

## CROSS INFECTIONS WITH BACTERIAL CONTAMINATED HANDS DURING ROUTINE CARE IN MEDICAL WARDS.

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**ABSTRACT:** Health worker's hands though not totally free from microorganisms, are more contaminated with microbial pathogens during routine care on patients attending to treatments. These contaminated hands thereafter transferred pathogens from one patient to another and also in the health care environment. This study detailed on the number, bacterial types and the risk factors for hand contamination of health workers during patients' interaction; and the antibiotic profile of isolated bacteria. The hands of health workers before and after patients' interactions were carried out in the medical wards of Afe Babalola University. Sixty four samples were collected on daily bases using sterile swab sticks, transported to the laboratory and streaked on various growth media such as MacConkey agar, nutrient agar, potato dextrose agar, mannitol salt agar, plate count agar and blood agar. Among the bacteria species isolate and identified, *Staphylococcus aureus* (4) was the most predominant contaminant, followed by *Citrobacter freundii* (2) and *Bacillus cereus* (2), all with different sensitive patterns to antibiotics. All isolated microbes were sensitive to Ciprofloxacin with varying degree of susceptibility. Hands of health workers needs protective means and routine washing of hands after attending to patients in order to reduce cross contaminations.

**KEYWORDS:** Contaminations, environment, health workers, hand, protection, bacteria, sensitivity.

### INTRODUCTION:

The hands of health workers are prone to microbial contaminations due to the various patients with varied degree of microbial infections that attend hospitals for treatments. The hands contamination and cross infection from patients to health workers; health care environment and from health workers to patients arise during interactions, hand feel and sample collections. <sup>1</sup>, observed this situation many

years back in a maternity ward where puerperal fever patients were admitted for treatments and the hands of physicians and other health care workers were found to be contaminated with microorganisms without their hands not been washed. This situation prone the hands of health care workers as a common vehicle to transmit microorganisms from one patient to another and also within the health care environment <sup>2</sup>. Though the hands of health care workers are not

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completely free from microorganisms in most cases before attending to patients, their hands are majorly contaminated with transient (contaminating) and resident (normal) microbial pathogens<sup>3</sup>. The difficulty in combating the resident pathogens is that they colonized deeper skin layers where hand washing has no possible effect on them. The resident microbial pathogens have been reported not to be too much involved in severe infection because they tend to be less aggressive.<sup>4,5,6</sup>, identified the Gram negative Staphylococci and Corynebacterium as examples of resident microbial pathogens which grow in the hair follicles and remain inactive for a long time. The transient microbial pathogens contaminate the hands of health care workers by direct hand contact during attending to patients<sup>4,5</sup>. These pathogens have been involved in series of infections among patients and health care workers. The collection of samples from patients for diagnosis and the touching of patients during interactions will populate the hands of health care workers with reasonable numbers of microorganisms.<sup>7</sup>, emphasized on how the hands of nurses were contaminated after 15 seconds of direct contact with groins of patients heavily colonized with *Proteus mirabilis*. The nurse's hands thereafter, transferred microorganisms to the urinary catheters (a small tube) inserted into a body cavity to remove fluid<sup>8</sup>. As this and similar incidence have caused serious problems in the health care system, the only identified measure and internationally recognized to prevent health associated infections is the hand hygiene practice among health care

workers<sup>9,10,11</sup>. Though it has been and now a routine practice among the health care workers mostly in advanced medical set up, more emphasis should be laid on hand hygiene to make it an adoptable practice by all categories within health care<sup>12</sup>. However, hand hygiene is of paramount importance and regular cleaning with disinfectants of environmental surfaces hence it will minimize the transfer of pathogens associated with health care infections.

Despite the advances in health care systems, patients remain vulnerable to unintentional harm in hospitals<sup>3,10,13</sup> or by hospital acquired nosocomial infection which develops as a result of treatment in the hospital<sup>14</sup>. In developed countries, hand hygiene compliance rates exceed 50%<sup>9,3,15</sup>.

