Journal of Public Health for Tropical and Coastal Region (JPHTCR)
Journal homepage: https:/ejournal2.undip.ac.id/index.php/jphtr/index
ISSN: 2597- 4378

Evolution of Maternal Care-Associated Infections at Bogdogo University Hospital in Burkina Faso.

W. Félicité Nana[1*], Absatou Ba[2], Abdoulaye So[1], Ghislain G. Poda[3], Adama Ouattara[2], Charlemagne Ouedraogo[2], Maxime K. Drabo[1]
[1]Institute for Research in Health Sciences, CNRST, Ouagadougou, Burkina Faso
[2]Bogdogo University Hospital, Ministry of Health, Ouagadougou, Burkina Faso
[3]World Health Organization, Bangui, Republik Afrika Tengah
*Corresponding Author: Email: naf.dqss@gmail.com

Abstract
Introduction: Healthcare-associated infections (HAIs) are major public health issues in healthcare facilities. It is one of the main causes of maternal mortality, particularly in developing countries, where infrastructure and infection control measures are often inadequate. This study aimed to determine the prevalence, most common infections, and responsible pathogens and antimicrobial resistance patterns of maternal HAIs in a healthcare facility in Burkina Faso.
Methods: This retrospective cross-sectional study was based on the patients' medical records between 1 and 30 March 2025. Data from patients who developed HAIs between 2018 and 2022 were collected, with a focus on endometritis, surgical site and urinary tract infections. The causative organisms were identified, and their resistance to antimicrobials was tested. Total sampling technique was used, based on available data. Trends and factors influencing the prevalence of HAIs were also analyzed.
Results: The overall prevalence of HAIs was 4.27%. The most common infections were endometritis (2.17%), urinary tract infections (1,36%), and surgical site infections (0.74%). The main pathogens identified were *Enterobacteriaceae* (43.3%), yeasts of the *Candida* genus (30.8%), and *staphylococci* (11%). Antimicrobial resistance was high, particularly multidrug resistance, in E. coli and K. pneumoniae strains, as well as a notable rate of methicillin-resistant Staphylococcus aureus (MRSA) at 19.04%.
Conclusion: The prevalence of HAIs is high, and multidrug-resistant pathogens are a major complication. There is an urgent need to strengthen infection prevention strategies, improve microbiological surveillance, and promote rational use of antibiotics to control the spread of resistance.

Keywords: Healthcare-associated infections; antimicrobial resistance; obstetrics

DOI: https://doi.org/10.14710/jphtcr.v8i2.26880

Article History: Received: 06th May 2025, revised: 13th August 2025 accepted: 15th August 2025

Introduction

Healthcare-associated infections (HAIs), formerly known as nosocomial infections, are a major public health issue, particularly in low-resource countries. Millions of patients and healthcare workers worldwide are affected by these infections every year. In Africa, the situation is especially concerning due to weak healthcare infrastructure, lack of preventive equipment, and limited training for healthcare personnel.[1]

According to a systematic review by Alemayehu et al., the overall prevalence of HAIs in Africa ranges from 1.6% to 90.2%, with a median of 15%.[2] This wide variation is mainly due to differences in surveillance capacity and hospital settings. In a study conducted in Mali, Diarra et al. reported a prevalence of 14% in intensive care units, with a predominance of respiratory and Surgical site infections (SSIs).[1]

Available data show that SSIs constitute the majority of HAIs in the African maternity wards. For example, in Benin, Afle et al. found that post-cesarean infections accounted for up to 67% of reported cases.[3] In the Democratic Republic of Congo, Bukasa et al. observed a high prevalence of HAIs in maternity units, with a significant incidence of neonatal and maternal infections related to obstetric care. [4]

HAIs particularly affect gynecology and obstetrics departments, where surgical procedures, such as cesarean sections, increase the risk of infection. Ouédraogo et al. conducted a study at the Yalgado Ouédraogo University Hospital in Ouagadougou and revealed that endometritis was common after cesarean delivery, particularly in the absence of systematic antibiotic prophylaxis. [5]

