Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2023i1.605
*Biol. Clin. Sci. Res. J., Volume, **2023**: 605*
Original Research Article

A COMPREHENSIVE ANALYSIS OF MICROBIAL CONTAMINATION ON MEDICAL PROFESSIONALS ATTIRE AND DEVICES

SHAIKH M[*1], ZAMEER S[2], DEVI D[3], AHMED Z[4], KHOSO FM[5], SHAIKH AP[6], AAMIR K[7], RAMZAN A[7]

[1]*Admin Registrar Thalassemia Ward, Civil Hospital Hyderabad, Pakistan*
[2]*Department of Pathology, DMC DUHS, Karachi, Pakistan*
[3]*Department of Pathology, Bilawal Medical College for Boys, Liaquat University of Medical and Health Sciences Jamshoro Hyderabad, Pakistan*
[4]*Laboratory of Animal Science, DMC, Pakistan*
[5]*Department of Oral Pathology, Muhammad Dental College Mirpurkhas. Pakistan*
[6]*Department of Gyne/Obs, DMJ, Pakistan*
[7]*Department of Pathology Liaquat University of Medical and Health Sciences Jamshoro Hyderabad, Pakistan*
**Corresponding author's email address:* dr.mariasami215@gmail.com

(Received, 25th September 2023, Revised 25th November 2023, Published 22nd December 2023)

Abstract: *This research aimed to evaluate the level of microbiological contamination on the hands, white coats, and cell phones of healthcare workers. The study was conducted as a cross-sectional study at the Pathology Department of Civil Hospital LUMHS Hyderabad between January 2021 and June 2021. A total of 130 participants were selected using convenience sampling and provided samples. Before sample collection, informed consent was obtained from all participants. Samples were randomly collected from the hands of healthcare professionals, white coats, and various cell phones. Data analysis was performed using SPSS 23.0. In our study, 86 (66.2%) were females and 44 (33.8%) were males. There were 46 (35.4%) cases age 20-30 years, 34 (26.2%) cases aged 31-40 years, 28 (21.5%) cases had age 41-50 years, and 22 (16.9%) cases had age >50 years. 62 (47.7%) samples were taken from lab coats, 43 (33.1%) from the hand of healthcare workers, and 25 (19.2%) from cell phones. The results of the lab coat contamination analysis revealed the following: Methicillin-Resistant Staphylococcus aureus MRSA (6%), Escherichia coli (8%), Pseudomonas (2%), Klebsiella (3%), and Staphylococcus aureus (65%). Healthcare workers who were observed had a majority of MRSA (35.4%), Staphylococcus aureus (33.1%), Staphylococcus epidermidis (26.2%), and Pseudomonas (5%) on their hands. The most common bacteria found on mobile phones were MRSA (40%), followed by Staphylococcus aureus (18%), Staphylococcus epidermidis (34%), and pseudomonas (8%). This study demonstrates that a significant portion of the clothing and personal items used by healthcare professionals were tainted with different microorganisms that can cause nosocomial infections.*

Keywords: Mobile Phones, White Coats, Healthcare Worker, Streptococcus, Klebsiella, Staphylococcus, Pseudomonas

Introduction

A medical professional's white coat is comparable to a person's skin. Medical and laboratory professionals wear a knee-length overcoat known as a "white coat" to prevent contamination of their street clothes (Pydi et al., 2015; Robati et al., 2013). The color white stands for goodness and purity, symbolizing professionalism, identification (Qaday et al., 2015), and respect from other people. In (Banu et al., 2012; Surase et al., 2016),, many medical institutions hold A "White Coat Ceremony" to officially welcome MBBS students into the medical field (Obu et al., 2013). PPE, or personal protective equipment, should cover the skin and clothing to a reasonable degree to reduce exposure to biologically hazardous materials. Most scientists and physicians working with hazardous materials prefer to wear knee-length, long-sleeved, elastic-cuffed white coats. If it becomes contaminated, a white coat is an easy way to be cleaned off (Albeladi et al., 2021).

