



## Disposal of expired drugs and the perception of residents in the municipality of Pombal – PB

### *La eliminación de medicamentos caducados y la percepción de los residentes en el municipio de Pombal - PB*

Zacarias Caetano Vieira<sup>1</sup>, Rafael Fernandes de Andrade Nóbrega<sup>2</sup> & Silvana Nóbrega de Andrade<sup>3</sup>

**Abstract:** This research aimed to conduct a survey of the disposal and collection of expired drugs in pharmacies and drugstores in the city of Pombal - PB, and verify the perception of residents on this subject. The methodology used consisted in the application of two questionnaires, one for the establishments, and the other for the residents, and later, the data were processed. Of the pharmacies that answered the questionnaire, 50% said they received the drugs and intended for a private company specialized for incineration, and the other 50% said they did not perform such action. About the habit of keeping medicines at home, 95% of the interviewees stated that they store medications in the residence, and of these, 91% reported taking all care to leave it out of reach of children. Regarding the disposal of expired drugs, the majority discards in the common waste (68%) or in the sink/toilet (23%). In the matter, the majority (91%) stated that they had not received any instruction on the disposal and storage of expired medicines. Even if not receiving information on the subject, it is clear that most are aware of the risks of irregular disposal. It is concluded that most of the interviewees are aware of the negative impacts, but still perform the inadequate disposal, probably because there is no greater orientation of government agencies. It is necessary and urgent compliance with the laws by the establishments, and greater dissemination to the population.

**Keywords:** *Drugs; Irregular disposal; Environment; Public health.*

**Resumen:** Esta investigación tuvo como objetivo realizar una encuesta sobre la eliminación y recogida de medicamentos caducados en las farmacias y droguerías de la ciudad de Pombal - PB, y comprobar cuál es la percepción de los residentes sobre este tema. La metodología utilizada consistió en la aplicación de dos cuestionarios, uno para los establecimientos y otro para los residentes, y luego se realizó el procesamiento de los datos. De las farmacias que respondieron al cuestionario, el 50% dijo que recibía los medicamentos y los enviaba a una empresa privada especializada en la incineración, y el otro 50% dijo que no realizaba dicha acción. En cuanto al hábito de guardar los medicamentos en casa, el 95% de los entrevistados dijo que los almacena en casa, y de ellos, el 91% informó de que toma todas las precauciones para mantenerlos fuera del alcance de los niños. En cuanto a la eliminación de los medicamentos caducados, la mayoría los tira a la basura normal (68%) o al fregadero/desagüe del urinario (23%). En cuanto a la información sobre el tema, la mayoría (91%) declaró no haber recibido ninguna instrucción sobre la eliminación y el almacenamiento de los medicamentos caducados. Incluso sin recibir información sobre el tema, está claro que la mayoría es consciente de los riesgos de la eliminación irregular. Se concluye que la mayoría de los encuestados son conscientes de los impactos negativos, pero siguen realizando la eliminación inadecuada, probablemente porque no hay mayor orientación por parte de los organismos gubernamentales. Es necesario y urgente el cumplimiento de las leyes por parte de los establecimientos, y una mayor difusión a la población.

**Palabras clave:** *Productos farmacéuticos; eliminación irregular; medio ambiente; salud pública.*

\*Author for correspondence

Received on 2021/10/15; approved on 2022/03/04.

<sup>1</sup> Master in Civil and Environmental Engineering, Professor, Instituto Federal de Sergipe, zacarias.vieira@yahoo.com.br; ORCID: 0000-0001-5019-0971; \*

<sup>2</sup> Graduating student in Mathematics, Student, UNINTER, rafael.andrade\_rfa@hotmail.com; ORCID: 0000-0003-1807-2953;

<sup>3</sup> Master's student in Agroindustrial Systems, Universidade Federal de Campina Grande, silvananobrerri@hotmail.com; ORCID: 0000-0002-1951-1199.

## **INTRODUCTION**

The growth of the population, coupled with a greater production of the pharmaceutical industry, has boosted the consumption of medicines in recent years. The drug market moves billions of reais, in production, distribution and consumption by the whole society (RODRIGUES, COSTA & KISS, 2018). In Brazil, it is estimated that about 30 thousand tons of medicines are discarded by consumers every year in the country (ANVISA, 2017).

This situation, as reported by Viana, Viana and Viana (2016), has contributed to the increase in the disposal of medicines in inappropriate places generating environmental impacts to rivers and soils, as well as danger to the health of living beings. Medicines are classified as to the potential risks of contamination to the environment by the standard NBR 10004:2004 as Class I Waste - Hazardous, and according to their origin in Solid Health Waste (SOUZA, 2019). Despite this classification, Vargas (2014) apud Feitosa and Aquino (2016) reports that medication waste is discarded along with Urban Solid Waste (USW) when it is generated by the population in their homes.

