ISSN 2664-3987 (Print) & ISSN 2664-6722 (Online)
South Asian Research Journal of Medical Sciences
Abbreviated Key Title: South Asian Res J Med Sci

| Volume-7 | Issue-5 | Sep-Oct -2025 | **DOI: https://doi.org/10.36346/sarjms.2025.v07i05.002**

Original Research Article

Bacterial Contamination of the Hands of Hospital Staff During Patient Care in Shendi City, Sudan

Mawda Ahmed Abd Allateef[1], Hadia Abass Eltaib Ahmed[1], Leila Mohamed A. Abdelgader[1], Ghanem Mohammed Mahjaf[1], Tibyan Abd Almajed Altaher[2], Mosab Nouraldein Mohammed Hamad[3]*

[1]Department of Medical Microbiology, Faculty of Medical Laboratory Sciences, Shendi University, Shendi, Sudan
[2]Department of Clinical Chemistry, Faculty of Medical Laboratory Sciences, Shendi University, Shendi, Sudan
[3]Assistant Professor, Microbiology Department, Faculty of Medicine, Elsheikh Abdallah Elbadri University, Sudan

***Corresponding Author:** Mosab Nouraldein Mohammed Hamad
Assistant Professor, Microbiology Department, Faculty of Medicine, Elsheikh Abdallah Elbadri University, Sudan

Article History
Received: 06.07.2025
Accepted: 09.09.2025
Published: 11.09.2025

Abstract: ***Background*:** Healthcare worker (HCW) hands becoming contaminated with microorganisms while providing patient care is thought to be the primary way nosocomial infections spread. Cross-contamination accounts for a large percentage of illnesses, and the primary means of transmission of germs is through the hands of healthcare workers (HCWs). ***Objective*:** Isolating and identifying bacterial contamination in hospital staff hands during patient treatment in Shendi hospitals was the aim of this investigation. ***Methodology*:** HCWs provided 60 samples between July and September of 2021. Seven different kinds of bacteria were separated from the 59 (98%) positive specimens throughout this investigation. ***Results*:** *Bacillus cereus* 1(1%), *Micrococcus luteus* 1(1%), *Bacillus species* 5(7%), coagulase-negative *staphylococci* 34(48%), *staphylococcus aureus* 27(38%), *Klebsiella pneumoniae* 2(3%), and other gram-negative oxidase positive bacilli (unknown) 1(1%) were the most frequently isolated bacterial contaminants from hospital staff hands, according to the results. Antimicrobial susceptibility tests revealed that some of the bacteria recovered from hospital staff member hands are extremely sensitive to *imipenem, ciprofloxacin,* and *gentamicin*, respectively, and resistant to *ceftriaxone.* ***Conclusion*:** According to this study, hospital employees at Shendi hospitals may have had bacterial contamination on their hands, which could have resulted in HAIs. Poor hand hygiene habits or the use of non-medicated soap when washing hands could be the cause of the contamination.

Keywords: Microbial Contamination, Imipenem, Bacillus Cereus, Gentamicin, S. Aureus, Gram-Negative Bacilli, Shendi.

INTRODUCTION

An infection contracted at a hospital by a patient who was admitted for a different reason is known as a nosocomial infection, or "hospital-acquired infection." An infection that develops in a patient who was not infected or incubating when they were admitted to a hospital or other healthcare facility. This covers occupational infections among facility employees as well as infections contracted in the hospital but manifesting after discharge [1]. Over the past few decades, nosocomial infections have grown in importance as a hazard to the healthcare system. They have been largely ascribed to inadequate antimicrobial stewardship protocols as well as inadequate hospital item sterilization, decontamination, and disinfection. Long hospital stays, a growth in antibiotic resistance, and disabilities in the afflicted patients are some of the effects of this healthcare obstacle, which significantly lowers their quality of life and human resource productivity. Understanding how hospital equipment and the surrounding environment contribute to the long-term maintenance of nosocomial infections and their transmission is therefore vital. Although the hospital setting may operate as a reservoir for these pathogens, hand-to-hand contact is the primary method of transmission to patients [2]. The primary way that nosocomial diseases spread is thought to be through the hands of healthcare professionals. For over a century, nosocomial infections have been

