



Guidelines and Recommendations from Emerging Countries to Support Recyclable Material Collectors During the COVID-19 Pandemic

Luiggia Girardi Bastos Reis de Araujo¹
Pammela Primo de Oliveira Silva²
Ana Ghislane Henriques Pereira Van Elk³

Abstract

The COVID-19 pandemic has exacerbated the challenges related to managing municipal solid waste, leading to substantial negative impacts on the livelihoods of waste pickers. An exploratory and documentary research was conducted to assess the actions of emerging countries in managing recoverables intended for collectors. The study focused on the main recommendations of 11 organizations of international relevance during the period of 2020 and 2021. The countries examined included South Africa, Argentina, Brazil, India, Mexico, and Turkey. The analyzed documents recommended 27 different actions, with the most prevalent ones being: a) segregating and identifying waste; b) using and distributing personal protective equipment (PPE); c) training and maintaining distance among workers; d) implementing quarantine for symptomatic individuals; e) practicing handwashing; and f) disinfecting surfaces. The United Nations National Environment Programme (UNEP), the International Association for Solid Waste (ISWA), and the European Commission (EC) have recommended the majority of the actions. Brazil proposed 25 measures, outperforming countries like Argentina, Mexico, South Africa, and Turkey. Furthermore, it was the only country with recommendations for financial assistance and social benefits for waste pickers. However, these recommendations were not developed by the executive branch, as in other nations. Instead, they were established by the Public Prosecutor and non-profit groups in the sanitation sector.

Keywords: Municipal Solid Waste Management; Waste Pickers; COVID-19; International Agencies; Emerging Countries.

¹PhD in Biological Sciences at Federal University of Rio de Janeiro - UFRJ; Brazil, Professor the Federal Institute of Education, Sciences and Technology of Rio de Janeiro – IFRJ; luiggia.araujo@ifrj.edu.br; <https://orcid.org/0000-0002-5471-7678>; <http://lattes.cnpq.br/7743823161733085>.

²Master of Environmental Engineering, State University of Rio de Janeiro – UERJ; Brazil; pammprimo@gmail.com; <https://orcid.org/0000-0001-7704-0818>; <http://lattes.cnpq.br/5605290469495514>.

³PhD in Environmental Geotechnics at Oviedo University; Brazil; Associate Professor at the State University of Rio de Janeiro, (Faculty of Engineering, Department of Sanitary and Environmental Engineering). – UERJ; anaghislane@eng.uerj.br; <https://orcid.org/0000-0002-7816-3622>; <http://lattes.cnpq.br/5792883380687165>.



Diretrizes e Recomendações de Países Emergentes para Apoiar Catadores de Materiais Recicláveis durante a Pandemia de COVID-19

Resumo

Com a Pandemia de COVID-19, a gestão de resíduos sólidos urbanos tornou-se mais problemática, impactando significativamente a provisão de rendimento para os catadores(as) de materiais recicláveis. Com a perspectiva de avaliar as ações de países emergentes na gestão de recuperáveis voltadas a catadores(as), foi realizada uma pesquisa exploratória e documental sobre as principais recomendações de 11 organizações de relevância internacional, durante o período de 2020 e 2021, em países como: África do Sul, Argentina, Brasil, Índia, México e Turquia. Nos documentos analisados 27 tipos de ações foram recomendadas, sendo as mais presentes nos documentos avaliados: a) a segregação e identificação de resíduos, b) uso e distribuição de EPIs, c) o treinamento e distanciamento de trabalhadores, d) quarentena para sintomáticos(as), d) lavagem das mãos e, e) desinfecção de superfícies. O Programa Nacional das Nações Unidas para o Meio Ambiente (UNEP), a Associação Internacional de Resíduos Sólidos (ISWA) e a Comissão Europeia (EC) realizaram o maior número de recomendações. O Brasil recomendou 25 ações, superando países como Argentina, Mexico, África do Sul e Turquia. Ademais, foi o único país com recomendações de auxílio financeiro e benefícios sociais para catadores(as). Todavia, essas recomendações não foram desenvolvidas pelo poder executivo como nos outros países, e sim pelo Ministério Público e organizações sem fins lucrativos do setor de saneamento.

Palavras-chave: Gestão de Resíduos Sólidos Urbanos; Catadores; COVID-19; Organizações Internacionais; Economias emergentes.

