EXECUTIVE SUMMARY

This paper shows the results achieved by the development and implementation of a Medical Waste Management Plan - MWMP in a Public Healthcare Unit, located in São Paulo city, Brazil. The methodology consisted in 5 steps: i) First diagnosis of the situation; ii) Development of the plan; iii) Implementation; iv) Second diagnosis; v) Results evaluation one year after beginning the implantation. For the first diagnosis, it was developed and applied a specific form to collect data, supported by current Brazilian legislation and technical standards. In addition, every type of waste, classified as infectious, sharps and common (recyclable and non-recyclable) were identified and quantified, considering the sectors of origin. Based on this diagnosis, a MWMP was developed and immediately implemented. The results evaluation consisted in comparing generated waste measurements and photographic records before and after the implementation of the plan. In 2008, the first quantification registered 22.5 kg/day of total waste generation, represented by 25% infectious, 62% common and 13% recyclable materials. One year later, the total generation rose to 25.9 kg, consisting on 25% infectious, 51% common, 17% recyclable materials and 7% organics sent to compost production. Although no decline had been detected at infectious waste percentage (persisting 25%), recyclable materials collection arose from 13% to 17% and had started segregation of organic waste to composting (7%). This analysis also showed a small reduction of infectious waste rate (generated in critical areas) from 0.021 to 0.018 kg/procedure.day. For more effective results, it is recommended to include dangerous chemical substances to the management plan; maintenance of monitoring process; conquer the commitment of managers, staff and users of the facility; development of an efficient employees training program and educational campaigns involving patients. The main benefits of this plan, as well as complying legislation, are reduction of the amount of common waste sent to landfill and consequently minimization of environmental impacts; reduction of risks of occupational accidents and contamination risks; implementation of appropriated routines and improvement at unit conditions offered to users.

INTRODUCTION

In Brazil, since 1988, medical assistance rights to all citizens are guaranteed by Constitution. This has been supported by a Brazilian Unified Health System called “Sistema Único de Saúde” (SUS), which develops actions and provides public healthcare services including prevention, diagnosis, treatment and recovery to most frequently illnesses (Brazil, 1988).

In the present time, according information from National Record of Healthcare Establishments, in São Paulo city, there is a great variety of health establishments under the municipal administrative sphere such as hospitals, emergency rooms, clinical laboratories, dental clinics and also 595 small capacity Healthcare Units (CNESNet, 2010).

As a result of health assistance provided by these establishments, occurs the generation of Medical Waste (MW) covered one part by common waste, similar to domiciliary garbage, and also by hazardous wastes comprehending infectious, sharp implements, chemical and pharmaceutical substances. Radioactive rejects are not generated at this units.

Medical wastes represent only a small amount of total residues generated in an urban way. However, this sort of waste must be handled with care as it is potentially infectious and hazardous.

Infectious waste generated from healthcare services includes: blood, bodily fluids, drainage fluids or excreta; contaminated materials (gloves, gauzes, cotton, bandages, dressings); laboratory plates and blades; microorganisms cultures; vaccine discarding and instruments used for transference, inoculation or mixture of cultures and chemical substances.

According to the World Health Organization, when this sort of waste is not managed properly, the healthcare service staff is exposed to contamination risk, comprehending occupational accidents and illnesses for being constantly exposed to microorganisms. Some examples of infections caused by exposure to infectious wastes are: Gastroenteric, Ocular, Respiratory, Skin and Genital infections, Antrax, Meningitis, Acquired Immunodeficiency Syndrome (AIDS), Hemorrhagic levers, Septicaemia, Bacteraemia, Candidaemia and Viral hepatitis A, B and C. Furthermore, other citizens such as companions, visitants, suppliers, volunteers and neighbors are also exposed to danger. Environmental problems may also arise due to foul odors, flies, cockroaches, rodents and vermin (WHO, 1999).

An additional threat turns out if solvents; acids; disinfectants; expired, apprehended or controlled medicines; heavy metals; laboratory reagents; image processing effluents (revealing and fixing) and other dangerous chemical substances are not previously treated or receive inadequate disposal.

