



The Knowledge of and Attitude to Hospital-acquired Infections among Public and Private Healthcare Workers in South-East, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author ANO designed the study, wrote the protocol and wrote the first draft of the manuscript. Author CCE managed the experimental process. Author AHO managed the literature searches. Author OSE did analyses of the study. Author IE critically reviewed the manuscript for intellectual content and author CCI conceptualized the study. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To ascertain and compare the knowledge and attitude of public and private health-care workers in South-East, Nigeria on hospital-acquired infections.

Study Design: A cross sectional surveillance report.

Place and Duration of Study: Randomly selected hospital workers in private and public hospital in South-east Nigeria were administered questionnaire between April and July 2013.

Methodology: Proportional sampling technique was used to obtain a representative sample of the health-care workers. Structured and validated questionnaires (n=660) were self-administered to randomly selected healthcare workers present on the days of visit and consenting to participate in the study. Data were analyzed using Chi square statistical tool.

Results: The workers have good knowledge of HAIs but their attitude to preventive measures is poor and significantly different ($p = 0.0002$: Chi-square (X^2) test). Hospital-acquired infections occurred more in public than private hospitals. The prevalence of nosocomial infections in the hospitals surveyed (as reported by the respondents) is urinary tract infection (34.9%), Gastroenteritis (27.1%), Hospital acquired pneumonia (20.3%), yeast infections (10.8%), Tuberculosis (9.0%), ventilator associated pneumonia (3.6%) and methicillin and/or vancomycin resistant infections (1.5%). The prevalence of the etiological agents of the nosocomial infections are the *Staphylococcus aureus* (31.0%), *Candida albicans/ Aspergillus species* (10.8%), *Pseudomonas aeruginosa* (10.5%), *Mycobacterium tuberculosis* (9.0%) and *Clostridium difficile* (3.9%). The workers know well about hospital-acquired infections, 322 (97.58%) and 297 (90%) in public and private hospitals respectively. About 11 (3.6%) and 19 (6.2%) workers in private and public hospitals respectively process their equipment as well as practice hand hygiene and use of personal protective equipment.

Conclusions/Recommendation: The burden of HAI is very high. UTI is the most prevalent HAI. The most common causative agent in both hospital setting is *Staphylococcus aureus*. The knowledge of the workers concerning hospital acquired infections is adequate but their attitude to the infections' prevention is poor and significantly different. Standardized surveillance of nosocomial infections has to be urgently addressed in Nigeria.

Keywords: Nosocomial Infections; hospitals; knowledge; attitude; healthcare workers.

1. INTRODUCTION

Hospital-acquired infection (HAI) is public health concern. It may be referred to as nosocomial infection or Health care-associated infection, or hospital infection and includes any infectious disease that patients in a hospital or other health-care facility encounter but is not present or incubating at the time of admission [1-3] or any occupational infection among health-care staff [2]. Infections acquired in health-care settings constitute major threat to hospitalization being the most frequent adverse event in health-care delivery worldwide [4-6].

In the United States of America, important nosocomial infections are bloodstream infections (BSIs) and were reported to be the major causes of morbidity and mortality in the country [7]. In Brazilian hospitals, the annual incidence of hospital infections is between 0.55 and 1.1 million [6,8]. In Egypt, the International Nosocomial Infection Control Consortium (INICC) findings reveal that Device-associated infection rates in adult and pediatric intensive care units is 32.8% [9].

Unlike in many developed countries, standardized surveillance of nosocomial infections [10] has not been addressed in Nigeria. Many reports exist in Nigeria about the incidence and prevalence of hospital acquired infection among hospitalized patients [11-13]. The occurrence of HAIs adversely affects the quality of healthcare services due to attendant costs both on the patients' and care givers and on the hospital management.

The knowledge and attitude of healthcare workers to HAIs is critical in reducing mortality, morbidity and cost due to hospital acquired infections. However, this information is lacking in South-eastern Nigeria, hence the study.

