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Comparative assessment of infection prevention and control practice among maternity unit health workers in public and private secondary health facilities in Kaduna state, Nigeria

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ABSTRACT

Objectives: Infection prevention and control (IPC) practice in health facility (HF) is abysmally low in developing countries, resulting in significant preventable morbidity and mortality. This study assessed and compared health workers' (HWs) practice of IPC strategies in public and private secondary HFs in Kaduna State.

Material and Methods: A cross-sectional comparative study was employed. Using multistage sampling, 227 participants each were selected comprising of doctors, midwives, and nurses from public and private HF. Data were collected using interviewer-administered questionnaire and observation checklist and analyzed using bivariate and multivariate analysis. Statistical significance determined at $P < 0.05$.

Results: The practice of infection prevention was poor. Overall, 42.3% of the HWs did not change their gowns in-between patients, with the significantly higher rates in 73.1% of private compared to 42.3% of public HF workers ($P < 0.001$). In addition, 30.5% and 10.1% of HWs do not use face mask and eye goggle, respectively, when conducting procedures likely to generate splash of body fluids, however, there was no significant difference in these poor practices in public compared to private HFs. The mean IPC practice was 51.6 ± 12.5%, this was significantly lower among public (48.8 ± 12.5%) compared to private (54.5 ± 11.9%) HF workers ($P < 0.0001$). Private HF workers were 3 times more likely to implement IPC interventions compared to public HF workers.

Conclusion: IPC practice especially among public HF workers was poor.

Keywords: Hospital-acquired infection, Infection prevention and control, Maternity unit, Practice

INTRODUCTION

Globally, hospital-acquired infections (HAIs) are a major cause of preventable illness and death among patients.[1] It also impacts on the health-care system by extending duration of hospitalization of affected patients and driving up the costs of diagnosis and treatment.[2] HAIs in developing countries are 2–3 times higher than in developed world.[3] The prevalence of HAI is 7.1% in Europe, 2.5–14.5% in Africa, and 2.5% in a tertiary center in Ibadan Nigeria with

1.63% occurring in the maternity unit.[4-6] Among obstetrics clients, infection is the third leading cause of maternal death globally accounting for 10.7% of all maternal deaths and is the second most common cause of maternal morbidity and mortality in the developing world.[7] Nigerian studies indicate that infection complicates 1.5% of deliveries and causes 12% of maternal deaths with a case fatality rate of up to 40%.[8-10] The emergence of antibiotic resistance organisms due to poor infection prevention and control (IPC) practice also leads to increased cost to patients and the health-care system.[11]

Semmelweis was the first, in 1847, to documented reductions in maternal mortality due to infection from 11.4% to 1.27% as a result of the introduction of scrubbing protocols with chlorine solution before every physical examination and the changing of bed sheet between patients.[12,13] This led to the universal introduction of infection interventions in health-care settings. These are standard WHO recommended IPC strategies in health facilities (HFs) to reduce the scourge of death due to infections.[14,15] This IPC strategies are simple, low-cost technology, and high-impact interventions that are proven to substantially reduce the incidence of infections and mortality in health-care settings.[16] A recent study showed that at least 20% of HAIs are preventable through IPAC interventions.[17]

IPC practice in health-care facilities is abysmally low in developing countries including Nigeria.[18,19] A study conducted in Federal Medical Center, Asaba, Delta State, Nigeria, showed only 37.7% of health workers (HWs) practiced standard IPC strategies.[20] IPC practice in the maternity unit can lead to the development of infection (puerperal infection) which can ultimately lead to maternal death.

This study assessed and compared IPC practice in maternity units of public and private secondary HFs in Kaduna State. The result will assist health managers and policy-makers to take informed decision to improve the standard of IPC practice in Kaduna State in particular and in Nigeria at large.

MATERIAL AND METHODS

Study area

The study was carried out in Kaduna State, Northwest Nigeria. The state has an estimated population of 8.9 million people in 2017. The state is divided into three senatorial zones with 23 LGAs and 255 wards.[21] Women of reproductive age (15–49 years) constitute about 46.7% of the total population of women. Secondary HFs that offer maternity services were more concentrated in urban than rural areas, especially private HFs.[22]

Study population

The study comprises skilled HWs (doctors, nurses, midwives, and nurse-midwives) who have worked for at least 6 months in the maternity units of secondary private and public HFs that have functional operating theater. An inclusion criterion included the conduct of at least four deliveries per day. A total of 18 public and 20 private secondary HFs met the criteria for inclusion in the study.[23]

Study design

This is analytic cross-section comparative study.

