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Determinants of Utilizing Non-Prescribed Antibiotics among Patients with Bacterial Diseases Visiting Community Pharmacies in Kigali, Rwanda

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Abstract: **Background: Non-prescribed antibiotic use is a major global public health concern because of its role in driving antimicrobial resistance (AMR), treatment failure, and escalating healthcare costs. This study aimed to determine the prevalence of non-prescribed antibiotic dispensing, assess KAP among community pharmacy staff, and identify associated public health risks in Kigali, Rwanda.**

Methods: A cross-sectional study was conducted among 207 community pharmacy staff across Gasabo, Nyarugenge, and Kicukiro districts. Data were collected using a structured and validated questionnaire. Descriptive statistics, Chi-square tests, and multivariate logistic regression were applied; statistical significance was set at $p < 0.05$.

Results: A total of 38.6% of respondents reported dispensing antibiotics without a prescription. Azithromycin (23.53%), amoxicillin (19.20%), ciprofloxacin (18.89%), and doxycycline (17.34%) were the most frequently dispensed antibiotics without prescriptions. Knowledge was predominantly moderate (87.0%), attitudes were mostly moderate (72.5%), and practice levels were moderate in 78.7% of participants. Practice level was the strongest and only statistically significant predictor of non-prescribed dispensing: staff with moderate practices were 78.5% less likely (aOR = 0.215; 95% CI: 0.092-0.503; $p < 0.001$), and those with high practice levels were 96.3% less likely (aOR = 0.037; 95% CI: 0.004-0.330; $p = 0.003$) to dispense without prescriptions compared to staff with low practice levels.

Conclusions: Non-prescribed antibiotic dispensing remains prevalent in Kigali, driven by patient pressure, economic incentives, and regulatory gaps. Practice adherence is the strongest modifiable determinant. Strengthening regulatory enforcement, continuous professional training, and targeted public health education are urgently recommended.

Keywords: **non-prescribed antibiotics, antibiotic dispensing, community pharmacy, antimicrobial resistance, knowledge, attitudes and practices, Rwanda.**

1. INTRODUCTION

Antimicrobial resistance (AMR) has emerged as one of the foremost threats to global public health, jeopardizing the effectiveness of antibiotics that have underpinned modern medicine for over seven decades. The World Health Organization (WHO) has characterized AMR as a global health crisis, with the most recent data from the Global Antimicrobial Resistance Surveillance System (GLASS) documenting a relentless rise in resistance rates across all world regions.[1] Each year, drug-resistant infections are responsible for an estimated 1.27 million deaths directly attributable to AMR worldwide, with the burden concentrated disproportionately in low- and middle-income countries (LMICs).[2]

A major driver of this crisis is the irrational use of antibiotics, defined by the WHO as the use of antibiotics in ways that are inconsistent with established clinical guidelines, including prescription without proper diagnosis, dispensing for viral infections, use of inappropriate doses or durations, and obtaining antibiotics without a valid medical prescription.[3] Community pharmacies play a central role in antibiotic distribution in many LMICs, often serving as first points of healthcare contact for patients presenting with infectious illness symptoms. Where regulatory oversight is weak, community pharmacies may operate as de facto primary care providers, dispensing antibiotics without clinical assessment or prescription, thereby contributing substantially to inappropriate antibiotic exposure at the population level.[4,5]

The factors driving non-prescribed antibiotic dispensing in community pharmacies are multifaceted and operate across individual, institutional, and systemic levels. Economic considerations are prominent, as profit motives may incentivize pharmacy staff to prioritize antibiotic sales over adherence to prescription requirements.[6] Consumer demand driven by misconceptions about antibiotics, self-diagnosis, and cultural norms around self-medication also plays a significant role.[7] Inadequate training of pharmacy staff, heavy workloads, time constraints, and limited communication with prescribers further compromise the quality of dispensing decisions.[8] Above all, regulatory environments characterized by lax enforcement of prescription-only policies create permissive conditions for non-prescribed antibiotic access.[9]

At the global level, systematic evidence underscores the magnitude of the problem. A systematic review by Batista et al[10] encompassing studies from sub-Saharan Africa found that approximately 69% of non-prescription antibiotic requests resulted in antibiotic supply without a valid prescription. Similar findings have been documented in Asia, where studies from China, India, Saudi Arabia, and Pakistan consistently report high rates of over-the-counter antibiotic sales.[11-13] Studies in Nigeria and Ethiopia further corroborate that non-prescribed dispensing is prevalent in African community pharmacy settings.[14,15]