In Burkina Faso, although specific data on HAIs remain limited, several initiatives have been launched to promote hospital hygiene and reduce the risk of infection in healthcare settings, particularly maternity services. To this end, the Prevention of Infectious Risk and Safety in Healthcare Settings (PRISMS) project was launched in 2018 by the Ministry of Health. This program strengthened preventive measures, such as hand hygiene and surface disinfection, in several healthcare facilities, including Bogodogo University Hospital. [6] This study aimed to assess the prevalence, types, trends, and pathogens responsible for HAIs in the Department of Obstetrics, Gynecology, and Reproductive Medicine (SGOMR) of CHU-B. We also sought to determine the antibiotic susceptibilities of the identified pathogens.

Methods

Study design and setting of the study

This retrospective cross-sectional study was based on the exploitation and analysis of patients' medical records between 1 and 30 march 2025. We collected data from patients who developed HAIs between 2018 and 2022, focusing on surgical site infections, urinary tract infections, and endometritis, in the Department of Gynecology, Obstetrics and Reproductive Medicine (SGOMR) of the University Hospital Center of Bogodogo (CHU-B). The causative organisms were identified, and their resistance to antimicrobials was tested.

The survey was conducted within the SGOMR at CHU-B, a tertiary-level referral facility located in Ouagadougou, the capital of Burkina Faso. CHU-B is one of three national university hospitals that provides specialized care for obstetric and gynecological conditions in the country.

Sampling method and calculation

The study included all patients hospitalized in the department during the study period who were suspected or confirmed to have HAI based on cytobacteriological tests (urine, pus, vaginal secretions, etc.). Only records with complete clinical and biological data allowing for the diagnosis of urinary tract infection, endometritis, or surgical site infection (SSI) were included, based on the definitions from Burkina Faso's national HAI surveillance guidelines.

Cases were purposively selected, focusing on three priority types of obstetric-related infections based on national data: urinary tract infections, endometritis, and surgical site infection. The choice was based on the three main infections under national surveillance in the maternity wards. All medical documents (clinical records, hospitalization logs, and laboratory results) related to these patients during the study period were reviewed. Patients with incomplete records or those not meeting the inclusion criteria were excluded.

Case definitions

❖ Urinary tract infections (UTI)

Patients who had a urinary catheter inserted in the previous seven days and had at least two of the following symptoms with no other apparent cause were considered cases.

- Fever > 38°C,
- Dysuria
- Pollakiuria,
- Suprapubic tension,
- Urge to urinate.

The diagnosis was confirmed by at least one of the following criteria:

- Leukocyturia or presence of nitrites on examination of urine,
- Pyuria > 10 leukocytes/mL,
- Observation of bacteria at Gram staining,
- Positive uroculture (≥ 10^5 CFU/mL with leukocyturia ≥ 10^4/mL).

❖ Endometritis

Patients who had given birth and had undergone an intrauterine procedure in the previous 30 days with clinical suspicion of endometritis leading to a vaginal swab for microbiological analysis were included. Clinical endpoints included at least two of the following signs in the absence of other etiologies.

- Fetid lochia,
- Fever > 38°C,
- Abdominal pain
- Uterine sensitivity to palpation.

❖ Surgical site infections

Women who had undergone a caesarean section and had purulent discharge, abscess, or cellulitis at the surgical site within 30 days, confirmed by a cytobacteriological sample, were included.

Data collection methods

Data were extracted using a standardized data collection sheet developed in accordance with national HAI surveillance case definitions. The sheet was used to systematically collect information from the clinical records and microbiological analysis reports.

Variables studied and data analysis

The main variables analyzed were as follows:

- Overall and specific prevalence of HAIs
- Type of infection (UTI, endometritis, SSI)
- Trends in prevalence over time
- Pathogens identified through microbiological tests
- Antimicrobial susceptibility of the pathogens identified

Data analysis was mainly based on frequency and proportion calculations using Excel software.

