

## Handling of Solid Waste of Health and Its Risks: Ambulatory of Oncology

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**ABSTRACT**

**Objective:** Investigate and describe the production, collection and disposal of residues of health services (RHS) and characterize the exposure of Oncology staff from Cape Verde Hospital.

**Method:** A descriptive study with quantitative and qualitative methodology, using semi-structured questionnaire, check list and on-site observations to investigate the situation of the solid health waste handling and its risks. The participants in this study were professionals from a hospital who handle solid chemotherapy waste, in total 50 participants.

**Results:** The data point to the lack of training of professionals exposing them to risks of occupational accidents, inadequate handling of RHS in the oncology outpatient clinic and to serious socio-environmental risks.

**Conclusion:** Professionals, patients, general population and the environment are exposed to risks because of lack of training and an appropriate management plan of RHS.

**Keywords**

Environmental health, Oncology, Occupational risks, Residues of Health Services.

**Introduction**

From the second half of the 20th century, with the new patterns of consumption of industrial society, solid waste production has been growing continuously in pace higher than the absorption capacity of nature [1].

There are several types of waste that society can generate, and waste from health services, when not collected and disposed of inappropriately, can cause serious risks to the community. They contain biological hazards such as pathogenic microorganisms, hazardous chemicals, physical hazards with puncturing materials, and even radioactive waste [2].

The waste generated by antineoplastic agents can present a complex involving dangerous products harmful to the professionals that handle, to patients, families and the environment. The residues

contaminated with cytotoxic drugs must be separated, conditioned, identified and intended for incineration following all the rigor of the law [3].

Decree-Law No. 31/2003 of September 1 Cape Verde, establishes the essential requirements and classification of hospital solid waste in 4 groups [4].

In Cape Verde, the largest hospital is situated on the island of Santiago, the city of Praia. Is unique in the country that offers outpatient Oncology since 2008 and had been watching some mismatches in their solid waste management of health (RHS). In this way arose the need to investigate how these are being managed, from the collection to the final disposal in order to avoid the risk to whom the handles or the general public, in relation to the physical, chemical, biological risks and environment associated with them. This research aims to investigate and describe what is happening the production, collection and final destination of the RHS at the oncology ambulatory and characterize the exposure of professionals who handle these RHS in order to highlight risks and

propose actions for better management of this waste to be followed properly.

## Methods

This is a descriptive study with qualitative and quantitative approach. The data was collected through semi-structured questionnaires, observation spot, followed by a check list. The individual questionnaire sought to characterize the professionals of Oncology ambulatory and investigate their knowledge and practices in connection with the RHS. Qualitative issues investigated how occurred the exposures and risks in relation to the oncology outpatient clinic in the perception of each professional. 50 questionnaires were distributed by the following services: Oncology ambulatory - 8 = (2 Doctors, 2 Nurses, 2 Pharmacists, 2 Auxiliary General Services). Medical Service - 11 Nurses, Surgery Service - 14 nurses, Orthopedics Service -13 Nurses, hygiene and safety - 4 (Biotechnology Engineer 1, Hygienist 1, Auxiliary general services 1 and 1 driver.

The subjects of the research were defined and selected by the eligibility criteria, the people responsible directly or indirectly through the process from generation to final disposal of RHS in the Oncology ambulatory and patients services necessarily have to continue chemotherapy treatment, when it exceeds 6 hours.. Each respondent corresponds to the letter "E". This was called E1, E2... as we can observe during the transcription of the interview.

10 on-the-spot observations were made in different times and places (morning, at the beginning of work, at noon, when patients had already started treatment and later at the time of collection of waste), in the months of March and April 2012, on three occasions, to identify the problems in the handling of solid wastes, production, packaging, internal transport, intermediate storage, and final disposal, following the route of the RHS produced by

this hospital.

Check list made it possible to record all activities carried out in oncology ambulatory involving since production of waste to final location. The research project has been approved by the National Committee on ethics in health research, deliberation No. 7/12, in 23/02/2012, by Direction of the Hospital and the participants signed an informed consent form.

