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Gender Disparities and Practice Gaps in Healthcare Waste Management among Gombe State Health Workers

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Abstract

Healthcare waste poses a significant public health risks due to the potential exposure of humans and animals to hazardous materials from healthcare facilities. This study aimed to assess the knowledge, attitude, and practices (KAP) of health workers regarding waste management in Gombe State, Nigeria. This was a cross-sectional descriptive study and was conducted from January to October 2020. A total of 271 healthcare workers were selected from 17 healthcare facilities using a stratified random sampling technique. Data was collected using a structured interviewing questionnaire. The data was analyzed using IBM SPSS statistical software version 20.0. The level of significance was determined at p≤0.05. It was found that male participants demonstrated significantly more positive attitudes towards healthcare waste management (88.8% vs 76.4%, p=0.008) and perceived all waste as infectious (91.4% vs 83.5%, p=0.018) compared to their female counterparts. Furthermore, there was no significant association between knowledge of risks associated with improper waste management among male and female participants (72.5% vs 62.7%); x^2=1.15; p=0.192, awareness of infection exposure (89.4% vs 83.6%); x^2=2.26; p=0.069 and level of personnel training on healthcare waste management (89.4% vs 83.6%); x^2=1.96; p= 0.113 among male and female participants, respectively. While overall KAP levels were high, significant gender disparities in attitudes necessitate tailored interventions alongside continued training and policy reinforcement.

Keywords: Healthcare waste, waste management, health workers, Gombe, Nigeria.

INTRODUCTION

Healthcare wastes (HCWs) continue to raise a significant public health concern due to the risks it pose to humans, animals, and the environment (Horttanainen *et al.*, 2020). Waste generated from healthcare facilities may include infectious, toxic, or radioactive materials, which, if improperly managed, can lead to serious health hazards and environmental degradation (Adnane *et al.*, 2013; Hassan et al., 2018). Management of HCWs is particularly challenging in developing countries, where limited technological resources, inadequate funding, insufficient staff training, and social constraints undermine effective waste management systems (Janik-Karpinska et al., 2023; Sorrenti *et al.*, 2023). Improper handling and disposal of medical waste (MW), including unsafe behaviours, lack of waste segregation, and inappropriate disposal practices, exacerbate health risks in healthcare environments (Tamplin et al., 2005; Patwary et al., 2009; Hossain et al., 2011). According to the World Health Organization (WHO), high-income countries generate approximately 0.5 kg of hazardous waste per hospital bed per day, while low- and middle-income countries produce around 0.2 kg (WHO, 2011). However, the actual quantity of hazardous waste in developing countries may be underestimated due to poor waste segregation practices, leading to increased risks for healthcare workers and waste handlers(Deress et al., 2019).

In many healthcare facilities across low-resource settings, ineffective healthcare waste management (HCWM) practices contribute to the widespread exposure of personnel and the public to infectious agents and toxic materials (Win et al., 2019). This includes the indiscriminate disposal of sharps, blood-contaminated materials, infectious swabs, syringes, anatomical waste, laboratory cultures, pharmaceuticals, and chemical substances. Such

practices not only pose occupational health risks but also threaten environmental safety, potentially resulting in disease outbreaks and zoonotic transmission (WHO, 2011; Denloye, 2018).

In addition, healthcare waste often includes poorly decontaminated instruments and equipment that may harbour highly infectious organisms. Expired medications, unused or contaminated pharmaceuticals, genotoxic waste, radioactive substances, and heavy metals also contribute to environmental contamination and represent a challenge to the "One Health" approach, which emphasizes the interconnectedness of human, animal, and environmental health (Janik-Karpinska et al., 2023). Globally, it is estimated that 80% of healthcare waste is non-hazardous, while the remaining 20% comprises hazardous materials that may be infectious, toxic, or radioactive (WHO, 2018). In many developing countries, hazardous healthcare waste is often co-disposed with municipal waste, further increasing the risk of exposure among waste collectors, the surrounding communities, and ecosystems (Khan *et al.*, 2019). Gender-specific variations in HCWM perceptions and practices within Nigerian healthcare settings remain poorly characterized. This study aims to evaluate the knowledge, attitudes, and practices of healthcare workers on HCWM in selected healthcare facilities in Gombe State.