2. METHODOLOGY

2.1 The Study Area

With a population of 140,431,790 [14], Nigeria is divided into 6 geo-political zones. South-east Nigeria harbors 11.675% of the national population and is made up of five states, namely:

Abia, Anambra, Ebonyi, Enugu and Imo. There are 7 Teaching Hospitals, 2 Federal Medical Centres and several General Hospitals in the zone. Private clinics/hospitals also abound in the zone.

2.2 Sample Size Calculation and Sampling Technique

Sample size Calculation for prevalence studies:

$$N = (Z^2pq) / D^2 \quad \text{where}$$

$q = (1-p)$
 $N = \text{Sample Size}$
 $P = \text{Prevalence Rate in \%}$
 $Z = \text{Confidence interval of 95\% which is equivalent to Confidence of 1.96}$
 $D = \text{desired level of Size Significance (5\%)}$

The prevalence of HAI in a Nigerian hospital setting was reported as 22.5% [12]

So,

$$N = (1.96^2 * 0.225 * 0.775) / 0.05^2 = 267.9516$$

The minimum sample size is approximately 268 per category of hospital (public and private). Making an allowance of 22.5% for attrition gave a sample size of 328 which was approximated to 330. The categories of health professionals chosen were doctors, nurses, pharmacists and medical laboratory scientists because they encounter HAIs more. Proportional sampling technique was used to obtain a representative sample of the health-care workers. Out of the 7 Teaching Hospitals in the Zone, 5 were selected such that all the states were represented. The 2 Federal Medical Centers in the Zone were all sampled. General Hospitals and Private Clinics/hospitals were sampled by convenience but such that they were equally distributed throughout the states. Also, the participants were selected by convenience based on the participants that agreed to give attention to the questionnaires on the day of visit.

2.3 Research Instrument

The instrument or tool used in this study was a self-administered and validated questionnaire totaling 660. The questionnaire was structured. A cross section of healthcare workers consisting of 96 doctors, 170 nurses, 24 pharmacists and 40 medical laboratory scientists from selected public hospitals and 90 doctors, 180 nurses, 30

pharmacists and 30 medical laboratory scientists from selected private hospitals were administered the questionnaire.

2.4 Inclusion Criteria

Participants must have worked in the hospital for at least one full year in the case of public hospitals or 6 full months in the case of private hospitals and be working in any of the following areas of the hospital that have high tendency of encountering nosocomial infections: the medical, surgical and/or gynecology, neonatology and/or paediatrics wards, the theatre, intensive care unit, blood bank and/or hematology, chemical pathology, bacteriology and/or parasitology, histopathology laboratories, the HIV care unit and the compounding and/or dispensing pharmacy units. The 6 months allowed in private clinics was because of the observed high turnover rate of employees in the sector.

2.5 Data Collection

This was carried out between April and July 2013 by the investigator and assisted by intern pharmacists residing within each state. Prior to the study, the investigator trained the assistants on the research methodology and data collection procedure. At each selected health facility, the investigator or his assistant explained to the study participants the reasons for the study and its voluntary nature. Their consents were sought before the distribution of questionnaires.

2.6 Data Analysis

The results were analyzed using GraphPad Prism version 5.00 for Windows, GraphPad Software, Inc. San Diego California USA, www.graphpad.com". The statistical test used was Chi-square to determine association between categorical variables and a p-value of less than 0.05 was considered significant. Data were presented in tabular form and bar charts.

2.7 Ethical Approval

This was sought for and obtained from Nnamdi Azikiwe University Teaching Hospital, Nnewi and Anambra State University Teaching Hospital, Amaku-Awka Ethics Committees (approval numbers: NAUTH/CS/66/Vol.4/53 and ANSUTH/AA/ECC/29 respectively).

