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Reuse of Plastic Bottles Coming from the Yaoundé Central Hospital and Potential Health Risks

Réutilisation de bouteilles plastiques provenant de l'Hôpital Central de Yaoundé et risques sanitaires potentiels

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ABSTRACT

Introduction. Reusing plastic bottles could reduce pollution by plastic waste and be a source of income. However, the reuse of plastic bottles coming from some settings such as hospitals could be at risk. This study aimed at describing the reuse and recovery of these bottles at the Yaoundé Central Hospital in Cameroon, to assess the health risks associated to these practices. **Materials and methods**. A cross-sectional study was conducted within the Yaoundé Central Hospital, using questionnaires for patients, care givers and bottles' collectors, and observation grids. Participants received detailed information about the study and were proposed a free and anonymous consent prior to their inclusion. **Results**. Among 300 participants included, 83.3% were patients, 13.3% were caregivers and 3.3% were bottles' collectors. In total, 26% of the patients admitted reusing plastic bottles as foodstuffs containers and urinals, 20% of caregivers reused them as safety boxes or puncture fluid collectors, and 20% of collectors reported they only rinse bottles with water before selling them to the markets, where they serve as foodstuffs containers. **Conclusion**. Although generally considered as similar to household waste, plastic bottles coming from hospitals could be harmful for patients, care givers, bottles collectors and the large population due to improper reuse practices. Thus, special attention should be paid to these medical wastes in order to reduce their health risk.

RÉSUMÉ

Introduction. La réutilisation des bouteilles plastiques peut réduire la pollution par les déchets plastiques et constituer une source de revenus. Cependant, la réutilisation de bouteilles provenant de certains endroits tels que les hôpitaux pourrait être préjudiciable. Cette étude visait à décrire la réutilisation et la récupération de ces bouteilles à l'Hôpital Central de Yaoundé, afin d'estimer les risques sanitaires associés à ces pratiques. **Matériels et méthodes.** Une étude transversale a été menée au sein de l'Hôpital Central de Yaoundé, à l'aide de questionnaires destinés aux patients, aux soignants et aux récupérateurs de bouteilles, et de grilles d'observation. Les participants ont reçu des informations détaillées sur l'étude et un consentement libre et anonyme a été requis avant leur inclusion. **Résultats.** Parmi les 300 participants, 83,3% étaient des patients, 13,3% des soignants et 3,3% des collecteurs. Au total, 26 % des patients ont admis réutiliser les bouteilles plastiques comme contenants alimentaires et comme urinoirs, 20% des soignants les réutilisaient comme boîtes de sécurité ou collecteurs de liquides de ponction, et 20% de collecteurs ont déclaré juste les rincer à l'eau avant de les vendre dans les marchés pour servir de contenants alimentaires. **Conclusion.** Bien que considérées comme assimilables aux déchets ménagers, les bouteilles plastiques provenant des hôpitaux pourraient être nocives pour les patients, les soignants, les collecteurs et la population en raison de pratiques de réutilisation inappropriées. Une attention particulière devrait donc être portée à ces déchets médicaux afin de réduire leur risque pour la santé.

INTRODUCTION

Plastic is a material with advantageous properties and low production costs which has validly replaced more ephemeral materials such as wood, leather, linen or wool[1-3]. It became essential in many sectors such as construction, medicine, engineering applications, automotive and aerospace[3]; packaging industry being the sector using the largest share of this material[4]. In addition, economic growth and development coupled with a throw-away culture also increased the demand and dependency on plastics. This leads to plastic's accumulation in landfills, imposing risk on human health and animals, and

environmental pollution problems such as ground water contamination and sanitary related issues [3,5]. Thus, a sustainable and an efficient plastic waste management is essential[3,6].

There are many problems associated with plastic waste management in low-income countries particularly, including current practices, public participation and opinion, and government regulations[7]. Although figures vary, packaging accounts for around a third of all plastics used, and especially polyethylene terephthalate (PET) bottles. After their use, around 40% goes to landfill, while 32% escapes the collection system[8]. The "Reduce-Reuse-Recycle" approach is therefore essential to reduce and prevent pollution from plastic waste [9–11]. Indeed and despite waste treatment techniques such as incineration, in low-income and middle-income countries, landfill, informal recycling systems and reuse practices are the most common[7], mainly for packaging which dominates in the plastic waste flow [4].

However, when plastic is reused as food container, in addition to the risks associated with plastic components, it is important to question its origin and previous uses. For instance, reusing plastic coming from hospitals is at risk due to the presence in the hospital environment of dangerous physical, chemical and biological agents [12]. This is the case of plastic bottles which are widely used in hospitals. This study therefore aimed to assess the health risks associated with the reuse of plastic bottles at the Yaoundé Central Hospital (YCH) which is one of the most frequented reference hospitals in the capital. This specifically involved presenting the plastic bottles management circuit, describing the reuse and recovery practices of plastic bottles at the YCH, and assessing the potential health risks associated with these practices. We therefore conducted a cross-sectional study among patients, caregivers and plastic bottles collectors in this hospital.

