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Evaluation of Occupational Health and Infection Control Practices in Some Federal Medical Centers (FMCs) in Southern Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author OTA designed the study, performed the statistical analysis, wrote the protocol and the first draft of the manuscript. Author ILN managed the analyses of the study. Author KD managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The hospital is a high risk environment for the transmission of infections to health care workers, visitors, patients and the surrounding community. Healthcare workers are exposed to a variety of hazards which predisposes these "indispensable carers" to various life threatening infections and diseases. This study is aimed at evaluating the occupational hygiene and infection control practices in Federal Medical Center (FMC) Owerri and FMC Yenayoa, both located within southern Nigeria. Descriptive cross sectional study using a structured questionnaire and walk-through safety checklist was employed. A total of 379 healthcare workers were selected through disproportionate stratified sampling from the two facilities. The questionnaires were self-administered and analyzed using SPSS Version 22.0. Frequencies, chi-square were computed and multivariable logistic regression analysis was used to identify the predisposing factors to which health workers are exposed; 60.7% of respondents were male, dominant age group; 30 – 39yrs, nurses represented a

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larger proportion (34.8%) of healthcare workers in this study; 51.7% and 48.3% of respondents in FMC Yenagoa and FMC Owerri respectively had a good knowledge of hazards and controls. There was a significant difference with chi-square as, 9.710 p-Value <0.008. Good level of attitude was 44.7% in Owerri and 21.2% in Yenagoa, chi-square 18.295 p-Value <0.001. Overall level of occupational hygiene and infection control practices was poor in both facilities. Health care workers had a very high level of exposure to ergonomic hazards (88.9%) and biological hazards 47.6% in Owerri and 55.3% in Yenagoa. Nurses were 5 times more at risk of ergonomic hazards (95%CI) – 5.96 (2.19–16.24) p-Value < 0.001, while Medical Laboratory scientists were 5 times more at risk of chemical hazards (OR = 5.98, 95CI: 3.05–11.69, p-Value <0.001). The checklist revealed that both facilities were of imminent high risk category. Health care workers at FMC Yenagoa had higher exposures to all five categories of hazards than FMC Owerri. Working in FMC Owerri predisposes workers to higher health hazards than in FMC Yenagoa. There was better administrative controls including trainings and immunizations in FMC Yenagoa than in FMC Owerri.

Keywords: Independent variable; ergonomic hazards; Musculoskeletal Disorders (MSDs); FMC Yenagoa and FMC Owerri; Post Exposure Prophylaxis (PEP).

1. INTRODUCTION

The hospital is a high risk environment for transmission of infections to health care workers, visitors, patients as well as the surrounding community. Health care workers (HCWs) are at a great risk of acquiring infections varying from bacterial to viral and other hazards associated with the job [1,2]. Some of the hazards faced by Health Care workers (HCW) includes ergonomic hazards such as heavy lifting up patients, and standing long hours, latex allergy, blood borne pathogens, needle stick injuries, chemicals and drug exposures, laser hazards, radiation hazards from x-rays and other radioactive materials, waste anesthetic gas exposures, workplace violence and stress [1].

According to the Centre for Disease Control (CDC), 1 in 5 non-fatal occupational injury and illnesses occurred in Health Care Workers (HCWs). It is also reported by the CDC that about 1.7m infections and 99,000 associated fatalities occur annually in most hospitals [3] .The cost implications for these infections and fatalities rose from about $ 4.5 billion in the early 1990s to $ 6.65 billion thereabout in 2007 [4]. During a period of twenty (20) years of HIV epidemic about 57 HCWs were infected with HIV in the work place, 86% were exposed to blood and 88% had percutaneous injuries, 20% via sharps disposal, 41% during a procedure, 25% after a procedure and 14% still infected after post exposure prophylaxis (PEP). In most hospitals in Nigeria and the US by extension, death rate for HCWs from occupational events including infection is about 17-57 per 1,000,000 workers [5]. During the SARS epidemic, of the 8,098 cases about 1707 cases were HCWs (21%) which is quite alarming. SARS is one of the numerous infections to which health workers are exposed, a combination of all the statistics per every infectious disease that pose occupational risks will reveal the gravity of the situation and the need for continuous review of standard precautions with adequate monitoring to ensure complete or near complete adherence. Hygiene standards and compliance rates to standard precautions can be said to be at its lowest rate in Nigeria, Southern Nigeria to be specific, yet HCWs are not completely protected as they still remain vulnerable. The health care industry was considered one of the safest work place until a major discovery centered on the decline of Tuberculosis (TB) in the general population pointed to an increase in latent and active TB in those caring for the patients. TB was eventually tackled and Human Immunodeficiency Virus (HIV) surfaced. This prompted an increase in the awareness of needle stick injuries which necessitated the introduction of the use of engineered safety devices to prevent sharps, needle stick injuries as well as blood contacts between patients and HCWs. A surveillance data and monitoring systems for occupational diseases was put in place in developed countries as a result of increase in workplace accidents. The importance of occupational hygiene and infection control became dominant due to the data on occupational infectious disease and compensation claims. In a similar fashion, HCWs from other parts of the world are exposed to infections and diseases. Of 3008 infections claimed in Germany by HCWs it was reported that TB, MRSA, Influenza, HBV and HCV were of the highest frequencies [6]. One of the first recognized occupational blood-borne pathogen was HBV, the incidence rate in HCWs was 386

cases per 100,000 population, and it means the HCW was 10 times at a greater risk than the general population. HCV is one of the most commonly transmitted blood borne pathogens with incidence rates of 1- 22%. While Vaccination for HBV was a major intervention in reducing the transmission of HBV, HCV currently has no effective vaccine or post exposure prophylaxis. Two million needle stick injuries occur in health workers yearly which results in HBV, HCV and HIV [7]. Research has shown that 40–75% under reporting of NSIs occur in the developing countries, where Nigeria is grouped, therefore the 2 million figure above is probably lower than the real figure [8].

A study in the Niger Delta region of Nigeria on the status of infection control program in one of the hospitals revealed that a baseline score for practices such as waste management was 33.3%, 15.6% on isolation and standard precautions, 25% for TB precautions; hand hygiene was 54.6% and the entire infection control programme 21.3% [9]. In developing countries particularly in Nigeria the best of the infection control programmes in HCFs is centered on the standard precautions which from the result above lacks strict adherence. The risks of Hospital-acquired infection are highest in teaching hospitals. Teaching hospitals are majorly the first point of call in developing countries like Nigeria due to poorly developed primary health care (PHC) and poorly developed 2-way referral system [9]. There are more qualified health personnel in the Teaching Hospitals and patients tend to have more confidence in the tertiary institutions than the PHCs. They happen to be the largest in the country with about 300 - 1500 bed space. Major epidemics in the country are referred to the Teaching hospitals. Ongoing outbreaks such as Lassa fever have put health workers at the greatest risk. In recent times Nigeria has experienced a lot of out breaks such as Meningococcal Meningitis in the north; a highly transmissible disease, health workers who are not adequately protected are at the risk of acquiring the disease within 24 hours. In the recent monkey pox virus outbreak, the 2nd case was that of a medical doctor who was treating the patient. Most of the fatalities as a result of Lassa fever outbreak started with health care workers; in the current 2018 outbreak 4 medical health workers lost their lives in Ebonyi state, 1 in Kogi state and just recently a female doctor in Abia state. Others include the Ebola Haemorrhagic fever, cholera and others.