MATERIALS AND METHODS

Study Design and Setting

This study was a cross-sectional descriptive design and was conducted across three Local Government Areas (LGAs) in Gombe North, Gombe State, Nigeria: Dukku, Gombe, and Funakaye. Gombe State, located in northeastern Nigeria, covers an area of approximately 20,265 square kilometers and had an estimated population of 3,960,100 people in 2022 (Brinchof, 2022). The predominant languages spoken across the selected communities is Hausa and Fulfulde, which serves as the inter-ethnic medium of communication. The state's economy is primarily based on agriculture, livestock rearing, and commerce.

Study Population

The study population consisted of 271 healthcare workers, including Nurses, doctors, medical laboratory scientists, pharmacists, health assistants, and cleaners. These participants were drawn from private hospitals, primary healthcare centers (PHCs), and secondary health facilities across the three selected LGAs in Gombe State.

Sampling Technique and Facility Selection

A multistage sampling approach incorporating stratified, simple random, and convenience sampling methods was used to select 17 healthcare facilities. Ten PHCs were selected from a total of 541 PHCs using simple random and convenient sampling strategies. Similarly, five private hospitals were chosen from 114 registered private healthcare providers, while two secondary health facilities were selected from the 23 operating within the state. The selected healthcare facilities provided a wide range of services, including emergency care, medical and surgical services, pediatric care, maternal health, and various specialty services. To maintain confidentiality, all selected institutions were assigned code identifiers.

Data collection instrument and procedure

Data collection was carried out using a structured, interviewer-administered questionnaire adapted from a previously published study (Mugabi and Chima, 2018). The questionnaire was modified to suit the local context and included four main sections covering socio-demographic characteristics, knowledge of healthcare waste management, attitudes toward waste handling, and practices related to waste segregation and disposal. A pilot study was conducted using 10% of the total sample size, involving 27 participants, to assess the clarity and reliability of the questionnaire. The participants included in the pilot study were subsequently excluded from the study.

Knowledge was assessed using eight items. Attitude was assessed using eleven items. Practice was evaluated with nine questions. The proportions of themes on KAP responses were analysed based on gender, and the significant difference was determined.

Data analysis

All collected data were analyzed using IBM SPSS version 25.0. Descriptive statistics such as frequencies and percentages were used to summarize demographic data and responses related to knowledge, attitudes, and practices. Association between categorical variables was

determined using Pearson's Chi square. A p-value of 0.05 or less was considered statistically significant.

Ethical considerations

Ethical approval for the study was granted by the Health Research Ethics Committee of the Gombe State Ministry of Health (approval number: MOH/ADM/621/VOL.1/236). Participants were provided with a detailed explanation of the study, procedures, and their rights as respondents. Written informed consent was obtained from all participants before their inclusion in the study. Participation was entirely voluntary, and individuals who chose not to participate were excluded. Confidentiality and anonymity were strictly upheld throughout the study.

RESULTS

Of the 271 participants, majority (78.6%) were aged between 18–35 years, while 21.4% were older than 35 years. Males comprised 59.4% of the participants, and 40.6% were females. Most respondents resided in urban areas (63.0%) compared to 37.0% in rural locations. Slightly more than half were married (52.0%), with the rest unmarried (48.0%). Regarding job designation, medical officers (20.4%), medical Laboratory Scientists (11.0%), pharmacists (7.0%), nurses/midwives (18.8%), and cleaners (12.9%) formed significant portions, with 29.9% falling into other roles. In terms of educational attainment, the majority held a diploma (55.7%), followed by secondary education (14.8%) and degrees (13.6%). Participants worked across various departments, including outpatient (24.0%), laboratory (20.3%), and maternity (10.7%), while 41.0% were from other units. Most respondents (70.8%) reported receiving hepatitis B vaccination. Additionally, 55.0% had more than three years of job experience, and 64.6% worked less than 10 hours per shift, as shown in Table 1.

Table 2 summarizes the participants' knowledge of healthcare waste management. The majority of respondents (91.3% of males and 87.3% of females) were aware of the risks associated with poor waste management. However, the difference was not statistically significant (x^2 = 1.15, p = 0.192). Regarding the posed health risks to healthcare workers, 72.5% of males and 62.7% of females responded affirmatively. Although the numbers suggest greater awareness among male respondents, the difference was not statistically significant (x^2 = 2.62, p = 0.069). A large majority also agreed that infections caused by improper waste management could be prevented,89.4% of males and 83.6% of females, but again, the gender difference was not significant (x^2 = 1.96, p = 0.113). Regarding prior training, 51.3% of males and 45.5% of females reported attending a training session on healthcare waste management. However, no significant difference was observed between the two groups (x^2 = 0.79, p = 0.223). Figure 1 illustrates the general awareness of participants concerning the risks of poor healthcare waste management, with most respondents acknowledging the dangers involved.