Sample size determination and sampling method

Sample size was calculated using sample size formula for comparative study at 95% level of significance, 80% power, and 0.13 effect size given a sample size of 227 participants each in public and private HFs. About 10% of these participants were observed for IPC practice. Participants were selected using a multistage sampling method. Twelve LGAs (four from each of the three senatorial zones) were first selected from the 23 LGAs by balloting. All the secondary HFs that have a maternity unit with high case load of deliveries (at least four deliveries per day) were then selected (18 public and 20 private HFs). All the doctors, nurses, and midwives in the selected HFs were interviewed.

Data collection method

Data were collected using structured interviewer-administered questionnaire and an observation checklist, both adapted from the IPC Assessment Tool developed by Center for Disease Control and Prevention and United States Agency for International Development (USAID).[24,25] The tool assessed the practice of IPC in the maternity unit regarding hand washing practice, use of personal protective equipment (PPE), immunization of HW, frequency of vaginal examination, length of hospitalization post uncomplicated deliveries, and appropriate use of antibiotics. The tool was scripted and entered into android devices using Open Data Kit software. Participant observations were conducted on 56 participants (28 from public and 28 from private HFs). Participants were not aware they were being observed to reduce possibility of Hawthorn's effect.[26] Data were collected over 2 weeks' period from October 23, 2018, to November 3, 2018, by a team of four trained research assistants.

Data analysis

Data were imported from android devices into Statistical Package for the Scientific Studies version 23 and analyzed. Standard IPC practice was assessed from 18 structured questions. Incorrect responses attracted 0 point while correct response attracted 1 point giving a score range of 0–18. Student's *t*-test was used to determine and compare the mean practice score between public and private

HF workers. Score of IPC practice in percent was also grouped using USAID IPC assessment recommendation as: Excellent (score of 75+%); good (score of 50–74%), and poor (score of <50%).[25] Student's *t*-test was used to compare means, Chi-square and Fisher's exact tests were used to compare proportions. Statistical significance was determined at $P < 0.05$.

Ethical considerations

Ethical approval was obtained from Ahmadu Bello University Teaching Hospital health research ethics committee (ABUTHZ/HREC/AO7/2017). Permission for the study was obtained from Kaduna State Ministry of Health. Written informed consent was obtained from officers in charge of each facility and/or officers in charge of maternity units and each respondent and confidentiality of information was assured.

RESULTS

Overall, 81.0% of the HW self-reported scrubbing before every vaginal examination and this proportion of HW were significantly higher in private (85.0%) compared to public (77.0%) HF ($P = 0.031$) [Table 1]. However, only 44.6% of the HWs were observed to do so. This observed practice was also significantly higher among private (67.9% compared to public (21.4%) HF workers ($P < 0.001$) [Table 2]. Furthermore, 35.0% of them used hand operated faucet when turning water tap on and off during scrubbing; this poor practice was significantly higher among HWs in public (40.5%) compared to private (30.0%) HF workers ($P = 0.031$) [Table 1]. Almost half of all the HW (48.0%) used plain soap instead of antiseptic soap to wash their hands and this poor practice was also significantly higher among public (55.9%) compared to private (40.1%) HF workers ($P = 0.001$) [Table 1].

Overall, 89.9% and 84.6% of the HWs performed vaginal examination once per hour in the first stage of labor and <4 times/hour in the second stage of labor respectively as recommended in IPC guideline and there was no statistically significant difference in this practice among HWs in public and private HFs ($P < 0.120$ and 0.184, respectively) [Table 3]. About 98% of the HW hospitalized patients had uncomplicated vaginal delivery for <2 days and there was no significant difference in this practice in public compared to private HF ($P < 0.285$). However, only 35.7% of the HW retained patients in the hospital for less than four days' post uncomplicated cesarean section and there was also no significant difference in public compared to private HF ($P < 0.170$) [Table 3].