In this context, the aim of the study is to evaluate the occupational hygiene and infection control practices in tertiary health care facilities in FMC Owerri and FMC Yenagoa located within portions of Niger Delta, Nigeria. The aim is achievable by (1) assessing and comparing attitude and level of HCWs towards OH and IC practices with the knowledge of hazards and their control mechanisms inclusive among HCWs in tertiary HCFs in FMC Owerri and FMC Yenagoa and (2) identifying and analyzing the major hindrances to OH and IC practices as well as the risk factors within the area under review

2. LITERATURE REVIEW

Successful occupational hygiene and infection control programs is largely dependent on the senior management in the health care facilities. The safety of health workers in the hospitals has tended to be overlooked globally however in high income nations the much lower prevalence of transmissible communicable diseases and better infrastructure has mitigated the impact of occupational exposures [10]. Patients with a broad range of infections and diseases are present in the HCFs for treatment and care thus exposing the HCWs to these infections particularly the highly infectious/ communicable/ contagious ones. HCWs are exposed to infections and diseases such as Human immune deficiency virus (HIV), Tuberculosis, Hepatitis B and C virus, Influenza, Scabies, Measles. The emergence of these life threatening infections worldwide has necessitated the need to pay closer attention to the safety of HCWs.

A lot of studies have been conducted globally on the knowledge, attitude, practices, and perceptions on HCWs to standard precautions and infection control in general. A study in Iran [11] revealed that 43% of nurses had poor knowledge, 42% average practice and 37% had moderate attitude towards infection control and standard precautions, [3] in a study conducted on KAP of nurses in ICU of tertiary care hospitals in India found out that nurses had very good knowledge of infection control. Awareness was good in 37% of nurses; average in 40%and below average in 18%, only 5% had excellent knowledge. In infection control practices, 2% had excellent knowledge, 24% good, 63% average and 11% below average.

In tertiary health care hospitals (ICU) in Delhi, the level of awareness on infection control in doctors was 79.8%, 79.5% in nurses. For practices;

70.43% in doctors and 63.86% for nurses. For hand hygiene and use of PPE 96.15% and 76.92% in doctors while nurses was 98.18% and 47.27% respectively [12].

In the intensive unit of a Government hospital in India, 94% of respondents (Doctors, nurses and laboratory scientists) believed that PPE was an effective barrier for Infection control while only 85% actually used it by observation. 86% mentioned that they followed the 5 moments of hand hygiene but only 24% by observation. 64% indicated that they always wore fresh gloves in between patients but only 39% did by observation. 53% said they segregated waste appropriately while only 22% did by observation [13].

Another study in Birmingham UK on KAP on infection control focusing on blood borne pathogens revealed that 86% of nurses had good knowledge in contrast to 59% in doctors. Attitude of nurses and doctors respectively to hand hygiene, 90.9% and 36.0% had indicated that washing hands before patient contact was very important while 88.8% and 60.0% said it was very important after. 74.1% nurses believed in wearing gloves before taking samples while only 36.0% of doctors thought so [14].

In Saudi Arabia, a study was conducted on compliance rate of nursing students in a university; overall compliance was 61.0% while about 49.2% recapped needles. In nursing staffs in Brazil 69.4% compliance rate and 57.4% in Hong Kong, all using the same instrument [15].

Aluko, et al. [1] conducted a study on occupational hazards in a tertiary hospital in the south west of Nigeria. He found that 89% of respondents (Doctors, nurses and nursing aids) were knowledgeable on possible hazards. 80% had positive attitude and 20% negative attitude towards occupational hazards and preventive safety practices.

Similar but few studies have been carried out in Nigeria. In a southern hospital in Nigeria on compliance rates to hand hygiene, 50.3% of the respondents believed that the hand was the common route for infection transfer, 19.7% said through needles, 22.2% contacts between patients, 5.2% other routes and 2.5% didn't know at all. 70% of the respondents mentioned that they washed hands after every patient. This study did not include observations for infection control in the health care facility [2].

Another study in two tertiary hospitals in Nigeria revealed that HCWs had poor knowledge of injection safety but they complained of inadequate resources for compliance to standard precautions. House officers, laboratory scientists and junior cadres of nurses had lower knowledge and compliance with standard precautions than more experienced doctors and nurses. There was a median score of 90% on knowledge, 92.3% on attitude and 50.8% on practices of standard precautions in the two hospitals [16].

From the above studies, knowledge, attitude and practices vary in different countries and also among different classes of health workers. The majority of studies from around the world reported a higher compliance with standard precautions in nurses than doctors [17]. In general health workers have an average knowledge of occupational hygiene and infection control, and possess good attitude but could be impaired by non-availability of resources/ equipment to be used. In terms of practices, compliance rate is not good enough. In a particular study that used observations to complement questionnaire distribution it was found that most HCWs don't practice what they know. This is the reason for a more robust infection control policy in all health care facilities, industrial hygienists (occupational health experts) and adequate monitoring and surveillance systems. Hence the need for this research.

3. MATERIALS AND METHODS

3.1 Research Design and Population of Study

This study adopted the use of questionnaires and a walk through safety checklist. The questionnaire is structured for data collection from the study population at a particular time. The collection of data took place between November and December 2018 in both facilities as the questionnaires were self –administered within the various clinics, wards and laboratories in the facilities to the four categories of health care workers. Observations of the health care facilities via a walk through checklist was also conducted by Environmental health officers to determine the risk status of these facilities. The questionnaire is divided into 6 major parts: 1) socio demographic, 2) knowledge of occupational hygiene and infection control (hazards and controls), 3) attitude of HCWs to occupational hygiene and infection control 4) Occupational hygiene and infection control practices in the HCFs, and 5) hindrances to

effective occupational hygiene and infection control practices and 6) Exposure assessment. On the other hand, the general facility, laboratory, radiology and three wards (Medical, Paediatrics and Accident and Emergency) were assessed. A risk rating was computed and was categorized into very high risk (0-10%), high risk (11-40%), imminent high risk (41-60%), medium risk (61-75%) and low risk (>75%).

The study population includes health care workers (HCWs) from the two tertiary health care facilities purposively sampled in this study; Federal FMC Owerri in Imo State, Nigeria and FMC Yenagoa, Bayelsa State, Nigeria. There are different categories of health care workers such as doctors, nurses, pharmacists, medical laboratory scientists/technologists, nursing aids, and many others. The categories of health care workers considered in this study are those in the clinical areas such as Doctors, Nurses, Nursing aids/assistants and Medical laboratory scientists. They were from the different clinics, wards and various departments of the hospitals; Paediatrics, Accident and emergency, Special baby care unit, Obstetrics And Gynaecology, Public health, ophthalmology, radiology, mental health, internal medicine, surgical wards, medical laboratory (chemical pathology, haematology, microbiology and histopathology unit) and out patients clinics. The common feature to this four categories of health care workers are they interact daily with patients so exposure rates to hazards are likely to be higher than other categories of health care workers. HCWs in the clinical areas (come in contact with patients daily) who have worked for at least a year in that particular tertiary health care facility. The age spread of HCWs in this study is between 18 and 60 years of age. The study include both male and female HCWs. The educational qualification considered for HCWs in this study is a minimum of primary school education because of the nursing aids/health attendants. The study excludes other HCWs who are not in the clinical areas as they have minimal contacts with patients and those not interested in participating in the study despite eligibility. The category of staff considered in this study are Medical doctors, Nurses, nursing assistants/aids (health attendants) and Medical laboratory scientists.

3.2 Sample and Sampling Techniques

Purposive sampling was employed in choosing the two (2) states in this study based on the nature of the study, accessibility to the health care facilities and time available for the study. In choosing the sample for HCWs, stratified sampling was employed. The HCWs in the clinical areas are divided into strata based on their profession and the numbers of HCWs in the four categories were obtained through a dis-proportional sampling method. Minimum sample size, n, of 246 was computed using Fishers equation for estimating sample proportions where the sample size is 10,000. The Fishers equation is expressed as:

$$n = \frac{Z^2 p(1-p)}{d^2} \quad (1)$$

Where

Z = standard normal deviate at desired confidence level (we desired 95%) = 1.96
p = estimated proportion of attribute of interest (80%) (Aluko, et al. 2016)
d = level of precision (5%)
n = 246 ≈ (minimum sample size)

Nevertheless, a correction factor *nf* where the sample size is not up to 10,000 was employed to compensate for the respondents that could not return the questionnaires given to them.