To make matters worse, Blankenstein (2017) reports that water treatment technology cannot fully reverse chemical contamination, because even after advanced purification treatments, contaminants remain and can be found in small concentrations on the surface and in smaller concentrations in the groundwater. According to the author, the human metabolism does not process all the ingested medication, i.e., a portion will be excreted by the patient, also becoming a generator of water and soil contamination.

## **THEORETICAL FOUNDATION**

### **Causes of drug waste generation**

Medeiros, Moreira and Lopes (2014) report that part of the medicines prescribed and purchased by the population end up accumulating in homes, forming the so-called "Home Pharmacy". These drugs are often stored incorrectly, exposed to high temperatures or in humid environments, and end up not being used, and most often have as final destination the common trash or sanitary sewer (MARQUES; XAVIER, 2018).

Fischer and Freitas (2011) report as causes of unused medicines, and consequently, waste generation: overprescription (doctor prescribes more than necessary for the treatment), self-medication (the use of medicines without prescription, or use of medicines without any intervention by a doctor or other qualified professional), distribution of free samples (distributed by manufacturers laboratories to medical professionals as a form of advertising) and inventory management (good inventory management reduces the risks of detour, deterioration of medicines and loss by expiration).

### **Actions to minimize the generation and irregular disposal of medicine residues**

Among the actions to minimize the generation of drug waste, Borrelly et al (2012) mention the adoption of the possibility of fractional sales, in which the package will contain only the correct amount for the treatment, avoiding possible leftovers, i.e., the drugs will be purchased in the ideal amount for the treatment. Along the same line, Blankenstein (2017) presents the reformulation of packages, so that they are sold by daily doses (instead of unit packages), as a possibility to reduce the volume of drugs stored at home, and facilitate reuse. Intervention during treatment, checking whether the patient is using the medication as prescribed or if its consumption is still necessary; as well as, improved nutrition, physical exercise and stress reduction, are ways to reduce consumption, and consequently the disposal of medications (JESSON, POCOCK, WILSON (2005); BECKER, MÉNDEZ-QUIGLEY, PHILLIPS (2010) apud BLANKENSTEIN (2017). Other possible solutions are campaigns to donate unused medicines for reuse and the sale in fractionated form, i.e., in the exact quantity and dose for the treatment (FISCHER; FREITAS, 2011). On fractional sales, the Federal Senate is discussing a Bill (PLS) 98/2017 that aims to oblige laboratories to manufacture and pharmacies to sell medicines in fractional packages. Regarding reuse, a practice that is gaining momentum is the emergence of the so-called "solidary pharmacies", where people donate unused and expired medicines to people in need. Bertolotto et al. (2020) report that several municipalities, such as Araraquara (SP), Petrópolis (RJ), Uberaba (MG), Criciúma (SC) and Sinop (MT), have already created their solidary pharmacies; the State of Rio Grande do Sul has a law that encourages this practice, and bills on the subject are being discussed in the National Congress and in Legislative Assemblies, such as that of Minas Gerais.

### **Impacts of irregular disposal**

Among the pharmacological classes that require greater attention, with regard to incorrect disposal, we have the antibiotics, which according to Bila, Dezotti (2005) are responsible for the development of resistant bacteria; and estrogens that can affect the reproductive system of aquatic organisms and cause feminization of male fish present in rivers contaminated with sewage treatment plant effluent disposal (EICKHOFF, EINECK & SEIXAS, 2009 apud FERREIRA, ABREU, RAPADO, 2019). According to Blankenstein (2017) in China malformations of fetuses with termination of pregnancy have been verified, attributed to contamination of water and food irrigated with contaminated water.

### **Legislation on the disposal of expired medications**

Several cities have municipal laws that require pharmacies, drugstores, and drug distributors to provide containers for the collection of household medications, licit drugs, expired or unused

pharmaceutical supplies. Among these cities we can mention: Passo Fundo/RS (Law no. 4,462/2007); Porto Alegre/RS (Law 11,329/2012), Cuiabá/MT (Law no. 5,678/2013) and Aracaju/SE (Law no. 4745/2016). Some Brazilian states have their own laws, in general, obliging pharmacies to receive medicines and pharmaceutical products sold. Among them we can mention: Acre (Law 1.401/2001); Amazonas (Law nº 155/2013) Sergipe (Law nº 7.913/2014) and Mato Grosso (Law nº 10.600/2017).