acknowledged as a serious issue that compromises the standard of hospital treatment. According to the findings of earlier research, at least one-third of nosocomial infections can be avoided. Cross-contamination accounts for a large percentage of illnesses, and the primary means of transmission of germs is through the hands of healthcare workers (HCWs). Timely hand cleansing, which can be accomplished by washing or disinfecting the hands, is necessary to prevent bacterial contamination by transient flora and potential subsequent infection. Even though new guidelines outline when to wash your hands, they don't base their recommendations on proof of microbiologic contamination from regular patient care. We investigated the dynamics of bacterial contamination of healthcare worker hands in routine hospital procedures to present this proof. The results of the study should eventually be used to enhance hand-cleaning procedures by identifying patient care scenarios linked to elevated levels of contamination [3]. Hand decontamination is required with proper hand disinfectants after being in close proximity to sick individuals. Sterilized equipment and safe injection procedures should be employed. Healthcare delivery requires the use of masks, gloves, head coverings, or an appropriate uniform [4]. Everyone agrees that the most crucial way to stop microorganisms from spreading from one patient to another and prevent Healthcare-associated infections (HAIs) is to practice good hand hygiene. It is now acknowledged that one of the best ways to prevent the spread of illnesses in a hospital is to practice good hand hygiene. Ongoing education is also necessary for the correct application of hand hygiene practices. An efficient educational tool is the World Health Organization (WHO) poster display. Programs for ongoing medical education are also crucial for healthcare professionals at all levels [5]. The main way that hospital-acquired illnesses are spread is through direct contact. People can become infected by coming into direct contact with the hands and clothing of medical professionals who are carrying germs. Two significant pathogens that are spread via hand contact are *S. aureus* and *S. pyogenes*. If not adequately cleaned, contact with specific hospital equipment (such as endoscopes, bronchoscopes, cystoscopes, etc.) can also spread some pathogens, like *P. aeruginosa* [6].

MATERIALS AND METHODS

Study Design: This analytical cross-sectional study was conducted from August to September 2021.

Study Setting

The research took place in Shendi Locality, River Nile State, Sudan – a historic Ja'aliin tribal center and trading hub located 150 km northeast of Khartoum and 45 km southwest of Meroe. Its strategic position, with the suburb Al-Matamma linking Northwest Sudan via the Bayuda Desert trade route, supports multiple hospitals serving as critical healthcare access points for transient and resident populations.

Study Population

Clinical and non-clinical medical staff are actively employed in Shendi Locality hospitals. Current hospital employment in Shendi Locality. Willingness to provide informed consent.

Sample Size: 60 participants.

Sample Processing

Samples were collected by dipping sterile cotton swabs in normal saline, and then the hands of hospital staff were swabbed. The samples were transferred to the laboratory immediately for bacteriological examination.

Culture of Specimens

Under aseptic conditions (near Bunsen burner), all collected specimens were inoculated on blood agar and MacConkey agar manitol salt agar, and the inoculated plates were incubated aerobically at 37^0C for 24 hours.

Examination of the Growth

Discrete colonies from primary cultures that showed significant growth were tested at the end of the incubation period for their fermentative and non-fermentative character on MacConkey agar and mannitol salt agar, hemolysis on blood agar, and proceeded for further investigations.

Preparation of the Inoculum

For testing antibiotic sensitivity, the bacteria are first isolated in pure culture on a solid medium. At least three to four morphologically similar colonies of the bacteria to be tested are touched and inoculated into appropriate broth and incubated at 37°C for 4–6 hours. The density of bacterial suspension in the broth is adjusted to 1.5_108 cfu/mL by comparing its turbidity with that of a 0.5 McFarland opacity standard tube. The broth is inoculated on the medium by streaking with sterile swabs. A sterile cotton swab is dipped into the broth, and excess broth is removed by rotation of the swab against the sides of the tube above the fluid level. Only the clinically relevant antibiotics are tested in antibiotic susceptibility tests. Antibiotic discs (6-mm filter paper discs) can be prepared from pure antimicrobial agents in laboratories or can be obtained commercially. The discs are applied with sterile forceps, a sharp needle, or a dispenser onto the surface of the medium, streaked with test strains, and the reading is reported after incubating the plate for 18–24 hours at 37°C aerobically.

