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Prevalence and Determinants of Internet-Driven Antibiotic Self-Medication Among Patients in Private Clinics in Urban Uganda: A Cross-Sectional Study

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Abstract

The increasing use of the internet for self-directed antibiotic consumption has become a growing public health concern, as it may accelerate antimicrobial resistance and lead to avoidable health complications. This study therefore examines the extent of internet-facilitated antibiotic self-medication and the factors associated with it among patients attending private clinics in Kawempe Division, Kampala Capital City, Uganda. An analytical cross-sectional design was used in this study. Participants were recruited from private clinics located in randomly selected zones of Kawempe Division. Data were collected through structured, interviewer-administered questionnaires. Analysis was performed using STATA version 12. Logistic regression was applied, and variables with $P \leq 0.05$ were considered statistically significant predictors of internet-enabled antibiotic self-medication. Of the 313 respondents, 246 (79%) reported having ever used internet sources to guide antibiotic self-medication. Increased likelihood of internet-enabled antibiotic self-medication was associated with being male; being unmarried; having knowledge about antibiotics; believing that the internet is an appropriate source for antibiotic self-medication; living approximately 5 km from the nearest health facility; and residing close to an unregulated drug shop or pharmacy dispensing antibiotics without prescription. Conversely, a reduced likelihood was observed among participants from households with more than three members; those who reported routine antibiotic self-medication within the household; those who disagreed that illness can resolve without a physician's prescription; and those whose healthcare providers failed to explain prescribed antibiotic regimens adequately. The study demonstrates that internet-enabled antibiotic self-medication is widely practiced and is shaped by a combination of individual, household, and health system-related determinants. These findings highlight the importance of strict enforcement of national regulations on antibiotic dispensing. In addition, strengthened public health education at the community level is essential to reduce inappropriate antibiotic use.

Keywords: Internet-enabled, Antibiotics, Antibiotic resistance, Self-medication, Uganda

Introduction

Self-medication involves acquiring pharmaceuticals without a professional prescription, reusing expired prescriptions, sharing medications within social or familial networks, or utilizing leftover household medical supplies to manage self-diagnosed illnesses or symptoms [1]. As global digitization has accelerated, approximately 65% of the Ugandan population has gained internet access, with 88% of these users residing within the central region [2]. Furthermore, internet penetration is projected to expand substantially due to the escalating demand for information and communication technology (ICT), which facilitates information acquisition and remote labor practices intensified by the novel Coronavirus Disease-2019 (COVID-19) pandemic

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[3-6]. Conversely, this digital expansion has functioned as a critical driver for inappropriate antibiotic self-medication and has amplified adverse outcomes. These negative repercussions include inappropriate therapeutic choices, drug misuse, the masking of severe underlying pathologies, heightened risks of substance abuse and toxicity, accelerated antimicrobial resistance, and avoidable mortality [7-9]. Globally, self-medication is a widespread practice, with estimates ranging from 32.5% to 81.5% of the population engaging in it [10, 11]. Within Uganda, prevalence rates have been documented at 22.2% among patients at Mulago National Referral Hospital [9] and 63.5% among undergraduate students at Mbarara University of Science and Technology [12].

The specific practice of internet-enabled antibiotic self-medication involves using online platforms to obtain healthcare information, which is then used to acquire antibiotics without a licensed clinician's prescription. This phenomenon complicates medical care by increasing the incidence of severe adverse clinical events and elevating the risks of antibiotic resistance. Consequently, this trend threatens the efficacy of treatments for routine infectious diseases, limits access to economically viable healthcare, and deteriorates patient outcomes [7, 13-15]. Though highly complex, internet-enabled antibiotic self-medication (over-the-counter, OTC) persists amid escalating healthcare expenses, restricted health insurance coverage, and a deficiency in regulatory enforcement controlling pharmaceutical accessibility; this situation carries severe systemic implications [16-18]. Within Uganda, the primary distribution channels for medications, including antibiotics, comprise both public and private entities operating across health facilities, licensed pharmacies, and drug retail shops. The pharmaceutical sector is disproportionately clustered in urban municipalities. The Ministry of Health (MoH) and the Uganda National Drug Authority are tasked with quality assurance and hold the mandate to monitor national pharmaceutical utilization. Despite these regulatory and oversight roles, antibiotics and other prescription-only therapies remain broadly accessible without medical authorization, and no functional frameworks currently exist to restrict antibiotic use or conduct routine surveillance of antimicrobial resistance. This unmonitored landscape, combined with recent expansions in online access to medical information, has created an environment where antibiotic self-medication can rapidly proliferate [9].

