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Health Care Solid Waste Generation and Its Management in Hawassa Referral Hospital of Hawassa University, Southern, Ethiopia

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Abstract:

Background: Health-care waste is a by-product of health care services. Its poor management exposes health-care workers, waste handlers and the community to infections, toxic effects and injuries including damage to the environment.

Objectives: To assess present potential of generation of hazardous and non-hazardous wastes in the HURH in order to predict the future potential.

Methods and Materials: A waste generated daily in various wards of the Hawassa Referral Hospital was measured three times per day for two months using standard weighing scale. Various aspects of healthcare wastes' management was observed by the researchers. All 93 janitors were interviewed personally to assess their level of awareness about the risk of their exposure to the hazardous healthcare wastes and safe handling and disposal of the wastes. Printed questionnaire was also distributed among the janitors for this purpose. The study was conducted from December 20, 2013- March 15, 2014.

Results: All janitors (100%) agreed that improperly managed wastes could transmit infection to patients and 88 (94.62%) to janitors. All (100%) of the respondent reported that they did not have receive any guideline Document on health care most management Document in working area (Hospitals). 11(11.82%) of respondents reported that they had needle sharps injury in the preceding 12 months. All types of wastes collected three times a day by the janitors. And also segregation of wastes and treatment of infectious waste was absent in the hospital. The Average daily waste generated in the hospital was 286.92 kg/day; of which 170.435kg/day was non- hazardous and the rest116.84kg /day was hazardous High amount waste was generated from surgical (52.4 kg/day) and small amount of waste was generated from dentistry unit (3.7kg/day).

Conclusion and Recommendation: health care waste management practice in the hospital was unsatisfactory because of the lack of waste management of supervision and carelessness of patients, visitors, low awareness of janitors and health workers .therefore the hospital should develop the waste management supervision and strictly follow the National Health Care Waste Management guideline.

1. Introduction and Background

Health care facilities, services, and coverage have been increasing in developing countries, particularly more so since the past 15 years in order to reach the targets of the Millennium Development Goals (MGDs). Consequently, waste generation from the health care institutions also has also been increasing (1). Health care wastes (HCW) present challenges both to the health of the environment and health of the humans. Medical and health science professionals, civil societies and governments of many countries are by now well aware of the potential hazards of the HCW (2).

Inappropriate collection, storage, processing, transport, and handling of the HCW expose the staff of the health-care facility, patients and their attendants to the risk of serious health hazards. Inadequacy and inefficiency of the medical waste treatment technology, and the improper disposal of the waste cause serious environmental problems such as air, water and land pollution not only in the campus of the health care facility but also around it. Unsafe practices, such as dumping of hospital waste into municipal wastes, open spaces and water bodies, burning of the waste in open places or in primitive incinerators, etc., are quite common in most of the developing counties. Such unscientific management of the HCW results in the spread of diseases and adversely affects the public health.

In Ethiopia, health care facilities are increasing in number. Health care services and infrastructure such as number of beds, capacity of handling more number of patients, etc., in the hospitals also are increasing. Such a growth in the health care infrastructure and services may possibly increase the generation of the HCW that needs to be quantified and characterized. Very few studies were conducted on the composition, generation rates, and management of the HCW in Ethiopia (3, 4, 5,6,7,8 and 9). Studies on the effects of the HCW on the health of the health care workers, particularly janitors, were also very scanty (10 and 11). Therefore, more studies are required to generate sufficient baseline data from several health care facilities in the country.

Hawassa Referral Hospital of the University of Hawassa is one of the bigger government hospitals in Ethiopia functioning as a teaching and regional referral hospital since April 2005. It is situated on the eastern shore of Lake Hawassa (fresh water lake) in Hawassa, the capital city of Southern Nations, Nationalities and Peoples Regional State (SNNPRS) to provide health care services to the patients referred by other health centers, hospitals and clinics in the region. The Hospital had been progressively increasing its capacity of beds and health care services to ever increasing number of patients. In the year 2008 the hospital had 258 beds with average occupancy of 19 beds per day and average 67 outpatients per day. In the year 2010 the number of functional beds were 305 in six wards of the hospital, the admitted inpatients per day were in the range of 120 – 220, the outpatients per day were 90 – 120, and 70 – 135 patients per day visited antiretroviral therapy (ART) clinic in the hospital (9 and 12). As a consequence of such growth, the HCW generation by the hospital also may be in larger quantity. However, the hospital did not have records of its waste generation either in terms of quantity or composition and its management of the HCW also was poor (9 and 12). The effects of the hazardous HCW on the staff particularly on the janitors handling the waste and the awareness and perception of the janitors about the risk of handling the HCW was also not documented by the hospital.

