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Adherence to healthcare waste management protocols in selected health facilities, Greater Accra and Eastern Regions, Ghana, 2021

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Abstract

Background Managing healthcare waste is crucial for infection prevention and control. The World Health Organization targets proper management of the 15% infectious waste generated in healthcare settings. We examined adherence to proper healthcare waste management in two regions of Ghana and its predictors to improve occupational health and safety.

Methods A cross-sectional study assessed 104 health facilities in the Greater Accra and Eastern Regions of Ghana in 2021. A checklist was adapted from the WHO/UNICEF Water and Sanitation for Health Facility Improvement tool. Data was collected using interviews, observation and records review. Adherence levels were categorized as < 50% score being low, 50%–79% as medium and ≥ 80% as high. Descriptive and inferential analyses were done with significance considered at 95% confidence level and results presented using texts, tables and charts.

Results Of 104 facilities, majority, 54.8% (57/104) were in Greater Accra with 45.2% (47/104) in Eastern Region. Across the two regions, Community-Based Health Planning and Services (CHPS) Compounds were 38.4% (40/104) with 26.9% (28/104) of facilities having high adherence to healthcare waste management protocols. Factors that influenced adherence included availability of placenta pit (AOR = 27.28, CI: 3.09–240.64), having PPEs (AOR = 9.52, CI: 1.27–71.24) and presence of colour coded waste bins (AOR = 16.63, CI: 1.28–216.31).

Conclusion Adherence to HCWM protocols was low among facilities in Eastern and Greater Accra regions. Factors that influenced adherence were related to availability of logistics. Health facility heads should ensure the availability of waste management logistics to ensure high-level adherence to waste management protocols.

Keywords Waste management · Healthcare facilities · Ghana · Occupational health · Sanitation · Adherence · Cross sectional study

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1 Introduction

Globally, healthcare facilities provide essential prevention and curative services to improve health of individuals. Healthcare waste is generated as a byproduct of service provision in facilities [1]. There are two main classifications of healthcare waste which include hazardous and non-hazardous waste [2]. Hazardous waste constitutes about fifteen percent of total healthcare waste generated while the non-hazardous is about eighty five percent [2]. Infectious hazardous healthcare waste can potentially lead to infection, cause injuries and worsen environmental pollution if not disposed properly [3–7].

The volume of healthcare waste generated worldwide seems to be growing exponentially [8]. Proper management of generated healthcare waste is essential for prevention and control of infections, reduction of associated environmental and public health risks and ensuring occupational safety of health workers [6, 9, 10]. Conversely, improper management of healthcare waste can lead to the release of dioxins, furans, and particulate matter that harm public health, the community and the environment both directly and indirectly [6, 11, 12].

The World Health Organisation (WHO) and the United Nations International Children's Emergency Fund (UNICEF) developed the Water and Sanitation for Health Facility Improvement (WASH FIT) tool for countries to adopt and use for health facility assessments [13]. The Environmental Protection Agency (EPA) and Ghana's Ministry of Local Government and Rural Development through a consultative process begun the development of Ghana's guideline for management of healthcare and veterinary waste in 2002 [14]. The Ministry of Health has also implemented the National Guidelines for healthcare waste management to guide the management of waste in healthcare facilities in Ghana, [4, 14]. This guideline classifies Healthcare waste into two broad categories: Hazardous and Non-hazardous waste. The hazardous category includes subgroups such as infectious waste, sharps, pathological/organic human/animal tissue, pharmaceutical waste, chemical waste, radioactive waste and waste residues. Whiles the non-hazardous category has subgroups such as recyclable general waste and non-recyclable general waste. The guideline also provides regulation for the management of these categories of waste at the various stages of the healthcare waste management with the aim of regulating safe disposal of healthcare sector generated waste.

Despite the availability and implementation of these guidelines, previous studies have reported poor waste management practices in Ghanaian health facilities [15–20] with much focus on hospital solid waste management.Studies from six selected hospitals in the Eastern Region of Ghana reported poor waste separation practices with no records on quantity of solid waste generated [17]. Janik-Karpinska et al., in describing the problem health care waste causes in Global Health highlight how improper disposal of solid waste such as needles and syringes result in the entry of harmful microorganisms, chemicals or pharmaceuticals into soil and groundwater [8]. Another study in five hosiptals in Ghana to assess the behavioural patterns on sorting of waste found that even though contaminated sharps were separated, inconsistencies were seen across health facilities [18]. Similarly, a study in Brazil and Pakistan found inconsistencies in waste segregation, and improper handling, storage and transportation of healthcare waste contrary to WHO standards and country specific bio-safety rules [19, 20]. With focus on all types of healthcare waste generated (solid and non-solid), this study assessed the level and predictors of adherence to proper healthcare waste management protocol in health facilities in the Greater Accra and the Eastern Regions of Ghana. Findings from these two high burden healthcare waste generation regions in Ghana will be useful for guiding design and implementation of interventions towards improving proper health care waste management and promoting occupational health and safety in Ghana and beyond.

