

# *Reverse Logistics as a sustainable instrument for the management of expired medicines in Brazil*

*Logística Reversa como instrumento sustentável para gestão de medicamentos vencidos no Brasil*

*La Logística Inversa como instrumento sostenible para la gestión de medicamentos vencidos en Brasil*

Recebido  
Received  
Recibido  
Jun. 2024

Aceito  
Accepted  
Aceptado  
Nov. 2024

Publicado  
Published  
Publicado  
Jan./Mar. 2025  
Ene./Mar. 2025

<https://git.fateczl.edu.br>

e-ISSN  
2965-3339

DOI  
10.29327/2384439.3.2-10

São Paulo  
v. 3 | n. 2  
v. 3 | i. 2  
e32310  
Janeiro-Março  
January-March  
Enero-Marzo  
2025



**Gabriella Silvestre da Silva**<sup>1</sup>

[gabriella.silva7@fatec.sp.gov.br](mailto:gabriella.silva7@fatec.sp.gov.br)

**Júlio Cesar Silva Santos**<sup>1</sup>

[julio.santos81@fatec.sp.gov.br](mailto:julio.santos81@fatec.sp.gov.br)

**Álvaro Camargo Prado**<sup>1</sup>

[alvaro.prado@fatec.sp.gov.br](mailto:alvaro.prado@fatec.sp.gov.br)

1 – Fatec Rubens Lara

## **Abstract :**

The growing concern about the proper disposal of expired medications has driven the need for a more responsible approach to dealing with pharmaceutical products at the end of their lifecycle. This article explores the importance of raising awareness about the correct disposal of medications, highlighting the environmental and health risks associated with improper disposal. Additionally, it discusses the crucial role of pharmaceutical reverse logistics in managing these waste products and their packaging, aiming to mitigate environmental risks, protect public health, and promote sustainability. The challenges faced in implementing pharmaceutical reverse logistics, including logistical and public awareness issues, are also addressed. Through a deeper understanding of the role and benefits of pharmaceutical reverse logistics, the aim is to promote more efficient and sustainable management of medications. In an effort to minimize improper disposal and to analyze the main impacts of expired pharmaceutical reverse logistics for sustainability and safety contributions, methodologies such as ethnography, participant research, and bibliographic review, among others, were used to conclude that with the application of this tool, the trend is a decrease in environmental damage, contributing to a sustainable future.

**Keywords:** *Expired medications; Proper disposal; Reverse logistics.*

## **Resumo:**

A crescente preocupação com o descarte adequado de medicamentos vencidos, tem impulsionado a necessidade de uma abordagem mais responsável para lidar com os produtos farmacêuticos no final do seu ciclo de vida útil. Este artigo explora a importância da conscientização sobre o descarte correto de medicamentos, destacando os riscos ambientais e de saúde associados à sua má destinação. Além disso, discute o papel crucial desempenhado pela logística reversa de medicamentos na gestão responsável desses resíduos e suas embalagens, visando mitigar riscos ambientais, proteger a saúde pública e promover a sustentabilidade. Os desafios enfrentados na implementação da logística reversa de medicamentos, incluindo questões logísticas e de conscientização pública também são abordados. Por meio

da compreensão mais aprofundada do papel e dos benefícios da logística reversa de medicamentos, busca-se promover uma gestão mais eficiente e sustentável dos medicamentos. No intuito de minimizar esses descartes incorretos, e com o objetivo de analisar os principais impactos de logística reversa de medicamentos vencidos para contribuição com a sustentabilidade e segurança, foram utilizadas metodologias como a etnográfica, a pesquisa do participante, a revisão bibliográfica entre outras para concluirmos que com a aplicação dessa ferramenta, a tendência é a diminuição dos danos ao meio ambiente, contribuindo para um futuro sustentável.