The hospital is situated at the shore of the Lake Hawassa that is one of the Great Rift Valley Lakes of Ethiopia and an important tourist attraction. As the Lake Hawassa is a fresh water lake, its water is being used by communities for irrigation of food crops. The lake is an important source of commercial fishery as well. Hence, any improper management of the HCW may pollute the lake with the hazardous medical waste that may damage both the health of the lake's ecosystem and public health.

Therefore, the present study was conducted in Hawassa Referral Hospital during December 2013–March 2014 with the objectives of quantification of health care solid wastes being generated from all the wards, operation rooms and outpatient departments, characterization of the wastes, assessment of the HCW management and awareness and perception of the janitors about the risks of handling the hazardous medical wastes.

2. Methods and Materials

Solid wastes generated daily from all the medical related departments, wards, operation rooms (OR) and out-patient departments (OPD) of the Hawassa Referral Hospital were categorized on the basis of their potential health hazard broadly into two types namely, 'hazardous' and 'non-hazardous wastes. The hazardous solid wastes were further characterized as (i) infectious and pathological waste, (ii) pharmaceutical waste, (iii) sharps (injection syringes, needles, blades, scalpels, scissors, glass pieces of broken test tubes and injection vials, etc.) , and (iv) radioactive waste on the basis of the type of hazard they could cause. The non-hazardous solid waste included the general materials, such as paper, plastic bottles, etc., that was not in contact with patients and not contaminated with any body fluids. Accordingly, all those wastes were segregated and deposited into the prescribed standard colour coded bins, and weighed three times per day during a period of two months, precisely in 62 days. The weighing was done strictly before janitors emptied the bins to carry away the wastes for disposal. A standard portable weighing scale was used. Laundry department was included because it handles the bed sheets contaminated with blood, urine, stools and such other body fluids of patients. Hospital kitchen and cafeteria functioning in the hospital campus were not included in the study as they do not produce medical related hazardous wastes.

Various activities of the HCW management – sorting and segregation at the point of waste generation, i.e., deposition of the wastes into the appropriate waste bins by the health care staff and attendants of patients, collecting, handling, interim storage, and transporting of the wastes to the waste disposal site by janitors, functioning and effectiveness of waste disposal and sanitation system present in the hospital – were physically observed daily.

93 janitors were handling the HCW during the study period. All of them were interviewed individually to assess their awareness and perception about the risks of the hazardous HCW, and safe handling and disposal of the wastes. Printed questionnaires were also provided to all of them for recording their responses.

3. Results

During the study period, 630 beds were functional in Hawassa Referral Hospital of which 600 beds were in all the inpatient wards and 30 beds in the emergency unit of the outpatient department (OPD). The hospital provided health care services to about 400 patients (outpatients and inpatients) per day on an average.

3.1. Waste Generation

Seventeen departments of Hawassa Referral Hospital generated 17,789 kg of solid waste that included both the hazardous waste and the nonhazardous waste during 62 days of the study period. Four departments – surgical, gynecology and obstetrics, pediatrics, and medical – generated more than 55 per cent of the total waste. Of these four departments, surgical and gynecology/obstetrics departments generated highest amounts of waste, 3,266.6 kg and 3,067.5 kg respectively. Pediatrics and laundry departments generated solid wastes of nonhazardous character whereas all other 15 departments generated both hazardous and nonhazardous solid

wastes. Of the total waste generated (17,789 kg), the hazardous waste was 7,270.1 kg (41%) and the non-hazardous waste was 10,518.9 kg (59%) (Table 1).