Keeping hands clean is one of the most important ways to prevent infections from spreading in hospitals (Gómez-Gonzales et al., 2023). Good hand hygiene practices stop infections from spreading and help avoid health-associated infections. Still, healthcare professionals handle a variety of medical devices in the course of their work, including mobile phones and stethoscopes. Recent research has brought attention to the possibility that mobile phones used by medical personnel or even members of the public can spread harmful bacteria (Brady et al., 2011) and (2009). Mobile phones are contaminated because they are handled frequently during patient care activities and are near the hands of healthcare providers.

Mobile phones used by healthcare personnel have been shown to act as reservoirs for nosocomial infections (Kumar et al., 2014). Due to their propensity to stick to phone surfaces, pathogenic bacteria can be transferred from an HCW's phone to a patient's or between departments by hand (Mark et al., 2014). Researchers are worried about how exactly mobile phone contamination spreads healthcare-associated infections (HAIs) in light of these trends. Owing to patients' weakened health and invasive medical equipment, specific hospital departments, including critical care, operating rooms, intensive care units, and burn units, are especially susceptible to HAIs.

[Citation: Shaikh, M., Zameer, S., Devi, D., Ahmed, Z., Khoso, F.M., Shaikh, A.P., Aamir, K., Ramzan, A. (2023). A comprehensive analysis of microbial contamination on medical professionals attire and devices. *Biol. Clin. Sci. Res. J.*, **2023***: 605*. doi: https://doi.org/10.54112/bcsrj.v2023i1.605]

In this case, one typical exogenous source of microbial contamination is the air inside the OR. Bioaerosols, or airborne microorganisms, include bacteria, viruses, and fungal spores. The diameter of bioaerosol particles ranges from 0.3 to 100 µm (microbial cells approximately 1 µm, virus particles 1 nm, and fungal spores greater than 1 µm). Skin cells, dust, and other organic or inorganic materials are frequently contaminated with microbial and viral particles (Stetzenbach, 2009). For all kinds of surgeries, various traditional ventilation and conditioning systems with a mixed or turbulent flow are used to lower the operating room's bioaerosol- and particle load and direct their flow. The purpose of laminar airflow (LAF) systems is to direct ultra-clean, particle-free air over the aseptic operating field at a constant speed, thereby dispersing bioaerosols and particles. To stop airflow from less clean areas into the operating room, most operating rooms are also kept at positive pressure compared to the surrounding corridors and areas. Early research has described a link between postoperative infections and air ventilation systems in the operating room (Lidwell et al., 1983). These and other studies, however, show that even in an empty OR, the particle and microbial load is never completely removed due to the ventilation system.

Hand cleaning, which can be accomplished by washing or disinfecting the hands, is necessary to prevent bacterial contamination by passing flora and potential infection. While current guidelines outline when to wash your hands, they do not rely on proof of microbiologic contamination obtained during standard patient care (Larson, 1988). To furnish this proof, we examined the patterns of bacterial contamination on healthcare workers' hands during routine hospital procedures. The study results should eventually lead to better hand-cleaning procedures by assisting in identifying patient care scenarios linked to high levels of contamination (Doebbeling et al., 1992).

Methodology

A cross-sectional study was conducted in Pathology Department Civil Hospital LUMHS Hyderabad. Healthcare professionals' hands, white coats, and cell phones were the random places where the samples were taken. The participants were asked to verbally give their informed consent to collect the sample and proceed with a portion of the study.

Demographic information, as well as details about lab coat-washing habits, coat-wearing times, hand hygiene practices, and methods for cleaning any mobile phones, were gathered using a quick, structured questionnaire that was self-administered. A total of 130 samples, including the healthcare personnel's hands, lab coats, and cell phones, were chosen randomly. Aseptic methods were used to gather the samples. Samples were taken using sterile swabs from three distinct locations: hands, mobile phones, and lab coats. The researcher collected the samples, used hand sanitizer, and cleansed his hands with antiseptic soap. Within 24 hours of collecting the sample, the applicators were carefully placed in their containers and brought to the laboratory. After being inoculated in Blood agar and MacConkey agar, the samples were incubated for an entire night at 37 degrees Celsius. The bacteria underwent various biochemical tests to isolate the specific organism. Other selective biochemical tests, such as the urease, citrate, and sugar media tests, were employed in addition to Gramme staining to isolate microorganisms. SPSS version 23.0 was used to analyze the data.

