Microbial Population of *Staphyloccous aureus* from Inanimate Surfaces in a General Hospital Environment in Rivers State, Nigeria

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ABSTRACT: The isolation of *Staphylococus aureus* from inanimate objects in a General hospital in Rivers State was studied. Swabs were obtained from different sources comprising of; toilet seat, floor, switch, side rail bed, side rail chair, door handle, sink tap, bed spread, pillow case, and locker using the swab technique. High frequency of *S. aureus* was observed in toilet seat with perecentage distribution of 78%, followed by floor with percentage distribution of 70% and locker with percentage distribution of 65% and the lowest frequency occurence was observed in switch with percentage distribution of 30%. Frequency occurrence of *S. aureus* was 48.9% out of 50 isolates, indicating that antibiotics resistance pool especially betalactamase is to be widely available in the hospital environment and poor hygyine practices.

Staphpylococcus. aureus has the ability to resists various types of dry environments, including the surface of inanimate objects thought to be fomites. The hospital environment includes all surfaces outside a given patient zone, namely the healthcare facility environment and other patient zones. The Healthcare area may be contaminated by microorganisms from different patient zones (Sax *et al*., 2007). Hospital workers that come across patient in different zones of the hospital may cause cross-transmission and may further contaminate the environment due to poor hygiene practices (Pittet *et al*., 2006; Wertheim *et al*., 2005; Russotto *et al*., 2015). Methicillin-resistant *S. aureus* infection has become endemic in hospitals around the world despite conscious efforts by infection control professionals (Harbarths *et al*., 2003). Most MRSA are acquired in hospital and many of them can be prevented. MRSA can be transmitted between patients on the hands of the hospital staff, and hand washing is widely recognized as the single most important factor for prevention of colonization and infection (Boyce *et al.,* 2003; Davis *et al*., 2012). Despite the implementation of standard infection control practices, the widespread failure to control *S. aureus* infection and MRSA is still on the increase. The hospital environment may be another important, but neglected factor in hospital cross-infection. Hospital Acquired MRSA strains are resistant to an array of antibiotics for which reason the treatment of infection due to this organisms is always a challenge, more so when the critically ill patients are affected. Contamination of the hospital inanimate environment by *S. aureus* and MRSA is a serious concern in human medicine which is a current trend in the world today. Historically hospital associated MRSA infections have predominated in humans and have contributed to significant illness and death (Simpson *et al.,* 2007). Based on this there is a need to improve on the current situation, the necessity of mass screening of inanimate hospital environment for Methicillin *Staphylococcus aureus* must be evaluated by prospective studies, with the aim of determining the frequency of nosocomial MRSA in the hospital, and also to guide the development of local control and treatment policies. The study was carried out to ascertain the prevalence rate of *S. aureus* on inanimate surfaces within the hospital environment and the presence of resistant genes.

MATERIAL AND METHODS

*Study area and sample collection***:** This study was carried out in five (5) different wards in a General hospital in Rivers State, Nigeria. Details on the source of sample are detailed in Table 1 below. Samples were collected using sterile swabs sticks (Bibby sterilin, Stone, Staffordshire, Uk) moistened with sterile saline and used to swab surface area of around 5x5cm of the various locations (Mizumachi *et al*. 2011)

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Isolation and Identification of Staphylococcus sp: Bacteria on the swabs were inoculated onto Mannitol Salt Agar (Oxoid) plates in an aseptic manner. All the inoculated plates were incubated under aerobic condition at 37°C for 24 hours to observe for developed colonies. A sterile wire loop was used to pick distinct colonies from Mannitol Salt Agar plates and streaked on Nutrient Agar plates. Plates were incubated at 37°C for 24 hours to observe for pure developed colonies of S*taphylococcus aureus.* The bacterial isolates were characterized and identified based on their colonial morphology and biochemical characteristics namely catalase test, coagulase test, fermentation, motility and Gram stain. Pure isolates of *S. aureus* were inoculated into slants and stored at 37°C for 24 hours (Cheesbrough, 2000).