2 Methods

2.1 Study design

An analytic cross-sectional study was conducted in Greater Accra and Eastern Regions of Ghana from July to September 2021 to determine the level and association between proper healthcare waste management adherence to other exposure variables. A cross-sectional study design was utilized to enable measurement of both exposure and outcome simultaneously [22].

2.2 Study sites

This study was conducted in the Greater Accra and Eastern Regions of Ghana. Greater Accra is one of the coastal regions of Ghana that houses the national capital. It has a total of 29 metropolitan, municipal and district areas with an estimated population of 5,055,883 with a growth rate of 2.4%. The region has eighty-eight (88) hospitals, twenty-two (22) health centers, one hundred and thirty-seven (137) clinics, one hundred and forty-two (142) CHPS, as well

as forty-seven (47) maternity homes making a total of 426 health facilities. There is an estimated 5,564 health staff in the region. The Eastern Region is also bordered by Greater Accra Region to the south and covers an area of 19,323 km^2. The region has 33 municipalities and districts with at least 22 of these Municipal, and district assemblies (MDAs) having at least one hospital each. There are a total of 380 health facilities comprising of 130 CHPS, 84 Clinics, 22 Health Centers, 38 Hospitals (18 district hospitals, 27 other government hospitals, 3 CHAG), 30 private Maternity Homes, and 96 private facilities. The region has a total projected population of 3,318,855 with health staff estimated at 6,600 in the region (Fig. 1). These two regions were selected as study sites based on being two of the three regions with the largest health facility bed capacities in Ghana (over 3,500 hospital beds) [21]. Previous studies have established that higher number of beds correspond to higher healthcare waste generation with healthcare facilities estimated to generate 1.2 kg/bed/day in Greater Accra Region [23]. The Eastern and Greater Accra regions therefore generate over 4,200 tonnes of healthcare waste daily making them critical regions for answering these research questions [21].