Ethical considerations

The study protocol was approved by the institutional ethics committee of Deliberation CRES No. 2019-5-68 du 15/2019 and by the administrative authorities of CHU-Bogodogo. Data confidentiality was maintained strictly. Patient anonymity was preserved during the data collection and analysis.

Results

General characteristics of the sample

During the study period, 47,544 women were admitted to the Department of Obstetrics, Gynecology, and Reproductive Medicine (DGOMR) of Bogodogo University Hospital (CHU-B). Based on the inclusion criteria, 34,062 women were eligible for the study on urinary tract infections, 20,580 for endometritis, and 13,482 for surgical site infections (SSIs).

During the study period, 1525 biological samples were collected for cytobacteriological examination in the laboratory. In terms of specimen type, urine accounted for the majority (56.25%, 704/1255), followed by lochia (vaginal secretions) (35.69%, 448/1255), pus samples (7.25%, 91/1255), peritoneal fluid (0.63%, 8/1255), and catheter tips (0.15%, 2/1255).

Prevalence of healthcare-associated infections (HAIs)

Based on the confirmed cases, the prevalence of HAIs was calculated as follows:

- Endometritis: 2.17% (448/20580)
- UTI: 1.36% (466/34062)

- Surgical site infection: 0.74% (100/13482)

The prevalence of these three infections was 4.27%. Table 1 shows the annual distribution of each IAS type.

Trends in the prevalence of HAIs

The trend in overall HAI prevalence showed an initial increase from 2018 (5.16%) to 2019 (8.31%), followed by a steady decline in 2020 (1.88%) and 2021 (1.54%), before increasing again in 2022 (4.73%). Each HAI type followed a similar pattern with a marked downturn after 2019 (Table 1).

Germs responsible for HAIs

A total of 383 germs were isolated and divided into six main groups (Table 2). The most represented Enterobacteriaceae were Escherichia *coli* (51.2%, n=85) and *Klebsiella spp*. (33.7%, n=56), *and Enterobacter spp*. (7.2%, n=12), and others (*Serratia, Pantoea*, etc.) for 7.9% (n=13).

Distribution of isolated germs by type of infection

- ***Urinary tract infections:*** A total of 187 germs were identified in the urine samples (Figure 1). *Enterobacteriaceae* were the most frequently isolated, accounting for 56% of the cases (n=105), followed by yeasts of the genus *Candida* in 24% of the cases (n=45). Among *Enterobacteriaceae*, *Escherichia coli (E. coli)* was predominant with 24.44% (n=46), followed by *Klebsiella* with 12.78% (n=24). In addition, nine cases of co-infection (4.97 %) were recorded, systematically involving *Candida spp.* associated with another germ cell.

  Endometritis. For endometritis, 157 germ cells were isolated from the analyzed samples. Two germ co-infections were identified in 22 cases, representing 14.01% of the isolates. Of these co-infections, *Candida spp.* was involved in 90.90% of cases, and an association with Escherichia coli was observed in 27.27% of cases.

In the isolates from the samples for endometritis, Candida spp. was found in nearly half of the cases (47%), followed by *Enterobacteriaceae* (37%), including *Escherichia coli* in 60% of cases and *Klebsiella pneumoniae* in 34%(Figure 2).

Surgical site infection. A total of 49 germs were isolated (Figure 3). Three coinfections were identified, two of which involved *Escherichia coli* and *Staphylococcus aureus* (S. aureus.

Staphylococcus is the germ most often found in nearly one-third of SSIs cases. The same was true for *Enterobacteriaceae.* In terms of microbial species, *Staphylococcus aureus* and *Acinetobacter baumannii* were the most common in SSIs (26.5% and 16.33 %, respectively).

