

Quantification of Hospital Waste in Kinshasa in the Democratic Republic Of Congo (Rd.Congo): Cases of Four Health Facilities

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Abstract: The purpose of this study is to help Congolese decision-makers and hospital authorities to set standards for hospital waste in terms of quantity. It is a first since no health care organization knows the quantity produced per day and per month of solid hospital waste as a function of the beds that compose it. The finding is that in the four hospitals mentioned, all waste is mixed together: household waste, anatomical waste, pharmaceutical waste, chemical or toxic waste, radioactive waste, health care waste (HCW) and waste products. Infectious risk care activities (DARSI). The work is focused in each department and/or department by weighing the contents of the garbage cans daily in the morning and evening before they are evacuated. Knowing the number of active beds in each hospital structure, this study gives a weight between 2.55 (CUK), 2.75 (HGK), 4.32 (HGRN) and 5.70 (HGRK) kg/day /bed an average of 3.83 kg /bed /day of hospital solid waste. Thus the waste must be sorted at the place of initial production (initial collection). Non-recyclables will be either incinerated or landfilled.

Keywords: Quantification, hospital waste, hospitals, Kinshasa, DR Congo.

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Introduction

The management of hospital waste remains a major problem in African countries and in Kinshasa in particular. The finding shows that solid hospital waste mixes with other municipal waste. In healthcare establishments a large quantity of waste is managed every day and has an impact not only on the environment but also on human health, especially on

medical personnel. These people are at the forefront of this management within the hospital structures. Just finding one's waste in the wild poses a real problem of pollution that has an irreversible effect on the ecosystem. It is not uncommon to meet in the streets, public squares, along the avenues, even within hospitals, filth, garbage mixed with solid biomedical waste such as syringes, needles, transfusion kits, used bags of blood, placenta.

Each department within the care environment produces general waste (office waste, food services, packaging, plasters, building materials,...), anatomical waste (composed of human fragments, blood, anatomical parts), chemical or toxic waste (laboratory reagents, solvents, photographic developers, heavy metals, explosive and corrosive products ...), pharmaceutical waste (drug residues, toxic or cytotoxic drugs, containers of pharmaceutical products...), radioactive waste (isotopes, etc.), hazardous activity waste (soft waste, compresses, sharp objects, sharp or sharp, syringes, blades, needles) (Fortan, 2004).

All the waste listed above is produced within various hospital departments such as administrative departments and public areas, laboratory, gynecology, pediatric surgery, stomatology, operating room, hospital rooms, emergencies, internal medicine...

Without a coordinated and rational management plan, solid biomedical waste is found in nature without knowing its weight. All hospitals that do not treat their hospital waste in situ, throw it into wild dumps that litter the city of Kinshasa and make it unhealthy (Kambau and *al.*, 1999).

To achieve the objective of the study, we estimate that sorting at source in each department is the ultimate step followed by conditioning (collection, weighing and storage). To avoid occupational and public health risks, avoid all routes of exposure when collecting and sorting hospital waste to be weighed such as wounds, skin contact or by inhalation or ingestion.

After this step, the waste is directed to the final disposal site, i.e. open burning, pit or burial (lack of controlled landfill) or uncontrolled land filling.

Methodology and Material

The study area is Kinshasa University Clinics (CUK), Kinshasa Provincial Reference General Hospital (HGPRK), Kintambo General Hospital (HGK) and Ndjili General Referral Hospital (HGRN).

The University Clinics of Kinshasa are located on the hill of Mount Amba and occupy a space of 270 hectares. Delimited to the north by the university campus of Kinshasa, behind the faculty of medicine and pharmacy, are located in the municipality of Lemba. They are bounded on the north by the School of Public Health, on the south by the two faculties mentioned above, on the east by University Avenue and on the west by Kimwenza Avenue. His missions are more academic and deal with preventive, curative, promotional and rehabilitative medicine. In this way, they provide the Faculty of Medicine with a favorable framework for providing clinical and practical lessons, initiating research for the advancement of the medical sciences and training of doctors and other paramedical personnel. They include in its organization chart five directions (administrative, financial, nursing, pharmacy and medical and technical medical with 10 departments). The current workforce is composed of 1967 agents including 38% of health professionals, 35% of administrative staff and 26% of doctors. The number of beds occupied is 1158 out of 1721 budget beds.

