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Letter to the Editor

High prevalence of multidrug-resistant bacteria on patient medical file surfaces at five critical care units in Kampala, Uganda: an explanatory sequential mixed-methods study

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Introduction

Intensive care units (ICUs) and high-dependency units (HDUs) care for critically ill patients, many of whom have multidrug-resistant (MDR) bacteria.[1,2] Healthcare providers (HCPs) interact with patients and their medical records in these settings daily. For example, HCPs often place patient files near the bedside and in various locations throughout the units, which may increase the risk of transferring MDR among patients and providers.[2] In Uganda, most health facilities rely on a paper-based system for recording and storing patient clinical data,[3] raising concerns about cross-contamination of bacteria and hospital-acquired infections. Nevertheless, research on MDR contamination of patient medical records in Ugandan ICUs and HDUs remains sparse. To address this gap, our study investigated the prevalence and distribution of MDR bacteria on the surfaces of patient medical files. Additionally, we explored HCP perspectives regarding infection prevention and control (IPC) at three ICUs and two HDUs in Kampala through an explanatory sequential mixed-methods approach.[4]

Methods

We studied three ICUs – the cardiac ICU at Uganda Heart Institute, the pediatric and main ICUs at Mulago National Referral Hospital (MNRH) – and two HDUs at MNRH in Uganda. First, we conducted a descriptive cross-sectional study that used simple random sampling to select patient medical files through unique codes recorded in a health information electronic system. We included 33 out of 40 medical files based on Kish and Leslie's formula for finite population, assuming a 95% confidence level, a 50% outcome prevalence, and a 5% sampling error. Specimens from files not expected to be cleaned or disinfected daily were collected one hour after the unit's daily cleaning and disinfection. We used Copan's Flexible Minitip Flocked Swab with Liquid Amies Medium, manufactured by Murrieta, United States, to swab a standardized surface area of 10 centimeters squared per file. Specimen collection occurred one hour after daily cleaning and disinfection of the units to maintain consistent exposure conditions. Swabs were collected in liquid Amies transport media, clearly labeled with the specimen source, collection date, and time. Samples were transported to the Makerere University Medical Microbiology Laboratory, where a certified Senior Medical Microbiologist conducted testing for World Health Organization priority pathogens: *Enterococcus, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii*, and *Pseudomonas aeruginosa*. Upon arrival, the specimens were immediately plated on sheep blood agar to isolate *Staphylococcus aureus*, and MacConkey agar for isolating gram-negative organisms.

MDR was defined as laboratory confirmation of the WHO priority pathogens following the 33rd edition of the Clinical Laboratory Standards Institute on Antimicrobial Susceptibility testing guidelines for antibiotic susceptibility interpretation.[5,6] We descriptively summarized the data by computing the prevalence of MDR bacteria on medical record surfaces. Second, we purposively sampled HCPs, specifically Heads of ICUs and HDUs, as key informants for our interviews, which offered valuable insights into IPC measures in their units. All interviews were audio-recorded, transcribed verbatim, and independently coded by two analysts to prevent subjective bias and maintain methodological rigor in our thematic analysis. Quantitative and qualitative results were jointly interpreted. Clarke International University Research Ethics Committee approved the study (CIU-REC 2021-69).

Results

Six of 33 files (18.2%) had MDR bacteria on their surfaces (Table 1). Contamination was significantly associated with the type of medical diagnosis ($P = 0.014$) and the file storage location (P=0.010). The MDR pathogens identified were Fastidious *Acinetobacter* (5/33; 15.2%) and methicillin-resistant *Staphylococcus aureus* (1/33; 3%).

Qualitative data revealed that HCPs were knowledgeable about IPC measures:

> *"We have to maintain a sterile ICU. Nurses should decontaminate the unit with JIK [sodium hypochlorite] solution plus soap. We also have to damp dust before every shift." [Nurse In-Charge 1].*

However, HCPs' adherence to ICP measures was compromised by heavy workloads:

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Table 1. Participant characteristics stratified by the presence of multidrug-resistant bacteria on patient medical file surfaces

