



Microbiological Surveillance of High-Contact Surfaces in the Faculty of Nursing's Clinical Skills Centre

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ABSTRACT

The investigation focuses on microbial contamination on high-contact surfaces within the Faculty of Nursing's Clinical Skills Centre, emphasising the urgent need for effective infection control measures. Despite global efforts to reduce healthcare-associated infections (HAIs), these infections continue to pose significant risks, particularly in educational settings where nursing students frequently transition between clinical and academic environments. Using purposive sampling methods, we collected microbial samples from doorknobs, light switches, cardiac tables, and bedside rails over two weeks, revealing a consistent presence of bacteria, predominantly Gram-positive (74 isolates) and rod-shaped (71 isolates). The findings emphasise the importance of robust cleaning practices and advanced disinfection technologies to mitigate infection risks. By integrating the Islamic principles of *tazkiyah*, this research reinforces the moral obligation to protect the well-being of all individuals. The study provides a foundation for implementing targeted interventions to enhance patient safety and foster a healthier environment for students and patients.

KEYWORDS: Microbial Contamination, High-Contact Surfaces, Infection Control, Gram Staining Analysis, Islamic Ethics.

ABSTRAK

Kajian ini menganalisa pencemaran mikrob pada permukaan sentuhan tinggi di Pusat Kemahiran Klinik Fakulti Kejururawatan, bagi menekankan keperluan langkah kawalan penyakit berjangkit yang berkesan. Walaupun terdapat pelbagai usaha global telah dilakukan untuk mengurangkan jangkitan penyakit berjangkit berkaitan dengan pusat penjagaan kesihatan, namun ianya masih menjadi ancaman Kesihatan, terutamanya dalam persekitaran pendidikan di mana pelajar kejururawatan kerap bergerak daripada hospital ke universiti. Melalui kaedah persampelan bertujuan, sampel mikrob dikumpulkan daripada tombol pintu, suis lampu, meja kardiak, dan palang katil dalam tempoh dua minggu. Hasil kajian menunjukkan kehadiran bakteria yang konsisten, dengan dominasi bakteria Gram-positif (74 isolat) dan berbentuk rod (71 isolat). Penemuan ini menegaskan kepentingan amalan pembersihan yang menyeluruh serta penggunaan teknologi nyahjangkit yang lebih maju bagi mengurangkan risiko jangkitan. Dengan mengintegrasikan prinsip *tazkiyah* dalam Islam, kajian ini menekankan tanggungjawab moral untuk melindungi kesejahteraan semua individu. Kajian ini menyediakan asas bagi pelaksanaan intervensi yang lebih berfokus untuk meningkatkan keselamatan pesakit dan mewujudkan persekitaran yang lebih sihat bagi pelajar dan pesakit.

KATA KUNCI: Pencemaran Mikrob, Permukaan Sentuhan Tinggi, Kawalan Jangkitan, Analisis Pewarnaan Gram, Etika Islam.

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1.0 INTRODUCTION

Healthcare-associated infections (HAIs) remain a persistent challenge worldwide despite ongoing efforts to reduce their incidence. These infections are responsible for significant morbidity, increased healthcare costs, and extended lengths of hospital stays (Sulaiman et al., 2023). The World Health Organization (WHO) estimates a 7.5% prevalence of HAIs in high-income countries. In contrast, due to limited data, the prevalence in developing nations is estimated to range from 5.1% to 19.1% (Maphossa et al., 2022). This global issue highlights the critical need for effective infection control strategies across various healthcare settings, including clinical training environments like nursing schools.

High-contact surfaces, frequently touched by healthcare workers, patients, and visitors, serve as reservoirs for nosocomial pathogens and significantly contribute to transmitting HAIs (Firesbhat et al., 2021). Surfaces such as doorknobs, bed rails, and chairs are particularly vulnerable to contamination, posing risks to patients, healthcare professionals, and visitors (Querido et al. 2019). In the context of nursing education, students regularly move between hospital environments and clinical skills centres, creating a potential vector for transmitting pathogens. This movement raises concerns about introducing harmful microorganisms into educational facilities, potentially leading to infection outbreaks among students and faculty.