Provincial General Reference Hospital of Kinshasa: is located in the municipality of Gombe, it is bounded on the north by the Colonel Ebeya Avenue, on the south by the zoo to the east by the avenue of the hospital and to west by Wangata Avenue. This hospital occupies an area of 99,342.79 m². Its mission is also to provide mentorship in the form of internships, graduated professionals from universities and medical technical institutes. It is also a research environment in the field of health. It ensures maximum care to the population in the form of curative and preventive medicine. Similarly, it provides referral care to patients from health zones. Of the initial 2000 planned beds, 1004 beds are currently occupied and distributed in different departments (gyneco-obstetrics, internal medicine, pediatrics, resuscitation, community care, specialized medicine, surgery,..) with 31 pavilions. This hospital receives 2000 patients in internal and external consultation. It has 2368 agents distributed by socio-professional categories.

General Reference Hospital of Ndjili: is located in the municipality of Ndjili near the municipality of Lemba in district 7. The capacity of beds is 260 budgeted beds. As for the staff, they are 315 distributed as follows: 35 interview agents, 130 paramedics, 90 doctors and 150 administrative agents. We register 20 services or departments in this hospital ranging from administrative services, medical and technical services to maintenance services.

General Hospital of Kintambo: is located in the commune of Kintambo close to the commune of Gombe. The staff is 718 distributed as follows 222 doctors, 259 nurses, 232 administrative and 5 technical sanitation agents. 230 beds are occupied on the 500 inventoried beds. There are also several services ranging from administrative services, hospital services to technical sanitation services.

The fact is that all the hospitals mentioned have garbage cans without a lid (not standardized) such as plastic bags, cartons, bottles.

The model of this work proceeds by the direct and descriptive observation of the way in which all the personnel of the health structures work.

The survey technique by means of a questionnaire allows deepening the search. This made it possible to answer the main question of investigation. This gave a general overview of the amount of hospital waste composed of DAOM and DASRI during multiple visits to the study hospitals.

The material used consists of an investigation sheet (slip) and a logbook, a digital scale DUNLOP with a capacity of 40 kg, gloves, mufflers, garbage bags of black, red, yellow, green and a yellow card as well as a camera.

The survey took place in March 2018 (which was a period of observation) and in April 2018 a focus is the weighing period in each hospital structure. Each day of the month the weighing took place in the morning and in the evening and each week to determine the weight of the day and the week in each department or service. The collection was carried out by category of waste to avoid mixing. The sorting took place at the source by staff from each department in the prepared bins. The waste was consolidated in an intermediate storage room for all solid hospital waste. In the cases, 680 weightings were carried out in April 2018.

The procedure involves a stage of collection with sorting at the source of production, then the packaging and the selective collection. Solid hospital waste was taken for weighing in an

intermediate storage room for either an incineration site or a landfill within the hospital structure.

Finally, statistical calculations (mean, variance, standard deviation and coefficient of variation) make it possible to verify the representativeness of the data. The percentages obtained express the dispersion and show heterogeneity of the sample. These studies were done by an Excel program.

Results and Discussion

To categorize the waste collected before quantification, all services in each hospital structure were grouped into three types:

SMT as medico-technical services composed of resuscitation department, dentistry, surgery, gynecology and obstetrics, internal medicine, laboratory.

SRF composed of the central library, assignment of trainees, technical, transfusion center, physiotherapy services, and physiotherapy.