Participants generally expressed positive attitudes toward proper healthcare waste management, as shown in Table 3. Nearly all respondents (100% of males and 98.2% of females) believed that HCWM is important. The vast majority also agreed on the need for strict implementation of HCWM protocols, 96.3% of males and 96.4% of females. These differences were not statistically significant. However, when asked whether they believed HCWM is a serious issue, a significantly higher proportion of males (88.8%) than females (76.4%) agreed (x^2 = 6.61, p = 0.008). Similarly, more males (91.4%) than females (83.5%) considered all waste as potentially infectious, which also showed a statistically significant difference (x^2 = 5.31, p = 0.018). In terms of workplace safety, 75.6% of male and 72.7% of female participants reported always wearing personal protective equipment (PPE) while working, but the difference was not statistically significant (x^2 = 0.38, p = 0.317). Figure 2 reflects participants' perception of poor healthcare waste management, highlighting the seriousness with which most respondents view the issue.

Table 4 presents findings on the actual practices of HCWM among participants. Most respondents reported engaging in good waste management practices. For instance, 73.8% of males and 77.3% of females stated that their facilities had proper waste segregation systems in place, and that these were being followed. This difference was not statistically significant (x^2 = 0.55, p = 0.275). The practice of disposing of used items in sharp containers immediately after use was high, 89.4% among males and 90.9% among

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females (x^2 = 0.31, p = 0.366). Similarly, 85% of males and 81.8% of females reported using protective clothing when handling hazardous waste (x^2 = 0.59, p = 0.272). Additionally, most respondents indicated that hazardous waste containers in their facilities were in good condition (76.9% males and 80% females), and that these containers were properly closed and labelled (75.6% males and 80% females). None of these differences were statistically significant.

Table 1: Socio-demographic characteristics among the study participants

Variable	Frequency (n=271)	(%)
Age (years)		
18 - 35	213	78.6
>35	58	21.4
Gender		
Male	161	59.4
Female	110	40.6
Residential area		
Urban	171	63.0
Rural	100	37.0
Marital Status		
Married	141	52.0
Unmarried	130	48.0
Job designation		
Nurse/Midwife	51	18.8
Medical Officer	55	20.4
Medical Laboratory Scientist	31	11.4
Pharmacist	18	6.6
Cleaner	35	12.9
Others	81	29.9
Level of Education		
Non-formal	4	1.5
Secondary	40	14.8
Diploma	151	55.7
Degree	37	13.6
Post-graduate	13	4.8
Others	26	9.6
Department		
Outpatient department	65	24.0
Maternity ward	29	10.7
HIV Section	11	4.0
Laboratory	55	20.3
Others	111	41.0
Evidence of Hepatitis-B vaccination		
Yes	192	70.8
No	79	29.2
Job experience		
<3 years	122	45.0
>3 years	149	55.0
Duration of duty		
<10 hours	175	64.6
>10 hours	96	35.4

DISCUSSION

This study revealed generally high levels of knowledge, positive attitudes, and good practices toward HCWM among participants. While most gender differences were not statistically significant, notable variations were observed in attitudes. Male healthcare workers were significantly more likely to perceive HCWM as a serious issue and to view all healthcare waste as potentially infectious. Knowledge and practice levels were comparable across genders,

with both groups demonstrating strong adherence to standard HCWM protocols.

The present study explored the knowledge, attitudes, and practices (KAP) of healthcare workers toward healthcare waste management (HCWM) in Gombe State, Nigeria. It highlights how frontline health workers understand and respond to the challenges of handling healthcare waste, a growing concern in many low- and middle-income countries where systems for waste disposal often face infrastructural and policy limitations. Our results show that both male and female healthcare workers in Gombe State demonstrated a good understanding of the risks associated with poor waste management. Our findings support similar studies from other settings. For example, Previous work of Denloye et al. (2019) reported that health workers in Lagos showed strong awareness of HCWM principles. Likewise, Wafula *et al.* (2019) in Uganda and Mugabi *et al.* (2018) in Botswana found that healthcare staff generally had good knowledge of waste management protocols and risks, particularly regarding infectious materials. However, our findings differ from a study conducted in Abuja by Audu *et al.* (2022), where healthcare workers were found to have poor knowledge of HCWM practices. These differences might reflect variations in regional training programs, institutional support, or the presence of active waste management policies. Gombe State has benefited from capacity-building initiatives like the Nigeria State Health Investment Project (NSHIP), which may help explain the relatively strong performance observed among healthcare workers in our study.

