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The Risk of Nosocomial Infection Transmission in the Paediatric Outpatient Clinic in a Developing Country

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Authors' contributions

This work was carried out in collaboration between all authors. Authors AOF, NIK and CAT designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AIN, EU and NOC managed the analyses of the study. Authors ICC and OCJ managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Objective: As more care is provided for children in outpatient facilities, it is increasingly important to understand the potential for disease transmission and this is particularly so for nosocomial infections which are infections originating in hospitals. Knowledge of the profile of bacterial isolates of surfaces in outpatient facilities and their sensitivity patterns serves as a guide for prevention of nosocomial infection transmission.
Material and Methods: This hospital-based cross-sectional study was conducted in the Children's Outpatient Clinic (CHOP) of Enugu State University Teaching Hospital, Parklane, Enugu, Nigeria

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(ESUT-TH). Samples for culture were collected from equipment and hospital surfaces. Antimicrobial susceptibility testing was determined for each isolate by the Agar diffusion method using Standard Nutrient Agar 1 discs.

Results: Out of 122 samples collected from various sites, bacterial growth was observed in 55 **(45.0%)** specimens. Staphylococcus aureus and Coagulase-negative Staphylococcus were the most common isolates cultured from 23 different locations. Among the Staphylococcus aureus isolates, 17.4% (4/23) were MRSA. Levofloxacin and Imipenem showed the best sensitivity pattern for Staphylococcus aureus

Conclusion: Staphylococcus aureus, Coagulase-negative Staphylococcus were the commonest isolates.

There is need to develop specific protocols that will ensure hand hygiene, judicious use of antimicrobials, active surveillance, and enhanced cleaning/disinfection of surfaces in outpatient clinics as essential components of prevention and control of nosocomial infections.

Keywords: Nosocomial infection; outpatient; paediatric; developing country.

1. INTRODUCTION

Outpatient care is provided by hospitals when patients do not need to stay overnight, and such visits have been noted to be on the increase [1]. Schappert and Rechtsteiner2 reported that between 1997 and 2007, out patient visits increased by 25% [1,2] Therefore, as more care is provided in outpatient facilities, it is increasingly important to understand the potential for disease transmission. This is particularly so for nosocomial infections, also called hospital-acquired infections (HAI), which are defined as infections originating in hospitals [3,4,5] It is also essential to encourage practices that ensure infection prevention in outpatient clinics [6].

The risk of transmission of nosocomial infections in the outpatient clinic was once believed to be lower than in critical hospital settings because of fewer encounters, shorter contact times, and exposure to a smaller number of bacteria [3,7]. However, many healthcare-acquired infections have now been linked to outpatient settings, and this has been attributed to poor compliance with recommended infection-prevention procedures [8] It has been demonstrated that equipment used in non-critical settings, such as outpatient clinics, is less likely to have standard cleaning protocols than the equipment used in the critical or acute setting [1] Such equipment is more likely to carry a large number of microorganisms.[1] Thus, infection prevention and control in outpatient settings are vital [9].

Nosocomial infections remain a global health burden with greater incidence in Africa [10] The high prevalence in recent times of community-associated diseases caused by resistant microorganisms such as community-acquired methicillin-resistant Staphylococcus aureus (MRSA) has been recognized in many parts of the world [10,11]. These organisms have the potential to cause severe infections among patients attending clinics, thus making outpatient clinics areas of potential transmission risk [7].

Transmission of infection in the paediatric outpatient clinic is an issue of increasing concern because young children have unique behavioural characteristics. These include incontinence of urine and stool, inadequate hygiene, frequent mouthing of hands and toys or other objects, drooling and direct contact among children during play, readily acquire and transmit infections [12,13] Preventing transmission of disease in the physician's office is, therefore, an essential component of patient care [12].

This study was conducted to evaluate the potential risk of the children's outpatient clinic at Enugu State University Teaching Hospital, Parklane, Enugu, to the community by determining the profile of the bacterial isolates of medical equipment and surfaces in the CHOP of the hospital and their sensitivity patterns as a guide for appropriate treatment and prevention of infection.

2. METHODOLOGY

This hospital-based prospective study was conducted in the Children's Outpatient Clinic (CHOP) of Enugu State University Teaching Hospital, Parklane, Enugu, Nigeria (ESUT-TH). ESUT-TH Parklane is the Enugu State-owned Teaching Hospital, located at the centre of Enugu, the capital city of Enugu State. Children's Outpatient Clinic runs every weekday between the hours of 8 am and 4 pm. The authors

obtained approval from the ethics committee before the commencement of the study (reference number ESUTHP/C-MAC/RA/034/Vol. 1/283)

The sample size was 122 consisting of 30 floors/walls (15 surfaces each of floors and walls), 33 electrical appliances (11 sockets, 11 fan switches, seven air-conditioner switches, two light switches, one mouse, one desktop computer), 13 doorknobs, nine portable medical devices (2 stadiometers, two sphygmomanometers, one bassinet scale, one nebulizer, one infra-red thermometer, one diagnostic set, 1 measuring tape), seven examination couches, 24 furniture surfaces (12 surfaces of both chairs and tables each).