SA composed of administrative services, internal audit, public relations, maintenance, community medicine, laundry, sterilization, hospital care, recovery, accounting.

The tables that will be discussed are waste assimilated to household waste, waste assimilated to infectious risks, pungent waste, cutting, syringes, chemical and pharmaceutical waste, glasses, bottles of all kinds and other solid waste to be put in rebus.

The quantification of solid hospital waste was carried out in each hospital structure of the study. These are HPGRK, CUK, HGRN and HGK whose tables are detailed here.

Table 1. Waste category at HPGRK (kg /day /bed)

	DAOM	DASRI	PIC/ TRANCH	CHIM/ PHARM	GLASSES	TOTALS
SMT	2500.1	720.5	50.8	280.5	99.2	3651.1
SRF	810.2	60.2	27.2	15	30.4	943
SA	990.3	100	10.5	15.1	15.9	1131.8
TOTALS	4300.6	880.7	88.5	310.6	145.5	5725.9
MEAN	614.4	125.8	12.6	44.4	20.8	818.0
%	75.11	15.38	1.55	5.42	2.54	100.00

This table shows that it produces 5725.90 kg of hospital waste per day of which the DAOM occupy 4300.60 kg or 75.11%, then 880.70kg or 15.38% of the DASRI. Sharp and sharp waste occupies 88.50 kg for 12.64% and chemical and pharmaceutical waste and glasses (bottles) respectively occupy 310.60kg (5.42%), 145.50kg (2.54%). The beds occupied are 1004 out of 2000 inventoried. This shows a quantity of 5.7 kg / bed / day occupied largely by DAOM.

Table 2. CUK Hospital Waste Category (Kg /day /lit)

	DAOM	DASRI	PIC/ TRANCH	CHIM/ PHARM	GLASSES	TOTALS
SMT	920.5	510.1	30.2	120.5	68.2	1649.5
SRF	350.15	70.2	17.5	15	20.2	473.05
SA	400.6	65.3	11.2	20.1	13.9	511.1
TOTALS	1671.25	645.6	58.9	155.6	102.3	2633.65
MEAN	238.75	92.23	8.41	22.23	14.61	376.23
%	63.46	24.51	2.24	5.91	3.88	100

If we divide 2633.65 kg / day by the number of operational beds or 1033 beds instead of 1721 beds, we obtain 2.55kg / day / bed. Much of the waste collected in the CUK is composed of 238.75 kg / /daybed / or 63.45% of the DAOM added to the 92.23 kg / /bed/ day (24.59%) of the DASRI. Chemical, pharmaceutical, pungent, cutting and glass waste accounted for 8.41 kg / day / bed (2.24%), 22.23 kg / day / bed (5.91%) and 14.61 kg /day/ bed respectively (3.38%).

Table 3. Hospital waste category at HGRN (Kg /day /bed)

	DAOM	DASRI	PIC/ TRANCH	CHIM/ PHARM	GLASSES	TOTALS
SMT	220.2	210.5	20.2	106.1	68.4	625.4
SRF	150.05	90.5	15.4	22.1	19.8	297.85
SA	100.5	55.6	12.2	18.9	12.7	199.9
TOTALS	470.75	356.6	47.8	147.1	100.9	1123.15
MEAN	67.25	50.94	6.83	21.01	14.41	160.45
%	41.91	31.75	4.26	13.10	8.98	100.00

This hospital structure produces 1123.15 kg of waste or 160.45 kg / bed / day composed of 67.25 kg / bed / day (42%) DAOM, 50.94 kg / bed / day (31.75%) , and respectively 21.01 kg / lit / d or 132.10% composed of chemicals and pharmaceuticals, 14.41 kg / bed / day (8.98%) glasses and finally sharp objects and sharp for 6.83 kg / bed / day (4.25%). This set corresponds to 4.32kg / bed / day.