3. RESULTS

Fig. 1 shows the analysis of knowledge of hospital acquired infections in the hospitals visited. This knowledge was based on the ability to correctly define or explain what HAI is. It shows that 612 (92.73%) of the workers have heard about hospital acquired infections. The study also showed that 322 (97.58%) and 297 (90%) of healthcare workers in public and private hospitals respectively have knowledge of hospital acquired infections and there is significant difference in this knowledge among the hospitals (Chi-square = 16.75 and P = value 0.0002). Therefore, the knowledge of healthcare workers on nosocomial infections is satisfactory.

Fig. 2 shows the analysis of modes of transmission of hospital acquired infections in the hospitals visited as opined by the healthcare workers visited. It shows that 88.5% of the study participants in both hospitals opined that all the modes (comprising indwelling catheter, airborne, contact with blood and body fluids, needle sticks, contaminated instruments, contaminated hands) are implicated in HAIs transmission. There is a significant difference (Chi-square = 21.91 and P value = 0.0002) in the different transmission modes within the hospitals with indwelling catheter being the most important mode of transmission.

Table 1 showed that the reported prevalence of the nosocomial infections in the two sets of hospitals is in the following descending order: urinary tract infection (34.9%), Gastroenteritis (27.1%), Hospital acquired pneumonia (20.3%), Tuberculosis (9.0%), ventilator associated pneumonia (3.6%), methicillin and/or vancomycin resistant infections (1.5%).

Table 2 showed that the reported culprit micro-organisms were *Staphylococcus aureus* (31.0%), *Candida albicans/Aspergillus* (10.8%), *Pseudomonas aeruginosa* (10.5%), *Mycobacterium tuberculosis* (9.0%), *Clostridium difficile* (3.9%) and methicillin and/or vancomycin resistant bacteria (1.5%).

Table 3 shows the ways adopted by healthcare workers to prevent nosocomial infections. The study shows that 385 (58.33%) chose 'All' in the option which includes hand hygiene, use of personal protective equipment (PPE), proper disposal of medical waste, processing of instruments (decontamination, sterilization, high-level-disinfection), isolation. The percentage that chose 'All' in public and private hospitals is 60.9% and 56.2% respectively. This signifies poor attitude to infection prevention.

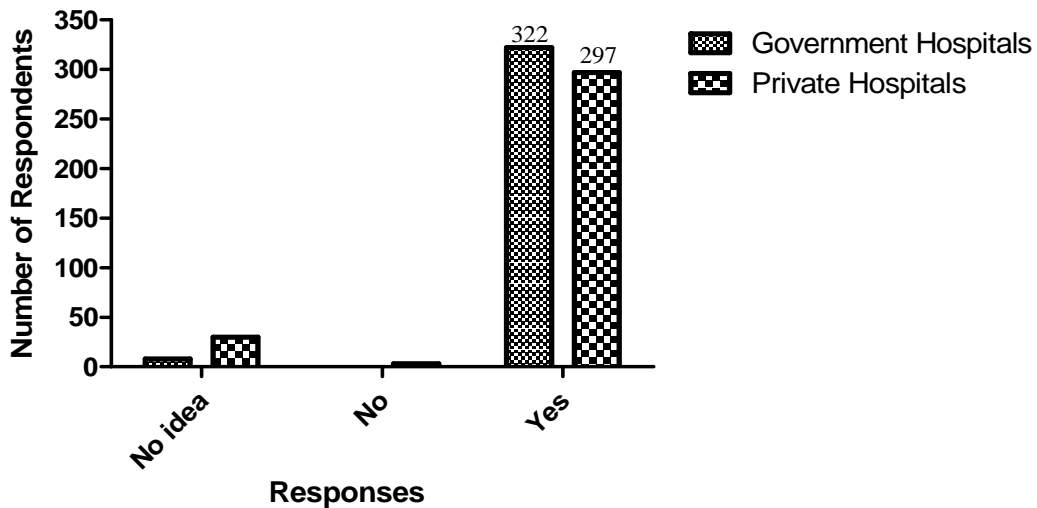


Fig. 1. Knowledge of hospital acquired infections in the hospitals visited. The knowledge of HAIs between public and private hospitals was analysed with Chi-square test; $\chi^2 = 16.75$, $df = 2$ and P value = 0.0002. Statistically significant? (alpha<0.05) Yes