Antimicrobial resistance

Escherichia coli has a very high resistance to ampicillin (more than 84%) and amoxicillin-clavulanic acid (67.14%), while Klebsiella pneumoniae also shows strong resistance to amoxicillin-clavulanic acid (61.90 %). *Staphylococcus aureus* is extensively resistant to penicillin G (80.95%) and 19% of MRSA strains. 3rd generation cephalosporins have shown limited efficacy, with approximately 40% resistance in *Enterobacteriaceae.* Although carbapenems generally remain effective, significant resistance is observed, particularly in *Acinetobacter baumannii* (21.73%) and *Pseudomonas aeruginosa* (25%), suggesting the presence of carbapenemases. Resistance to aminoglycosides, fluoroquinolones, and sulfonamides was also significant, reducing therapeutic options. These data revealed a worrying circulation of multidrug-resistant germs, requiring increased vigilance, systematic use of antibiograms, and review of antibiotic therapy strategies in hospitals.

Table 1. Distribution of healthcare-associated infections by type and year

HAI Type	2018 N (%)	2019 N (%)	2020 N (%)	2021 N (%)	2022 N (%)	Total N (%)
Endometritis	106 (2.79%)	196 (5.41%)	20 (0.50%)	15 (0.39%)	111 (2.08%)	448 (2.17%)
Urinary tract infection	106 (1.63%)	108 (1.82%)	55 (0.82%)	50 (0.79%)	147 (1.71%)	466 (1.36%)
SSI	20 (0.74%)	25 (1.08%)	15 (0.56%)	9 (0.36%)	31 (0.94%)	100 (0.74%)
Total	232 (5.16%)	329 (8.31%)	90 (1.88%)	74 (1.54%)	289 (4.73%)	1014 (4.27%)

Table 2 Germs responsible for HAIs (N = 383)

Germs	Frequency (n)	Percentage (%)
Enterobacteriaceae	166	43.3
Candida spp	118	30.8
Staphylococcus	42	11.0
Non-fermentative bacteria	39	10.2
Enterococcus	15	3.9
Streptococcus	3	0.8

