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Choosing antibiotics in the laboratory, clinic and pharmacy in Lubumbashi, Democratic Republic of Congo

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Abstract

Introduction: Antibiotic susceptibility testing is used to raise awareness of antibiotic resistance and to monitor resistance patterns over time. The objective of this study was to assess the level of practical knowledge about antibiotics sold in Lubumbashi.

Materials and methods: This was a descriptive cross-sectional study conducted from December 22, 2024, to March 10, 2025. The study involved doctors, pharmacists, and medical biologists working in medical facilities, pharmacies, and bacteriology laboratories. Data were collected through a three-questionnaire survey administered to doctors, pharmacists, and medical biologists in various medical settings.

Results: Generalists doctors have shown that 31% did not use the results of the antibiogram to guide their decision on prescribing antibiotic, sand 35% did not know that antibiotics should only be prescribed if the infection is confirmed by bacterial culture. The specialist doctors responded with 100% accuracy. 91% pharmacists and 59% no pharmacy degree respected the medical prescriptions issued by the prescribers. 100% Pharmacists and no pharmacy degree did not sell antibiogram discs. At the medical biologists, 71% did not carry out quality controls in their departments. 39% of antibiotic discs were neither prescribed nor available in pharmacies.

Conclusion: In Lubumbashi, the limited number of bacteriology laboratories poses enormous problems in the prevention of antibiotic resistance.

Keywords: Choice; Antibiotics: Laboratory; Clinic; Pharmacy

1. Introduction

Antibiotic susceptibility testing is used to increase awareness of antibiotic resistance and to track resistance profiles over time [1]. While it provides prescribers with a resource for selecting empirical antimicrobial therapy, it is essential that the antibiotic susceptibility test be a practical and user-friendly resource for monitoring recent patterns of antimicrobial susceptibility in order to track changes in bacterial resistance [2, 3, 4]. Therefore, in practice, the antibiotic susceptibility test should list the most frequently encountered relevant organisms in typical infections, as well as the common antibiotics used to treat these infections [5].

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Susceptibility data derived from an antibiogram should be used when generating treatment pathways for infectious diseases, including prescription sets [6, 7]. Disseminating the antibiogram to first-line prescribers in settings where prescription sets are not used can be challenging [8].

In developing countries, 50% of antibiotics are used without a prescription, most often purchased from a pharmacy. Approximately half of all medications are prescribed, dispensed, or sold inappropriately. The practice of prescribing antibiotics depends on the healthcare professional's ability to determine the most beneficial choices for patients [9]. In the Democratic Republic of Congo (DRC), 85% to 95% of antibiotics are prescribed in outpatient settings, while the few studies conducted on this topic focus primarily on antibiotic management in hospitals rather than in the community [10].

The implementation of antibiograms could be effective in improving empirical antibiotic prescribing in healthcare facilities [11], due to its clinical impact as an intervention aimed at optimizing antibiotic prescribing and patient outcomes [1]. This approach involves establishing a relationship between the antibiotics on the discs used in the bacteriology laboratory, the medical prescription, and the availability of antibiotics delivered to pharmacies. Therefore, this study aims to assess the level of practical knowledge about antibiotics sold in Lubumbashi in order to enable medical biologists to correctly select the antibiogram discs available in local pharmacies; to enable prescribers to follow the guidelines for antibiogram results; and to ensure pharmacists adhere to medical prescriptions.

2. Material and methods

This was a descriptive cross-sectional study to evaluate the impact of the availability and use of antibiogram results among healthcare providers in Lubumbashi. The study was conducted over two months and two weeks, from December 22, 2024, to March 10, 2025. It included doctors, pharmacists, and medical biologists working in medical facilities, pharmacies, and bacteriology laboratories. Data were collected through a survey using three specific questionnaires administered to doctors, pharmacists, and medical biologists in various healthcare settings. The sample size was convenience-based, encompassing 97 healthcare facilities, where 92 generalists doctors and 5 specialists were interviewed; 107 private pharmacies and those within healthcare facilities; and 7 bacteriology laboratories. The study focused on healthcare providers involved in prescribing and dispensing antibiotics, specifically physicians and pharmacists. Regarding medical biologists, only those working in the bacteriology department were included. Doctors and pharmacists who declined to participate in the study, those with incomplete questionnaires, healthcare administrators, maintenance staff, and individuals not directly involved in prescribing antibiotics or working in non-clinical settings, including biomedical analysis laboratories without a bacteriology department, were excluded. This study was approved by the Medical Ethics Committee of the University of Lubumbashi under number UNILU/CEM/008/2025 after its completion. Verbal consent was obtained from the respondents and their anonymity was guaranteed in the processing of the data. The data were entered into Excel 2016 and processed using Excel 2016 and SPSS 23 (Statistical Package for Social Science version 23). We calculated the frequencies and percentages of the different distributions at a significance level of 0.5% with a 95% confidence interval.

3. Results

3.1. Data on prescribing doctors

The results in figure 1 show that health centers and polyclinics occupied the high thresholds with 43% and 34% respectively; then came the other structures (n=97).

