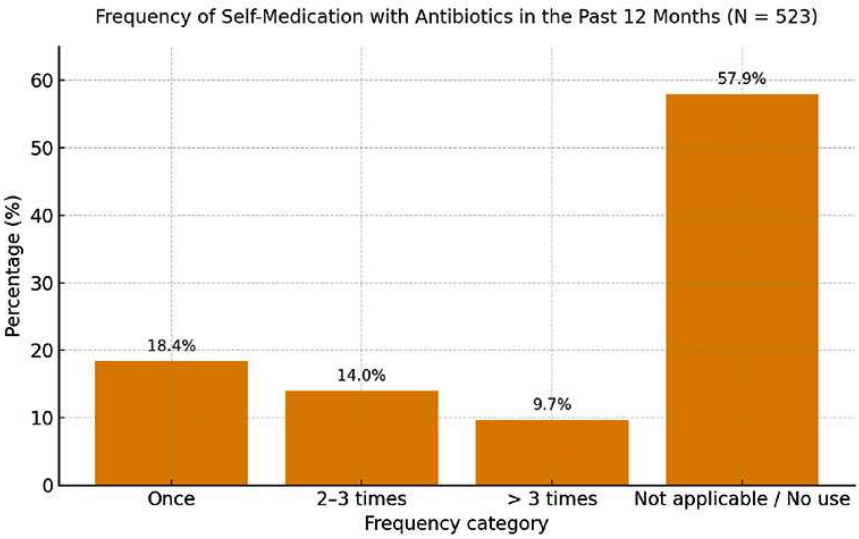

Figure 2. Frequency of self-medication with antibiotics in the past 12 months among participants (N = 523).

nearly the same proportion (49.3%) were unwilling, suggesting mixed levels of motivation for engaging in educational or behavioral change programs.

The relationship between antibiotic knowledge and self-medication behavior is summarized in Table 5. Participants who reported self-medicating with antibiotics had a significantly lower mean knowledge score (1.74 ± 0.91) compared with those who did not self-medicate (2.28 ± 0.63). The mean difference of –0.54 was statistically significant ($p < 0.001$).

Bivariate χ^2 tests were conducted to explore the unadjusted relationships between self-medication with antibiotics and key demographic and attitudinal variables (Table 6). Among the examined

factors, perceived ease of antibiotic access and support for stricter enforcement of prescription-only sales were the only variables showing statistically significant associations with self-medication behavior. Participants who agreed that antibiotics are easily obtainable without a prescription were significantly more likely to self-medicate (χ^2 = 12.53, p = 0.0004). Conversely, those who supported stricter regulatory enforcement were less likely to engage in self-medication (χ^2 = 9.87, p = 0.0016).

The multivariable binary logistic regression model (Table 7) examined independent predictors of self-medication with antibiotics among 423 respondents who provided complete data. The overall model was statistically significant (χ^2 = 31.07, p < 0.001) and demonstrated acceptable fit (Nagelkerke R^2 = 0.055), indicating that the included variables explained approximately 5.5 % of the variance in self-medication behavior. After adjusting for all covariates, three factors were significantly associated with antibiotic self-medication.

Participants with higher antibiotic knowledge scores were significantly less likely to self-medicate (aOR = 0.73, 95%CI 0.58–0.91, p = 0.006), showing that better understanding of appropriate antibiotic use reduced the odds of misuse by approximately 27%. Conversely, those who perceived antibiotics as easy to obtain were almost twice as likely to self-medicate compared with those who disagreed with this statement (aOR = 1.89, 95%CI 1.20–2.97, p = 0.005). In contrast, respondents who supported stricter enforcement of prescription-only sales had significantly lower odds of self-medication (aOR = 0.58, 95%CI 0.36–0.92, p = 0.021).

Employment status, chronic disease, and medical insurance coverage were not statistically significant predictors (p > 0.05). The direction of their associations, however, suggested that employed and insured participants were slightly less likely to self-medicate, whereas those with chronic diseases had higher but non-significant odds of doing so.

