

KNOWLEDGE ATTITUDE AND PRACTICES OF NURSES ON THE SEGREGATION OF  
HOSPITAL WASTE: CASE OF DISTRICT HOSPITAL KRIBI AND EBOME HOSPITALDr. Lukong Hubert Shalanyuy<sup>1,2\*</sup>, Njiomene Matuedem Vanina Luz<sup>3</sup> and Dr. Tanlaka Lucas Mengnjo<sup>4</sup><sup>1</sup>National Polytechnic University Institute Bamenda, Cameroon.<sup>2</sup>Essential Health Higher Institute – Foumbot Cameroon.<sup>3</sup>Institut Universitaire de la Pointe de Bafoussam, Cameroun.<sup>4</sup>The Cameroon Baptist Convention (CBC) Health Services, Cameroon.

\*Corresponding Author: Dr. Lukong Hubert Shalanyuy

National Polytechnic University Institute Bamenda, Cameroon.

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## ABSTRACT

**Background:** Hospital waste refers to solid, liquid, or gaseous substances generated from healthcare activities, whether related to diagnosed cases or not, and is produced by healthcare facilities. It poses a significant concern to both medical and general communities due to its higher potential for causing infections and injuries compared to other waste types. Globally, healthcare waste presents a serious threat to public health and the environment. It includes waste from services such as vaccinations, diagnosis, treatment, disability support, drug preparation centers, pharmacies, funeral homes, and informal healthcare providers. The objective of the study was to examine nurses' knowledge on waste segregation, to explore and describe their attitude and practices on compliance with the waste segregation in District hospital of Kribi and Ebome hospital. **Methods:** A hospital based descriptive cross-sectional study design was used to assess the knowledge, attitude and practices of 56 freely consented nurses on the segregation of hospital waste in the Kribi and Ebome hospital, who were sampled using the convenience sampling technique. Data was collected using a well-structured questionnaire divided into 4 sections, depending on the specific objectives of the study. Inferential statistics was computed using the chi square test. Data was analysed using SPSS version 21, and significance was considered at  $p < 0.05$ . **Results:** A total of 56 nurses participated in the study, with a majority being female (80.4%) and the dominant age group between 26–30 years. Most held a Bachelor's degree and had over 10 years of professional experience. The study found that 57.1% of participants had good knowledge about hospital waste segregation, though only 19.6% were aware of the WHO color-coded bin system, and just over one-third had formal training in medical waste handling. Regarding attitude, 44.6% exhibited a good attitude towards waste segregation, with many acknowledging the importance of sharps safety, colour codes, and post-exposure prophylaxis, though some saw reporting injuries as a burden. In practice, only 42.9% demonstrated good segregation practices, with high adherence to sorting and protective measures, but low awareness of post-disposal waste outcomes. A significant association was found between nurses' service ward and knowledge ( $p=0.032$ ) and between education level and practice ( $p=0.032$ ), while other socio-demographic factors showed no significant impact. **Conclusion:** In conclusion, while 57.1% of nurses had good knowledge on hospital waste segregation, 55.4% showed poor attitudes, and only 42.9% demonstrated satisfactory practices at Kribi and Ebome hospitals. It is recommended that targeted training and regular sensitization be implemented to improve attitudes and practices among nurses.

**KEYWORDS:** Knowledge, attitude; practice, nurses, segregation; hospital waste.

## BACKGROUND

Hospital waste, produced during diagnostic, treatment, and research activities, includes various hazardous materials such as sharps, pharmaceuticals, and infectious substances. Effective segregation at the source using color-coded containers is the most essential step in healthcare waste management.<sup>[1]</sup> The type and volume of waste generated depend on healthcare facility characteristics, available resources, and management systems.<sup>[2]</sup> According to the World Health Organization

(WHO), 80% of healthcare waste is non-hazardous, while 20% is hazardous; comprising sharps, infectious, pharmaceutical, and toxic waste.<sup>[3,4]</sup> In countries with poor segregation, such as Pakistan and Kenya, the proportion of hazardous waste may rise dramatically, reaching up to 50% in some settings.<sup>[5]</sup>