One prominent example of surface-associated pathogens is *Acinetobacter baumannii*, a bacterium known for its resilience on dry surfaces and ability to

survive in nutrient-deprived environments (Moubareck & Halat, 2020). Its persistence on surfaces exacerbates the risks of infection transmission, compromises hygiene standards, and increases the likelihood of HAIs. Furthermore, such bacteria on surfaces may contribute to the growing issue of antibiotic resistance, complicating efforts to manage infections effectively (Salam et al., 2023).

This study aims to establish a baseline understanding of microbial contamination in the clinical skills centre by identifying the types of microorganisms commonly found on high-contact surfaces and assessing their potential to cause HAIs. By pinpointing areas with the highest contamination risks, this research will allow for targeted interventions, ultimately enhancing infection control practices. The findings will provide valuable data to inform resource allocation, ensuring that cleaning efforts are focused on the most critical areas. In Islamic ethics, maintaining such spaces aligns with the *Maqasid al-shariah*, which prioritises protecting life and well-being. Thus, ensuring that these areas are free of harmful pathogens is not only a scientific obligation but also a religious duty. This study has the potential to significantly benefit the Faculty of Nursing by preventing infections and fostering best practices in maintaining hygiene within the Clinical Skills Centre.

2.0 MATERIALS AND METHODS

2.1 Time and Place of Study

The study was conducted in May 2024 over a two-week period during the clinical posting at the Faculty of Nursing's Clinical Skills Centre, International Islamic University

Malaysia (IIUM). Sampling was performed five days per week during this period, providing a comprehensive dataset for assessing microbial contamination on high-contact surfaces within the Clinical Skills Centre.

2.2 Sample Location

Samples were collected from four high-contact surfaces, which students and faculty members frequently touch, including doorknobs, light switches, cardiac tables and bedside rails. These surfaces were chosen due to their high risk of harbouring nosocomial pathogens and potential for transmission of infections.

2.3 Sampling Modes and Techniques

Each day, two samples were collected from each of the selected surfaces, resulting in eight samples per day. This sampling process was conducted five consecutive days per week over two weeks, resulting in a total of 80 samples. The sampling procedure involved the use of sterile cotton swabs and Falcon tubes. Each swab was used to collect a sample from the surface, which was then transferred into a Falcon tube containing a sterile liquid nutrient broth (BHI) (Millipore, USA). The Falcon tubes were labelled with the date, time, and surface from which the sample was collected to ensure traceability.

Following sample collection, the samples were incubated at a temperature of 30 ± 1 °C for 24 h. This broth was used to streak plates containing the culture medium (nutrient agar), which were incubated at 30 ± 1 °C for 24 h to promote microbial growth. The presence of microbial growth was monitored daily by observing the turbidity in the broth media. Once microbial growth was

detected, Gram staining was performed to categorise the microorganisms into Gram-positive or Gram-negative bacteria. The staining process began with crystal violet, followed by iodine as a mordant. The cells were decolourised with alcohol and counterstained with safranin. Under microscopy, Gram-positive bacteria appeared purple, retaining the crystal violet stain, while Gram-negative bacteria appeared pink due to the safranin counterstain. Observations were made regarding the morphology of the bacteria, including rod-shaped (bacilli) and sphere-shaped (cocci) bacteria. Aseptic techniques were maintained throughout the sampling and analysis process to minimise the risk of contamination (Figure 1).

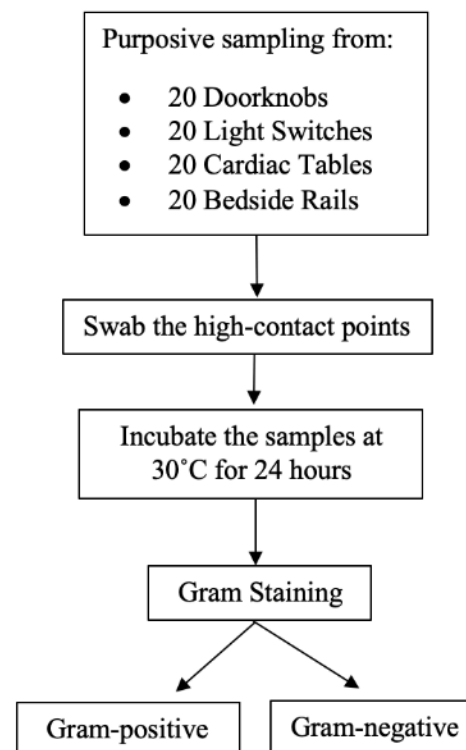


Figure 1. The sample processing flow for the microbiology surveillance study in the Clinical Skills Centre.