The correction factor equation is expressed as

$$nf = \frac{n}{1+{}^{n}/_{N}} \quad (2)$$

Where

N = Total population of HCWs
N = approximately 3000
nf = 227

The minimum sample size is thus 227.

Nevertheless, the minimum sample size increased to 250 due to 10% of the calculated minimum sample size which was added for non-response, inappropriately filled, missing questionnaires as the questionnaires were majorly self- administered, apart from the nursing aids which required assistance in filling the questionnaires.

3.3 Method of Data Analysis

The data analysis was carried out using the Statistical package for social sciences IBM SPSS 22.0 software. Chi square was used to test associations between the two facilities and amongst healthcare workers. Spearman's correlations was used to test for associations

between different variables. Bivariate regression model was also used to establish/determine the relationship between the variables; the socio demographic data were used as continuous variables and the exposure assessment of the health care workers as the dependent variable.

4. RESULTS

The summary of the participants socio demographic data (Table 1) showed that a higher percentage of the respondents in both facilities were male. The dominant age group is 30–39 with a total percentage of 57%. There was no statistically significant difference between the age group distributions in both facilities. Only few participants were 50 and above. Majority of the respondents in FMC Owerri had tertiary education likewise FMC Yenagoa but more respondents had primary and secondary education when compared to FMC Owerri and this was statistically significant. There was no major difference in both facilities as regarding the specialty of the respondents (occupation). The highest group were nurses (35%) just a little over the Doctors (32%). The senior staff (level 7-14) were the highest of the respondents (83%), next to the junior staff (below level 7) and then the management staff (level 15 and above) .

Both facilities had very poor practice levels of occupational hygiene and infection control. Only about 5% of the respondents indicated that their

Table 1. Socio demographics data of HCWs within the study areas

Variable	FMC Owerri Freq. (%) n = 189	FMC Yenagoa Freq.(%) n = 190	Total Freq. (%) n = 379
Sex			
Male	60	62	61
Female	40	38	39
chisquare 0.13 df =1 pvalue = 0.72			
Age			
20 - 29 Yrs	21	20	20
30 - 39 Yrs	53	61	57
40 - 49 Yrs	20	16	18
> 50 Yrs	6	3	5
chisquare 3.86 df =3 p value 0.28			
Religion			
Christianity	98	98	98
Islam	1	1	1
Traditionalist	0	0	0
Others	1	1	1
chisquare 1.66 df =3 p value 0.65			
Educational level			
Primary	1	5	3
Secondary	1	8	5
Tertiary	98	87	92
*chisquare 18.54 df 2 p value < 0.01***			
Specialty of respondents			
Doctors	33	31	32
Nurses	31	38	35
Nursing aids	12	14	13
MLS*	24	40	20
chisquare 4.99 df = 3 p value = 0.17			
Grade level			
Junior staff	12	14	13
Senior staff	88	77	83
Management staff	0	8	4
chisquare 2.2 df = 2 p value = 0.33			

Table 2. Knowledge, attitude and practice of occupational hygiene/infection control within the study area

Variable	FMC Owerri Freq. (%) n = 189	FMC Yenagoa Freq. (%) n =190	Total Freg. (%) n =379
Level of Knowledge			
Poor	15	22	19
Fair	40	26	33
Good	45	52	48
*chisquare 9.71 df = 2 p-value = 0.01***			
Level of Attitude			
Poor	24	44	34
Fair	42	35	38
Good	34	21	28
*chisquare 18.3 df =2 p value <0.001***			
Attitude on recapping of needles	64	60	61
Chisquare = 49.44 df = 3 p-value <0.01			
Level of Practice (Hand Hygiene)			
Poor	70	63	67
Fair	24	24	24
Good	6	13	9
chisquare 5.83 df =2 p value 0.05			
Level of Practice (Environmental health practice)			
Poor	35	67	50
Fair	59	27	44
Good	6	6	6
*chisquare 37.63 df =2 p-value < 0.01***			
Overall Level of Practice			
Poor	59	75	66
Fair	37	20	29
Good	4	5	5
*chisquare 12.19 df = 2 p-value = 0.02***			

facilities had good level of OH/IC practices (Table 2). Statistically, levels of knowledge in both facilities were represented using a pie chart (Fig. 1 and Fig. 2).

About 48.0% of the respondents had good knowledge of the hazards and the needed control mechanisms in health care facilities. Just about 33% had fair knowledge and less than 20% had poor knowledge. There was a statistically significant difference between the levels of knowledge in both facilities; FMC Yenagoa had about 22% with poor knowledge compared to Owerri 15%. Just about 28% of all the respondents had good attitude to infection control, 44.0% of respondents in FMC Yenagoa had poor attitude when compared to 24% in FMC Owerri. The difference was statistically significant as *pvalue* is less than 0.05. In FMC Owerri, 73% said an infection control team existed in the facility while just 56% of those in FMC Yenagoa knew of any infection control team, though many didn't know how long they had been in existence.

Fig. 3 illustrates the attitude of health care workers on recapping of needles within the researched area. It revealed that doctors tend to recap needles more than the other groups of HCWs.

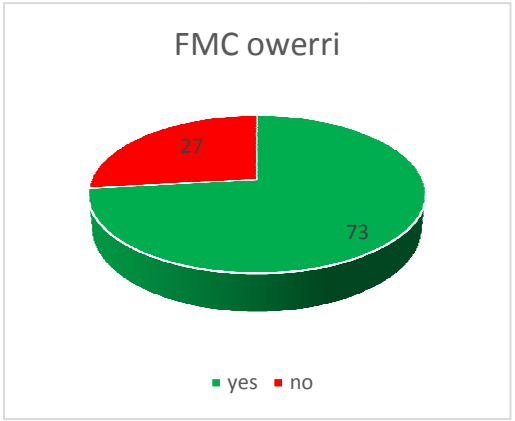

Fig. 1. Knowledge of the existence of an infection control team in FMC Owerri

Table 3 depicts that about 80% of HCWs in FMC Owerri had been trained on infection control and 67% in FMC Yenagoa, but of the 80% only 29% were trained at least once a year, while 47% of those trained in FMC were in the last one year. Most of the HCWs as seen in Table 3 had access to both periodic health checkup and/medical services when ill /accidents occur including Post Exposure Prophylaxis (PEP). A higher percentage (63%) of HCWs in FMC Yenagoa had been immunized against Hepatitis B Virus while only 39% of those in FMC Owerri were immunized against HBV.

Exposure assessment of health care workers to hazards present revealed ergonomic hazards as the highest factor to which they were predisposed, next to biological hazards, physical, chemical and psychosocial which had the lowest value of 19% (Table 4). There was statistically significant difference between the workers exposure to Biological, chemical and physical hazards in both facilities as shown in Table 5 and 6.

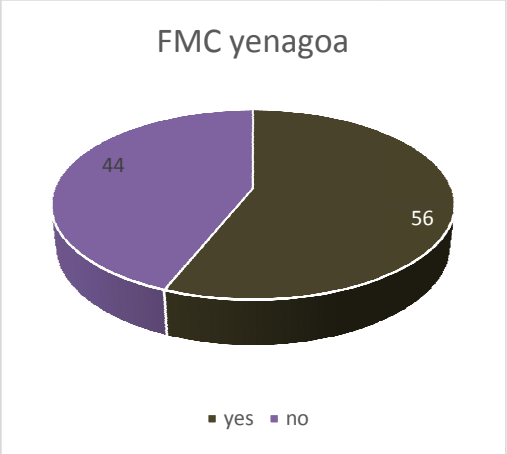

Fig. 2. Knowledge of the existence of an infection control team in FMC Yenagoa

Table 3. Practices of occupational hygiene and infection control within the study area (Administrative controls)