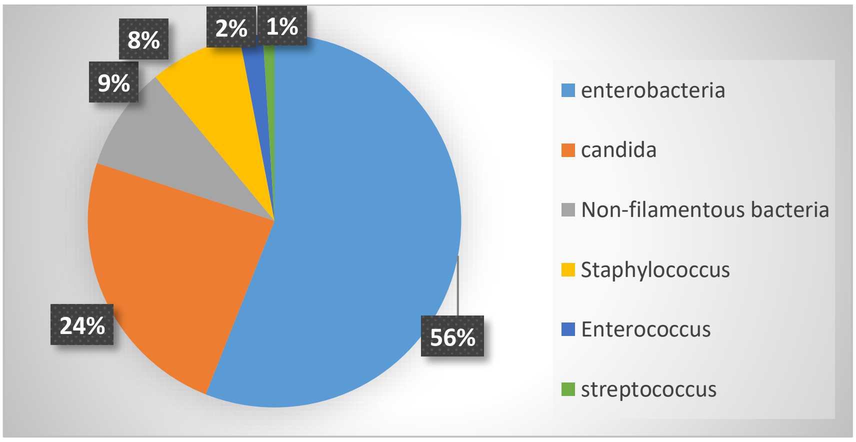

Figure 1: Proportion of germs responsible for urinary tract infections

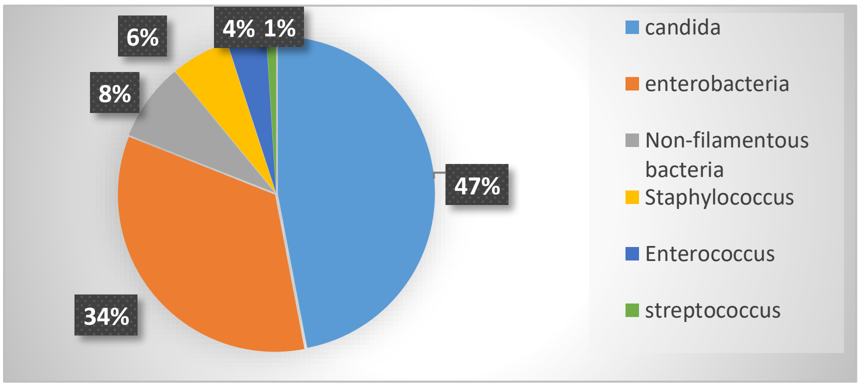

Figure 2: Proportion of germs responsible for endometritis

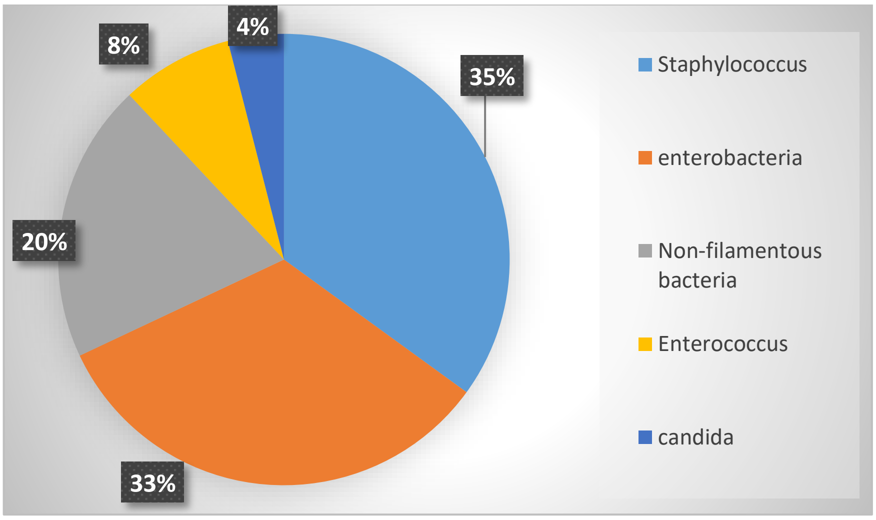

Figure 3: Germ profile responsible for Surgical Site Infections

Discussion

Prevalence of Healthcare-Associated Infections (HAIs)

In our study, the prevalence of healthcare-associated infections (HAIs) was 4.27%. This finding is consistent with the 4.23% prevalence reported in the maternity unit of CHZ Abomey-Calavi/ So-Ava.[3] Internationally, our figure is comparable to that observed in developed countries. For instance, the European Centre for Disease Prevention and Control[7] reported an average HAI prevalence of 6.5% in European hospitals, whereas Magill et al.[8] observed a rate of 3.2% in acute care hospitals in the United States.

Our results are within the lower range of rates reported in Africa. A meta-analysis of 43 studies by Ojerinde (2024) found a median HAI prevalence of 15%, with rates ranging from 1.6% to 90.2%, reflecting wide institutional variability. [9] An earlier review by Nejad et al. (2011) reported prevalence rates from 2.5% to 14.8%, with surgical site infections (SSIs) being the most common.[10] Regionally, Jacques (2014) recorded a 5.9% prevalence at the maternity unit of the Departmental Hospital Center of Ouémé-Plateau in Benin, [11] while Bukasa et al. (2021) reported a much higher rate of 24.8% in the DRC.[4]

Our prevalence figure may be underestimated because it only includes HAIs confirmed via laboratory testing. In Burkina Faso, laboratory investigations are not systematically conducted for suspected infections, and are typically reserved for cases in which empirical treatment fails. Despite national guidelines and available surveillance tools, HAIs are not consistently identified or documented through dedicated medical records; instead, they are often managed without a precise classification.

Distribution of Infection Types

We examined three primary types of HAIs common in maternity units: endometritis, urinary tract infections (UTIs), and SSIs. Endometritis was the most prevalent infection, followed by UTIs and SSIs. This pattern mirrors findings from Bukasa et al. (2021) in the DRC and reflects the obstetric nature of our study population.[4] In contrast, Nkosi et al. (2020) in Burkina Faso reported SSIs as most frequent, followed by UTIs and nosocomial pneumonia.[12] Similarly, a systematic review by Ojerinde et al. (2022) found SSIs to comprise 41.6% of HAIs, followed by UTIs (21%) and pneumonias (17%).[9]

In our study, the prevalence of endometritis was 2.71%, ranging from 5.81% in 2019 to 0.39% in 2021. This is higher than the rates reported by Ouédraogo et al. (2016) [5] but lower than those reported by Jacques et al. (2014).[11] Known risk factors for endometritis include prolonged rupture of membranes, labor lasting over 12 h, multiple vaginal examinations, and suboptimal hygiene. In our context, poor bedding conditions (women sometimes lying directly on the floor) combined with inadequate hand hygiene and insufficient equipment disinfection likely contributed to these high rates. Frequent vaginal examinations without proper hand hygiene may also explain the notable prevalence of Candida infections, suggesting a possible cross-transmission.