Recebido em: 13/03/2024

Aceito em: 11/04/2024

Publicado em: 17/04/2024

1 Introduction

Dealing with SARS-CoV-2 was a challenge for public authorities, especially for the waste selective collection due to its high transmissibility by droplets and aerosols (Luhar I., Luhar S., Abdullah, 2022). Initially, studies suggested that the pandemic would bring a high risk of contagion to those directly involved with municipal solid waste (MSW). In this context, it was considered that professionals such as waste pickers would be more vulnerable to the risk of contamination by SARS-CoV-2, as their safety was already permeated by weaknesses (ABES, 2020).



In emerging and middle-income countries, such as Brazil, characterized by significant capital flows, relevant consumer markets, strong growth, stability, and the capacity to produce higher value-added goods (Dutttagupta; Pazarbasioglu, 2021; IMF, 2021), economic growth is accompanied by a significant increase in solid waste generation (Bui et al., 2022).

However, these countries generally show insufficient solid waste management, with low rates of selective collection and recycling and high rates of disposal in inappropriate locations (Bui et al., 2022; Oliveira; Klafke; Chaerki, 2022). With the challenges brought by the pandemic, the management of MSW, which already had performance issues, has become even more problematic. These countries largely were not prepared to implement best handling and hygiene practices in the management of SDRs in order to avoid exposure of workers to potentially contaminated waste (Kulkarni; Anantharama, 2020). Moreover, the provision of financial support was almost non-existent (Moghaddam et al., 2023).

During the first wave, municipal leaders ordered the suspension of the activities of several cooperatives around the world. Safety protocols were developed by government authorities and international agencies to protect the working class in resumption of selective collection and recycling activities. Public policies of financial assistance and measures to contain the spread of the disease (disinfection of sorting spaces and distribution of personal protective equipment - PPEs) have been recommended (Luhar I., Luhar S., Abdullah, 2022; Protasio, 2022). The Brazilian executive branch disregarded the advice of the World Health Organization, downplaying quarantine measures and social isolation, and instead promoted early medication treatment, despite the lack of scientific evidence supporting it (Marques Júnior, 2020; Teixeira; Santos, 2023).

In this context, the objective of this article was to conduct an overview of the actions recommended by emerging and middle-income countries in the management of recoverable urban solid waste for waste pickers.

2 Methodology

The present work consists of an exploratory research using qualitative methods, divided into two stages. The first phase included a survey of documents developed in 2020 by international organizations and other entities specializing in topics such as waste management, public health, environment, labor, occupational safety and health, and economic development. The selected documents provided recommendations for managing recyclable municipal solid



waste during the 2020-2021 pandemic. These documents included guides, reports, briefings, and manuals with information on the management of recyclable municipal solid waste during the pandemic, providing instructions and measures for selective collection and waste sorting for waste pickers (Table 1).

Table 1. Selected documents with recommendations for waste management during the COVID-19 pandemic.

Document Title	Agencies	Countries/ Regions
Managing Infectious Medical Waste during the COVID-19 Pandemic Protecting the Safety and Well-Being of Workers and Communities from COVID-19	Asian Development Bank (ADB)	Asiatic countries
Technical Guidelines for Disinfection of Special Sites for COVID-19	Chinese Center for Disease Control and Prevention (CCDC)	China
Waste management in the context of the coronavirus crisis	European Commission (EC)	European Union
COVID-19 crisis and the informal economy Immediate responses and policy challenges Social protection responses to the COVID-19 pandemic in developing countries: Strengthening resilience by building universal social protection. Extending social protection to informal workers in the COVID-19 crisis: country responses and policy considerations	International Labor Organization (ILO)	All countries
Management during the Covid-19 pandemic ISWA's recommendations	International Solid Waste Association (ISWA)	All countries
Environmental health and strengthening resilience to pandemics	Organization for Economic Cooperation and Development (OECD)	OECD countries
Solid Waste and Wastewater Management Workers and Employers	Occupational Safety and Health Administration (OSHA)	United States
Recommendations for the Management of Solid Waste	Pan American Health Organization (PAHO)	Pan American countries
COVID-19 Waste management Factsheets Waste Management during the COVID-19 Pandemic From Response to Recovery	United Nations Environmental Programme (UNEP)	All countries
Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes Covid-19: interim guidance	World Health Organization (WHO)	All countries
Recommendations for the prevention of the spread of Coronavirus disease (COVID-19) among solid waste workers	Women In Informal Employment: Globalizing And Organizing (WIEGO)	All countries

Source: ADB (2020a; 2020b); CCDC (2020); EC (2020); ILO (2020a; 2020b; 2020c); ISWA (2020); OECD (2020); OSHA (2020); PAHO (2020); UNEP (2020a; 2020b); WHO (2020); WIEGO (2020).