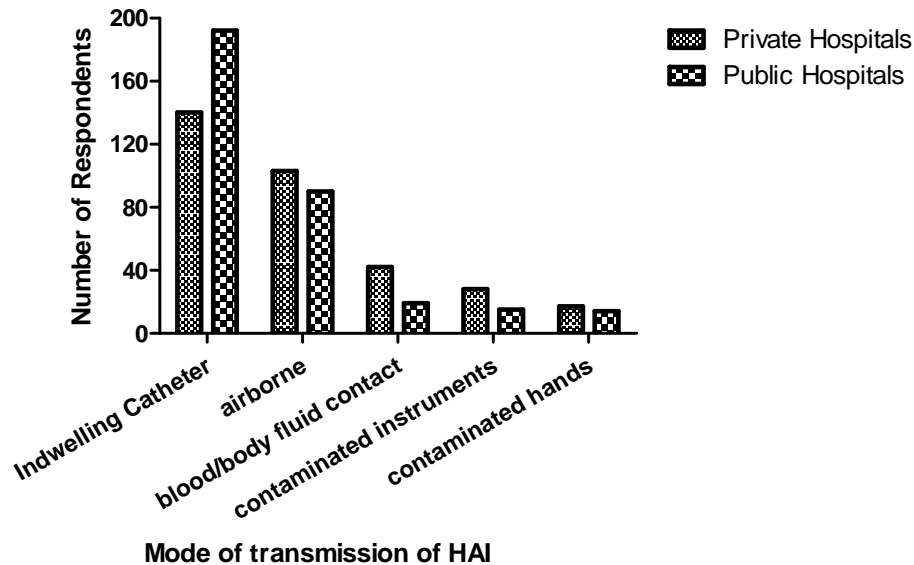


Fig. 2. Analysis on modes of transmission of hospital acquired infections. The analysis was between public and private hospital. Chi-square = 21.91, df = 4; P value = 0.0002. Statistically significant? (alpha<0.05) Yes

Ten (3.2%) health care workers in public hospital responded that they process their equipment before use. Eleven (3.6%) and 19 (6.2%) workers in private and public hospitals respectively process their equipment, practice hand hygiene and use of personal protective equipment all at same time. Although the percentage is low, it shows that workers in public hospital were adopting better methods to control infection than those in private. There is significant difference ($p = 0.003$) in the ways adopted by both workers in the hospitals with public hospitals adopting better method of control.

Table 4 shows the use of PPE by the study participants and reveals that 58 (17.58%) and 136 (41.21%) participants always wear personal protection equipment (PPE) in private and public hospitals respectively. The workers in public hospitals therefore have more knowledge on the need for PPE for self-protection and spread of infections. They more readily apply the precautions necessary for reducing the spread of infections. Significant difference ($p = 0.001$) exists between workers in the two institutions, with those in public hospitals wearing PPE more often.

The percentage of healthcare workers that wear PPE always is 194 (29.39%). This is low and is below average and signifies poor attitude.

This study (Table 5 and 6) shows the poor knowledge of the workers about infection control committee in the hospitals. In the private and public hospitals, only 61 (18.48%) and 150 (45.45%) of the hospital workers (Table 5) respectively are aware of the existence of infection control committee. Of this low number, as much as 23 (37.70%) and 62 (38.75%) do not know if the committee meet or not (Table 6).