About 13.0% of the HW never received hepatitis B immunization to protect themselves from blood borne infections, this poor practice was significantly higher among HW in private (15.9%) compared to public (9.7%) HF ($P = 0.049$) [Table 1]. Furthermore, 36.6% of them did not report punctured injuries or related accidents. This practice was also significantly higher among private (44.9%) compared to public (28.2%) HF workers ($P < 0.00001$).

Only 57.7% of the HW self-reported that they changed apron or gowns between patients. This practice was significantly higher among private (73.1%) compared to public (42.3%) HF workers ($P < 0.00001$). Only 10.0% and 30.5% of HWs self-reported that they wear goggle and face mask, respectively, when carrying out procedures capable of generating splash of blood or other body fluids and there was no significant difference in both types of HFs ($P < 0.351$ and < 0.308, respectively). This level of self-reported poor practice aligned with the result of observation as only about 28.6% of the health worker uses mouth, nose, and eye protection together during such procedures and there was no significant difference in both types of HFs ($P < 0.237$) [Table 1].

About 33.0% of HW wrongly prescribed prophylactic antibiotics to clients who had uncomplicated vaginal birth, this poor practice was significantly higher among private (47.6%) compared to public (18.5%) HF workers ($P < 0.00001$). Furthermore, 52.0% and 64.3% of the HW administer prophylactic antibiotics after CS instead of before or during cord clamping and hospitalize clients for 4 days or more post-CS, respectively, instead of <4 days as recommended by the WHO, there is no significant difference in these poor practices in both types of HFs ($P < 0.452$ and < 0.170, respectively) [Table 3].

The mean score of participant's levels of correct practice of IPC was 51.6±12.5%. This was higher among private (54.5%) compared to public (48.8%) HF workers and the difference was statistically significant ($P < 0.001$) [Table 4]. About 38.3% of the HWs had poor practice of IPC which was higher among public (51.5%) compared to private (25.1%) HF workers and the difference was also statistically significant ($P < 0.001$) [Table 5]. The result also showed that private HF workers were 3 times more adherent to standard IPC strategies compared to public and this relationship was statistically significant ($P < 0.001$) [Table 6].

DISCUSSION

About two-fifth of the participants demonstrated poor practice of IPC strategies overall in this study, which is poorer among public compare to private HF workers. This finding is contrary to similar study on IPC practice in a Palestinian hospital in 2015 where only 8.9% poorly practiced IPC in the maternity unit. This disparity may be because the study was conducted in a tertiary health center. Logistic regression analysis in this study showed that private HF workers in the maternity units were 3 times more likely to adhere to standard IPC practice compared to public.

Hand washing practice was found to be poor and poorer among public HF workers although most of the HWs

Table 1: Comparison of IPC strategies among maternity health workers in public and private secondary health facilities in Kaduna State.

IPC strategies	Type of health facility			Test statistics		
	Public (*n*=227) *n* (%)	Private (*n*=227) *n*	Total (*n*=454) *n* (%)	χ^2 value	Df	*P* value
Scrub before every vaginal examination	175 (77.1)	193 (85.0)	368 (81.1)	4.648	1	0.031*
Type of soap used to scrub						
Antiseptic soap	100 (44.1)	136 (59.9)	236 (52.0)	11.436	1	0.001*
Plain soap	127 (55.9)	91 (40.1)	218 (48.0)			
How do you turn the water on and off						
Hand operated faucet	92 (40.5)	68 (30.0)	160 (35.1)	12.292	2	0.002*
Elbow operated faucet	80 (35.3)	117 (51.5)	197 (56.6)			
Someone else pour water for me	55 (24.2)	42 (18.5)	97 (21.3)			
Immunized against blood born infections (hepatitis B)	205 (90.3)	191 (84.1)	396 (87.2)	3.874	1	0.049*
Wear gown or apron during splashable procedures						
Wear apron	203 (89.4)	201 (88.5)	404 (89.0)	5.210	2	0.074
Wear gown	8 (3.6)	17 (7.5)	25 (5.5)			
Wear both gown and apron	16 (7.0)	9 (4.0)	25 (5.5)			
Use eye goggles during splashable procedure	26 (11.5)	20 (8.8)	46 (10.1)	0.871	1	0.351
Change apron or gown before attending to the next patients	96 (42.3)	166 (73.1)	262 (57.7)	44.223	1	<0.001*
Use face mask during splashable procedure	64 (28.2)	74 (32.6)	138 (30.5)	1.041	1	0.308

*Statistical significance, χ^2: Chi-square test, df: Degree of freedom. IPC: Infection prevention and control

Table 2: Comparison of observed IPC strategies in maternity unit of public and private secondary health facilities in Kaduna State.