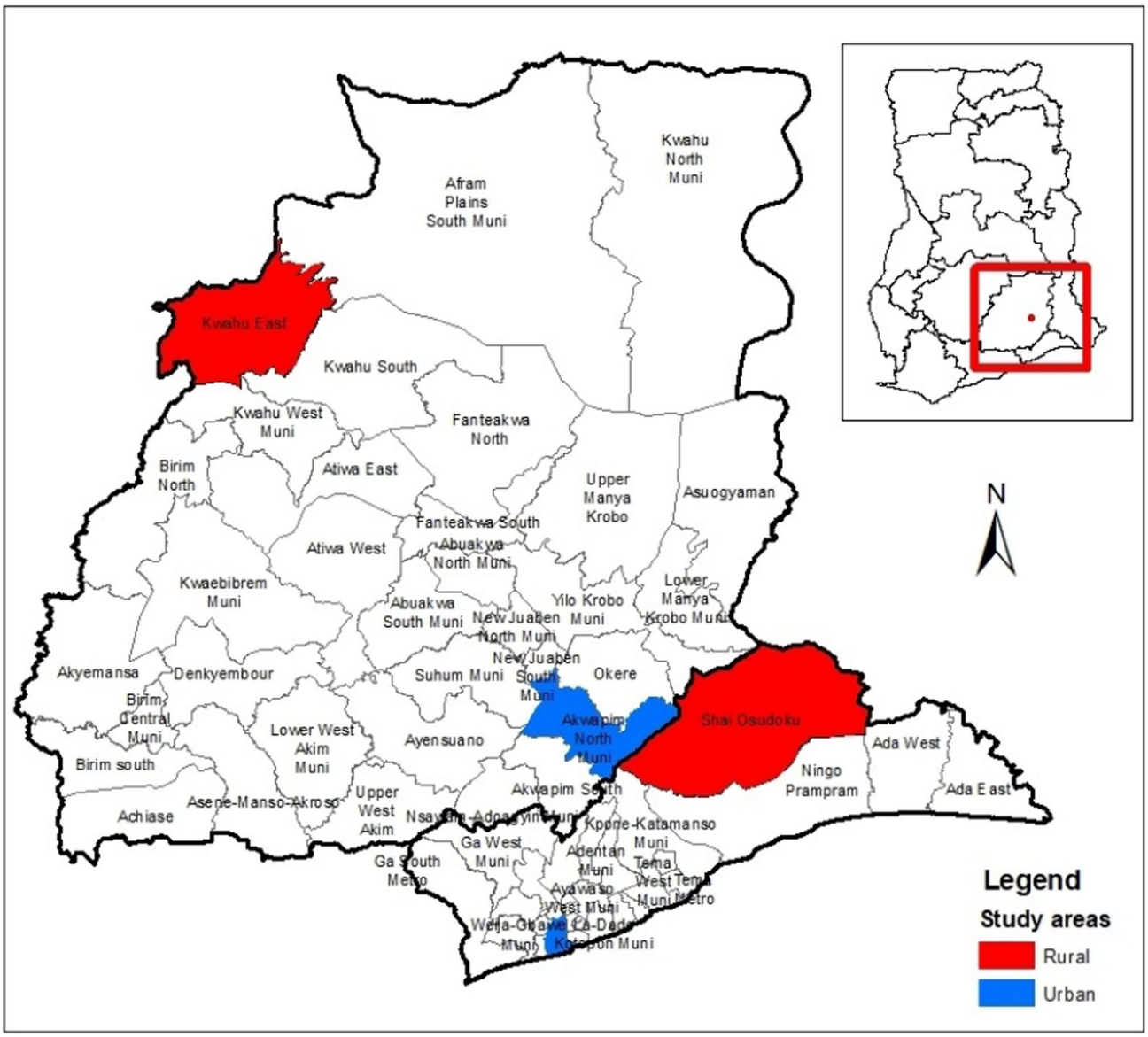

Fig. 1 Map of Greater Accra and Eastern Regions highlighting Accra Metropolis and Shai-Osudoku District; Akuapim North and Kwahu East Districts respectively, 2021

2.3 Sampling

Within each region, one urban and one rural district was sampled. In selecting the districts, all the urban and rural districts were numbered in alphabetical order per region. Using the random number generator in Open Epi, one number was selected randomly, and the corresponding district was included in the study. For Greater Accra Region, Accra Metropolis (urban) and Shai-Osudoku District (rural) were selected whilst in the Eastern Region, Akuapim North (urban) and Kwahu East (rural) were selected. All functional health facilities in the selected urban and rural districts were enrolled in the study (Fig. 2).

2.4 Data Collection

A checklist from the waste management section of the Water and Sanitation for Health Facility Improvement (WASHFIT) tool developed by WHO/UNICEF [13] was adapted to assess health facility adherence to waste management protocols. The WASHFIT tool is an indicator-based tool for assessing health facilities to prioritize WASH improvements. An electronic version of the adapted WASHFIT checklist was programmed in Epi info 7 and used for the data collection. Interviews, observation and records reviews were the data collection methods used. The facility focal person or facility in-charge was interviewed. Observation of waste management practices including waste generation, segregation, temporal storage and final disposal of waste were done. The study also reviewed training reports and minutes from IPC/waste management meetings in order to fill the checklist.

2.5 Data analysis

Data recorded into Epi Info 7 was extracted into an excel sheet and cleaned prior to analysis. Variables were coded, and analysis was conducted using Epi info 7 and STATA/SE version 15 to calculate frequencies and proportions. Per the WASHFIT checklist [13], an indicator that meets the required target is scored 3, one that partially meets target is scored 2, the indicator that does not meet the target is scored 1 whereas indicators that were not applicable to a health facility depending on its level were not scored at all. A total of 12 indicators were assessed with the highest possible total score of 36 points, however, health facilities with not applicable indicators had a total score of (36– (N/A*3). The percentage adherence score was computed using these maximum scores as denominators. To assess the health facility adherence level, the following scale was used; A score of < 50% of the indicators on the checklist indicated 'low level adherence', 50%–79% indicated 'medium level adherence' and ≥ 80% score meant 'high level adherence' [3–7]. For the regression analysis, adherence levels were recoded to; 'adherence' and 'non-adherence', where ≥ 80% indicated 'adherence' and < 80% indicated 'non-adherence'. Bivariate analysis was performed to determine the association between adherence and the

