

Research



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Waste management practices among dental surgery staff of major hospitals in Accra: a descriptive cross-sectional study

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Abstract

Introduction: *the practice of dentistry in contemporary times produces considerable waste that could be harmful to individuals and the environment at large. In Ghana and many other jurisdictions, there are guidelines that outline how these wastes should be managed. This study was conducted to explore practices concerning dental waste management among dental surgery staff in some public facilities in Accra, Ghana. **Methods:** a descriptive cross-sectional study involving dental surgery staff of four major facilities in Accra was done. Overall, 124 staff from the selected facilities participated in the study, and 51 different dental surgeries were assessed. Data were collected using a structured questionnaire and an observation checklist. The questionnaire included questions on socio-demographics, as well as knowledge and practices regarding dental waste management. **Results:** there was unsatisfactory knowledge of waste disposal, while practices did not generally meet international recommendations and the Ministry of Health's (MOH) guidelines. Though all respondents stored their sharp waste in puncture-proof containers, 98.4% did not label their clinical waste, while 62.9% would dispose of used X-ray fixers by pouring them down the drain. None of the 51 surgeries observed had more than one colour code available. **Conclusion:** there is a palpable need for education, monitoring, and empowerment concerning waste management in Ghana's oral healthcare system.*

Introduction

Globally, there are challenges in the management of health facility wastes. Efficient waste management poses a significant challenge in many parts of the world, while that of dental surgery waste is considered to be an important

environmental problem [1]. Wastes may generally be classified as clinical, hazardous or domestic. Clinical waste refers to that which partly or entirely consists of human or animal tissue, blood or body fluid, excretions, pharmaceutical products, swabs or dressings, syringes, needles, or any sharp instruments [2]. Hazardous wastes on the other hand refer to those which cause harm to living organisms or the environment, either by themselves or through its component, while domestic wastes describe those that are generated in a dwelling [3]. Management of oral health conditions could potentially yield hazardous wastes in the form of dental amalgam, etchants, used X-ray developers and fixers, lead foil packets, and disinfectants, among others [4]. Amalgam, for example, contains mercury which makes it toxic to both humans and the environment, if not properly disposed of [5]. Although its use is gradually waning, the effects of mercury on the entire population and the environment have been a source of global concern [6].

Similarly, improper disposal of sharps and other dental waste may put clinical staff, patients and their families at risk of infections such as hepatitis B and C, and HIV [7]. A previous study showed that general dental offices could produce 59 kg of waste per day, while specialist dental offices averagely produced 18 kg of waste per day. Of these generated wastes, 34% were potentially infectious, and 12% were toxic and chemical wastes [8]. In Africa, and Ghana in particular, it has been noted in previous reports that medical waste is poorly sorted, characterized and disposed of, further highlighting its pertinence in the health system framework [9,10]. The challenges in the management of health facility waste are particularly more evident in developing countries [11]. Improper handling, storage, transportation and ultimately, disposal of clinical waste have led to a surge in health hazards and environmental pollution [12,13]. This has been attributed to legislative challenges, unavailable specialized staff, and low awareness [14]. Limited resources in developing countries make it even

more difficult to manage clinical waste by accepted standards [12]. Dental surgery staff, therefore, have the responsibility of ensuring that dental waste is managed according to standard guidelines. This involves proper waste segregation, storage, transportation and final disposal [6,15,16]. In exploring the challenge and possible action areas, this study set out to explore the practices of dental surgery staff in major facilities in Accra regarding dental waste management.

Methods

Study design: this was a descriptive cross-sectional study involving dental surgery staff of selected major hospitals in Accra.

Study setting: the study was conducted at the dental units of Korle-Bu Teaching Hospital, 37 Military Hospital, Greater Accra Regional Hospital and the Ghana Police Hospital. Data collection was done in June 2018.

Study participants and sampling: the study was a census of all the dental surgery staff in the selected facilities. Staff who were on leave were not included in this study. The registered clinical staff of the hospital officially assigned to the Dental department of the facilities were included. The participants were dentists, community oral health officers, registered dental surgery assistants, diploma nurses, and on-the-job trained personnel who consented to be part of the study. At each visit to a selected facility, workers meeting the inclusion criteria were selected consecutively to be part of the study. All the dental surgeries of the various facilities were also assessed.