Table 4. Category of hospital waste at the HGK (Quantity in Kg / bed / day)

	DAOM	DASRI	PIC/ TRANCH	CHIM/ PHARM	GLASSES	TOTALS
SMT	110.5	110.5	10.5	60.2	25.5	317.2
SRF	100.75	40.25	6.4	12.3	9.2	168.9
SA	95.5	30.5	5.2	8.5	6.3	137.5
TOTALS	306.75	181.25	22.1	81	41	632.1
MEAN	43.82	25.89	3.16	11.57	5.86	90.3
%	48.53	28.67	3.50	12.81	6.49	100.00

The number of functional beds available to the HGK is 230. According to the waste production per week corresponding to 632.10 kg, we obtain an average daily of 2.75 kg / bed / day of the hospital waste of which DAOM, DASRI.

If we have to compare the quantity of waste obtained on the four hospital structures, we get Table 5.

Table 5. Average Quantity of Hospital Waste in Four Hospitals (kg /day /bed)

	HGRK	CUK	HGRN	HGK	Mean
Kg/day/bed	5.7	2.55	4.32	2.75	3.83

The study shows that the average produced is 3.83 kg / lit / day, which is the calculated quantity. It turns out that most of the waste corresponds to waste assimilated to household waste, i.e. 6749.4 kg for 2567 beds (2.6 kg /day /bed versus 1.23 kg /bed /day, made up of other waste).

In view of this result, in developing countries, it has been established that the rate of production of hospital waste is between 0.016 and 3.23 kg / day / bed (Diaz and al., 2003). However, for the four hospitals in Kinshasa, the production rate is between 2.55 and 5.70 kg / day / bed, which are high. This quantity is as high as that produced in Jordan's hospitals, which is between 0.83 and 3.49 kg / day / bed (Abdoullah et al, 2008). The highest rate was in Tanzania, where the amount of solid hospital waste is between 0.84 and 5.8 kg /day /bed (Mato *et al.*, 1997).

The International Red Cross reports in its studies on solid hospital waste in a hospital with more than 100 beds that the amount of waste generated averages 1.5 to 3 kg /day /bed per patient with all categories of waste including domestic waste. This work also tends to confirm this statement by the ICRC.

This work indicates that overall waste assimilated to household waste (office kitchen, table-service and domestic waste) accounts for most of the waste and occupies more than 80% of all waste.

This situation makes it possible to say that to reduce the amount of hospital waste to put in rebus, it is necessary to sort: a simplicity (the typology of waste must be known to all), a security (which means not to put in the same trash DAOM and DASRI), consistency (insists on standards and development of a controlled disposal pathway) and monitoring (ensuring quality in sorting conditions and its assessment by ensuring the safety of people for the respect of hygiene).

Conclusion

The aim of the research is to quantify waste in kg /day /bed in order to set up a solid hospital waste management system in the four hospitals of the city of Kinshasa in April 2018.

These hospitals produce an average of 3.83 kg /day /bed, i.e. a quantity ranging from 2.55 to 5.70 kg /day/bed. These values make the difference between large hospitals and hospitals with medium occupancy.

These results show that knowledge of the quantity of solid hospital waste leads to rational management of various category of wastes in their typology. It reduces the cost of collecting and transporting waste. The sanitation of the hospital environment and the protection of the health of the hospital population (against pathogens, typhoid fever) also depends on the good management of hospital waste.

To better quantify hospital waste, the initial recommendation is to have standard bins recommended by WHO. In fact it is necessary to do color coding as for domestic waste, black bag, sharps waste, yellow containers, anatomical waste and / or which represent the dangers, in the yellow plastic bags with signs of danger, infectious waste in the yellow bag or containers with a highly infectious sign and finally chemical or pharmaceutical waste, in the appropriate brown plastic bag.

Personnel equipment should include gowns (thick fabrics), gloves (thick plastic), boots (rubber), goggles (durable), garbage cans (hard plastic and washable), very sensitive scales and finally land for burial and incineration.

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