The quantitative data were analyzed by using SPSS (Statistical Package for the Social Sciences) for Windows version 20.0. Qualitative data analysis was performed by means of the technique of the discourse of the Collective subject [5], consisting of a speech synthesis, the fruit of individual speeches fragments gathered by similarity of senses. And finally were characterized the risks according to the physical area and the waste management process ambulatory Oncology.

## Results

The data were analyzed and discussed considering the law in force in Cape Verde on the RHS. The table 1 presents the results, recommendations and risks. The existence of professional and environmental risks at all stages of solid waste from production to the final disposal and risks associated with the lack of patient safety and to professionals. The physical area of the oncology outpatient clinic has been shown to be small in size, which shows a projection not considered for the future, taking into account the number of patients attended.

The lack of some important rooms for the treatment as well as a cafeteria where the professionals can make their meals, due to long hours of work, causes them to improvise a cafeteria inside the work place, constituting a greater risk.

	Results found	Recommendations	Risks
Physical area	- Absence of nursing room; - Absence of cafeteria for professionals; - Absence of washbasin for hand aseptic in the drug preparation room.	The area destined to the Central of Manipulation of Chemotherapy (CMQ) and Medicine Administration Room (MAR) should be planned in order to meet the characteristics of each institution and provide safety to the worker, the patient and their caregivers [7].	- Patient and professional safety
Medication storage and transport to oncology outpatient clinic	- Breakage of broken bottles and jars; - Lack of identification of medicines on pharmacy shelves, although they are visible; - Carried in improvised boxes.	- Medicines intended for the treatment of chemotherapy should be separated from the others, stored under appropriate conditions, in order to preserve their identity and integrity [6]. - Medicines should be stored and transported in exclusive isothermal containers, protected from the elements and direct sunlight, at a temperature that guarantees physical and chemical stability, with a spill kit [6,7].	- Safety of professionals; - Security in the conservation of medicines; - Medication Identification Error; - Patient Safety
Collection and internal transport of solid waste of health	Carried by General Service Auxiliaries in black plastic bags inside a cardboard box by hand; - The sharps are separated into containers in the oncology clinic but improvised, in plastic bottles in the Services where they continue the treatment; - Personal protective equipment is not used properly.	- Those responsible for the collection may be a team intended only for this activity [1]. - Sharp punches shall be separated into sharp punch boxes; - Appropriate use of personal protective equipment [1,7].	- Professional safety; - Incident / incident prevention - Environmental risk
Internal storage	- Storage initially in the sick room; - Later in an improvised place.	- The collected waste must be taken to the "waste room" located in the generating unit itself and in appropriate containers [19].	- Patient and professional safety; - Environmental risks

