

Connaissances, attitudes et pratiques sur les bactéries multirésistantes dans les services de réanimation

Knowledge, attitudes, and practices regarding multidrug-resistant bacteria in intensive care units

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Résumé :

Introduction : Les formes graves du paludisme sont souvent décrits chez le sujet non immun. Le but de ce travail était de décrire les profils clinique, thérapeutique et évolutif du paludisme grave de l'adulte résidant au Gabon hospitalisé en réanimation au Centre Hospitalier Universitaire de Libreville. **Matériel et méthodes :** Il s'agissait d'une étude observationnelle, descriptive à recueil de données rétrospectif sur 12 ans. Les patients adultes résidents au Gabon, hospitalisés pour paludisme grave selon les critères de l'OMS étaient inclus. **Résultats :** Sur 221 cas de paludisme grave, 90 (40,7%) étaient des adultes résidents au Gabon. Le sexe ratio était de 1,5. L'âge moyen était de $41,7 \pm 19,3$ ans. Il n'y avait pas d'usage de moustiquaires imprégnées dans 88 cas (97,8%). Les défaillances neurologique et rénale étaient observées respectivement chez 64 patients (71,1%) et 44 patients (48,9%). L'artésunate était utilisé dans 76 cas (84,4%). Une ventilation mécanique était instaurée chez 20 patients (22,2%) et 13 patients (14,4%) avaient bénéficié d'une épuration extra-rénale. La durée moyenne d'hospitalisation était de $5,7 \pm 4,4$ jours. Le taux de mortalité était de 42,2%. **Conclusion :** La fréquence du paludisme grave chez l'adulte vivant au Gabon est élevée. L'adulte jeune est plus concerné. La prise en charge fait appel à des thérapeutiques très lourdes en raison des défaillances neurologique et rénale. **Mots-clés :** Paludisme grave, Adulte, Réanimation, Libreville

Abstract

Background: The emergence of nosocomial infections in intensive care units raises questions about the levels of knowledge, attitudes, and practices (KAP) among healthcare personnel regarding multidrug-resistant bacteria (MDRB). Our objective was to assess the KAP levels of medical staff in intensive care units concerning multidrug-resistant bacteria. **Methods:** We conducted a cross-sectional study over a three-month period in the intensive care units of five hospitals in the city of Douala, including 72 medical personnel from these departments. KAP levels were assessed using a validated 48-item survey questionnaire. Data were analyzed using R software, and Pearson's Chi-square independence tests with Fisher's exact extraction were used to compare KAP levels among medical staff. **Results:** Physicians (n = 22) generally had better knowledge of multidrug-resistant bacteria (MDRB) in intensive care compared to nurses (n = 50), particularly in key areas such as infection prevention (82% vs. 56%, p = 0.04) and the objective of combating antibiotic resistance (73% vs. 20%, p < 0.001). Attitudes and practices regarding MDRB were generally homogeneous between the two groups, with high compliance rates, particularly for systematic handwashing (100% in both groups, p = 1). However, some areas for improvement remain, particularly regarding systematic screening and the use of procalcitonin in cases of suspected infection. **Conclusion:** Our findings highlight the importance of strengthening the training of nursing staff, particularly in infection prevention and resistance management, to improve the care of MDRB infections. **Keywords:** Multidrug-resistant bacteria, intensive care, knowledge-attitudes-practices, infection prevention.

Déclaration de liens d'intérêts : Aucun lien d'intérêt

Introduction: Nosocomial infections represent a major global public health threat, affecting approximately 7% of hospitalized patients in developed countries and up to 15% in developing countries [1]. They significantly increase patient morbidity and mortality, prolonging hospital stays by approximately 5 to 29 days and raising healthcare costs by 20% to 30% [2,3]. For healthcare personnel, these infections increase the risk of exposure to resistant pathogens, compromising both their health and their ability to provide quality care [4]. In intensive care units (ICUs), the prevalence of nosocomial infections is even higher, reaching up to 50% in some units, primarily due to invasive procedures and the severity of patients' conditions [5]. Globally, nosocomial infections account for approximately 4.1 million cases annually in Europe, with a particularly significant impact in intensive care units, where more than 30% of hospitalized patients are affected [6]. In Africa, infection rates can reach up to 25%, exacerbated by inadequate infrastructure and limited access to resources [7]. In Cameroon, a study conducted in the ICU of Laquintinie Hospital in Douala reported a high prevalence of nosocomial infections associated with multidrug-resistant bacteria (MDRB), mainly Gram-negative bacteria such as *Escherichia coli* (23.1%) and Gram-positive cocci (15.4%) [8]. Multidrug-resistant bacteria (MDRB) are one of the leading causes of nosocomial infections, accounting for 50% to 60% of infections in ICUs worldwide [9]. These pathogens complicate therapeutic management, prolong hospital stays, and are associated with mortality rates ranging from 30% to 50% [10]. In Africa and Cameroon, their emergence is attributed to factors such as inappropriate antibiotic use, lack of standardized prevention protocols, and deficiencies in infection control measures [11,12]. In this context, the emergence of MDRB in