As a result, the following suggestions were examined: (1) partial or total suspension of selective collection and sorting activities; (2) social distancing in workplace; (3) recommendations and working conditions for vulnerable groups (e.g. elderly population); (4) regular use of adequate personal protective equipment; (5) surface disinfection procedures; (6) temporary storage of recyclable waste before collection and sorting; (7) staff training; and (8) provision of financial and food support. Based on the documents, the recommendations were categorized for further data tabulation. Graphs and comparative tables were then developed to evaluate the most common categories and the organizations with the most recommendations for waste pickers and recycling cooperatives during a pandemic. Finally, the categories of reference documents formed the basis for evaluating the measures recommended by the emerging economies selected for this study.

The second phase of the research consisted of analyzing the categories in the solid waste management documents developed by six countries: South Africa, Argentina, Brazil, India, Mexico and Turkey. These six countries are from different continents, classified as emerging and middle-income economies by the International Financial Monetary (IFM) Monitor, 2021, with a large population and area.

MSW Management documents developed by environmental and sanitary organizations, and by public authorities were selected (Table 2). The categories previously defined in the reference documents were identified and compiled in spreadsheets for analysis of the countries with the most recommendations. Specific actions for waste pickers were also categorized and quantified. The data was processed into tables and graphs to provide an overview.



Table 2: Technical documents and official guides with recommendations for waste management during the COVID-19 pandemic in selected countries.

Document Title	National Organization(s)	Country
Disaster Management Act: Directions: Measures to address, prevent and combat the spread of Coronavirus COVID-19 in relation to recycling of waste	Department of Environment, Forestry and Fisheries (2020)	South Africa
COVID-19: Environmental Health Guidelines	National Department of Health (2020)	
Recommendations for the management of recyclable waste in the context of COVID-19	Ministry of Science, Technology and Innovation – MINCYT Ministry of Environment and Sustainable Development – MAYDS Ministry of Health – MINSAL National Council for Scientific and Technical Research - CONICET Argentine Federation of Waste Pickers - FACCYR (2020)	Argentina
Recommendations for solid waste management during the coronavirus pandemic (COVID-19)	Brazilian Association of Public Cleaning and Special Waste Companies - ABRELPE (2020)	Brazil
Recommendations for solid waste management during the Coronavirus Pandemic (COVID-19)	Brazilian Association of Sanitary and Environmental Engineering - ABES (2020)	
Technical Note on the role of members of the Brazilian Public Prosecutor's Office for the prevention of COVID-19 in selective collection and in the activities carried out by waste pickers associations and cooperatives of reusable and recyclable materials	National Council of Public Prosecutors - CNMP (2020a,b)	
Technical and legal guidelines for the selective collection and sorting of recyclable materials during the COVID-19 pandemic		
Guidelines for Handling, Treatment and Disposal of Waste Generated during Treatment/Diagnosis/Quarantine of COVID-19 Patients – Revision 2	Central Pollution Control Board/ Ministry of Environment, Forest & Climate Change (2020a,b)	India
Guidelines for Handling, Treatment and Disposal of Waste Generated during Treatment/Diagnosis/Quarantine of COVID-19 Patients – Revision 4		
COVID-19 Best Practice Guide for the Prevention of COVID-19 in Municipal Solid Waste (MSW) Management	Ministry of Environment and Natural Resources Ministry of Health National Council of Science and Technology (2020)	Mexico
Turkey emergency COVID-19 health project (P173988). Environmental and social management framework	Ministry of Health (2021)	Turkey
COVID-19 Response and Recovery Medical Waste Ecosystem in Turkey During COVID-19	Istanbul International Center for Private Sector in Development - IICPSD United Nations Development Programme - UNDP (2021)	

Fonte: ABES (2020); ABRELPE (2020); CNMP (2020a,b); CPCB (2020 a,b); DEFF (2020); IICPSD & UNDP (2021); MINCYT et al. (2020); Ministry of Health (2021); SMARN, SS & CNCT (2020).



3 Results and Discussion

The documents contained five types of recommendations, generating the 27 categories summarized in Table 3.

Table 3: Categories for the management of recyclable waste in the COVID-19 pandemic recommended by organizations.