In view of this, the aims and objectives of this research are to culture hand swabs of health workers in Afe Babalola University clinic, characterize and identify isolated bacterial species and test their susceptibility to antibiotic.

## **MATERIALS AND METHODS:**

The clinic wards of Afe Babalola University, Ado Ekiti was chosen as a case study for this investigation. Four hundred and twenty samples were collected from health care workers and included in this study, where three doctors (2 males and 1 female), one laboratory attendant, five nurses and five patients per day giving a total of fourteen people in a day for the duration of one month. To assess bacterial contamination, an initial hand swab was

collected from all participants before entering the ward in the morning and a second one after attending to patients in the evening.

### Collection of samples and culture procedures

Samples from the dominant hand of participants were obtained by swabbing fingers and palms. Observed health care workers were mostly registered nurses (90%), nursing assistants, laboratory attendants and doctors. All the health workers were sampled once a day for microbiological analysis. The collected swab samples were immediately transported to the laboratory and cultured for the determination of heterotrophic bacteria by spread plate method on standard plate count Agar (PCA), MacConkey agar (MCA), blood agar, chocolate agar, mannitol salt agar and salmonella-shigella agar media. Plates were incubated at 37 °C for 24 - 48 hours. Colonies were counted, purified and identified to species level with standard methods of identification.

### Antibiotics susceptibility test

This was carried out by placing commercial antibiotic discs on plates seeded with test isolates and incubated at 37 °C for 24 h. Sensitivity was identified with clarity around a disc which was then measured and interpreted as the degree of sensitivity according to the criteria of (16).

### Statistical analysis

The obtained data were subjected to statistical analysis and expressed as mean  $\pm$  standard deviation (SD) by one way analysis of variance (ANOVA). Least significant difference was performed and values were

resolved to be significantly different at ( $P < 0.5$ )

### RESULTS :

The bacteria species isolated and identified were nine; where three were Gram-negative and six Gram-positive. The morphological and biochemical characteristics of the bacteria isolated from the cultured samples identified *Bacillus subtilis*, *Staphylococcus aureus*, *Bacillus cereus*, *Enterococcus enteridis*, *Streptococcus faecium*, *Streptococcus faecium* and *Micrococcus luteus* as the Gram positive bacteria while the Gram negative isolates were *Shigella boydii*, *Klebsiella pneumoniae* and *Citrobacter freundii*. *Staphylococcus aureus*, *Citrobacter freundii* and *Bacillus cereus* were the most predominant bacteria species.

Figure 1 shows the frequency of bacterial isolates from hand swab. *Bacillus cereus* and *Staphylococcus aureus* had the highest frequency (30%) followed by *Citrobacter freundii* with a frequency of 20% and others with frequency occurrence of 10% each.

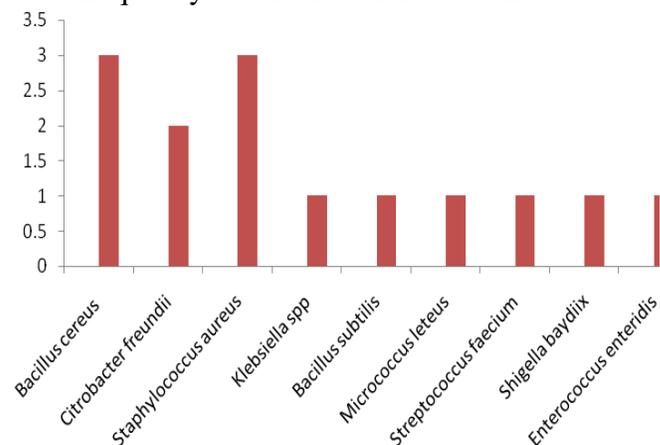


Figure. 1. Frequency of bacterial isolates from hand swabs

Duration of patient care was positively associated with the amount of bacterial contamination in health care workers who did not wear hand gloves than the acquisition rate of those with hand gloves. Also shown in Table 1 is the increasing bacterial contamination over time in the different clinical wards. Contamination of hands was more after attending to patients from direct contacts as compared to the less population before attending to patients.