**Palavras-chave:** Medicamentos vencidos; Descarte adequado; Logística reversa.

**Resumen:**

La creciente preocupación por la eliminación adecuada de los medicamentos caducados ha impulsado la necesidad de adoptar un enfoque más responsable a la hora de tratar los productos farmacéuticos al final de su ciclo de vida. Este artículo explora la importancia de crear conciencia sobre la correcta eliminación de medicamentos, destacando los riesgos ambientales y de salud asociados con su mala disposición. Además, se discute el papel crucial que juega la logística inversa de medicamentos en la gestión responsable de estos residuos y sus envases, con el objetivo de mitigar los riesgos ambientales, proteger la salud pública y promover la sostenibilidad. También se abordan los retos a los que se enfrenta la aplicación de la logística inversa de los medicamentos, incluidas las cuestiones logísticas y de concienciación pública. A través de una comprensión más profunda del papel y los beneficios de la logística inversa de medicamentos, se busca promover una gestión más eficiente y sostenible de los medicamentos. Con el fin de minimizar estos descartes incorrectos, y con el fin de analizar los principales impactos de la logística inversa de medicamentos vencidos para contribuir a la sostenibilidad y seguridad, se utilizaron metodologías como la etnográfica, la investigación participante, la revisión de la literatura, entre otras, para concluir que con la aplicación de esta herramienta, la tendencia es reducir el daño al medio ambiente, contribuyendo a un futuro sostenible.

**Palabras clave:** Medicamentos caducados; Eliminación adecuada; Logística inversa.

## 1. INTRODUCTION

It is possible to observe that, over the years in Brazil, concerns about sustainability acts have advanced and strengthened considering what is determined to be ecologically correct for the proper functioning of the ecosystem (MOURA, 2016).

One of the main factors that drastically affected the increase in the destruction of natural resources was the Industrial Revolution, as humanity began to use machines to increase production and sales without worrying about the damage caused to the environment (DRUCK, 1998).

One of the major problems detected by the consequences of human interventions in the environment is the incorrect disposal of expired or unused medicines. The growth in the consumption of prescription and over-the-counter medicines increases the challenge because if they are not separated correctly, they can harm the soil, water, animals, and people; even if the damage is not visible and immediate, it occurs when decomposition begins. Therefore, as a research question, this article seeks to identify ways to reduce the incorrect disposal of these products in Brazil (*Superintendência de Administração do Meio Ambiente - SUDEMA*, 2022).

With this concern, reverse logistics emerges as a fundamental tool to address issues related to raising awareness in society and reducing the impacts caused by the improper disposal of these products. It is a consolidated concept in several industries that support sustainability and is essentially relevant in the pharmaceutical industry, where the responsible management of expired or unused medicines is essential to minimize environmental risks and protect the health of the population (Lar Plásticos, 2020).

Despite the numerous environmental benefits of reverse logistics, its implementation still faces several challenges, such as bureaucratic issues of adherence, transport logistics, handling, disposal, and mainly public awareness (Lar Plásticos, 2020).

This research aims to analyze the main impacts of a reverse logistics system for expired medicines and how this analysis can contribute to sustainability and safety. In addition to having specific objectives, it also aims to conceptualize and develop innovative tools to promote public awareness since consumers are the main tools for other areas to be able to allocate these products for the appropriate purpose for the environment. Highlighting the impacts on the ecosystem and the direct health risks associated with improper disposal and demonstrating how this sustainable proposal can minimize or even eliminate this damage (Lar Plásticos, 2020).

For the purpose of understanding the scientific research presented, methodologies were used in its development, including ethnography, which aims to understand the daily processes in their modalities. In addition, participant research is where the researcher identifies with the researcher to observe the problems encountered, interacting with them in all situations and actions (SEVERINO, 2013). In addition, action research was also applied, where the

researcher understands and aims to intervene in the situation by reporting the problem, highlighting that for every problem, there is a solution. For every solution, there is an action. Thus, while the analysis is carried out to obtain a diagnosis of a given situation, the research presented was carried out to try to solve a large part of the problem in Brazil, to solve it completely (Severino, 2013).

The literature review methodology was also applied to collect information through reliable sources to structure the article. Furthermore, it is observed that the explanatory methodology, which, in addition to recording and analyzing the phenomena studied, seeks to identify their causes. Finally, the research methodology is the operational procedure for practical measurement of achievement; for example, without an adequate operational system, it would be more challenging to identify specific problems. It is, therefore, a very important method among others (SEVERINO, 2013).

