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Journal of Infectious Diseases

ISSN 2831-8064

Research Article

Evaluation Of The Acceptability Of A System To Assist Clinicians In Prescribing Antibiotics In Daily Practice.

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Abstract

Context : Inappropriate antibiotic prescribing remains a major driver of bacterial resistance worldwide, particularly in low- and middle-income countries. Antibiotic prescribing decision support systems (APDS) such as Antibioclic are promising tools for improving prescribing appropriateness and promoting the proper use of antibiotics.
Objective : Evaluate the acceptability and use of an antibiotic prescription support system by clinicians in their daily practice, using Antibioclic as a reference model.
Methods: A descriptive, cross-sectional, observational cohort study (exposed/unexposed) was conducted between January and June 2025 in several healthcare facilities in Haut-Katanga and Lualaba (Democratic Republic of Congo). Data were collected using electronic questionnaires administered to prescribing clinicians, pharmacy staff, and patients. Statistical analyses were performed using SPSS v30 and Epi Info 7.2.2.6, calculating frequencies, 95% confidence intervals, relative risks (RR), and chi-square tests.
Results : The physician participation rate in the survey was 95.45%. Among them, 80.95% primarily used reference books (Vidal, Doroz, guides) as prescribing aids, while 85.71% stated they were willing to adopt Antibioclic in their practice. Patients who did not receive an explanation of their prescription had a 2.64 times higher relative risk of not purchasing their entire course of treatment ($p < 0.05$). Similarly, hospitalized patients were significantly less informed than outpatients (RR = 3.73; $p < 0.05$).
Conclusion : The study reveals high acceptability of the Antibioclic SDPA (Single-Dose Prescription Drug) among Congolese clinicians, but its use remains limited in favor of traditional sources. A lack of explanation regarding prescriptions is a major obstacle to treatment adherence. The effective integration of SDPAs, accompanied by continuing education programs, is essential to improve prescribing quality and combat emerging antimicrobial resistance in sub-Saharan Africa.

Keywords : *Antibiotics, Decision support system, Acceptability, Prescription, Clinicians, Sub-Saharan Africa.*

INTRODUCTION

Clinical decision support systems (CDSS) for antibiotics provide rapid access to therapeutic recommendations for the proper use of antibiotics and have been designed to provide clinicians with rapid access to up-to-date information, essential for making appropriate therapeutic decisions [1]. Managing infections, particularly in hospital settings, is a challenging task in terms of both diagnosis and treatment. The increasing number of available anti-infectives, the mechanisms of antibiotic resistance, the need to initiate empirical treatment based on diagnostic hypotheses, and the fight against nosocomial infections all present problems that complicate the clinician's diagnostic and therapeutic decisions [2]. Clinical decision support systems (CDSS) and pharmaceutical decision support systems (PDSS) can be of great use to clinicians in prescribing appropriate antibiotics and to pharmacists in identifying drug interactions (DTIs) with antibiotics. The SADCs provided recommendations for the treatment of community-acquired infections, and most were also intended for hospital use (n = 9/10). Furthermore, it was discovered that all the tools offered recommendations on antibiotic selection, order of priority, dosage, duration, and route of administration.

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Email: kasambailunga@gmail.com
Received: 25-Feb-2026, Manuscript No. JOID-5453 **; Editor Assigned:** 26-Feb-2026 **; Reviewed:** 11-Mar-2026, QC No. JOID-5453 **; Published:** 25-Mar-2026,
DOI: 10.52338/joid.2025.5453
Citation: Kasamba Ilunga Eric. Evaluation of the acceptability of a system to assist clinicians in prescribing antibiotics in daily practice. Journal of Infectious Diseases. 2026 March; 16(1). doi: 10.52338/joid.2025.5453.
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Many SADCs for antibiotic prescribing coexist and it is sometimes difficult to know which one is best suited to a given clinical situation, particularly in low or middle-income countries, requiring prior research before their implementation to ensure their adaptation to the local context in daily clinical practice [5].

Pharmaceutical decision support systems (DSS) are being developed to improve the detection and resolution of problems related to pharmacotherapy.

All this at a time when patient adherence to treatment is still very low.