Cameroonian hospitals, particularly in ICUs, could be linked to gaps in the knowledge, attitudes, and practices (KAP) of medical personnel. Assessing healthcare workers' KAP is therefore crucial to identifying deficiencies and proposing appropriate interventions to reduce MDRB transmission and improve healthcare quality. **Methodology:** We conducted a cross-sectional study in five public hospitals in Douala, Cameroon, each with an ICU (General Hospital of Douala, Gyneco-Obstetrics and Pediatric Hospital of Douala, Laquintinie Hospital, Nylon District Hospital, and Douala Regional Military Hospital) over a six-month period from May 2024 to November 2024. The selection of hospitals was based on their capacity to provide intensive care services and the presence of at least one anesthesiologist-intensivist. A three-stage stratified probabilistic sampling method was used to systematically recruit eligible medical personnel, including intensivists, residents, general practitioners, senior nurses, state-certified nurses, and nursing assistants. For analysis, participants were grouped into physicians and nurses. Active ICU staff during the study period were included, while those who refused to participate by withholding their consent were excluded. Data were collected using a standardized and pre-tested questionnaire comprising 48 questions divided into four sections: staff identification, knowledge of antimicrobial resistance, attitudes toward patients with MDRB infections, and practices in high-risk situations. The studied variables included sociodemographic characteristics (gender, age, profession, experience), as well as knowledge, attitudes, and practices, which were assessed using a predefined scoring system (**Table 1**). Performance levels were classified as good, average, poor, or weak.

Table 1: Correspondence between the percentage of correct answers and the level of knowledge on antibiotic resistance [13]

Percentage of correct answers (%)	Level
≤ 50%	Weak
≤ 65%	Poor
≤ 85%	Average
≥ 85%	Good

Data were entered into an Excel spreadsheet and analyzed using R software version 4.4.2 for Windows. Data were presented as frequency (N, n) and percentage (%) in tables. Fisher's exact test was performed to compare the proportions of each variable between physicians and nurses. For this test, the confidence interval for the null hypothesis was set at 95%, with a margin of error of 5% (significant p-value if $p < 0.05$). Approval was obtained from the Institutional Ethics Committee for Human Health Research of the University of Douala and the ethics committees of the respective hospitals under reference numbers: N° 164 AR/MINSANTE/HGD/DM/05/24, N°

2024/0444/L/HGOPED/DG/DFRI, N° 01230529 CEHMR2,N°1062/AR/MINSANTE/DHL,N° 083/MINSANTE/DRSPL/DNSHDN. Written informed consent was obtained from all participants, including the possibility of withdrawal at any time without consequences. Data anonymization was ensured to guarantee confidentiality. **Results: Knowledge of Multidrug-Resistant Bacteria** Physicians (n = 22) generally had better knowledge of MDRB in intensive care compared to nurses (n = 50), although both groups showed a perfect score (100%) for general knowledge ($p = 1$).

Significant differences were observed in key areas such as MDRB infection prevention (82% vs. 56%, $p = 0.04$), the objective of combating antibiotic resistance (73% vs. 20%, $p < 0.001$), and antibiotic selection pressure (50% vs. 68%, $p = 0.03$). Both

groups had gaps in knowledge regarding MDRB species (14% vs. 8%, $p = 0.6$). These results highlight the need to strengthen nurse training, particularly in infection prevention and resistance management (**Table II**).

Table II: Comparison of knowledge of multidrug-resistant bacteria between physicians and nurses.