## 2. THEORETICAL BASIS

### 2.1 Environmental Risks

According to Roig (2010), pharmaceutical products in the environment are not a new problem, but they have recently become a priority concern again. The incorrect disposal of expired or unused medicines can pose numerous environmental and safety risks to the soil, water, animals and people who encounter them; that is, they directly affect the ecosystem and health. These medicines are most often thrown in the standard trash. They are usually packaged in materials that are not biodegradable, which means they end up being sent to landfills and release chemical substances that are harmful to the environment (*Superintendência de Administração do Meio Ambiente - SUDEMA*, 2022).

According to biologist Fabiana Cristina Lima Barbosa, head of the Environmental Management Unit (*Unidade de Gestão Ambiental - UGA*), the chemical substances present in various medications, such as painkillers, antibiotics, and antidepressants, are diluted and infiltrate the soil and groundwater. When discarded in the sewage system, the drugs mix with the water and go to treatment plants. Despite undergoing filtration, this waste is practically impossible to eliminate, causing the water to remain contaminated and released into rivers, lakes and oceans, harming everyone who depends on this natural resource, including aquatic biodiversity (Kümmerer, 2004). According to studies and data collected in 2010 by Brazil Health Service (BHS), 1 kg of expired or unused medications discarded via sewage contaminates 450 thousand liters of water (CARVALHO, 2017).

In terms of public health, this contamination can have serious consequences, such as exposing people to chemical substances and causing poisoning through improper use. Around 28% of poisoning cases in Brazil are caused by medications, which are cases that can occur with waste pickers and animals in landfills, as they come into contact without protection with the risk of ingesting them. There is also the risk of developing drug-resistant bacteria, which is the case with

antibiotics if exposed to the environment, making common medical treatments less effective and bringing the risk of fatal diseases (Universidade Federal do Vale do São Francisco, 2019).

Given all these risks, it is important to adopt measures to deal with the disposal of medicines responsibly. The main reason for this environmental crime is the lack of information, highlighting the correct way and the risks for consumers in general, since the largest portion of improper disposal is of leftover medicines stored at home, as Brazilians have the habit of stockpiling medicines as a precaution against future illnesses or pain. Implementing the reverse logistics process is essential to reduce risks and protect the environment and public health (Universidade Federal do Vale do São Francisco, 2019).

## 2.2 Reverse Logistics

According to Campos (2017), excessive consumption motivated by great economic growth increases the number of waste items discarded, generating greater concern for the environment. This is how reverse logistics emerged with its concepts and legislation, which are capable of planning and implementing sustainable methods of recycling and reusing products as a common logistics process.

Reverse logistics is a process that aims to care for the product at the end of its useful life, giving it its proper destination with a focus on minimizing the environmental and economic impacts that it may have. It involves all the activities necessary to recover these products (Gupta, 2013). According to the Ministry of the Environment, reverse logistics is characterized by actions that make visible the return of solid waste to the business sector for reuse or other environmentally appropriate destinations. It serves the entire operational system of a supply chain, from the point of origin to the end consumer, with the main objective of managing the return of these products, whether for reasons of recycling, proper disposal, returns, or other forms of reuse. This responsibility is provided for in the National Solid Waste Policy (PNRS – *Política Nacional de Resíduos Sólidos*), established by Law 12,305/2010 (Ministry of the Environment, n.d.).

Toward to minimize environmental impact and promote sustainability, it considers not only the direct flow of products and packaging to the end consumer but also the need to plan and manage the reverse flow, prioritizing the degree and extent of damage and risks to public health and the environment of the waste generated (Brasília, 2024).

It is important to highlight that this is a shared responsibility, that is, involving all those responsible for the creation, commercialization and consumption of products, as this system only happens with the correct return of waste by consumers, delivering it directly to traders, who then go on to distributors, importers and finally to manufacturers, who in turn receive the waste for correct disposal, whether through recycling or environmentally appropriate reuse, where the public authorities have the role of monitoring these stages and raising

awareness among citizens for continuous practice, benefiting everyone to live in a cleaner and healthier environment, minimizing the extraction of new raw materials, increasing the efficiency in the use of natural resources, among others (Brasília, 2024).