**Table 1. Information on respondents (n = 4).**

Information	Frequency (%)
Gender	.....
Male	3
Female	1
Formal Education	.....
Primary	4
Secondary	3
Tertiary	1
Years of experience	.....
5 – 10	0
11– 15	0
16 – 20	2
21 – 25	1
26 – 30	1

Table 2 expresses susceptibility of test organisms to commercial antibiotics. Ciprofloxacin among the commercial antibiotics inhibited all test bacteria species followed by Rocephin and Pefloxacin. *Bacillus cereus*, *Bacillus subtilis*, *Citrobacter freundii*, *Streptococcus faecium* and *Klebsiella spp* were however observed resistant to rocephin and pefloxacin. All the test isolates were resistant to Zinnacef. *Micrococcus luteus* was susceptible only to

**Table 2. Susceptibility of test organisms to commercial antibiotics (mm)**

Isolated bacteria	PEF	GN	AM	R	CPX	S	SXT	E	CH	SP
<i>Staphylococcus aureus</i>	-	22	-	15	23	10	-	-	-	-
<i>Shigella boydii</i>	15	20	-	10	30	-	-	-	-	-
<i>Enterococcus enteridis</i>	30	15	-	20	25	20	-	-	-	-
<i>Staphylococcus aureus</i>	20	13	-	20	24	12	-	-	-	-
<i>Citrobacter freundii</i>	-	-	-	-	20	17	-	-	-	-
<i>Bacillus cereus</i>	-	22	-	-	25	-	-	-	-	-
<i>Bacillus subtilis</i>	-	-	-	-	16	-	-	-	-	20
<i>Citrobacter freundii</i>	-	-	-	-	-	-	-	-	16	15
<i>Streptococcus faecium</i>	-	-	-	-	20	-	-	-	-	-
<i>Micrococcus luteus</i>	-	20	-	-	30	-	-	-	-	-
<i>Bacillus cereus</i>	25	14	-	20	21	21	15	16	-	-
<i>Staphylococcus aureus</i>	30	-	25	-	25	15	16	18	-	-
<i>Staphylococcus aureus</i>	17	-	15	23	-	10	-	-	-	-
<i>Klebsiella pneumoniae</i>	-	-	15	24	28	12	-	-	-	-

Gentamycin and Ciprofloxacin with zones of 20 and 30 mm respectively. *Shigella boydii* was inhibited with zones of 15, 20, 10 and 9 mm by Pefloxacin, Gentamicin, Rocephin and Ciprofloxacin respectively. *Shigella boydii* was inhibited with zones of inhibition of 15, 20, 10 and 9 mm by Pefloxacin, Gentamicin, Rocephin and Ciprofloxacin respectively.

## **DISCUSSION:**

This study identified bacterial contamination of hands of clinic staff. The hand samples collected during routine patients care by health workers were found to contain some bacteria species. Every single bacterial species isolated were pathogenic, except *Micrococcus luteus*. These pathogens could be responsible for the illness (es) the patients suffers to sort medical care at the clinic, hence evidence of the patient's illness in relation to the isolated pathogens are unknown. It is basically clear that the isolated pathogens were from different individuals colonizing the hand gloves of the health workers who attended to patients for examination, interactions and collection of clinical samples. This is evident because, same species of some particular isolated pathogens responded differently to the antibiotic assay for sensitivity and resistant patterns. Cross contamination is bound to occur most especially in the cases where hand gloves are not changed after examining each individual. This observation suggests that the patients who attended clinics for repeated times on same disease infection on diagnosis, could likely be colonized with resistant species. If it is possible for health workers to change hand gloves at the inspection of an individual or sample collection, the level of cross contamination will be minimized and could help to check minor illness which ordinarily could be treated in a short given time than those compounded with resistant bacteria pathogens. The use of hand gloves has

served as means of protecting the hands of health care workers from microbial pathogens during routine care in medical wards<sup>17,18</sup>.