In Rwanda, antibiotics are legally classified as prescription-only medicines; however, evidence suggests that non-prescribed dispensing is commonplace. National regulations mandate the presentation of a valid prescription for antibiotic purchase, yet enforcement remains inconsistent.[16] Several national reports and advocacy initiatives have addressed rational antibiotic use, but empirical data specifically quantifying the prevalence of non-prescribed dispensing and the determinants thereof in Kigali's community pharmacies remain scarce. A study by Ndayisenga et al[17] documented gaps in antibiotic knowledge and irrational use among patients attending primary healthcare in Rwanda, and a related study on antimalarial dispensing without prescription in Rwandan community pharmacies underscored the broader context of non-prescribed medicine access.[18] However, a targeted assessment of non-prescribed antibiotic dispensing from the pharmacy provider perspective had not previously been conducted for Kigali.

Understanding the behavioral, professional, and systemic determinants of non-prescribed antibiotic dispensing is essential for designing effective antimicrobial stewardship strategies at the community pharmacy level. The Theory of Planned Behavior posits that individual behavior is shaped by attitudes toward the behavior, subjective norms, and perceived behavioral control,[19] while the Socio-Ecological Model highlights the interplay of individual, interpersonal, community, and societal factors in health behavior.[20] Applied to antibiotic dispensing, these frameworks suggest that improving dispensing practice requires not only addressing knowledge gaps but also transforming professional norms, reinforcing regulatory controls, and modifying the economic and structural conditions that incentivize non-prescribed dispensing.

This study therefore aimed to determine the prevalence of non-prescribed antibiotic dispensing in community pharmacies, assess the KAP of community pharmacy staff regarding antibiotic use without prescriptions; and identify the perceived public health risks associated with inappropriate antibiotic use.

2. METHODS

Study Design and Setting

A cross-sectional study design was employed, a widely used observational approach that captures current practices and associated factors at a single point in time, making it appropriate for this type of prevalence and determinants assessment.[21] The study was conducted in Kigali City, the capital of Rwanda and its most populous urban center, comprising three administrative districts: Gasabo, Kicukiro, and Nyarugenge. According to the National Institute of Statistics of Rwanda, Kigali has a population of approximately 1,208,000 residents, and a total of 429 registered community pharmacies operate across its three districts.

Study Population and Sampling

The target population comprised all individuals actively involved in antibiotic dispensing at community pharmacies in Kigali, including licensed pharmacists, pharmacy assistants, and nurses. The sample size was calculated using the Taro Yamane formula for finite populations: $n = N / [1 + N(e)^2]$, where N = 429 pharmacies and e = 0.05 (5% margin of error), yielding a required sample of 207 pharmacies. Pharmacies were allocated equally across the three districts (69 per district). Systematic random sampling was applied, with a sampling interval of K = 2, selecting every second pharmacy from an ordered sampling frame of all registered pharmacies in each district.

Data Collection Instrument

Data were collected using a structured, self-administered questionnaire covering five domains: (1) demographic and pharmacy characteristics; (2) antibiotic dispensing practices; (3) KAP regarding antibiotic use and resistance; (4) factors influencing dispensing decisions; and (5) perceptions of public health risks associated with non-prescribed antibiotic use. The questionnaire was validated through expert content review and tested for reliability using Cronbach's alpha coefficient, test-retest reliability, and inter-rater reliability.[22] Factor analysis was conducted to assess construct validity. Data collection was performed by trained research assistants. All participants provided written informed consent before participation.

Data Analysis

Data were analyzed using Microsoft Excel and SPSS Version 27.0. Descriptive statistics (frequencies, percentages, means, standard deviations) summarized respondent characteristics and the prevalence of non-prescribed dispensing. KAP scores were categorized into low, moderate, and high levels using predefined cut-off ranges. Chi-square tests examined associations between KAP levels and non-prescribed dispensing behavior. Multivariate logistic regression identified independent predictors of non-prescribed dispensing while adjusting for potential confounders.

Ethical Considerations

Ethical clearance was obtained from Mount Kenya University. Written informed consent was obtained from all participants prior to data collection. Participation was entirely voluntary, and respondents were free to withdraw at any time without consequence. Confidentiality and anonymity were maintained throughout by use of coding systems rather than identifying information. Data storage and processing complied with Rwanda's Data Protection Law (No. 058/2021 of 13/10/2021).