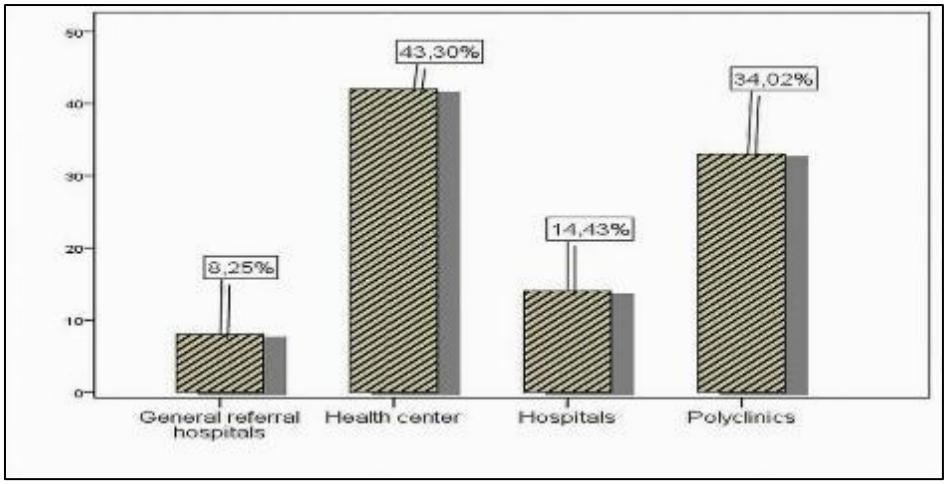

Figure 1 Distribution of cases according to the prescribers' medical facilities

The results in figure 2 show that the municipalities with the most medical facilities were those of Lubumbashi at 39% and Annexe at 23%; and the others (n= 97).

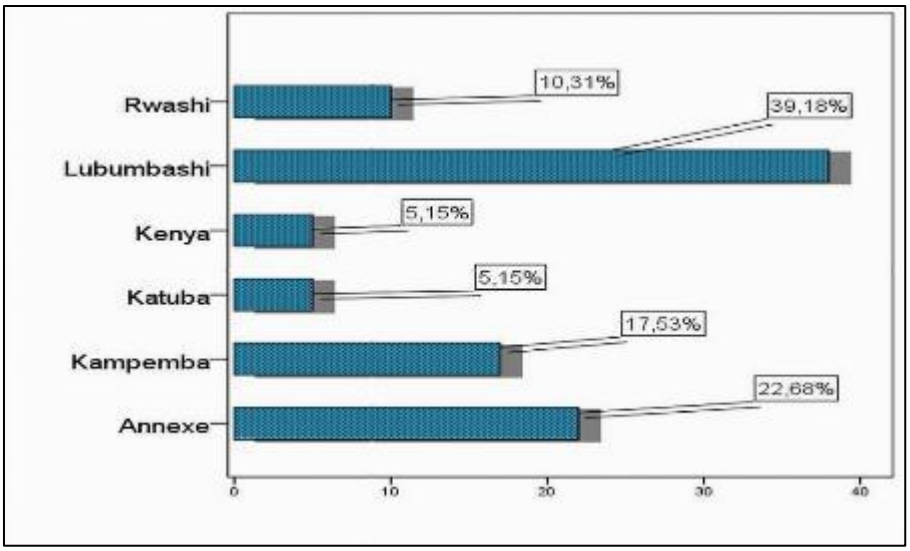

Figure 2 Distribution of cases according to the municipalities of medical facilities

The results in figure 3 demonstrate that the male and female internal medicine services and the general consultation accounted for 45% and 34% respectively; (n=97).

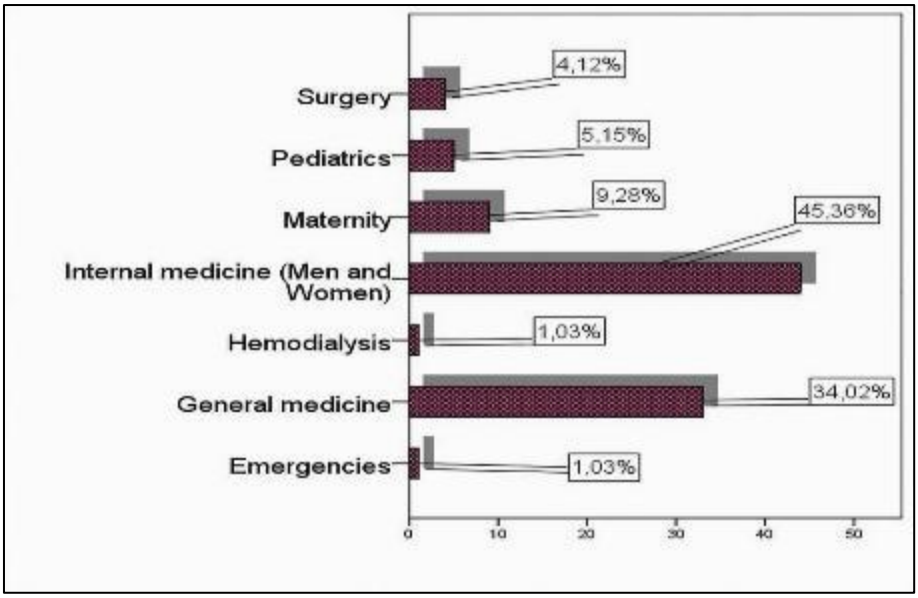

Figure 3 Distribution of cases according to the prescribers' hospital departments

The results in figure 4 show that generalists doctors were at 95% (n = 92), compared to specialists doctors at 5% (n = 5), (N = 97).