Data collection: data were collected using a structured questionnaire, and an observation checklist. The observation checklist served as a form of triangulation to minimize bias. The questionnaire included questions on socio-demographics (age, sex, status, years of experience), as well as knowledge and practices regarding dental waste management. Questions

on knowledge explored colour coding of clinic waste, main content of used X-ray fixers, appropriate disposal of amalgam waste, disposal of blood-soaked gauze and disposal of developed X-ray films. The observation checklist used to assess the dental surgery consisted of a ten-item specification which checked for color-coded bins, matching of contents of the bins with the colour code, appropriate disposal of infectious waste, presence of puncture-resistant sharps' container, waste container labelling, and presence of an amalgam separator.

Data management and analysis: data were entered using Microsoft Excel 2010 and analysed using Stata 14 software (StataCorp. College Station, TX). Socio-demographic characteristics were descriptively summarized, with report of proportions. Responses on knowledge and practices were coded as a dichotomous variable and scored for correct responses. A 95% confidence interval was used and a p-value of 0.05 was accepted as statistically significant.

Ethical considerations: ethical approval was sought from the Ghana Health Service Ethics Review Committee (GHS- ERC: 133/12/17), the 37 Military Hospital Institutional Review Board (37MH-IRB IPN 211/2018), and the Korle Bu Teaching Hospital Institutional Review Board (KBTH-IRB 00045/2018). Verbal consent was obtained from participants. All identifiers that would allow for the linking of data to an institution or individuals were removed from the data. Electronic versions of the data were saved under a password, and hard copies were stored in a lock that could be accessed by only the principal investigator.

Results

A total of 124 respondents out of the estimated 155 dental surgery staff in the selected facilities were included in the study, the difference was accounted for by staff who were on leave at the time of the study. A total of 51 dental surgeries

(rooms where dental surgeries are done) were assessed using an observation checklist. The median age of the respondents was 29 years (IQR: 27-35). The majority of the respondents 63 (50.8%) were within the age range of 20-29 years. A greater proportion of the respondents 79 (63.7%) were females. Most of the participants 69 (55.7%) were Dentists. Other background characteristics are shown in Table 1. About 95% of the respondents knew how to dispose of used sharps, while 23% responded accurately to the colour-code for radioactive waste. Furthermore, only 19% of the respondents knew the recommended method of amalgam disposal (Table 2).

None of the respondents segregated their clinic waste in colour-coded bins. Also, all the respondents store their sharp waste in puncture-proof containers. Blood-soaked gauze was disposed of with other clinic waste by all respondents. Almost all participants 122 (98.4%) did not label their clinical waste, while more than half 78 (62.9%) would dispose of used X-ray fixers by pouring them down the drain. According to 61.3% of this study's respondents, regular waste transporters are responsible for the final transportation of dental surgery waste out of their facilities. Furthermore, none of the 124 respondents knew of record-keeping in their facilities concerning clinical waste activities (Table 3). Less than 10% of the respondents 11 (8.9%) had read the MOH policy on Clinical Waste Management. Observation of the 51 surgeries in the 4 referral facilities showed that all these surgeries stored their generated waste in colour-coded bins, however, none of the observed surgeries had more than one colour-code available (Table 4). All the observed surgeries had a puncture-resistant sharp container, most of which 49 (96.1%) were labelled. The colour code available in most of the surgeries 47, (92.2%) was black. It was also found that the content of the bins did not match the colour code of the bins for all surgeries. All observed bins contained a mixture of domestic and infectious waste, while none of

the observed bins was labelled. There were no missing data.

Discussion

This study set out to explore and describe the dental waste practices among dental surgery staff in some major facilities in Accra. There was unsatisfactory knowledge of waste disposal, while practices did not generally meet international recommendations and the Ministry of Health's (MOH) guidelines. Ghana's Ministry of Health policy on clinical waste management states that various waste categories need diverse ways of handling, treatment, and disposal methods, hence waste should be segregated. The policy also states that segregation of waste into appropriate colour-coded bins is the responsibility of the one who produces the waste and must take place at the source of waste generation. The policy further requires an instruction poster on the procedure involved in waste separation to be posted at every area of waste segregation [15]. This study found that only 23% of the participants accurately responded to questions on colour coding of clinic waste. Comparatively, studies in India and the Philippines reported 48% and 4% respectively in this area [17,18]. We also found that none of the respondents segregated their dental surgery waste into different colour-coded bins. Of the 51 dental surgeries observed, 47 (92%) of them had only black colour-coded bins. Jumau-as *et al.* also reported that only four facilities out of 50 in a study in India practiced waste segregation [18].