UTIs have a prevalence of 1.36%, with a peak in 2019 (1.82%) and a low prevalence in 2021 (0.79%). This rate exceeds that reported by Afle et al. (2014)[3] in Benin but is lower than that found by Mbutshu (2017) in the DRC.[13] The most common cause was catheter-associated UTIs, likely due to poor aseptic technique during catheterization. Inadequate hand hygiene was a major contributing factor.

The prevalence of SSIs in our study was 0.74%, ranging from 1.08% in 2019 to 0.36% in 2021islower than figures reported in Tunisia (Merzougui et al., 2018)[14]and the DRC (Mbutshu, 2017).[13] Many maternity units do not systematically monitor SSIs, and only those that occur during hospitalization are typically recorded, leading to underreporting. In our case, only laboratory-confirmed SSI cases were captured because surgical wound logs and patient files lacked consistent documentation.

Trends in HAIs (2018–2022)

The annual prevalence of HAI fluctuated significantly between 2018 and 2022. An increase was observed from 2018 to 2019, followed by a steady decline until 2021, and a rebound in 2022. This pattern may reflect the implementation of a hand hygiene promotion initiative in 2019–2020 and heightened awareness during the COVID-19 pandemic, both of which are likely to improve hygiene practices. The increase in 2022 may indicate a regression in these practices. Notably, the number of laboratory samples doubled in 2022, potentially reflecting increased efforts to confirm infections bacteriologically, instead of relying solely on empirical treatment.

Causative Pathogens

Enterobacteria were the most frequently isolated pathogens (43.3%), followed by Escherichia coli (51.2%) and Klebsiella spp. (33.7%), followed by Candida species. (30.8%). This aligns with findings from Ojerinde et al. (2024)[9], who identified *E. coli, S. aureus*, *Klebsiella spp.*, *Pseudomonas spp.,* and *Acinetobacter spp*. as dominant HAI pathogens in Africa. Similarly, Okeke et al. (2018) reported enterobacteria, particularly *E. coli* and *K. pneumoniae,* as major pathogens in UTIs and SSIs.[15]

In endometritis, *Candida spp*. was isolated in nearly half of the cases, followed by E. coli and *Klebsiella pneumoniae*. These findings are consistent with those of Lamy et al. (2012)[16] and Ouédraogo et al. (2016)[5], who found E. coli to be predominant. The combination of ruptured membranes and repeated vaginal examinations without aseptic precautions likely facilitated ascending infections.

For UTIs, enterobacteria were dominant (*E. coli* being the most common), followed by *Klebsiella spp.* (Larabi et al., 2003; MSHP, 2024).[17,18] *The uropathogenic properties of E. coli* and perineal colonization likely explain its dominance.

SSIs are mainly caused by *Staphylococcus aureus*, *Acinetobacter baumannii,* and *E. coli*. These results are consistent with those of Mali [19] and Benin [20]. *S. aureus*, the most common SSI pathogen, is best controlled through rigorous hand hygiene, skin preparation, and proper wound management.[21]

Antimicrobial Resistance

Antimicrobial resistance (AMR) emerged as a major concern in our study. *E. coli* and *K. pneumoniae* exhibited resistance rates above 84% to ampicillin and significant resistance to third-generation cephalosporins. Extended-spectrum beta-lactamase (ESBL) production was found in 13.57% of the isolates, with *E. coli* accounting for 51.9% of ESBL producers. Notably, 26.9% of *the Klebsiella* isolates and 3.13% of all isolates were carbapenemase producers, most of which were E. coli. These figures exceed the national average of 29.16% ESBL rate[18], suggesting the overuse of beta-lactams in both clinical and community settings. This highlights the urgent need to revise the national treatment protocol that currently relies on beta-lactams as first-line agents.