Variables	Categorical variables	Multidrug-resistant bacterial contamination		P-value
		No (N = 27)	Yes (N = 6)	
Sex	Male	20 (91)	2 (9)	0.146
	Female	7 (64)	4 (36)	
Duration in hospital (days)	< 5	15 (83)	3 (17)	1.000
	05 October	7 (78)	2 (22)	
	>10	5 (83)	1 (17)	
Medical unit	HDUs	19 (83)	4 (17)	0.603
	ICUs	5 (71)	2 (29)	
Type of diagnosis	General surgery	7 (100)	0 (0.0)	0.014
	Orthopedic	4 (100)	0 (0.0)	
	Neurosurgery	16 (84)	3 (12)	
	Heart failure	0 (0.0)	1 (100)	
	Pulmonary failure	0 (0.0)	2 (100)	
Number of antibiotics prescribed	1	9 (90)	1 (10)	0.733
	2	12 (80)	3 (20)	
	≥3	6 (75)	2 (25)	
Class of antibiotics prescribed	Penicillin	10 (91)	1 (9)	0.515
	Cephalosporin	24 (86)	4 (14)	
	Aminoglycoside	9 (75)	3 (25)	
	Nitroimidazole	8 (80)	2 (20)	
	Glycopeptides	1 (50)	1 (50)	
	Colistin	2 (67)	1 (33)	
Patient treatment modalities	Diagnostic	11 (79)	3 (21)	0.872
	Invasive medical procedures	4 (80)	1 (20)	
	Intubation	8 (73)	3 (27)	
	Surgery	13 (87)	2 (13)	
Size of the patient file	Small size (<10 papers)	8 (80)	2 (20)	1.000
	Medium size (10-15 papers)	11 (85)	2 (15)	
	Large size (≥16 papers)	8 (80)	2 (20)	
Storage of medical file	Separate cabinet in the nurses' room	1 (33)	2 (67)	0.01
	Nurse's workstation	25 (93)	2 (7)	
	Patient's bedside	1 (33)	2 (67)	
Patients transferred from other facilities	Yes	13 (93)	3 (7)	1.000
	No	14 (82)	3 (12)	

Note: Row percentages are presented as total in a row as a denominator.

> *"The protocol for admitting patients to the intensive care and high dependence units says that the patient should have a chlorhexidine bath, but it is never done. Also, all invasive tubes should be removed at admission, but it is never done. Staff also rarely keep a log to ensure we change tubes every seven days" [Nurse In-Charge 2].*

Training in IPC information, education, and communication (IEC) was identified as a strategy to prevent MDR on patient medical files:

> *"It is vital that IPC guidelines are known to all healthcare providers and taught to all new staff. The guidelines and posters should be available, and a procedure book should be in our vicinity. The entrance and noticeboards are good places to put the IPC guidelines" [Nurse In-Charge 5].*

Discussion

Our study revealed that nearly one in five patient medical files in ICUs and HDUs were contaminated with MDR bacteria. Most contaminated files belonged to patients treated with aminoglycoside or glycopeptide-based regimens, aligning with findings from previous research.[7] Additionally, medical files for patients who underwent invasive procedures showed the highest surface contamination levels with MDR—consistent with an earlier study.[8] The nature of invasive procedures for critically ill individuals—which demand frequent interaction from HCP both during and post-procedure—alongside the educational environment of teaching hospitals where trainees are present may explain

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the contamination observed on patients' medical files. Although the surveyed HCPs were aware of IPC measures, adherence to them was lacking, primarily due to their heavy workloads. They proposed training sessions on IEC materials focused on IPC measures to improve compliance. Although our findings are preliminary and limited by small sample size, they indicate that adopting straightforward strategies such as monitoring and reviewing hand hygiene practices in ICUs and HDUs could improve adherence to IPC protocols.

Data availability statement. The data sets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Author contributions. MK and SO conceptualized and designed the study. MK acquired the data. MK, JI, and SO analyzed and interpreted the data. JI and SO drafted the manuscript. JI, AM, and SO revised the manuscript for intellectual content. All authors (MK, JI, AM, and SO) read and approved the final manuscript.

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Competing interests. The authors declare that they have no competing interests.

Ethical standard. This study was approved by the Clarke International University Research Ethics Committee (CIU-REC 2021-69) and received administrative clearance from Mulago National Referral Hospital. After thoroughly explaining the study's purpose, benefits, and potential risks, all HCPs provided written informed consent before the key informant interviews.

Declarations. We declare that authors have no conflict of interest.

List of abbreviations. HDU: High Dependence Unit.
ICU: Intensive Care Unit.
IEC: Information, Education, and Communication.
IPC: Infection Prevention and Control
WHO: World Health Organization

Consent for publication. Not applicable

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