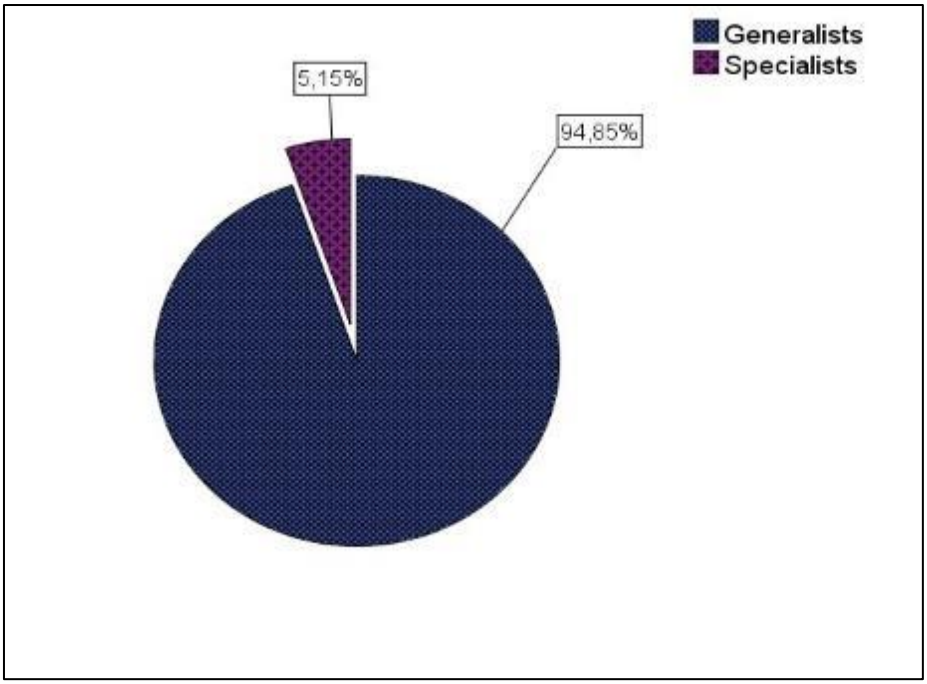

Figure 4 Distribution according to the category of prescribing doctors

The results in figure 5 show that 100% of generalists doctors advised patients to avoid self-medication and to adhere to the treatment, and 98% prescribed antibiotics according to the type of infection and laboratory results and 91% prescribed antibiotics only after clinical examinations and laboratory analyses of the patient according to the care flowchart; (n= 92).

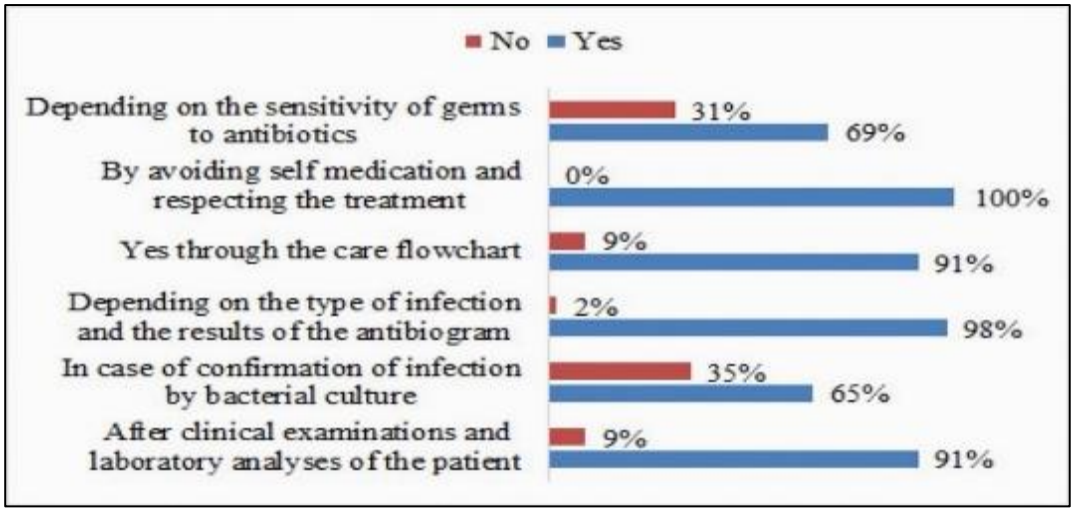

Figure 5 Distribution according to generalists doctors' responses regarding their knowledge and attitudes on antibiotic use

The results in figure 6 show that 100% of specialists doctors prescribed antibiotics only after clinical examinations and laboratory analyses of the patient, after bacteriological culture based on the results of the antibiogram, using the care flowchart, and advised patients to avoid self-medication and to adhere to the treatment; (n=5).