A variety of determinants have been associated with internet-enabled antibiotic self-medication. Demographic variables such as participant age, gender, household size, formal education level, and monthly income have been well documented [14, 19-22]. Additional factors influencing this digital self-medication behavior include specific knowledge regarding antibiotics and the associated hazards of misuse, geographical accessibility, financial affordability, structural conditions at health facilities, alternative illicit suppliers (such as marketplace vendors), and residential location [14, 16, 19-26]. Prior literature has also highlighted geographic distance to formal medical centers, the professional attitudes of healthcare workers alongside corresponding patient perceptions, financing mechanisms for medical consultations or prescriptions, internalized stigma, psychological reluctance to seek formal care, an unwillingness to report high-risk behaviors to clinical staff, and organizational quality regarding tracking systems and regulatory frameworks for prescribed antimicrobials [21, 27-29].

According to data from the Uganda National Drug Authority (NDA), approximately 8 out of every 10 individuals engage in self-medication or purchase over-the-counter pharmaceuticals [30]. Simultaneously, the NDA governs the development and implementation of the National Drug Policy (NDP), which aims to promote rational pharmaceutical use and regulate domestic manufacturing of essential therapeutics [30]. Consequently, Class A and Class B pharmaceuticals, which include controlled substances such as antibiotics, require a valid prescription before dispensing. Nevertheless, the novel COVID-19 pandemic has worsened this issue, as millions of individuals intensively searched for digital health data, leading to a marked rise in the empirical administration of antibiotics, including azithromycin, for the prevention and management of COVID-19 [31-33]. As the COVID-19 pandemic continued to unfold and amid persistent ambiguities about emerging viral waves and novel variants, internet-enabled antibiotic self-medication poses a severe public health hazard that demands structured, multi-sectoral interventions. The objective of this investigation is to evaluate the utilization of internet-enabled antibiotic self-medication and analyze its underlying determinants among patients seeking care at private outpatient clinics within the Kawempe division of Kampala Capital City, Uganda.

Materials and Methods

Study design, duration, and area

This investigation utilized an analytical cross-sectional study design incorporating quantitative methodologies. The fieldwork was executed between March and September 2022. The study area was located in Kawempe Division, one of Kampala's five administrative divisions. This division shares its western, northern, and eastern boundaries with Wakiso District, its southeastern boundary with Nakawa Division, its southern boundary with Kampala Central Division, and its southwestern boundary with Lubaga Division. Geographically, the division is positioned at 00 23N, 32 33E (specifically Longitude: 32.5574; Latitude: 0.3792). It encompasses the distinct municipal zones of Kanyanya, Kazo, Mpererwe, Kisaasi, Kikaya, Kyebando, Bwaise, Komamboga, Mulago, Makerere, and Wandegeya. Administratively, the division comprises 19 parishes, with informal settlements in 18 of them. Kawempe Division accommodates a resident population of 338,665 individuals, with females comprising 52% of the demographic; its 94,202 households account for 25% of the aggregate capital city population and are predominantly characterized by informal slum settlements [34].

Study population and sample size estimation

The target population for this investigation comprised patients seeking care at private healthcare facilities within the Kawempe Division of the Kampala district. For data collection, eligible patients were defined as individuals who had experienced any medical condition in the preceding 12 months. To determine the optimal sample size required to achieve the targeted precision and confidence level, based on the estimated prevalence of the trait in the population, Cochran's formula was applied [35]. The calculations were informed by a previously reported 22.2% prevalence of self-medication at Kiruddu National Referral Hospital [9]. Incorporating a Z-score of 1.96 alongside an allowable margin of error of 5%, the initial sample size was estimated at 264 participants. Following an adjustment to account for an anticipated 20% non-response rate, the final target cohort was established at 315 individuals.

Sampling procedure

A systematic sampling approach was implemented to select participants. The initial stage of selection involved the Kawempe division, which contains 12 distinct zones. Because the number of private medical centers across these zones was unverified, 60% of the zones were randomly selected. This strategy was based on the methodological principle that a sample comprising more than 10% of the cluster units is sufficiently representative of the wider population [36], leading to the selection of 7 zones. Within these designated zones, private clinics, drug shops, and pharmacies were randomly selected.

Selection criteria

Inclusion in this study was restricted to patients who sought medical attention at private clinics, resided within Kawempe Division, were at least 18 years of age, and were capable of providing written informed consent. Conversely, individuals exhibiting signs of cognitive impairment were excluded from participation.