Contamination progressively increased during routine patient care on average health care worker with 16 colony forming unit of bacteria in a minute. The major reason of this high contamination was associated with direct contact by patients attending to treatments in the wards and from collection of patient's samples for laboratory analysis. These activities were associated with increased hand colonization independent of other factors such as the environmental situations due to the number of patients in the studied area. In the present study, samples from hands of health care workers indicated that contamination was higher after attending to patients than when they have not been attended to<sup>19</sup>. From the statistical analysis, it was observed that contamination of bacteria pathogens on an average health care worker in the clinic within an hour of attending to patients increased to 52 colony forming units. This allowed us to deduce that latex gloves only protects the hands of health workers but not the patients who they routinely attended to without using a new hand glove on each individual. It was also observed that from the initial hands of health workers where few bacterial loads were observed before attending to patients, increased bacterial load was observed on their palms after attending to quite numbers of patients. This

could be responsible for the possible transfer of bacterial pathogens from hand gloves as a result of moisture and heat generated on hand surface during the period of attending to patients. Though the study of hand contaminations have been mainly in intensive care units<sup>20,21</sup>, some reports of high degree of hand contamination in health care workers in medical wards are also available. However, patients irrespective of health care unit they are, when examined will ever be populated with bacterial contamination due to their state of health which may not allow them to take proper care of themselves in term of hygiene to reduce bacterial colonization. The isolation of bacterial contaminations in this study from the hands of health care workers in a mini health care unit of Afe Babalola University health centre is comparable to what is performed in intensive health care and advanced medical units<sup>22,23</sup>. Bacterial contamination of the hands of hospital staff is a dynamic process that results from multiple factors probably related to the kind of patient care<sup>24</sup>. Risk factors for hand contamination have been studied extensively. Afe Babalola University clinic is just a small health centre unit where minor treatments are carried out on patients. The number of bacterial isolated from contaminated hands suggests the severity of hand contaminations of health workers in advanced medical units where more patients and severe health issues are referred. In this study, the use of hand hygiene before patient contact was not part of the experimental design because the tendency of how the

hands of health care workers could be contaminated and how it can lead to cross contamination was one of the specific objectives. However, the washing of hands before attending to patients has been dully recommended<sup>25</sup> as a means of preventing microbial pathogens from cross infections within a health care unit<sup>26</sup>. In this study however, there were limitations such as comparing the hands of male and female workers, the level at which hand hygiene could decrease microbial load, the load and types of pathogens from individual patient and the areas of health care workers' hands that are mostly populated with pathogens. This is one of the few studies that have indulged in the culture of samples from health care workers before and immediately after patient contact.

In this study, the majorly encountered bacteria pathogen was *S. aureus* in conjunction with other Gram negative bacteria species from the health worker's hand gloves. It has earlier been reported that these bacteria are major skin commensals and are common in hospital environment where they are involved in nosocomial infection<sup>27</sup>. Most uniform of nurses were found to be highly contaminated with methicilin resistant *Staphylococcus aureus* (MRS) after attending to patients with wounds<sup>2</sup>. However, *S. aureus* has been reported as one of the human pathogens with multiple drug resistance acquired hospital and community diseases<sup>29,30</sup>. *Bacillus subtilis*, *Citribacter freundii*, *Streptococcus faecium* and *Klebsiella pnunioniae* exhibited

high resistance rates against streptomycin, septrim, erythromycin, chloramphenicol, sparfloracin, penfloxacin, gentamycin amoxilin and rocephim. The resistant ability of these bacteria pathogens from the hand gloves of health care workers observed in this study is of concern to public health. The isolation of *Staphylococcus aureus* and *Klebsiella pneumoniae* among the drug resistant bacteria has been reported in nosocomial infections requiring urgent treatment from the spread<sup>31</sup>.

### **CONCLUSION:**

Few bacterial populations are present in the hands of health workers when patients are not yet attended to. These populations' increases as patients are received for complaints on their health conditions most especially during feel, tests and collection of clinical samples. Therefore, contamination of health worker's hand cannot be limited to patients and their samples alone but also from the clinic or hospital environment that are populated with bacterial pathogens.

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