Model diagnostics were performed to evaluate the validity and reliability of the logistic regression model (Table 8). Variance Inflation Factor (VIF) values for all predictors were below 2.0, indicating the absence of multicollinearity and confirming that independent variables were statistically distinct.

The Hosmer–Lemeshow goodness-of-fit test showed a non-significant result (χ^2 = 7.63, df = 8, p = 0.47), suggesting that the model fit the data well and that the predicted probabilities corresponded closely to observed outcomes. The Nagelkerke R^2 value of 0.055 indicated that the model explained approximately 5.5% of the variance in self-medication behavior, an expected range for behavioral and knowledge-based public health models. Overall, the model was statistically

Table 3. Patterns of self-medication: conditions, sources, and reasons (N = 523)

Item	Option	n	%
Conditions treated without prescription (Q15)	Cold / flu / sore throat	248	47.4
	Diarrhea/stomach upset	119	22.8
	Urinary tract infection	97	18.5
	Dental or gum infection	78	14.9
Sources of antibiotics (Q16)	Community pharmacy	284	54.3
	Family or friends	192	36.7
	Leftovers from the previous prescription	133	25.4
Reasons for self-medication (Q17)	Avoiding doctor consultation costs	247	47.2
	Convenience/saving time	218	41.7
	Previous successful experience	165	31.6
	Influence from family or friends	142	27.1

Table 4. Perceptions and willingness toward antibiotic regulation and awareness (N = 523)

Item	Response	n	%
Q18. Antibiotics can be obtained too easily in Saudi Arabia	Strongly agree	102	19.5
	Agree	182	34.8
	Neutral	129	24.7
	Disagree	79	15.1
	Strongly disagree	31	5.9
Q19. Stricter enforcement of prescription-only sales is necessary	Yes	347	66.3
	No	176	33.7
Q20. Willing to attend awareness sessions on appropriate antibiotic use	Yes	265	50.7
	No	258	49.3

Table 5. Association between knowledge score and self-medication with antibiotics (N = 423)

Statistic	Value
Mean knowledge score (Self-medicated = Yes)	1.74 ± 0.91
Mean knowledge score (Self-medicated = No)	2.28 ± 0.63
Mean difference	−0.54
p-value	< 0.001
Point-biserial correlation (*r*)	−0.28

significant (Likelihood Ratio $\chi^2 = 31.07$, $p < 0.001$).

An exploratory mediation analysis was conducted to examine whether perceived ease of antibiotic access mediated the relationship between antibiotic knowledge and self-medication behavior (Table 9). The analysis revealed a statistically significant indirect effect of knowledge on self-medication through perceived accessibility (estimate = –0.065, boot SE = 0.021, 95%CI = –0.109 to –0.026). The direct effect of knowledge on self-medication remained significant after accounting for the mediator (estimate = –0.312, boot SE = 0.086, 95%CI = –0.481 to –0.144).

Among males, higher antibiotic knowledge was significantly associated with lower odds of self-medication (aOR = 0.71, 95%CI 0.52–0.96, p = 0.028), while perceiving antibiotics as easy to obtain nearly doubled the odds of self-medication (aOR = 2.01, 95%CI 1.11–3.63, p = 0.021). Supporting stricter enforcement of prescription-only regulations showed a protective but borderline-significant association (aOR = 0.61, 95%CI 0.35–1.07, p = 0.085).

Similarly, among females, knowledge remained a significant protective factor (aOR = 0.76, 95%CI 0.59–0.98, p = 0.034), and perceived ease of antibiotic access remained a strong positive predictor (aOR = 1.82, 95%CI 1.10–3.01, p = 0.019). Support for stricter enforcement also demonstrated a significant protective effect (aOR = 0.58, 95%CI 0.33–1.00, p = 0.048).