In September 2020, Decree No. 10,388 was signed, establishing the system of "Reverse Logistics for Overdue or Unused Drugs" at home, i.e., consumers dispense the overdue or unused drugs at pharmacies, where the product is removed by the distributor that takes it back to the industry that will be in charge of taking it to a destruction point at an environmentally appropriate location such as incinerators, coprocessors and/or grade 1 dumps approved by environmental entities. The decree does not provide for the collection of home care products, material for hospital use, clinics, outpatient clinics, etc. (FEBRAFAR, 2021).

Cabral et al (2013) report that the State of Paraíba, in order to reduce environmental damage by irregular disposal created Law No. 9646 of December 29, 2011, which deals with the environmentally appropriate final destination for the disposal of expired medicines or unfit for use, at the state level. This law establishes that drugstores and pharmacies, including compounding pharmacies, are required to install points for receiving drugs already sold, expired or unfit for consumption, in visible locations, marked with signs and informing customers how to proceed with the expired drugs.

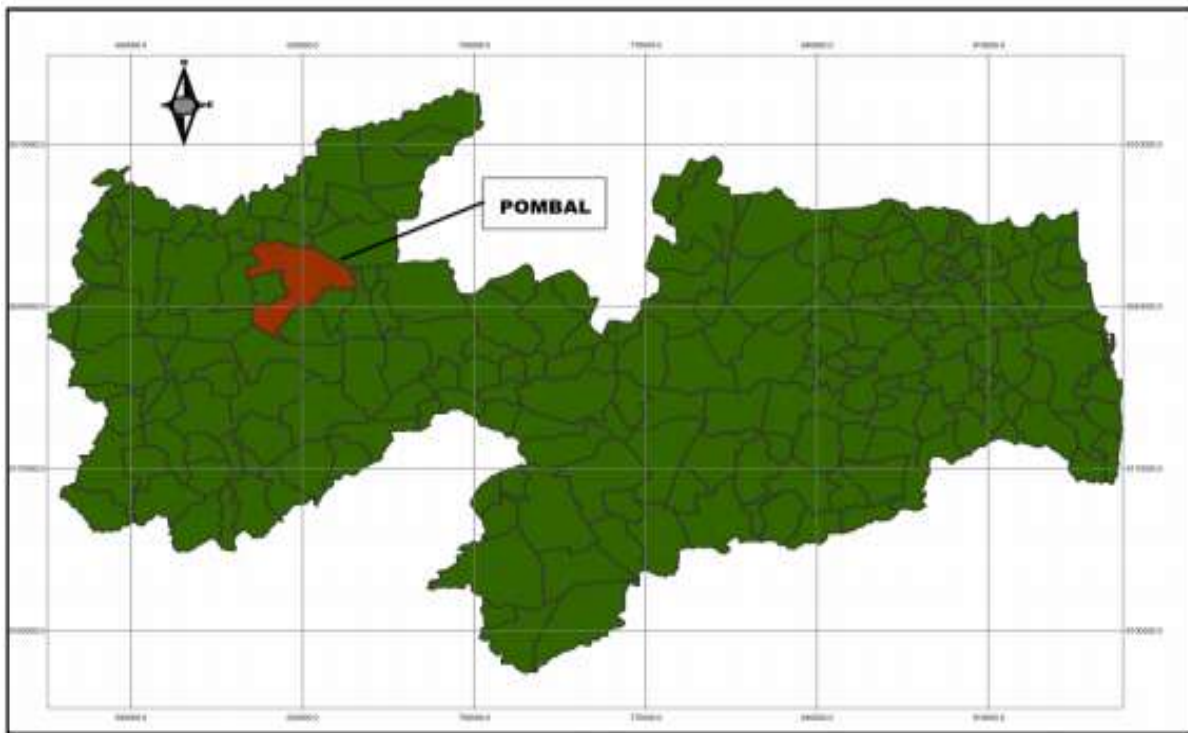
Given the above, this study aims to conduct a survey of the disposal and collection of expired drugs in pharmacies and drugstores in the city of Pombal - PB, and to verify what is the perception of the residents on this subject.

## **METHODOLOGY**

### **Description of the study area**

The study was conducted in the municipality of Pombal (Figure 1) which is at an altitude of 184 meters and inserted in the interior of the state of Paraíba, Northeast region of Brazil, with an area of approximately 889 Km<sup>2</sup> (MELO, et al 2017). It belongs to the mesoregion of Sertão Paraibano and microregion of Sousa and its boundaries are the municipalities of Cajazeirinhas, São Bentinho, Paulista, São Domingos, Aparecida, Condado and Lagoa, all in the state of Paraíba (AZEVEDO, 2014). An estimated population of 32802 people in the year 2020 (IBGE, 2020).

**FIGURE 1:** Location of the municipality of Pombal - PB.



**SOURCE:** Azevedo (2014).

In the city there are 15 pharmacies distributed mostly in the city center; this research sought to contemplate all of them, considering their quantity and location.