Ethical Consideration

Permission was given by the College Ethical Committee of SHENDI UNIVERSITY and Hospitals. Participants have been notified, and no coercion of any sort has been done, and any information that may disclose the participant's identity was not kept in consideration.

Data Collection and Analysis

A self-administered questionnaire was used and supported with coding numbers to facilitate the sorting of data. Data were entered, checked, and analyzed using Microsoft Excel 2007. The final results were presented as frequencies and percentages.

RESULTS

Table 1: Type and Frequency of Bacteria Isolated from Healthcare Workers' Hands

Bacterial Isolate	Frequency	Percentage
Coagulase-negative staphylococci (CoNS)	34	48%
Staphylococcus aureus	27	38%
Bacillus species	5	7%
Klebsiella pneumoniae	2	3%
Bacillus cereus	1	1%
Micrococcus luteus	1	1%
Acinetobacter lwoffii	1	1%
Oxidase-positive Gram-negative bacilli	1	1%
Total	**72**	**100%**

Table 2: Bacterial Distribution on Doctors' Hands

Bacterial Isolate	Frequency	Percentage
Coagulase-negative staphylococci (CoNS)	9	69%
Staphylococcus aureus	3	23%
Oxidase-positive Gram-negative bacilli	1	8%
Total	**13**	**100%**

Table 3: Bacterial Distribution on Nurses' Hands

Bacterial Isolate	Frequency	Percentage
Coagulase-negative staphylococci (CoNS)	25	42%
Staphylococcus aureus	24	41%
Bacillus species	5	8%
Klebsiella pneumoniae	2	3%
Bacillus cereus	1	2%
Micrococcus luteus	1	2%
Acinetobacter lwoffii	1	2%
Total	**59**	**100%**

Table 4: Antimicrobial Susceptibility of Predominant Isolates

Bacterium	GEN	IPM	CRO	CIP
Staphylococcus aureus (n=27)	96%	100%	85%	100%
Coagulase-neg. staphylococci (n=34)	93%	100%	85%	93%
Klebsiella pneumoniae (n=2)	100%	100%	100%	100%
Bacillus cereus (n=1)	100%	100%	0%	100%

DISCUSSION

To prevent bacterial contamination by transient flora and potential infection, hospital staff members must keep their hands clean when interacting with patients. The primary way that nosocomial diseases spread is thought to be through the hands of healthcare professionals. Hospital employees' hands are polluted by a variety of organisms; the goal of our study was to separate bacterial pollutants from hospital employees' hands. Of the 60 samples taken from healthcare workers, 59 (98%) had microbial growth and 1 (2%) did not. Gram-negative oxidase-positive bacteria accounted for 8% of the organisms isolated from doctors, coagulase-negative staphylococcus (CoNS) for 69%, and *S. aureus* for 23%. Coagulase-negative Staphylococcus accounted for 42% of the isolates in nurses, followed by *S. aureus* (41%), and 8% *Klebsiella pneumoniae,* accounted for 3% of the Bacillus species, followed by Bacillus cereus at 2%, micrococcus species at 2%, and