Among participants with higher education (bachelor's degree or above), greater antibiotic knowledge was significantly associated with reduced odds of self-medication (aOR = 0.72, 95%CI 0.56–0.93, p = 0.012). Similarly, perceiving antibiotics as easily obtainable significantly increased the likelihood of self-medication (aOR = 1.88, 95%CI 1.14–3.09, p = 0.013). Support for stricter enforcement of prescription-only policies showed a protective effect, reaching the threshold of statistical significance (aOR = 0.60, 95%CI 0.36–1.00, p = 0.048).

Among participants with lower education (high school or below), the same directional relationships were observed

Table 6. Bivariate χ^2 tests for associations with self-medication (N = 423)

Variable	χ^2	p-value
Gender (Male/Female)	1.34	0.247
Education (High vs. Low)	2.16	0.142
Employment status	0.89	0.345
Chronic disease (Yes/No)	2.74	0.098
Medical insurance (Yes/No)	1.67	0.197
Perceived ease of antibiotic access (Agree/Disagree)	12.53	0.0004*
Supports stricter enforcement (Yes/No)	9.87	0.0016*

*p<0.05 is significant

Table 7. Binary logistic regression analysis of factors associated with self-medication using antibiotics (N = 423)

Predictor	aOR	95% CI	p-value
Employment status (Employed = 1)	0.84	0.52 – 1.35	0.472
Chronic disease (Yes = 1)	1.42	0.91 – 2.21	0.118
Medical insurance (Yes = 1)	0.76	0.48 – 1.21	0.257
Knowledge score (0–3)	0.73	0.58 – 0.91	0.006
Perceives antibiotics as easy to obtain (Agree = 1)	1.89	1.20 – 2.97	0.005
Supports stricter enforcement (Yes = 1)	0.58	0.36 – 0.92	0.021

Table 8. Model diagnostics: Multicollinearity and model fit

Diagnostic	Result	Interpretation
Variance Inflation Factors (VIF)	All predictors < 2.0	No multicollinearity detected
Hosmer–Lemeshow χ^2	7.63	8 df, p = 0.47
Nagelkerke R^2	0.055	5.5% variance explained
Model significance	Likelihood Ratio $\chi^2 = 31.07$, $p < 0.001$	Model significant overall

Table 9. Exploratory mediation analysis

Effect	Estimate (log-odds)	Boot SE	95% CI	Interpretation
Indirect effect (a × b)	–0.065	0.021	–0.109 – (–0.026)	Significant mediation
Direct effect (c′)	–0.312	0.086	–0.481 – (–0.144)	Remains significant

Table 10. Stratified logistic regression analyses based on gender

Predictor	Male (n = 180) aOR [95% CI]	p	Female (n = 243) aOR [95% CI]	p
Knowledge score (0–3)	0.71 [0.52–0.96]	0.028	0.76 [0.59–0.98]	0.034
Easy access (Agree = 1)	2.01 [1.11–3.63]	0.021	1.82 [1.10–3.01]	0.019
Enforcement need (Yes = 1)	0.61 [0.35–1.07]	0.085	0.58 [0.33–1.00]	0.048

but did not reach conventional significance levels. Knowledge remained protective (aOR = 0.75, 95%CI 0.49–1.14, p = 0.174), while perceived ease of access remained a risk factor approaching significance (aOR = 1.95, 95%CI 1.00–3.80, $p = 0.051$). Support for stricter enforcement also trended toward a protective association (aOR = 0.62, 95%CI 0.33–1.15, p = 0.128).

Figure 3 presents adjusted odds ratios (aOR) with 95% confidence intervals for three key predictors, knowledge score, perceived ease of antibiotic access, and support for enforcement policies, separately for male and female participants.