### **Analysis and data collection**

The methodology employed followed the one applied by Silva Junior et al. (2018), which consisted in the application of two questionnaires, one in the pharmacies and drugstores, and another one for residents of the city of Pombal-PB, and subsequent data treatment in Excel, with the preparation of graphs. First, a questionnaire was applied in the commercial establishments, with the following questions: 1. Do you receive expired drugs? If yes, we ask question 2, and if not, we ask question 3. 2. Where are the collected drugs sent to? 3. how many pharmacies do you have in Pombal - PB? 4) In the other pharmacies in the chain, do we repeat what was answered in item 1)?

To analyze the perception of the population, regarding the disposal of expired medications, an existing questionnaire was applied and adapted from Silva Junior et al. (2018). Due to the pandemic of COVID-19, we chose to apply the questionnaire through Google Forms, where it was forwarded via WhatsApp, and had as a requirement to participate in the research, being a resident in the municipality of Pombal - PB. The form contained the following questions: 1. do you live in urban or rural areas? 2. how

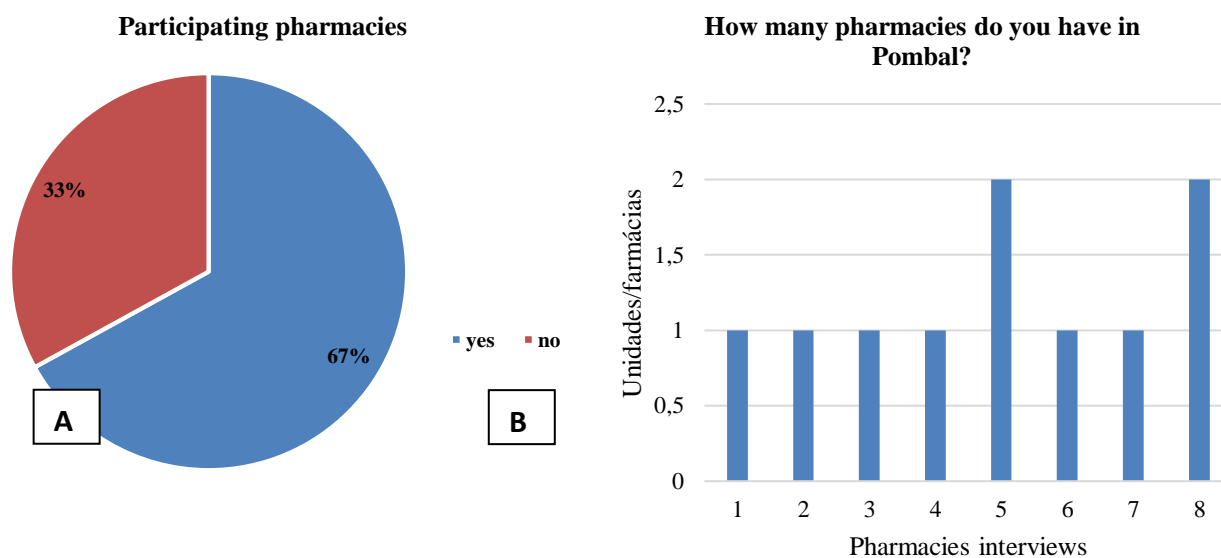
old are you? 3. what is your gender? 4. are medications stored in your home? 5. are the stored medications stored out of the reach of children? 6) Where do you and your family dispose of expired medications? 7) Have you ever received any information about the disposal and storage of expired medications? 8. to the best of your knowledge, name three negative consequences of the irregular disposal of expired medications.

## RESULTS AND DISCUSSIONS

### Collection in drugstores and pharmacies in Pombal - PB

The 15 pharmacies in the city were visited for the application of the questionnaires, but 5 units refused to participate (FIGURE 2A); and those that agreed to participate informed the number of businesses they have in the city, as shown in figure 2B, among which 2 expressed having more than one unit.

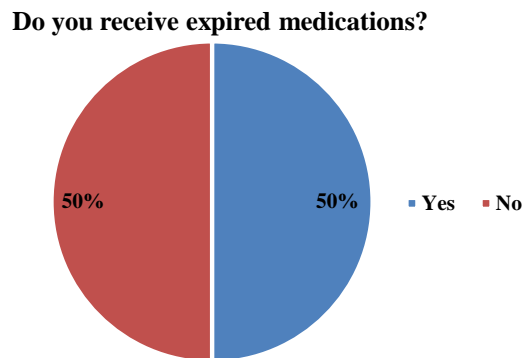
**FIGURE 2:** (A) Percentage of pharmacies participating in the survey and (B) number of units per pharmacy in the municipality.