It appears as a tool for reducing waste, reusing and reducing pollution in environmental issues. It favors the circular economy, keeping products and materials within the usage cycle and reducing costs with travel and disposal in landfills. In the economy, recyclable materials can be returned for sale, generating business opportunities. The provision of collection and recycling services also gives the company great prominence in the market for environmental preservation practices. Not to mention, it contributes to cost reduction by reusing returnable packaging or remanufacturing products. Addressing social issues, reverse logistics generates jobs in the recycling and material recovery sector, promotes awareness of the impacts of waste on the environment and contributes to the development of a more sustainable society (Lar Plásticos, 2020).

### 2.3 Reverse Logistics of Medication

Reverse logistics for medicines begins with raising awareness in society about the environment, with the act of taking expired or unused medicines to specific collection points located in pharmacies. There, consumers identify a container with clear instructions on correctly disposing of it, with an anti-return system. It identifies two disposal options: one for medicines and primary packaging and another for secondary packaging and leaflets. In addition, it must be visually informed that no other products should be discarded. When pharmacists identify that the maximum levels have been reached, the correctly classified bags are removed and closed with numbered seals. Once this is done, they are stored in specific locations for transportation. There is no need to hire management companies for these functions; this transportation can be carried out by the distributors themselves when delivering the medicines for sale, as they are qualified to carry out this collection in a safe and controlled manner, avoiding damage and ensuring the integrity of the logistical process (Regional Pharmacy Council of the State of São Paulo, 2022).

Registered pharmacies are responsible for complying with all procedures required by federal decree 10,388 based on the National Solid Waste Policy (PNRS - *Política Nacional de Resíduos Sólidos*), where the bags are collected, returned to the distribution centers and collected again for environmentally appropriate final disposal, where they will depend on the specification of the medicine and the regulations, and may be incinerated, co-processed or taken to class 1 landfills, that is, some packaging can be reused and, if possible, the raw material can be recovered (Regional Pharmacy Council of the State of São Paulo, 2022).

Generally, it is necessary to maintain strict control with reports and information in appropriate systems detailing the quantity and type of medication collected. These reports include the destination of each batch collected. To monitor these procedures, the Performance Monitoring Group (GAP - *Grupo de*

*Acompanhamento de Performance*), which is formed by entities representing manufacturers, importers, distributors, and traders at a national level, is responsible for managing the mechanism for providing all necessary information. In addition to the entire logistics process, strategic plans to raise awareness among the population, which play a key role in ensuring that the reverse logistics process works, need to be drawn up so that the campaigns reach the largest number of people in a clear and specific way. Without this, it is impossible to guarantee the success of processes in favor of sustainability (Regional Pharmacy Council of the State of São Paulo, 2022).

Reverse logistics for expired or unused medicines is an essential tool that promotes sustainability and safety to reduce environmental impacts and health damages associated with incorrect disposal (Logmed, 2024). According to Dr. Marcelo Polacow (2024), president of the Regional Pharmacy Council of the State of São Paulo (CRF-SP), in Brazil, most municipalities dump their solid waste in landfills instead of sending it to landfills, incineration and co-processing. These attitudes cause several risks to the environment and health. Therefore, it is very important that pharmacies and drugstores are committed and assume their role in correctly managing the large quantity and diversity of waste produced daily, complying with the law and ethics.

#### **2.4 Challenges of Implementing Reverse Logistics for Medication**

Implementing reverse logistics for medicines is a multifaceted challenge that requires cooperation and coordination from multiple stakeholders, from manufacturers and distributors to consumers and regulatory authorities. This practice aims to ensure proper disposal of unused or expired medicines, minimizing environmental, health, and safety impacts (Regional Pharmacy Council of the State of São Paulo, 2022).

The main challenge in implementing reverse logistics for expired or unused medicines is raising awareness and educating consumers. Although this is already stated in Decree No. 10,388 of June 5, 2020, which determines the dissemination of the reverse logistics system through digital media, websites, promotional material and collection advertising campaigns (BRASIL, 2020), society reacts more responsibly when the information is visible at any time and especially on the product, as consumers can be influenced by cultural, social, personal and psychological factors. Therefore, sustainably, it would be interesting for those responsible for manufacturing packaging and leaflets with clear information on environmentally correct disposal. In addition, the government could run incentive campaigns in TV commercials to reach as many people as possible (KOTLER and ARMSTRONG, 2015).