Table 7 highlights the members of the infection committee in the hospitals visited. The options available in the questionnaire include medical doctors, pharmacist, Nurses, Medical Laboratory Scientists, Hospital Environmentalist and others (which should be specified by the respondents). The study showed that 31 (50.82%) and 88 (55.00%) workers in private and public hospitals respectively stated that all the medical personnel listed are represented in the membership of the committee in their hospitals. Also 6 (9.84%) and 8 (5.00%) workers stated that all the medical personnel listed together with cleaners are members.

Table 1. Frequency of occurrence of kind of hospital acquired infections (HAIs)

Kinds of hospital acquired infections (HAIs)	Percent occurrences in private hospitals (%)				Percent occurrences in public hospitals (%)				X ²	df	p-value
	H	L	M	N	H	L	M	N			
Ventilator associated pneumonia	2.6	51.7	16.9	25.2	4.5	46.4	14.9	22.1	53.025	3	0.001
Tuberculosis	7.3	57.0	21.9	12.3	10.7	49.0	17.9	16.2	14.617	3	0.006
Hospital acquired pneumonia	18.9	30.1	40.7	8.6	21.8	24.7	38.0	11.7	6.741	3	0.150
Methicillin and/or Vancomycin resistant infections	2.3	34.8	13.6	46.4	0.6	23.7	15.6	48.7	24.733	3	0.001
Yeast infections	8.3	46.0	21.5	20.2	13.3	35.1	23.7	18.2	16.104	3	0.003
Gastroenteritis	14.2	38.1	37.1	8.9	41.2	12.7	35.7	5.8	85.043	3	0.001
UTI	22.5	32	39.7	5.0	47.1	14.9	30.2	5.2	53.025	3	0.001

Key: High (H) = > 10 cases in 1 year, Medium (M) = 8 - 10 cases in 1 year, Low (L) = 5 - 7 cases in 1 year, Occasional; (N) = 1 - 4 cases in 1 year

Table 2. Frequency of occurrence of the etiological agents of the hospital acquired infections (HAIs)

Microbial agents of the HAIs	Percent occurrences in private hospitals (%)				Percent occurrences in public hospitals (%)				X ²	df	p-value
	H	L	M	N	H	L	M	N			
<i>Staphylococcus aureus</i>	20.9	36.1	32.1	9.3	40.9	13.6	31.8	10.4	52.613	3	0.001
<i>Clostridium difficile</i>	4.0	38.7	13.2	35.4	3.9	28.9	16.6	37.0	9.064	3	0.06
<i>Candida albicans/Aspergillus</i>	8.3	46.0	21.5	20.2	13.3	35.1	23.7	18.2	16.104	3	0.003
<i>Pseudomonas aeruginosa</i>	8.9	38.4	28.8	19.5	12.0	34.4	27.9	15.3	11.342	3	0.023

Key: High (H) = > 10 cases in 1 year, Medium (M) = 8 - 10 cases in 1 year, Low (L) = 5 - 7 cases in 1 year, Occasional; (N) = 1 - 4 cases in 1 year

Table 3. Ways adopted by healthcare workers to prevent hospital acquired infections

S/N	Preventive methods	Number of respondents private (%)	Number of respondents public (%)	X ² test for trend	df	p-value
1	process instruments (Decontamination, sterilization, high-level-disinfection)	0 (0.0)	10 (3.2)	3.566	1	
2	isolation and proper disposal of medical waste	0 (0.0)	5 (1.6)			0.059
3	hand hygiene and use of personal protective equipment	24 (7.3)	23 (7.1)			
4	All the Methods	184 (56.2)	201 (60.9)			
5	No response	1 (0.3)	7 (2.1)			
6	Methods 1 and 2	0 (0.0)	2 (0.6)			
7	Methods 1 and 3	11 (3.6)	19 (6.2)			
8	Methods 2 and 3	93 (28.1)	80 (24.4)			
9	Total	330 (100)	330 (100)			