Table 2: Knowledge of healthcare waste management of the study participants

Variables	Male	Female	x^2	p value
Knowledge on risk of poor HCW management				
Yes	147	96	1.15	0.192
No	14	14		
Knowledge on the level of risk to Health workers				
Yes	116	69	2.62	0.069
No	45	41		
Infections due to poor HCWM can be avoided				
Yes	144	92	1.96	0.113
No	17	18		
Have you attended any training on HCW management?				
Yes	82	50	0.79	0.223
No	79	60		

Where HCWM = Health Care Waste Management; p-value ≤ 0.05 is statistically significant

Table 3: Attitude to healthcare waste management among the study participants

Variables	Male	Female	x^2	p value
HCW management is important				
Yes	161	108	2.95	0.165
No	0	2		
Strict implementation is necessary for proper HCWM				
Yes	155	106	0.46	0.348
No	6	6		
HCWM is a serious issue				
Yes	142	84	6.61	**0.008***
No	19	26		
Do you consider every waste as potentially infectious?				
Yes	148	91	5.31	**0.018***
No	13	19		
Do you always wear PPE while working?				
Yes	121	79	0.38	0.317
No	40	31		

Where HCWM = Health Care Waste Management; PPE = Personal Protective Equipment; p-value ≤ 0.05 is statistically significant

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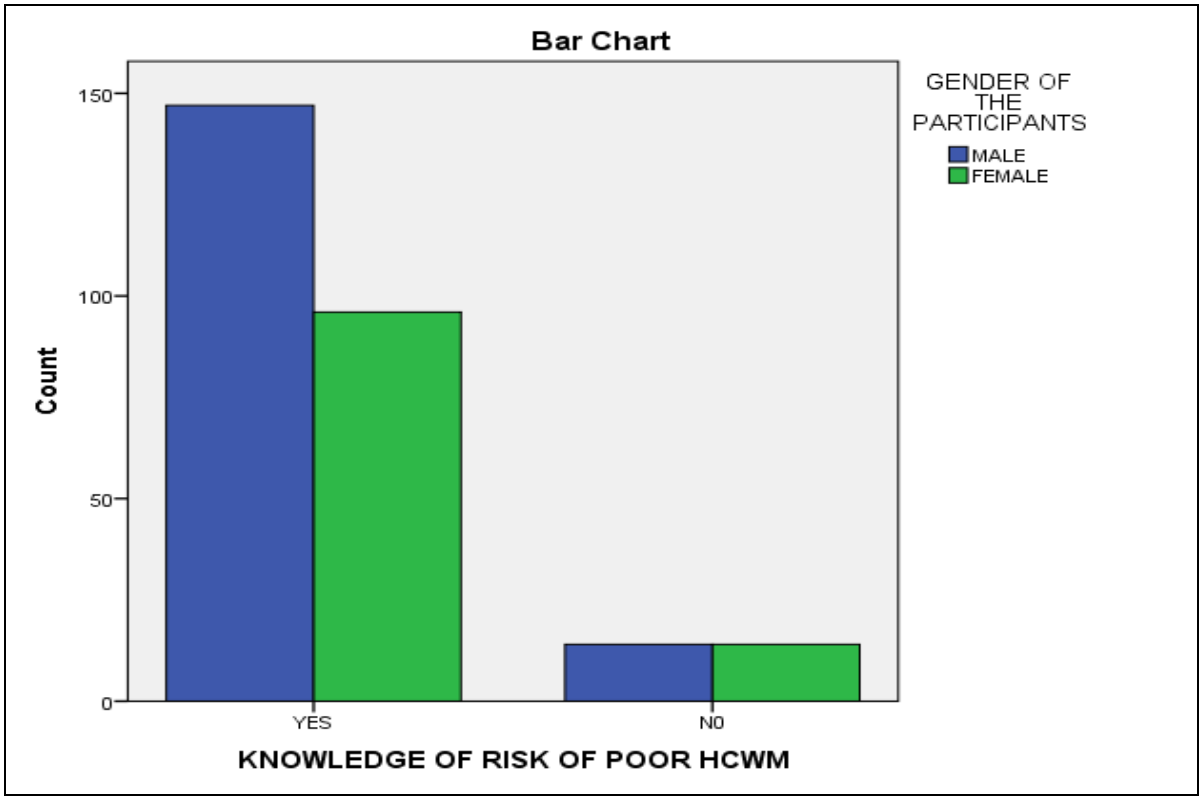