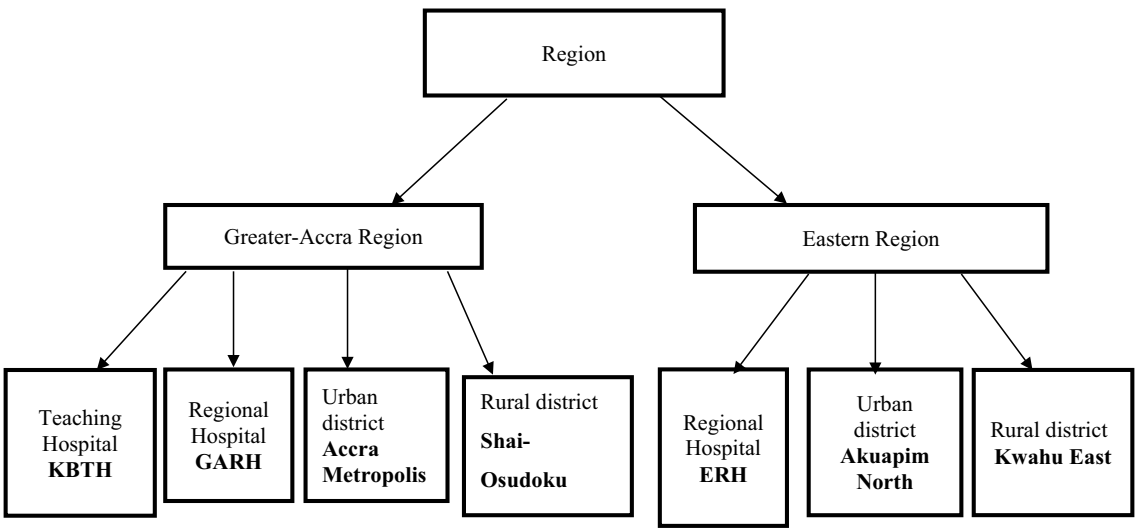

Fig. 2 Facilities selection in Greater-Accra and Eastern Region

other exposure variables (health facility, staff, waste collection and disposal factors) with statistical significance set at p-value < 0.05. Multiple logistic regression using the stepwise backward elimination method was then performed to assess the adjusted strength of the association between exposure variables and adherence. Odds ratio with their corresponding 95% confidence interval were reported. Results were presented in tables, text, charts, graphs and maps.

2.6 Quality control

Pre-testing of the questionnaire was conducted in Okaikoi North District within the Greater Accra Region and the New Juaben South and Kwahu South Municipalities in the Eastern Region. These districts were selected based on their similar characteristics as the selected districts in the Greater Accra and Eastern Regions. Data collectors were trained on the data collection tool prior to full deployment of the tool. Using the adapted checklist, interviews were conducted with IPC focal persons in the selected health facilities. Additionally, waste management activities were observed and records on waste management meetings were reviewed. The pre-test allowed the team to make revisions for finalization of the tool to ensure quality of the main data collected [24].

3 Results

3.1 Demographics

Of the 109 operational facilities obtained from the DHMIS for the selected regions, a total of 104 health facilities were enrolled onto the study with a response rate of 95.4%. Of these, 57 54.8% (57/104) were in Greater Accra and 96.1% (100/104) were at Primary/Periphery level. The CHPS Compounds were the predominant health facilities, representing 38.4% (40/104), with the Teaching hospital being the least, representing 0.96% (1/104). About 55.7% (58/104) of the health facilities were in the urban area and 60.6% (63/104) of the facilities were government owned. Among the health workers engaged, the predominant age group was 30–39 years, 48.1% (50/104), with most 34.6% (36/104) having less than 5 years of working experience. Majority of respondents were Nurses/Midwives 59.62% (62/104), with about 45.2% (47/62) officers playing supervisory roles in waste management (Table 1).

3.2 Compliance to WASHFIT checklist for health care waste management

Using the WASHFIT checklist, majority, 64.5% (64/104) of health facilities had functional waste collection containers for non-infectious and general waste. About 47.1% (49/104) segregated hazardous and non-hazardous waste at all waste generation points. In 87.5% (91/104) of health facilities, the incinerator or alternative treatment technology for the treatment of infectious and sharps waste were non-functional (Table 2).

3.3 Health facility waste management adherence level

Overall, 26.9% (28/104) of the health facilities had high level of adherence to healthcare waste management protocols (Fig. 3).

Quasi-government facilities had 60.6% (6/10) high adherence level whiles privately owned facilities had 16.1% (5/31) high adherence. About 64% (64/100) of facilities at primary level had medium adherence while 66.8% (2/3) of secondary facilities had high adherence level. Facilities located in urban 63% (29/46) and rural settings 62.1% (29/58) mostly had medium adherence level (Table 3).

3.4 Factors influencing adherence to waste management protocols

At bivariate level, facilities that have SOP's available and implemented had 7.3 times higher odds of adherence compared to facilities without SOP's (OR = 7.37, 95% CI: 2.66–20.39). The odds of adherence among health facilities with color coded bins available was 7.37 times higher compared to facilities without color coded bins (OR = 13.4, 95% CI: 3.04–61.81). Additionally, facilities with PPE's available had 7.47 times higher odds of adherence compared to facilities without PPE's (OR = 7.47, 95% CI: 2.85–19.66). Facilities with incinerator had 8.11 times higher odds of adherence compared to facilities without incinerators (OR = 8.11, 95% CI:1.93–34.13). Facilities with placenta pit available had 10.17 times higher odds of

Table 1 Socio-demographic variables of Respondents at the health facility focal persons