Types of recommendation	Categories	Short description
Recommended actions for the population and/or companies	Separation of non-infectious recyclable and infectious waste	People and organizations should separate recyclable waste from other waste to avoid contamination and allow recycling
	Identification of contaminated waste bags	Potentially infected waste bags should be reinforced and identified to protect waste pickers
	Simple guidelines for the population	Local authorities should prepare guidelines for selective collection during the pandemic
	Environmental education for the population to separate waste at home	Provide a variety of environmental education activities to raise awareness and encourage selective collection
	Circular economy practices for homes and companies	People and organizations should think about the material circularity by reducing, reusing, and using less impactful materials
Recommended actions for public authorities	Tax and income subsidies	Public authorities should consider tax reductions/exemptions to encourage recycling and create subsidies for workers in the sector
	Development of policies, legislation and regulations at the national and local levels	Public authorities should develop regulations for the recyclable waste management during the pandemic
	Partnership development and international cooperation	Partnerships with non-governmental organizations and international cooperation to support workers and recycling
	Total or partial interruption of selective collection during emergency periods	The government could reduce or interrupt the selective collection in periods of lockdown and high transmission
	Sanitation works classification as an essential activity	The collection of recyclable waste should be an essential activity and not be paralyzed in the pandemic
Recommended actions for workers' operational practice	Use of PPEs by waste pickers	Waste pickers should wear PPEs, such as gloves, masks and glasses, to reduce the possibility of contamination
	Waste pickers training	Waste pickers should be trained for safe collection, sorting and processing of waste, avoiding contamination
	Development of guidelines for waste management by waste pickers	Official documents for pandemic waste management should be developed by public authorities
	Handwashing procedures	Handwashing should be carried out before and after removing gloves, before meals, after using the toilet
	Sharing personal objects	Personal objects, such as tableware and cell phones, should not be shared to avoid contamination
	Instructions for use and removal of masks	The use of the mask should be carried out in an appropriate way to avoid contamination, taking care not to contaminate it during adjustment, use and removal
	Ventilation of spaces	The workplace and waste storage should be well ventilated for air circulation
	Surface disinfection	Surfaces, bags, vehicles, containers, floors and walls should be disinfected with hypochlorite solutions
	Waste quarantine	Recyclable waste could be stored in people's homes or in recycling centres before processing until the virus is inactivated
Recommended actions of material support to workers	Distribution of PPEs to workers	Public authorities should ensure that all waste pickers have access to the PPE they need to avoid infection
	Distribution of personal hygiene items	Public authorities should ensure that all waste pickers have access to hand sanitizing products
	Food distribution	Food assistance, with the distribution of basic food baskets and food vouchers, should be considered for waste pickers
	Financial support	Financial support should be guaranteed to waste pickers during partial or total suspension of selective collection
Recommended actions to contain crowds	Social distancing guidelines	Workers should remain at least 1 meter apart in the workplace
	Reduction in the number of workers (rotation)	The number of workers working at the same time should be reduced to avoid crowds and reduce transmission
	Quarantine for symptomatic individuals	Symptomatic workers or those in contact with symptomatic workers should remain in isolation for 14 days
	Relocation of workers from vulnerable groups	Pregnant women, the elderly, those diagnosed with hypertension and diabetes, and other vulnerable groups should be kept away from in-person work to reduce the risk of infection.

Source: Research data



The recommendations were divided into five groups: (1) recommended actions for the population and/or companies; (2) recommended actions for public authorities; (3) recommended actions for workers' operational practice; (4) recommended actions of material support to workers and (5) recommended actions to contain crowds.

The recommended actions for the population and companies were designed to promote adequate waste management and were important for waste pickers to receive uncontaminated materials. The recommended actions for the public authorities served to establish that selective collection as an essential activity and to avoid its discontinuation. Public authorities also played a key role in developing regulations, providing funding and building partnerships to reach the needs of the category.

The recommended actions for workers' operational practice and to contain crowds were the most important for the operationalization of the selective collection activity. However, with the intensification of the health emergency and the possible reduction and/or suspension of collection, material support actions were crucial to ensure appropriate working and living conditions.