Surfaces to be sampled were swabbed using sterile cotton swab sticks moistened with normal saline (0.9% w/v). The samples were sent to the Laboratory within thirty minutes and inoculated into CLED, Salmonella Shigella Agar, and blood agar. The inoculated agar plate was incubated at $37^{o}C$ for 2 days for primary bacterial isolation, and different bacteria strains were selected.

Antimicrobial susceptibility testing was done for each isolate using Standard Nutrient Agar 1. Discs containing the following antibiotics: - Cefoxitin (30 µg), Ciprofloxacin (5µg), Erythromycin(5µg), Gentamicin (10 µg), Amoxicillin-Clavulanate (30 µg), Nitrofurantoin (300µg), Levofloxacin (5µg), Ceftriaxone (30 µg), Ceftazidime (30 µg), Cefuroxime(30 µg), Ofloxacin(5µg), Cefixime(5 µg), Cloxacillin(5µg), imipenem (10 µg), Cefuroxime axetil (30 µg) were used. Methicillin-resistant Staphylococcus aureus (MRSA) were checked by cefoxitin disc using diffusion method; Oxoid Ltd. Company, UK produced the cefoxitin disc.

The data obtained were analysed using SPSS version 20.0 (Chicago IL), and the result presented in prose, tables, and charts.

3. RESULTS

Out of 122 samples collected from various sites, bacterial growth was observed in 55 **(45.0%)** specimens, while the remaining 67 **(54.9%)** did not show bacterial growth. A total of 59 bacterial isolates were cultured from the 55 sites. Mixed bacterial flora was isolated from four (4) surfaces. Staphylococcus aureus and Coagulase-negative Staphylococcus were the most common isolates cultured from 23 different locations. Details of the specimen and bacterial isolates are shown in Table 1. Most of the Staphylococcus aureus isolates were from walls/floor surfaces 47.8% (11/23), followed by furniture 30.4% (7/23), examination couches and electrical appliances were 8.7% (2/23) each, while doorknobs and portable medical devices yielded no growth. Among the Staphylococcus aureus isolates, 17.4% (4/23) were MRSA.

The resistance pattern of Staphylococcus aureus isolates is shown in Table 2. Levofloxacin and Imipenem showed the best sensitivity pattern for Staphylococcus aureus with only 4.3% (1/23) each. However, the Staphylococcus aureus that were resistant to Levofloxacin and Imipenem were both MRSA. Escherichia coli was the only Gram-negative isolate. All the Escherichia coli isolates were susceptible Levofloxacin and Imipenem. The resistance pattern of Gram-negative isolates is shown in Table 3. Fig. 1 shows the overall distribution of the isolates.

Table 1. Swabbed surfaces and their bacterial isolates

Swabbed Surfaces	**N=122**	***S. aureus* (n=23)**	***Escherichia coli* (n=13)**	***CONS* (n=23)**	**Total =59**
Walls/floors	30	11 (47.8%)	2 (15.4%)	5 (21.7%)	18 (60.0%)
Door knobs	13	0	2 (15.4%)	0	2 (15.4%)
Hand-washing devices	6	1 (4.3%)	1 (7.7%)	1 (4.3%)	3 (50.0%)
furniture	24	7 (30.4%)	2 (15.4%)	5 (21.7%)	14 (58.3%)
Couches	7	2 (8.7%)	2 (15.4%)	4 (17.4%)	8 (114.3%)
Portable medical appliances	9	0	2 (15.4%)	4 (17.4%)	6 (66.7%)
Electrical appliances	33	2 (8.7%)	2 (15.4%)	2 (8.7%)	6 (18.2%)

Table 2. Antibiotic resistance pattern of Staphylococcus aureus (MRSA and MSSA) isolates

Antibiotics	*S. aureus* isolates (n=23) Frequency (%)	MRSA isolates (n=4) Frequency (%)	MSSA isolates (n=19) Frequency (%)
Cloxacillin	19 (82.6%)	4 (21.1%)	15 (78.9%)
Ceftriaxone	17 (73.9%)	3 (17.6%)	14 (82.4%)
Erythromycin	18 (78.3%)	4 (22.2%)	14 (77.8%)
Imipenem	1 (4.3%)	1 (100.0%)	0
Cefuroxime axetil	10 (43.5%)	3 (30.0%)	7 (70.0%)
Levofloxacin	1 (4.3%)	1 (100.0%)	0
Gentamycin	10 (43.5%)	1 (10.0%)	9 (90.0%)
Cefuroxime	17 (73.9%)	4 (23.5%)	13 (76.5%)
Ceftazidime	19 (82.6%)	4 (21.1%)	15 (78.9%)
Amoxicillin-clavulanate	20 (87.0%)	4 (20.0%)	16 (80.0%)
Ofloxacin	11 (47.8%)	1 (9.1%)	10 (90.9%)