Table .1: Source of Sample

S/N	Isolate	Ward	S/N	Isolate	Ward
1	TS	Female(fw)	26	DH	Accident & emergency (A/E w)
2	FL	Female(fw)	27	ST	Accident & emergency (A/E w)
3	Sw	Female(fw)	28	BS	Accident & emergency (A/E w)
4	SRB	Female(fw)	29	PC	Accident & emergency (A/E w)
5	SRC	Female(fw)	30	L	Accident & emergency (A/E w)
6	DH	Female(fw)	31	TS	Orthpaedic (O W)
7	ST	Female(fw)	32	FL	Orthpaedic (O W)
8	BS	Female(fw)	33	Sw	Orthpaedic (O W)
9	PC	Female(fw)	34	SRB	Orthpaedic (O W)
10	L	Female(fw)	35	SRC	Orthpaedic (O W)
11	TS	Male(mw)	36	DH	Orthpaedic (O W)
12	FL	Male(mw)	37	ST	Orthpaedic (O W)
13	Sw	Male(mw)	38	BS	Orthpaedic (O W)
14	SRB	Male(mw)	39	PC	Orthpaedic (O W)
15	SRC	Male(mw)	40	L	Orthpaedic (O W)
16	DH	Male(mw)	41	TS	Children emergency(CHEW)
17	ST	Male(mw)	42	FL	Children emergency(CHEW)
18	BS	Male(mw)	43	Sw	Children emergency(CHEW)
19	PC	Male(mw)	44	SRB	Children emergency(CHEW)
20	L	Accident & emergency (A/E w)	45	SRC	Children emergency(CHEW)
21	TS	Accident & emergency (A/E w)	46	DH	Children emergency(CHEW)
22	FL	Accident & emergency (A/E w)	47	ST	Children emergency(CHEW)
23	Sw	Accident & emergency (A/E w)	48	BS	Children emergency(CHEW)
24	SRB	Accident & emergency (A/E w)	49	PC	Children emergency(CHEW)
25	SRC	Accident & emergency (A/E w)	50	L	Children emergency(CHEW)

Key: TS = Toilet seat ; **SRC =** Side rail chair; **FL =** Floor; **DH =** Door handle; **SW =** Switch; **ST =** Sink tap; **SRB =** Side rail bed;
BS = Bed spread; **L =** Locker; **PC =** Pillow case

Antibiotic sensitivity test: The test was carried out using single disc-method. A loop-full of the isolated test organism was inoculated into saline solution to ensure the even distribution of the organism. This was then use to flood nutrient agar plate. Excess were discarded into disinfectant jar. Disc were aseptically placed on the agar plate and incubated at 37°C for 24 hours.

RESULT AND DISCUSSION

A total of fifty (50) surfaces from a General hospital in Rivers State Nigeria were screened for *Staphylococcus aureus*. The percentage distributions of isolates from different sources in female ward (fw) are shown in figure 1. Results shows that toilet seat (16%) had the highest frequency next to floor (14%) and door handles (11%) while switch (10%) had the lowest frequency of *S. aureus*. Percentage distribution of *S. aureus* from male ward (MW) is shown in Figure 2. Results shows that the floor (14%) had the highest frequency of *S. aureus* next to

toilet seat (10%) and locker (11%) while the bed spread (8%) had the lowest frequency of *S. aureus*.
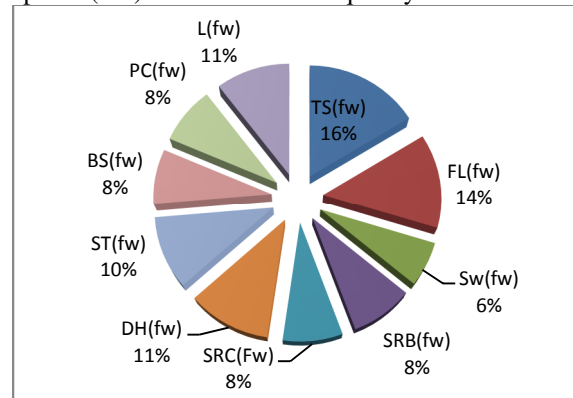