Results

In our study, 86 (66.2%) were females and 44 (33.8%) were males. There were 46 (35.4%) cases aged 20-30 years, 34 (26.2%) cases aged 31-40 years, 28 (21.5%) cases had age 41-50 years and 22 (16.9%) cases had age >50 years. (Table 1).

Among all, 62 (47.7%) samples were taken from lab coats, 43 (33.1%) from the hand of healthcare workers, and 25 (19.2%) from cell phones. (Table 2)

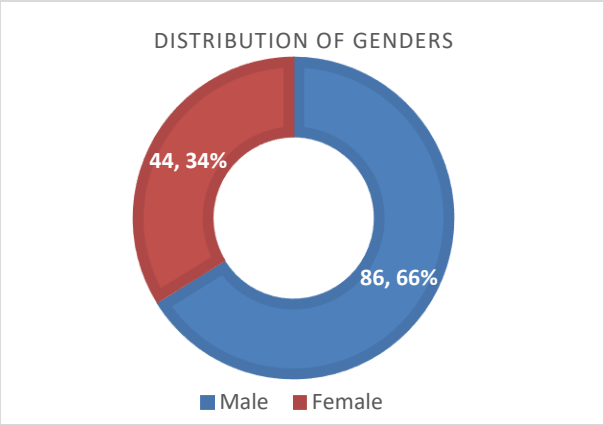

Figure 1: Distribution of gender in the study population

Table 1: Age and gender of the enrolled cases

Variables	Frequency (130)	Percentage
Gender		
Male	86	66.2
Female	44	33.8
Age		
20-30 years	46	35.4
31-40 years	34	26.2
41-50 years	28	21.5
> 50 years	22	16.9

Table 2: Association of contaminated samples among presented cases

Variables	Frequency (130)	Percentage
Contaminated Samples		
Lab coats	62	47.7
Hands of HCW's	43	33.1
Cell phones	25	19.2
HCW= Healthcare workers		

The results of the lab coat contamination analysis revealed the following: Methicillin-Resistant Staphylococcus aureus MRSA (6%), Escherichia coli (8%), Pseudomonas (2%), Klebsiella (3%), and Staphylococcus aureus (65%). Healthcare workers who were observed had a majority of MRSA (35.4%), Staphylococcus aureus (33.1%), Staphylococcus epidermidis (26.2%), and Pseudomonas (5%) on their hands. The most common bacteria found on

[Citation: Shaikh, M., Zameer, S., Devi, D., Ahmed, Z., Khoso, F.M., Shaikh, A.P., Aamir, K., Ramzan, A. (2023). A comprehensive analysis of microbial contamination on medical professionals attire and devices. *Biol. Clin. Sci. Res. J.*, **2023***: 605*. doi: https://doi.org/10.54112/bcsrj.v2023i1.605]

mobile phones were MRSA (40%), followed by Staphylococcus aureus (18%), Staphylococcus epidermidis (34%), and pseudomonas (8%). (Table 3)

Table 3: Comparative study of various microorganisms on various objects

Microorganisms	Lab Coats	Hands of HCW's	Cell Phones
MRSA	6%	35.4%	40%
Escherichia	8%	1%	2%
Pseudomonas	2%	5%	8%
Klebsiella	3%	2%	1%
Staphylococcus aureus	65%	33.1%	18%
Staphylococcus epidermidis	17.8%	26.2%	34%

Discussion

The purpose behind the white coat is to elevate the medical field's standing (Chiereghin et al., 2020). Individuals ranging from postgraduate doctors to undergraduate students wore it to project a professional image. However, because the wearer spends hours on hospital property and the doctor is constantly in contact with the patient and the hospital environment, it spreads many infections among the professionals who wear it (Dhayhi et al., 2023).