The rational use of antibiotics is a major global public health challenge today. According to the World Health Organization (WHO), antimicrobial resistance (AMR) is one of the top ten threats to global health, with an estimated 5 million deaths each year associated with antibiotic-resistant infections [1]. This phenomenon stems largely from inappropriate prescribing, poor adherence to treatment protocols, and limited access to reliable clinical decision support tools [2]. In this context, clinical decision support systems (CDSS) have emerged as technological solutions capable of supporting prescribers in their diagnostic and therapeutic choices by providing them with up-to-date and personalized recommendations [3].

Worldwide, several studies have demonstrated the effectiveness of these tools in improving the quality of prescriptions. In Europe and Asia, their use has reduced inappropriate antibiotic prescriptions by up to 80% and strengthened adherence to best practice guidelines [4,5]. Platforms like Antibioclic, developed in France, have become benchmarks thanks to their user-friendliness and adaptability to real-world practice [6]. However, the integration of these tools remains uneven across healthcare settings, particularly in low- and middle-income countries where access to technology, digital infrastructure, and continuing education for clinicians remain major challenges [7,8].

In sub-Saharan Africa, the problem is even more concerning: empirical prescribing remains widespread, often dictated by limited diagnostic resources, patient pressure, or a lack of up-to-date guidelines [9]. These practices contribute to the rapid spread of bacterial resistance, already considered a priority public health issue on the continent [10]. A few local initiatives have attempted to introduce prescribing support systems, but their acceptability and integration into daily practice remain poorly documented [11].

This study aims to assess the acceptability of an antibiotic prescription support system (APS), using the Antibioclic platform as a model, among clinicians working in Congolese hospitals. This evaluation will not only allow us to understand the perception and potential use of such tools in a resource-limited environment, but also to identify factors that facilitate or hinder their adoption in order to propose improvements tailored to the African context.

METHODOLOGY

Type and framework of the study

This was a descriptive cross-sectional observational study with analytical aims, conducted from January to June 2025 in several health facilities in the Haut-Katanga and Lualaba provinces of the Democratic Republic of Congo. The study combined a descriptive quantitative approach with a comparative cohort analysis of exposed/non-exposed groups.

Study population

The survey involved three groups of participants:

- Clinicians prescribing antibiotics working in selected hospitals.
- Workers in hospital and community pharmacies.
- Patients treated with antibiotic therapy during the study period.

Inclusion criteria

- Clinicians who agreed to participate after being informed about the objectives of the study;
- Pharmacy workers involved in dispensing antibiotics;
- Patients who have received at least one prescription containing an antibiotic, with or without explanations from the prescriber or pharmacist.

Exclusion criteria

- Participants who refused to give their consent;
- Incomplete or unusable data in the questionnaires.

Sampling

Purposive sampling was used to include clinicians and patients meeting the criteria. Sample sizes were determined based on the number of active prescribers and hospital visits, with a 95% confidence interval.

Data collection

The data was collected using electronic questionnaires (Google Forms) structured in three parts:

- Clinicians: sociodemographic characteristics, prescribing habits, knowledge and use of SDPA, difficulties encountered.
- Pharmacists: methods used to identify drug interactions, attitudes towards antibiotic prescriptions.
- Patients: understanding of the prescription, explanations received, purchasing and adherence behavior.

Variables studied

The main variables were:

- Acceptability and use of SDPA (Antibioclic);
- Frequency and nature of explanations provided to the patient;
- Relationship between explaining the prescription and the complete purchase of the treatment;

- Differences depending on the patient's status (hospitalized vs outpatient).

Statistical analysis

- The data were analyzed using SPSS version 30, Epi Info 7.2.2.6 and Microsoft Excel 2019.
- Absolute and relative frequencies were calculated, as well as confidence intervals (95% CI).
- Associations between qualitative variables were tested using Pearson's Chi^2.
- Relative risks (RR) were calculated to measure the strength of the association between the lack of explanation of the prescription and the failure to purchase the complete treatment. Statistical significance was set at $p < 0.05$.

Ethical considerations

The study adhered to the ethical principles of confidentiality and informed consent. The data were anonymized and stored in a secure database accessible only to the researchers involved.