The “Overview of Solid Waste in Brazil – edition 2009”, carried by Brazilian Public Cleaner’s Companies and Special Waste Association (ABRELPE), alerts that, until now, the destination of MW is inadequate in most Brazilian cities. Only 49.3% of MW generated in Brazil is sent for treatment: incineration (35.1%), sterilizer (8.4%) and microwaves (5.8%). The remaining amount is destined for disposal to sanitary landfills (26.0%) or septic ditches (11.5%) and 13.2% are discarded on uncovered dump sites. (ABRELPE, 2010).
This situation shows that is urgently necessary an special attention from generators and Public Administration Agencies to every step of Medical Waste Management, including segregation, packaging, internal collection, storage, external collection, transportation, treatment, disposal and all that must comprise any type of waste generated.

An adequate medical waste management encloses also waste minimization: preventive wastefulness and unreasonable use of single-use disposable appliances; reuse and selective segregation of recyclable materials, in order to reduce the amount of common waste sent to landfills.

In Brazil, the standard for medical wastes management is the Resolution nº 306/ 2004 from National Agency for Sanitary Vigilance (ANVISA) which states that every generator is responsible for the appropriated management of medical wastes generated inside the facility. Some other statements are the establishment of a medical waste commission, implantation of a Medical Waste Management Plan (MWMP) and development of a training program (ANVISA, 2004). Also in accordance to resolution nº 306, medical wastes are classified in 5 groups based on the risks they represent:

Group A: (infectious-biological) wastes that represent risk to public and environment health due the presence of biological agents.

Group B: substances representing risk to public health or environment, depending on its characteristics of inflammability, corrosively, reactivity and toxicities.

Group C: radioactive reject.

Group D: common waste represented by recyclable (office paper, cardboard, plastics, metal cans and glasses) or not recyclable (food leftovers, toilet paper and some kind of packing materials).

Group E: sharp implements (needles, syringes, lancets and similar tools).

In 2005, National Environmental Council (CONAMA) instituted that an implantation of Medical Waste Management Plan was obligatory and established a period of 2 years for generators to adequate themselves conforming to those requirements (CONAMA, 2005).

Despite the extension of these regulations, including either great or small generators, the situation did not advance as expected. In fact, until now, a minority of health establishments fulfill those determinations in an appropriate way.

Currently, the large quantity generators, such as hospitals and great part of small private health establishments are trying to adjust themselves to fulfill those legal requirements, credit by the effort of assorted professionals who learned how to manage the situation based on guides published until now.

A Brazilian study about waste handling, comprising 48 small public healthcare units in Rio Grande do Sul, registered the percentage of Public Healthcare Units that were applying adequate practices as showed in table below (Silva, Hoppe, Ravanello & Mello, 2005).

<table>
<thead>
<tr>
<th>Practices</th>
<th>% Healthcare Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biohazards segregation</td>
<td>79.2</td>
</tr>
<tr>
<td>Sharp waste segregation</td>
<td>97.9</td>
</tr>
<tr>
<td>Hazardous segregation (Group B)</td>
<td>41.7</td>
</tr>
<tr>
<td>Storage on external areas</td>
<td>40</td>
</tr>
<tr>
<td>Recyclable materials segregation</td>
<td>41.7</td>
</tr>
<tr>
<td>Medical Waste Management Plan</td>
<td>4.2</td>
</tr>
<tr>
<td>Training Programs</td>
<td>10.4</td>
</tr>
<tr>
<td>Presence of Medical Waste Commission</td>
<td>0</td>
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</tbody>
</table>
According to the authors, the situation is far from ideal, but it is still better than in other regions in Brazil.

In line with Brazilian literature, some factors pointed as contributory to inadequate conditions of MW handling inside healthcare establishment are: not prioritization of the question; unfamiliarity with the legislation and good sanitary practices; beyond few technical-financial supports. (Rezende, 2006; Garcia & Zanetti-Ramos, 2004).

The aim of this study was to evaluate the situation of medical waste management in a small capacity Healthcare Unit, before MWMP and one year after the implantation.

METHODOLOGY

The Healthcare Unit chosen for this study, has about 1,100 m² of built area, is located inside the Public Health Faculty (Faculdade de Saúde Pública/USP) and is available to graduation and post-graduation students to develop nutrition, nursing and medical training skills and researches.