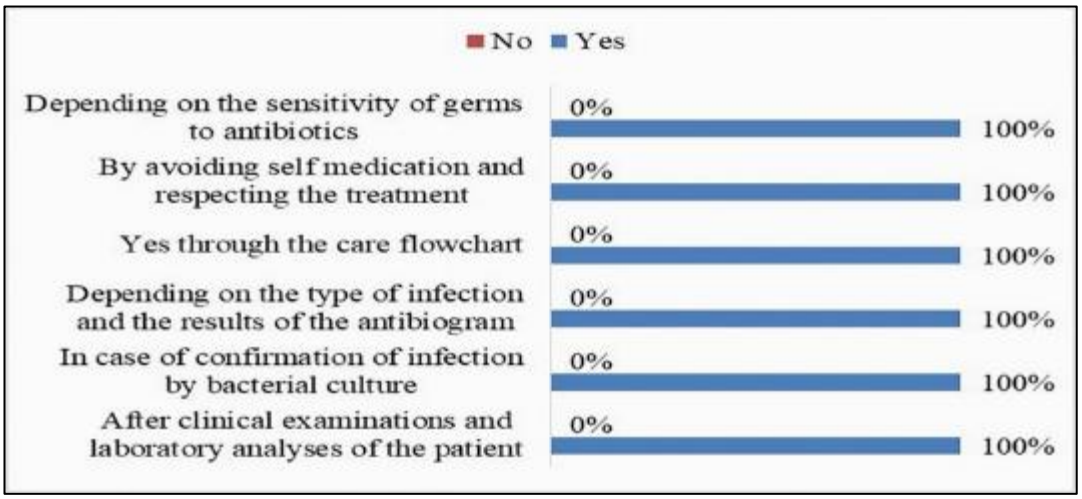

Figure 6 Distribution according to specialists doctors' responses regarding their knowledge and attitudes on antibiotic use

3.2. Data on pharmacists

The results in figure 7 show that private pharmacies and those of polyclinics accounted for 42% and 24% respectively; (n= 107).

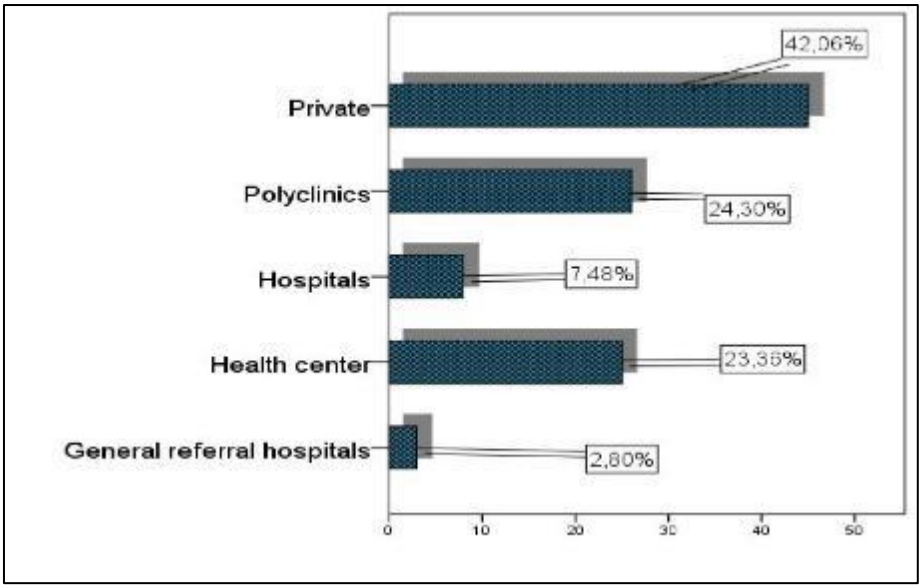

Figure 7 Distribution according to pharmacy location

The results in figure 8 demonstrate that the pharmacies in the municipalities of Lubumbashi, Annexe and Kampemba had respectively 47%; 25% and 17%; (n= 107).