3.0 RESULTS

A comprehensive series of surface sampling inspections was conducted on various high-contact items within the Clinical Skills Centre, with the results being reported the following day. Samples were collected from four distinct surfaces: doorknobs, light switches, cardiac tables, and bedside rails. The findings indicated consistent bacterial growth across all inspected surfaces, as summarised in Table 1.

Table 1. Bacterial growth across all surfaces in the clinical skills centre.

Surfaces	Bacterial Growth (out of 20 samplings)
Doorknobs	20/20
Light Switches	20/20
Cardiac Tables	20/20
Bedside Rails	20/20

3.1 Gram Staining Assessment

The Gram staining analysis revealed a significant predominance of Gram-positive bacteria across the sampled surfaces, followed by Gram-positive and Gram-negative bacteria on the same isolates and a small percentage of Gram-negative bacteria isolated (Figure 2).

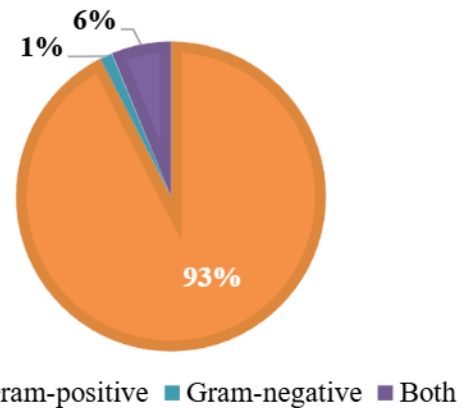


Figure 2. Distribution of bacterial classification identified by Gram staining analysis.

The chart shows a significant predominance of Gram-positive bacteria, accounting for 74 bacteria isolates (representing approximately 93.% of the total), while Gram-negative bacteria were identified in only 1 instance (approximately 1%). Additionally, 5 isolates (approximately 6%) showed the presence of both Gram-positive and Gram-negative bacteria.

These findings also highlight the variety of bacterial morphology on the sampled surfaces (Figure 3). The consistent presence, variety, and morphology of bacteria across all sampled surfaces highlight significant concerns regarding infection control within the Clinical Skills Centre. The data indicates a diverse range of bacterial shapes, with 71 rod-shaped and 3 sphere-shaped bacteria. There were 6 bacteria where both shapes were present.

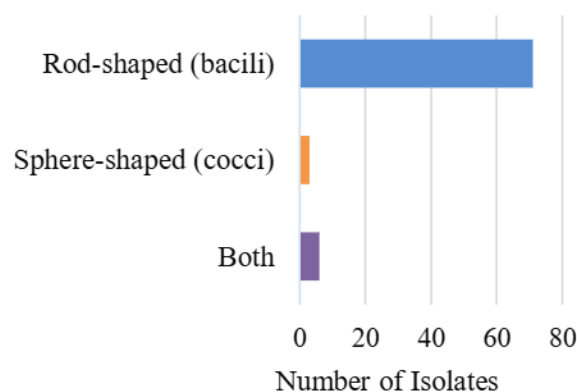


Figure 3. The morphological assessment of bacteria collected from the sampled surfaces.

4.0 DISCUSSION

This study highlights the widespread presence of bacteria on various surfaces commonly found in healthcare settings, particularly in the Clinical Skills Centre of the Faculty of Nursing. Our findings revealed that surfaces such as doorknobs, bedside rails, cardiac tables, and light switches are frequently touched and serve as significant reservoirs for microbial contamination. The consistent detection of bacteria across all sampled surfaces underscores the urgent need for stringent infection control measures in these environments.