Improper waste disposal poses significant health and environmental risks globally. Hazardous emissions from burning waste in open pits or poorly designed

incinerators, including dioxins and heavy metals, harm ecosystems and human health.<sup>[6,7]</sup> In many developing countries, lack of infrastructure and awareness exacerbates these problems. Healthcare workers, patients, waste handlers, and even children are often exposed to discarded infectious items such as syringes due to poor disposal practices.<sup>[3,8]</sup> WHO reports that between 18% and 64% of healthcare facilities in developing nations fail to follow proper waste disposal guidelines.<sup>[9]</sup>

In Cameroon, poor medical waste management is attributed to limited financial resources, lack of functional incinerators, and low awareness and attitude of healthcare workers towards health waste management.<sup>[10,11]</sup> In many facilities, waste is openly burned in pits, emitting hazardous fumes.<sup>[12]</sup> Waste handlers often work in unsafe conditions, endangering both themselves and their families. Although medical waste management remains underprioritized, it is crucial for preventing future disease outbreaks and reducing long-term healthcare costs.<sup>[13]</sup> Studies show that healthcare waste management in Cameroon is ineffective due to weak policy frameworks and inadequate training of staff which leads to poor knowledge, poor attitudes and poor practices of healthcare staff towards healthcare waste segregation.<sup>[14,15]</sup> The success of any waste management system relies on competent personnel, proper regulations, and regular training programs.<sup>[16]</sup> A lack of understanding of the risks associated with poor disposal methods has contributed to nosocomial infections among waste handlers.<sup>[17]</sup> Therefore, this study aims to assess the knowledge, attitude, and practices of nurses regarding hospital waste segregation at the District Hospital of Kribi and Ebome Hospital.

## METHODS

**Study Area and Design:** The study was carried out at the Kribi District Hospital and the Ebome Hospital in Cameroon. A descriptive cross-sectional design was adopted from the 9 of January to the 5 of February 2024.

**Participants:** The study population was made up of all consented nurses working in the District hospital of Kribi and Ebome hospital who were sampled using the convenience sampling technique.

**Data Collection and Analysis:** Data was collected using a well-structured questionnaire divided into 4 sections, depending on the specific objectives of the study. Inferential statistics was computed using the chi square test. For knowledge quantification from respondents, for sections relating to knowledge, excellent knowledge has been considered of patients who answered 80% and more correct questions in that particular section. Good knowledge was considered when the correct answers ticked by the nurses constitute 60 – 70.9% of all answers in that section. Fair knowledge was considered when nurses answered 50 – 59.9% of the answers in that section correctly. Poor knowledge was considered when less than 50% of the answers chosen by the nurses were correct. Data was analysed using SPSS version 21, and significance was considered at  $p < 0.05$ . Informed consent was obtained from all participants and ethical clearance was obtained from the Regional Delegation of Public Health for the West Region of Cameroon.

## RESULTS

A total of 56 nurses were included in this study, with more than two-third been female (80.4%,  $n=45$ ) and 19.4% ( $n=11$ ) been male participants. The age varies from 19 to 50 years and mean age been 33.08 years. The most representative age group were nurses aged between 26-30 years (35.7%) and the least represented age group were those aged 36-40 (8.9%). Regarding their level of education, the entire respondent had attained a certain level of education with the Bachelor degree, being the most common level attained (35.7%,  $n=20$ ). With respect to their services most of the respondent were from the surgical ward (44.1%,  $n=23$ ) and 23.2% ( $n=13$ ) were from the medical ward. Again, majority of the respondent had more than 10 years of professional experiences (48.2%). The results are further illustrated in table below:

**Table 1: Socio-demographic data of the study participants.**

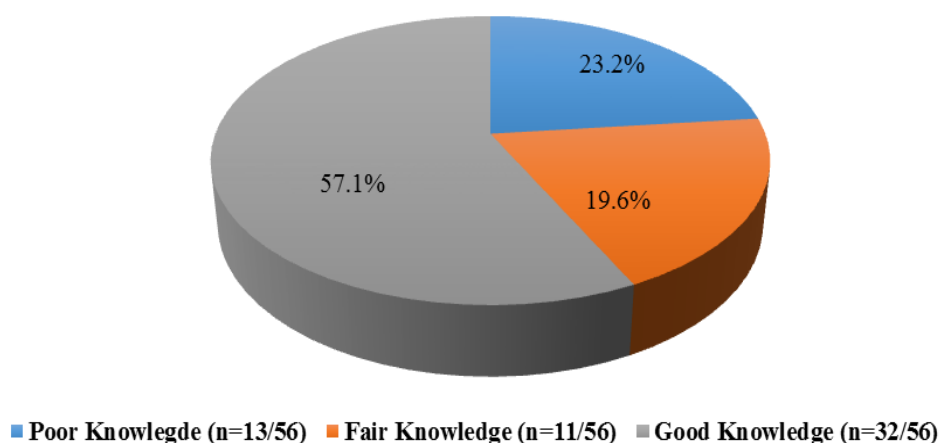
Characteristics	Frequency (n)	Percentage (%)
<b>Age-group (years)</b>	Mean (33,08 $\pm$ 8.098)	
<= 25	7	12,5
26 – 30	20	35,7
31 – 35	12	21,4
36 – 40	5	8,9
> 40	12	21,4
<b>Total</b>	<b>56</b>	<b>100,0</b>
<b>Gender</b>		
Female	45	80,4
Male	11	19,6
<b>Total</b>	<b>56</b>	<b>100,0</b>
<b>Education</b>		
GCE+1	16	28,6
HND	8	14,3

Bachelor	20	35,7
Master	6	10,7
PHD	6	10,7
<b>Total</b>	<b>56</b>	<b>100,0</b>
<b>Service/ ward</b>		
Surgical	23	41,1
Medicine	13	23,2
Paediatric	12	21,4
Gynaecology	4	7,1
Maternity	4	7,1
<b>Total</b>	<b>56</b>	<b>100,0</b>
<b>Professional experiences</b>		
More than 1-5 years	21	37,5
More than 5-10 years	8	14,3
More than +10 years	27	48,2
<b>Total</b>	<b>56</b>	<b>100,0</b>
<b>Site of collection</b>		
Kribi district hospital	28	50,0
EBOME hospital	28	50,0
<b>Total</b>	<b>56</b>	<b>100,0</b>

#### Level of knowledge of nurses towards segregation of hospital waste

The mean score for knowledge was 8.52 ( $\pm$  1.24 SD). Respond who scored above the mean score was said to have a good knowledge while those who scored below were said to have a poor knowledge, however

participants have the exact mean were said to have a fair knowledge. The results revealed that 32 (57.1%) of the respondents had good knowledge, 11 (19.6%) had fair knowledge, while 13 (23.2%) of the respondents had poor knowledge. The results were as shown in the figure 1 below:



**Figure 1: Knowledge of nurse toward segregation of medical waste.**

Table 2 below presents the responds to knowledge towards segregation of hospital waste. All the study participants were knowledgeable about what is medical waste, types of medical waste and who hazardous they are. Also, 98.2%, 98.2% and 91.1% of these nurses were knowledgeable on the need of sorting hospital waste, presence of containers in each unit of the health facilities and proper disposal of expired medicine and blood waste respectively. Again, 87.5% and 66.1% of these nurses acknowledge the presence of labelled containers and

knew the adequate disposal procedures. However, they were less Knowledgeable on how waste are disposed/ treated from the hospital and approximately one-third that received formal training on medical waste handling. Only 19.6% (n=11) of the study participants knew the color-coded bins system for proper disposal of waste recommended by the WHO.

**Table 2: Knowledge towards segregation of hospital waste.**

Knowledge variable	Yes (%)	No (%)
Any discarded biological products such as tissues and blood from wards and laboratory can be regard as medical waste?	56 (100)	0 (0.00)
There are diffident types of waste generated at the hospital?	56 (100)	0 (0.00)
Is hospital waste hazardous?	56 (100)	0 (0.00)
Is there any need to sort hospital waste?	55 (98.2)	01 (1.8)
Is/are there waste containers at each unit of the health facility?	55 (98.2)	01 (1.8)
Are the containers labelled?	49 (87.5)	7 (12.5)
Are you aware of the WHO recommendation color-coded for different categories of hospital waste containers?	11 (19.6)	45 (80.4)
Do you know the adequate disposal procedures?	37 (66.1)	19 (33.9)
Have you ever received any formal training on medical waste handling?	20 (35.7)	36 (64.3)
Disposal of expired medicine and blood waste into domestic waste is an adequate procedure?	5 (8.9)	51 (91.1)
Do you know how waste is disposed and treated from the hospital?	31 (55.4)	25 (44.6)

Figure 2 below represent the response of participants regrading the type of waste generated by their unit they are working in. It was revealed that biological waste

(48.2%) was the most common waste generated in the service of our study participants followed by infectious waste (23.2%).