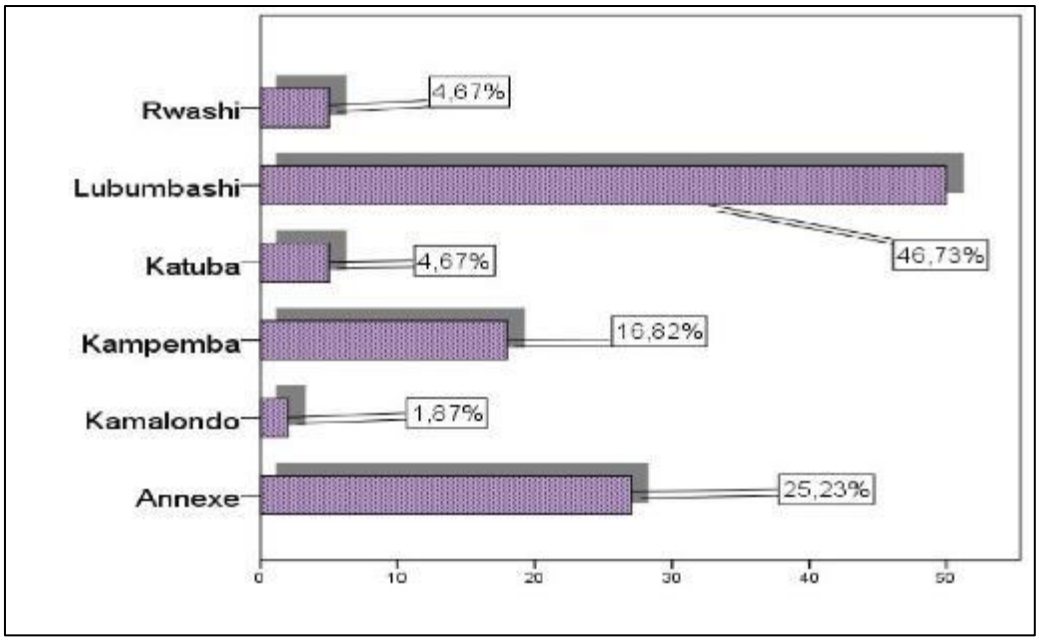

Figure 8 Distribution of pharmacies by municipalities

The results in figure 9 show that no pharmacy degree had 59% (n = 63) and pharmacists 41% (n = 44); (N=107).

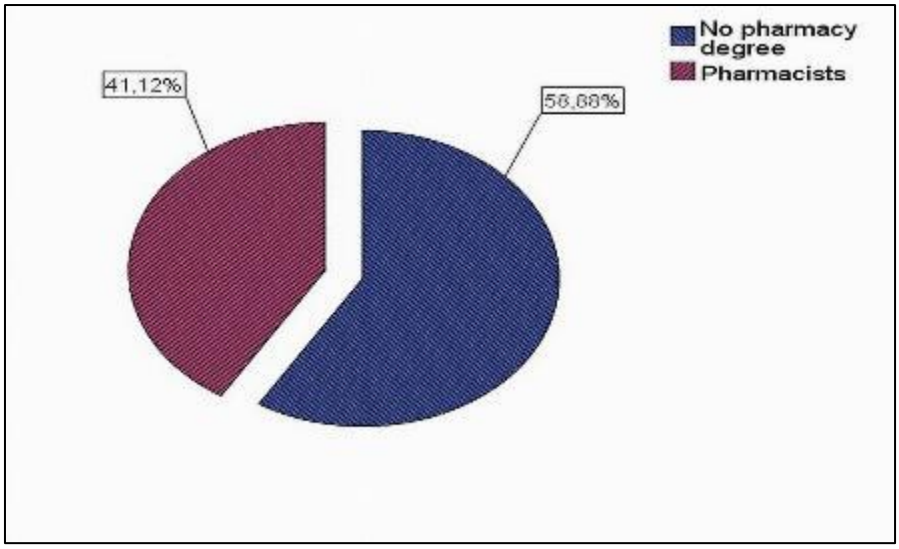

Figure 9 Distribution according to pharmacy studies

The results in figure 10 show that 100% of pharmacists did not sell antibiogram discs; 95% respected the dosage on prescriptions; 93% respected the quality of antibiotics by their proper storage and verification of the expiry date; (n= 44).

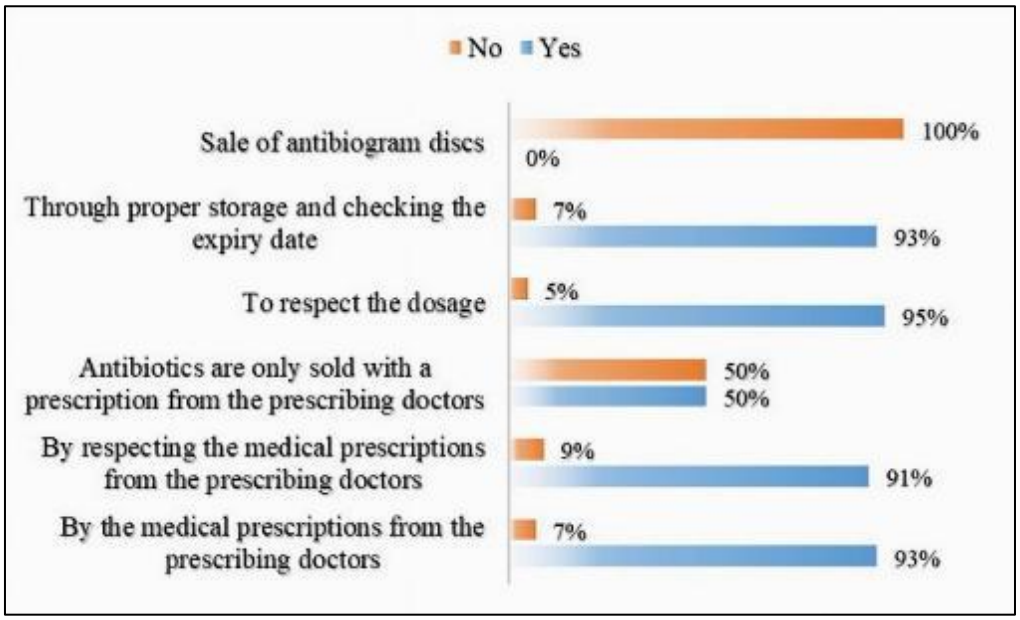

Figure 10 Distribution according to pharmacists' responses regarding their knowledge and attitudes about antibiotics