Doctors who wear white coats come into contact with other microorganisms, Gram-positive cocci being the most common type, in addition to the hospital environment. On the skin, commensals are the most typical form of gram-positive bacteria. The current study shows the presence of coagulase-negative staphylococci, while the study conducted on medical students found staphylococcus aureus (Ahmed et al., 2015). Since most of the patients at the government hospital were from lower socioeconomic classes, there is a higher risk of infection when conducting research there. Because of their unhygienic living conditions and lack of hygiene, they may be the carriers of numerous diseases that they can transmit to physicians and medical students.

In our study, 86 (66.2%) were females and 44 (33.8%) were males. There were 46 (35.4%) cases age 20-30 years, 34 (26.2%) cases aged 31-40 years, 28 (21.5%) cases had age 41-50 years, and 22 (16.9%) cases had age >50 years. This might result from more female students enrolling in degree programs in medicine and dentistry. Staphylococcus aureus accounted for about 65% of the organisms recovered from the white coats. Numerous illnesses, from minor infections such as blemishes, impetigo, carbuncles, and facial space infections to more severe conditions like pneumonia, meningitis, bacteremia, and sepsis, can be caused by it. Large wounds, catheters, and prosthetic joints can become infected with Staphylococcus epidermidis, the second most commonly found organism (17.8%). These were comparable to the previous study (Boppanna et al., 2023).

Hand contamination is a severe issue for healthcare professionals. The high rate is because they are the source of everything, including white coats and cell phones. MRSA, Staphylococcus aureus, Staphylococcus epidermidis, and pseudomonas are the organisms recovered from the hands, with MRSA impacting a significant proportion of people. Since MRSA (Methicillin-resistant Staphylococcus aureus) is resistant to numerous antibiotics, it is a complex bacteria to deal with. Pneumonia is mainly caused by droplets that cause skin infections or direct contact. Two of the most contagious agents in our study are Staphylococcus aureus and epidermidis (Dreikausen et al., 2023; Saj et al., 2016).

Nonstandardized hand samples were collected for our study during standard healthcare procedures, which is worth mentioning. This makes it possible to see the bacterial load on our hands. The hazards of microbial contamination can be reduced by employing disinfectants in clinical settings and adhering to good hygiene standards. Mobile phones were discovered to be infected with S. epidermidis and MRSA (Methicillin-resistant Staphylococcus Aureus). Skin infections, rashes, sores, boils, and some serious infections such as bloodstream infections, lung infections, surgical wounds, or urinary tract infections can all be brought on by MRSA. The reason for the increased attention given to S. epidermidis is its ability to cause nosocomial infections. The results were in line with the previous studies (Naidu et al., 2014; Whittington et al., 2009).

The earlier research classified skin commensals like coagulase-negative Staphylococci and diphtheroid species, and other bacteria, including gram-negative bacilli, as environmental microorganisms with little clinical importance (Grabsch et al., 2006). Approximately 14% of S. aureus isolates were methicillin-resistant S. aureus (MRSA) strains. Hospital-acquired infections now feature MRSA as a significant pathogen. The Centers for Disease Control and Prevention indicate that MRSA is the culprit behind over 60% of hospital infections in the United States (Boyce et al., 1997).

Conclusion

This study demonstrates that a significant portion of the clothing and personal items used by healthcare professionals were tainted with different microorganisms that can cause nosocomial infections.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department Concerned.

Consent for publication
Approved

Funding
Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

MARIA SHAIKH
Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript

[Citation: Shaikh, M., Zameer, S., Devi, D., Ahmed, Z., Khoso, F.M., Shaikh, A.P., Aamir, K., Ramzan, A. (2023). A comprehensive analysis of microbial contamination on medical professionals attire and devices. *Biol. Clin. Sci. Res. J.*, **2023***: 605*. doi: https://doi.org/10.54112/bcsrj.v2023i1.605]

SAMBREEN ZAMEER
Data entry and Data analysis, drafting article
DURGA DEVI
Manuscript revisions, critical input.
ZAMEER AHMED
Supervision, funding acquisition.
FAIZ MUHAMMAD KHOSO
Coordination of collaborative efforts.
ASIYA PARVEEN SHAIKH
Study Design, Review of Literature
KIRAN AAMIR
Data entry and Data analysis, drafting article
AAMIR RAMZAN
Manuscript revisions, critical input.