Fig 1: Percentage distribution of isolates from different sources in female Ward (fw)

Percentage distribution of *S. aureus* from children emergency ward (chew) is shown in Figure 3. Results shows that the side rail bed (12%) had the highest frequency of S. *aureus* next to floor (12%) and rail

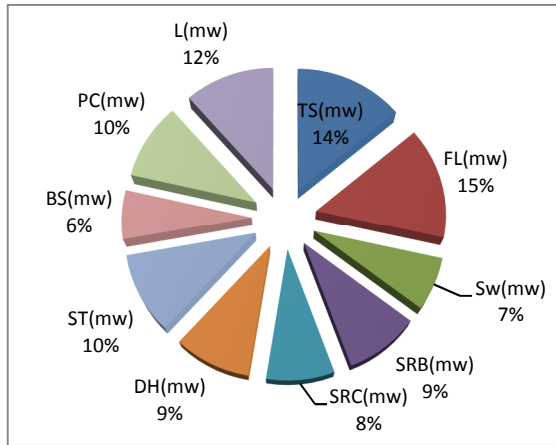tap (11%) while the pillow case (7%) had the lowest frequency of *S. aureus*.

Fig 2: Percentage distribution of isolates from different sources in male ward (MW)
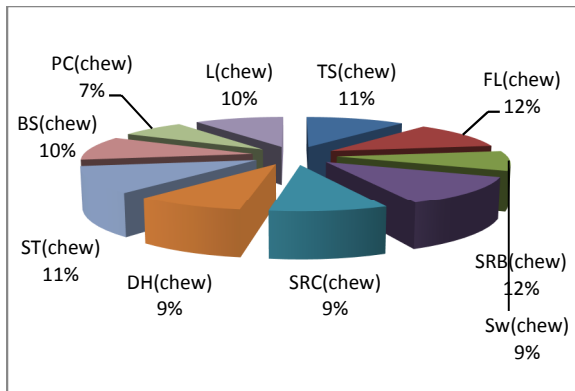

Fig 3: Distribution of Isolates from different sources in children emergency ward (Chew)

Percentage distribution of *S. aureus* from accident and emergency ward (a/e w) is shown in figure 3.4. Result shows that the locker (10%) had the highest frequency of *S. aureus* next to toilet seat (11%) and door handle (9%), while the side rail chair (9%) had the lowest frequency of *S. aureus*. Percentage distribution of *S. aureus* from orthopedic ward (OW) is shown in Figure 3.5. Results shows that locker (13%) had the highest frequency of *S. aureus* , the floor (10%) and toilet seat (11%), while the switch (9%) and side rail chair had the lowest frequency of *S. aureus* (8%).

The study was carried out to investigate the frequency of *S. aureus* in inanimate surfaces in hospital environment. Results obtained from the study revealed that the frequency of isolation of *S. aureus* in this in investigation was 50%. Isolation of *S. aureus* from the inanimate areas of the hospital can be successfully accomplished with a combination

of several microbiological analyses. The hospital environment represents a secondary reservoir of microorganisms such as *Staph aureus (*Nadia *et al*., 2016).
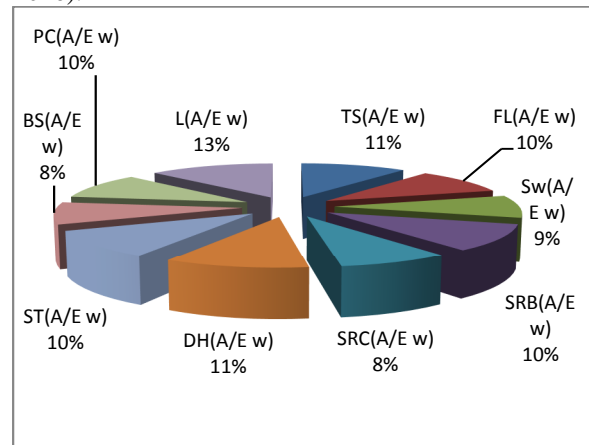