Data collection tool, quality control, and collection process

Data were gathered using a structured questionnaire (Appendix I) modeled after existing validated literature [8-10, 12-14, 16, 17, 21-27]. The survey instrument included a combination of open- and closed-ended items to evaluate socio-demographic variables, antibiotic consumption patterns over the prior year, usage frequency, information sources, and specific drug details. Three trained research assistants supported the research team by administering the questionnaires and ensuring data completeness and accuracy. To facilitate rapid error rectification, data consistency checks were conducted concurrently while investigators were in the field. Face and content validity were established through a formal review process involving three academic experts specializing in social and behavioral research, whose feedback was systematically integrated into the final draft. The instrument demonstrated acceptable validity, yielding an overall content validity index exceeding 0.8 [37]. To evaluate internal reliability, the questionnaire was pilot-tested among 20 patients in the Nakawa Division of Kampala, allowing any identified structural gaps to be resolved before deployment. The finalized and validated questionnaires were used to collect data from the target patient population at private clinics in Kawempe Division. Valid participant responses were systematically coded and converted into numerical formats for analysis.

Data analysis

The collected data were processed using Stata version 12. The analytical framework encompassed descriptive frequency distributions and bivariate and multivariate regularized modeling. Cross-tabulations were deployed to analyze relationships between paired categorical variables, specifically evaluating the practice of internet-enabled antibiotic self-medication (the dependent variable) against various individual, household, and health system determinants [the independent variable(s)]. The probability values (P) derived from these cross-tabulations were computed using logistic regression models, which yielded crude odds ratios and corresponding 95% confidence intervals, evaluated at a significance threshold of 0.05. Variables demonstrating statistical significance ($P \leq 0.05$) during bivariate screening were included in a binary multiple regression model to adjust for potential confounding factors. Variables that maintained significance at $P \leq 0.05$ in this multivariate framework were identified as independent predictors. The magnitude of these associations was reported as adjusted odds ratios (aORs), with 95% confidence intervals as the measure of statistical precision.

Ethical considerations

The Ethics Review Committee of Uganda Christian University granted ethical clearance for this study. Additionally, administrative approvals were obtained from the Kampala City Council Authority (KCCA) and the management of the participating private clinics. Patient enrollment was completely voluntary, and all participants provided written informed consent. The research design prioritized respondent anonymity, confidentiality, and data privacy. Completed questionnaires were secured under lock and key, with access restricted exclusively to the primary research team. All research procedures were executed in strict accordance with the ethical tenets of the Declaration of Helsinki.

Results and Discussion

Among the cohort of 313 participants, 211 (67.4%) were male. The mean age of the sample was 25.0 years (range: 19–53). Additionally, 217 participants (69.3%) lacked medical insurance coverage, and 134 individuals (43.09%) were engaged in informal employment.

Regarding behavioral patterns, 246 respondents (79%) reported utilizing online resources to practice antibiotic self-medication. Furthermore, 232 participants (74.8%) maintained the misconception that antibiotics are effective interventions for the common cold, though a substantial majority (296 respondents, 94.9%) demonstrated basic familiarity with what antibiotics are. In terms of behavioral frequency, 87 individuals (28.1%) reported self-medicating with antibiotics one to two times within the previous 12 months, whereas 181 participants (58.4%) engaged in this practice at least twice per year. Based on guidance obtained from online platforms, Metronidazole (Flagyl) emerged as the most frequently procured antibiotic (n = 162, 63.3%), followed sequentially by Co-trimoxazole (Septrine) (n = 153, 59.8%), Amoxicillin (n = 111, 43.4%), Azithromycin (n = 92, 35.9%), and Amoxicillin/Clavulanic acid (n = 52, 20.3%).

Bivariate analysis revealed that a range of individual, household, and health system elements were significantly associated with the utilization of internet-enabled antibiotic self-medication.

Subsequent multivariate regression models were executed to evaluate these individual, household, and health system determinants concurrently. At the individual level, higher odds of engaging in internet-enabled antibiotic self-medication were observed among male respondents (aOR= 4.1; CI: (1.7–9.8); P = 0.001), single individuals (aOR= 12.6; CI: (3.8–41.8); P < 0.001), and participants who possessed an existing awareness of antibiotics (aOR= 15.2; CI: (2.0–117.0); P = 0.009). Similarly, elevated odds were found among individuals who perceived the access and utilization of online medical data to be difficult (aOR= 5.2; CI: (1.6–17.4)) and those who believed the internet should not be utilized for self-medication purposes (aOR= 3.6; CI: (1.2–11.9); P = 0.036).