Table 4 shows the recommended actions from the eleven selected organizations. The organizations whose documents presented the highest number of recommendations were the United Nations Environment Programme (UNEP), with 23 of the 27 recommended actions; the International Solid Waste Association (ISWA), with 22 actions; the European Commission (EC), with 20 recommendations; the Asian Development Bank (ADB); and WIEGO (Women in Informal Employment: Globalizing and Organizing), with 18 recommendations. In this sense, UNEP was notable for developing a report that provided practical information, suggestions, and guidelines on Municipal Solid Waste Management (MSWM) during the pandemic, with a focus on developing countries, and a series of technical sheets on waste management to be adopted by all countries.

ISWA, as an organization focused on solid waste management, also produced a detailed document. However, the work of WIEGO is noteworthy for producing a series of informative guides directed to recycling associations and waste pickers in different countries, not just for waste management workers in general (Penteado; Castro, 2021).



Table 4: Categories for the management of recyclable waste during the COVID-19 pandemic recommended by different organizations in the world.

Categories	ADB	CCDC	EC	ILO	ISWA	OECD	OSHA	PAHO	UNEP	WHO	WIEGO	Total
Separation of non-infectious recyclable and infectious waste												8
Identification of contaminated waste bags												8
Simple guidelines for the population												4
Environmental education for the population to separate waste at home												5
Circular economy practices for homes and companies												4
Tax and income subsidies												1
Development of policies, legislation and regulations at the national and local levels												6
Partnership development and international cooperation												3
Total or partial interruption of selective collection during emergency periods												5
Sanitation works classification as an essential activity												6
Use of PPEs by waste pickers												9
Waste pickers training												11
Development of guidelines for waste management by waste pickers												6
Handwashing procedures												10
Sharing personal objects												5
Instructions for use and removal of masks												6
Ventilation of spaces												4
Surface disinfection												9
Waste quarantine												4
Distribution of PPEs to workers												4
Distribution of personal hygiene items												8
Food distribution												4
Financial support												3
Social distancing guidelines												9
Reduction in the number of workers (rotation)												3
Quarantine for symptomatic individuals												8
Relocation of workers from vulnerable groups												6

Source: Research data

Table 5 shows the categories in the documents produced by the countries in this study. Brazil was the country that produced official documents with the highest number of recommendations, identifying 25 of the 27 categories, followed by Argentina with 20 categories. India and Mexico had the fewest recommendations, with 15 and 13 categories identified, respectively.



Table 5: Categories for the management of recyclable waste during the COVID-19 pandemic recommended by different countries.

Categories	South Africa	Argentina	Brazil	India	Mexico	Turkey
Separation of non-infectious recyclable and infectious waste						
Identification of contaminated waste bags						
Simple guidelines for the population						
Environmental education for the population to separate waste at home						
Circular economy practices for homes and companies						
Tax and income subsidies						
Development of policies, legislation and regulations at the national and local levels						
Partnership development and international cooperation						
Total or partial interruption of selective collection during emergency periods						
Sanitation works classification as an essential activity						
Use of PPEs by waste pickers						
Waste pickers training						
Development of guidelines for waste management by waste pickers						
Handwashing procedures						
Sharing personal objects						
Instructions for use and removal of masks						
Ventilation of spaces						
Surface disinfection						
Waste quarantine						
Distribution of PPEs to workers						
Distribution of personal hygiene items						
Food distribution						
Financial support						
Social distancing guidelines						
Reduction in the number of workers (rotation)						
Quarantine for symptomatic individuals						
Relocation of workers from vulnerable groups						

Source: Research data

Circular economy practices were recommended in all countries except Brazil. Yuan et al. (2021) noted that it is the role of public authorities to ensure that the plastic waste generated at this time is properly collected, sorted, and disposed, with regulatory measures to reduce it. Virus transmission knowledge was essential for planning management practices from a circular economy perspective (Teymourian et al., 2021). Regarding the quarantine of potentially contaminated waste, Argentina recommended storing waste for 72 hours before collection (MINCYT et al., 2020). Mexico recommended a minimum quarantine period of 5 days before the waste was delivered to recycling associations (SMARN; SS; CNCT, 2020).

Regarding recommended actions for public authorities, no country proposed taxation and subsidies for recycling, although this recommendation came from a technical document produced by the International Labour Organization (ILO, 2020 b, c). Among the



recommendations for public authorities, the development of partnerships and international cooperation was considered by South Africa, Brazil and Turkey. In Brazil, the technical note prepared by the National Council of Public Prosecutors recommended cooperation and partnerships with reverse logistics and sanitation private companies to support and fund safety measures for waste pickers and maintain infrastructure (CNMP, 2020a). Gutberlet et al. (2023) showed that there was support from a range of organizations, including NGOs and private companies, with measures targeting waste pickers. Finally, only Brazil, in documents from ABRELPE (2020) and CNMP (2020a), explicitly stated that selective collection was an essential activity, although activities could be suspended with the intensification of the health emergency.