References

Ahmed, S., Kashif, M., Butt, A. I., and Faisal, S. S. (2015). Pattern of Bacteraemia After Non-Surgical Extraction of Tooth. *Annals ASH & KMDC*.

Albeladi, F. I., Alluli, M. M., Daghriri, K. A., Almalki, Y. H., Wafi, M. Y., Otaif, F. A., Sulays, Z. Y., Hakami, A. A., Alharbi, A. A., and Alhazmi, A. H. (2021). Level of adherence to COVID-19 preventive measures among health care workers in Saudi Arabia. *Cureus* **13**.

Banu, A., Anand, M., and Nagi, N. (2012). White coats as a vehicle for bacterial dissemination. *Journal of clinical and diagnostic research: JCDR* **6**, 1381.

Boppanna, S. H., Kutikuppala, L. S., Sivaraj, N., Raman, K. V., and Radhika, B. (2023). A cross-sectional study to evaluate the apron contamination among health-care professionals of a rural tertiary care setting. *APIK Journal of Internal Medicine*.

Boyce, J. M., Potter-Bynoe, G., Chenevert, C., and King, T. (1997). Environmental contamination due to methicillin-resistant Staphylococcus aureus possible infection control implications. *Infection Control & Hospital Epidemiology* **18**, 622-627.

Brady, R., Hunt, A., Visvanathan, A., Rodrigues, M., Graham, C., Rae, C., Kalima, P., Paterson, H., and Gibb, A. (2011). Mobile phone technology and hospitalized patients: a cross-sectional surveillance study of bacterial colonization, and patient opinions and behaviours. *Clinical Microbiology and Infection* **17**, 830-835.

Chiereghin, A., Felici, S., Gibertoni, D., Foschi, C., Turello, G., Piccirilli, G., Gabrielli, L., Clerici, P., Landini, M. P., and Lazzarotto, T. (2020). Microbial contamination of medical staff clothing during patient care activities: performance of decontamination of domestic versus industrial laundering procedures. *Current Microbiology* **77**, 1159-1166.

Dhayhi, N., Kameli, N., Salawi, M., Shajri, A., Basode, V. K., Algaissi, A., Alamer, E., Darraj, M., Shrwani, K., and Alhazmi, A. H. (2023). Bacterial Contamination of Mobile Phones Used by Healthcare Workers in Critical Care Units: A Cross-Sectional Study from Saudi Arabia. *Microorganisms* **11**, 1986.

Doebbeling, B. N., Stanley, G. L., Sheetz, C. T., Pfaller, M. A., Houston, A. K., Annis, L., Li, N., and Wenzel, R. P. (1992). Comparative efficacy of alternative hand-washing agents in reducing nosocomial infections in intensive care units. *New England Journal of Medicine* **327**, 88-93.

Dreikausen, L., Blender, B., Trifunovic-Koenig, M., Salm, F., Bushuven, S., Gerber, B., and Henke, M. (2023). Analysis of microbial contamination during use and reprocessing of surgical instruments and sterile packaging systems. *Plos one* **18**, e0280595.

Gómez-Gonzales, W., Alvarado-Garcia, A., Suárez-Mamani, M., Dámaso-Mata, B., Panduro-Correa, V., Maguiña, J. L., Pecho-Silva, S., Rabaan, A. A., Rodriguez-Morales, A. J., and Arteaga-Livias, K. (2023). Contamination by Antibiotic-Resistant Bacteria on Cell Phones of Vendors in a Peruvian Market. *Medicina* **59**, 669.

Grabsch, E. A., Burrell, L. J., Padiglione, A., O'Keeffe, J. M., Ballard, S., and Grayson, M. L. (2006). Risk of environmental and healthcare worker contamination with vancomycin-resistant enterococci during outpatient procedures and hemodialysis. *Infection Control & Hospital Epidemiology* **27**, 287-293.