<b>Intermediate Storage</b>	<ul style="list-style-type: none"> <li>- Location behind the hospital kitchen;</li> <li>- Within the oncology clinic;</li> <li>- Packed inside black color bag;</li> </ul>	The intermediate or temporary storage consists of the temporary storage of the containers containing the already conditioned waste, in a place near the generation points, in order to speed up the collection inside the establishment and to optimize the displacement between the generating points and the point destined to the provision for external collection [1].	<ul style="list-style-type: none"> <li>- Patient and professional safety;</li> <li>- Environmental risks</li> </ul>
<b>Packaging</b>	<ul style="list-style-type: none"> <li>-Residues stored in fragile containers up to a level exceeding 2/3 of the capacity;</li> <li>-Packaging in black plastic bags, with no separation in colored bags;</li> <li>- The waste is stored in green containers;</li> <li>- he sharps, from an oncology ambulatory, are packed in their own containers;</li> <li>- In Treatment Continuity Services, they are packaged in makeshift recipients and are not collected frequently;</li> <li>- Sometimes they get full until they pierce the bottle.</li> </ul>	<ul style="list-style-type: none"> <li>- Only up to 2/3 of the capacity of the plastic bag should be filled and it is not acceptable to empty the contents of one bag into another [1].</li> <li>Both rigid containers and plastic bags can only be filled up to 2/3 of their volumetric capacity. Sacks should be fully enclosed in such a way that they do not allow the contents to spill when turned upside down [1,4].</li> <li>The capacity of the packaging containers must be compatible with the daily generation of each type of waste, the collection must be in the daily production source. The sealed bags shall then be placed in yellow containers with a capacity of 60 liters [4].</li> <li>The management of solid health waste provides greater safety for professionals, patients and also the environment [20].</li> </ul>	<ul style="list-style-type: none"> <li>- Professional safety;</li> <li>- Patient safety;</li> <li>- Population risk;</li> <li>- Environmental risks.</li> </ul>
<b>Collection and external transport</b>	<ul style="list-style-type: none"> <li>- The external collection is done every 15 days;</li> <li>- The waste transport vehicle is private in nature and has other functions;</li> <li>- Not suitable for solid waste transportation of oncology.</li> </ul>	<ul style="list-style-type: none"> <li>They should be collected at least 3 times a week, reducing the risk of environmental contamination and the spread of infections [1].</li> <li>Vehicles used for the transport of solid waste must have their own characteristics, with a sign of dangerous hospital waste and only for this purpose [19].</li> </ul>	<ul style="list-style-type: none"> <li>Professional safety;</li> <li>Environmental risks.</li> </ul>
<b>Treatment and final disposal</b>	Residues produced at the oncology outpatient clinic are incinerated but the waste produced in the services where chemotherapy treatment is also provided to patients goes to the common trash.	<ul style="list-style-type: none"> <li>Solid residues of chemotherapy belong to group IV and are of mandatory incineration [4].</li> <li>The proper destination of these wastes is of fundamental importance for the correct management of solid health residues, which also includes the knowledge and involvement of the entire staff of the establishment, since the correct management is performed by each member of whatever health unit in question [12].</li> </ul>	<ul style="list-style-type: none"> <li>Professional risks;</li> <li>Environmental risks;</li> <li>General population.</li> </ul>

**Table 1:** Description of sites and steps related to RSS in the ambulatory of oncology, 2012.

In the treatment room is strictly prohibited eating and food storage of any kind – solid or liquid. There must be a mess hall for the use of employees, but outside of outpatient Oncology. The volatile chemicals suspended in the air can penetrate the food and be ingested [1,6].

The nurses were professionals with greater representativeness (76%) in this study. The professionals were not fixed to this service, generating huge turnover, and providing services in other parts of the Hospital. As the average age was of 41.96 years, median of 41, minimum of 23 and a maximum of 61. Sex with greater predominance was 66% female.

In relation to the length of service, it was found that 38% worked in 4 years and 8% the length of service is less than 6 months (1 to 3 months). You can check that the average years in oncology outpatient clinic is very low, accounting for 1.69 years. Is justified by being a small service, created in 2008 and has suffered personnel transfer. Regarding the perception of health risk in the oncology clinic, 78% are of the opinion that there is a risk to their health and 22% believe that it does not exist.

When trying to understand the occupational hazards according to the perception of professionals, these reported some concerns:

*"I think so, because the drugs cause many problems such as hair loss. I felt hair loss, slept and woke up with hair on the pillow. I was afraid, until a foreign doctor explained to us that we should use gloves and be careful because it's dangerous we can catch disease". (E1, E6, E40).*

The case of the professionals also refer to hair loss, suggests that they may be handling incorrectly the cytostatics, and consequently the RHS, being exposed to direct contact, which can be associated with the use or not use improperly the Individual Protection Equipment (IPE), favoring the dermatologic toxicity with hair loss caused by these medicines.

Some commented that:

*"There is a risk in handling and exposure with cytostatics (...) the professional has to be careful because the exhibition is large and (missing) equipment, infrastructure (for preparation of medicines) suitable not only in existing oncology outpatient clinic and also in services where we provide patient care in treatment. Because if handles larger quantities the risk is greater if they are not used as security equipment must be ... Because that service care is doubled, by confronting direct toxic medicines and residues toxic too " (E4, E30,E18,E39,E49).*

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Associate professionals the risk to your health due to exposure to and handling cytostatics, aggravated by the lack of infrastructure and equipment.