4. DISCUSSION

This study, carried out in South-east Nigeria, tries to ascertain and compare the knowledge and attitude of health-care workers in public and private hospitals on nosocomial infection. The

study (Table 1) showed that the frequency of occurrence of the HAIs is higher in public hospital than in private hospitals. This can be attributed to the higher population of patients leading to overcrowding, and higher healthcare waste been generated in the hospitals. Urinary

tract infection is the most common nosocomial infection as revealed in this and previous studies [15-17]. As much as 80% of the HAIs are associated with the use of an indwelling bladder [15,16]. Nosocomial pneumonia occurs in several different patient groups and most important are patients on ventilators in intensive care unit where rate of pneumonia is up to 3% per day [16,17]. Gastroenteritis is the most common nosocomial infection in children and rotavirus is reported as the chief pathogen while *Clostridium difficile* is the major cause of nosocomial gastroenteritis in adults in developed countries [17]. A 5 years study at university college hospital Ibadan (Nigeria) indicated that urinary tract infection and surgical site infection were the most prevalent (43.9%) and the major isolates were *Klebsiella species* (34.3%) and *Staphylococcus aureus* (20.1%) [13]. A similar study in Morocco involving 1195 patients shows urinary tract infections to be the most prevalent (35%), *Staphylococcus aureus* to be most isolated microbe (18.7%) which was methicillin

resistant in 50% cases. The overall prevalence of HAI was 10.3% [17]. These studies are in agreement with the observations of our respondents in this study as most opined that UTI is the most common nosocomial infection encountered and the commonest microbial culprit is *Staphylococcus aureus*. The implication of this is that infertility may likely be on increase via cystitis or pyelonephritis in the females or urethritis and prostatitis in the males. Untreated UTI may also cause stillbirth, low-birth-weight neonate, spontaneous abortion, premature delivery and sepsis. Our findings differs slightly with the research conducted at Obafemi Awolowo University Teaching Hospital Ile-Ife were out of 515 nosocomial infection cases, 491 (78.8%) were gram negative rods (*E. coli*) followed by *Staphylococcus aureus* and other organisms 17 (2.7%) [18]. Our finding also differ from cases seen in developed countries where *E. coli* is the most common cause of UTI cases in hospitalized patients [1,7,10].

Table 4. Analysis on the use of personal protective equipment (PPE)

Response	Number of respondents private (%)	Number of respondents public (%)	X ² test	df	p-value
Always	58 (17.58)	136 (41.21)	56.45	3	<0.0001 Statistically significant at (α<0.05)
Never	0 (0.0)	8 (2.43)			
Rarely	49 (14.84)	27 (8.18)			
Sometimes	223 (67.58)	159 (48.18)			
Total	330 (100)	330 (100)			

Table 5. Analysis on the existence of Infection control committee

Response	Number of respondents private (%)	Number of respondents public (%)	X ² test	df	p-value
No	147 (44.54)	20 (6.06)	139.2	2	<0.0001 Statistically significant at alpha<0.05
No Idea	122 (36.97)	160 (48.48)			
Yes	61 (18.48)	150 (45.45)			
Total	330 (100)	330 (100)			

Table 6. Analysis on the knowledge of the frequency of meetings of the committee

Frequency of meetings of the committee	Number of respondents private (%)	Number of respondents public (%)	X ² test for trend	df	p-value
As often as possible	22 (36.07)	69 (43.125)	0.08664	1	0.7685
Rarely	15 (24.59)	28 (17.5)			
Never	1 (1.64)	1 (0.625)			
No Idea	23 (37.70)	62 (38.75)			
Total	61 (100)	160 (100)			