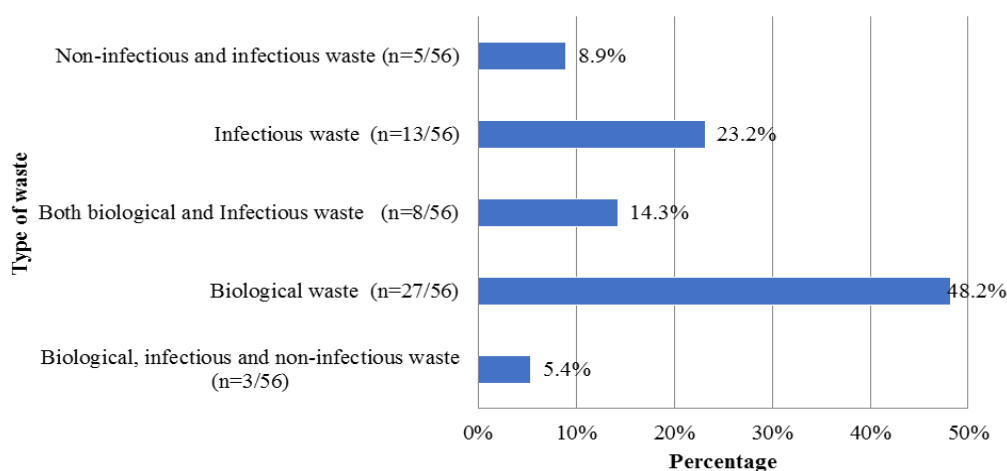
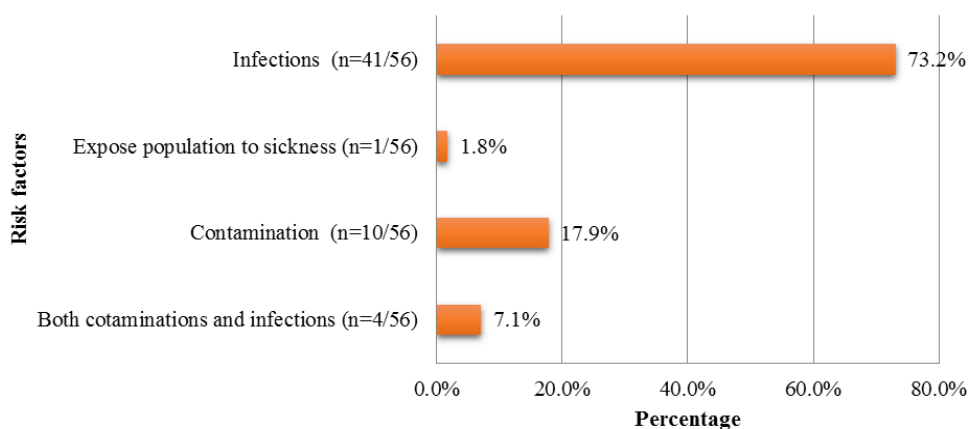
**Figure 2: Types of waste produce in the different wards.**

Figure 3 below represent the response of participants regrading the risk factors associated with hospital waste. After analyses, it was revealed that more than half

(73.2%, n=41) of the nurses identified infections as the most probebel risk factors.

**Figure 3: Risk factors associated with hospital waste.**

### Association between nurses Knowledge on segregation of hospital waste and socio-demographic factors

In relation to age group, the highest rate of good knowledge towards segregation of hospital waste of 58.3% was obtained among participants aged between 31-35 years old. However, there was no significant association between age-group and overall knowledge ( $X^2=6.16$ ;  $p=0.629$ ). With respect to gender, female participant was more knowledgeable than male with knowledge rate of 62.2% and 36.4% respectively. No significant association was between gender and overall

knowledge with p-value greater than 0.05. Similarly, there was no significant association between education and knowledge of segregation of waste ( $X^2= 7.13$ ;  $p=0.522$ ). A positive association was noted between participant's service and knowledge with a p-value of 0.032, were the highest rate of overall good knowledge observed in nurse from the gynaecological ward and the lowest from those of the maternity ward. On the other hand, professional experiences ( $p=0.560$ ) and site of collection ( $p=0.779$ ) did not impact significantly on the knowledge of the study participants. This is further illustrated in the table below.