S. aureus showed 80.95% resistance to penicillin G, and 19% of strains were methicillin-resistant (MRSA). These figures align with those of Ojerinde et al. (2024) [9], who found a 70.5% MRSA prevalence among S. aureus isolates in Africa. Poor hand hygiene, environmental contamination, and improper wound care may have contributed to the spread of MRSA. Given the virulence of S. aureus, the rising prevalence of MRSA threatens the current treatment options. Carbapenems, considered last-resort antibiotics, are increasingly compromised owing to the emergence of carbapenemase-producing organisms, notably *E. coli* and *P. aeruginosa.* [22] The World Health Organization and other authorities have flagged carbapenem-resistant bacteria, especially *Acinetobacter baumannii* and *Pseudomonas aeruginosa*, as growing global threat[23]. Without urgent intervention, resistant "superbugs" could cause 39 million deaths by 2050.[9]

Implications for Prevention and Control

These findings underscore the urgent need to strengthen the HAI prevention and control strategies. Key priorities included improving hand hygiene compliance, enhancing staff training, and instituting robust microbiological surveillance. WHO advocates a multimodal strategy for infection prevention, integrating evidence-based protocols, behavior change, and continuous performance monitoring. [23]

Limitations of the Study

The main limitations of our study were the poor traceability of the clinical data and low completeness of patient records. As a result, we relied more heavily on laboratory data, which were more consistently documented. This reliance may have led to an underestimation of the true prevalence of healthcare-associated infections (HAIs), particularly surgical site infections (SSIs), which are often not confirmed by laboratory testing and may become undocumented if not clinically severe or captured during hospitalization.

Conclusion

This study highlights the significant prevalence of healthcare-associated infections (HAIs) in health facilities, with a predominance of endometritis and urinary tract infections. Antimicrobial resistance, including multidrug resistance in *E. coli* and *K. pneumoniae* strains as well as resistance to beta-lactams and carbapenems, is a major challenge. These results underline the urgent need to strengthen prevention, microbiological monitoring, and rationalization measures for antibiotics. Context-specific strategies and ongoing training for healthcare personnel are essential for reducing infection rates and improving patient safety.

Ethics approval

The study protocol was approved by the institutional ethics committee of Deliberation CRES No. 2019-5-68 du 15/2019 and by the administrative authorities of CHU-Bogodogo. The ethical provisions were respected throughout the study.

Availability of data and materials

The data generated and analyzed during the study are available from the corresponding author. They can be consulted upon request.

Acknowledgments

We the authors express our gratitude to the Bogdogo University Hospital management.

Funding:

Self-funding.

Author Contribution

All authors made significant contributions to the conception, study design, execution, acquisition of data, analysis, and interpretation. All authors drafted, revised, and critically reviewed the manuscript. Finally, all the authors have agreed on the journal to be submitted, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