Variable	Number	Percentage (%)
Age group		
< 30	21	20.2
30–39	50	48.1
40–49	17	16.3
50–59	11	10.6
≥ 60	5	4.8
Sex		
Male	35	33.6
Female	69	66.4
Cadre		
Medical officer	6	5.8
Physician assistant	11	10.6
Nurse/Midwife	62	60.0
Biomedical Scientist	1	1.0
Environmental Health Officer	3	2.9
Others (specify)	21	20.2
Number of Years in Service		
< 5	36	34.6
5–9	27	26.0
10–14	19	18.3
15–19	6	5.6
20 or more	16	15.0
Role in Healthcare Waste Management		
Environmental health focal person	4	3.9
Occupational Health & Safety focal person	3	2.9
Supervisor	47	45.2
Wash/ IPC	43	41.3
Others	7	6.7

adherence compared to facilities without placenta pits (OR = 10.17, 95% CI: 3.76–27.51). After adjusting for key variables, having color coded waste bins, having PPE's and having placenta pits remained significantly associated with adherence to health facility waste management protocols. The odds of adherence among health facilities with colour-coded waste bins available was 16.63 times higher than facilities without colour-coded bins (AOR = 16.63, 95% CI: 1.28–216.31). The odds of adherence in facilities with PPEs available was 9.52 times higher compared to facilities without PPEs (AOR = 9.52, 95% CI: 1.27–71.24). The odds of adherence was 27.3 times higher among facilities with placenta pit compared to those without placenta pit (AOR = 27.28, 95% CI: 3.09–240.64) (Table 4).

4 Discussion

This study was conducted to assess the level of adherence to waste management protocols and influencing factors in health facilities within Eastern and Greater Accra Regions of Ghana. About a third of the health facilities had high adherence to healthcare waste management protocols. The factors that were associated with adherence to health care waste management protocols were availability of colour coded waste bins, personal protective equipment and placenta pits.

Findings from our study showed that only a third of facilities had high adherence to healthcare waste management protocols. This low level of adherence to HCWM protocols is very concerning given the importance of proper waste management in healthcare settings. The ability of facilities to prevent and control the spread of infections through proper waste management within its operational areas is key in health promotion and occupational safety. Our finding is in concordance with previous studies that found equally low adherence to proper healthcare waste management protocols in Accra, Eastern, Ashanti, and Volta Regions in Ghana [13, 17–27]. Other studies across

Table 2 Healthcare waste management compliance in selected facilities in Ashanti and Eastern Region, 2021

No	Indicator	Meets target N (%)	Partially meets target N (%)	Does not meet target N (%)
1	A trained person is responsible for the management of health care waste in the health care facility or Facility focal person	46 (44.2)	14 (13.5)	44 (42.3)
2	Functional waste collection containers for 1) non-infectious (general) waste, 2) infectious waste and 3) sharps waste in close proximity to all waste generation points	64 (61.5)	33 (31.8)	7 (6.7)
3	Waste correctly segregated at all waste generation points	49 (47.1)	50 (48.1)	5 (4.8)
4	Functional burial pit/fenced waste dump or municipal pick-up available for disposal of non-infectious (non- hazardous/general waste)	35 (33.7)	20 (19.2)	49 (47.1)
5	Incinerator or alternative treatment technology for the treatment of infectious and sharps waste is functional and of a sufficient capacity	9 (8.7)	4 (3.8)	91 (87.5)
6	Sufficient energy available for incineration or alternative treatment technologies (mark if not applicable). N = 13	7 (53.4)	2 (15.4)	4 (30.8)
7	Hazardous and non-hazardous waste are stored separately before being treated/disposed of or moved off site	64 (61.5)	11 (10.6)	29 (27.9)
8	All infectious waste is stored in a protected area before treatment, for no longer than the default and safe time	43 (41.3)	18 (17.4)	43 (41.3)
9	Anatomical-pathological waste is put in a dedicated pathological waste/ placenta pit, burnt in a crematorium or buried in a cemetery (mark if not applicable)	30 (28.8)	3 (2.9)	71 (68.3)
10	Dedicated ash pits available for disposal of incineration ash (mark if not applicable). N = 35	9 (25.7)	6 (17.1)	20 (19.2)
11	Protocol or SOP (Standard Operating Procedure) for safe management of health care waste clearly visible and legible	33 (31.7)	12 (11.5)	59 (56.7)
12	Appropriate protective equipment for all staff in charge of waste treatment and disposal	31 (30.1)	46 (44.7)	26 (25.2)

*Not applicable for 91 (87.5%) health facilities ** Not applicable for 69 (66.3%) health facilities