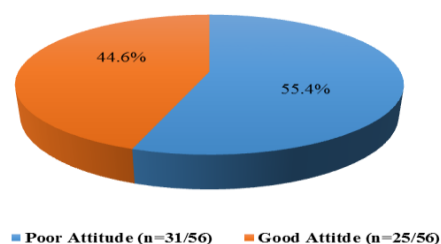
**Table 3: Association analysis of nurses' knowledge on segregation with socio-demographic data.**

Characteristics	Overall, Knowledge			Chi-square (p-value)
	Poor Knowledge	Fair Knowledge	Good Knowledge	
<b>Age-group (years)</b>				
<= 25	2 (28.6)	2 (28.6)	3 (42.9)	
26 - 30	3 (15.0)	6 (30.0)	11 (55.0)	6.16
31 - 35	4 (33.3)	1 (8.3)	7 (58.3)	(0.629)
36 - 40	2 (40.0)	1 (20.0)	2 (40.0)	
> 40	2 (16.7)	1 (8.3)	9 (75.0)	
<b>Gender</b>				
Female	10 (22.2)	7 (15.6)	28 (62.2)	3.08
Male	3 (27.3)	4 (36.4)	4 (36.4)	(0.214)
<b>Education</b>				
GCE+1	4 (25.0)	4 (25.0)	8 (50.0)	
HND	1 (12.5)	3 (37.5)	4 (50.0)	7.13
Bachelor	6 (30.0)	2 (10.0)	12 (60.0)	(0.522)
Master	0	2 (33.3)	4 (66.7)	
PhD	2 (33.3)	0	4 (66.7)	
<b>Service/ ward</b>				
Gynaecological	3 (13.0)	5 (21.7)	15 (65.2)	
Medicine	2 (15.4)	4 (30.8)	7 (53.8)	16.85
Pediatric	3 (25.0)	2 (16.7)	7 (58.3)	(0.032) *
Surgical	1 (25.0)	0	3 (75.0)	
Maternity	4 (100.0)	(0.0)	(0.0)	
<b>Professional experiences</b>				
< 1-5 years	5 (23.8)	6 (28.6)	10 (47.6)	2.99
< 5-10 years	1 (12.5)	2 (25.0)	5 (62.5)	(0.560)
< 10 and more years	7 (25.9)	3 (11.1)	17 (63.0)	
<b>Site of collection</b>				
Kribi district hospital	8 (19.2)	5 (19.2)	16 (61.5)	0.50
EBOME hospital	8 (26.7)	6 (20.0)	16 (53.3)	(0.779)

\*-statistically significant at 0.05 significance level

### Attitude of nurses on segregation of hospital waste

The mean score for knowledge was 3.36 ( $\pm 1.07$  SD). Respond who scored above the mean score was said to have a good attitude while those who scored below were said to have a poor attitude. The results revealed that 25 (44.6%) of the respondents had good attitude, while 31 (55.4%) of the respondents had poor attitude. The results were as shown in the figure 4 below:



**Figure 4: Attitude of nurses toward segregation of medical waste.**

Over 85% of the nurses presented a positive attitude toward safe management of sharps and the importance of post exposure prophylaxis. Questioned on the use of colour codes for segregation 75% of nurse's mention its usefulness. Also, more than half (58.9%) said reporting

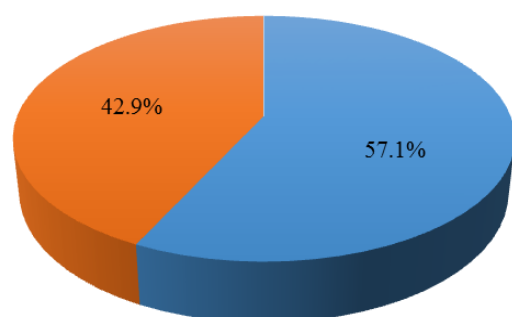
needle-stick injury is not an extra burden on work. However, few of the nurses (17.9%) presented a positive attitude toward segregation of waste as a source increased the risk of injury to waste handlers. This is presented in the table below;

**Table 4: Attitude towards segregation of hospital waste.**

Attitude variable	Yes (%)	No (%)
Segregation of waste at source increased the risk of injury to waste handlers	46 (82.1)	10 (17.9)
Contaminated sharps do not help in safe management of hospital waste	3 (5.4)	53 (94.6)
Reporting of needle-stick injury is an extra burden on work	23 (41.1)	33 (58.9)
Use of colour codes for segregation is not a must	14 (25.0)	42 (75.0)
Post exposure prophylaxis should be put in place where necessary and respected	50 (89.3)	6 (10.7)