Attributes	FMC Owerri Freq.(%)	FMC Yenagoa Freq.(%)	Chi-square X^2(df =1)	P-value
Training on infection control				
Doctors	76	49	9.19	0.002**
Nurses	95	77	8.41	0.004**
Nursing Aids	96	82	2.20	0.138
MLS	59	68	0.65	0.422
Total	80	67	7.65	0.006**
Training at least once a year				
Doctors	13	41	8.83	0.003**
Nurses	33	42	0.93	0.334
Nursing Aids	0	75	26.25	<0.01**
MLS	68	42	3.07	0.080
Total	29	47	11.02	0.001**
Access to periodic/ongoing medical check up				
Doctors	57	62	0.39	0.53
Nurses	56	67	1.58	0.21
Nursing Aids	64	44	1.79	0.18
MLS	41	15	2.63	0.11
Total	53.4	61	2.23	0.13
Access to medical checkup when ill/accidents occur (PEP)				
Doctors	92	86	0.95	0.33
Nurses	93	86	1.79	0.18
Nursing Aids	59	85	4.24	0.04
MLS	91	93	0.10	0.75
Total	88	87	0.13	0.72
Immunization against HBV				
Doctors	40	74	13.96	<0.01**
Nurses	59	63	0.14	0.711
Nursing aids	0	59	19.36	<0.01**
MLS	28	45	2.32	0.127
Total	39	63	21.98	<0.01**

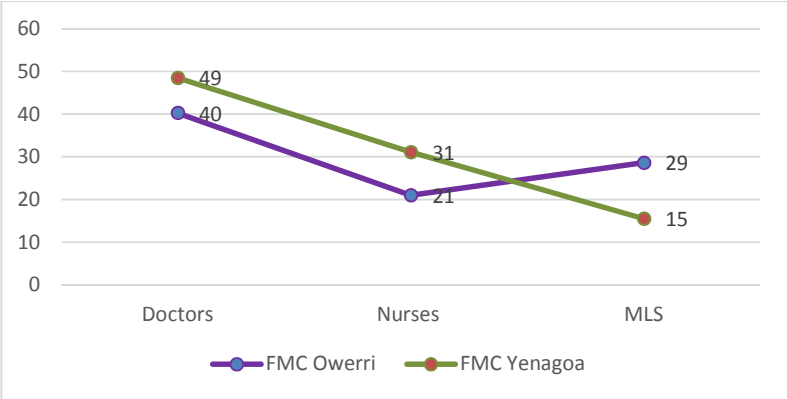

Fig. 3. Attitude of health care workers on recapping of needles in FMC Owerri and FMC Yenagoa health care facilities

Table 4. Assessment of participants' exposure to hazards within the study area

Exposure assessment	FMC Owerri Freq. (%) n = 189	FMC Yenagoa Freq. (%) n = 190	Total Freq. (%) n = 379
Exposure to Biological hazards			
Low	52	37	45
High	48	63	55
*chi square 9.00 df = 1 p value = 0.003***			
Exposure to chemical hazards			
Low	59	46	53
High	41	54	47
*chisquare 6.91 df = 1 p value = 0.01***			
Exposure to physical hazards			
Low	60	44	52
High	40	56	48
*chisquare 8.92 df = 1 p value = 0.003***			
Exposure to ergonomics hazards			
Low	13	9	11
High	87	91	89
chisquare 1.76 df = 1 p-value = 0.18			
Exposure to psychosocial hazards			
Low	88	75	81
High	12	25	19
*chisquare 10.26 df = 1 p-value = 0.001***			
Suffered health hazards			
No	0	3	2
Low	40	18	29
Moderate	31	45	38
High	29	34	31
*Chisquare 25.36 df = 3 p-value = <0.01***			

HCWs in FMC Yenagoa seemed to have higher exposures to all categories. Most of the health care workers has suffered one symptom (health hazards) or the other based on their exposure, this also differed significantly in the two facilities with p-value less than 0.01.

Table 7 shows factors that determine exposure of respondents in the study to chemical hazards. Age, years of experience (post qualification and at present post) were analyzed as continuous variables in the bivariate regression analysis and were found not to be statistically significant in the exposure of respondents to chemical hazards. However, facility of practice and professional groups were found to be statistically significant in determining exposure to chemical hazard, while respondents in FMC Yenagoa

have a slightly higher chance (OR=1.73, 95%CI: 1.15–2.60, p=.009) of exposure than those in FMC Owerri, medical laboratory scientists are five times more at risk of exposure (OR=5.98, 95CI: 3.05–11.69, p-Value <.001) to chemical hazards when compared to medical doctors.

Based on Table 8, female respondents (OR= 2.53, 95CI:1.31–4.86, p=.006) are two times more at risk when compared to male respondents and nurses (OR=5.96, 95% CI:2.19 –16.24, p=<.001) have five times more odds than doctors in the exposure risk assessment to ergonomic hazard.

Facility of practice (OR=1.88, 95%CI: 1.25– 2.82, p=.003), years of experience post qualification (OR=1.04, 95%CI: 1.00–1.08, p=.028), nurses among professional group (OR=1.86, 95%CI: 1.13 –3.06, p=.015), respondents with good level of knowledge (OR = 2.23, 95%CI: 1.26 –3.94, p=.006) and those with good level of attitude (OR=0.38, 95%CI: 0.22–0.66, p=.001) appear to be significantly important in the exposure to physical hazard in Table 9. However, surprisingly while good level of attitude reduces the odd (OR=0.38), good level of knowledge increases the odds (OR=2.23) of exposure to physical hazards among respondents.

Table 5. Exposure of participants to biological hazards within the study area

Attributes	FMC Owerri Freq(%)	FMC Yenagoa Freq(%)	Chi square df = 1	P-value
Exposure to body fluids				
Doctors	52 (88.1)	44 (71.0)	5.436	0.020**
Nurses	69 (94.5)	57 (96.6)	0.328	0.567
Nursing Aids	18 (66.7)	13 (59.1)	0.299	0.584
MLS	20 (64.5)	22 (47.8)	2.081	0.149
Total	159 (83.7)	136 (72.0)	7.553	0.006**
Sustained Needle stick/sharps injury				
Doctors	44 (74.6)	23 (37.1)	17.185	<0.01**
Nurses	28 (38.9)	33 (55.9)	13.786	0.052
Nursing Aids	8 (29.6)	8 (36.4)	0.250	0.617
MLS	14 (45.2)	29 (63.0)	2.402	0.121
Total	94 (49.7)	93 (49.2)	0.011	0.918
Exposure to TB				
Doctors	58 (98.3)	54 (87.1)	5.516	0.019
Nurses	68 (93.2)	34 (57.6)	23.446	<0.01
Nursing Aids	14 (51.9)	0 (0.0)	15.970	<0.01
MLS	30 (96.8)	40 (87.0)	2.160	0.142
Total	113 (61.1)	128 (67.7)	26.670	<0.01

Table 6. Exposure of participants to chemical, physical and ergonomic hazards in 2 tertiary health care facilities of the study area

Attributes	FMC Owerri Freq (%)	FMC Yenagoa Freq (%)	Total Freq (%)	Chi square df = 1	P-value
High exposure to Chemical hazards					
Doctors	17 (27.4)	32 (54.2)	49 (40.5)	9.023	0.003**
Nurses	20 (33.9)	38 (54.3)	58 (45.0)	5.377	0.020**
Nursing Aids	0 (0.0)	10 (37.0	10 (20.4)	10.237	0.001**
MLS	40 (87.0)	21 (70.0)	61 (80.3)	3.296	0.69
High exposure to Physical hazards					
Doctors	14 (22.6)	38 (64.4)	52 (43.0)	21.581	<0.01**
Nurses	36 (61.0)	40 (55.6)	76 (61.0)	0.397	0.529
Nursing Aids	5 (22.7)	13 (48.1)	18 (36.7)	3.371	0.066
MLS	21 (45.7)	14 (45.2)	35 (45.5)	0.002	0.966
High exposure to Ergonomic hazards					
Doctors	42 (67.7)	56 (94.9)	98 (81.0)	9.023	0.003**
Nurses	56 (94.9)	71 (97.3)	127 (96.2)	5.377	<0.020**
Nursing Aids	21 (95.5)	23 (85.2)	44 (89.8)	10.237	<0.01**
MLS	45 (97.8)	23 (74.2)	68 (88.3)	3.296	0.069