At the household level, a positive association with internet-enabled self-treatment was documented among individuals from families in which antibiotic self-medication was viewed as a widespread, conventional practice (aOR = 7.13; CI: (2.1–24.7); P = 0.002). Conversely, negative associations were observed in households containing three or more residents (aOR= 0.1; CI: (0.03–0.4); P = 0.001) and within households adhering to the belief that recovery from sickness strictly requires a formal physician prescription (aOR= 0.16; CI: (0.01–0.6); P = 0.004).

With respect to health system determinants, patients living within a 5-kilometer radius of their closest medical center (aOR= 4.60; CI: (1.5–14.5); P = 0.009) and those

whose local pharmacy or drug shop dispensed antibiotics without requiring a prescription (aOR= 7.08; CI: (1.8–28.1); P = 0.005) exhibited an increased likelihood of practicing internet-driven self-medication. Conversely, individuals who felt that clinical staff failed to provide adequate explanations regarding their diagnoses (aOR= 0.27; CI: 0.1–0.8); P = 0.024) demonstrated a reduced likelihood of engaging in the practice.

More than three-quarters of the surveyed population reportedly engaged in internet-enabled antibiotic self-medication to treat various conditions, including the common cold. This observed trend closely aligns with the 75.7% prevalence rate documented in northern Uganda [38]; however, it falls short of the 90% estimate reported by the National Drug Authority (NDA) [30]. Conversely, the internet-driven antibiotic self-medication rate observed in this study exceeds the 22.2% reported at Kiruddu National Referral Hospital in central Uganda [9].

This geographical variance can be attributed to differences in study locations and respondents' socio-demographic characteristics. Critically, the high prevalence of internet-enabled antibiotic self-medication highlights a deeply concerning public health challenge that could undoubtedly accelerate the development of antimicrobial resistance. This has severe ramifications for resource-limited settings, where healthcare systems face persistent infrastructure bottlenecks. The most frequently utilized antibiotics in this cohort match the patterns observed in northern Uganda [38] and earlier data from central Uganda [39]. Given that both comparative studies were conducted in Uganda [38, 39], it is highly probable that these specific medications are widely accessible and relatively affordable.

Furthermore, because these agents are broad-spectrum treatments for multiple infectious diseases [30], their irrational and unguided consumption risks inducing microbial resistance. Such an outcome would have catastrophic implications for communities operating under a highly restricted formulary of alternative antibiotics. Although not explicitly quantified in this work, the consequences of widespread antibiotic resistance will inevitably ripple across the continuum of care, severely complicating and exacerbating future healthcare delivery.

In this study, knowledge of antibiotics was significantly associated with internet-enabled self-medication. This correlation aligns with several prior investigations [7, 40], though it directly contradicts the outcomes of alternative studies [41-43]. Our observations can be conceptualized through Orem [44]'s self-care deficit theory, which posits that an individual engages in health-related behaviors based on foundational conditioning factors; these dynamics often extend beyond baseline literacy to encompass broader socio-cultural inclinations. From this perspective, individuals who possess theoretical knowledge about antibiotics and choose to self-medicate may fail to evaluate the long-term clinical risks of unsupervised drug consumption critically.

Concurrently, individuals who perceived the internet as a complex or difficult tool to navigate were more likely to self-medicate based on online material. This suggests that, in line with prior literature [45], these users may struggle to filter and retrieve high-quality, evidence-based data required for safe health choices. It appears that the internet is conceptualized as an easily accessible mechanism for obtaining rapid medical guidance. Consequently, an inability to efficiently search for authoritative data on antibiotic risks may inadvertently increase self-medication rates, as users miss critical literature cautioning against antibiotic use without direct clinical oversight. Because the majority of respondents maintained that online resources should be utilized for antibiotic self-treatment, future health promotion campaigns must evolve. Educational messages should move beyond basic descriptions of antibiotic functions to actively emphasize the long-term risks of antibiotic resistance, while reinforcing the standard that online resources must serve only as supplementary tools, not as a substitute for a qualified healthcare professional's prescription.

In agreement with previous studies [14, 15], individuals residing in smaller households with fewer occupants were more likely to self-medicate with antibiotics. The socio-dimensional structure of the community shapes this multifaceted behavioral characteristic. According to Orem [44]'s self-care theory, healthcare decisions within a domestic unit do not occur in isolation; rather, they are guided by conditioning elements such as immediate resource availability and established cohabitation patterns. Furthermore, prior research [14] hypothesizes that reduced rates of internet-driven self-medication in larger domestic units may stem from an increased reliance on inter-family and peer consultations for health remedies, rather than seeking digital solutions. This explanation is reinforced by the urban setting of the present cohort, in which individual care-seeking

preferences directly dictate antibiotic selection and subsequent administration practices.