#### Practices of nurses on segregation of hospital waste

The mean score for knowledge was 6.30 ( $\pm 1.19$  SD). Respond who scored above the mean score was said to have a good practice while those who scored below were said to have a poor practice. The results revealed that 24 (42.9%) of the respondents had good practice, while 32 (57.1%) of the respondents had poor practice. The results were as shown in the figure 6 below:



■ Poor Practice (n=32/56)    ■ Good Practice (n=24/56)

**Figure 6: Practice of nurse toward segregation of medical waste.**

Over 95% of the nurses sorted medical waste during collection and separate sharp waste from blunt waste. Also, over 90% of the respondent used protective tools when handling medical waste and acknowledged the presence of standard stores for storage of medical waste. Out of the 56 nurses questioned, 44 (78.6%) collected liquid and blood waste in bags to prevent leakage, 36 (64.3%) did not collect these liquid waste together with other waste and 30 (53.6%) did clean the waste trolleys directly after each collection. Poor practice of disposal of medical waste was noted also only 10.7% knew the outcome medical waste after disposal and only 44.6% move this medical waste on trolleys.

**Table 5: Practice towards segregation of hospital waste.**

Practice variable	Yes (%)	No (%)
Do you sort medical waste during collection?	54 (96.4)	2 (3.6)
Do you separate sharp waste from blunt waste?	55 (96.4)	1 (1.8)
Do you move medical waste using trolleys?	25 (44.6)	31 (55.4)
Do you clean the waste trolleys directly after each collection	30 (53.6)	26 (46.4)
Do you use personal protective tools ever or when handling medical waste?	52 (92.9)	4 (7.1)
Do you collect liquid waste and blood in bags that prevent leakage?	44 (78.6)	12 (21.4)
Do you collect liquid waste and blood in bags together with other waste?	20 (35.7)	36 (64.3)
Does the hospital have standard stores for temporary or permanent storage of medical waste?	51 (91.1)	5 (8.9)
Does the hospital depend on the city cleaning authority in moving and disposing of medical waste outside the hospital?	6 (10.7)	50 (89.3)



### Association between nurse's practice on segregation of hospital waste and socio-demographic factors

Regarding age group, the highest rate of good practice towards segregation of hospital waste of 65.0% was obtained among participants aged between 26-30 years old. However, there was no significant association between age-group and overall practice ( $p=0.132$ ). With respect to gender, male participants were more knowledgeable than female with good practice rate of 45.5% and 42.2% respectively. No significant association was between gender and overall knowledge with  $p$ -value greater than 0.05 ( $p<0.999$ ). Similarly, there was no significant association between service and

practice of segregation of waste ( $p=0.522$ ), with the lowest practice rate observed in the gynaecology ward (25.0%). A statistically significant association was noted between participant's level of education and practice with a  $p$ -value of 0.032, were the highest rate of good practice observed in nurse from the bachelor's degree (65.0%) and the lowest from those with PhD (0%). On the other hand, professional experiences ( $p=0.826$ ) and site of collection ( $p=0.315$ ) did not impact significantly on the practice of segregation of hospital waste of the study participants. This is further illustrated in the table below.

**Table 6: Association analysis of nurses' attitude on segregation with socio-demographic data.**

Characteristics	Overall Practice		Chi-square (p-value)
	Poor practice	Good practice	
<b>Age-group (years)</b>			
<= 25	4 (57.1)	3 (42.9)	
26 – 30	7 (35.0)	13 (65.0)	7.08
31 – 35	8 (66.7)	4 (33.3)	(0.132)
36 – 40	4 (80.0)	1 (20.0)	
> 40	9 (75.0)	3 (25.0)	
<b>Gender</b>			
Female	26 (57.8)	19 (42.2)	0.038
Male	6 (54.5)	5 (45.5)	(<0.999)
<b>Education</b>			
GCE+1	10 (62.5)	6 (37.5)	
HND	4 (50.0)	4 (50.0)	<b>10.54</b>
Bachelor	7 (35.0)	13 (65.0)	<b>(0.032) *</b>
Master	5 (83.3)	1 (16.7)	
PhD	6 (100.0)	0	
<b>Service/ ward</b>			
Surgical	15 (65.2)	8 (34.8)	
Medicine	6 (46.2)	7 (53.8)	3.47
Paediatric	7 (58.3)	5 (41.7)	(0.483)
Gynaecology	3 (75.0)	1 (25.0)	
Maternity	1 (25.0)	3 (75.0)	
<b>Professional experiences</b>			
< 1-5 years	13 (61.9)	8 (38.1)	0.398
< 5-10 years	4 (50.0)	4 (50.0)	(0.823)
< 10 and more years	15 (55.6)	12 (44.4)	
<b>Site of collection</b>			
Kribi district hospital	13 (50.0)	13 (50.0)	1.01
Ebome hospital	19 (63.3)	11 (36.7)	(0.315)

