Circular design and household medication: a study on the voluntary drug disposal program of the city of Betim Municipality

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ABSTRACT

Household medicines, like all types of hazardous waste, require proper disposal. However, that is often not the case. It is estimated, according to researchers, that roughly 20% of drugs consumed at home are disposed of in the conventional sewage system or simply thrown away. In the face of this problem, the present study intends to explore the disposal of household medicines in the city of Betim, Minas Gerais, with a specific focus on the voluntary proper disposal program created by the city. In addition, the research intends to explore the state-of-the-art relationship between circular design and the handling of residential pharmaceutical waste. The research takes a qualitative approach and includes a case study, descriptive in nature. The expected outcomes are a description of the home waste disposal program as well as a theoretical cross-reference of design and waste management.

1. INTRODUCTION

Sustainability is one of the most important contemporary demands and has been gaining more centrality since the 1990s with many different sectors of contemporary society (DIJON, 2013). To achieve sustainability goals, it is necessary to review the current models of development. As Vezzoli (2006) argues, the transition to a sustainable model requires radical changes in methods of production and consumption and, moreover, in societal practices. According to the author, taking a sustainable perspective places the development model under discussion.

The circular economy has been gaining force globally as a promising alternative to the conventional linear economic of extraction, fabrication, use and disposal. According to the Report on the Circular Economy in Brazil (2017), the new circular model is an opportunity for society to prosper and simultaneously reduce the dependency on finite natural resources and non-renewable energy sources. This would mean gradually disassociating economic activity from the consumption of finite resource and designing waste out of the system, aiming for a transition to renewable energy sources. According to the Ellen MacArthur Foundation (EMF), the circular economy is based on the principles of: (a) designing out waste and pollution (2) keeping products and materials in use; and (c) regenerating natural systems (source: https://www.ellenmacarthurfoundation.org/circular-economy/concept). According the EMF, economic activity in a circular economy builds and rebuilds the overall health of the system.

Design emerges as a space of opportunity to face the complexity of the world due to its interdisciplinary nature (CARDOSO, 2012). Design as a discipline has been assuming the role of facilitator and innovator. Emerging trends have shifted design to a more sustainable approach that focuses on circularity in the product life cycle.

Considering the above, this study analyzes user adherence to the Household Medicine Disposal Program at primary care clinics in Betim with the objective of understanding how the initiative can help with the reverse logistics required to ensure that medicines used at home can be disposed of properly.

2. BACKGROUND

2.1 Design and the circular economy

The circular economy was born out of great schools of thinking (EMF, 2019). Among them and of interest is the “Cradle to Cradle” design philosophy developed by William McDonough e Michael Braungart. Cradle to Cradle concepts challenges the pervasive scarcity mindset and brings together such diverse areas of study economics and design, business and ecology, consumer product manufacturing and urban planning. (MCDONOUGH; BRAUNGART; 2013)

The useful life of products is declining (LAYARARGUES, 2008, p. 3) which leads to increased consumption of natural resources and, consequently, a large amount of solid waste. According to the RSA Royal Society for the encouragements of Arts, , “waste affects all aspects of our society” (RSA, 2016) and compromises the planet’s capacity to meet human needs as trash piles up. As supporting evidence, the Royal Society of Arts has shown a large decrease in biodiversity combined with an unsustainably increasing demand for natural resources.

Waste generation is of a concern from the very beginning of the production process. As Ribeiro and Kruglianskas (2014) affirm, 80% of the factors determining environmental impacts and product life cycle are defined in the design phase. The Royal Society also states that 90% of extracted natural resources become waste before products leave the factory. The significant waste generation in the fabrication process extends through the chain and, according to McDonough and Braungart (2013) “what the majority of people see in their trash cans is just the tip of the materials iceberg; by itself, the product contains on average only 5% of the raw materials involved in its production and distribution.”

Sophie Thomas, Projects Director at The Great Recovery, affirms that design plays a fundamental role in the transition to a circular economy. To her, it is necessary to educate and inspire industrial design to accept the challenge (RSA, 2014). According to the RSA (2016), “in order to understand how to change how we teach, practice and utilize design in a more circular economy, we need to redefine the current thinking focused on the product to design approach focused on the system.”

Also fundamental is the need to expand the discussion around the process of “design” to consider all of the participants in the “design chain” in order to discover where things fail too early on and become waste. We have learned that design has a significant influence on how we make, consume, and dispose of our products (RSA, 2016) and that design has a critical role to play in the shift to a circular economy.

