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Assessment for Bacterial Contamination of Toilet Door Handles in a Liberian Referral Hospital

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ABSTRACT

Background: Bacteria are microbes that are found almost everywhere. These microbes are found on fomites, such as door handles. Bacteria contamination of fomites leads to the emergence and spread of healthcare-associated infections. This is of major concern which may rapidly metamorphous into a global public health threat. **Methods**: Using full aseptic precautions, samples of fomites were obtained from of the male and female wards and the Emergency Department of the Eternal Love Winning Africa Hospital in Liberia. The swabbed samples were inoculated in Petri dishes containing nutrient agar, and selective media as McConkey agar. The plates were incubated aerobically for 24 hours at 37˚C. The identification, characterization and differentiation of bacterial isolates were done by visual observation of colonies, microscopic, and biochemical examination using biochemical Kligler iron agar, Lysine iron agar and Motility iodine Ornithine. **Results**: The most prevalent bacterial species identified were *Staphylococci aureus* (46.15 %) and *Listeria monocytogenes* (23.08 %). *S. aureus* was 100 % susceptible to Clindamycin, 66.67 % susceptible to tetracycline, 33.33% susceptible to Gentamycin and 100% resistant to Ciprofloxacin, Ceftriaxone, Erythromycin and Cefoxitin. **Conclusion**: Toilet door handles of hospitals are highly contaminated. The spread of infections and microbes is expected to occur when individuals use the toilets without proper hygienic practices. Hand washing facilities should be made available and encouraged for use before and after using the toilets to minimize microbial contamination of door handles and limit the spread of hospital-acquired infections.

BACKGROUND

Bacteria are the causative agents of many diseases in humans. They are found on inanimate objects or fomites such as door handles, toilet seats, faucets, sinks, lockers, chairs, and tables. Fomites significantly assist in the transmission of bacteria and other micro-organisms in health and diseases.[1,2.]

The contamination of hospital toilet door handles by an infected person may increase the transmission of hospital-acquired infections like Hospital-acquired pneumonia, caused by Pseudomonas aeruginosa, MRSA (Methicillin-resistant Staphylococcus aureus), VRSA (Vancomycin-resistant Staphylococcus aureus), and Staphylococcus aureus.[3] Hospital-acquired infections meaningfully contribute to longer periods of hospital stay and a huge financial burden.[4,5] Thus becoming a global public health concern.[6]

In developing countries, hospital-acquired infections are rarely reported.[7] There is scarcity of published literature regarding the occurrence of contamination of door handles in hospital toilets in Liberia. The aim of the study was to assess bacterial contamination of toilet door handles in a Liberian Referral Hospital. The specific objectives were:

1. To determine the ward with the highest bacteria isolates on doorhandles,
2. To determine the most prevalent bacteria species among the bacteria isolates,
3. To assess antibiotic sensitivity against the most prevalent isolated bacterial species.

METHODS

This study was conducted at the Eternal Love Winning Africa Hospital (ELWA), an eighty-five-bed facility in Monrovia, Liberia. ELWA is a fee-for-service Hospital owned and operated by the Samaritan Purse. The staff comprised general practitioners and specialists in various disciplines of medicines, pharmacy, and nursing.

The study employed a laboratory-based research design to determine bacterial isolates on six (6) toilet doorhandles, two doors of each ward in the males and females' wards, and the emergency department. The instruments used for the study included an incubator, Bunsen burner, biosafety cabinet, hot plate machine, autoclave, inoculating lobes, weighing machine, and laboratory timer. The six toilet doorhandles on the male and female wards and the emergency department were swabbed to collect the samples using full aseptic precaution techniques.

The toilet doorhandles were swabbed with sterile cotton-tipped applicator (swab stick) moistened with sterile water and transported to the laboratory in a cold chain within three hours. The swabbed samples were evenly spread over the entire surface of Petri dishes containing nutrient agar, such as Brain Heart infusion agar and Muller Hinton agar, and selective media as McConkey agar. This was done to allow quick recovery of all organisms picked up in the swab. The plates were incubated aerobically for 24 hours at 37˚C.

The identification, characterization and differentiation of bacterial isolates were done via visual observation of colonies. Furthermore, microscopic examinations of the colonies were done by the Gram Stain method.[8] The colonies were differentiated based on size and color as large cream, small cream, large, pink and small pink colonies. Several biochemical tests were performed using KIA (Kligler Iron Agar), LIA (Lysine Iron Agar) and MIO (Motility Iodine Ornithine) for further identification of various bacterial isolates.[8] Indole test was conducted using Kovac's Reagent to determine both indole negative and indole positive organisms. Catalase test was also performed to identify *S. aureus* after Gram Stain and microscopic observations. Sensitivity of *S. aureus* against the seven antibiotics was performed.[9]

Data were analyzed using laboratory techniques and Microsoft Excel. The data were also analyzed as frequency and described using frequency percentages while some were presented as pie chat and bar graphs. Ethical approval was obtained from the Health Research and Ethics Board of the ELWA Hospital.