This unit provides preventive and primary assistance to the neighbor population, as well others activities and correlated support. The sectors considered critical for generating infectious and sharp waste are two laboratories (clinical and dermatological analyses); consulting-rooms (dental, woman’s health, dermatology and acupuncture) and sectors for nurse assistance such as immunization, medication and curatives.

The methodology of the study consisted of 5 steps: i) First diagnosis, ii) Development of the plan, iii) Implementation, iv) Second diagnosis; v) Results evaluation one year later.

Step 1: First diagnosis

- Data was collected and registered using a form specifically developed for that purpose and supported by current Brazilian legislation and technical standards, comprehending:
  - Documents revision (licenses, contracts, certificates, etc.);
  - Investigation of type of assistance and professionals involved;
  - Observations about facilities characteristics, equipment and available materials;
  - Identification of critical areas: sectors designated to invasive procedures, such as, curatives, immunization, injections, laboratories and some consulting-rooms.
  - Observation of operational practices in waste handling: main aspects of segregation, packing, collection, internal and external storage, transport, treatment and final disposal, taking notes and photos about deficiencies, not conformity and practices contrary to legislation and effective norms.

- Characterization of waste generation according to groups A, B, D and E. Group C (radioactive rejects) isn’t generated in this unit.

- Quantification of waste generation per day: total and per group (kg waste/day). During five consecutive days, every bag of waste generated was physically weighed, except Group B, because chemical and pharmaceutical collection is not regular.

- Investigation of number of medical procedures applied to patients at critical areas at the time of measurements, pondering the production of hazardous waste.
Observation: Differently from hospitals, in this sort of establishment, patients are not internee and number of beds couldn’t be used as unit of reference. Neither could be consider the number of patients assisted, because each patient might be submitted to more than one procedure at the same day, as for example: injections, curatives, collection of clinical tests material, vaccines, etc. In this study, was considered the number of medical procedures with possibility to generate infectious and/or sharp waste.

Step 2: MWMP elaboration, including proposal of adequacies according to currently regulations to correct any fault or absence.

Step 3: MWMP implantation and monitoring for a complete year. The unit was visited at least once a month and other times according to necessity. It was applied employee’s mobilization strategies and sensitization about adequate segregation of different type of wastes.

Step 4: Second diagnosis, employing the same form and reproducing first diagnosis steps.

Step 5: Results evaluation analyzing the following indicators:
- Daily total waste generation average, except chemical residues (Kg/day);
- Daily common and recyclable waste generation average (Kg/day);
- Daily infectious waste and sharp implements average, originated from critical sectors (Kg/day)
- Waste perceptual per group: A + E; D recyclable and D no recyclable
- Infectious waste (Group A + Group E) generation rate according sector of origin (kg/procedure.day).

RESULTS AND DISCUSSION

According to the first diagnosis, the small healthcare unit studied was not complying with many principles stated in Brazilian resolutions. It was detected absence of policy, plans or protocols about waste handling. There was a lack of documents and certificates, they haven’t established any commission, don’t have a training program or even a professional responsible for waste management.

Regarding segregation, packing, collection and storage, some examples concerning inappropriate equipment and operational practices that were observed are:
- No allocation, in strategic areas, of distinguished waste baskets for common, recyclable, sharps and infectious, causing defaults of segregation (several hazardous and recyclable materials were discarded as municipal solid waste and vice versa);
- Infectious waste baskets no conforming to Brazilian standards: colorful baskets, without infectious symbol and no pedal bin (Figure1).

Figure 1 - Infectious waste basket utilized before MWMP
• Some puncture proof containers staying directly over sinks or floor, bringing risk of spoiling and contamination (Figure 2);

  **Figure 2** - Puncture proof container located on the floor

• Absence of a specific white wheeled container to carry and store temporarily biohazard waste, resulting on plastic bags containing infectious waste laying on corridors (Figure 3) and inside the shelter (Figure 4);

  **Figures 3 e 4** - Plastic bags containing biohazard waste lying directly on the floor

• External infectious waste shelter in disagreement with Brazilian technical standards;
• Absence of autoclave to treat infectious materials from laboratories and consequently only chemical process for decontamination practices was utilized;
• Doubts about how to discard expired medicines, using sometimes common, infectious or sharp receptacles;
• Lack of knowledge about medical waste hazards among the unit staff.