This awareness is vital because, according to research, people have the habit of throwing these products into the common trash or in toilets without being aware of the seriousness and negative impacts that this attitude causes on the environment. The implementation of Federal Decree No. 10,388 was distributed in phases and is still in progress, according to the schedule provided by the government. Therefore, there are campaigns initiated individually by several

universities, NGOs, and organizations that have already encouraged society to use correct disposal methods (SCHIAVON, 2022).

Another challenge about the population is what is not foreseen in the Federal Decree, when it comes to sustainability, at the end of the implementations, all large pharmaceutical chains should be required to adhere to this program in all their drugstores and pharmacies, as it is an action that must be easily accessible for each and every citizen to contribute to the environment, since according to the finalization of the standards, the obligation is only for cities with more than 100 thousand inhabitants, with one collection point for every 10 thousand people (SCHIAVON, 2022).

Besides, the challenges imposed on pharmacies are financial and infrastructure related. Upon joining, they are entirely responsible for training employees to handle these products, acquiring containers, bags and seals following government standards, and providing a fixed space for managing the number of products deposited, closing and separating the sealed bags to be collected by distributors (Febrafar, 2022).

In summary, implementing reverse logistics for medicines is a challenge that requires coordinated efforts across the supply chain, including regulation, public awareness, investment in infrastructure and collaboration between different stakeholders. However, the potential benefits are important for both environmental protection and public health, so these activities require increased attention across all sectors (Febrafar, 2022).

## **2.5 Decree No. 10,388**

Decree No. 10,388 of June 5, 2020, aims to protect the environment and public health through the reverse logistics process for expired or unused household medications, whether industrialized or compounded. According to its regulations, manufacturers, importers, distributors, and marketers must implement this process through monitoring and inspection (Brazil, 2020).

Implementation must occur in two phases. In the first phase, a group is formed to monitor performance (GAP) and the mechanisms that will be used. In the second phase, service providers, communication plans and the installation of reception locations are defined (Brazil, 2020).

Pharmacies and drugstores must make collection points for these medicines available to the public according to the local population. In municipalities with a population greater than 100,000 people, there must be at least one collection point for every 10,000 inhabitants, and consumers have the fundamental role of disposing of them according to the instructions provided (Brazil, 2020).

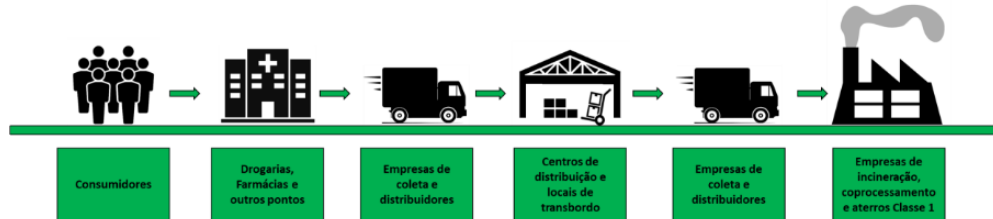
Manufacturers, importers and distributors are responsible for collecting the waste in the possession of pharmacies and drugstores and sending it to an environmentally appropriate final disposal site. The products must be in bags, boxes or containers that prevent leakage and must be sealed or, if necessary, physically and chemically adapted to the packaged content. In addition, they are also responsible for generating reports that must record the number of



medicines collected, collection points, and campaigns that were carried out, among other details, for accurate monitoring (Brazil, 2020).

Figure 01 shows the flow of the process concerning medications after use.

Figure 1-Actors in reverse logistics of medicines



Source: Adapted from the Regional Council of Pharmacies of the State of São Paulo - Technical Report (2022)

### 3. METHOD

In the article presented, the ethnographic methodology was used to understand the current reverse logistics processes in Brazil. Participant research was also selected, where the researcher undertakes to identify with the respondents the problems encountered, such as raising awareness among the population about the negative impacts that the incorrect disposal of expired or unused medicines can have on the environment, analyzing various situations and actions that serve as a warning (SEVERINO, 2013). In addition, action research was also applied to understand and intervene in the situation by reporting the problem, highlighting that for every problem, there is a solution. For every solution, there is an action. That is, it is necessary to encourage people more intensely with government support so that everyone can have easy access to information and how to practice correct disposal. Thus, at the same time that the analysis is carried out to obtain a diagnosis of a given situation, the research presented was carried out to encourage attempts to resolve a large part of the problem in Brazil, to solve it entirely over time, intervening in various educational information methods (SEVERINO, 2013).