The analysis demonstrated a marked predominance of Gram-positive bacteria, which were significantly more prevalent than Gram-negative bacteria. This finding is critical, highlighting the need for targeted interventions to address the types of infections commonly associated with Gram-positive organisms. The study by Firesbhat et al., (2021) supported this observation, providing valuable insights into the prevalence and types of bacterial infections

within a clinical population. Among 384 samples, 26.6% were culture-positive, revealing a notable presence of bacterial infections. Of the 114 bacterial isolates identified, Gram-positive bacteria comprised 64.9%, whereas Gram-negative bacteria accounted for 35.1%. The distribution of bacterial isolates from our study, along with findings from Firesbhat et al. (2021), highlights the pressing need for effective infection control measures to manage and prevent environmental bacteria contamination and cross-infections.

Implementing effective cleaning protocols is crucial for reducing microbial load on high-contact surfaces in the Clinical Skills Centre. Direct observation during cleaning sessions can significantly enhance these protocols by allowing supervisors to provide immediate feedback and corrective actions. This real-time oversight reinforces adherence to established cleaning practices and fosters a culture of accountability among staff members. Additionally, innovative assessment methods, such as fluorescent markers and ATP bioluminescence systems, offer objective measures of cleaning effectiveness (Niephaus et al., 2024). Fluorescent markers reveal areas missed during cleaning when viewed under UV light, drawing attention to spots requiring improvement. Similarly, ATP bioluminescence systems quantify the organic material remaining on surfaces, providing quantitative data that accurately gauges cleanliness levels.

Moreover, employing advanced disinfection technologies, such as vapour and aerosol hydrogen peroxide systems, can further enhance infection control efforts

(Ayub et al., 2024). These systems have proven effective against a wide range of pathogens, including Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant enterococci (VRE), multidrug-resistant Gram-negative bacilli, and *Clostridium difficile*, as well as various viruses and fungi (Amodio et al., 2020). Combining robust cleaning practices with these advanced disinfection methods, the Faculty of Nursing could significantly enhance patient safety and mitigate the risk of healthcare-associated infections.

Furthermore, the Islamic concept of *tazkiyah*, often associated with the purification of the soul, can also be applied to the physical environment. Just as individuals strive for spiritual purity, maintaining a clean and hygienic healthcare setting reflects a broader commitment to the well-being of the community. The Prophet Muhammad (peace be upon him) emphasised the significance of cleanliness, stating that “cleanliness is half of faith”. In this context, implementing effective disinfection measures in healthcare settings serves a practical purpose in preventing infections and fulfills a religious obligation to promote health and well-being within the community. The findings of this study provide a crucial foundation for understanding microbial contamination in clinical settings, paving the way for targeted interventions that enhance infection control practices. By integrating these efforts, we embody the holistic approach to health that is central to both medical practice and Islamic teachings, fostering an environment where both physical and spiritual well-being are prioritised. This alignment reinforces the importance of cleanliness as a core value,

ultimately contributing to the safety and health of students, faculty, and patients within the faculty.

5.0 CONCLUSION

In conclusion, this study stresses the critical need for increased awareness and proactive strategies to address microbial contamination in healthcare settings, with particular focus on the Faculty of Nursing’s Clinical Skills Centre. The consistent presence of bacteria on high-contact surfaces highlights vulnerabilities in infection control practices and calls for immediate action to safeguard the health of students, faculty, and patients alike. By understanding the types and prevalence of bacteria present, we can implement targeted interventions that comply with best practices in infection prevention and align with the fundamental Islamic values of cleanliness and communal well-being.

The integration of advanced disinfection technologies, coupled with robust cleaning protocols, offers a promising pathway to reduce healthcare-associated infections significantly (Garcia et al., 2022). By fostering a culture of accountability and employing innovative assessment methods, we can ensure that our disinfection efforts are effective and comprehensive. Ultimately, this study lays the groundwork for ongoing efforts to enhance patient safety and health outcomes, reinforcing our commitment to creating a safer and healthier learning environment. Through these initiatives, we can embody the holistic approach to health vital to medical practice and Islamic teachings, promoting an atmosphere of care

and responsibility that benefits the entire community.

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