The results in figure 11 show that 100% of no pharmacy degree did not sell antibiogram discs; 97% respected the dosage on prescriptions; 82% respected the quality of antibiotics by their proper storage and verification of the expiry date; (n= 63).

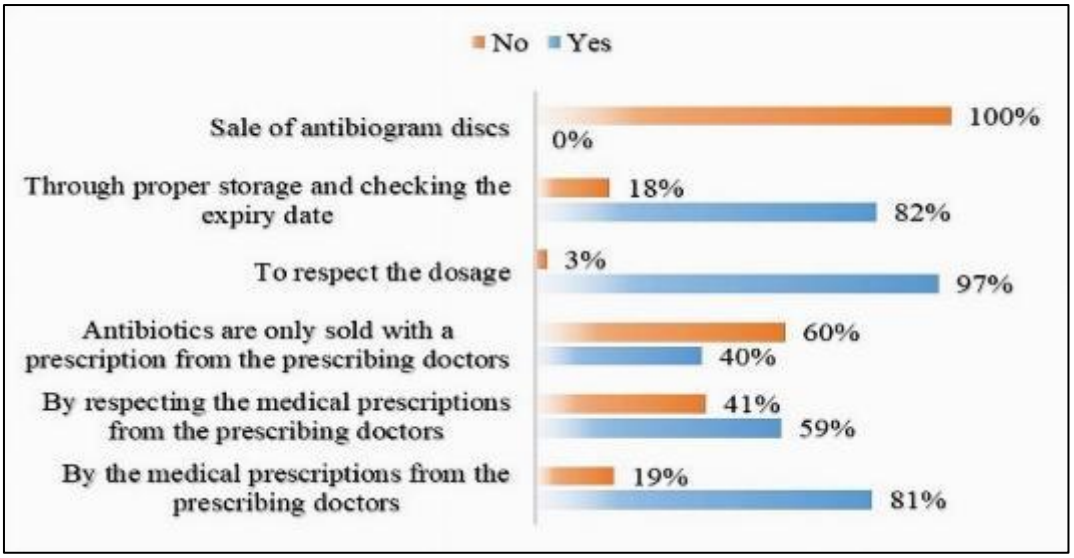

Figure 11 Distribution according to no pharmacy degree' responses regarding their knowledge and attitudes about antibiotics

3.3. Data on medical biologists in the bacteriology laboratory

The results in Figure 12 show that hospital and private bacteriology laboratories accounted for 43% and 29% respectively; then came the other categories; (n=7).

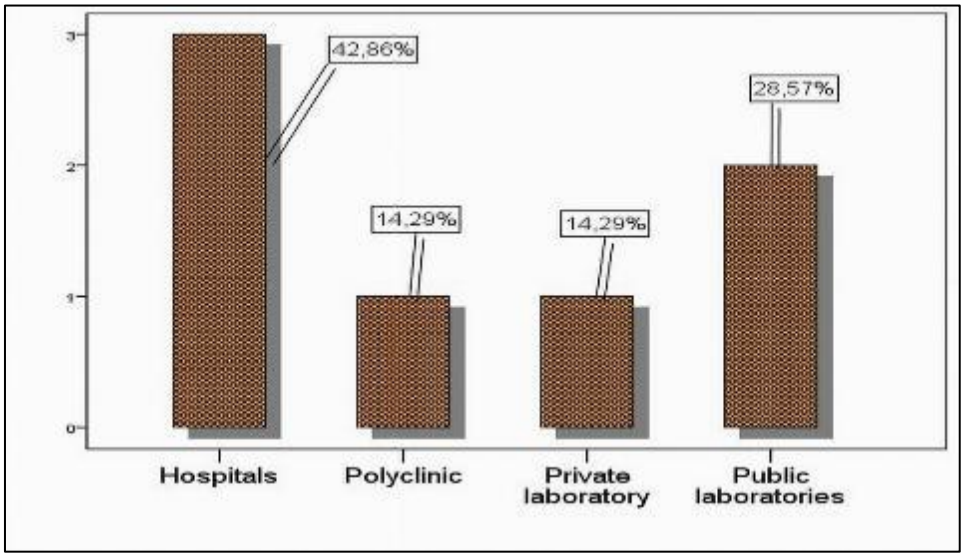

Figure 12 Distribution of Bacteriology Laboratories according to location

The results in Figure 13 show that 100% of the biologists selected the antibiogram discs according to the pathogen; 100% performed the antibiogram according to the disc diffusion method; 100% interpreted the results according to susceptibility, intermediate, and resistance; and 100% stored their antibiogram discs between 2 and 8°C in the refrigerator. 71% did not perform quality control on their antibiogram discs and had no approach to resistant organisms (n = 7).