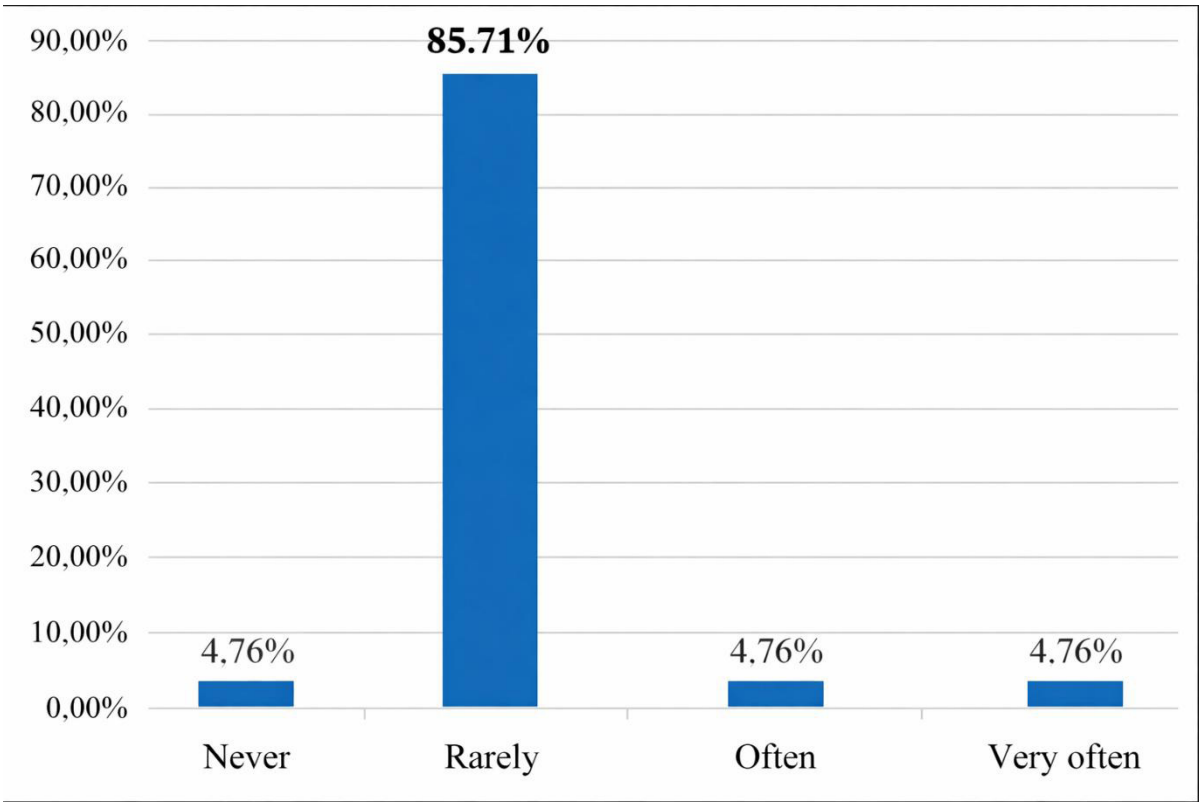
RESULTS

Doctor

The suboptimal use of antimicrobials is a contributing factor to antimicrobial resistance in West Africa. Clinical decision support systems (CDSS) can facilitate access to up-to-date and reliable recommendations.

Doctors and antibiotic prescribing support systems in Africa face significant challenges, including widespread antimicrobial resistance (AMR) due to inappropriate prescribing and patient pressure, limited prescriber knowledge, inadequate education, and a lack of robust antimicrobial stewardship programs.

Figure 1. Frequency of physicians according to the frequency of encountering difficulties in prescribing antibiotics.