3. RESULTS

Characteristics of Pharmacies and Respondents

A total of 207 community pharmacy staff participated in the study. The sample was equally distributed across the three districts of Kigali, with 69 respondents (33.3%) from each of Gasabo, Nyarugenge, and Kicukiro. By professional position, nurses constituted the largest group (38.6%), followed by pharmacists (37.7%) and pharmacy assistants (23.7%). The majority of respondents (42.1%) had one to five years of professional experience, 27.0% had six to ten years, 20.3% had more than ten years, and 10.6% had less than one year of experience (Table 1).

Table 1. Characteristics of pharmacies and respondents (N = 207)

Characteristic	Category	Frequency (n)	Percentage (%)
District	Gasabo	69	33.3
	Nyarugenge	69	33.3
	Kicukiro	69	33.3
Respondent Position	Pharmacists	78	37.7
	Assistants	49	23.7
	Nurses	80	38.6
Years of Operation	<1 year	22	10.6
	1-5 years	87	42.1
	6-10 years	56	27.0
	>10 years	42	20.3

Prevalence of Non-Prescribed Antibiotic Dispensing

Of the 207 respondents, 80 (38.6%) reported dispensing antibiotics without a valid prescription, while 127 (61.4%) dispensed antibiotics only upon presentation of a prescription (Table 2). Azithromycin was the most commonly dispensed antibiotic without a prescription (23.53%), followed by amoxicillin (19.20%), ciprofloxacin (18.89%), and doxycycline (17.34%) (Table 3). The most frequently cited factors driving non-prescribed dispensing were patient demand (19.90%), lack of awareness (17.23%), time constraints (16.99%), economic incentives (16.50%), and lack of regulatory enforcement (13.35%) (Table 4). The most common presenting symptoms prompting antibiotic requests were diarrhea (18.79%), unexplained fever (17.88%), painful urination (17.27%), nausea and vomiting (16.97%), runny nose (14.85%), and cough with fever (14.24%) (Table 5).

Table 2. Prevalence of non-prescribed antibiotic dispensing (N = 207)

Prescription Requirement	Frequency (n)	Percentage (%)
Dispensing without prescription	80	38.6
Dispensing with prescription	127	61.4

Table 3. Most frequently dispensed antibiotics without prescriptions (N = 80)

Antibiotic	Frequency (n)	Percentage (%)
Azithromycin	76	23.53
Amoxicillin	62	19.20
Ciprofloxacin	61	18.89
Doxycycline	56	17.34
Other	68	21.05

Table 4. Factors influencing non-prescribed antibiotic dispensing (N = 207)

Factor	Frequency (n)	Percentage (%)
Patient demand	82	19.90
Lack of awareness	71	17.23
Time constraints	70	16.99
Economic incentives	68	16.50
Lack of regulation enforcement	55	13.35
Other	66	16.02

Table 5. Symptoms frequently associated with antibiotic requests (N = 207)

Symptom	Frequency (n)	Percentage (%)
Diarrhea	62	18.79
Unexplained fever	59	17.88
Painful urination	57	17.27
Nausea and vomiting	56	16.97
Runny nose	49	14.85
Cough with fever	47	14.24

Knowledge, Attitudes, and Practices of Community Pharmacy Staff

Knowledge

The majority of respondents (87.0%) demonstrated moderate knowledge levels, while 9.7% had low knowledge and only 3.3% displayed high knowledge (Table 6). Although 63.3% reported familiarity with antibiotic resistance, familiarity with national dispensing guidelines was limited. Only 17.9% correctly identified completing a full antibiotic course as the recommended treatment duration, and fewer than one-quarter of respondents demonstrated a thorough understanding of antimicrobial stewardship principles. Only 20.8% of staff reported always checking patient symptoms before dispensing antibiotics.

Table 6. Level of knowledge of community pharmacy staff regarding antibiotic use (N = 207)

Knowledge Level	Score Range	Frequency (n)	Percent (%)
Low knowledge	0-10	20	9.7
Moderate knowledge	11-20	180	87.0
High knowledge	21-31	7	3.3
Total	0-31	207	100.0

Attitudes

Most respondents (72.5%) demonstrated moderate attitudes, while 26.1% exhibited low attitudes and only 1.4% demonstrated high attitudes (Table 7). Opinions regarding the acceptability of dispensing without a prescription were divided: 34.8% disagreed that it was acceptable, 32.9% were unsure, and 32.4% considered it acceptable under certain circumstances. Only 39.6% of respondents expressed a clear desire for additional professional training.