Table 7. Determinants of chemical hazard risk exposure

Independent Variable – reference or baseline	B coefficient	OR (95%CI)	p-Value
Facility – Facility 1			
Facility 2	0.55	1.73 (1.15 – 2.60)	0.009**
Sex – Male			
Female	-0.24	0.79 (0.52 – 1.19)	0.265
Professional groups – Doctors			
Nurses	0.18	1.20 (0.73 – 1.98)	0.476
Nursing Aid	-0.98	0.38 (0.17 – 0.83)	0.015**
MLS	1.79	5.98 (3.05 –11.69)	<0.001**
Level of Knowledge – Poor			
Fair	-0.04	0.98 (0.52 – 1.78)	0.897
Good	0.86	2.37 (1.33 – 4.23)	0.003**
Level of attitude - Poor			
Fair	-0.43	0.65 (0.40 – 1.06)	0.086
Good	-0.14	0.87 (0.52 – 1.47)	0.611
Age	-0.003	0.99 (0.96 – 1.03)	0.814
Years of experience (Post Qualification)	0.013	1.01 (0.98 – 1.05)	0.462
Years of experience (Present post)	0.027	1.03 (0.97 – 1.08)	0.321

Table 8. Determinants of ergonomic hazard risk exposure

Independent Variable – reference or baseline	B coefficient	OR (95%CI)	p-Value
Facility – Facility 1			
Facility 2	0.44	1.55 (0.81 – 2.98)	0.187
Sex – Male			
Female	0.93	2.53 (1.31 – 4.86)	0.006**
Professional groups – Doctors			
Nurses	1.79	5.96 (2.19 – 16.24)	<0.001**
Nursing Aid	0.72	2.07 (0.74 – 5.79)	0.168
MLS	0.57	1.78 (0.77 – 4.07)	0.176
Level of knowledge – Poor			
Fair	-0.99	0.37 (0.14 – 0.95)	0.039**
Good	0.36	1.43 (0.51 – 4.03)	0.500
Level of attitude - Poor			
Fair			
Good			
Age	-0.02	0.98 (0.94 – 1.02)	0.314
Years of experience (Post Qualification)	-0.11	0.99 (0.94 – 1.04)	0.670
Years of experience (Present post)	0.02	1.02 (0.93 – 1.11)	0.731

Psychosocial hazard risk exposure has only the facility of practice (OR=2.41, 95%CI: 1.39– 4.16, p=.002) and years of experience post qualification (OR=1.07, 95%CI: 1.03–1.11, p=.001) has its significant determinants (Table 10) while level of knowledge, age of respondents and years of experience post qualification are the predictors identified for exposure to biological hazards (Table 10).

It was shown that in Table 11 respondents working in FMC Yenagoa appears to reduce the risk (OR=0.40, 95%CI: 0.26–0.63, p=.001) of ever suffering any hazard. While being a nurse (OR=0.39, 95%CI: 0.22 – 0.68, p=.001), nursing aid (OR=0.75, 95%CI: 0.38–1.51, p=.424) and medical laboratory scientist (OR=0.53, 95%CI: 0.29–0.99, p=.046) is associated with reduced odds, the odd ratio of being a nursing aid is not statistically significant (p>0.05). Furthermore, fair knowledge (OR=2.52, 95%CI: 1.32–4.81, p=.005) and good attitude (OR=2.03, 95%CI: 1.15–3.69, p=.015) are also associated risk factors to suffering hazards in the health workplace.

Table 9. Determinants of physical hazard risk exposure

Independent Variable – reference or baseline	B coefficient	OR (95%CI)	p-Value
Facility – Facility 1			
Facility 2	0.63	1.88 (1.25 – 2.82)	0.003**
Sex – Male			
Female	0.06	1.07 (0.71 – 1.61)	0.760
Professional groups – Doctors			
Nurses	0.62	1.86 (1.13 – 3.06)	0.015**
Nursing Aid	-0.26	0.77 (0.39 – 1.53)	0.454
MLS	0.10	1.11 (0.62 – 1.97)	0.732
Level of knowledge – Poor			
Fair	0.11	1.11 (0.61 – 2.04)	0.736
Good	0.80	2.23 (1.26 – 3.94)	0.006**
Level of attitude - Poor			
Fair	-0.01	0.99 (0.61 – 1.60)	0.972
Good	-0.96	0.38 (0.22 – 0.66)	0.001**
Age	0.02	1.02 (0.99 – 1.05)	0.187
Years of experience (Post Qualification)	0.04	1.04 (1.00 – 1.08)	0.028**
Years of experience (Present post)	0.04	1.04 (0.99 – 1.10)	0.137

Table 10. Determinants of psychosocial hazard risk exposure

Independent Variable – reference or baseline	B coefficient	OR (95%CI)	p-Value
Facility – Facility 1			
Facility 2	0.88	2.41 (1.39 – 4.16)	0.002**
Sex – Male			
Female	0.35	1.42 (0.82 – 2.46)	0.208
Professional groups – Doctors			
Nurses	0.57	1.77 (0.95 – 3.29)	0.070**
Nursing Aid	-0.56	0.57 (0.20 – 1.63)	0.296
MLS	-0.16	0.86 (0.38 – 1.90)	0.700
Level of Knowledge – Poor			
Fair	0.08	1.08 (0.49 – 2.39)	0.855
Good	0.18	1.19 (0.57 – 2.53)	0.640
Level of attitude - Poor			
Fair	0.02	1.02 (0.54 – 1.92)	0.954
Good	0.24	1.27 (0.66 – 2.45)	0.479
Age	0.01	1.01 (0.98 – 1.05)	0.446
Years of experience (Post Qualification)	0.07	1.07 (1.03 – 1.11)	0.001**
Years of experience (Present post)	0.06	1.06 (0.99 – 1.12)	0.062

The health and safety walk through check list which spanned different sections of the health care facilities when summed up gave a percentage of 48.17 % and 46.3% in FMC Owerri and Yenagoa respectively which is categorized as an imminent high risk facility (Table 12).

5. DISCUSSION

This study involves two tertiary health care facilities in the Niger Delta with four groups of health care workers; Doctors, Nurses, Medical Laboratory scientists and Nursing aids/health attendants. The number of respondents from both facilities was 379. The nurses were the highest of the four categories in FMC Yenagoa (38.4%), while in Owerri; doctors were just slightly above the nurses (32.8% to 31.4%). There was low participation among the nursing aids just about 12% in both facilities combined this may be attributed to poor levels of education which may translate into little understanding of the questions. This was corroborated with a study that included a variety of health care workers with nurses as the highest and ward attendants as the lowest which is of concern [18].