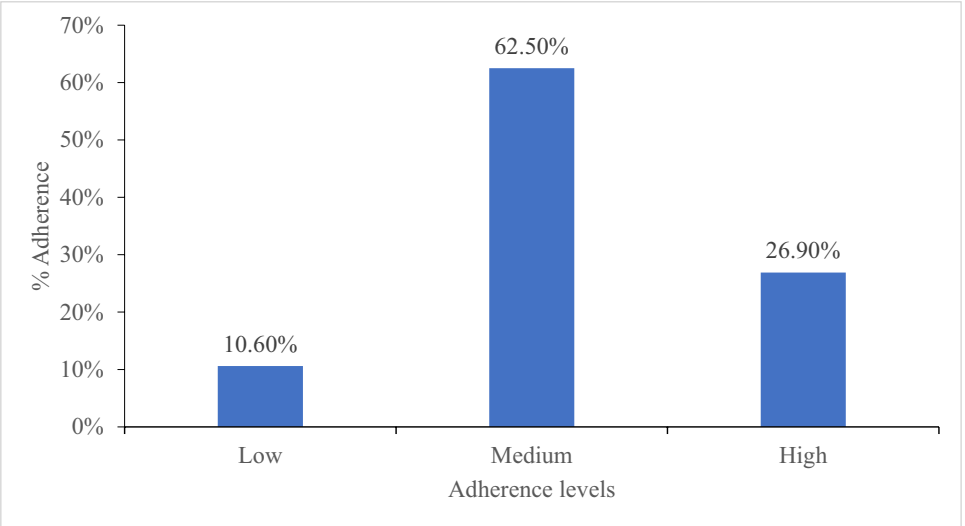

Fig. 3 Level of Adherence to healthcare waste management protocols in Greater Accra & Eastern Region, Ghana, 2021

Africa showed mostly low levels of adherence to healthcare waste management protocols with 25.8% recorded in a Kenyan study, 36.4% and 41% in Nigeria while a study in Nepal recorded 74.8% [28, 29]. These previous studies recommended practical interventions including organization of trainings on waste segregation, provision of logistics and resources and collaboration with stakeholders to ensure best practices are followed in relation to healthcare waste management. Our study further adds to this body of knowledge and highlights the lack of improvement in adherence levels over the years.

With regards to facility type, the highest adherence level was observed among secondary and tertiary facilities. These facilities served as Covid-19 treatment centres during our study period and were frequently supplied with PPEs by the government and other donor agencies. The availability of PPEs such as mask, gloves and gowns form a core part of the standard transmission precautions that ensure reliable improvements in infection prevention and control (IPC) practices. A previous study by Ashinyo et al., (2021), to assess compliance to IPC and WASH protocols in COVID-19 Treatment Centres in the early stages of the COVID-19 pandemic found poor adherence to the protocols with only one of the seven facilities assessed scoring more than 40% of the total score for the WASH FIT domain [30]. The improved finding within secondary and tertiary facilities from our study supports the notion that availability of PPEs within healthcare facilities is key to ensuring compliance. This finding is in concordance with findings by Babirye et al. in Wakiso district of Uganda where proper health care waste management practices was 4.5 times higher among hospitals as compared with Health Care level IV facilities [31]. The Ugandan study however used a different tool for the assessment of adherence and attributed the high level of adherence at higher level facilities to the availability of human resource [31].

After controlling for other factors, availability of placenta pit increased the odds of adherence by over twenty percent. Across the study sites, about 80% and close to 70% did not have functional incinerators and placenta pits respectively. Lack of access to placenta pits and other waste treatment technologies in the facilities may be due to financial constraints leading to lack of prioritization of these important waste management technologies. However, their unavailability means that either infectious waste will be mixed with general waste or will be openly burned at designated point within the facilities as reported in previous studies [16, 18, 32]. Once made available, healthcare workers are likely to adhere to their use. This finding emphasizes the need to ensure availability of appropriate waste treatment technologies in all health facilities to promote adherence to healthcare waste management.

The availability of colour coded waste bins in a facility increased the odds of adherence by over sixteen percent. The colour coded bins serve as a constant reminder to staff to segregate their waste properly. In a study by Mato and Kassenga [33] in Dar es Salaam city on problems of management of medical solid wastes and their remedial measures, the authors indicated that the use of well labelled colour coded bins appropriate for the specified type of waste ensures effective segregation of medical waste [18]. The availability of colour coded bins has also been reported as one of the factors that positively influence health care waste management adherence in other settings including Uganda [16, 18, 31–34].'Similarly, Personal protective equipment availability increased the odds of adherence. This has been documented by several studies and may be linked with staff having a sense of self protection [16, 18, 31–35].