Kumar, B. V., Hobani, Y. H., Abdulhaq, A., Jerah, A. A., Hakami, O. M., Eltigani, M., and Bidwai, A. K. (2014). Prevalence of antibacterial resistant bacterial contaminants from mobile phones of hospital inpatients. *Libyan Journal of Medicine* **9**.

Larson, E. (1988). Guideline for use of topical antimicrobial agents. *American journal of infection control* **16**, 253-266.

Lidwell, O., Lowbury, E., Whyte, W., Blowers, R., Stanley, S., and Lowe, D. (1983). Bacteria isolated from deep joint sepsis after operation for total hip or knee replacement and the sources of the infections with Staphylococcus aureus. *Journal of Hospital Infection* **4**, 19-29.

Mark, D., Leonard, C., Breen, H., Graydon, R., O'Gorman, C., and Kirk, S. (2014). Mobile phones in clinical practice: reducing the risk of bacterial contamination. *International journal of clinical practice* **68**, 1060-1064.

Naidu, K., Nabose, I., Ram, S., Viney, K., Graham, S. M., and Bissell, K. (2014). A descriptive study of nosocomial infections in an adult intensive care unit in Fiji: 2011-12. *Journal of tropical medicine* **2014**.

Obu, H. A., Chinawa, J. M., Manyike, P. C., Obi, I., Eke, B. C., Ekwochi, U., and Agwu, S. (2013). Pediatrician wearing a white coat: A survey of preferences among children and their care givers. *Annals of Tropical Medicine & Public Health* **6**.

Pydi, S., Pachava, S., and Sanikommu, S. (2015). Microbial contamination of the white coats among preclinical and clinical dental students: A comparative cross-sectional study. *Journal Of Indian Association of public health dentistry* **13**, 193-196.

Qaday, J., Sariko, M., Mwakyoma, A., Kifaro, E., Mosha, D., Tarimo, R., Nyombi, B., and Shao, E. (2015). Bacterial contamination of medical doctors and students white coats at Kilimanjaro Christian

[Citation: Shaikh, M., Zameer, S., Devi, D., Ahmed, Z., Khoso, F.M., Shaikh, A.P., Aamir, K., Ramzan, A. (2023). A comprehensive analysis of microbial contamination on medical professionals attire and devices. *Biol. Clin. Sci. Res. J.*, **2023***: 605*. doi: https://doi.org/10.54112/bcsrj.v2023i1.605]

Medical Centre, Moshi, Tanzania. *International journal of bacteriology* **2015**.

Robati, R., Farokhi, M. M., Jaberi, F. M., and Hashemi, S. A. (2013). Effect of white coats on spread of nosocomial infection. *European Journal of Experimental Biology* **3**, 156-159.

Saj, T., Murali, P., Bohra, S., Shenoy, S., and Krishnanayak, U. (2016). Microbial flora on the white coats of dental health care professionals. *Indian Journal of Oral Sciences* **7**, 107-107.

Stetzenbach, L. (2009). Airborne infectious microorganisms. *Encyclopedia of Microbiology*, 175.

Surase, P., Nataraj, G., Kuyare, S., and Mehta, P. (2016). The Ever Increasing Reservoirs of Infection in the Health Care Environment-Time for a Sixth Moment of Hygiene. *The Journal of the Association of Physicians of India* **64**, 31-36.

Whittington, A., Whitlow, G., Hewson, D., Thomas, C., and Brett, S. (2009). Bacterial contamination of stethoscopes on the intensive care unit. *Anaesthesia* **64**, 620-624.

[Citation: Shaikh, M., Zameer, S., Devi, D., Ahmed, Z., Khoso, F.M., Shaikh, A.P., Aamir, K., Ramzan, A. (2023). A comprehensive analysis of microbial contamination on medical professionals attire and devices. *Biol. Clin. Sci. Res. J.*, **2023***: 605*. doi: https://doi.org/10.54112/bcsrj.v2023i1.605]