Knowledge	Doctors (n = 22)				Nurses. (n = 50)				p-value
	Correct		Incorrect		Correct		Incorrect		
	n	%	n	%	n	%	n	%	
General knowledge of MDRB in intensive care	22	100	0	0	50	100	0	0	1
Definition of multidrug-resistant bacteria	15	68	7	32	33	66	17	34	1
How to prevent MDRB infections	18	82	4	18	28	56	22	44	0,04*
Knowledge of MDRB species in intensive care	3	14	19	86	4	8	46	92	0,6
Modes of MDRB transmission in intensive care	14	64	8	36	27	54	23	46	0,6
Main causes of MDRB selection	17	77	5	23	32	64	18	36	0,4
Objective of combating antibiotic resistance	16	73	6	27	10	20	40	80	<0,001***
Main consequences of MDRB	13	59	9	41	27	54	23	46	0,7
Selection pressure of antibiotics on MDRB	9	41	13	59	34	68	16	32	0,03*
Factors triggering antibiotic resistance	18	82	4	18	38	76	12	24	0,7

The data are presented as frequency (n) and percentage (%). P-value: Fisher's exact test was performed to compare the proportions of each variable between physicians and nurses. For this test, the confidence interval for the null hypothesis was set at 95%, with a margin of error of 5%

Attitudes in Cases of Multidrug-Resistant Bacteria Infections: Table 2 compares the attitudes towards multidrug-resistant bacteria (MDRB) infections between physicians (n = 22) and nurses (n = 50). The rates of correct responses were high for most variables in both groups, generally exceeding 80%. Differences between physicians and nurses were not significant for most variables, such as the attitude towards a patient carrying MDRB ($p = 1$) or

the presence of a hygienist responsible for disinfecting MDRB ($p = 1$). However, more pronounced gaps were observed in specific aspects, such as systematic nasal or anal screening (73% for physicians vs. 84% for nurses, $p = 0.4$), although the difference remained non-significant. These results demonstrate a good uniformity in knowledge and practices between the two groups, with some areas for improvement (**Table III**).

Table III: Comparison of attitudes in cases of MDRB infections between physicians and nurses.

Attitudes in cases of multidrug-resistant bacteria infections	Doctor (n = 22)				Nurses(n = 50)				Pvalue
	Correct		Incorrect		Correct		Incorrect		
	n	%	n	%	n	%	n	%	
Attitudes toward a patient carrying MDRB	20	91	2	9	46	92	4	8	1
Hospitalization of MDRB and septic patients in the unit	20	91	2	9	46	92	4	8	1
Attitudes towards the management of MDRB patient waste	19	86	3	14	39	78	11	22	0.6
Management of MDRB patients	19	86	3	14	41	82	9	18	0.9
Protocol for managing MDRB patients	20	91	2	9	43	86	7	14	0.8
Presence of a hygienist responsible for disinfecting MDRB	21	95	1	5	49	98	1	2	1
Systematic nasal or anal screening for MDRB colonization	16	73	6	27	42	84	8	16	0.4
Attitude before and after caring for an MDRB patient	20	91	2	9	47	94	3	6	1
Availability of shared hospitalization rooms	21	95	1	5	46	92	4	8	0,9

The data are presented as frequency (n) and percentage (%). P-value: Fisher's exact test was performed to compare the proportions of each variable between physicians and nurses. For this test, the confidence interval for the null hypothesis was set at 95%, with a margin of error of 5%.

Practices in High-Risk Situations: The rates of positive responses ("Yes") were generally high in both groups (physicians and nurses), with perfect compliance for certain practices, such as systematic handwashing before and after each procedure (100% for both groups, $p = 1$). Differences were not statistically significant for all variables ($p > 0.05$). Practices such as the laboratory's identification of the MDRB family, the systematic administration of an antibiotic in case of fever, and biological sampling

before probabilistic antibiotic therapy showed similar rates between physicians and nurses. The most notable differences were observed in "procalcitonin use in case of suspected infection" (91% for physicians vs. 84% for nurses, $p = 0.7$) and "designation of the area for donning PPE before procedures" (68% vs. 76%, $p = 0.5$), although these differences remained non-significant. Overall, these results reflect good consistency in practices, with some areas for improvement (Table 4).

Table 4: Comparison of practices in high-risk infection situations between physicians and nurses in intensive care units.

Practices in case of risk situations	Doctors (N = 22)				Nurses (N = 50)				p-value
	Yes		No		Yes		No		
	n	%	n	%	n	%	n	%	
Use of gloves during patient care	21	95	1	5	49	98	1	2	0,5
Systematic handwashing before and after each procedure	22	100	0	0	50	100	0	0	1
Identification of the MDRB family by the laboratory	21	95	1	5	49	98	1	2	0,5
Number of days required to obtain bacterial culture results	21	95	1	5	42	84	8	16	0,2
Choice of antibiotic therapy upon admission of an infected patient	21	95	1	5	44	88	6	12	0,4
Systematic administration of an antibiotic in case of fever	19	86	3	14	44	88	6	12	1
Performing biological sampling before initiating probabilistic antibiotic therapy	20	91	2	9	45	90	5	10	1
Is procalcitonin systematically performed in case of suspected infection?	20	91	2	9	42	84	8	16	0,7
Wearing PPE before providing care to an MDRB patient	15	68	7	32	38	76	12	24	0,5
Do you perform laundry treatment and daily disinfection of rooms?	19	86	3	14	47	94	3	6	0,3

The data are presented as frequency (n) and percentage (%). P-value: Fisher's exact test was performed to compare the proportions of each variable between doctors and nurses. For this test, the confidence interval for the null hypothesis was set at 95%, with a margin of error of 5%.