The first quantification, in August 2008, registered 22.5 kg/day of total waste generation, represented by 25% infectious and sharp implements, 62% common and 13% recyclable materials (mostly comprehending papers and cardboards).

After analyzing this first diagnosis, it was elaborated and presented a Medical Waste Management Plan. Immediately plan implantation had begun, enclosing actions of waste
minimization, adequacy of the equipment, improvement of selective materials collection, development of lectures for employees and training about good operational practices to cleaners.

Some examples of changes adopted during implantation period were:

- Distribution of separated baskets to common and recyclable wastes (Figure 5), fomenting segregation and adding other materials such as plastic, cans and bottles;

  **Figure 5** - Distinguished waste basket to common and recyclable wastes

- All infectious waste baskets had been substituted, in accordance to Brazilian norms (ABNT, 1993). Was adopted only white colors baskets, provided by cover set in motion for pedal, with the infectious international symbol printed and index specifying the material to be discarded was fixed next them (Figure 6);

  **Figure 6** - Infectious waste basket acquired in accordance with ABNT standards

- Hangers had been set to fix puncture proof containers to the walls and was displayed next to the box an index specifying the material to be discarded (Figure 7);

  **Figure 7** - Puncture proof container fixed to the wall

- A white wheeled container to transport and store internally biohazard waste was provided (Figure 8);
Figure 8 – Distinguished cars to transport and store infectious and common waste

- Adjustments at the shelter in consideration to regulations. Was installed a net to obstruct flies entrance; containers to store the plastic bags and fixed the infectious symbol at the door;
- An autoclave to threat contaminate materials at the laboratory was acquired;
- Continuous monitoring and training to cleaners and health professionals involved was developed and carried out.

In August 2009, the total generation rose to 25.9 kg, consisting on 25% infectious and sharp implements, 51% common, 17% recyclable materials and 7% organics sent to compost production.

Figure 9 shows the difference between first (2008) and second (2009) quantification of medical waste production.

Figure 9 – Medical waste production, by groups, in 2008 and 2009

Any change happens at infectious percentage, while common waste production reduced from 62% (2008) to 51% (2009). This difference occurred due to improvements on recyclable selective collection from 13% to 17% and implantation of organic collection (7%). These organic materials are generated during lunch time at the staff’s pantry and consist in coffee dregs, fruits and vegetable remain portions and rinds. Consequently, 11% of the waste previously directed to landfill had been directed to recyclable industry in order to be reused or returned to the ground as organic manure.
Although no decline had been detected in the percentage of infectious waste (persisting 25%), as desired, there was some reduction (0.003 kg waste/ procedure.day) at infectious waste generation rate owing to the raise of procedures at the same period.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2008</th>
<th>2009</th>
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<tbody>
<tr>
<td>Daily infectious waste average (kg/day)</td>
<td>5,805</td>
<td>6,424</td>
</tr>
<tr>
<td>Daily number of assistance on critical areas</td>
<td>274</td>
<td>344</td>
</tr>
<tr>
<td>Daily infectious waste rate (kg/procedure.day)</td>
<td>0,021</td>
<td>0,018</td>
</tr>
</tbody>
</table>

**CONCLUSION**

This study shows that, until the present time, poor attention is paid to waste problems in Brazil, especially with reference to small public Healthcare Units, where professionals are not enough worried about adopting safer practices of handling or minimizing waste production.

Furthermore, Medical Waste Management could not be only centered in fulfillment of legislation and application of new technologies. It also implies a change in the behavior of the professionals involved.

The first step in the brainstorming would be to extend the knowledge of impacts inherent from medical waste and then to develop and to implant an integrated management plan suitable to the port of the establishment and to the Brazilian reality.

For more effective results, it is also recommended to include dangerous chemical substances to the management plan; maintenance of monitoring process; conquer the commitment of the manager, staff and users of the facility; development of an efficient employee training program and educational campaigns involving patients.

The main benefits of this plan, as well as complying legislation, are reduction of the amount of common waste sent to landfill with consequently minimization of environmental impacts; reduction of occupational accidents and contamination risks; implementation of appropriated routines and good practices and improvement at health services conditions offered to users.

**ACKNOWLEDGEMENTS**

The authors thank to the Healthcare Centre professionals for the pleasant reception and helping.

**REFERENCES**