S. No.	DEPARTMENT		HAZARDOUS WASTE					NON-HAZARDOUS WASTE (General Waste)	TOTAL WASTE
			Infectious & pathological waste	Pharmaceutical waste	Sharps	Radio-active waste	Total		
1	Surgical	OPD	100.7	97.6	29.6	0	227.9	513.9	741.8
		Ward	382.8	142.5	41.3	0	566.6	854.9	1421.5
		OR	437.7	147.8	62.4	0	647.9	455.4	1103.3
		SUB TOTAL 1	921.2	387.9	133.3	0	1,442.4	1,824.2	3,266.6
2	Gyn/Obs	OPD	127.6	88.9	22.4	0	238.9	381.2	620.1
		Ward	283.8	150.0	48.9	0	482.7	778.3	1261.0
		Obs OR	555.2	144.8	54.8	0	754.8	431.6	1186.4
		SUB TOTAL 2	966.6	383.7	126.1	0	1,476.4	1,591.1	3,067.5
3	Medical	OPD	89.0	71.4	16.9	0	177.3	407.8	585.1
		Ward	196.6	124.0	40.5	0	361.1	687.1	1048.2
		SUB TOTAL 3	285.6	195.4	57.4	0	538.4	1,094.9	1,633.3
4	Pediatrics	OPD	101.0	83.5	18.2	0	202.7	436.8	639.5
		Ward	237.5	119.9	41.5	0	398.9	889.6	1288.5
		SUB TOTAL 4	338.5	203.4	59.7	0	601.6	1,326.4	1,928.0
5	Ophthalmology	OPD	37.5	51.6	12.8	0	101.9	389.2	491.1
		Ward	115.5	77.8	23.5	0	216.8	524.6	741.4
		SUB TOTAL 5	153.0	129.4	36.3	0	318.7	913.8	1,232.5
6	Emergency		497.6	170.4	47.7	0	715.7	696.3	1,412.0
7	Laboratory		385.9	258.3	84.1	0	728.3	396.5	1,124.8
8	ART		38.8	36.6	24.0	0	99.4	211.8	311.2
9	ICU		96.8	74.5	16.8	0	188.1	362.2	550.3
10	Dentistry		56.2	23.4	10.5	0	90.1	139.0	229.1
11	Dermatology		36.6	44.3	4.6	0	85.5	169.7	255.2
12	Morgue		22.1	29.7	5.7	0	57.5	316.0	373.5
13	ENT		63.4	51.4	12.1	0	126.9	227.6	354.5
14	Pharmacy		-	475.7	18.3	0	494.0	243.2	737.2
15	Radiology		-	20.5	-	286.6	307.1	196.3	503.4
16	Psychiatry		-	-	-	0	0	288.0	288.0
17	Laundry		-	-	-	0	0	521.9	521.9
TOTAL WEIGHT			3,862.3	2,484.6	636.6	286.6	7,270.1	10,518.9	17,789.0

Table 1: Quantity of wastes (weight in kg) generated during 62 days in Hawassa Referral Hospital

The average rate of generation of the total waste by all the departments was 287 kg per day of which 117 kg per day was hazardous waste and 170 kg per day was non-hazardous waste. The average rates of generation of both the hazardous and nonhazardous wastes were highest in surgical (52.68 kg per day) and gynecology/obstetrics departments (49.47 kg per day) (Table 2).

S. No.	Department	Hazardous waste	Non-hazardous waste	Total waste	
1	Surgical	OPD	3.675	8.288	11.964
		Ward	9.138	13.788	22.927
		OR	10.450	7.345	17.795
		Sub-total 1	23.26	29.42	52.68
2	Gyn/ Obs	OPD	3.853	6.148	10.001
		Ward	7.785	12.553	20.338
		Obs OR	12.174	6.961	19.135
		Sub-total 2	23.81	25.66	49.47
3	Medical	OPD	2.859	6.577	9.437
		Ward	5.824	11.082	16.906
		Sub-total 3	8.68	17.66	26.34
4	Pediatrics	OPD	3.269	7.045	10.314
		Ward	6.433	14.348	20.782
		Sub-total 4	9.70	21.39	31.09
5	Ophthalmology	OPD	1.643	6.277	7.921
		Ward	3.497	8.461	11.958
		Sub-total 5	5.14	14.73	19.87
6	Emergency	11.54	11.23	22.77	
7	Laboratory	11.74	6.40	18.14	
8	ART	1.60	3.41	5.01	
9	ICU	3.03	5.84	8.87	
10	Dentistry	1.45	2.24	3.69	
11	Dermatology	1.38	2.73	4.11	
12	Morgue	0.92	5.10	6.02	
13	ENT	2.04	3.67	5.71	
14	Pharmacy	7.97	3.92	11.89	
15	Radiology	4.95	3.16	8.11	
16	Psychiatry	0	4.64	4.64	
17	Laundry	0	8.41	8.41	
All Departments Total		117	170	287	

Table 2: Waste generation rate (kg/day) in Hawassa Referral Hospital

Percentage distribution of the hazardous and nonhazardous wastes generated by each of the department is shown in Figure 1.