Table 11. Determinants of biological hazard risk exposure

Independent Variable – reference or baseline	B coefficient	OR (95%CI)	p-Value
Facility – Facility 1			
Facility 2	-0.09	0.92 (0.61 – 1.38)	0.677
Sex – Male			
Female	-0.22	0.80 (0.53 – 1.21)	0.800
Professional groups – Doctors			
Nurses	0.30	1.35 (0.82 – 2.21)	0.240
Nursing Aid	-0.54	0.59 (0.29 – 1.19)	0.137
MLS	-0.33	0.71 (0.39 – 1.29)	0.269
Level of Knowledge – Poor			
Fair	0.86	2.36 (1.24 – 4.50)	0.009**
Good	0.89	2.42 (1.31 – 4.48)	0.005**
Level of attitude - Poor			
Fair	0.031	1.03 (0.64 – 1.67)	0.901
Good	-0.35	0.70 (0.41 – 1.20)	0.196
Age	0.05	1.05 (1.02 – 1.09)	0.001**
Years of experience (Post Qualification)	0.06	1.06 (1.03 – 1.10)	0.001**
Years of experience (Present post)	0.06	1.06 (0.99 – 1.11)	0.072

Table 12. List of imminent high risk facilities

Sections	FMC Owerri (%)	FMC Yenagoa (%)
General facility	60	63
Accident and Emergency Wards	44	34
Paediatrics (children) wards	44	51
Medical wards	44	40
Laboratory	54	50
Radiology	53	40
Overall score	**48.17**	**46.3**

51.7% of HCWs in FMC Yenagoa had a good level of knowledge of the hazards and theircontrols, while in Owerri it was about 48.3% but those with fair knowledge were higher in FMC Owerri (40.2%) compared to 25.8% in Yenagoa. Many of the studies conducted on occupational health/infection control just included one group of health workers. This result on knowledge/awareness was consistent with a study in India were 37% of the nurses had good awareness and 40% average [3]. A study in Nigeria on occupational hazards/safety with 3 categories of health care workers recorded that 89% of the respondents were knowledgeable on the possible hazards and controls, though this study just had 2 groupings; good and poor levels [1] unlike this study with 3 groupings; good, fair and poor in which if the fair was put together with good will have recorded higher levels of good knowledge on hazards and controls among HCWs. Less than 20% of HCWs had poor level of knowledge which is at par with the study mentioned just above. Despite the relatively good knowledge of HCWs on hazards and their controls in the workplace, the attitude seemed not to be so good as only 21.2% had good attitude to infection control in FMC Yenagoa and 34.4% in FMC Owerri. Some of the questions on attitude include hand washing before and after attending to patients this was consistent with a study in India were only 24% of the HCWs (Doctors, nurses and medical laboratory scientists) observed the 5 moments of hand hygiene [13]. Other questions are whether HCWs wore gloves between patients, waste was segregated at the point of generation this was consistent with the study that most HCWs in practice have quite a poor attitude towards infection control. This was not really in sync with another study in New Delhi were hand hygiene and the use of PPE practice was about 97% and 65% on the average in doctors and nurses respectively. The reason for this difference in the studies above may be due to the industrial/occupational hygiene status of the tertiary health care hospitals. Level of occupational hygiene and practices (Hand hygiene and Environmental hygiene practice) in both FMC Owerri and Yenagoa was quite poor just 4.3% and 4.9% of HCWs

respectively indicated good level of practice in their facilities.

Some of the questions indicating this were availability of hand hygiene facilities such as clean/ safe water, provision of liquid hand wash, alcohol hand rubs, availability of cleaning agents, Personal protective equipment, provision of sharp boxes and others. This is consistent with a study where HCWS gave reasons of their poor attitude to infection control as non-availability of the resources mentioned above [2]. Another very important question on attitude of health care workers was on recapping of needles, 60.4% and 61.4% of HCWs in FMC Yenagoa and Owerri respectively had recapped needles at one time or the other which is a procedure that exposes HCWS to needlestick injuries. This is consistent with a study in Saudi Arabia where 49.2% of the respondents recapped needles. Unsafe sharps disposal and two handed recapping happen to be the two most frequent causes of NSIs which means prohibition of recapping needles and safe sharps disposal will reduce occurrence of NSIs drastically [19]. The most frequent routes of occupationally acquired blood borne infections is exposure to NSIs as more than 20 blood borne exposures including HBV and HCV are as a result of NSIs [20].

Exposure to blood/body fluids was quite high; 83.7% of HCWs in FMC Owerri had been splashed by blood/body fluids and 72.0% in Yenagoa. Nurses in both facilities had the highest exposure see Table 4. This is consistent with many other studies; 62.6% of nurses in a study in Ethiopia had been exposed to blood/body fluids [21]. Another study on blood and body fluid exposure in African health care system revealed a high prevalence of HCWs over a 12 month period with a range of 33.9% in South Africa to 60.7% in Northern Africa as the highest, however very few studies have been conducted on Body fluid exposure between 2000 – 2017 in African [22]. Exposure to blood and body fluids puts HCWs at a high risk of HBVs.

About half of the population (49%) of HCWs in this study (both facilities) had sustained needle stick injuries which shows a high susceptibility to blood borne pathogens e.g. HBV, HCV, HIV. In FMC Owerri, the Doctors were more exposed (74.6%) while in FMC Yenagoa it was the nurses with a frequency of 55.9%. this is consistent with a number of studies , a study in Africa revealed that 55.0% of HCWs had percutaneous injury (Auta, et al. 2017) and another in South Africa, 91% of junior doctors reported had sustained NSIs in the previous 12 months and 55% were from patients which HIV [7]. WHO records that 2 million NSIs that occur yearly results in infections with HBV, HCV and HIV and the figure is actually due to under reporting of NSIs as also corroborated by the CDC that 50% of sharps injuries go unreported. In Nigeria where records are poor it is difficult to give the accurate statistics of HCWs who sustain NSIs yearly, the source from which they occur and how many results in blood borne infections due to poor follow up and surveillance systems.

In Southwest Ethiopia, 58.8% of respondents (nurses) had sustained needle stick and sharps injury [23]. Various ways through which NSIs occur are when manipulating a needle in a patient, sharps disposal, recapping of needle, clean up and collision with worker or sharp [24]. Multiple studies indicated manipulating needles in a patient as the most frequent way by which NSIs occur; 14.9% to 69.4% of HCWs who have sustained an NSI occurred through hypodermic-intramuscular, sub-cutaneous or intradermal injections and 35.4% of all percutaneous injuries were attributed to disposable syringes [20,24]. This study also revealed the same, in both facilities of all the respondents that sustained NSIs about 28% were as a result of manipulating needles in a patient, next to sharps disposal, during clean up and recapping of needles. In FMC Owerri, the pattern was; manipulating needles in a patient as the highest (31%), sharps disposal (23.8%), then recapping of needles (21%) see Fig. 3. as seen in literature, though recapping accounted for about 11.1% [20,24].

HCWs also had a high exposure to TB, doctors and the medical laboratory scientists had the highest frequency of exposure. The nature of their job is most likely the reason for this where patients come in contact first with Doctors and next to the laboratory for diagnosis before any further treatments/ admissions. The nurses in FMC Owerri also had a high exposure. This high exposure is not surprising as Nigeria has the 4th annual number of TB cases among countries [25]. The prevalence of TB in the general population is a determinant of the risks faced by HCWs who care for TB patients. Environmental isolation, ventilation mechanisms and the use of PPE is a major control in reducing exposures to TB, these controls were quite unsatisfactory in both facilities which further exacerbates the risk HCWs face. A study by [26] in a tertiary health

care facility revealed a baseline score for some infection control practices as 15.6% on isolation and standard precautions, 25% for TB precautions, this is consistent with the findings above. Other studies also shows that HCWs are three to ten times more susceptible than the general populace as concerning TB. Though immunizations are available, the high imminent risk status of the facilities reduces its effectiveness and other predisposing factors. The Bivariate regression analysis identified age, level of knowledge and years of experience as predisposing factors to Biological hazards.

Some of the controls in preventing blood borne pathogens include immunizations against HBVs, continuous trainings on infection control, proper sharps disposal and engineering controls using engineered safety needles. This study examined some of these controls in the health care facilities, 79.9% and 67.4% of HCWs in FMC Owerri and FMC Yenagoa said they had been trained at one time or the other on infection control and safety, but within the last one year it was rather low. While it seemed like more of the HCWs in Owerri had been trained, only 28.6% occurred in the last one year and 47.4% of those trained in FMC Yenagoa was in the last one year and this result was statistically significant < 0.001 particularly for Doctors and Nursing aids.