Table 3 Characteristics of health facilities, adherence of waste management protocols, Greater Accra and Eastern Regions, Ghana 2021

Variable	Frequency (%)	Adherence level		
	All N = 104 (%)	High N = 28 (%)	Medium N = 65 (%)	Low N = 11 (%)
Health facility ownership				
Government	63 (60.6)	17 (27.0)	42 (66.8)	4 (6.3)
Private	31 (29.8)	5 (16.1)	20 (64.5)	6 (19.3)
Quasi-government	10 (9.6)	6 (60.0)	3 (30.0)	1 (10.0)
Health facility Level				
Primary/Periphery	100 (96.1)	25 (25.0)	64 (64.0)	11 (11.0)
Secondary	3 (2.9)	2 (66.8)	1 (33.3)	0 (0.0)
Tertiary	1 (0.1)	1 (100)	0 (0)	0 (0.0)
Region				
Eastern	47 (45.2)	10 (21.3)	32 (68.1)	5 (10.6)
Greater Accra	57 (54.8)	18 (31.6)	33 (57.9)	6 (10.5)
District within which facility is Located				
Accra Metropolitan Assembly	35 (33.7)	9 (25.7)	20 (57.1)	6 (17.4)
Akuapim North Municipal Assembly	21 (20.2)	5 (23.8)	16 (76.2)	0 (0.0)
Kwahu East District Assembly	25 (4.0)	4 (16.0)	16 (64.0)	5 (20.0)
Shai Osu-Doku District Assembly	21 (20.2)	8 (38.1)	13 (61.9)	0 (0.0)
Korley Klottey Municipal Assembly	1 (0.96)	1 (100)	0 (0.0)	0 (0.0)
New Juaben South	1 (0.96)	1 (100)	0 (0.0)	0 (0.0)
Category of district within which facility is located				
Urban	46 (44.2)	12 (26.1)	29 (63.0)	5 (10.9)
Rural	58 (55.8)	16 (10.3)	36 (62.1)	6 (10.3)
Type of Health Facility				
Teaching Hospital	1 (0.96)	1 (100)	0 (0.0)	0 (0.0)
Regional Hospital	1 (0.96)	1 (100)	0 (0.0)	0 (0.0)
District Hospital	10 (9.6)	6 (60.0)	4 (40.0)	0 (0.00)
Health center	20 (19.2)	6 (30.0)	12 (60.0)	2 (10.0)
Clinic	42 (30.8)	9 (28.1)	18 (56.2)	5 (15.6)
CHPS compound	40 (38.5)	5 (12.5)	31 (77.5)	4 (10.0)
Location/ Department within health facility generating infectious waste				
Medical	104 (100)	28 (26.9)	65 (62.5)	11 (10.6)
Surgical	52 (50.0)	15 (28.8)	34 (65.4)	3 (5.8)
Laboratory	48 (46.1)	19 (39.6)	25 (52.1)	4 (8.3)
Others	14 (13.5)	6 (42.9)	5 (35.7)	3 (21.4)
Number of units within facility generating infectious waste				
1	21 (20.2)	3 (14.3)	15 (71.4)	3 (14.3)
2–10	80 (76.9)	8 (10.0)	50 (62.5)	8 (10.0)
> 10	3 (2.9)	3 (100)	0 (0.0)	0 (0.0)
Total Adherence	104 (100)	28 (26.9)	65 (62.5)	11 (10.6)

4.1 Study limitations

Our study is limited by the small sample size which reflects in the wide confidence intervals recorded. Particularly, the small number of secondary and tertiary facilities affects generalizability of our findings. That notwithstanding, the health facilities included in the study cuts across the various health facility types in Ghana's health system and provides useful evidence of adherence practices in these health facilities in the two study regions. Future studies should include appropriate number of tertiary and secondary facilities. Also, the study relied on information from the facility focal Persons which may present some form of information bias. To counter this, the interviews were

Table 4 Factors influencing adherence to waste management protocols, Greater Accra and Eastern Regions, Ghana, 2021