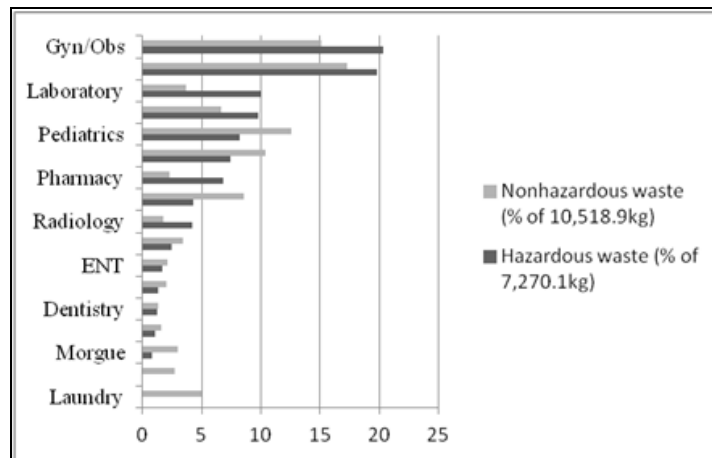


Figure 1

The total 7,270.1 kg hazardous waste generated by 15 departments consisted of 3,862.3 kg (53%) infectious and pathological waste, 2,484.6 kg pharmaceutical waste (34%), 636.6 kg (9%) sharps, and 286.6 kg (4%) radioactive waste (Figure 2).

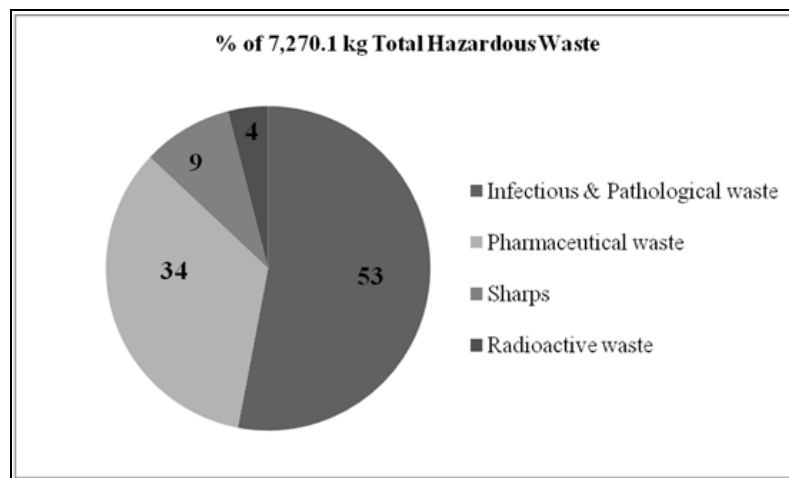


Figure 2: Types of hazardous waste generated in Hawassa Referral Hospital

3.2. Risk Perception of Janitors

Being a bigger hospital, it hired many janitors from different civil organizations, but they were not oriented to any hospital related works particularly the hazardous waste handling. Hence, the janitors had a low level of awareness about the adverse effects of handling the HCW.

All of the 93 janitors handling the HCW participated in the study. All of them were females, and their average age was 32 years. Fifty seven percent of them were not educated, 28% completed secondary education, 11% completed high school level education, and only 4% had certificate or diploma after high school education in a specific field but mostly not related to their current job i.e., HCW handling.

All janitors (100%) agreed that improperly managed HCW could transmit infection to patients, and 88 janitors (94%) opined that it could transmit infection to janitors. Eighty nine janitors (95%) agreed that HIV/AIDS could be acquired through contact with HCW but four respondents (4%) did not agree about such possibility. Thirty seven janitors (39%) noted that the HCW could transmit infection to the other health care workers, and only five janitors (5%) expressed that general public also could be infected.