**SOURCE:** Survey data (2021).

Of the pharmacies that answered the questionnaire, it can be seen that 5 (50%) do not receive, and 5 (50%) receive the expired drugs, as shown in figure 3. Of the establishments that informed they receive, all informed that the collected material is sent to a specialized private company for incineration.

**FIGURE 3:** Percentage of pharmacies that do or do not receive expired medications.



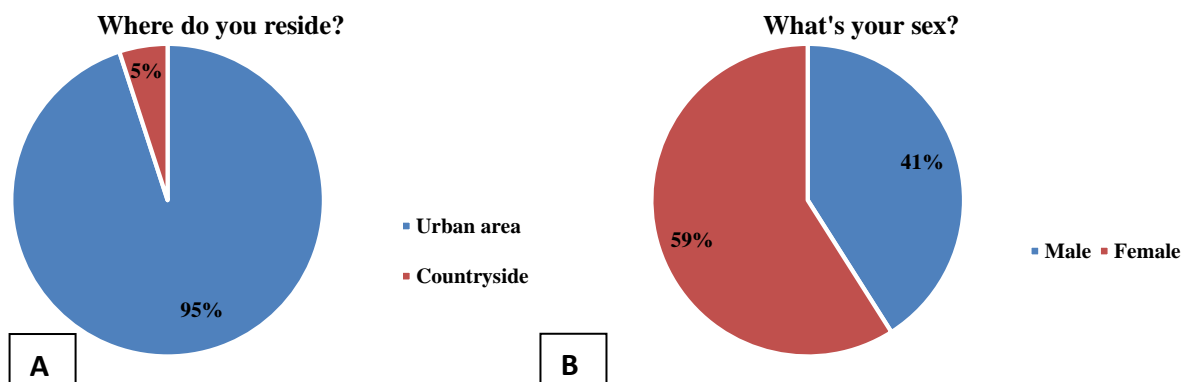
**SOURCE:** Survey data (2021).

From the information presented in the previous figure, we can see the concern of a considerable portion of the establishments in complying with the legislation in force regarding the receipt and disposal of expired drugs; on the other hand, the other portion disobeys the legislation by not receiving this waste, as it considers this measure of little relevance.

### Perception of residents about the disposal of expired medications

Regarding the perception of residents about the disposal of expired medicines, a total of 22 people participated in the research by answering the online form, all residents of Pombal - PB. The results obtained are presented and discussed in the sequence. Of the 22 interviewees, 13 (59%) are female and 9 (41%) are male, as shown in figure 4B. Figure 4 shows that 95% (21) live in urban areas, and 5% (1) live in rural areas.

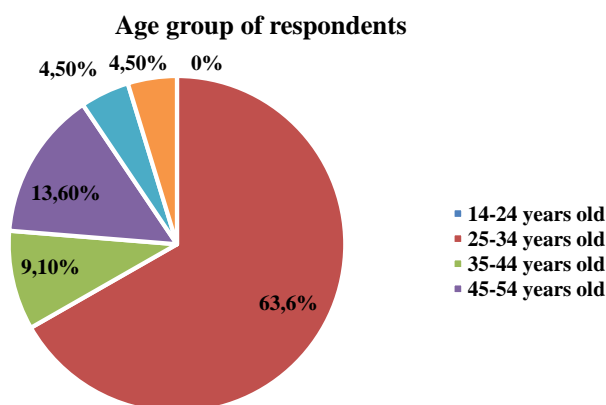
**FIGURE 4:** Percentage of the population according to where they live (A) and sex (B).



**SOURCE:** Survey data (2021).

Regarding age, it can be seen that the research sample is quite diverse, ranging from 17 to 65 years old. Most are concentrated in the 25 to 34 age bracket (63.5%), followed by the 45 to 54 age bracket (13.6%), and followed by the 15 to 24 age bracket (4.5%) and the 65 to 74 age bracket (4.5%). There were no respondents in the 55 to 64 age group, as per figure 5.