Variable	Adherence Status		Unadjusted OR (95% CI)	Adjusted OR (95% CI)
	High n (%)	Low n (%)		
Facility ownership				
Government	17 (26.98)	46 (73.02)	Ref	Ref
Private	5 (16.13)	26 (83.87)	0.52 (0.17–1.57)	0.56 (0.05–6.24)
Quasi government	6 (60.00)	4 (40.00)	4.06 (1.010–16.17) *	2.29 (0.18–29.67)
Facility type				
CHPS	5 (12.50)	35 (87.50)	Ref	Ref
Clinic/Health Centre	15 (28.85)	37 (71.15)	2.84 (0.93–8.63)	1.5 (0.16–14.19)
District Hospital	6 (60.00)	4 (40.00)	10.50 (2.17–50.69) *	0.36 (0.02–6.22)
Regional/Teaching Hospital	2 (100.00)	0	–	–
Availability of focal person				
No	10 (14.49)	59 (85.51)	Ref	Ref
Yes	18 (51.43)	17 (48.57)	6.25 (2.43–16.03) *	0.69 (0.08–6.23)
Training of staff				
No	3 (6.52)	3 (6.52)	Ref	Ref
Yes	25 (43.10)	33 (56.90)	10.86 (3.02–39.08) *	6.8 (0.80–58.07)
Proportion of staff trained				
< 20%	4 (8.70)	42 (91.30)	Ref	Ref
20–39	4 (36.40)	7 (63.60)	6.0 (1.21–29.67)	3.51 (0.08–156.5)
40–59	4 (36.40)	7 (63.60)	6.0 (1.21–29.67)	7.06 (0.20–243.94)
60–79	3 (50.00)	3 (50%)	10.5 (1.57–70.12)	10.73 (0.09–1221.17)
80 or more	13 (43.30)	17 (56.70)	8.0 (2.29–28.09) *	0.15 (0.00–12.86)
Monitoring and supervision				
No	3 (13.04)	20 (86.96)	Ref	Ref
Yes	25 (30.86)	56 (69.14)	2.98 (0.81–10.94)	82.82 (0.93–7349.59)
Health facility location				
Rural	12 (26.09)	34 (73.91)	Ref	
Urban	16 (27.59)	42 (72.41)	1.08 (0.45–2.59)	3.63 (0.31–42.580
SOP availability				
Not available	8 (13.33)	52 (86.67)	Ref	Ref
Available but not implemented	3 (25.00)	9 (75.00)	2.17 (0.48–9.75)	2.22 (0.22–22.59)
Available and implemented	17 (53.13)	15 (46.88)	**7.37 (2.66–20.39)***	7.30 (0.84–63.15)
Availability of colour coded waste bins				
No	2 (4.88)	39 (95.12)	Ref	Ref
Yes	26 (41.27)	37 (58.73)	**13.4 (3.04–61.81)***	**16.63 (1.28–216.31)***
Availability of PPEs				
No	11 (14.86)	63 (85.14)	Ref	Ref
Yes	17 (56.67)	13 (43.33)	**7.47 (2.85–19.66)***	**9.52 (1.27–71.24)***
Availability of incinerator				
No	21 (22.34)	73 (77.66)	Ref	Ref
Yes	7 (70.00)	3 (30.00)	**8.11 (1.93–34.13)***	0.66 (0.04–9.74)
Availability of placenta pit				
No	8 (11.59)	61 (88.41)	Ref	Ref
Yes	20 (57.14)	15 (42.86)	**10.17 (3.76–27.51)***	**27.28 (3.09–240.64)***
Final waste disposal				
Facility owned	14 (25.45)	41 (74.55)	Ref	Ref
Waste disposal company	12 (35.29)	22 (64.71)	1.60 (0.63–4.04)	0.12 (0.00–4.28)
Sent to other health facilities	2 (13.33)	13 (86.7)	0.45 (0.09–2.25)	0.07 (0.00–6.86)

Table 4 (continued)

Bold Values indicate statistically significant association

For facility type Regional/Teaching Hospital zero value was recorded for non-adherence hence the odds and conference interval were not presented

supplemented with observations and review of training reports and IPC/ waste management meeting minutes to ensure triangulation of most of the information collected. Additionally, this study did not consider the individual level behavior of the health workers which could largely affect facility adherence to the HCWM practices. Future studies should consider this in their design.

5 Conclusion

Adherence to healthcare waste management protocols was low with less than a third of the healthcare facilities in Greater Accra and Eastern Regions having high adherence level to healthcare waste management protocols. Secondary and tertiary health facilities were observed to have the highest adherence levels compared to primary health facilities. The factors that influenced adherence to healthcare waste management protocols were availability of colour coded waste bins, personal protective equipment and placenta pits. As a form of public health action, researchers during the period of data collection sensitised focal persons involved in waste management on the proper ways of managing health care waste according to the WASHFIT protocol. Findings of this study were also shared during an annual conference organised by the Ghana Field Epidemiology Training Programme where health professionals from the Ghana Health Service and International partners involved in WASH were present.

5.1 Recommendations

We recommend the following to policy makers. Health facility heads should ensure the availability of waste management logistics such as color code bins and PPEs in each facility. The Ministry of Health should formulate a policy on routine training of facility health staff in management of healthcare waste to promote high-level adherence to waste management protocols. Additionally, the Environmental Protection Agency and the ministry of local government should update the healthcare waste management guidelines to include compulsory availability of placenta pits and incinerators to support proper healthcare waste management in Ghana. A policy on the availability of functional placenta pits and incinerators should be instituted by the Ministry of Health to support implementation of the updated guidelines.

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Declarations

Ethics approval and consent to participate The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Ethical approval for the study was obtained from the Ghana Health Service Ethics Review Committee (ERC) with number GHS-ERC: 002/08/21. Permission was also obtained from the regional health administration of the two regions as well as the district health directorates of the selected districts. Informed consent was obtained from all participants. The contents of the checklist were explained to participants, and they were also provided with a printed participant's information sheet in English prior to consent.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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