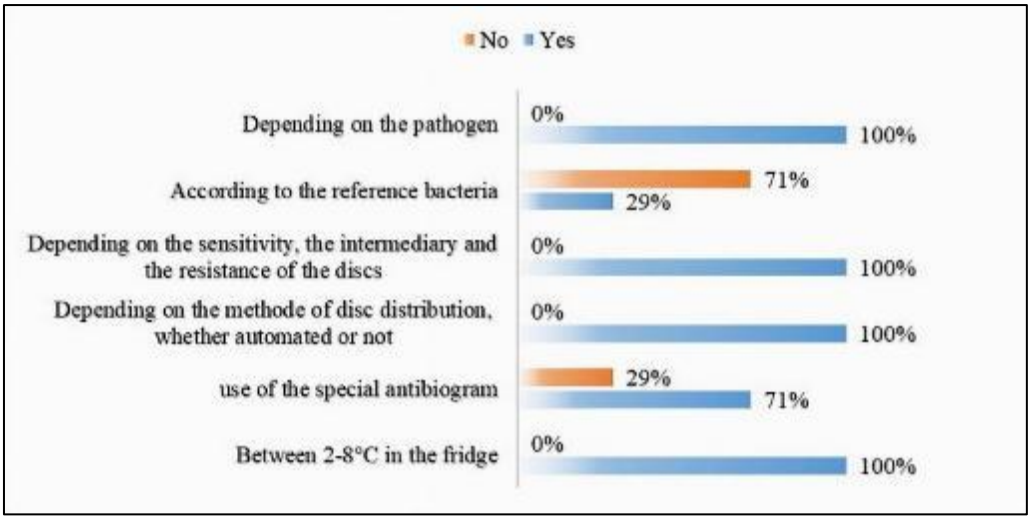

Figure 13 Distribution according to medical biologists' responses regarding their knowledge and attitudes on antibiotic use

The results in Figure 14 show that bacteriology laboratories chose 39% of antibiotics that were not prescribed in clinics or sold in pharmacies.

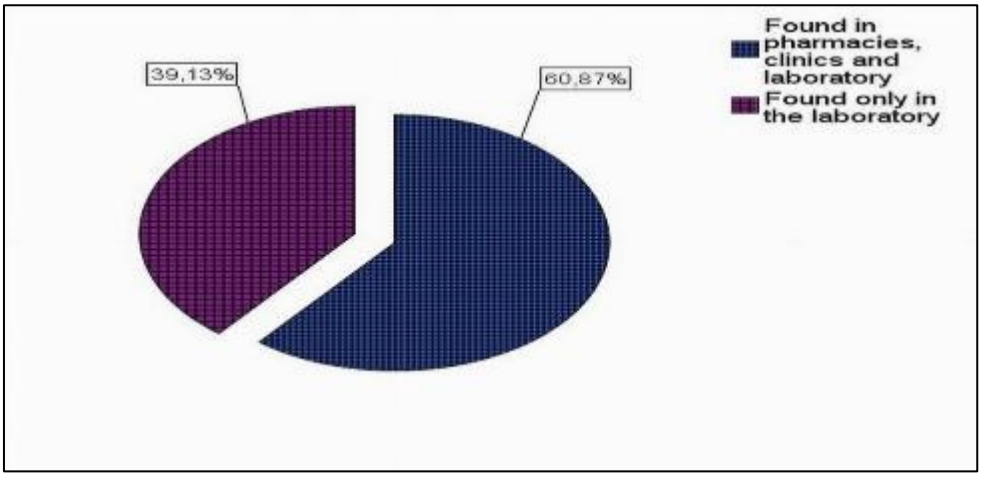

Figure 14 Distribution according to antibiotics found in pharmacies, clinics and the bacteriology laboratory

4. Discussion

The results found in this study share, on a number of points, the findings of other researchers who have worked on knowledge and attitudes regarding medical prescriptions and antibiotic use. Our research reveals both strengths and weaknesses. Among the strengths are the limited coverage of bacteriology laboratories serving the medical facilities in the city of Lubumbashi; the near unavailability of antibiotic susceptibility testing discs in local pharmacies in Lubumbashi, which poses a significant problem regarding the quality of discs obtained from elsewhere; and the fact that bacteriology laboratories sometimes select antibiotics that are unusable by prescribers and pharmacies.

The data covered referral hospitals, general hospitals, polyclinics, health centers, pharmacies, and bacteriology laboratories (Figures 1, 7, and 12). Hospital departments included internal medicine (men's and women's), general consultations, maternity, pediatrics, surgery, emergency, and hemodialysis (Figure 3). This data was collected in all municipalities of the city of Lubumbashi (Figures 2 and 8).

Generalists doctors were more represented (95%) than specialists doctors (5%) (Figure 4). No pharmacy degree were more represented (59%) than trained pharmacists (41%) (Figure 9).