Figure 1: Distribution of participants' knowledge on the risk of poor healthcare waste

Table 4: Practices of healthcare waste management among study participants

Variables	Male	Female	x^2	p value
Is there a system for the Segregation of waste and are they appropriately adhered to?				
Yes	118	85	0.55	0.275
No	43	25		
Are used items disposed off in an appropriate sharp-containers immediately after use?				
Yes	143	100	0.31	0.366
No	18	10		
Do staff use appropriate protective clothing when handling hazardous wastes?				
Yes	136	89	0.59	0.272
No	25	21		
Are all hazardous waste containers in good conditions?				
Yes	123	88	0.49	0.292
No	38	22		
Are hazardous waste containers closed and labelled?				
Yes	121	88	0.87	0.217
No	40	22		

Where HCWM = Health Care Waste Management; PPE = Personal Protective Equipment; p-value ≤ 0.05 is statistically significant

One encouraging aspect of our findings is that a majority of respondents recognized the importance of waste segregation at the point of generation. This practice is critical because it helps prevent the mixing of hazardous and non-hazardous waste, reducing the risk of needle-stick injuries, contamination, and disease transmission. Our findings are consistent with those of Asadullah et al. (2020), who found that over 90% of healthcare workers in Bangladesh agreed that waste segregation should begin where waste is generated.

We also found that most respondents reported using safety boxes for the disposal of sharps, aligning with the World Health Organization's

recommendations for the safe handling and disposal of needles and other sharp instruments (WHO, 2017). Adhering to such guidelines is essential in reducing the spread of bloodborne infections such as hepatitis B, hepatitis C, and HIV (Chartier et al., 2014). While overall practices were commendable, the study uncovered notable gender-related differences in attitudes. Male participants were more likely to perceive HCWM as a serious issue and to view all healthcare waste as potentially infectious. Differences may influence this in job roles or exposure levels, as males may be more involved in waste handling roles in some settings, or might be due to differences in training and work-related experiences. These variations highlight the need for targeted messaging and training that takes gender into account.