Table 3. Antibiotic resistance pattern of Gram negative isolates

Antibiotics	*E. coli* n=13 (%)
Cefuroxime axetil	10 (76.9%)
Cefixime	12 (92.3%)
Gentamycin	4 (30.8%)
Cefuroxime	13 (100.0%)
Ceftazidime	13 (100.0%)
Nitrofurantoin	7 (53.8%)
Amoxicillin-clavulanate	13 (100.0)
Ofloxacin	2 (15.4%)

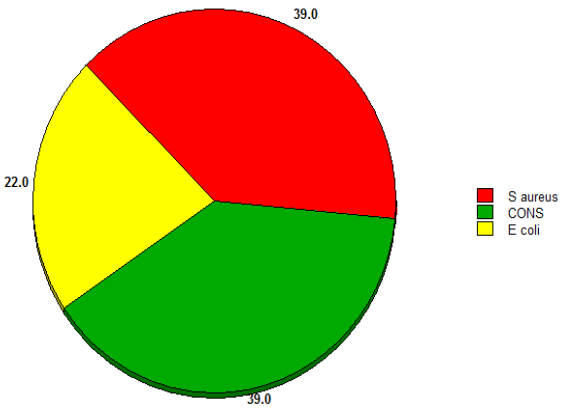

Fig. 1. Bacterial Isolates

4. DISCUSSION

Infections with antibiotic-resistant bacteria are usually considered hazards of inpatient care [1] There is a misconception that the outpatient clinic surfaces and environment are devoid of any pathogens and play a minor role in the endemic transmission of microorganisms [1,7,14] However, the propensity to acquire these organisms is not confined to the acute or long-term care setting [7] Our study yielded a total of 59 bacterial isolates from the 55 sampled sites. This is in keeping with the findings of other studies [12,15-17] and suggests that health care workers should pay more attention to infection prevention measures in outpatient hospital settings.

Among the Staphylococcus aureus isolates, 17.4% (4/23) were MRSA, and the remaining

were MSSA. Similarly, Johnson et al. [15] studied community-acquired Methicillin-Resistant Staphylococcus aureus skin infections among healthcare workers in an outpatient setting and reported that 19% of the 36 environmental cultures grew MRSA. Nosocomial infections are no longer confined to the hospital environment, and many outbreaks have been linked to outpatient settings [1] Methicillin-resistant MRSA is a major nosocomial pathogen associated with infection outbreaks that cause severe morbidity and mortality in many hospitals worldwide.15,33 It can remain viable on dry surfaces for days, weeks, or even months, and transmission of MRSA from environmental surfaces to health care workers and patients has been documented [4,14,18-20].

Outpatient settings have been known to lack infrastructure and resources to support infection prevention and surveillance activities compared to inpatient acute care settings [21-24] It is, therefore, a significant cause of concern that surveillance of outpatients for MRSA colonization is done chiefly for inpatients on high-risk sections even in developed countries, while in the outpatient setting, no special precautions are taken [15].

Escherichia coli was the only Gram-negative isolate in our study. Similarly, Ali et al. [25] cultured Escherichia coli from the outpatient clinic of a teaching hospital in Kuwait. Escherichia coli has been identified as one of the most common pathogens that cause nosocomial infections [26,27].

It was assumed in the past that Gram-negative bacteria survive poorly on surfaces [28] However, recent work has challenged this, as Escherichia coli may survive desiccation for more than a year [29] There is a growing consensus that environmental cleanliness could be just as crucial for controlling transmission of multiple drug resistance coliforms as it is for MRSA and other organisms [30,31].

Therefore, preventing the acquisition of infection from the inanimate environment is vital. As a critical component of prevention, routine cleaning and disinfection of environmental surfaces should be assigned to appropriately trained staff with periodic monitoring [13]. Prevention also includes observing standard precautions with all patients, purpose-built offices, and appropriate administrative policies for personnel [13]. Efforts should also be made to minimize crowding and shorten wait times in clinics [32,33]. The role of alcohol-based hand rubs (ABHR) and handwashing with soap and water in infection control has been emphasized and recommended by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) [34].

CONCLUSION

This high degree of contamination suggests a risk of transmission of nosocomial infections from such areas of a hospital.

RECOMMENDATION

There is a need to develop specific protocols that will ensure hand hygiene, judicious use of antimicrobials, active surveillance, and enhanced cleaning/disinfection of surfaces in the outpatient clinic as essential components of prevention and control nosocomial infections in outpatient clinics.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The authors obtained approval from the ethics committee before the commencement of the study (reference number ESUTHP/C-MAC/RA/034/Vol. 1/283)

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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