Fig 4: Distribution of isolates from different sources in accident and Emergency ward (a/e w)
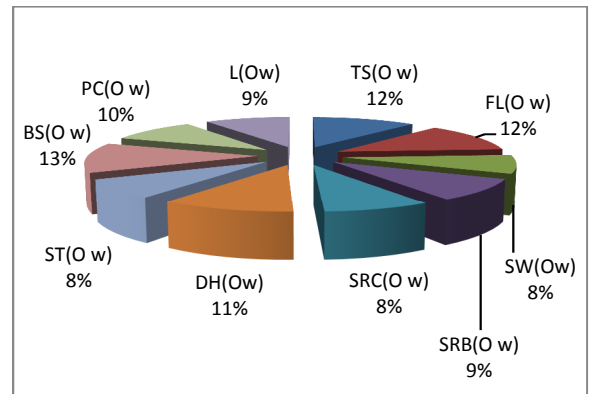

Fig 5: Distribution of isolates from different sources in orthopedic ward (OW)

They have the ability of colonizing almost any surface even fabrics (Neely and Maley, 2000; Wagenvoort *et al*., 2002; Chaibenjawog and Foster, 2011). The counts of *S. aureus* recorded in this study however may be related to the level of sanitation control policy in the health care unit where this study was conducted hence the urgent need for one. A study carried out in a hospital in Libya which revealed the highest count of MRSA in ICU and dialysis wards with percentage of 9.5%, 7.8% and 5% respectively (Nadia *et al*., 2016). The high frequency found in these inanimate objects is seen as a challenge because they have high frequency of contact with patient and are likely to transmit the disease. These underscores the necessity for a preventive intervention in our hospital, more importantly studies have shown that nosocomial spread of MRSA strains are harbored in inanimate environment of the hospital. Staphyloccoci can

become pathogenic based on the toxins it produces at its stationary phase. These toxins produced by *Staphyloccocus* have the ability to destroy the host tissue thereby causing disease. Strains of *Staphylococcus* found in the hospital can cause different diseases and it is also responsible for nosocomial infections. High prevalence of *Staphylococcus aureus* in hospital settings can lead to MRSA associated diseases. A study carried out on emergency workers and bacterial contamination on touch surfaces showed that the carriage of MRSA was not affected by clinical exposure in the hospital because of the existing infection control policy in our hospital (Oguzkayaa- Artan *et al.*, 2015).

Further advantage of eradication MRSA carried by hospital staff and institution of effective control policies in prevention of its transmission to healthy people visiting the hospital. In addition the financial implication of handling such hospital spread of MRSA is huge reason for which MRSA has been described as a public health issue with economic consequences (Mirelli *et al.,* 2007). Resistance in commonly used antimicrobial such as cloxacillin has shown increasing prevalence in the last 15 years (Okeke *et al.,* 2000). It is thought that sustained pressure like antibiotics may enhance the ability of microbes to resist the presence of antibiotics or drugs. Antibiotic resistance increasingly compromises the outcome of many infections that were until recently treatable and remains the most common diseases in Africa. The more often bacteria are exposed to antibiotics, the more likely that resistance will develop. The spread of infections that are resistant to antibiotic treatment has serious consequences for public health. It is advisable that prudent use of antibiotics and infection control, sanitation and hygiene practices are steps that must be taken now to stem the trend of rising resistance.

*Conclusion***:** *Staphylococcus* isolated from the inanimate environment in the hospital showed various microbial load. The result obtained might be due to that the antibiotic gene pool especially beta lactamase that is responsible for a wide range of resistance in hospital environment. Thus there is need for the adoption, development and enforcement of appropriate control policies in hospitals with many points of critical care like our own where there are no existing or effective disease control programs, washing of hands and sterilization of hospital equipment.

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