Références

1. Diarra A, Kassogué A, Soumaré M, et al. Prevalence of infections associated with intensive care in

Mali. Rev Mal Infect Microbiol. 2022;17(1):77–83.
2. Alemayehu T, Taye G, Abate D, et al. Prevalence and risk factors of healthcare-associated infections in Africa: a systematic review and meta-analysis. BMC Infect Dis. 2024;24(1):112.
3. Afle FCD, Quenum KJM, Hessou S, Johnson RC. Overview of healthcare-associated infections in two public hospitals in southern Benin. J Appl Biosci. 2017;118:11852–60.
4. Bukasa JC, Muteba P, Kazadi A, et al. Incidence of nosocomial infections in maternity wards in the city of Mbujimayi, DRC. Pan Afr Med J. 2021;38:95.
5. Ouédraogo CMR, Ouattara A, Sana A, et al. Obstetric endometritis at the Yalgado Ouédraogo University Hospital in Ouagadougou (Burkina Faso). Bull Soc Pathol Exot. 2016;109(5):334–9.
6. Ministry of Health of Burkina Faso. Project of Prevention of Infectious Risk and Safety in Healthcare Settings (PRISMS). Ouagadougou, Ministry of Health. 2019
7. European Centre for Disease Prevention and Control. Healthcare-associated infections: point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals 2016–2017. ECDC.
8. Magill SS, O'Leary E, Janelle SJ, et al. Changes in prevalence of health care–associated infections in U.S. hospitals. N Engl J Med. 2018;379(18):1732-1744.
9. Ojerinde A, Salami A, Okoro F. Prevalence, risk factors, and antimicrobial resistance of endemic healthcare-associated infections in Africa: a systematic review and meta-analysis. BMC Infect Dis. 2024;24(1):1-13.
10. Nejad SB, Allegranzi B, Syed SB, Ellis B, Pittet D. Health-care-associated infection in Africa: a systematic review. Lancet Infect Dis. 2011;11(11):649-56.
11. Jacques S, Laurent O, Moussiliou NP, Paul A, Alphonse K, René D, Esther T. Epidémiologie et prise en charge des infections du per-partum à la maternité du centre hospitalier départemental de l'Ouémé-Plateau au Bénin. Pan Afr Med J. 2014 Feb 4;17:89.
12. Nkosi Z, Mkhize M, Khumalo P. Healthcare-associated infections in South African hospitals: A prevalence study. S Afr Med J. 2020;110(5):370-375.
13. Mbutshu Lukuke H. Profil épidémiologique et écologique des surfaces hospitalières et des infections nosocomiales urinaires et des sites opératoires dans les maternités des hôpitaux publics de Lubumbashi; thèse de Doctorat en Santé Publique. Inédit, ESP, Université de Lubumbashi. 2017.
14. Merzougui L, Marwen N, Hannachi H, Asma M, Olfa BE, Waddah M, et al. Incidence et facteurs de risque de l'infection du site opératoire après césarienne dans une maternité de Tunisie. Santé publique. 2018;30(3):339-344.
15. Okeke I, Adeniran A, Bamidele M. Prevalence of healthcare-associated infections in a Nigerian teaching hospital. Afr J Clin Exp Microbiol. 2018;19(2):123-129.
16. Lamy C, Zuily S, Perdriolle E, et al. Les infections génitales hautes: prise en charge des infections du post-partum. J Gynecol Obstet Biol Reprod (Paris). 2012;41(8):886–903.
17. Larabi K, Masmoudi A, Fendri C. Étude bactériologique et phénotypes de résistance des germes responsables d'infections urinaires dans un CHU de Tunis : à propos de 1930 cas. Médecine et maladies infectieuses. 2003;33:348–352.
18. Ministère de la santé et de l'hygiene publique, Rapport de la surveillance de la résistance aux antimicrobiens au laboratoire 2023. MSHP, 2024.
19. Berthé B, Traoré SO, Konaté I, et al. Etude comparative des

infections du site opératoire: césarienne systématique versus césarienne itérative au centre de santé de référence de la commune V du district de Bamako/Malin. Rev Mali Infect Microbiol. 2019;14:27.

20. Hodonou Montcho Adrien. Aspects bactériologiques des infections du site opératoire au Centre Hospitalier Départemental Du Borgou à Parakou (Benin). Eur Sci J. 2016;12(9):1-10.
21. Lepelletier D. Impact du dépistage et de la décontamination sur la prévention des infections du site opératoire à Staphylococcus aureus. Journal des Anti-infectieux. 2011;13(4):209-216.
22. Ling ML, Apisarnthanarak A, Madriaga G. The burden of healthcare-associated infections in Southeast Asia: a systematic literature review and meta-analysis. Clin Infect Dis. 2015;60(11):1690-1699.
23. WHO. Core components for effective infection prevention and control programmes: new WHO evidence-based recommendations. Antimicrob Resist Infect Control. 2017;6(1):1-8.