Incidence And Antibiotic Susceptibility Profile Of *Staphylococcus aureus* On Door Handles In Ahmadu Bello University, Zaria, Nigeria.

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PRESENTATION OUTLINE

- Introduction
- Methodology
- Results and Discussion
- Conclusion
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INTRODUCTION

- Environmental contamination with pathogenic microorganisms which are of clinical importance, due to their contribution to morbidity and mortality is increasing daily.

- Such microorganisms especially skin associated ones like *Staph. aureus* have been isolated from various sites or surfaces touched by hands both in hospitals and non-hospital environments (Benjamin *et al.*, 2013; Adriano *et al.*, 2011; Josh, 2011).

- This wide spread of *Staph. aureus* contributes to its importance as a nosocomial and community-acquired pathogen, whose genetic plasticity could facilitate the evolution of many virulent and antibiotics resistant strains, which could present a major and constantly changing clinical problems (Matthew *et al.*, 2004).

- As a means of checkmating the global challenges associated with antibiotic resistance in microorganism, this study evaluates the antibiotics susceptibility profile of *Staph. aureus* isolated from door handles in the Faculty of Pharmaceutical Sciences and Amina female hostels in Ahmadu Bello University, Zaria, Nigeria

- in order to quantify the level of antibiotics resistance and to proffer better treatment or management options to infections associated with *Staph. aureus* contacted from door handles in this area.

METHODOLOGY

Sample Collection

- A total of one hundred and forty three (143) samples from door handles were randomly collected using sterile swab sticks containing sterile normal saline.

- The samples were aseptically collected from Amina female hostel, Pharmacy main block and Pharmacy old block of Ahmadu Bello University Zaria, Samaru Campus (A.B.U).

Microbial Identification, Isolation and Microscopy

- Collected samples were suspended in sterile nutrient broth for 24hrs and then inoculated on the surface of sterile nutrient agar (NA), and incubated at $37^{O}C$ for 18hrs.

- Gram staining and microscopy using the method described by Chakraborty and Nishith, (2008),

- while further morphological characterization of the colonies as described by Cheesbrough (2000).

Biochemical Test

- The following conventional biochemical tests; catalase, coagulase and oxidase tests described by Cheesbrough (2000) were adopted to distinguish *Staph*. *aureus* from other forms of *Staph*. *spp*.

- While the Gram negatives organisms were identified by their colour on indole, methyl red, Vogue Prosker, citrate and urease described by Chakraborty and Nishith (2008).

Antibiotic Susceptibility Test and Multiple Antibiotic Resistance Index (MARI) Evaluation

- The susceptibility profiles of the identified *Staph. aureus* was tested against twelve (12) selected antibiotics using disc diffusion method as described by Cheesbrough (2000) and the corresponding results interpreted using CLSI (2014).

- The multiple antibiotic resistant (MAR) index was determined for each isolate. This is defined as the number of antibiotics to which the organism is resistant to, divided by the total number of antibiotics tested (Paul *et al*., 1997).

RESULTS AND DISCUSSION

- Out of the 143 door handles sampled, the incidence of *Staph. aureus* was 23.8% (34)

- with highest occurrence in Amina female hostel (16.8%),

- followed by Pharmacy main block (4.2%) and Pharmacy old block (2.8%) as shown in Table 1.

Table 1: Distribution of *Staph. aureus* In Door Handles in Ahmadu Bello University, Zaria

S/N	Sample Source	No. Of Sample Collected	Number of *Staph. aureus*	Percentage of *Staph. aureus* (%)
1	Amina female hostel	89	24	35.8
2	Pharmacy main block	40	6	8.9
3	Pharmacy old block	14	4	6.0
Total		**143**	**34**	**50.7**

- Among the samples collected, culture identification, microscopy and biochemical tests also showed the presences of other microorganisms.

- The incidence of *E. coli* (9%) and *Shigella dysentery* (7.5%) were found to be the most common bacteria compared to other microorganisms isolated after *Staph. aureus*.

- This is shown in Table 2.

Table 2: Percentage of Bacteria Isolated from the Door Handles Sampled

This result showed the microbial contaminate on door handles in the areas sampled.