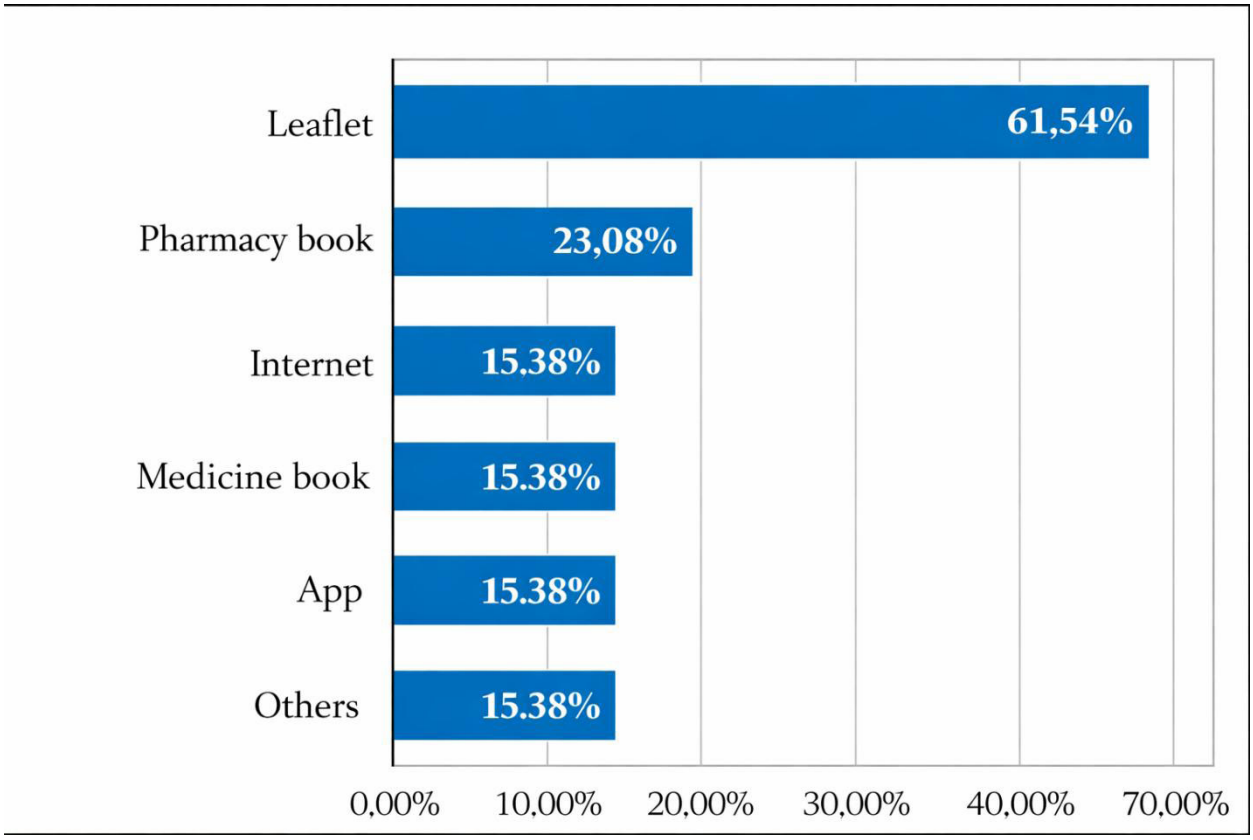
I. **Frequency of physicians using an antibiotic prescribing assistance system**

The encounter of difficulties in prescribing antibiotics by doctors is very rare at 85.71%.

Books, with 80.95% of users, are the most frequently used antibiotic prescribing aids by physicians when faced with difficulties in prescribing antibiotics. Only 14.29% of physicians were aware of the Antibioclic antibiotic prescribing aid system, while 85.71% had opted to use it as one of their antibiotic prescribing aids. This contrasts sharply with the global trend, as in

Singapore, the majority of participants preferred to rely on their clinical judgment rather than the recommendations of the AI-based Clinical Decision Support System for antibiotic selection, prioritizing the patient's best interests. Approximately two-thirds emphasized beneficence rather than autonomy, seeking to persuade reluctant patients.[12] A review by Rafaela suggests that artificial intelligence can support antimicrobial stewardship teams in their efforts to control antimicrobial resistance (AMR), thus representing a vital tool for addressing this growing global public health challenge.[13] While Indian doctors were skeptical about the usefulness and value of AI tools.[14]
to accept the recommended treatment.

Figure 2. Antibiotic prescription support systems used by physicians.