Acinetobacter lwoffii at 2%. Nurses had the highest incidence of harmful microorganisms, followed by physicians. Nearly all of the microorganisms were not harmful. These, however, can be important when the patient is immunocompromised since the presence of these bacteria can cause invasive infections. *Bacillus cereus* 1 (1%), *Micrococcus species* 1 (1%), Gram-negative bacilli oxidase positive 1 (1%), *Acinetobacter lwoffii* 1 (1%), *staphylococcus aureus* 27 (38%), Bacillus species 5 (7%), and *Klebsiella pneumoniae* 2 (3%). Coagulase-negative *Staphylococcus* 34 (48%) was the most commonly isolated bacterium in this study. Out of 200 samples taken from physicians, medical students, nurses, and attendants from the hospital departments of medicine and anesthesia, healthcare workers who were actively providing medical care were included in the study conducted by Snehlata Singh and Amit Kumar Singh among HCWs employed at Chha Trapat Shivaj Subhart Hospital in Meerut between November 2011 and April 2012. 95 (47.5%) samples had microbe growth, whereas 106 (53%) samples had none. Staphylococcus aureus was the most frequently isolated germ, found in 35 (70%) nurses, 30 (60%) students, and 20 (40%) attendants. Acinetobacter ssp was also shown to be highly prevalent in nurses (10%), students (8%), and physicians (2%), in that order [7]. Another study by Kylesh D. Pegeu, Helen Perrie, Juan Scribante, and Maria Fourtounas involved medical professionals (surgeons, anesthetists, and nurses) in the operating room of the Chris Hani Baragwanath Academic Hospital. A total of 75 samples, comprising 25 anesthetists, 25 surgeons, and 25 nurses, were gathered. All hands of the HCPs showed growth in 18 commensals and 21 pathogenic bacteria, with 95% of the hands exhibiting cultured commensals and 64% exhibiting cultured pathogens. 76% of hands have two or more microbes living on them. *Staphylococcus epidermis* (54.7%), *Bacillus cereus* (32%), *Micrococcus luteus* (28%), and *Staphylococcus capitis* (13.3%) were the most common commensal microbes. Because *Staphylococcus epidermidis* can manufacture toxins and develop biofilms on indwelling medical devices, it may contribute to sepsis. Bacillus cereus is linked to hematogenous spread and can result in bacteremia and localized infection. *Bacillus cereus* can infiltrate the central nervous system in hematological patients. Healthcare-associated infections (HAIs) in immunocompromised patients have been linked to *Micrococcus luteus.* One pathogen that can affect newborns is *Staphylococcus capitis*, and in neonatal intensive care units, a drug-resistant strain of the bacteria has been linked to sepsis. If commensal microbes get into a sterile bodily cavity, they could lead to illness. Sixty-four percent of subjects had pathological microorganisms cultivated. Of the twenty-one pathogenic organisms that were grown, the most common ones were *Leclercia adecarboxylata* (4%), *Acinetobacter Iwoffii* (5.3%), and *Staphylococcus aureus* (12%). *Staphylococcus aureus* is one of the deadliest bloodstream bacteria and tends to become resistant to antibiotics. Patients with chronic illnesses may contract Healthcare-associated infections (HAIs) from *Acinetobacter Iwoffii*, which can also lengthen hospital stays and increase death. Immunocompromised people are frequently afflicted with Leclercia adecarboxylata, and although it is responsive to medications, resistant forms have now been found [8]. Another study was conducted from May 1, 2017, to June 30, 2017, at a tertiary care hospital in Gujarat state, India. The study included 300 mobile phone samples and the dominant hands of resident physicians (Group A), nurses (Group B), and support staff (Group C; sweepers and helpers) who worked in the intensive care unit (ICU), pediatric intensive care unit (PICU), neonatal intensive care unit (NICU), and emergency ward (EW). Each group of 50 employees contributed 100 samples. 150 HCW dominant hands and 150 cell phones in total were evaluated. One or more types of bacteria were found to be contaminated in 145 (96.66) of these dominant hands. A total of 172 bacterial isolates were found in the dominant hands of healthcare workers. Following CoNS (87; 50.58%), Bacillus species (25; 14.53%), MSSA (17; 9.88%), k. *pneumoniae* (12; 6.97%), *Enterococcus species* (10; 5.81%), *A. baumannii* (8; 4.65%), and MRSA (4; 2.32), the following isolates were recovered [9]. When isolated bacteria were subjected to antimicrobial susceptibility testing, the results indicated that some of the organisms were resistant to ceftriaxone and extremely sensitive to imipenem, ciprofloxacin, and gentamicin, respectively.