Discussion: Multidrug-resistant bacteria (MDR) represent a major challenge in hospital settings, particularly in intensive care units, where patients are more vulnerable due to the severity of their health conditions. These pathogens are responsible for increased mortality rates, prolonged hospital stays, and higher healthcare costs. We are justified in attributing, at least in part, the spread of MDR to gaps in the knowledge, attitudes, and practices (KAP) of healthcare professionals regarding their management and prevention. Addressing these KAP deficiencies is essential for identifying weaknesses, enhancing staff competencies, and implementing appropriate prevention and management strategies. Therefore, our study aimed to bridge this gap by analyzing the KAP of intensive care unit staff in five public hospitals in Douala, Cameroon, to contribute to better MDR management, reduce nosocomial infection rates, and improve patient care. Our study results revealed notable differences between doctors and nurses regarding their knowledge of multidrug-resistant bacteria (MDR), with significantly higher scores among doctors for key aspects such as infection prevention (82% vs. 56%, $p = 0.04$) and antimicrobial resistance control (73% vs. 20%, $p < 0.001$). This difference is mainly attributed to the more comprehensive medical training that doctors receive compared to nurses in Cameroon and worldwide. This explanation is supported by a study conducted by Atalay and Gelaw in 2023, which showed that doctors have a better understanding of MDR, particularly resistance mechanisms and prevention protocols [14]. Additionally, research by Bunduki et al. revealed that nurses face greater challenges in implementing infection control measures related to MDR. These gaps are often due to a lack of continuous training and limited access to educational resources, compromising their ability to implement effective prevention strategies [11]. This finding aligns with the conclusions of Tadesse et al.,

who also highlighted that in African hospitals, nurses receive fewer updates on MDR management strategies compared to doctors, explaining the observed disparities [15]. Another possible explanation is that local intensive care units lack libraries to facilitate access to and updating of knowledge on MDR for nurses, although this does not exclude the possibility of personal updates through online resources and university libraries. The high compliance rate for hand hygiene practices in both groups (100%, $p = 1$) is a positive point. However, as highlighted by the study of Ateudjieu and Yakum in Cameroon, this practice, while essential, is often insufficient if not accompanied by complementary measures such as systematic MDR screening or the use of biomarkers like procalcitonin [16]. The gaps regarding these advanced practices are concerning, as they play a crucial role in preventing MDR dissemination, as demonstrated by a global meta-analysis by Vincent et al. [17]. In Africa, MDR infection rates in intensive care units are alarming, reaching up to 40% of hospitalized patients, as reported by Bunduki et al. [15]. These rates are exacerbated by the absence of standardized protocols and the heavy workload of healthcare personnel. In Cameroon, Essi and Njoya have emphasized the urgent need to develop continuous training programs to improve healthcare workers' knowledge and practices, particularly in high-risk environments such as intensive care units [18]. Our results confirm that initial training differences between doctors and nurses contribute to the observed knowledge gaps. However, the uniformity of attitudes and practices concerning basic aspects, such as hand hygiene, suggests that widespread awareness campaigns could be beneficial for nurses. **Conclusion:** Our study highlighted significant disparities in knowledge between doctors and nurses in intensive care units regarding KAP on multidrug-resistant bacteria (MDR).

Doctors demonstrated a better understanding of key aspects, particularly infection prevention and antimicrobial resistance control. In contrast, attitudes and practices were generally homogeneous between the two groups, with high adherence to basic measures such as systematic handwashing. However, gaps remain, particularly in systematic screening and the use of biomarkers such as procalcitonin. Strengthening continuous training and improving access to educational resources are necessary to bridge knowledge gaps while reinforcing practices for optimal MDR management in intensive care settings. **Ethical Approval and Consent to Participate:** The study was reviewed and approved by the Institutional Ethics Committees of the respective hospitals. Written informed consent to participate in this study was properly explained to the healthcare personnel in intensive care units, and their agreement to participate was obtained without coercion. **Data and Materials Availability:** The raw data supporting the conclusions of this study will be made available by the authors without excessive restriction and with a reasonable justification from

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Author Contributions

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