Table 11. Stratified logistic regression analyses based on education level

Predictor	High education (n = 306) aOR [95% CI]	*p*	Low education (n = 117) aOR [95% CI]	*p*
Knowledge score (0–3)	0.72 [0.56–0.93]	0.012	0.75 [0.49–1.14]	0.174
Easy access (Agree = 1)	1.88 [1.14–3.09]	0.013	1.95 [1.00–3.80]	0.051
Enforcement need (Yes = 1)	0.60 [0.36–1.00]	0.048	0.62 [0.33–1.15]	0.128

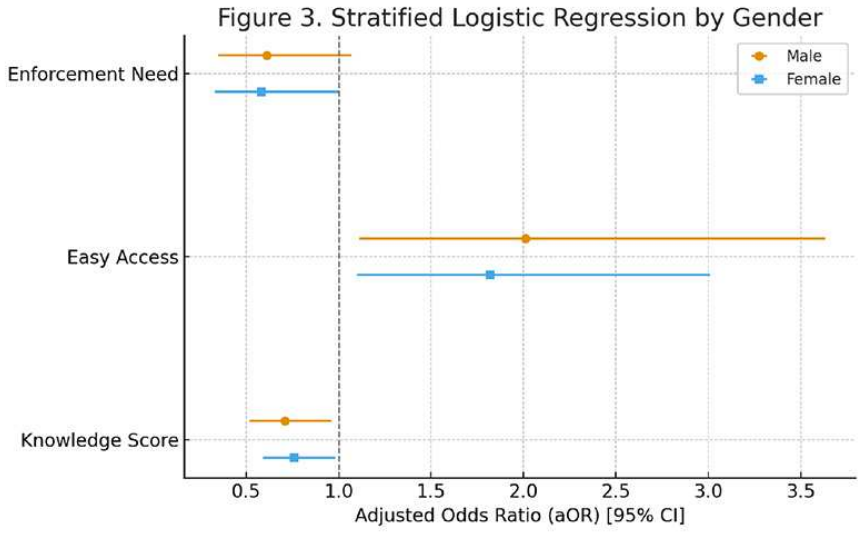

Figure 3. Stratified logistic regression by gender showing adjusted odds ratios (aOR) and 95% confidence intervals for predictors of self-medication with antibiotics.

DISCUSSION

This study examined the prevalence and determinants of self-medication with antibiotics (SMA) among adults in Saudi Arabia. The findings indicate that SMA remains highly prevalent (42.1%), confirming that antibiotic misuse continues to represent a major public health challenge in the Kingdom despite ongoing regulatory and educational efforts. The patterns observed align with national and international literature, highlighting that antibiotic misuse is sustained by inadequate knowledge, easy access, and social normalization of self-treatment.[1–5]

The current prevalence aligns closely with several reports in Riyadh[1,3,5], Dammam[2], Medina[10], and Al-Baha[13] regions, where SMA rates have ranged from 35% to 60%. Similar proportions were documented in systematic reviews of Saudi and global populations[17]. Alghamdi et al.[13] and Alrasheed et al.[3] both noted that SMA continues to occur across all age groups and educational levels, suggesting that misuse is deeply ingrained in community health behavior. Recent evidence by Morsy[18] and Malli et al.[19] further confirms that this behavior persists even among health-educated individuals, including university and healthcare students, underscoring the limited impact of existing awareness campaigns.

Low antibiotic knowledge emerged as a key predictor of SMA in this study, particularly misconceptions about antibiotics' role in viral infections and incomplete treatment courses. These findings are consistent with earlier work by Al-Shibani et al.[1], Albusalih et al[2], and Al-Mehmadi et al.[4], who demonstrated that knowledge gaps and inappropriate storage of leftover antibiotics were common across the Saudi population. Similarly, a recent cross-sectional study by Al-Mehmadi et al.[4] and an updated national review[7] reaffirmed that poor understanding of antibiotic resistance remains widespread. Internationally, comparable associations have been observed in meta-analyses from university settings in the Middle East and North Africa, highlighting the universality of this behavioral determinant.[20]

The observed negative correlation between knowledge score and self-medication supports behavioral models suggesting that cognitive awareness is central to rational antibiotic use. Bu-Khamsin et al.[11] reported that higher antibiotic literacy was protective against misuse among university students. Knowledge shapes attitudes and perceived control, thereby influencing intention and practice. The mediation effect identified in this study strengthens this framework by demonstrating that knowledge indirectly reduces SMA through perceptions of accessibility.[3]