CONCLUSION

According to the current study, 59 (98%) of healthcare workers had microorganisms on their hands. Because of their close contact with patients, nurses had the highest level of bacterial contamination. Coagulase-negative Staphylococcus 34 (48%), followed by Staphylococcus aureus 27 (38%), was the most common organism isolated from hospital staff hands. It is often regarded as a significant pathogen that causes HAI. Additionally, this could be a sign of inadequate hand hygiene, ineffective hand washing, or the use of non-medicated soap. A portion of the isolated organisms is extremely susceptible to the other antibiotics and resistant to ceftriaxone.

Recommendations

1. To prevent infections in both themselves and their patients, healthcare professionals (HCPs) should wash their h ands both before and after interacting with patients.
2. One of the fundamental elements of an infection control program is hand hygiene.
3. Everyone agrees that maintaining good hand hygiene is the most crucial step in preventing Healthcare-associate d infections (HAIs) and the spread of microorganisms from one patient to another.
4. Hand sanitizing gel, hygienic hand antisepsis, hygienic hand massage, or hand washing with antimicrobial soap and water are the best ways to stop the spread of germs.
5. Sterilization of surfaces and equipment that come into contact with patients and healthcare workers.

Acknowledgment

The authors appreciate the ethical review committee, and thanks are also due to the Department of Microbiology at the Faculty of Medical Laboratory Sciences providing the research facilities for this study.

Sources of Funding: There was no specific grant for this research from any funding organization in the public, private, o r nonprofit sectors

Conflict of Interest: The authors have declared that no competing interests exist.

REFERENCES

1. G. Ducel, Fondation Hygie, Geneva, Switzerland J. Fabry, Université Claude-Bernard, Lyon, France L. Nicolle, University of Manitoba, Winnipeg, Canada, World Health Organization, Prevention of hospital-acquired infections, published by WHO/CDS/CSR/EPH/2002.12, for more information see http://www.who.int/emc .
2. Ivan Sserwadda, Mathew Lukenge, Bashir Mwambi, Gerald Mboowa, Apollo Walusimbi and Farouk Segujja, Microbial contaminants isolated from items and work surfaces in the post- operative ward at Kawolo general hospital, Uganda,Biomed center, Sserwadda et al. BMC Infectious Diseases (2018) 18:68, https://doi.org/10.1186/s12879-018-2980-5 .
3. Didier Pittet, MD, MS; Sasi Dharan, MT; Sylvie Touveneau, RN; Vale´rie Sauvan, RN; Thomas V. Perneger, MD, PhD, Bacterial Contamination of the Hands of Hospital Staff During Routine Patient Care, ©1999 American Medical Association, ARCH INTERN MED/VOL 159, APR 26, 1999.
4. Hassan Ahmed Khan, Fatima Kanwal Baig, Riffat Mehboob, Nosocomial infections: Epidemiology, prevention, control and surveillance, Asian Pacific Journal of Tropical Biomedicine, journal homepage: www.elsevier.com/locate/apjtb , Available online 7 Jan 2017, Available from http://dx.doi.org/10.1016/j.apjtb.2017.01.019.
5. Snehlata Singh, Amit kumar Singh, Prevalence of bacteria contaminating the hands of health care workers during routine patient care: A hospital-based study, Journal of the academy of clinical microbiologists,28 jun-2016, volume 18, page 60-62.
6. Subhash Chandra Parija, Text book of microbiology and immunology, 2nd Edition 2012, india, Published by Elsevier,630,68,69.
7. Snehlata singh, Amit Kumar Singh, Prevalence of bacteria contaminating the hands of healthcare workers during routine patient care: Ahospital based study, Journal of the Academy of clinical Microbiologists 28-June-2016;18,1,60-62.
8. Kylesh D. Pegu, Helen Perrie, Juan Scribante, Maria Fourtounas, Microbial contamination of the hands of health care providers in the operating theatre of a central hospital, Southern African Journal of Infectious Diseases, 08 Apr.2021, Vol 36, No 1.
9. Shah PD, Shaikh NM, Dholaria KV, Microorganisms isolated from mobile phones and hands of health-care Workers in a tertiary care hospital of Ahmedabad, Gujarat, India, Indian Journal Public Health, 2019;63:147-50, https://www.ijph.in/text.asp.