Observed IPC practices	Type of health facility			Test statistics		
	Public (*n*=28) *n* (%)	Private (*n*=28) *n* (%)	Total (*n*=56) *n* (%)	χ^2 value	df	*P* value
Observed hand washing practice						
Hands washed before wearing and after removing gloves	6 (21.4)	19 (67.9)	25 (44.6)	12.212	1	<0.001*
Wash hand with soap/alcohol hand rub before and after every procedure	23 (82.1)	26 (92.9)	49 (87.5)	F	1	0.422
Hands washed with running water using a form of water dispensing method	12 (42.9)	19 (67.9)	31 (55.4)	3.541	1	0.060
Observed use of PPE						
Fresh gloves used in-between procedures and between clients	20 (71.4)	28 (100.0)	48 (85.7)	F	1	0.004*
Gowns are worn during procedures likely to generate splashes of blood or other body fluids	28 (100.0)	28 (100.0)	56 (100.0)	-	-	-
Mouth, nose, and eye protection used together during procedure likely to generate splashes of blood and other body fluids	6 (21.4)	10 (35.7)	16 (28.6)	1.400	1	0.237

*Statistical significance, df: Degree of freedom, IPC: Infection prevention and control, PPE: Personal protective equipment

reported washing their hand before and after every procedure. This may be associated with high workload in public HFs. This shows that HAIs are likely to be high in the maternity units, especially in public HFs. In a similar study carried out on infection control in delivery unit, Gujarat, India, majority (95%) of the staffs routinely wash their hands before every procedure and soap is always available for hand washing though type of soap was not specified.[19] The hand washing practice in the study was better compared to this study, however, observations were not carried out to verify the claim. In another study conducted in South Nigeria, 92% of HWs routinely wash their hands before carrying out procedure and all of them routinely do same after each

procedure and soap was always available at all time.[18] This showed that hand hygiene practice in the study was better compared to this study. This partly explains why maternal death is higher in North compared to South Nigeria.

Table 3: Comparison of IPC strategies in maternity unit between health workers in public and private secondary health facilities in Kaduna State.

Maternity unit IPC strategies	Type of health facility			Test statistics		
	Public (*n*=227) *n* (%)	Private (*n*=227) *n* (%)	Total (*n*=454) *n* (%)	χ^2 value	df	*P* value
Frequency of vaginal examination in first stage of labor						
One/hour in first stage of labor	199 (87.7)	209 (92.1)	408 (89.9)	2.419	1	0.120
≥Twice/hour in first stage of labor	28 (12.3)	18 (7.9)	46 (10.1)			
Frequency of vaginal examination in second stage of labor						
<Four/hour in second stage labor	187 (82.4)	197 (86.8)	384 (84.6)	1.689	1	0.194
≥Four/hour in second stage labor	40 (17.6)	30 (13.2)	70 (15.4)			
Prophylactic antibiotic given in uncomplicated vaginal delivery	42 (18.5)	108 (47.6)	150 (33.0)	43.369	1	<0.001*
Prophylactic antibiotic given in CS						
<2 h b4 CS or soon after cord clamping	113 (49.8)	105 (46.3)	218 (48.0)	0.565	1	0.452
Post-cesarean section	114 (50.2)	122 (53.7)	236 (52.0)			
Client hospitalized for ≥ 2 days post-SVD						
≥2 days post-SVD	2 (0.9)	6 (2.6)	8 (1.8)	F	1	0.285
<2 days post-SVD	225 (99.1)	221 (97.4)	446 (98.2)			
Client kept in hospital for ≥4 days post-CS						
≥4 days post-CS	153 (67.4)	139 (61.2)	292 (64.3)	1.881	1	0.170
<4 days post-CS	74 (32.6)	88 (38.8)	162 (35.7)			
Instruments soaked in antiseptic solution used for multiple patients	130 (57.3)	61 (26.9)	191 (42.1)	43.029	1	<0.001*