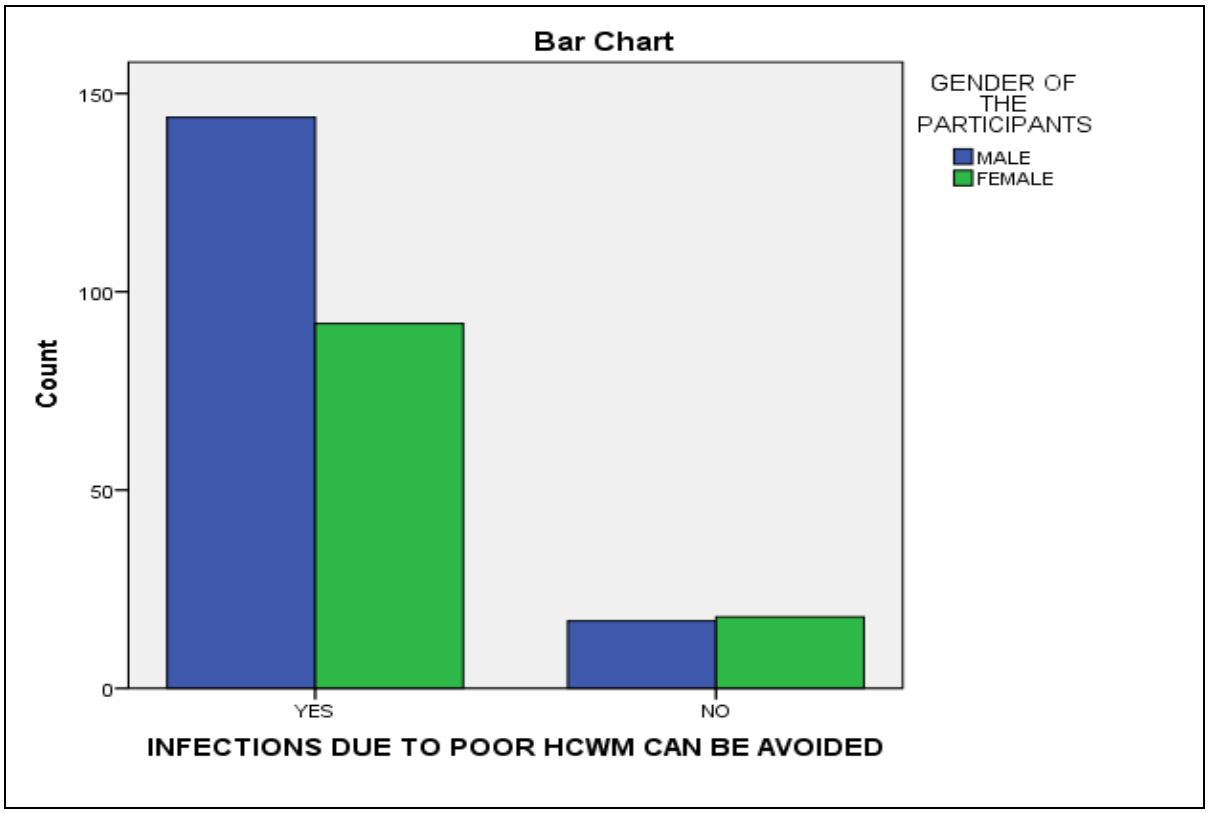

Figure 2: Distribution of participants' perception on poor healthcare waste

The findings from this study have important implications for both practice and policy. First, the generally high levels of knowledge and adherence to safe waste management practices suggest that ongoing training and policy efforts (Odonkor & Mahami, 2020). However, the gender differences in risk perception indicate that awareness alone is not enough (Okotume *et al.*, 2025). Training must also address attitudes and beliefs, using tailored approaches to ensure that all staff, regardless of gender or role, fully understand and commit to safe HCWM practices. Secondly, these findings call for institutionalizing HCWM as part of routine healthcare worker induction and continuing professional development. Integrating waste management more clearly into infection prevention and control (IPC) protocols can help ensure that good practices are sustained over time, even as staff turnover occurs (Odonkor & Mahami, 2020).

Finally, from a public health perspective, improving healthcare waste management is not just about protecting hospital staff; it's also about preventing wider community exposure to infectious and hazardous materials. Poorly managed healthcare waste has been linked to disease outbreaks, environmental pollution, and even long-term ecosystem damage (Windfeld & Brooks, 2015). Therefore, stronger enforcement of waste management policies, investment in infrastructure (such as incinerators and protective equipment), and regular monitoring should be prioritized. In a world increasingly threatened by emerging infectious diseases, antimicrobial resistance, and climate change, healthcare waste management must be viewed

as a critical component of health systems strengthening and environmental health protection.

CONCLUSION

The findings revealed that the study participants generally demonstrate good knowledge, positive attitudes, and appropriate practices toward healthcare waste management. However, the observed gender-based differences in attitudes highlight the need for more targeted and inclusive training programs. Strengthen policy implementation and ensure continuous training to promote safe and effective practices in healthcare waste management.

AUTHORS CONTRIBUTION

Conceptualisation and Study design: Nneka Anyaegbu, Yakubu Ibrahim, Lateef Famoriyo and Aliyu Samuel Abdulmumuni
Data collection: Nneka Anyaegbu, Yakubu Ibrahim, Lateef Famoriyo, Aliyu Samuel Abdulmumuni
Data analysis and interpretation: Yakubu Ibrahim, Nneka Anyaegbu and Muhammad Shuaibu Abdurrahman
Writing of the manuscript: Yakubu Ibrahim
Manuscript Editing for important intellectual content: Yakubu Ibrahim, Nneka Anyaegbu, Lateef Famoriyo, Aliyu Samuel Abdulmumuni, Muhammad Shuaibu Abdurrahman
Final approval of the manuscript: Yakubu Ibrahim, Nneka Anyaegbu, Lateef Famoriyo, Aliyu Samuel Abdulmumuni Muhammad Shuaibu Abdurrahman
Agreement to be accountable for all aspect of the work: Nneka Anyaegbu, Yakubu Ibrahim, Lateef Famoriyo, Aliyu Samuel Abdulmumuni Muhammad Shuaibu Abdurrahman

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None

CONFLICT OF INTEREST

None exists among the authors

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