RESULTS

Table 1 Most Prevalent Bacterial Isolate

Name of Isolate	Frequency	Percent
S. aureus	6	46.15
L. monocytogens	3	23.08
E. coli	1	7.69
Enterobacter	1	7.69
Serratia	1	7.69
Klebsiella spp.	1	7.69
Total	**13**	**100**

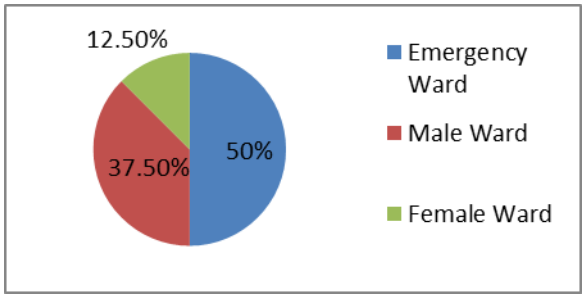

Figure 1 Shows the ward with the most contaminated doorhandle based on the number of isolates.

Table 2 Showing the Sensitivity of S. aureus to Seven Antibiotics

Name of Antibiotics	*S. aureus* Sensitive	%	Interpretation
Clindamycin	6	50.0	100.0% Susceptible
Tetracycline	4	33.3	66.6 Susceptible
Gentamycin	2	16.6	33.3 Susceptible
Ciprofloxacin	0	0.00	100.00 Resistant
Ceftriaxone	0	0.00	100.00 Resistant
Erythromycin	0	0.00	100.00 Resistant
Cefoxitin	0	0.00	100.00 Resistant
Total	12	100	----

DISCUSSION

Results from the current study revealed the sensitivities of *S. aureus* to different antibiotics. The results showed that *S. aureus* was 100 % susceptible to clindamycin and resistant to ciprofloxacin and other antibiotics as reported in the results section. A reason for this could be that *S. aureus* are common hospital infections wherein patients could fuel its transmission on doorhandles when they are using the toilets. Another reason could be that *S. aureus* usually colonize surfaces and human skin and often cause skin infections, pneumonia and heart valve infections. Thus, the human palms frequently encounter the toilet doorhandles and

contribute immensely to its widespread colonization of toilet doorhandles. The results support findings of previous studies.[10,11,12,13]

The appearance of *E. coli* as one of the least prevalent in the current study differs with the previous report where *E. coli* was reported as the most prevalent isolates that were found on toilet door handles.[14] This was probable because 7,482 samples were used in that study. Another reason for this disagreement in results could be due to the utilization of different materials like the restroom door handles, toilet faucets, washbasin taps, toilet hoses, flush bottoms, soap dispenser bottoms, liquid soaps, bar soaps, toilet papers and paper towels, and hand dryer machines, which were sampled compared to the current research that sampled only 6 toilet doorhandles. In addition, the results differed because Matini[14] swapped both indoor and outdoor handles of toilets while this research swabbed only outdoor handles of toilets.

The Emergency Department had the highest number of bacterial isolates on its toilet doorhandles. This result differed from previous findings where the male toilet door handles had the most bacterial isolates followed by the female wards.[15] This difference in findings could be due to the lack of inclusion of the Emergency Department in the previous study.[15] However, if the current study had not included the Emergency Department, the males ward would have had the toilet door handles with the highest bacterial isolates.[2,16.]

Moreover, the Emergency Department is often the first point of service and creates a gateway for frequent use of its toilet door handles. Such frequent use, devoid of hygienic practices, may contribute immensely to the high degree of bacterial contamination of the emergency department's toilet door handles than the male and female wards. In addition, the emergency department, the first point of entry and place for first care for a variety of critical cases, could be one reason why its toilet door handles had the highest number of bacterial contaminants compared to the male and female wards.

The sensitivity results of the current study support previous findings where *S. aureus* showed 100% susceptibility to clindamycin.[1,16] *S. aureus* showed 100% resistance to Ciprofloxacin, Ceftriaxone, Erythromycin, and Cefoxitin, some of the most frequently prescribed antibiotics in the Liberian Healthcare system. Alarmingly, with the passage of time, this could lead to treatment failures for the most common bacterial infections.

CONCLUSION

The emergency department's toilet door handles are highly contaminated with *S. aureus*. These fomites immensely contribute to the transmission of hospital-acquired infections. Hence, Clindamycin is proven effective against *Staphylococcus aureus* infections. Clindamycin could be used as a suitable alternative to ciprofloxacin, ceftriaxone, erythromycin, and cefoxitin in *Staphylococcus aureus* infections. It could be recommended for combating skin infections, pneumonia, heart valve infections, bone infections (Osteomyelitis), and other infections that are caused by *Staphylococcus aureus*.

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