Just about 38.6% of all HCWs in FMC Owerri had been immunized against HBV as against 62.8% in FMC Yenagoa. There was a statistical difference in Doctors and Nursing aids but not in Nurses and Medical Laboratory scientist. Apparently a higher percentage of Nurses had been trained and also immunized against HBV in both facilities. Looking at the results from the exposure to blood/body fluids and sustaining a NSI, the frequencies were higher in HCWs in FMC Owerri and conversely the controls above were lower. The study also explored access to periodic and ongoing check-ups and medical services such as PEP after occurrence of accidents/injuries. The result showed that more of HCWs in Yenagoa had access than those in FMC Owerri though the result was not statistically significant. The Bivariate analysis showed that HCWs in FMC Owerri were more predisposed to suffering health hazards , the reason for this may not be farfetched from the results seen in administrative controls were FMC Yenagoa had better results particularly in the frequency of trainings and immunization against HBVs. The presence of an infection control team is also a control, 73% of HCWs in FMC Owerri indicated that an infection control team existed in the facility while just 56% in FMC Yenagoa, the efficiency of these teams are questionable as the results do not show much impact, they may just be functional during outbreaks but also laid back in their actions due to lack of funding as the final decisions lie with management.

From these studies the most prevalent hazards HCWs face are Ergonomic hazards with a frequency of 86.8% and 91.1% in FMC Yenagoa and FMC Owerri respondents respectively. This is consistent with a report from ISHN 2002, that over exertion (including lifting) is the number one care of injury or illnesses in health services with 45% of all cases in the health industry and NIOSH reports of 66,910 cases of occupational MSDs in HCWs. Work related Musculoskeletal disorders (MSDs) are as a result of high exposure to ergonomic hazards. Ergonomic hazards included lifting of heavy objects (patients), standing long hours, use of seats with poor back and arms rests and repeated bending and lifting. Various studies showed a high exposure of HCWs to ergonomic hazards, 55.5% and 50% of HCWs mentioned repeated bending and twisting and heavy lifting respectively as ergonomic risk factors [27]. In another study in India 59% reported repeated bending and twisting, 42% heavy lifting, 44% chairs with no back rests and 37% standing long hours in ergonomic hazards [28]. All these studies corroborates the high exposure of HCWs to ergonomic hazards and invariably susceptibility to back aches and sprains. A correlation of health workers who said they had suffered back aches to ergonomic hazards was statistically significant with a pvalue < 0.001 and an r coefficient of 0.24 though not a very strong one. Nurses in FMC Yenagoa had the highest exposure. The Bivariate regression analysis showed that nurses were 5 times at more risk to these hazards than doctors OR (95%CI) –5.96 (2.19–16.24) with a p-Value<0.001. Also females were twice more predisposed to ergonomic hazards than males OR (95%CI) 2.53 (1.31–4.86) with a p-Value < 0.006. A study in Uganda revealed the high level of exposure of nurses to ergonomic hazards and MSDs, the nurses in the public hospitals were even at a higher risk than those in the private sector [29].

Chemical hazards; medical laboratory scientists had the highest exposure in both facilities (80.3%) and they were 5 times more at risk than any of the other HCWs see Table 4. Of all health care workers those who work in the laboratory

make use of loads of chemicals (formaldehyde, toluene, xylene, ethanol, some radioactive material) which are carcinogenic in nature, a laboratory technician came down with bladder cancer within a two year period of working with these chemicals (Fuller & Environmental, n.d.). A Spearman ranks correlation between experiencing irritation in the eye and chemical hazards was statitstically significant p- value < 0.001

Exposure to physical hazards was higher in FMC Yenagoa (55.6%) than Owerri (40.7%), the culprit were nurses whose odds were higher. Working in FMC Yenagoa was a predisposing factor of exposure to physical hazards with 2 times a higher rate than owerri. Physical hazards included slips, trips/falls, high noise levels, radiation and excessive heat, a study revealed exposure of HCWs to slips /trips/falls with a frequency of 65.0%, high noise levels 64.0%, exposure to radiation 51.5% (Hamid, et al. 2018) which is quite consistent with this study.

Exposure to Psychosocial hazards was quite low 25% in FMC Yenagoa and 12% in FMC owerri, the questions include workplace violence, work underload, this is also consistent with a another study where exposure to psychosocial hazards (physical or verbal abuse to work) by HCWs was frequency of 20.5%.

The walk-through checklist and inspections which spanned different sections in the hospital; Laboratory wards, radiology and the general facility revealed that both health care facilities were categorized as imminent high risk. The checklist majored on waste management and hand hygiene practices, availability of PPEs, general cleanliness, ventilation and environmental isolation, the percentage score in both facilities of 48.17% in FMC Owerri and 46.3% substantiates the respondents' answers to the level of hand hygiene and environmental hygiene practice as very poor. It is obvious that the tertiary health care facilities in Niger Delta predisposes HCWs to all variety of hazards as all forms of controls (Engineering, substitution, administrative, use of PPE) available to mitigate these hazards are so poor or available at a very minimal level. This is consistent with a number of studies on health care facilities were poor infrastructure, inadequate PPE, poor hand hygiene facilities, lack of injection safety boxes for safe sharps disposal, little or no trainings were reasons HCWs for poor infection control practice [30,1,2].

This study further probed into identifying the core hindrances to effective occupational hygiene and infection practices. In FMC Owerri, the top three hindrances were; lack of hand hygiene facilities (80.4%), Overcrowding/Work overload (76.2%) and Poor Infrastructure (72.0%) while in FMC Yenagoa, they were little or no funding designated for IH/IC (79.5%), Poor infrastructure (74.2%) and lack of surveillance/monitoring systems for occupational health hazards (70.2%). A study carried out on referral systems in the University teaching hospital in Ilorin showed that overcrowding was a major issue in tertiary health care facilities due to poor primary health care [9]. Various studies also showed that the number of beds available in Nigeria hospitals were not commensurate to the population, this also gives rise to work overload were there are very few HCWs in proportion to the number of patients. This further predisposes health care workers to greater risk coupled with the poor infrastructure, lack of hand hygiene practices and little or no surveillance systems. In situations as such it is difficult to maintain strict adherence to standard precautions and to uphold infection prevention and control measures even when there is a will by the HCWs to comply. A few pictures from the facilities revealed unsafe disposal methods of sharps- over filled sharp boxes,or even lack of them.

Many studies have examined compliance of HCWs to standard precautions and their attitude, but from this study it is apparent that occupational hygiene and infection practices should be investigated and then brought to par with developed countries. Incident monitoring and surveillance systems for occupational hazards is also a major hindrance which is one of the core practices of developed Nations to help reduce risks associated with the high exposures faced by HCWs.

6. CONCLUSION

This study revolved around the fundamental principles of occupational hygiene and the exposure risk assessment and management model (ERAM). Hazards in the health care facilities were identified by testing the awareness/knowledge of health care workers to their presence, exposure assessment of HCWs, their risk factors, the controls available and commitment of the management in effecting these controls as well as the hindrances encountered. The following conclusions were drawn;

Firstly, HCWs in FMC Yenagoa had a higher good level of the knowledge of the hazards and their controls than those in FMC Owerri relating to occupational hygiene and infection control though their attitude seemed to be poorer than their counterparts in Owerri.

Level of occupational hygiene practice (hand hygiene) did not differ much in both facilities, they were quite poor. Level of Environmental health practice was also quite poor in both facilities though there was a difference of statistical significance between the facilities.

Secondly, administrative controls such as trainings was more frequent in FMC Yenagoa and was more inclusive of all HCWs than FMC Owerri. Nurses in both facilities are better trained than any other category of HCWs. In FMC Owerri, Doctors and Nursing aids were the least trained. Doctors in FMC Owerri were more exposed to NSIs yet just about 40.3% had been immunized against HBV while none of the nursing aids in this study had been immunized. A higher percentage of HCWs in FMC Yenagoa had been immunized against HBV and the difference was statistically significant. More than 87% of all HCWs in both facilities had access to medical services /post exposure prophylaxis after the occurrence of accidents and injury.