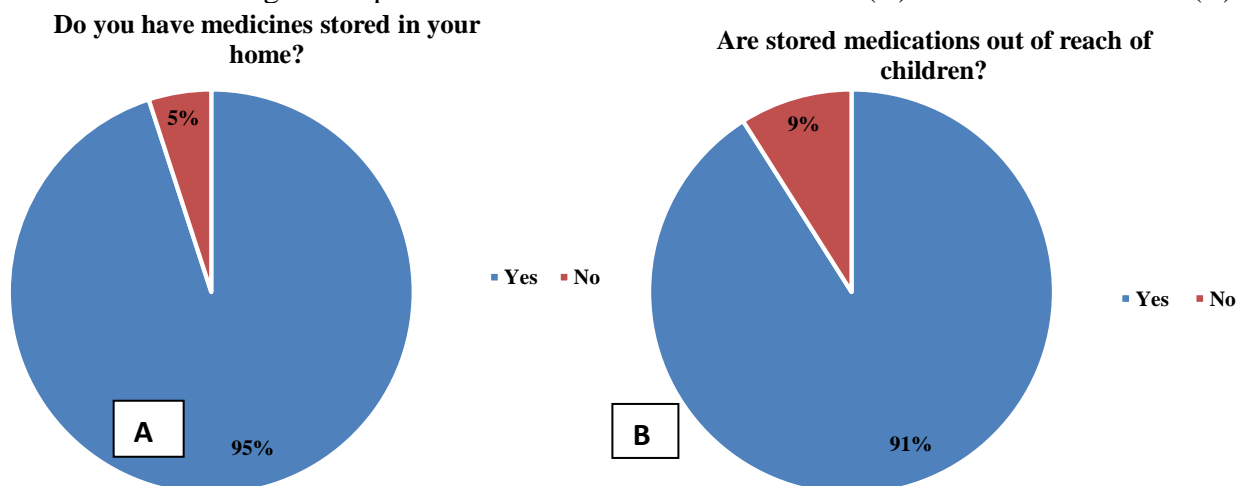
**FIGURE 5:** Age range of the interviewees Location of the municipality of Pombal - PB.



**SOURCE:** Survey data (2021).

Regarding the storage of medicines, as can be seen in figure 6A, 95% of the sample population stated that they store medicines at home, and a large portion (91%) are careful to store the medicines out of the reach of children (FIGURE 6B), which shows that they are aware of how dangerous it can be to allow this contact, however, it demonstrates that there is still carelessness in a small portion (9%).

**FIGURE 6:** Percentage of respondents who store medicine at home (A) and care for children (B).

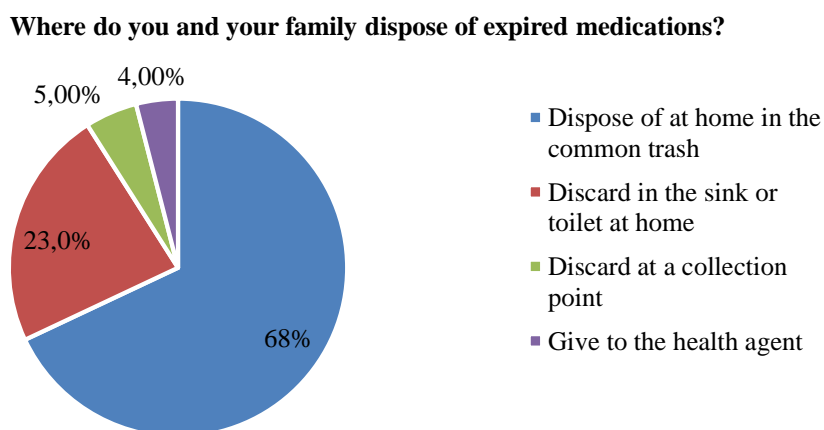


**SOURCE:** Survey data (2021).



It appears that most of the population still discards the medications in the regular trash (68%), followed by those who discard them in the sink or toilet (23%), as shown in Figure 7. A small portion of the interviewees reported disposing of them at collection points (5%) and another portion declared to give them to the neighborhood health agent. Among those who reported returning at collection points, all said they delivered at places other than where they bought the medicines.

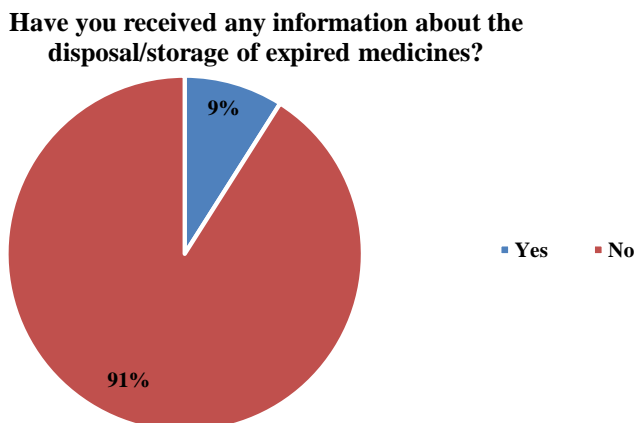
**FIGURE 7:** Percentage of discarded expired medicines.



**SOURCE:** Survey data (2021).

Regarding the knowledge about the disposal and/or storage of medicines at home, the vast majority (91%) reported never having received any information, such as the importance of correct disposal, the risks arising from incorrect disposal or the care that should be taken when storing at home. This information presented by figure 8, indicates that there is a need for greater dissemination on the subject, in order to make the population aware of this issue.