Table 7. Level of attitudes of community pharmacy staff regarding antibiotic use (N = 207)

Attitude Level	Score Range	Frequency (n)	Percent (%)
Low attitude	0-4	54	26.1
Moderate attitude	5-9	150	72.5
High attitude	>9	3	1.4
Total		207	100.0

Practices

The majority of respondents (78.7%) demonstrated moderate practice levels, while 15.5% showed low practices and only 5.8% demonstrated high practice levels (Table 8). Only 21.7% of respondents reported always providing counseling when dispensing antibiotics, while 19.8% reported never doing so. Training participation was infrequent: 27.5% had never received training, and 25.6% received it only rarely.

Table 8. Level of practices of community pharmacy staff regarding antibiotic dispensing (N = 207)

Practice Level	Score Range	Frequency (n)	Percent (%)
Low practice	0-8	32	15.5
Moderate practice	9-16	163	78.7
High practice	>16	12	5.8
Total		207	100.0

Association Between KAP and Non-Prescribed Antibiotic Dispensing

Chi-square analysis revealed a statistically significant association between practice level and non-prescribed antibiotic dispensing ($x^2 = 20.817$, $p < 0.001$, Cramer's V = 0.317), indicating a moderate and meaningful relationship. In contrast, neither knowledge ($x^2 = 5.377$, $p = 0.068$) nor attitude ($x^2 = 1.812$, $p = 0.404$) was significantly associated with non-prescribed dispensing (Table 9).

Table 9. Association between KAP levels and non-prescribed antibiotic dispensing

Variable	Category	Without Prescription (n)	With Prescription (n)	Chi-Square (x2)	p-value	Cramer's V
Knowledge	Low	4	16	5.377	0.068	0.161
	Moderate	75	105			
	High	1	6			
Attitude	Low	25	29	1.812	0.404	0.094
	Moderate	54	96			
	High	1	2			
Practice	Low	23	9	20.817	0.000**	0.317
	Moderate	56	107			
	High	1	11			

*** Significant at p < 0.001*

Multivariate logistic regression confirmed that practice level was the strongest and only statistically significant independent predictor of non-prescribed antibiotic dispensing. Compared to staff with low practice levels, those with moderate practice levels were 78.5% less likely to dispense antibiotics without a prescription (aOR = 0.215; 95% CI: 0.092-0.503; p < 0.001), and staff with high practice levels were 96.3% less likely (aOR = 0.037; 95% CI: 0.004-0.330; p = 0.003). Knowledge and attitude levels were not statistically significant predictors in the adjusted model (Table 10).

Table 10. Logistic regression analysis of KAP and non-prescribed antibiotic dispensing

Variable	Category	Without Prescription (n)	With Prescription (n)	Sig.	aOR	95% CI
Knowledge	Low	4	16	Ref		
	Moderate	75	105	0.134	2.445	0.760-7.864
	High	1	6	0.559	0.476	0.039-5.752
Attitude	Low	25	29	Ref		
	Moderate	54	96	0.368	0.735	0.376-1.437
	High	1	2			
Practice	Low	23	9	Ref		
	Moderate	56	107	0.000**	0.215	0.092-0.503
	High	1	11	0.003*	0.037	0.004-0.330

*aOR = Adjusted Odds Ratio; CI = Confidence Interval; * Significant at p < 0.05; ** Significant at p < 0.001*

Perceived Public Health Risks

Community pharmacy staff identified multiple public health risks associated with non-prescribed antibiotic use. The most frequently cited perceived risk was the occurrence of side effects or adverse drug reactions (28.1%), followed by reduced treatment effectiveness (24.4%), development of antibiotic resistance (24.4%), and increased healthcare costs (23.1%) (Table 11).

Table 11. Perceived public health risks associated with inappropriate antibiotic use

Perceived Risk	Frequency (n)	Percentage (%)
Side effects	90	28.1
Reduced effectiveness	78	24.4
Resistance	78	24.4
Increased cost	74	23.1

4. DISCUSSION

This study provides context-specific evidence on the prevalence and determinants of non-prescribed antibiotic dispensing in community pharmacies in Kigali. A prevalence of 38.6% is notable and, while lower than the pooled 69% reported by Batista et al[10] across sub-Saharan African drug retail outlets and the high rates documented by Sono et al[23] across the region, it confirms that non-prescribed dispensing remains a substantial public health problem in Rwanda's regulated urban pharmacy setting. The gap between this figure and the regional average may reflect a degree of regulatory awareness in Kigali pharmacies, though social desirability bias in self-reported data cannot be excluded.