The institution must provide to its employees the IPE so that they can carry out their activities with the lowest risk of contact with the chemotherapeutic drugs and enable them to understand the need and importance of use.

*"In the area of health we are always subject to risks in relation to the ambulatory de oncology, is because we work directly with toxic drugs. There's always a risk, but in chemotherapy because the characteristics of medicinal products and of the RHS that are highly toxic." (E1, E7, E27, E10, E12, E15, E19, E20, E30, E31, E33, E34, E38, E42, E43, E44,E45, E46,E47,E48,E49).*

The importance of exposure control of professionals involved in the various stages of antineoplastic therapy can be effectively controlled with the correct use of IPE available [7].

Not using IPE commitment to worker's health and exposes the risks, but the commitment to health is not a conscious and responsible behavior of many workers [8,9]. Confronting with the observation in loco and check list, it was found that the use of IPE is incorrectly, especially when handling the RHS.

This research was also the opinion of professionals about the exhibition about the risks in the oncology outpatient clinic comparing with other services.

*"In Oncology ambulatory the risk is greater because the exhibition is straightforward, and is large, the professional has to be very careful. The exposure is greater because it has many patients and different medicines and cumulative effects and exposure are greater." (E4,E9,E13,E20,E22,E32,E36,E39,E42, E44,E45,E46,E48,E49).*

As regards the occupational risk derived from the cytostatic chemotherapy can cause harm to healthy people if there is direct contact with drugs or through scattered particles in the air, present in the environment and the excreta of patients with active metabolites of chemotherapeutic drugs [10]. You may experience transient symptoms such as watery eyes, irritation to the eyes, mucous membranes and skin, bitter taste in mouth, nausea, headache or even myelosuppression and induction of malignancy.

What about the toxicity of the medicinal product, respondents:

*"Because the chemotherapy medications are toxic to health, it is different when you have other medicines. The chemotherapy drugs are very dangerous, and also the RHS we produce are dangerous. Because the toxic medications are more used to that in other services. These medications are used every day and in great quantity and the RHS too. Sometimes the bottles are with leftover medicines, these fall on the ground, it is very dangerous to our health." (E1,E2,E5,E6,E7,E8,E10,E11E12,E15,E17,E18,E 21,E30,E33,E34,E37,E38,E40,E42,E43,E44).*

With respect to indicators of toxicity, has detected high levels of chemotherapeutic agents in the air and on surfaces, when laminar flow chapels are not used in the preparation of chemotherapy and even when this monitoring is carried out within the Chapel, this exhibition is evidenced when detects if saturation of these agents in the filters HEPA (High Efficiency Particulate Air Filter) [7].

A plan of management of RHS well designed and established allows your handling is efficient, economical and safe. Still, facilitates your suitable segregation, reducing health risks and making more efficient the management process your [11].

Before the waste disposal highly contaminated with cytostatic medicines must be sealed in special containers, or they can be inactivated by chemical reactions. The remaining solutions of bottles of medicines cannot be unloaded in the sewer system. In most countries, cytostatic waste must, by law, be disposed of as hazardous waste by incineration, and that the contaminated waste in bulk (syringes or partially empty infusion bottles) require special handling, typically, high temperature incineration, i.e. above 1000°C [7]. Chemotherapeutic residues are considered hazardous waste because of their toxicity [1].

The study site is not the practice of sealing the plastic bags or inactivate by chemical reactions. There are no special receptacles except for sharps. All residues are placed within a single bag of black color and are incinerated at temperatures between 900°C to 1100°C.

The waste produced in the services, where patients are also treated as patients, go to the common trash. Group IV RHS, specific hospital waste, which includes chemotherapy RHS, is a mandatory incineration waste [4].

The lack of awareness and awareness, the continuous and systematic supervision of improper practice, the individual risk perception and not the lack of continuing education are factors associated with the occurrence of accidents at work [11].

When asked if they care or treatment that should be given to each of the waste produced, 68% answered Yes and 32% responded No. It is understood that the proportion (32%) of those who do not know what to do with the waste produced is cause for concern. We think that the question of training of professionals is essential and urgent. Moreover, only 16% replied that it should be incinerated, since this practice is mandatory for all character residues produced at the ambulatory of Oncology.