2.2 HOUSEHOLD MEDICINES AND REVERSE LOGISTICS

To Rogers and Tibben-Lembke (1999), reverse logistics is the process of planning, implementing, and controlling the flow of used goods from the point of consumption back to where they originated, including all the relevant information about the goods themselves. To these authors, the purpose of reverse logistics is to recapture the value or guarantee the appropriate destination. As it relates to household medicines in Brazil, consumption has been increasing driven by multiple factors, among them self-medication. Given the strong relationship between consumption and waste (WWF, 2012), the more medicine consumed in the home the more wastes are generated.

For Alvarenga and Nicoletti (2010), this rise in consumption will cause an increase in the amount of packaging and leftover medicines thrown away in domestic trash bins. The common waste stream is not an appropriate place for disposal of medicines. The Akutu Institute (2011) defends that medications should not be disposed of in common residential waste bins since they contain chemical substances that may contaminate soil and groundwater. Alvarenga and Nicoletti (2010) corroborate this statement arguing that medications contain substances capable of impacting both the environment and human health. Falqueto and Klingerman (2013) affirm that the chemical industry, which includes pharmaceutical companies, generate large quantities of hazardous waste.

According to the World Health Organization, health wastes are those that originate from hospitals, medical research centers and laboratories and as well as small and dispersed sources like domiciles where health treatments occur (for example, home dialysis, self-administration of insulin, and recovery care) (World Health Organization, 2014). The handling and disposal of these wastes is of great importance, considering the associated risks to human health and the ecosystem. It is estimated that around 20% of the medications taken at home are disposed of in the sewage system or thrown away in the common trash stream (FALQUETO; KLIGERMAN, 2013).

According to Bila and Dezotti (2003), studies conducted in multiple countries identified the presence of pharmaceuticals in the environment. Hirsch et al., (1999), in a German study, affirm to have found a large variety of pharmaceutical residues in the effluents from the sewage treatment plant and surface waters. Kummerer (2001) emphasizes that ingested medications are excreted into wastewater and that unused medications are often disposed of down drains. According to the same author, studies show that the presence of pharmaceuticals in surface water, groundwater and potable water, however little is know about the significance of emissions from residences and hospitals.

3. RESEARCH METHOD

The current work is a qualitative study that aims to evaluate the effectiveness of the Voluntary Medication Disposal Program in the city of Betim, Minas Gerais (Brazil), with a focus on patients of primary health clinics, in order to explore how much they are aware of and participate in the Program.

Data was collected through a questionnaire containing questions of a socio-economic nature related to medication disposal habits as well as questions regarding knowledge of the Voluntary Medication Disposal Program in Betim. The municipality has 25 primary health clinics (Unidades Básicas de Saúde or UBSs) throughout the 9 regional areas in the city. (Fonte: http://www.betim.mg.gov.br/noticias/43124%3B64878%3B06%3B8248%3B127298.asp).

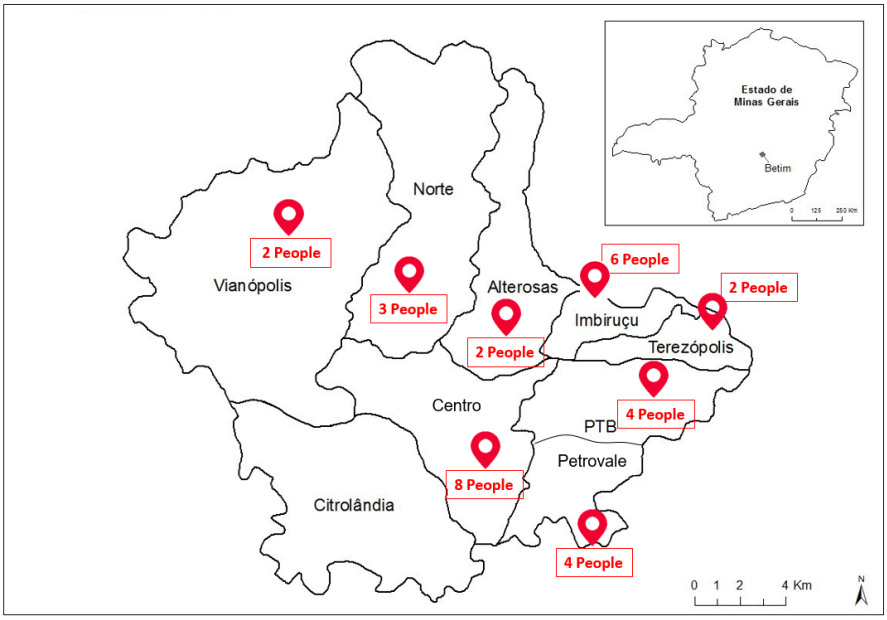
The UBS patients were chosen randomly at entrances or from the entrance halls. The study's authors explained the purpose of the interview to potential participants and request their participation with the survey.