Despite the 2018 Saudi Ministry of Health directive banning non-prescription antibiotic sales, the persistence of SMA reflects ongoing access through community pharmacies. This is consistent with reports by Alghamdi et al.[13] and Hafez et al.[21], which documented that antibiotics remain easily obtainable without prescription in Saudi Arabia and other Arab countries. Alrasheed et al.[22] recently emphasized the role of pharmacists as key stakeholders in controlling antibiotic misuse, showing that targeted pharmacist interventions can significantly reduce inappropriate sales. Likewise, Alghamdi et al.[13] found that individuals obtaining antibiotics directly from pharmacies were less likely to receive appropriate guidance on dosage or duration.

The perception of antibiotics as "too easy to obtain" was strongly associated

with SMA in this study. Similar findings were reported by Allam et al.[10] in Medina and by Nazari et al.[15] in broader Middle Eastern populations. Participants who favored stricter enforcement were less likely to self-medicate, reinforcing that regulatory trust and compliance attitudes influence antibiotic behavior. Globally, Xu et al.[20] and Gebregziabher et al.[16] observed that even in regions with restrictive laws, weak enforcement mechanisms, and cultural acceptance of self-care perpetuate misuse.

Consistent with prior Saudi and regional studies[1–5], demographic factors such as gender, age, and income were not significant predictors once knowledge and attitudes were controlled for. However, stratified analysis revealed slightly stronger protective effects of knowledge among women and those with higher education, echoing findings from Behzadifar et al.[6] These results suggest that antibiotic literacy, rather than sociodemographic status alone, drives behavioral change.

The persistence of SMA despite national interventions highlights the need for integrated and sustainable strategies. Public awareness campaigns must extend beyond information dissemination to include behavioral insights and culturally tailored messaging. As recommended by the WHO's Global Action Plan on Antimicrobial Resistance, education should target both the public and healthcare professionals. Engaging pharmacists as community educators, as proposed by Alrasheed et al.[22], and leveraging digital health tools to monitor and regulate dispensing, in alignment with Vision 2030 priorities, could provide sustainable solutions. Moreover, lessons from international systematic reviews[20] and regional collaborations[3] indicate that successful antimicrobial stewardship depends on multi-sectoral governance, linking public health education, pharmacy regulation, and digital reporting systems.

This study contributes to the growing Saudi literature by applying multivariable, mediation, and stratified analyses to identify both direct and indirect pathways influencing SMA. Nonetheless, its cross-sectional nature precludes causal inference, and reliance on self-reported data may introduce bias. Future longitudinal studies should explore causal pathways and assess the impact of digital awareness interventions and pharmacy-based regulatory audits.

This study provides updated national evidence on SMA in Saudi Arabia and applies multivariable, mediation, and stratified analyses to understand behavioral drivers. The questionnaire underwent expert review and pilot testing, enhancing its validity. However, the cross-sectional design limits causal interpretation, and the convenience sampling limits generalizability. Self-reported data may also introduce recall or desirability bias. Future studies using probability sampling and longitudinal designs are recommended.

CONCLUSION

Self-medication with antibiotics remains a persistent problem in Saudi Arabia, underpinned by low public knowledge, easy access to antibiotics, and limited enforcement of prescription policies. Interventions should integrate educational, regulatory, and behavioral components, supported by pharmacists, clinicians, and digital health initiatives. A sustained national strategy, anchored in evidence from both Saudi and global contexts, is essential to curb antibiotic misuse and preserve antimicrobial efficacy.