On the waste disposal of chemotherapy, the bodily secretions of patients in hospitals who receive or have received prior chemotherapy 48 hours before or who are still getting in continuous infusion, should be isolated in special containers, marked with logo of risk material, and removed in the same way that the remains of chemotherapy. Patients and their families should be directed to after using the bathroom must do 3 consecutive discharges [6,7]. A bout removal of patients observed in situ and annotated in the

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check list, it turns out that they and their families are not instructed how to proceed after elimination.

On the final destination of solid wastes oncology, 44% of respondents do not know the final destination of these products. It is noted the need to train or professionals and it is seen that there is much to be done in terms of education / training so that waste has a correct handling.

To investigate whether the professionals had received any training on RSS, the study reveals that 49% of respondents had no kind of training, 23% received some information, read own 20% have already made, and 8% received reading material on the subject.

The health professional must develop a sense of responsibility with regard to your own safety and the safety of patients. To this end, it is necessary to obtain specific knowledge about how there may be accidents at work, as well as being responsible for maintaining the safety of the environment through educational actions [12].

This study showed that only 23% reported receiving training on the handling and disposal of RHS. The problems related to RHS are complex, and require that health professionals are not only a conscious position, but, above all, willingness to collaborate in its resolution [13]. The entities must involve themselves in the training of health professionals on the RSS through urban planning. There are relational problems training for dealing with waste, expressed by the difficulties in properly segregate these RHS. An efficient training program demonstrates the interest of the institution to improve the working conditions of its employees [14].

The appropriate destination of such waste is of fundamental importance for a correct management of RHS, which also includes, the knowledge and the involvement of all staff in the establishment plan for the establishment, since the correct management is performed by each member of whatever health unit concerned.

This research also reveals the concern of professionals, who consider it important that the Hospital offer appropriate infrastructure and equipment to minimize the risk of accidents involving chemicals.

The RHS from the oncology outpatient clinic of this hospital is incinerated but those from other outpatient clinics that also undergo chemotherapy are thrown in the common trash along with other types of waste.

A carcinogenic chemical released into the environment, today, cannot reach a person until it has passed through the food chain for months or years, and even then, can cause the development of a tumor not noticeable for decades. In addition, the various wastes with different characteristics and capabilities can lead to changes in soil, water and air, representing risks to human health and the environment if improperly managed [15].

It can contribute to the occurrence of chronic-degenerative diseases and cancer, it may manifest after a long time of exposure, away or

even having ceased the source of exposure [16,18].

These solid waste deposits are potential sources of exposure to populations, and increased risks for various cancers have been reported for birth defects, birth defects, and neonatal deaths in these and in populations adjacent to those sites [17].

The authors' opinion raises the question of the extent to which environmental health is compromised if measures are not taken immediately, as the consequences of poor management of RHS may only be known in subsequent generations.

## Conclusion

To investigate as the production, collection and final destination of the RHS of this Hospital of Cape Verde, with focus on outpatient Oncology solid waste and how being the exhibition of health professionals in this service, one can observe many inadequacies in the process. Aspects observed identifying much non-conformity in the management of RSS that can lead to various situations of risk for health professionals, patients, family and the environment. There has been a lack of professional training and awareness of same in handling the waste.

This is an essential point that the Hospital should discuss and take appropriate measures such as immediate need for training and continuing education program for professionals, especially those working in outpatient Oncology.

Were suggested and later implemented some measures for improving the service and professional safety and the environment as soon as this research encountered these problems. Measures such as proper use of IPE, training of professionals; acquisition of containers for drill cutting edges; containers of different colors, risk assessment measures in services; as well as guidelines for practitioners regarding the handling of solid residues of chemotherapy.

The elaboration of a protocol for handling and disposal of waste from chemotherapy and the implementation of a risk map were discussed for future implementation. It is recommended that further study in this area to evaluate some of the speeches made and suggested to study the management of RHS in general at the central hospital and the national level in Cape Verde, in order to avoid these risks.

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