MATERIALS AND METHODS

This was a cross-sectional descriptive study conducted from February to April 2020 at the YCH, a third level referral hospital in the capital city of Cameroon.

The target population was made up of 21 years and older conscious hospitalized patients, caregivers (nurses and nursing assistants) and plastic bottles collectors from this hospital who accepted to participate in the study. The total sample size was set by convenient sampling to 250 patients, 40 caregivers and 10 collectors.

The study was quantitative and qualitative. Quantitative data were collected using 3 interviewer-administered questionnaires (one per target). For the patients and the caregivers, the questionnaire aimed to assed their reusing practices of plastic bottles; and for the collectors, the purpose was to assess their bottles collection procedure and the uses made of these bottles. Data from the questionnaires could be subject to declarative bias. Qualitative data were collected using an observation grid to assess the management of plastic bottles in the hospital, and their condition, using organoleptic parameters.

Quantitative data were analyzed using the Statistical Package for the Social Sciences software version 23.0. Qualitative data were analyzed using a comprehensive approach.

An ethical clearance from the Regional Ethics Committee of the Center Region and an authorization from the director of the Yaoundé Central Hospital were obtained before the start of the investigation. Participants received detailed information about the study and gave their free and informed consent before inclusion. Data were collected anonymously.

RESULTS

Socio-demographic characteristics of the respondents

The sample consisted of 159 men and 141 women (sex ratio 1.1). Their age ranged from 21 to 86 years old. Table 1 shows the distribution of participants by category and by sex.

Table I: Distribution of people surveyed by category and sex

Categories	Men N (%)	Women N (%)	Total N (%)	Sex-ratio
Patients	140 (56%)	110 (44%)	250 (83.3%)	1.2
Caregivers	10 (25%)	30 (75%)	40 (13.3%)	0.3
Bottles collectors	9 (90%)	1 (12%)	10 (3.3%)	9
Total	**159 (53)**	**141 (46)**	**300**	**1.1**

Management of used plastic bottles at the Yaoundé Central Hospital

After use, the plastic bottles followed a three-way circuit as shown in Figure 1: they were thrown in the trash, reused, or collected for sale.

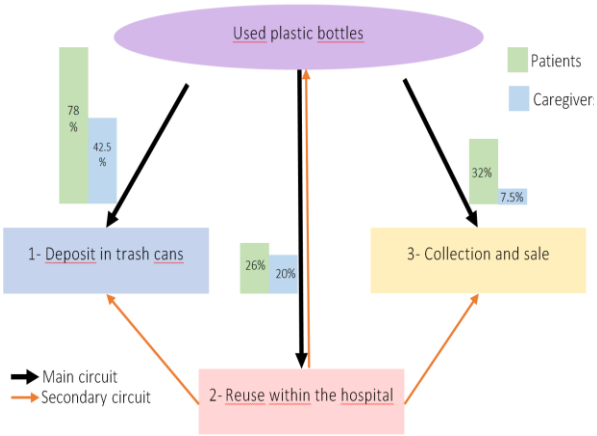

Figure 1: Management of plastic bottles at the Yaoundé Central Hospital

Deposit of used plastic bottles in trash cans

Figure 1 shows 195 patients (78%) and 17 caregivers (42.5%) put plastic bottles in non-hazardous waste trash cans. These wastes were then transported to a centralized storage location, outside the hospital, in a bigger trash can. This can was emptied daily by a company in charge of

household waste collection. Most of the bottles were thrown without particular measures but in the Internal Medicine unit, the bottles were punctured before leaving the unit and their caps were crushed with the foot, in order to avoid their reuse.

Reuse of plastic bottles within the hospital

Figure 1 shows 65 patients (26%) reported reusing plastics bottles. Among them, 11 patients (14%) reused them as urinals, saying the hospital toilets were unsanitary and they did not want to be exposed to a possible contamination. The remaining 54 patients (83%) reused them as foodstuffs containers (porridge, juice, broth) and to keep water for drinking, toilet and laundry, in case of an interruption in the water supply in the hospital. Figure 1 also shows 8 caregivers (20%) reused plastic bottles for clinical waste during patient care: to collect biological fluids extracted during punctures (pus, ascites fluid, pleural fluid), or as safety boxes for the collection of sharp objects (dirty needles, scalpels and blades).

Collection and sale of plastic bottles

Figure 1 shows plastic bottles were recovered by 80 patients (32%) and even by 3 caregivers (7.5%), although they should normally be aware of the risks associated with medical waste. Those bottles were sold to make some money. At the waste centralized storage location, plastic bottles were picked up on a daily basis by informal waste collectors to be sold in markets. They emptied the bottles if there was something in them and placed them in large bags. Among 50 collected bottles observed, 14 bottles (28%) had traces of colorful liquids inside, and 27 bottles (54%) had particles inside and outside that we could not identify. The collectors proceeded to clean the bottles, using water, soap and bleach as shown in Figure 2.