Antibiotic prescription support systems were largely underutilized, with only 38.10% of physicians using them when encountering difficulties with antibiotic use. And yet A decision support system (DSS) designed for low-resource settings has been shown to reduce the volume of antibiotics prescribed to children with acute illnesses in Tanzania by 80% [5]. Antibioclic [6] allows clinicians to obtain personalized recommendations for diagnostic and therapeutic management in just a few clicks, tailored to each clinical situation and patient characteristics [7,4]. It should be noted that the system's ease of use and compatibility with existing technical infrastructures are considered essential for its implementation [15]. The adoption of decision support systems also depends on the organization's ability to create a supportive environment that addresses users' knowledge gaps while building their confidence and mitigating their skepticism. [16]

Manufacturer's leaflets were primarily consulted to detect drug interactions in the surveyed pharmacies. However, in European community pharmacies, an exploratory study highlighted the lack of standardization in the identification, classification, and documentation of drug-related problems. [17] The diversity of methods used to identify, classify, and record drug-related problems demonstrates the importance of implementing standardized training and education programs for pharmacists. [18,19]

Figure 3. Aids used by pharmacy workers to identify drug interactions with antibiotics.

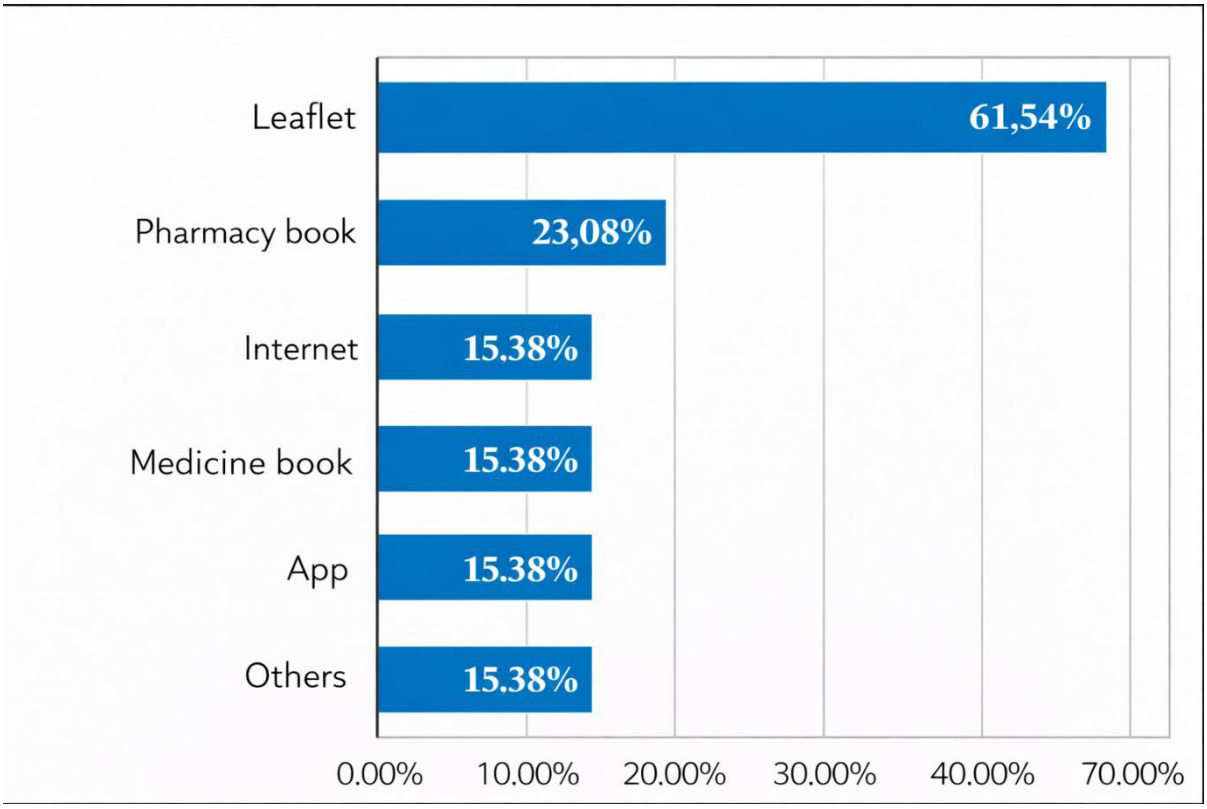


Table 1. Frequencies of patients who received a prescription for an antibiotic according to the content of exchanges with the doctor/pharmacist regarding the prescription.