Eleven janitors (12%) reported that they were injured by sharps present in the HCW during 12 months before the study commenced. 89 janitors (95%) reported that they had no knowledge about the color codes of the HCW containers/bins and their respective uses. All the janitors (100%) reported that they were neither provided with any document of guidelines by the hospital administration nor trained in HCW handling and management. 90 janitors (96.77%) reported that they were not satisfied with their job due to lack of basic requirements in the work set ups.

4. Discussion

Health care solid waste generation by Hawassa Referral Hospital increased substantially. During March–October 2008 Hawassa Referral Hospital had 258 beds and generated in a period of seven consecutive days total solid HCW at the rate of 155.60 kg per day i.e., 56.8 tonnes per year (9). The current study found that the beds in the hospital increased to 630, the medical services increased to serve 400 patients per day, and during 62 consecutive days in the period of December 2013 – March 2014 the total solid HCW generation rate increased to 287 kg per day i.e., 104.8 tonnes per year. Thus the total waste generation increased by 1.8 times, a little less than doubling, during the period of six years. Such an increase proved our presumption that increase in the health services and infrastructure including of any hospital in Ethiopia would also result in increased HCW generation.

The other study done in Ethiopia in 2009 reported that the accessibility of this document was 15% of the surveyed HCFS(1,2,3, 4); However the accessibility of the health care waste management document for health care professional in south Africa was 91% which is different from the result of this study. This difference may be due to their educational status (57%) were illiterate & regular supervision by responsible bodies.

Of the study participants, 89(95.69%) reported that they had not knowledge on the color codes of containers (waste bins) and classification of the health care wastes. This finding was different from the study done by WHO reported that 11.2% & the other study in Gondar Ethiopia by 10.0% of Janitor knew correctly the classification of Health care waste & color code (8, 13 &14).

In Addition to this, it is also different from the study one Assessment of biomedical waste management in Ludhiana India indicate that 9.8% janitors Knew classification of waste & 93.7 % of janitor knew the color code (8). This may be due to degree of emphasis of health care waste (including hospitals) on health care waste management, Job training, budget allocation and the availability of health care waste management document. Again this difference may be due to the availability of treatment methods, awareness & educational status of janitors, lack of regular supervision by responsible body & absence of training in any activities.

In this study the majority of participants (95.69%) agreed and only 4.36 % disagreed that HIV/AIDS could transmit through contact with infectious waste. This finding was higher than the study done in South Africa in 2009 that indicted 82% of the participants agreed, 13% disagreed & the rest 5% not sure (8). Again, this difference might due to the time gap of the study, the promotion of HIV/AIDS to prevention and control using different methods to alert the country & availability of the difference facilities.

In this study all of janitor agreed that improperly managed health care waste could transmit infection to patient and 88(94.6%) to them. And also 38(40.54%) of the janitor reported that improperly managed hospital waste might cause infection to the health care workers and 5(5.37 %) to the public in general. This result is consistent with the study done in Gondar 99 % to the patient & to them, in South Africa 98.5 % agreed that improper management of healthcare waste could lead to the transmission of infections among HCWS and patients (6, 7, 16 &17). This difference may be due to the time gap of the study and awareness of janitors.

None of the respondents reported that they segregated waste by their type with the available dust bin. This result is inconsistent with study done in Gondar Ethiopia, South Africa & India indicated that 31.9%, 97% & 67 % of the janitors segregate health care wastes into readily available waste bins (8, 15, and 18). This could be due to lack of comprehensive training of janitors, high level of illiterate (57%) among janitors, lack of health care waste management guideline documents, low enforcement of the regulation body, Job unsatisfaction of janitors (96.7%) and to a lesser extent due to insufficient containers buckets.

In this study majority of janitors (80%) did not use gloves during handling of waste. This is inconsistent with the study done in Gondar Ethiopia & South Africa indicated that 93% & 95% used glove during handling of health care waste respectively (9, 17, 10, 11, and 12). And also there is no waste treatment before disposing of, which is inconsistent with the study done in Gondar Ethiopia & South Africa showed that they treated infectious health care wastes before disposing of (10, 11, 15, and 19).