The survey was supported by a Field Diary in which the authors recorded information that couldn't be obtained by the questionnaire or that arose from the interaction with the patients and was considered relevant to understanding the study.

4 RESULTS AND ANALYSIS

The field work was realized February 4 – 13th, 2019, during the morning and the afternoon, divided up as to reach the largest number of UBSs, resulting in visits to 9 clinics in 8 of the 9 regional areas in the city. The study amounted to 31 patients from 22 neighborhoods throughout the municipality.

Figure 1. Betim and regions, highlighting the regions that were visited and the respective number people interviewed.



Source: Elaborated by the authors

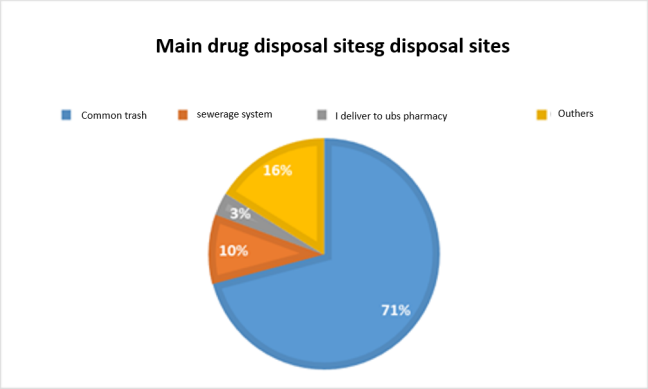
Regarding the socio-economic data of the interviewees, the majority are female (71%) and, in large part, concentrated within the 26 to 35 age group (35.5%), with 22,6% between the ages of 36 to 45 and almost a forth of respondents above 56 years of age (19,4%). The average household income was predominately up to 3 times the minimum wage (90,4%), with the highest level of educational attainment divided up between high school (29%), middle school (25,8.7%) and primary school (29%). Only four of the respondents had a college degree.

Most of the patients interviewed stated that "no" they do not undergo continual health treatment (74,2%). This is contrasted by the 41,9% that responded "yes" to regularly taking medications, indicating the possibility of self-medication, a common practice by Brazilians, particularly as it relates to over-the-counter medicines (ARRAIS et al, 2016).

Regarding home possession, 77.2% of the patients stated that they "always" or "almost always" have medications at home. This confirmation is in line with studies (ARRAIS et al, 2016; LASTE et al, 2012) that is common for Brazilians to keep over-the-counter medications in their homes. The medicine cabinet or "little pharmacy" is treated as a back-up for eventual situations, including the sick's dissatisfaction with "delays and low-quality treatment for health services" (NAVES et al, 2010).

For the storage of household medications, most people said that they keep a small box in their closets or in cabinet drawers. The survey showed one case in which a medication – insulin – was kept in the refrigerator. With respect the habit of checking expiration dates, the majority said that they verify validity "always" or "almost always" (70,9%) as well as "sometimes" (9,7%), "rarely" (3.2%) and "never" (16,1%). It is important to stress that the percent of respondents who said that they don't check expiration dates is significant.

Figure 2. Main drug disposal sites identified in the survey



Source: Elaborated by the authors

As you can see in the graph in Figure 2, the common waste stream is the destination of the majority of medications that are disposed of by the survey respondents (67,7%), followed by the sewage system (9,7%). Only 3,2% of respondents said that they drop-off unused medications at the pharmacy located in the UBS. These figures are concerning, given the problems of environmental pollution that result from inadequate disposal of medications. Given that the sewage treatment plants in Brazil are not capable of removing medications during the treatment of domestic wastewater (SOUZA, FALQUETO, 2015), these effluents are released into bodies of water containing substances that affect fauna, flora, and microbiota, as well as human health (BILA, DEZOTTI, 2003). Likewise, when medications are discarded as general waste this can cause soil and groundwater contamination, encouraging the emergence of resistant microorganisms (FREITAS JR, BARROS, 2018).