The responses from generalists doctors regarding their knowledge and attitudes on antibiotic use show that 91% decide to prescribe antibiotics that after clinical examinations and laboratory analyses of the patient. So, Kalpana et al., 2023 had confirmed that the practice of prescribing antibiotics depends on the health professional's ability to determine the most beneficial choices for patients [9]. 91% use the care flowchart when prescribing antibiotics and 100% educate patients to avoid self-medication and adhere to the prescribed antibiotic treatment. These results contrast with those found by Massado in Mali in 2023, where almost all prescribers (97.2%) were unaware of the factors guiding antibiotic prescriptions [12]. This observation was also made by El Matal in his medical thesis in Marrakech in 2022 (96.5%) [13]. 98% estimated that the type of infection and the results of the antibiogram these are the factors that influence the decision to choose a specific antibiotic for a patient. But on the other hand 31% do not use the results of the antibiogram to guide their decision on prescribing antibiotics according to the sensitivity of germs to antibiotics and 35% do not know that antibiotics should only be prescribed in the context of a bacterial infection if the infection is confirmed by bacterial culture (Figure 5), however Tallman et al. (2018) found that over 12% of residents identified the antibiogram as a resource when prescribing empirical antimicrobial therapy [14]. Selekman et al. found that only half of practitioners used the local antibiogram despite having access to it [15]. Other studies have shown improved antimicrobial prescribing practices following responsible antimicrobial management and/or antibiogram training [16, 17, 18].

The responses from specialists doctors regarding their knowledge and attitudes on antibiotic use show that they possess a high level of knowledge, as they answered the various questions posed with 100% accuracy (Figure 6). These results can be explained by the fact that their expertise in a specific area of medicine provides them with a stable level of medical knowledge.

In pharmacy, data on knowledge and attitudes regarding antibiotic use demonstrate that 93% of pharmacists and 81% of no pharmacy degree stated that they collaborate with prescribing physicians through their medical prescriptions to ensure responsible use of antibiotics by patients. Community pharmacists, as primary care providers, are an underutilized resource in antibiotic management [19]. Primary care plays an important role in combating antibiotic resistance, as the principle of balancing access to antibiotics while ensuring optimal use is independent of the health context [20]. 91% pharmacists and 59% no pharmacy degree believed they were respecting medical prescriptions issued by the prescribers, and there fore not offering similar antibiotics to patients; however, at least 41% of no pharmacy degree do so, which poses a risk of administering any antibiotic to patients, potentially leading to therapeutic failure. This is why Kalpana Ghimire et al. (2023) indicated that in developing countries, more than 50% of antimicrobials are most often purchased from pharmacies, dispensed, or sold inappropriately [9]. 50% pharmacists and 40% no pharmacy do not sell antibiotics without a medical prescription and 96% pharmacists and 97% no pharmacy advise patients to follow the prescribed dosage to avoid bacterial resistance. In the same vein, a study conducted in Lubumbashi found non-compliance with the prescribed treatment duration in proportions ranging from 35.48% to 84.08% [21]; in the review and meta-analyses by Maria R Gualano et al., 47.1% (95% CI 36.1–58.2) of subjects reported stopping antibiotics when they felt better [22], and in another study conducted in Moshi, Tanzania, 58.6% reported having stopped antibiotics according to the prescribed dosage [23]. The distribution of antibiotics without a prescription in pharmacies contributes significantly to the growing global public health crisis of antibiotic resistance [24]. 93% pharmacists and 82% no pharmacy ensure the quality of antibiotics sold by their proper storage and verification of the expiry date. This should be encouraged to ensure that patients have access to good quality antibiotics, since pharmacists are considered essential members of the healthcare team who play an important role in medication use and in providing advice on how to use medications appropriately [25]. 100% pharmacists and no pharmacy do not sell antibiogram discs because they expire due to a lack of customers (Figures 10 and 11); we say that this aspect of things does not facilitate the correct choices of antibiotics in bacteriology laboratories due to a critical lack of antibiogram discs on site in Lubumbashi.

Among medical biologists, 100% choose antibiotics to include in antibiogram discs depending on the pathogen. But, 28.6% validate the performance and quality of the antibiogram discs by however, 71.4% of the reference bacteria do not perform quality control checks in their departments, risking false results in antibiograms. Let's say 100% interpret the results of the antibiogram according to the sensitivity, intermediate, and resistance of the bacteria. 100% perform the antibiogram using the disk diffusion method. 28.6% perform the special antibiogram for resistant bacteria and 100% retain the antibiogram discs between 2-8 °C in the fridge (Figure 13)[26, 27]. In this study, bacteriology laboratories selected 39% of antibiotics that were neither prescribed in clinics nor sold in pharmacies (Figure 14). Such practices represent a waste of financial resources in laboratories and demonstrate a lack of the necessary knowledge for selecting antibiotic discs for antibiograms.

5. Conclusion

In conclusion, we say that in our research environment, the limited number of bacteriology laboratories poses enormous problems in the prevention of antibiotic resistance.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to declare.

Statement of ethical approval

This study was approved by the medical ethics committee of the University of Lubumbashi under number UNILU/CEM/008/2025.

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