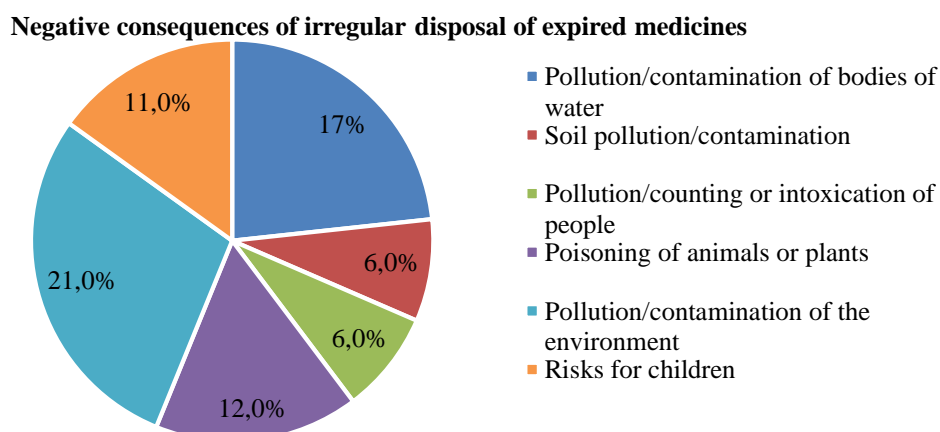
**FIGURE 8:** Informing the population about the disposal of medicines.



**SOURCE:** Survey data (2021).

Despite the majority declaring not to have received information about the incorrect disposal of medicines, it can be seen that this sample population has a solid awareness of the risks that this practice can cause, according to figure 9.

**FIGURE 9:** Impacts of irregular disposal cited by interviewees.



**SOURCE:** Survey data (2021).

The most mentioned negative consequences were pollution/contamination of water bodies (21%), health problems in the population (17%), and pollution/contamination of the environment (15%). They also mentioned pollution/contamination of the soil (12%), intoxication of animals and plants (12%), risk for children (11%), contamination, pollution, intoxication (6%) without specifying the type and/or what affects them, and 6% reported not knowing the consequences of the irregular disposal of expired drugs.

## CONCLUSIONS

The results show that most of the interviewees are aware of how the irregularly discarded expired drugs can harm the environment and public health, and even so, they discard this material improperly, probably because there is not a greater guidance from government agencies.

It is necessary and urgent that the pharmaceutical establishments comply with the current law, with the availability of collection points for the expired drugs, as well as a greater dissemination among the population, which could induce their proper disposal.

The fact that half of the pharmacies interviewed do not comply with the state law that requires them to perform the collection of expired drugs, and continue operating normally, coupled with the absence of awareness campaigns, on radio stations, TV and social networks, by the public, demonstrates a disregard with this issue.

## REFERENCES

- [1] AGÊNCIA NACIONAL DE VIGILÂNCIA SANITÁRIA (ANVISA). Anuário Estatístico do mercado farmacêutico 2016. Brasília: ANVISA, p. 14-27, 2017.
- [2] AZEVEDO, P. B. Diagnóstico da degradação ambiental na área do lixão de Pombal - PB. 2014. 68 f. TCC (Graduação) - Curso de Engenharia Ambiental, Centro de Ciências e Tecnologia Agroalimentar, Universidade Federal de Campina Grande, Pombal, 2014.
- [3] BERTOLOTTI, R. Sobras de remédios alimentam farmácias solidárias em tempo de pandemia. 2020. Disponível em: <https://www.uol.com.br/ecoa/ultimas-noticias/2020/07/22/sobras-de-remedios-alimentam-farmacias-solidarias-em-tempo-de-pandemia.htm>. Acesso em: 21 abr. 2021.
- [4] BILA, D. M.; DEZOTTI, M. Fronteiras da Engenharia Química I: Identificação de Fármacos e Estrogênios Residuais e Suas Consequências no Meio Ambiente. 1. ed. Rio de Janeiro: Epapers; 2005. 141-175p.
- [5] BLAKENSTEIN, G. M. P. Descarte de medicamentos industrializados para uso humano no contexto da sustentabilidade: análise crítica. 200f. Tese (Doutorado em Ciências) - Faculdade de Saúde Pública, Universidade de São Paulo, São Paulo, 2017.
- [6] BORRELY, S.I. Contaminação das águas por resíduos de medicamentos: ênfase ao cloridrato de fluoxetina. São Paulo-SP: [s.n.], 2012. 8 p. Disponível em: [http://www.saocamilosp.br/pdf/mundo\\_saude/97/03.pdf](http://www.saocamilosp.br/pdf/mundo_saude/97/03.pdf). Acesso em: 19 Mar. 2021.
- [7] CABRAL, M. N.; CHAVES, A. M. M.; CHAVES, M. E. T.; JALES, L. T. L.; MEDEIROS, L. E. S. Política de descarte de medicamentos na Farmácia Ensino do SAS. In: XIV ENCONTRO DE
- [8] EXTENSÃO E XV ENCONTRO DE INICIAÇÃO A DOCÊNCIA, 2013, João Pessoa. Anais do XIV ENEX e XV ENID. João Pessoa: UFPB, 2013. Disponível em: <http://www.prac.ufpb.br/enex/trabalhos/> Acesso em: 21 abr. 2021.
- [9] FEDERAÇÃO BRASILEIRA DE FARMÁCIAS (FEBRAFAR). Entenda o sistema de logística reversa de medicamentos. 2021. Disponível em: <https://www.febrafar.com.br/entenda-logistica-reversa-de-medicamentos>. Acesso em: 21 abr. 2021.