The MOH Policy on clinic waste management instructs that sharps be stored in puncture-proof containers that are well-labelled and bear the biohazard symbol [15,19]. Sharps, when managed according to recommended standards, protect dental surgery staff from puncture wounds that could lead to cross infection [16]. This study showed that all the respondents adhered to this guideline. A similar observation was made from the checklist evaluation. When temporary amalgam storage materials are full, a registered

amalgam waste transporter should ideally be contacted to send the waste amalgam for recycling or disposal. Waste amalgam should not be put in the garbage, washed into the drain or put in the container for sharps [16]. This study found an unsatisfactory practice with amalgam disposal. A study in India reported that 79% of the respondents disposed of their generated amalgam waste together with general waste, while 13% of them disposed of this waste in other inappropriate ways [17]. In a facility-based study in Iran, it was found that 92% of the facilities disposed of amalgam waste in toilets as well as the sewer system [20]. A study done in Palestine found that over 80% of generated amalgam waste was disposed of into either the clinic garbage or drain [3]. Lead foil packets are the waste products left behind after conventional X-rays are taken. This study found that they were disposed of with the rest of the clinical waste in all the facilities that provided X-ray services. The lead could leach into the soil and ground if disposed into landfills, causing environmental pollution. Lead waste should be returned to manufacturers for recycling or disposal [16]. Intake of high levels of lead can predispose one to reproductive defects, nerve defects, cancers, hypertension, impairment in kidney function and immunological impairments [19]. Similarly, a study in Iran showed that 78% of the facilities studied disposed of lead foil packets with general waste [20].

Generators of medical/dental waste refer to those producing more than 23 kg of regulated medical/dental waste per month [21]. Generators who manage their waste by transporting it to offsite disposal facilities are supposed to separate, package, label, mark, and track the waste according to stipulated regulations [10]. It is quite evident from this exploratory study that there is a palpable need for education, monitoring, and empowerment concerning waste management in Ghana's oral healthcare delivery system. While unsatisfactory practices in waste management may be looked at in the broader scope of all healthcare personnel [9] and even the general

populace [22], peculiar attention is required for dental waste generation, as they are a potential source of environmental pollution [10]. Concerted efforts must be made to implement recommended guidelines and standard practices in Ghana. Dental waste management and associated environmental pollution should be comprehensively taught during the training of the Dental surgeon, Nurse, and all other allied professionals. Furthermore, training and continuous professional development programs should regularly focus on waste management practices. As awareness and knowledge are improved, a significant responsibility might also befall administrators and managers to ensure an enabling working environment with the necessary materials. Healthcare leaders and Dentists must ensure that training is provided to all employees at the commencement of employment and to all contract workers [23]. There could be a need for the MOH to evaluate its methods of policy dissemination considering the finding that less than 10% of respondents had read the MOH policy on Clinical Waste Management. In the future, there will be the need to conduct a similar study among dental surgery staff of private facilities.

Limitations: the small sample size for sub-populations did not favour further analyses to determine associations. The findings of this study are not widely generalisable. However, findings from this study would inform institutional guidelines and practices concerning waste management.

Conclusion

There was a low level of knowledge on and adherence to dental waste management guidelines among the staff of the facilities studied. There is a need to create an enabling environment to promote adherence to dental waste management guidelines.

What is known about this topic

- *There is evidence of the harmful effects of certain dental waste on the environment. Mercury from dental amalgam, lead from X-ray film packets are all known to be hazardous to the environment. Some researchers have described waste management practices in Ghanaian hospitals generally.*

What this study adds

- *This study provides data on dental waste management practices among dental surgery staff in some public health facilities in Accra.*

Competing interests

The authors declare no competing interests.

Authors' contributions

Alex Ansah Owusu conceptualised the study, collected data, wrote the manuscript, designed the questionnaire, analysed the data; Patricia Akweongo and Abu Manu facilitated the structuring of the study and reviewed the manuscript; Emma Edinam Kploanyi helped with data analysis and reviewed the manuscript; Paa-Kwesi Blankson, Richard Nii Armah and Ruby Yayra Goka critically reviewed the manuscript. All the authors have read and agreed to the final manuscript.