The methodology of the bibliographic review was also critical in the development, as it aims to collect information through reliable sources to structure the article, such as the data referenced in the Federal Decree and with important notes from renowned authors. In addition, it is observed that the explanatory methodology, which, in addition to recording and analyzing the phenomena studied, seeks to identify their causes, that is, the total contamination of the soil groundwater, affecting fauna, flora and human life by medications, is the sole responsibility of human beings for environmentally inappropriate disposal. Finally, the methodology of the research technique is the operational procedures for practical performance measurement; for example, without an adequate operational system, it would be more difficult to identify certain problems, so it is a very important method among others. Therefore, the creation of the Federal Decree is completely benevolent, intending to determine reverse logistics methods with monitored and systematized inspection for the benefit of all (SEVERINO, 2013).

#### 4. RESULTS AND DISCUSSION

According to the previous chapters, the article's main objective is to show how we can use reverse logistics to solve the problem of incorrect disposal of expired or unused human medicines, industrialized and manipulated, and their packaging, to preserve the environment and public health, with its main objective being the appropriate destination for the discarded product, whether by incinerating it, sending it to a co-processor or class 1 landfill, intended for hazardous products.

In the context of expired medicines, it is possible to note that there is a great environmental impact and that many studies indicate how these drugs, incorrectly discarded, can be harmful. In other words, there must be priority actions in dissemination and awareness of society focused on reducing these impacts, even in the face of great challenges. It is believed that reverse logistics is the only tool capable of combating damage through studies and planning that are attributed throughout the national territory, with the support of all states and municipalities in matters of environmental licensing.

Reverse logistics is the proposal for implementation by the Ministry of the Environment itself to reverse the degree and extent of the impact of inadequate disposal. According to data released by the National Information System on Solid Waste Management (SINIR), in 2021, 52,779.48 kg of packaging and medication waste were collected at 3,634 collection points distributed across 74 municipalities. In other words, this waste could contaminate our environment, but it was disposed of correctly through reverse logistics. Also, according to SINIR, with the improvement of the project proposed in Federal Decree 10,388 2022, there was a 495% increase in waste collected, totaling 261,439.47 kg (Brasília, 2024).

Even without the entities updating the reports, according to the Reverse Logistics System for Expired or Unused Human Home Medications and their Packaging (LOGMED), created and managed by 16 entities in the pharmaceutical sector (retail, distribution and industry), since its implementation in 2021 to the present day, an estimated amount of more than 600 tons of waste has been collected in 650 municipalities in Brazil, with 6,800 collection points, data reported in an online event held in February 2024 by important representatives of the pharmaceutical industry, retail and distribution. The lawyer specializing in environmental law and consultant for the LOGMED System highlights, "The numbers presented are a source of great pride, as the initiative already benefits more than half of the Brazilian population" (Logmed, 2024).

The results demonstrate that reverse logistics effectively promotes more responsible and sustainable management of expired or unused medicines. The increase in the amount of waste collected during the period made available by SINIR shows greater awareness on the part of consumers and greater engagement on the part of those involved in the medicine supply chain.

Despite the positive data, monitoring and improving this system is essential. We must seek to identify and overcome new challenges that may occur throughout the process. The commitment of everyone involved is essential to guaranteeing

success in all procedures.

## 5. CONCLUSION

Throughout the research, the importance of using reverse logistics to manage expired medicines becomes clear. With growing concern for the environment and the high consumption of medicines, the concern for properly disposing of these products after their expiration date has driven the need for an approach to deal with them after the end of their useful cycle.

It can be observed that through awareness and implementation of reverse logistics, ways can be identified and promoted to mitigate environmental risks, protect public health and promote sustainability.

Reverse logistics is considered an essential process for managing and returning medicines to the business sector, considering the possibility of reuse or correct final disposal. As mentioned, its implementation is challenged by legal, consumer technical and operational issues.