Regarding orientation about the disposal of medications, a large part of those interviewed (90,3%) did not receive any information and only two people said that they received some form of orientation. This result shows that lack of information is one of the biggest bottlenecks in the reverse logistics of medications, requiring increased attention by public health authorities. No reverse logistics program seeking excellent results can succeed without participant collaboration and legislation can be the principal tool for resolving this issue (BLANKESTEIN; PHILIPPI JUNIOR; 2018). Article 255 of the Brazilian Federal Constitution of 1988 states that "all have the right to an ecologically balanced environment, a common good used by the people and essential to a healthy quality of life, imposing on the government and the community the duty to defend and preserve it for present and future generations." The 2015 Brazilian National Solid Waste Policy (the Política Nacional de Resíduos Sólidos or PNRS Law #12.305) is considered the regulatory benchmark for solid waste management in Brazil and was the result of a wide multi-sector debate (government, private institutions, non-governmental organizations and civil society). The PNRS brings together principles, objectives, instruments, and guidelines for waste management in the country. . (LINHARES MAIA *et al.* 2014) "The growing concern for the preservation of natural resources and the question of public health related to solid waste indicates that public policies to deal with these issues will tend to be demanded by society in an increasing fashion" (PNRS, 2010, p. 07).

The majority of the respondents (54.8%) said that they can see the negative aspects of disposing of medications in the trash or sewage and the remaining 38,7% responded that they can not see the negative aspects or that they do not know what bad could come of it. The interviewees that recognized the negative aspects of improper medication disposal were asked to cite some examples and, in general, the responses are divided in two groups: environmental contamination risk or access and incorrect consumption by children.

When it was asked where the appropriate place would be to dispose of expired and/or undesired medications the answers were varied. In general, the respondents' suggestions can be grouped as: 1) drop off at the health clinic, 2) take to an appropriate place, not sure of where that might be, 3) the trash is still the best option. Many did not know how to respond regarding the appropriate discard location for medications. Among the responses were some rather curious suggestions like: put them together with recyclable materials and burn them in the yard. These options present risks to individual health and need to be reviewed by the health authorities involved in the promotion of public policies about the reverse logistics of medications. Article 30 of 2010's PNRS instituted a shared responsibility for the life cycle of products. "Shared responsibility is instituted for the life cycle of products and should be implemented

individually and throughout the chain, involving the manufacturers, importers, distributors, sellers, consumers, and those responsible for the public services of street cleaning and waste management, according to the attributions and procedures specified in this Section." (PNRS, 201). The lack of information regarding the adequate destination aggravates the problem, as defended by Tonet et. al., (2017, p. 1) "despite the elevated daily consumption of medications by the world population, there is a diffuse lack of orientation about the disposal of these products and the specific demands for the treatment of wastes"

The Voluntary Disposal Program in the city of Betim is not widely known by UBS patients, given that a majority (93,5%) stated that they had never participated in the city program and 90,3% mentioned never receiving any information about it. Among the patients that responded yes, three stated that they had dropped off medications at a UBS, either for donation (3.2%) or for disposal (6,4%). When asked if they were to find out about an existing program to collect expired or undesired medications whether or not they would stop bringing them to be disposed of at a UBS, 90,3% of the respondents stated that they would bring the medicines to be discarded at the health center, 6.5% stated that they might, and one person said that they would not take them to a health center.

As Gontijo and Dias (2014) state, there is still a lot of inefficiency and lack of sustainability in reverse chains. Sectorial accords or contracts between the government and the supply chain participants are required for certain products, as the PNRS from 2010 lays out in Articles 33 and 34. The intent of these agreements is to make environmentally adequate disposal viable (GONTIJO; DIAS; 2014). This situation is even worse given the limitations of municipalities most of which are still having difficulties implementing the propositions of the PNRS.

7. CONCLUSION

The theme being discussed is of great importance given the capacity for medications to contaminate the environment. Studying household medication disposal programs at the municipal level can contribute to the verification of the results of these public initiatives, as well as analyze the population's adherence to these programs. The results found here demonstrate that the patients of the UBS know next to nothing about the Voluntary Medication Disposal Program in Betim. Future studies could look at the gaps not covered under this study. Circular design and reverse logistics are directly linked to environmental management, seeing that the union of these two areas can contribute to the design of solutions for the adequate disposal of household medicines. In order to so, it is necessary to start working from the moment of conception to the final product and including its return back to the productive cycle or to an adequate destination.

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