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Tables

Table 1: background characteristics of respondents

Table 2: the distribution of knowledge on dental waste management among respondents

Table 3: the distribution of dental waste management practices among respondents

Table 4: objective assessment of waste management in dental surgeries using observation checklist

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Table 1: background characteristics of respondents

Background characteristics	Frequency (n=124)	Percentage (%)
Sex		
Male	45	36.3
Female	79	63.7
Age of respondent		
20-29	63	50.8
30-39	40	32.3
40-49	13	10.5
50-59	8	6.5
Qualification of respondent		
Dentists	69	55.7
Dental surgery assistants	35	28.2
Nurses	13	16.1
Others	8	9.9
Where respondent trained		
Ghana	114	91.9
African country other than Ghana	3	2.4
Outside Africa	7	5.7
Years of practice		
0-5	75	60.5
6-10	27	21.8
11-15	9	7.3
16-20	6	4.8
21-25	3	2.4
26- 37	4	3.2

Table 2: the distribution of knowledge on dental waste management among respondents

Question on knowledge of respondents	Frequency n=124	Percentage (%)
What colour code should be used for radioactive waste?		
Correct response	29	23.4
Other responses	95	76.6
Used X-ray fixers have high concentration of.....		
Correct response	41	33.1
Other responses	83	66.9
How should amalgam waste be disposed of?		
Correct response	24	19.4
Other responses	100	80.6
How should blood-soaked gauze ideally be disposed of?		
Correct response	9	7.3
Other responses	115	92.7
How should sharps be disposed of?		
Correct response	118	95.2
Other responses	6	4.8
Developed X-ray films can be discarded with regular waste		
Correct response	42	33.9
Other responses	82	66.1

Table 3: the distribution of dental waste management practices among respondents

Practices of respondents	Frequency (n= 124)	Percentage (%)
Is your surgery waste segregated into color-coded bins?		
No	124	100.0
Yes	0	0.00
How would you store waste amalgam?		
Stored under water in a closed container	102	82.3
Other responses	22	17.7
How do you dispose of sharps in your surgery?		
Stored in a puncture-proof container	124	100.0
How do you dispose of blood-soaked gauze in your surgery?		
Disposed of with other clinic waste	124	100.0
Do you label your clinic waste?		
No	122	98.4
Yes	2	1.6
How would you dispose of used X-ray fixers in your surgery?		
Pour down the drain	78	62.9
Other responses	46	37.1
How is your stored dental waste finally transported out of your facility?		
By regular waste transporter	76	61.3
By approved clinical waste transporters	6	4.8
Other responses	42	33.9
Do you have the contact of any of the manufacturers of the materials and chemical you use, such that you can send used or expired products back for recycling?		
No	121	97.6
Yes	3	2.4
When temporary storage of amalgam is full, how do you dispose of it?		
Disposed of with other clinical waste	43	34.7
Other responses	81	65.3
Do you keep records of waste management activities?		
No	124	100.0
Yes	0	0.0
Do you give detailed information on your clinical waste to the waste carriers?		
No	117	94.4
Yes	7	5.6
Does any of the facility administrators ever visit the surgery to monitor how the generated waste is managed?		
No	91	73.4
Yes	33	26.6

Table 4: objective assessment of waste management in dental surgeries using observation checklist

Observation	Frequency (n=51)	Percentage (%)
Is waste stored in colour-coded bins?		
Yes	51	100.0
How many different colour codes are present?		
One (1)	51	100.0
What colour code(s) are available		
Black	47	92.2
Yellow	4	7.8
Do the contents of the bins match the colour code?		
No	51	100.0
Content of bins		
A mixture of domestic and infectious waste	51	100.0
Infectious waste only	0	0.0
Domestic waste only	0	0.0
Are bins labelled?		
No	51	100.0
Is a puncture resistant sharps container present?		
Yes	51	100.0
Is puncture resistant sharps container labelled?		
No	2	3.9
Yes	49	96.1
Does label contain all the required information?		
No	38	74.5
Yes	11	21.6
Not applicable	2	3.9
Is there an installed amalgam separator?		
No	51	100.0