Azithromycin, amoxicillin, ciprofloxacin, and doxycycline were the most frequently dispensed antibiotics without prescriptions, a pattern consistent with findings from India,[13] Greece, and Kenya,[24,25] where amoxicillin and broad-spectrum agents dominate self-medication. The unsupervised use of these drugs is particularly concerning because resistance to first-line antibiotics in sub-Saharan Africa is already critical; resistance rates of 45% to 97% have been documented for ampicillin, chloramphenicol, co-trimoxazole, and tetracycline in isolates from patients with shigellosis and related bacterial infections in Tanzania and Kenya,[26] demonstrating the direct clinical consequences of irrational antibiotic access at the pharmacy level.

Patient demand, lack of awareness, time constraints, and economic incentives were the principal drivers of non-prescribed dispensing, reflecting the multi-level interplay of client pressure, provider knowledge gaps, and structural economic incentives documented in Pakistan[12] and Ethiopia.[15] The near-even split in perceptions of regulatory effectiveness highlights that enforcement is neither consistent nor convincing to those it is meant to govern, a finding with direct implications for pharmacy regulatory strategy.

Knowledge and attitude levels were predominantly moderate but were not statistically significant predictors of dispensing behavior in either bivariate or multivariate analyses, consistent with the Ethiopian[15] and Pakistani[12] literature showing that awareness of antibiotic resistance risks does not reliably translate into compliant dispensing when structural incentives and patient pressure operate in the opposite direction. The ambivalence on whether skipping prescriptions is acceptable further illustrates the absence of a consolidated professional norm. In contrast, practice level was the strongest and only significant independent predictor: staff with moderate and high practice adherence were 78.5% and 96.3% less likely, respectively, to dispense without prescriptions. The high proportions who had never attended training or attended only rarely represent the most actionable gap identified by this study, reinforced by evidence from Zawahir et al[29] that structured pharmacist-led training substantially improves dispensing quality. Mudenda et al[27] similarly found in Zambia that professional development, rather than attitudinal change alone, drove improvements in dispensing conduct.

Community pharmacy staff recognized the key risks of non-prescribed antibiotic use, including side effects, reduced effectiveness, AMR, and increased costs, yet this awareness did not prevent inappropriate dispensing, a risk perception-behavior gap reported consistently in Ethiopia[15] and Pakistan.[12] The symptom profile driving antibiotic requests, predominantly diarrhea, unexplained fever, painful urination, nausea and vomiting, runny nose, and cough with fever, largely corresponds to self-limiting or viral conditions for which antibiotics confer no benefit, as documented in Mozambique by Mavale et al[30] and across sub-Saharan Africa.[10] This reinforces that patient education must accompany regulatory and provider-level interventions if non-prescribed dispensing is to be reduced.

Limitations of the Study

Several limitations of this study should be acknowledged. First, the cross-sectional design limits causal inference. Second, data on dispensing practices were self-reported, which introduces the potential for social desirability bias, possibly resulting in underreporting of non-prescribed dispensing. Third, the study was restricted to community pharmacies in Kigali and may not be generalizable to rural Rwandan settings, where access to prescribers and regulatory oversight may differ substantially. Future research employing longitudinal designs, simulated client methodologies, or direct observation of dispensing practices would provide more objective evidence. Studies exploring patient-side determinants of antibiotic self-medication and evaluations of the effectiveness of targeted antimicrobial stewardship interventions at the community pharmacy level in Rwanda are also warranted.

5. CONCLUSIONS

While the majority of pharmacy staff demonstrated moderate knowledge and attitudes regarding appropriate antibiotic use, these factors alone were not sufficient to determine dispensing behavior. Practice level emerged as the strongest and only statistically significant independent predictor, with staff who consistently adhered to recommended procedures being significantly less likely to engage in non-prescribed dispensing. Key drivers included patient demand, economic incentives,

inadequate training, and weak regulatory enforcement. These findings underscore the need for multi-level interventions that go beyond awareness campaigns to include mandatory continuous professional training, rigorous regulatory enforcement, and sustained public health education campaigns targeting both pharmacy staff and the communities they serve.

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from Mount Kenya University. All participants provided written informed consent prior to data collection. The study was conducted in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

ITP conceptualised and designed the study and collected and analysed the data. ET drafted the manuscript. AKA supervised the study. JDD and ES critically reviewed the manuscript. All authors read and approved the final manuscript.

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