Table 7. Analysis on the membership to the infection control committee

Membership to the committee	Number of respondents private (%)	Number of respondents public (%)	X² test for trend	df	p-value
All	31 (50.82)	88 (55.00)	0.02871	1	0.8654
All + Cleaners	6 (9.84)	8 (5.00)			
Hospital Environmentalist	1 (1.64)	1 (0.625)			
Med. Doctors, Pharmacists, Nurses	0 (0.0)	1 (0.625)			
Medical Doctors	1 (1.64)	1 (0.625)			
Medical Doctor, Med Lab. Scientist	1 (1.64)	1 (0.625)			
Med. Lab Scientist	1 (1.64)	1 (0.625)			
No Idea	20 (32.77)	59 (36.875)			
Total	61 (100)	160 (100)			

The study shows that the workers has good knowledge of nosocomial infection (Fig. 1) probably because all the health professionals in the country now do mandatory continuing professional education and some programs incorporate patient safety and hospital environment courses. This notwithstanding, in order to help minimize the transmission of microorganisms from equipment and the environment adequate methods for cleaning, disinfecting and sterilization must be put in place [17].

The workers [Fig. 2] opined that nosocomial infections in the zone are most commonly transmitted through indwelling catheter and then airborne compared to other routes. Modes of transmission between the two hospital settings are significantly different ($p = 0.0002$) – Chi Square Test and significantly correlated ($p= 0.008$) with a correlation coefficient of 0.963). This is in agreement with previous studies [15,16]. The higher case of infection via indwelling catheter observed in public hospitals than private hospitals is due to higher patients' population observed in the setting and not necessarily due to other factors like expertise and dedication to duty. Transmissions via other routes were lower in the public setting compared to private setting showing a better observance of universal precaution in public hospitals.

The workers (Table 3) are more aware of the need for decontamination and sterilization and also have materials for doing so readily available. Generally, the knowledge of the workers in prevention of nosocomial infection is adequate. This is essential for improvement in patients care. Unfortunately, their attitude to infection is poor considering the global goal of reducing HAIs to zero through infection prevention practices. The practice of infection is poor. The use of disposal medical devices (particularly syringes),

their re-sale and re-use without sterilization significantly raises the burden of HAIs [19,20]. High level disinfection is expected to destroy all microorganisms except large bacterial spores [21]. The hand is the most common vehicle for microbial transmission and hence hand hygiene is an effective method for preventing the spread of infections and infectious agents [22]. Hand washing reduces the number of potentially infectious microorganisms on the hand and decreases the incidence of infection transmission in the healthcare facility [23-25].

The poor use of personal protective equipment (PPE) by the workers in this study (Table 4) explains both the high risk of self-contamination and spread of nosocomial infections encountered on the study (Table 1). The purpose of protective measures is to reduce the risks of accident/exposure or the consequences [26]. The study also shows that the workers in public hospitals were better trained in infection control and in universal precaution practices. Also prophylaxis and vaccination of healthcare workers is needed in case of accidents to avoid getting infected. The hospital management and infection control committee should therefore ensure optimum availability of PPE to the healthcare workers and make sure they comply and wear it in their day-to-day activities.

The poor knowledge of the health workers about infection control committee in their hospitals (Tables 5 and 6) is most likely a problem of management not necessarily due to nonchalant attitude from the workers. The management must therefore ensure that the infection control committee performs its duties efficiently by ensuring that they meet constantly to address infection issues in the hospitals. It was recommended that the team should meet several times a week or preferably daily especially in

countries where there is high incidence of nosocomial infection [27].

Membership to Infection Control Committee (Table 7) should include a wide representation from relevant programmes e.g. management, physician, other healthcare workers, clinical microbiology, pharmacy, central supply, maintenance, housekeeping, training services [17,28].

5. CONCLUSIONS

The burden of HAI in this part of the world is still very high. UTI is the most prevalent HAI. The most common causative agent both hospital setting is *Staphylococcus aureus*. The knowledge of the workers in both sets of hospital in the prevention of nosocomial infection is barely adequate; their attitude is poor and significantly different. Standardized surveillance of nosocomial infections has to be urgently addressed in Nigeria

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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