S/N	ORGANISMS	Number of Isolates (n = 67)	Percentage (%)
1	*Staphylococcus aureus*	34	50.7
2	*Eschericheria coli*	6	9
3	*Shigella dysentery*	5	7.5
4	*Salmonella typhi*	4	6
5	*Pseudomonas aeruginosa*	4	6
6	*Serretia spp.*	4	6
7	*Klebsiella spp.*	3	4.4
8	*Citrobacter spp.*	2	3
9	*Proteus mirabilis*	2	3
10	*Salmonella paratyphi A*	2	3
11	*Enterobacter spp.*	1	1.4
		67	100

Antibiotics Susceptibility Profile of *Staph. aureus* from the Sampled Areas

- The isolates were highly susceptible to Erythromycin, Ciprofloxacin, and Tetracycline (100%),
- 97% susceptible to mupirocine and cotrimoxazole, 90% to Pefloxacine, and 85% to Oxacillin.
- But the isolates were observed to be 100% (34) resistant to Cefotaxime and Amoxicillin, 96.7% (33) resistant to Cefuroxin sodium,
- 76.6% and 70 % resistant to Ofloxacine and Amoxicillin clavulanic acid respectively (Figure 1).

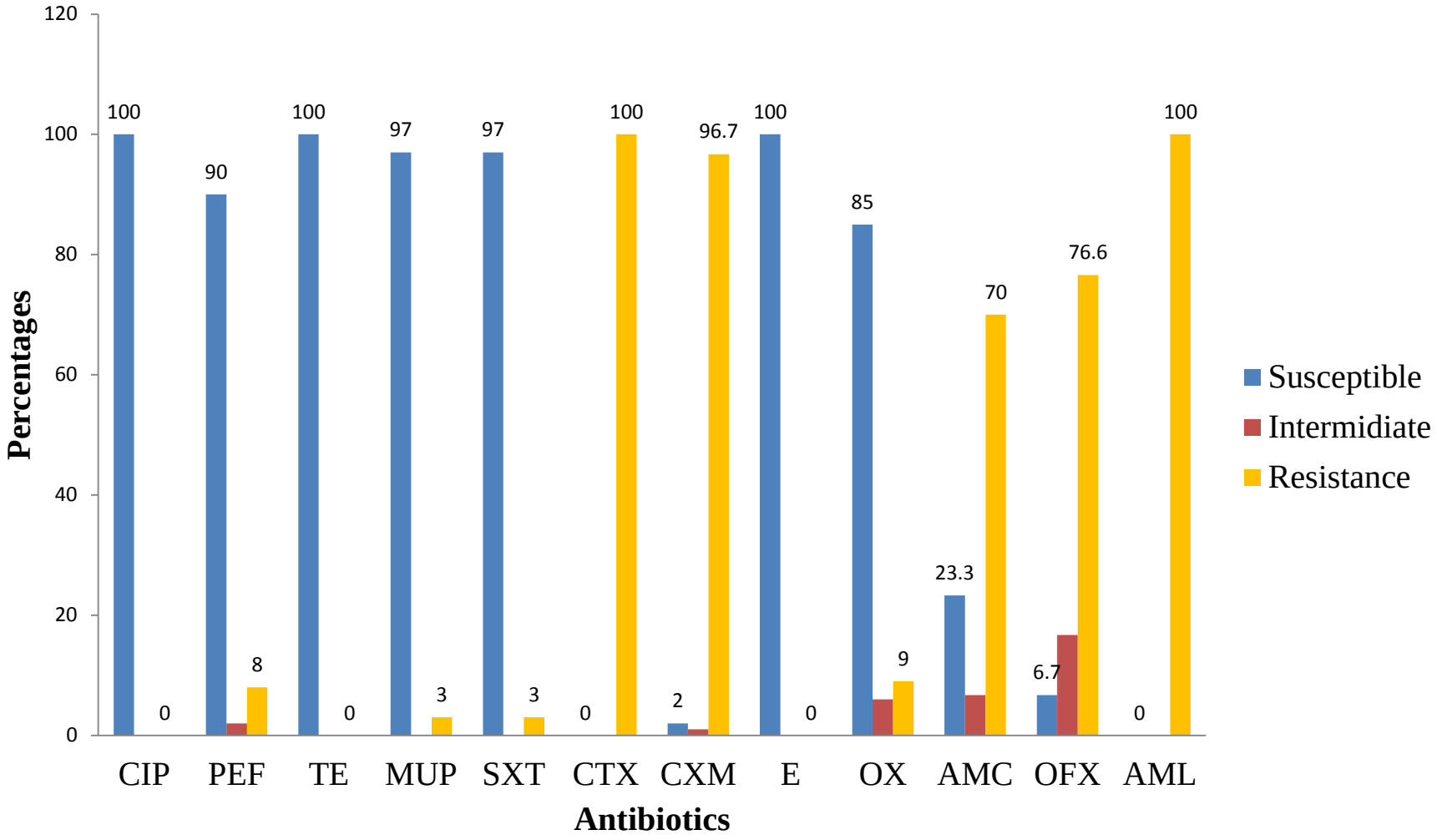

Figure 1: Antibiotics Susceptibility Profile of *Staph. aureus*

Keys: Tetracycline (TE), Cefuroxin sodium (CXM), Cefotaxime (CTX), Mupirocin (MUP), Ciprofloxacin (CIP), Ofloxacin (OFX), Perfloxacin (PEF), Oxacillin (OX), Erythromycin (E), Amoxicillin/clavulanic acid (AMC), Amoxicillin (AML), Cotrimoxazole (SXT).