AUTHOR CONTRIBUTIONS

- **Conceptualization:** Anas Ali Alhur, Jomanah Alghuwainem
- **Methodology:** Anas Ali Alhur, Hala Algahtni
- **Validation:** Sara Shabana, Nermeen Alqadi
- **Formal Analysis:** Anas Ali Alhur
- **Investigation:** Seham Mufarreh, Lama Musa
- **Data Curation:** Shahad Alshahrani, Rawan Fayhan
- **Writing – Original Draft:** Anas Ali Alhur, Taif Almutairi
- **Writing – Review & Editing:** Mohammed Althomali, Raghad Almathkouri, Seham Alsuhaymi
- **Visualization:** Abdullah Alqahtani
- **Supervision:** Mohammed Alharbi
- **Project Administration:** Mohammed Alharbi

FUNDING

This research received no external funding.

ETHICAL APPROVAL AND INFORMED CONSENT

This study received ethical approval from the Ministry of Health Institutional Review Board, Saudi Arabia (IRB Approval No: H-2025-1735). All participants provided electronic informed consent prior to completing the questionnaire. Participation was voluntary, anonymous, and no identifying information was collected.

CONFLICT OF INTEREST

The authors declare no conflicts of interest related to this study.

REFERENCE

1. Al-Shibani N, Hamed A, Labban N, Al-Kattan R, Al-Otaibi H, Alfadda S. Knowledge, attitude and practice of antibiotic use and misuse among adults in Riyadh, Saudi Arabia. Saudi Med J. 2017;38(10):1038–44.
2. Albusalih F, Naqvi A, Ahmad R, Ahmad N. Prevalence of Self-Medication among Students of Pharmacy and Medicine Colleges of a Public Sector University in Dammam City, Saudi Arabia. Pharmacy. 2017;5(3):51. Available from: http://dx.doi.org/10.3390/pharmacy5030051
3. Alrasheed A, Yagoub U, Alkhashan H, Abdelhay O, Alawwad A, Al Aboud A, et al. Prevalence and Predictors of Self-Medication with Antibiotics in Al Wazarat Health Center, Riyadh City, KSA. Biomed Res Int. 2016;2016.
4. Al-Mehmadi B, Alsubaie S, Al-Morikhi O, Alqahtani F, Almutairi W, Al-Mutairi M, et al. Knowledge and Attitude of self-medication with leftover antibiotics in Saudi Arabia: A cross-sectional study. F1000Res. 2024;12:304. Available from: http://dx.doi.org/10.12688/f1000research.130364.2
5. Alhabs G, Altulaihi BA, Alenezi F, Mandoorah J, Almuslamani R, Alhelal R, et al. The pattern of self-medication practice among adult patients attending primary healthcare centers at NGHA in Riyadh, Saudi Arabia. J Family Med Prim Care. 2025;14(5):1741–50.
6. Behzadifar M, Behzadifar M, Aryankhesal A, Ravaghi H, Baradaran HR, Sajadi HS, et al. Prevalence of self-medication in university students: systematic review and meta-analysis. Eastern Mediterranean Health Journal. 2020;26(7):846–57. Available from: http://dx.doi.org/10.26719/emhj.20.052
7. Alnemri AR, Almaghrabi RH, Alonazi N, Alfrayh AR. Misuse of Antibiotic: A Systemic Review of Saudi Published Studies. Current Pediatric Research. 2023;27(4).