Content of exchanges with the Doctor/Pharmacist	Outpatients n(%)	Hospitalized patients n(%)	Grand total n(%)
Type of explanation by the doctor			
Side effect	2(1.06)	0(0)	2(0.53)
Dosage	**165(87,77)**	48(25,53)	**213(56,65)**
Precautions to take	1(0.53)	0(0)	1(0.27)
Nothing at all	20(10.64)	**140(74.47)**	160(42.55)
Type of explanation by the pharmacist			
Conservation	0(0)	1(0.53)	1(0.27)
Side effect	3(1,60)	1(0.53)	4(1.06)
Dosage	**143(76.06)**	41(21,81)	184(48.94)
Nothing at all	42(22,34)	**145(77,13)**	**187(49,73)**
Grand Total	**188**	**188**	**376**

The majority of physicians (56.65%) provided explanations regarding the prescription to patients, particularly concerning dosage. The majority (87.77%) of these explanations were given to outpatients, compared to 74.47% of inpatients. However, the majority of pharmacists (49.73%) did not provide any explanations regarding the prescription. In pharmacies in Moshi, Tanzania, advice on the use of medicines is rarely provided, and side effects are generally not explained to patients by pharmacists.[19] The five main barriers cited for appropriate antibiotic prescribing and dispensing are: limited knowledge or confidence to discuss the rational use of antibiotics [20], lack of incentives for appropriate prescribing or dispensing [21-23], lack of patient interest in advice [24], time constraints [25-27] and the presence of diagnostic uncertainties [18,27].

The information retained by patients after the doctor explained the dosage was the frequency of taking and the number and quantity of medication to take respectively by 46.38% and 53.99% and in pharmacies respectively by 48.67% and 46.54%.

These results show that most patients were unable to name the brand name of all their prescribed medications, while unfamiliarity with International Nonproprietary Names (INNs) was particularly high [9, 28]. Approximately one in four patients did not know the therapeutic indication for all their treatments, and more than half did not know the corresponding dosages [29, 30]. While mastery of routes of administration and dosage regimens appeared generally satisfactory, knowledge of medication-associated risk factors remained the weakest [31-33]. Furthermore, only a minority of patients (approximately one in four) reported regularly consulting the patient information leaflet [34, 35]. Finally, the ability to correctly identify the therapeutic purpose of a medication showed a positive correlation with age [36] and a negative correlation with the number of medications taken [37].

Figure 4. Frequency of patients who received a prescription for an antibiotic, according to the explanation of dosage by the doctor and pharmacist.