*Statistical significance, SVD: Spontaneous vaginal delivery, CS: Cesarean section, F: Fisher's exact test, χ^2: Chi-square test, df: Degree of freedom, IPC: Infection prevention and control

Use of PPE especially face mask and eye goggle when carrying out procedures capable of generating splash of blood and other body fluids was very low and no significant difference exists between public and private HFs. This finding is similar to the findings in a study on IPC in labor and delivery unit in Iran where it was reported that none of the HW made use of eye shield or face mask during similar procedures.[27] This showed that most HW, especially in the maternity units of secondary HF, were highly susceptible to blood borne infections such as hepatitis B, C, and HIV.

Frequency of vaginal examination and length of patient hospitalization post uncomplicated deliveries as practiced by HW in this study conformed to standard WHO IPC recommendations, however, most of the HFs especially private, hospitalized clients who had CS for a longer period most likely for financial gains. This poor practice promotes the development of surgical wound infection that can lead to maternal death, although there was dirt of similar studies to compare these findings.

The WHO recommends that no prophylactic antibiotics be prescribed for uncomplicated vaginal birth, but antibiotics should be given within 2 h before cesarean section or during cord clamping. This study revealed inappropriate use of prophylactic antibiotics post uncomplicated deliveries. This deviation from standard practice was, however, higher among HWs in private HF, this may be associated with the prolong hospitalization in the private HFs. There was also a paucity of similar study to compare this finding, nevertheless, this poor practice is likely to promote development of antibiotic resistance and making the management of infection difficult, thereby increasing length of hospital stay with associated high social and economic burden to families and communities and eventual death hence increasing the scourge of maternal mortality.

This study was able to disaggregate findings between public and private HFs unlike others studies, observations were also carried out to verify the findings which were not seen in most other studies. This study is limited in its inability to determine the level of knowledge of IPC among HW in the maternity unit, availability of facilities and policies for standard IPC practice, and factors influencing the practice of IPC. Further

Table 4: Comparison of mean IPC practice in maternity unit of public and private secondary health facilities in Kaduna State.

Type of health	IPAC practice scores (%)						
Private	227	225	54.5±11.9	5.7	5.00	(7.98–3.48)	<0.001*
Public	227		48.8±12.5				
Total	454		51.6±12.5				

*Statistical significance, SD: Standard deviation, df: Degree of freedom, CI: Confidence interval, IPC: Infection prevention and control

Table 5: Comparison of proportion of IPC practice in maternity unit of public and private secondary health facilities in Kaduna State.

IPC practice	Type of health facility			Test statistics		
	Public (*n*=227) *n* (%)	Private (*n*=227) *n* (%)	Total (*n*=454) *n* (%)	χ^2 value	df	*P* value
Excellent	8 (3.5)	19 (8.4)	27 (5.9)	34.661	2	<0.001*
Good	102 (44.9)	151 (66.5)	253 (55.7)			
Poor	117 (51.5)	57 (25.1)	174 (38.3)			

*Statistical significance, df: Degree of freedom, IPC: Infection prevention and control

Table 6: Logistic regression of IPC practice in maternity unit of public and private secondary health facilities in Kaduna State.

Type of health facility	Logistic regression of IPC practice				
	B	S.E.	OR	(95% CI)	*P* value
Private	1.154	0.203	3.2	(2.132–4.719)	<0.001*
Public			1		

*Statistical significance, B: Regression coefficient, CI: Confidence interval, IPC: Infection prevention and control, OR: Odds ratio, S.E.: Standard error

studies need to be conducted to come up with findings in these areas so as to help inform policy direction that will improve the practice of IPC, especially in North Nigeria.

CONCLUSION

IPC practices in the maternity units of secondary HFs especially among public HF workers in Kaduna State is poor, with public HFs having significantly poorer IPC practices compared to private. This has the potential to promote the development of infection especially in the maternity units in the HFs in Kaduna State with its attendant consequence of increase maternal death.

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Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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