Table 3: Evaluation of the Antibiotic Resistance Pattern and Index (MARI) of *Staph. aureus*

- This result showed the antibiotic susceptibility profile of the *Staph. aureus* isolated from door handles in the areas sampled

S/N	ISOLATES	Antibiotics Resistant Pattern	MARI	CART	DR
1	F1a	CTX, CXM, AML	0.3	CEP, BET	XDR
2	D2b	CTX, CXM, AML, OFX	0.3	CEP, BET	XDR
3	I1b	AMC, CTX, CXM, AML, PEF, OFX	0.5	CEP, BET, FLU	MDR
4	H1b	AMC, CTX, CXM, AML, OFX	0.4	CEP, BET, FLU	MDR
5	H2c	AMC, CTX, CXM, AML, OX, OFX	0.5	CEP, BET, FLU	MDR
6	K2b	CTX, CXM, AML,	0.3	CEP, BET	XDR
7	I2	CTX, CXM, AML, OFX	0.3	CEP, BET, FLU	MDR
8	L1a	AMC, CTX, CXM, AML, OFX	0.4	CEP, BET, FLU	MDR
9	F1b	AMC, CTX, CXM, AML, OFX	0.4	BET, CEP, FLU	XDR
10	E2a	AMC, CTX, CXM, AML, PEF, OFX	0.5	BET, CEP, FLU	MDR
11	F2b	AMC, CTX, CXM, AML, OFX	0.4	BET, CEP, FLU	MDR
12	D2c	AMC, CTX, CXM, PEF, AML, OFX	0.5	BET, CEP, FLU	MDR
13	A2b	AMC, CTX, CXM, AML,	0.3	BET, CEP	XDR
14	A2a	AMC, CTX, CXM, AML	0.3	BET, CEP	XDR
15	H1a	CTX, OX, OFX, AML,	0.3	CEP, BET, FLU	MDR

16	I1a	CTX, CXM, AML, OFX	0.3	BET, CEP, FLU	MDR
17	H1c	CTX, CXM, OFX, AML,	0.3	CEP, BET, FLU	MDR
18	G2a	AMC, CTX, CXM, AML, OFX	0.4	BET, CEP, FLU	MDR
19	H2b	CTX, CXM, AML, OFX	0.3	BET, CEP, FLU	MDR
20	B1a	AMC, CTX, CXM, OFX, MUP, AML	0.5	BET, CEP, FLU, PS	MDR
21	J2	CTX, CXM, AML,	0.3	CEP, BET	XDR
22	F2a	AMC, CTX, CXM, OFX, AML,	0.4	BET, CEP, FLU	MDR
23	D1b	CTX, CXM, AML, OFX	0.3	CEP, BET FLU	MDR
24	K1b	AMC, CTX, CXM, AML, OFX	0.4	BET, CEP, FLU	MDR
25	L1b	AMC, CTX, CXM, AML	0.3	BET, CEP	XDR
26	M1a	AMC, CTX, CXM, AML, OX, OFX	0.5	BET, CEP, FLU	MDR
27	M1b	AMC, CTX, CXM, AML, OFX	0.4	BET, CEP, FLU	MDR
28	N2a	AMC, CTX, CXM, AML, OFX	0.4	BET, CEP, FLU	MDR
29	N2b	AMC, CTX, CXM, AML, OFX	0.5	BET, CEP, FLU	MDR
30	H2a	AMC, CTX, CXM, AML,	0.3	BET, CEP	XDR
31	M2p	AMC, CTX, CXM, AML,	0.3	BET, CEP	XDR
32	N2c	AMC, CTX, CXM, AML, SXT, OFX	0.5	BET, CEP, FLU, FPI	MDR
33	N2g	AMC, CTX, CXM, AML, OFX	0.4	BET, CEP, FLU	MDR
34	D2h	AMC, CTX, CXM, AML, OFX	0.4	BET, CEP, FLU	MDR

Keys:

- Tetracycline (TE), Cefuroxin sodium (CXM), Cefotaxime (CTX), Mupirocin (MUP), Ciprofloxacin (CIP), Ofloxacin (OFX), Perfloxacin (PEF), Oxacillin (OX), Erythromycin (E), Amoxicillin/clavulanic acid (AMC), Amoxicillin (AML).