Thirdly, all HCWs in this study were at great risk of coming down with musculoskeletal disorders as a result of a very high level of exposure to ergonomic hazards which shows that there is still a lot of gap to be filled by top management of these facilities in terms of work place controls for all hazard category. Exposure to biological hazards which was the second highest exposure recorded in this study which predisposes the health care workers to a greater risk of HBVs, HIV and TB infections. For all categories of hazards except for ergonomic hazards, HCWs in FMC Yenagoa had higher exposures which were all statistically significant. However, though all health care workers had suffered one health related hazard at one point or the other the odds were higher in FMC Owerri, which means working in FMC Owerri predisposes one to coming down with some health issues which is majorly as a result of poor administrative controls. Other controls such as engineering and workplace controls were almost non-existent in both facilities. Various groups of health care workers had higher exposures to certain hazards such as medical laboratory scientist to chemical hazards and nurses to ergonomic, physical and psychosocial hazards.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Aluko OO, Adebayo AE, Adebisi TF, Ewegbemi MK. Knowledge , attitudes and perceptions of occupational hazards and safety practices in Nigerian healthcare workers. BMC Research Notes. 2016;9:71-84.
2. Bello S, Effa EE, Okokon EE, Oduwole OA. Handwashing practice among healthcare providers in a teaching hospital in Southern Nigeria. International Journal of Infection Control. 2013;9(4):1–7.
3. Sodhi K, Shrivastava A, Arya M, Kumar M. Knowledge of infection control practices among intensive care nurses in a tertiary care hospital. Journal of Infection and Public Health. 2013;6(4):269–275.
4. Yokoe DS, Anderson DJ, Berenholtz SM, Calfee DP, Dubberke ER, Ellingson KD, Kaye KS Infections in Acute Care Hospitals. Updates. Infect Control Hosp Epidemiol. 2014;35(8):967–977.
5. Sepkowitz KA, Eisenberg, L. Occupational deaths among healthcare workers. Emerging Infectious Diseases. 2005;5(2): 34-45.
6. Nienhaus A, Kesavachandran C, Wendeler D, Haamann F, Dulon M. Infectious diseases in healthcare workers - an analysis of the standardised data set of a German compensation board. Journal of Occupational Medicine and Toxicology (London, England). 2012;7(1):8.
7. ICN, WHO, Wilburn S, BSN, MPH, Eijkemans G, MD. Preventing needlestick injuries among healthcare workers. International Journal of Occupational and Environmental Health. 2004;10(4):451–456.
8. Rais N, Jamil HM. Prevalence of Needle Stick Injuries Among Health Care Providers. International Journal of Endorsing Health Science Research. 2013; 1(2):73–79.
9. Akande TM. Referral System in Nigeria : Study of a Tertiary Health Facility. Annals of African Medicine. 2014;*3*(3):130–133.

10. Yassi A, Zungu M, Spiegel JM, Kistnasamy B, Lockhart K, Jones D, Darwin L. Protecting health workers from infectious disease transmission: An exploration of a Canadian-South African partnership of partnerships. Globalization and Health. 2016;12(1):1–15.
11. Sarani H, Balouchi A, Masinaeinezhad N, Ebrahimitabas E. Knowledge, Attitude and Practice of Nurses about Standard Precautions for Hospital-Acquired Infection in Teaching Hospitals Affiliated to Zabol University of Medical Sciences. Global Journal of Health Science. 2015;8(4):193.
12. Gogia H, Das JK. Awareness and practice of infection control amongst doctors and nurses in two ICUs of a tertiary care hospital in Delhi. Health and Population: Perspectives and Issues. 2013;36(1-2):1–11.
13. Jagota DR. Study of Knowledge, Awareness and Practices of Infection Control, Among Hospital Staff in Intensive Care Unit of Government Medical College and Hospital (Gmch), Infection Control in ICU. Panjab University Chandigarh India. 2010;27.
14. Stein AD, Makarawo TP, Ahmad MFR. A survey of doctors' and nurses' knowledge, attitudes and compliance with infection control guidelines in Birmingham teaching hospitals. The Journal of Hospital Infection. 2003;54(1):68–73.
15. Colet PC, Cruz JP, Alotaibi KA. Compliance with standard precautions among baccalaureate nursing students in a Saudi university: A self-report study. Journal of Infection and Public Health. 2017;10(4):421–430.
16. Ogoina D, Pondei K, Adetunji B, Chima G, Isichei C, Gidado S. Knowledge, attitude and practice of standard precautions of infection control by hospital workers in two tertiary hospitals in Nigeria. Journal of Infection Prevention. 2015;16(1):16–22.
17. Sadoh, WE, Fawole AO, Sadoh AE, Oladimeji AO, Sotiloye OS. Practice of universal precautions among healthcare workers. Journal of the National Medical Association. 2006;98(5):722–726.
18. Olaifa A, Govender RD, Ross AJ, Olaifa A, Govender RD, AJR. Knowledge , attitudes and practices of healthcare workers about healthcare waste management at a district hospital in KwaZulu-Natal. South African Family Practice. 2018;6(1):1–8.
19. Bekele T, Gebremariam A, Kaso M, Ahmed K. Attitude, reporting behavour and management practice of occupational needle stick and sharps injuries among hospital healthcare workers in Bale zone, Southeast Ethiopia : A cross-sectional study. Journal of Occupational Medicine and Toxicology. 2015;1–7.
20. Cooke CE, Stephens JM. Clinical, economic, humanistic burden of needlestick injuries in healthcare workers. Medical devices (Auck). 2017;10:225–235.
21. Sharew NT, Mulu GB, Habtewold TD, Gizachew KD. Occupational exposure to sharps injury among healthcare providers in Ethiopia regional hospitals. Annals of Ocuupational and Environmental Medicine. 2017;29:1–7.
22. Auta A, Adewuyi EO, Tor-anyiin A, Aziz D, Ogbole E, Ogbonna O. Health-care workers' occupational exposures to body fluids in 21 countries in Africa : Systematic review and meta-analysis. Bulletin of the World Health Organization. 2017;95(12): 831–841F.
23. Belachew YB, Lema TB, Germossa GN, Adinew YM. Blood/Body Fluid Exposure and Needle Stick/Sharp Injury among Nurses Working in Public Hospitals; Southwest Ethiopia. Front Public Health. 2017;5(299):1-6
24. Gorman T, Dropkin J, Kamen J, Nimbalkar S, Zuckerman N, Lowe T, Freund A. Controlling health hazards to hospital workers: A reference guide. New solutions: A Journal of Environmental and Occupational Health Policy. 2013; 23(1.suppl):1-169
25. Dokubo EK, Odume B, Lipke V, Muianga C, Onu E, Olutola A, Maloney S. Building and strengthening infection control strategies to prevent Tuberculosis — Nigeria, 2015. MMWR. Morbidity and Mortality Weekly Report. 2016;65(10):263–266.
26. Ogoina D, Selekere T, Oyeyemi SA, Olomo W T, Oladapo T, Kunle-Olowu O. Status of the infection control program in a Nigerian tertiary hospital before and after implementation of an improvement plan. American Journal of Infection Control. 2015;43(8):900–901.
27. Hamid A, Ahmad AS, Dar S, Sohail S, Akram F, Qureshi M I. Ergonomics Hazards and musculoskeletal disorders among workers of health care

facilities. Curr World Environ. 2018;13(2): 251-258.
28. Senthil A, Anandh B, Jayachandran P, Josephin D, Yamini R, Kalpana B. Perception and prevalence of work-related health hazards among health care workers in public health facilities in southern India. International Journal of Occupational and Environmental Health. 2015;21(1):74-81.
29. Munabi IG, Buwembo W, Kitara DL, Ochieng J, Nabriye CR, Mwaka SE. Musculoskeletal disorders among nursing staff: a comparison of five hospitals in Uganda. The Pan African Medical Journal. 2014;17(81):1–8.
30. Allegranzi B, Gayet-Ageron A, Damani N, Bengaly L, McLaws ML, Moro ML, Pittet D. Global implementation of WHO's multimodal strategy for improvement of hand hygiene: A quasi-experimental study. The Lancet Infectious Diseases. 2013; 13(4):843–851.

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