Additionally, this study demonstrated that households with an established history of self-medication were significantly more likely to use online data for antibiotic self-administration, an observation consistent with previous findings from Ethiopia [20, 22]. This trend is driven by the accumulation of prior experiential knowledge about which antibiotics to use for specific symptoms, alongside familial or peer compliance pressures within the home. Conversely, a household's collective belief that physical recovery is strictly contingent upon receiving a formal doctor's prescription was found to mitigate and reduce online-driven antibiotic self-medication practices within the family unit, matching similar Ethiopian findings [20]. This behavioral deterrent is supported by Orem [44]'s self-care theory, which frames socio-cultural orientation as a core conditioning factor dictating health-related choices.

Parallel to earlier literature [23], close geographic proximity of the household to the nearest health facility paradoxically stimulated online-driven antibiotic self-medication. This outcome may be closely linked to previous negative household experiences with institutional service quality—such as perceived poor provider attitudes—or to a prevailing belief that clinicians themselves rely solely on internet searches to formulate prescriptions. Consequently, the household unit should be designated as the primary target for public health communication campaigns.

Respondents whose closest pharmacy or drug retail shop dispensed antibiotics over the counter without requiring a formal prescription were significantly more likely to use online resources to self-medicate, corroborating prior findings [26, 28]. This dynamic is explained by patients using digital data to select and request explicit antibiotics directly from nearby commercial retail outlets, a vulnerability exacerbated by weak regulatory enforcement mechanisms at these points of sale. Furthermore, equipping individuals with detailed information about their historical medical diagnoses and prior antibiotic treatments was shown to drive subsequent internet-enabled self-medication, a finding that mirrors prior reports [46]. This is likely due to patients repurposing historical prescription insights to search the internet for familiar therapies, thereby increasing independent usage. Consequently, clinical advice delivered to patients must expand beyond single-illness counseling to address individual environmental factors, while emphasizing the long-term risks and resistance risks associated with recurrent, off-label antibiotic use.

This investigation possesses notable methodological strengths, including a balanced recruitment of participants across diverse age brackets, a high participant response rate, and the execution of multivariate regression modeling, which enhanced the statistical precision of the reported observations. However, the findings must be interpreted with caution. The documented associations are vulnerable to potential confounding and bias due to the relatively localized sample size and inherent recall bias. Furthermore, the scope of this study was limited by a pre-selected list of common antibiotics predominantly chosen by the respondents, and the reliance on self-reported data may constrain the external validity and generalizability of the conclusions. Future research should investigate the dynamics of internet-enabled antibiotic self-medication within rural cohorts.

The pervasive challenge of internet-driven antibiotic self-medication underscores the need for healthcare professionals to implement robust public awareness initiatives focusing on the clinical risks of unprescribed antibiotic usage. Concurrently, policymakers must formulate targeted regulatory frameworks and establish stringent implementation mechanisms to curb unauthorized over-the-counter dispensing.

Conclusion

This investigation demonstrated that a substantial proportion of the sample—specifically three out of every four participants—had previously utilized online resources to engage in antibiotic self-medication. Multiple determinants were significantly associated with this practice, including individual characteristics such as biological sex, marital status, baseline knowledge of antibiotics, and subjective perceptions of the utility of online data for self-treatment. At the household level, significant predictors included the total number of cohabitants, established domestic histories of antibiotic self-medication, and collective household beliefs regarding the appropriateness of digital health-seeking. Furthermore, significant associations were identified among systemic healthcare factors, notably geographic proximity to commercial drug retail outlets that dispense antibiotics without a physician's prescription, as well as the nature of the clinical information provided to individuals regarding their diagnoses.

Based on these empirical insights, several targeted recommendations are proposed:

- Patient-centered communication: There is an immediate requirement to design and implement targeted Information, Education, and Communication (IEC) materials. These resources should be structured to enhance public literacy about the long-term clinical consequences of irrational antibiotic use, while offering guidance on safely navigating online health data as a supplementary health-seeking behavior.
- Public health promotion: The Ministry of Health should revitalize national health promotion campaigns by deploying strategic messages that link antibiotic stewardship with digital media consumption. These initiatives must target both individuals and entire household units with structured educational narratives that define the biological function of antibiotics, emphasize the immediate and long-term evolutionary risks of antimicrobial resistance, and caution against the misuse of digital platforms for self-diagnosis.
- Regulatory enforcement: The National Drug Authority should systematically sensitize retail pharmacy staff and community healthcare practitioners regarding the statutory provisions of the National Drug Policy. Explicit focus must be on enforcing regulatory boundaries and restricting unauthorized, over-the-counter dispensing of antibiotic medications without a valid prescription from a certified medical professional

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