- [10] FEITOSA, A. de V.; AQUINO, M. D. de. Descarte de medicamentos e problemas ambientais: o panorama de uma comunidade no município de Fortaleza/CE. *Ciência e Natura*, [S.L.], v. 38, n. 3, p. 1590-1600, 28 set. 2016. Universidade Federal de Santa Maria. <http://dx.doi.org/10.5902/2179460x22249>.
- [11] FERREIRA, C. M.; ABREU, D. S. F.; RAPADO, L. N. Estudo relacionado ao descarte de medicamentos. *Revista Expressão da Estácio (REDE)*, América do Norte, v. 2, p. 84-93, 2019.
- [12] FISCHER, M. I.; FREITAS, G. R. M. de. Descarte de medicamentos. 2011. Boletim Informativo da CIM-RS. Disponível em: <http://www.ufrgs.br/boletimcimrs/descarteboletim.pdf>. Acesso em: 21 abr. 2021.
- [13] INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). *Cidades*. 2010. Disponível em: <https://cidades.ibge.gov.br/>. Acesso em: 21 abr. 2021.
- [14] MARQUES, R.; XAVIER, C. R. Responsabilidade socioambiental a partir da utilização e descarte de medicamentos. *Revista Brasileira de Educação Ambiental*, São Paulo, v. 13, n. 4, p. 174-189, 11 nov. 2018.
- [15] MEDEIROS, M.S.G., MOREIRA, L.M.F., LOPES, C.C.G. O. Descarte de medicamentos: programas de recolhimento e novos desafios. *Rev. Ciênc. Farm. Básica Apl.*, v. 35, n.4, pp.651-662, 2014.
- [16] MELO, F. J. da S.; SILVA FILHO, J. A. da; ANDRADE, S. N. de; VIEIRA, Z. C. Análise do saneamento básico e saúde pública na cidade de Pombal, Paraíba. *Revista Verde de Agroecologia e Desenvolvimento Sustentável*, [S.L.], v. 12, n. 1, p. 74-78, 22 fev. 2017. Grupo Verde de Agroecologia e Abelhas. <http://dx.doi.org/10.18378/rvads.v12i1.5151>.
- [17] RODRIGUES, P. H. A.; COSTA, R. D. F.; KISS, C. A evolução recente da indústria farmacêutica brasileira nos limites da subordinação econômica. *Revista de Saúde Coletiva*, Rio de Janeiro, 2018.
- [18] SOUZA, K. C. Diagnóstico do descarte de medicamentos vencidos e a relação com a logística reversa no município de Mariana (MG). 2019. 94 f. TCC (Graduação) - Curso de Engenharia de

Produção, Departamento de Engenharia de Produção, Universidade Federal de Ouro Preto, João Monlevade, 2019.

[19] VIANA, B. A. da S.; VIANA, S. C. dos S.; VIANA, K. M. da S. Educação ambiental e resíduos sólidos: descarte de medicamentos, uma questão de saúde pública. *Revista Geográfica Acadêmica, Roraima*, v. 10, n. 2, p. 56-66, 2016. Disponível em [revista.ufrr.br](http://revista.ufrr.br). Acesso em: 12 jan. 2021.

[20] SILVA JÚNIOR, C. G. da; VIEIRA, Z. C.; SOUZA, C. S. de; SANTOS, A. C. D.; SANTOS, D. L. Coleta de medicamentos vencidos em farmácias e drogarias e a percepção dos alunos do IFS – Campus Aracaju. In: CONGRESSO NORTE-NORDESTE DE PESQUISA E INOVAÇÃO, 12., 2018, Recife. *Anais do XII CONNEPI*. Recife: IFPE, 2018. p. 1-10.