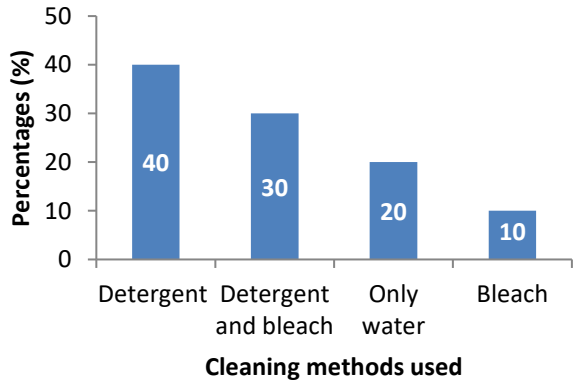

Figure 2: Cleaning methods of plastic bottles by collectors at the Yaoundé Central Hospital

Figure 2 shows that 4 collectors (40%) reported using only detergent, 1 collector (10%) declared using only bleach, 3 collectors (30%) said they used both, and 2 collectors (20%) said they rinse the bottles water. In collectors' opinion, the cleaning methods they used were enough to limit the risks associated with the contents of the bottles, and the complete disinfection of the bottles was the responsibility of the purchaser. All reported selling those bottles in markets to oil, yogurt, juices, herbal teas, and other foodstuffs' sellers, who used them as containers.

Perception of the health risks associated with the recovery of bottles

In total, 7 collectors (70%) believed that the reuse and recovery of these bottles had no health risk, and 8 (80%) relied on organoleptic parameters such as sight and sense of smell to estimate the contamination of bottles. Caregivers seemed to be more aware of the health risks associated with reusing plastic bottles; thus, they threw them in the trash, sold them or reuse them for clinical waste, but they did not reuse them for personal purposes, unlike patients. However, 8 patients (3.2%) said that they only reused bottles to store drinking water if they had been used by a patient whose disease was not severe, or for a newborn baby.

DISCUSSION

The reuse and recovery practices of plastic bottles at the Yaoundé Central Hospital expose people to chemical and biological health risks.

Concerning chemical risks, when plastic bottles served as foodstuffs containers, there could be a leach of phthalate and antimony, known as endocrine disruptors, in the bottle contents. This release could exceed the threshold dose for exposure temperature of more than 60°C, depending of the storage duration and the PET bottle brand[13–17]. Indeed, in many developing countries, lack of proper disposal facilities for empty PET bottles and the absence of legislation persuade people to reuse them for storing potable water[18] or other foodstuffs as in this study. As so, a study showed that using plastic with hot food on a daily basis was positively associated with thyroid-stimulating hormone, homocysteine and glycated A1C; while it was negatively associated with concentrations of vitamin E, zinc, and selenium among healthy pregnant Saudi women[19]. Reusing bottles that contained drugs or other chemical products as presented in this study is also risky.

Regarding biological risks, contamination can occur when drinking directly from the bottle[20]. The contaminants mainly come from dirty hands (fecal microorganisms) and from the mouth (pulmonary microorganisms)[21]. The biological risk is then more serious for bottles coming from hospitals, where various germs are present, some of them being particularly resistant to antibiotics. The reuse of plastic bottles by patients puts them at risk of nosocomial infections. For caregivers, there is a risk of needle stick injury and occupational infectious diseases when bottles are used as containers[22], for sharp wastes and for the puncture of biological fluids in patients.Waste collectors are also particularly exposed to infections and injuries as observed in a study conducted by Mochungong[23] in Cameroon. He found that lack of immunization, awareness and protective equipment, poor work postures and absence of support groups were associated with health hazards among clinical waste collectors. Their collection practices also expose consumers who will get foodstuffs from those bottles in selling places.

In this study, the awareness about health risks varied between participants, but was globally weak. These results

are consistent with those of the study conducted in Cameroon by Mbog and al., where knowledge on biomedical waste management was judged insufficient for 92.6% of the people questioned[24]. However, patients and caregivers seemed to be more aware, unlike collectors, what is dangerous because afterwards the bottles they collect are spreading everywhere. In Cameroon, medical waste management texts don't consider plastic bottles as hazardous waste, except when used as safety boxes. They fall under the category of packaging and are therefore considered similar to household waste[25], which is not true when looking at all the facts raised by this study.

CONCLUSION

This study shows that plastic bottles coming from hospitals should be managed like hazardous waste. Although the facts noted at the Yaoundé Central Hospital can be observed in other hospital settings, laboratory analyses could better establish the health risks of these bottles, compared to only organoleptic parameters. But despite this, these bottles should not be reused as foodstuffs containers. The poor management of biomedical waste and specifically plastic bottles can be addressed by sensitizing patients, caregivers, and waste bottles collectors, by providing suitable equipment for the collection of body fluids and sharp waste to caregivers, by ensuring good hospitalization conditions, and by implementing realistic management programmes and measures such as puncturing or crushing bottles before throwing them in the trash bin.

DECLARATIONS

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