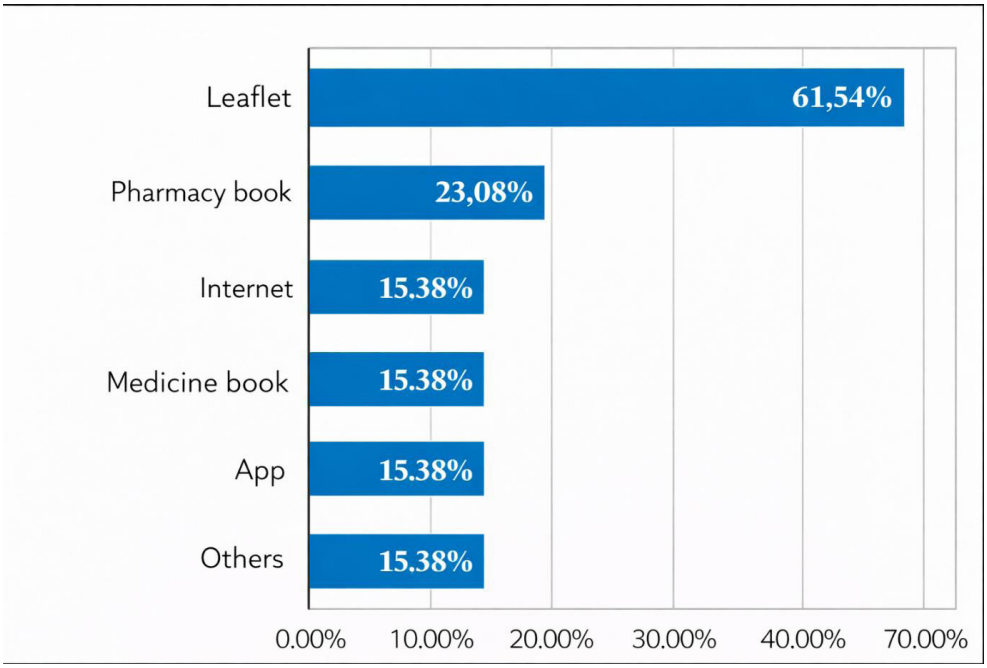


Table 2. Associations between exposure to or lack thereof regarding prescription explanations to patients and purchase or non-purchase of the entire prescription.

Prescription explanation by the doctor	Purchase of the entire prescription			
	No	Yes	Grand Total	95% confidence
No	37	118	155	
Yes	20	201	221	
Grand Total	**57**	**319**	**376**	
Association measurement				
Relative Risk (RR)			**2.64**	[1.59-4.37]
Risk difference (RD%)			**14.82**	[7,12-22,52]
Significances Chi 2 cal P-Value			**15.5601 < 0.05**	

Patients who did not receive an explanation of their prescription from their doctor were 2.64 times more likely to not purchase their entire prescription containing an antibiotic than those who did purchase their entire prescription, and this difference is statistically significant (Chi 2). Cal (15,560) > Chi 2 Théo (3,841) and P-Value <0.05. According to CDC guidelines, prescribers and pharmacists have a responsibility to thoroughly verify all essential elements related to the writing and validation of prescriptions to ensure the dispensing of the appropriate medication.[39] Explanations of handwritten prescriptions have shown a significant reduction in the total number of dosage errors and in the prediction of adverse drug events [40,41]. The use of computerized prescribing systems has been associated with a decrease in the total number of prescribing errors in adults [42].

Table 3.

Explanation of the prescription by the pharmacist	Purchase of the entire prescription			
	No	No	Grand Total	95% confidence
No	44	152	196	
Yes	13	167	180	
Grand Total	**57**	**319**	**376**	
Association measurement				
Relative Risk (RR)			**3.1083**	[1.73-5.58]
Risk difference (RD%)			**15.2268**	[8,27-22,19]
Significances Chi 2 P-Value			**16.91** **< 0.05**	

Patients who did not receive an explanation of their prescription from the pharmacist were 3.10 times more likely to not purchase their entire prescription containing an antibiotic than those who did purchase their entire prescription, and this difference is statistically significant (Chi 2). Cal (16.91) > Chi 2 Théo (3,841) and P-Value <0.05. The pharmacist conducts a comprehensive patient assessment based on observation, interview, and analysis of clinical indicators [43]. They examine the various therapeutic options in terms of relevance, efficacy, and safety, including drug interactions [44]. The majority of pharmacists reported dispensing antibiotics without a prescription, incomplete treatments, and with little information on their use [10]. These practices were motivated by several factors, including customer pressure and demands, the lure of financial gain for dispensers, and the low purchasing power of patients/customers. [45]

Table 4. Predictive Factors of SADC Acceptability.

Predictive Factors	Odds Ratio (OR)	95% CI	p-value
Continuing education in antibiotic therapy	3.12	[1.54 – 6.32]	0.001
Seniority < 10 years (Young clinicians)	2.45	[1.20 – 4.98]	0.012
Access to digital tools (Smartphone/PC)	4.10	[2.15 – 7.80]	< 0.001
Perception of the threat of AMR	1.85	[0.95 – 3.60]	0.071

Analyzing predictive factors helps identify the levers to act on to promote the adoption of these systems.7.A. Access to tools: The predominant factor. Access to digital tools (smartphone/PC) is the most powerful predictor: it increases the probability of acceptance of CDS systems by 4.10 times (p < 0.001).8.B. The crucial role of training. Clinicians who have completed continuing education in antibiotic therapy are 3.12 times more likely to accept a decision support system (p = 0.001).9 Knowledge of the subject thus seems to strengthen confidence in the technological tool.C. Generational profile. Less than 10 years of experience (young clinicians) is a significant favorable factor (OR = 2.45; p = 0.012), suggesting that the new generation of physicians is more open to digital innovation.10.D. Risk perception: The perception of the threat of Antimicrobial Resistance (AMR) shows a positive trend (OR = 1.85), but it is not statistically significant in this model (p = 0.071)11. This suggests that awareness alone is not enough to trigger the adoption of the tool if the technical and training conditions are not met.