In Decree No. 10,388 of June 5, 2020, reverse logistics is used as the main tool to ensure the proper disposal of expired medicines and their contribution to the protection of public health. The decree establishes obligations for all those involved in the pharmaceutical supply chain.

In short, it is possible to conclude that reverse logistics for expired or unused medicines are completely important to promote more efficient and sustainable management of these products. With the engagement of all those involved, and with continuous monitoring, it becomes a powerful tool for a more sustainable planet.

## REFERENCES

BRASIL. **Decreto nº 10.388, de 5 de junho de 2020**. Regulamenta o § 1º do caput do art. 33 da Lei nº 12.305, de 2 de agosto de 2010, e institui o sistema de logística reversa de medicamentos domiciliares vencidos ou em desuso, de uso humano, industrializados e manipulados, e de suas embalagens após o descarte pelos consumidores. Diário Oficial da União: Brasília, DF, 2020. Disponível em: <https://www.in.gov.br/en/web/dou/-/decreto-n-10.388-de-5-de-junho-de-2020-260391756>. Acesso em 05 abr. 2024.

BRASÍLIA. SINIR - SISTEMA NACIONAL DE INFORMAÇÕES SOBRE A GESTÃO DOS RESÍDUOS SÓLIDOS. s.d. **O que é Logística Reversa**. Disponível em: <https://sinir.gov.br/perfis/logistica-reversa/logistica-reversa/>. Acesso em: 16 abr. 2024.

CONSELHO REGIONAL DE FARMÁCIA DO ESTADO DE SÃO PAULO (São Paulo). Setor de Orientação Farmacêutica do CRF-SP. **Orientações sobre logística reversa de medicamentos e suas embalagens**. São Paulo, 2022. 8 p. Disponível em: [https://portal.crfsp.org.br/images/datep/informes%20t%C3%A9cnicos/Informe\\_Tcnico\\_-\\_Logstica\\_reversa\\_de\\_medicamentos\\_-\\_DOF\\_GTT.pdf](https://portal.crfsp.org.br/images/datep/informes%20t%C3%A9cnicos/Informe_Tcnico_-_Logstica_reversa_de_medicamentos_-_DOF_GTT.pdf). Acesso em: 01 abr. 2024.

CAMPOS, Alexandre de et al. **Logística Reversa Integrada**: sistema de responsabilidade pós-consumo aplicados ao ciclo de vida dos produtos. São Paulo: Érica, 2017. Disponível em:

[https://www.google.com.br/books/edition/Log%C3%ADstica\\_Reversa\\_Integrada/e4uwDwAAQBAJ?hl=pt-BR&gbpv=1&dq=LOG%C3%8DSTICA+REVERSA+INTEGRADA&printsec=frontcover](https://www.google.com.br/books/edition/Log%C3%ADstica_Reversa_Integrada/e4uwDwAAQBAJ?hl=pt-BR&gbpv=1&dq=LOG%C3%8DSTICA+REVERSA+INTEGRADA&printsec=frontcover).

Acesso em: 04 abr. 2024.

CARVALHO, Mateus et al. **Descarte irregular de medicamentos causa impactos à saúde e ao meio ambiente**. 2017. Elaborado pela secretaria de estado de saúde. Disponível em: [www.saude.mg.gov.br/component/gmg/story/9819-descarte-irregular-de-medicamentos-causa-impactos-a-saude-e-ao-meio-ambiente](http://www.saude.mg.gov.br/component/gmg/story/9819-descarte-irregular-de-medicamentos-causa-impactos-a-saude-e-ao-meio-ambiente). Acesso em: 11 abr. 2024.

DRUCK, Tânia Franco Graça et al. Padrões de industrialização, riscos e meio ambiente. **Ciência & Saúde Coletiva**, Salvador, v. 3, n. 2, p. 61-72, 1998. Mensal. Disponível em: <https://www.redalyc.org/pdf/630/63013484006.pdf>. Acesso em: 09 abr. 2024.

FEBRAFAR (São Paulo). **Logística Reversa de Medicamentos**: veja impactos para consumidores e farmácias. Veja impactos para consumidores e farmácias. 2022. Disponível em: <https://febrafar.com.br/logistica-reversa-de-medicamentos-farmacias/>. Acesso em: 05 abr. 2024.