8. Gashaw T, Yadeta TA, Weldegebreal F, Demissie L, Jambo A, Assefa N. The global prevalence of antibiotic self-medication among the adult population: systematic review and meta-analysis. Vol. 14, Systematic Reviews. BioMed Central Ltd; 2025.
9. Hafez H, Rakab MS, Elshehaby A, Gebreel AI, Hany M, BaniAmer M, et al. Pharmacies and use of antibiotics: a cross sectional study in 19 Arab countries. Antimicrob Resist Infect Control. 2024;13(1).
10. Allam AT, Amer SM. Prevalence and factors influencing self-medication in Medina Al-Munawara, Saudi Arabia. Archives of Pharmacy Practice . 2020;11(4):43–54.
11. Bu-Khamsin AY, Fabella E, Al Abdullah AH, Albather MR, Al-Hassan YT, Alramadan HA, et al. Association between Awareness on Antibiotic Resistance and Antibiotic Misuse Among Saudi University Students. Open Public Health J. 2021;14(1):545–54. Available from: http://dx.doi.org/10.2174/1874944502114010545
12. Thekkiniyakath Ali AS, A Alsheraihi AA, Ibrahim Alghamdi SS, Sulaiman Alsuwaylihi R, Sulaiman Alenazi S, Saad Bin Hussain L. A Cross-Sectional Study on Self-Medication Prevalence and Usage Patterns: An Alarming Concept Among the Saudi Population. Cureus. 2023;
13. Alghamdi SMS, Alzahrani RAJ, Alghamdi SSA, Alzahrani RMA, Alghamdi HAA, Alghamdi DAM, et al. Self-Medication Practices Among the General Population in Al-Baha City, Saudi Arabia: A Cross-Sectional Study. Cureus. 2023; Available from: http://dx.doi.org/10.7759/cureus.50810
14. Malli IA, Hubayni RA, Marie AM, Alzahrani DY, Khshwry EI, Aldahhas RA, et al. The prevalence of self-medication and its associated factors among college students: Cross-sectional study from Saudi Arabia. Prev Med Rep. 2023;36.
15. Nazari J, Ghafoury R, Chezani-Sharahi N, Moradzadeh R, Naghshbandi M. Prevalence and determinants of self-medication consumption of antibiotics in adults in Iran: a population based cross-sectional study, 2019–2020. Front Public Health. 2024;12.
16. Gebregziabher NK, Netsereab TB, Franchesko BT, Ghebreamlak HH, Yihdego NM. Prevalence of self-medication practices with antibiotics and associated factors among students in five colleges in Eritrea: a cross-sectional study. Antimicrobial Resistance & Infection Control. 2024;13(1). Available from: http://dx.doi.org/10.1186/s13756-024-01466-6
17. Saif A, Khan TM, Bukhsh A, Saif A, Baig MR, Tahir H. Prevalence and Associated Factors of Self-Medication with Antibiotics Worldwide: A Systematic Review. Arch Pharm Pract. 2024;15(4):25–38. Available from: http://dx.doi.org/10.51847/stw8psfrrv
18. Morsy SAA, Mohammed BA, AlShaeri HK, Zurob FJ, Shaikh LKA, Asiri NAA. Self-medication practice among adults in Kingdom of Saudi Arabia. Archives of Medical Science – Civilization Diseases. 2023;8(1):38–46. Available from: http://dx.doi.org/10.5114/amscd/173135
19. Malli IA, Hubayni RA, Marie AM, Alzahrani DY, Khshwry EI, Aldahhas RA, et al. The prevalence of self-medication and its associated factors among college students: Cross-sectional study from Saudi Arabia. Prev Med Rep. 2023;36:102457. Available from: http://dx.doi.org/10.1016/j.pmedr.2023.102457
20. Xu R, Mu T, Wang G, Shi J, Wang X, Ni X. Self-Medication with Antibiotics among University Students in LMIC: A systematic review and meta-analysis. The Journal of Infection in Developing Countries. 2019;13(08):678–89. Available from: http://dx.doi.org/10.3855/jidc.11359
21. Hafez H, Rakab MS, Elshehaby A, Gebreel AI, Hany M, BaniAmer M, et al. Pharmacies and use of antibiotics: a cross sectional study in 19 Arab countries. Antimicrobial Resistance & Infection Control. 2024;13(1). Available from: http://dx.doi.org/10.1186/s13756-024-01458-6
22. Alrasheed M, Hamdy Mansy W, Naser Al-Arifi M. Community pharmacist intervention in doxycycline self-medication for acne among pregnant women in Saudi Arabia. Saudi Pharmaceutical Journal. 2024;32(5):102027. Available from: http://dx.doi.org/10.1016/j.jsps.2024.102027