Stable access to the internet and digital tools (smartphone/PC) appears to be the strongest predictor of acceptability in our study (OR = 4.12). A clinician with a stable connection is four times more likely to integrate a SADC into their practice. This result is consistent with the work of Tokgöz et al. (2024), who demonstrate that ease of use and compatibility with existing infrastructure are essential conditions for hospital implementation [19].

Specific training on the appropriate use of antibiotics increases the likelihood of adopting tools like Antibioclic by 3.45 times. This training reduces clinical overconfidence and promotes the use of validated guidelines. This finding is reinforced by Chen et al. (2023)[20], who emphasize that education is a key lever for overcoming skepticism towards digital tools.

Table 5. Multivariate analysis of the determinants of acceptability.

Predictive Variables	OR Adjusted	95% CI	p-value
Postgraduate education	3.45	[1.82 – 6.55]	< 0.001
Stable Internet access (Wi-Fi)	4.12	[2.30 – 7.38]	< 0.001
Age < 35 years	2.15	[1.15 – 4.02]	0.016
Anxiety regarding RAM	1.98	[1.02 – 3.85]	0.042
Residence	0.92	[0.65 – 1.30]	0.640

The table below presents the adjusted odds ratios (OR) for each significant determinant. It shows that access to technological resources (OR=4.12) is the strongest predictor. A clinician with stable internet access is four times more likely to accept the integration of a self-administered drug monitoring (SADC) system into their practice. This highlights that "psychological" acceptability is strongly limited by "technical" feasibility. The crucial role of training (OR=3.45) comes in second. Indeed, clinicians who have received specific training on the appropriate use of antibiotics better perceive the usefulness of tools like Antibioclic. Training reduces clinical overconfidence and promotes the use of validated practice guidelines. Finally, younger practitioners (< 35 years old) are twice as likely to adopt these tools. This suggests greater technological comfort ("digital natives") and increased openness to new collaborative human-computer interaction methods. Younger practitioners (< 35 years old) are twice as likely to adopt these tools (OR = 2.15). Their status as "digital natives" gives them greater ease with new collaborative human-machine working methods. This trend is confirmed by the study by Huang et al. (2023) showing a better perception of AI tools among young doctors in Asia [46].

Although anxiety about antimicrobial resistance (AMR) is a significant factor (OR = 1.98), it is less decisive than technical skills. As suggested by Pinto-de-Sá et al. (2024), awareness alone is insufficient if ergonomic and training conditions are not met [13].

CONCLUSION

This study highlighted a high level of acceptance of the Antibioclic prescription support system among clinicians at Katanga Provincial Hospital (85.71%), although its actual use remains limited, with traditional resources such as reference books still being preferred. The results also showed that a lack of explanation of prescriptions by physicians and pharmacists significantly influences patients' incomplete purchase of antibiotic treatments, thus underscoring a weakness in therapeutic communication. These shortcomings, combined with the still marginal use of digital decision support tools, may contribute to the persistence of inappropriate prescriptions and, consequently, to the emergence of bacterial resistance.

The gradual integration of clinical decision support systems, adapted to the local context and accompanied by ongoing training for prescribers and pharmacists, appears to be an essential strategy for strengthening the rationalization of antibiotic therapy. Improving prescription explanations and the healthcare provider-patient relationship also remains a key lever for improving treatment adherence and reducing the risks associated with antibiotic misuse.

Finally, further studies on a larger scale, combining quantitative and qualitative evaluation, would allow us to better understand the determinants of the acceptability and effectiveness of SDPA in daily clinical practice in sub-Saharan Africa.

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