GUPTA, Surendra M. **Reverse Supply Chains**. Boca Raton: Crc Press, 2013. 422 p.

KOTLER, P. **Administração de Marketing: análise, planejamento, implementação e controle**. Tradução de Ailton Bomfim Brandão. 5. ed. 9. reimp. São Paulo: Atlas, 2011. KOTLER, P.; ARMSTRONG, G. **Princípios de Marketing**. Tradução de Sabrina Cairo. 15. ed. São Paulo: Pearson Prentice Hall, 2015.

KÜMMERER, Klaus. **Pharmaceuticals in the Environment: Sources, Fate, Effects and Risks**. 2. ed. S.l: Springer, 2004. 528 p.

LAR PLÁSTICOS (Atibaia). **Como a logística reversa contribui com a sustentabilidade?** 2020. Disponível em: <https://www.larplasticos.com.br/ultimas-noticias/como-a-logistica-reversa-contribui-com-a-sustentabilidade/>. Acesso em: 11 abr. 2024.

LOGMED (S.L.). **Saúde Para Toda Forma de Vida**: logística reversa. Logística Reversa. 2024. Disponível em: <https://www.logmed.org.br/>. Acesso em: 05 abr. 2024.

MINISTÉRIO DO MEIO AMBIENTE. **Logística Reversa**. Disponível em: <https://antigo.mma.gov.br/cidades-sustentaveis/residuos-perigosos/logistica-reversa>. Acesso em: 16 abr. 2024.

MOURA, Adriana Maria Magalhães de et al. **Governança Ambiental no Brasil**: instituições, atores e políticas públicas. Brasília: Ipea, 2016. 352 p. Disponível em: <https://repositorio.ipea.gov.br/handle/11058/6800>. Acesso em: 10 abr. 2024.

SCHIAVON, Fabiana. **Como descartar remédios para não contaminar o meio ambiente**. 2022. Disponível em: <https://saude.abril.com.br/medicina/como-descartar-remedios-para-nao-contaminar-o-meio-ambiente>. Acesso em: 11 maio 2024.

SEVERINO, Antônio Joaquim et al. **Metodologia do trabalho científico**. São Paulo: Cortez, 2013. 274 p. Disponível em: <https://www.ufrb.edu.br/ccaab/images/AEPE/Divulga%C3%A7%C3%A3o/LIVROS/Meto>

[dologia do Trabalho Científico - 1ª Edição - Antonio Joaquim Severino - 2014.pdf](#). Acesso em: 10 abr. 2024.

SUPERINTENDÊNCIA DE ADMINISTRAÇÃO DO MEIO AMBIENTE - SUDEMA (Tambá). **Descarte incorreto de medicamentos contamina solo e traz riscos à saúde**. 2022. Disponível em: <https://sudema.pb.gov.br/noticias/descarte-incorreto-de-medicamentos-contamina-solo-e-traz-riscos-a-saude#:~:text=%E2%80%9CPor%20menor%20que%20pare%C3%A7a%2C%20a,afirmou%20Walesca%20Lacerda%2C%20engenheira%20ambiental>. Acesso em: 11 abr. 2024.

POLACOW, Marcelo. **Descarte de Medicamentos e Embalagens**. 2024. Disponível em: <https://www.crfsp.org.br/index.php/sobre-o-crf-sp/transparencia.html?id=12249>. Acesso em: 14 abr. 2024.

ROIG, Benoit. **Pharmaceuticals in the Environment: Current Knowledge and Need Assessment to Reduce Presence and Impact**. S.l: Iwa Pub, 2010. 198 p.

UNIVERSIDADE FEDERAL DO VALE DO SÃO FRANCISCO (Petrolina). **Descarte de medicamentos vencidos: como e onde descartar corretamente**. 2019. Disponível em: <https://portais.univasf.edu.br/sustentabilidade/noticias-sustentaveis/descarte-de-medicamentos-vencidos-como-e-onde-descartar-corretamente>. Acesso em: 20 abr. 2024.

"The contents expressed in the work, as well as its spelling review and ABNT standards, are the sole responsibility of the author(s)."