\*-statistically significant at 0.05 significance level

### DISCUSSION

The socio-demographic analysis of the study revealed that the average age of the participating nurses was 33.08 years, with the majority being female (80.4%). This proportion is significantly higher than in studies conducted in Morocco and Yaoundé, which reported female representation at 40% and a younger average age, respectively.<sup>[18,19]</sup> Nearly half of the respondents had over 10 years of professional experience, and most had attained tertiary education. This distribution suggests a relatively mature and experienced workforce, potentially

influencing their capacity to understand and implement hospital waste management guidelines effectively.<sup>[20]</sup>

Regarding knowledge, 57.1% of the nurses had a good understanding of hospital waste segregation. All respondents were aware of what constitutes medical waste and its hazardous nature. However, only 35.7% had received formal training on waste management—a situation mirrored in studies from Cameroon but contrasting with findings from South Africa, where a larger proportion had received training.<sup>[18,21,22]</sup> The high level of knowledge was attributed to both educational

attainment and years of work experience, consistent with studies in Thailand and India that link knowledge with professional exposure and targeted training.<sup>[23,24]</sup>

The study found that attitudes toward medical waste segregation were generally poor, with 55.4% of nurses showing unfavourable attitudes. Many respondents (82.1%) believed that segregation at source increases risk to waste handlers, despite recognizing the role of sharps containers and post-exposure prophylaxis in infection control.<sup>[23]</sup> These attitudes may stem from limited safety training, high workloads, or unfavourable working conditions typical in developing countries, and contrast with more positive attitudes recorded in Thailand and South Africa.<sup>[23,25]</sup>

Though most nurses (over 90%) reported using personal protective equipment and followed good waste sorting practices, only 42.9% demonstrated overall satisfactory practice levels. Poor practices were attributed to insufficient human and material resources, inadequate infrastructure, and dependency on municipal services for final waste disposal. Improper handling of liquid and blood waste was also noted, as 64.3% of nurses mixed such waste with others. These results align with earlier research in India and Cameroon, which indicated that segregation protocols can effectively reduce biomedical waste if adequately implemented.<sup>[18,26,27]</sup>

Finally, the study identified a significant association between nurses' ward assignment and their knowledge of waste segregation ( $p=0.032$ ), with gynaecology nurses showing the highest levels of knowledge, possibly due to the nature of their work involving various biohazards. Educational level also significantly influenced waste management practices ( $p=0.032$ ), but no socio-demographic factor was found to significantly affect nurses' attitudes. These findings highlight the need for continuous training tailored to specific hospital units and educational levels to improve waste management outcomes.

## CONCLUSION

The findings from this study reveal that while a majority of nurses demonstrated good knowledge of hospital waste segregation, their attitudes and practices remain suboptimal, with over half exhibiting poor attitudes and unsatisfactory waste handling behaviours. Contributing factors include limited formal training, inadequate infrastructure, and high workload pressures. Notably, specialized wards like gynaecology showed higher knowledge levels, and educational attainment significantly influenced proper practice. These results underscore the urgent need for targeted training programs, improved institutional support, and policy enforcement to enhance safe and effective hospital waste management in healthcare facilities.

## Author's contribution

LHS, Study conception and design, writing of the manuscript; NMVL, Data collection and critical revision of the manuscript; LHS/NMVL, Study design, supervision of data collection and critical revision of manuscript; NMVL, Data analysis and critical revision of manuscript; TLM, Study design, acquisition and interpretation of data, critical revision of manuscript; All authors gave their consent for publication. All authors read and approved the final manuscript.

## Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Competing interests

The authors declare that they have no competing interests.

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