- Class of antibiotics resistant to (CART), Degree of resistance (DR), Betalactam/Betalactamase inhibitors (BET), Folate pathway inhibitors (FPI), Cephalosporine (CEP), Fluoroquinolone (FLU), Macrolide (MAC), Pseudomonic acid (PS).

- MDR: Multidrug-resistant, XDR: Extensively drug-resistant NIL: neither MDR nor XDR. MDR: non-susceptible to ≥1 agent in ≥3 antimicrobial categories. XDR: non-susceptible to ≥1 agent in all but ≥2 categories. PDR: non-susceptible to all antimicrobial agents listed.

- PDR was not considered because not all the antibiotics contained in the proposal of Magiorakos *et al.*, (2012) are used in this study.

CONCLUSION

- This study on *Staph. aureus* from door handles in A.B.U Zaria have proved that door handles could serve as reservoir and route of microbial dissemination in disease outbreak.

- It also suggests ciprofloxacin, erythromycin, tetracycline, mupirocin and oxacilline as the best antibiotics during infection associated with door handle *Staph*. *aureus*.

- It also encourages the need to promote proper hygienic practice and adherence to antibiotic treatment in order to prevent the spread of resistance bacteria.

RECOMMENDATIONS

- For immediate action, this study suggests the use of silver coated door handles with antimicrobial activity in other to reduce the microbial load from this source, and frequent use of disinfectant/hand sanitizer is recommended.

- Also proper periodic antibiotic surveillance should be encouraged to have referable documentaries in disease outbreak.

REFERENCES

- Adriano Menis Ferreira, Denise de Andrade, Marcelo Alessandro Rigotti, Margarete Teresa Gottardo de Almeida (2011). Methicillin-resistant *Staphylococcus aureus* on surfaces of an Intensive Care Unit. Acta paul. enferm., **24** (4)
- Benjamin A. Miko, Carolyn T. A. Herzig, Dhritiman V. Mukherjee, Montina Befus, Zoltan L. Apa, Ruo Yu Bai, Caroline J. Lee, Anne-Catrin Uhlemann, Elaine L. Larson, and Franklin D. Lowy (2013). Is Environmental Contamination Associated with *Staphylococcus aureus* Clinical Infection in Maximum Security Prisons?. Infect Control Hosp Epidemiol. **34**(5): 540–542.
- Charkraborty.P,Nishith Pal. (2008). *Manual of practical microbiology and parasitology*. 11th edition. New central book agency(P) Ltd., **40**(79):112-131.
- Cheesbrough M (2000). District laboratory practice in tropical countries (Part 11). Cambridge, University Press UK. Pp. 134-143.
- Clinical Laboratory Standard Institute (CLSI) (2014). Performance Standards for Antimicrobial Susceptibility Testing; Twenty-Fourth. This document provides updated tables for the Clinical and Laboratory Standards Institute antimicrobial susceptibility testing standards M02-A11, M07-A9, and M11-A8. **30**(1)

- Josh (2011). *Microbial biography of public rest room surfaces*.Word press and Atahualpa
- Magiorakos A.P., Srinivasan A., Carey R. B., Carmeli Y., Falagas M. E., Giske C. G., Harbarth S., Hindler J. F., Kahlmeter G., Olsson-Liljequist B., Paterson D. L., Rice L. B., Stelling J., Struelens M. J., Vatopoulos V, Weber J. T. and Monnet D. L. (2012). Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. *Clinical Microbial Infection*, 18: 268–281
- Matthew T. G. Holden, Edward J. Feil, Jodi A. Lindsay, Sharon J. Peacock, Nicholas P. J. Day, Mark C. Enright, Tim J. Foster, Catrin E. Moore, Laurence Hurst, *et al.*, (2004). Complete genomes of two clinical *Staphylococcus aureus* strains: Evidence for the rapid evolution of virulence and drug resistance. Proceedings of the National Academy of Sciences of the United States of America, **101(26**): 9786–9791
- Paul, S. Bezbarauh, R.L. Roy, M. K and Ghosh, A.C. (1997). Multiple antibiotics resistance (MAR) index and its reversion in *Pseudomomas aeruginosa*. *Letters in Applied Microbiology*, 24:169-71

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