4.1. Waste Management Practice

It has been found from the study that in Hawassa university referral hospital, all types of wastes are collected 3 times a day and more often wastes are collected in a greater quantity from emergency, gynecological wards and operation room. Almost all the cleaners were responsible to clean and manage the generated wastes. Some cleaners were found to be engaged to mishandle the generated wastes. Most of them did not segregate the used sharps (mainly syringes, needles), gloves, test tubes, blood bags, and other nonhazardous wastes. All of the respondents reported that they did not have access to any guideline document on health care wastes, types and color codes of containers, and they did not take any training on the management of health care wastes.

And also there was no any clear policy that guides them. All the respondents reported that the available showers were not functional to them. There was no safety instruction given to study participants in their working environment. With the exception of gloves, other personal protective equipment such as overcoats, boots, masks were not available (provided) by the side of the hospital waste management representatives.

In house Waste Management; Radioactive, infectious, and sharp wastes were not separated from non-infectious waste stream at the site of production and were stored in similar containers and disposed together. Also pharmaceutical and pressurized containers were disposed along with the general wastes.

Segregation ; This study reveals that segregation of all wastes was not conducted according to definite rules and standards .Some amount of infectious waste was stored in the same containers as the domestic wastes, and no control measures exist for the management of these wastes.

There was no segregation system for infectious and noninfectious waste stream at the site of generation in the hospital, even some patient attendants stored food wastes, urine & feces along with infectious wastes.

Temporary Storage; It has been found from the study that, with the exception of few wards, the majority of departments (units) did not have temporary storage. Due to this, when containers (buckets) become full, patient attendants simply store or place wastes on the floor or ground. There had not been storage containers placed outside of the hospital for health care waste patient attendants and others. Also there was no reserve container while the full containers are taken to the disposal site.

Collection and transport; during transporting period they use uncovered bucket which may really exposed them to volatile hazard compounds

Disposal system; the generated wastes were finally disposed in to final disposal site (incinerator or burial pit) located in some distances from the hospital. Waste generated in the hospital has been disposed of at appropriate site 3 times a day at 1:00 am, 7.30 am and 11:00 am by the janitors.

Incinerator: - wastes were disposed of (burn) at this disposal site 3 times per day. The incinerator had 3 inlets; 2 of the inlets were designed to burn general wastes whereas the remaining 1 inlet for sharps and other infectious wastes. But as we have observed, the 3 inlets had the same function that means sharps and infectious wastes and general hospital wastes were burned arbitrarily without any segregation as soon as the waste from the hospital reached, but in some cases food wastes, faces and others wastes were segregated by using stick. The 3 inlets were not used with respect to their designed function. The fence of the incinerator was not maintained regularly; as a result, goats from a nearby resident simply entered through the opening to feed on food wastes and other wastes at the 3 inlets of incinerator.

5. Conclusion

This study showed that all wastes, potentially infectious, office, general, food and hazardous chemical materials are all mixed together as they are generated, collected, transported and finally disposed of without any treatment and also some cleaners were found to be engaged to miss handle the generated waste by their type. The overall finding indicated that infectious waste was not treated before they are disposed of and also recyclable materials were not recycled. In general waste segregation was absent both at the generation and disposal site. In addition, Personal protective equipment such as overcoat, boots, masks and enough number of buckets was not provided.

5.1. Recommendation

Frequent training on risk associated with health care waste, type of waste, color codes of containers/buckets should be given to raise awareness of janitors.

The hospital should formulate health care waste management plan and guideline document

The supervisor assigned to monitor the overall activities of janitors should monitor those handlers on a regular basis or more frequently.

Additional buckets/baskets should be placed near the streets of the hospital premise and inside the hospital (especially emergency ward)

The concerned bodies to create awareness among patients, patient attendants and others by means of pictorial drawing chart and other means of notice on the color codes of containers and their respective uses to encourage the segregation of waste at the generation site.

Covered buckets should be used during transport of wastes to the deposal site since infectious wastes may contaminate the surrounding environment.

The responsible bodies treat infectious waste before they are disposing of Since wastes are generated in greater quantity in the hospital, so the concern bodies those waste to sort the recyclable wastes and reuse again.

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