In terms of workers' operational practice, all countries recommended the use of PPE, worker training, handwashing and surface disinfection. The correct use of masks was a much-discussed measure during the pandemic, since most masks were reusable and could be contaminated during use, becoming a vector for infection (WHO, 2020 a, b). In this context, Argentina, Brazil, Mexico and Turkey issued recommendations on the correct use of masks (CNMP, 2020b; MINCYT et al., 2020; Ministry of Health, 2020; SMARN; SS; CNCT, 2020). The temporary storage of potentially infected waste was recommended for recycling centers in Argentina, Brazil and Mexico, with different instructions. In Argentina, it was recommended that recycling centers store waste for 72 hours before processing (MINCYT et al., 2020). In Brazil, it was recommended that waste be quarantined for more than 72 hours in a dry, covered, ventilated place, exposed to sunlight and away from workers (CNMP, 2020b). In Mexico, a 5-day quarantine was recommended for waste that had not been previously segregated at the source of generation (SMARN; SS; CNCT, 2020).

Among the measures to material support for workers, all countries recommended providing personal hygiene products such as soap and alcohol (CNMP, 2020b; CPCB, 2020 a, b; DEFF, 2020; MINCYT et al., 2020; Ministry of Health, 2020; NDH, 2020; SMARN; SS; CNCT, 2020). For PPE, only South Africa did not recommend providing it to workers (NDH, 2020). Food distribution was recommended by Brazil and Turkey (CNMP, 2020b; Ministry of Health, 2020). Financial support was recommended only by Brazil (ABES, 2020; CNMP, 2020b).

All countries except Mexico have recommended social distancing between workers. The World Health Organization (WHO) established a minimum distance of 1.5 meters between workers (WHO, 2020a). Brazil recommended the same distance and Argentina recommended



two meters (CNMP, 2020b; MINCYT et al., 2020). South Africa and Turkey did not specify a minimum distance between workers (DEFF, 2020; Ministry of Health, 2020). Turkey was the only country that did not recommend a 14-day quarantine for symptomatic workers (Ministry of Health, 2020). In Argentina and Brazil, elderly people (over 60 years), pregnant women, and people with a disease that puts them in a high-risk group should avoid the workplace (CNMP, 2020b; MINCYT et al., 2020). In India, workers over 50 should not work with potentially infected waste (CPCB, 2020 a, b).

The increase in cases and deaths motivated the adoption of measures such as reinforced isolation and quarantine, which could lead to the reduction or suspension of selective collection in many countries. As a result, measures to support waste pickers were fundamental. The importance of these policies was highlighted by Hartmann et al. (2021) and Moghaddam et al. (2023). However, when analyzing the policies targeted at waste pickers in each country, it is important to note that India and Turkey did not develop recommendations for waste pickers, but rather for health and sanitation workers in general (CPCB, 2020 a, b; IICPSD & UNDP, 2021; Ministry of Health, 2020).

In response to the non-mention of the category in the Indian guide, the Alliance of Indian Waste Pickers wrote a letter to the government. The letter began with the following criticism "The government requires us to wash our hands with soap, but doesn't give us access to clean water," referring to the country's sanitation problems. It then listed seven demands: the provision and training in the use of PPE; conditions for hand hygiene; the provision of a basic emergency income; the provision of personal hygiene products and food; the monitoring of the health of waste pickers; the guarantee of housing, sanitation and electricity; and compensation for deaths (AIW, 2020).

Kothari et al. (2021), in an article on the Indian waste management scenario, criticized the non-inclusion of waste pickers in the official government document. In Brazil and Argentina, the recommendation documents were developed in collaboration with national waste picker organizations - the National Movement of Waste Pickers (MNCR) and the Argentine Federation of Cartonners, Waste Pickers and Recyclers (FACCyR). This has probably increased the number of recommendations in favor of the category during this period (CNMP, 2020b; MINCYT et al., 2020).

Although Brazil had the highest number of recommendations among the countries in this study, it was the only country where governmental ministries or secretariats were not involved in the preparation of the documents. In all the countries studied, except Brazil, the



executive branch, represented by the ministries or secretariats of health, environment and science and technology, were authors or co-authors of the documents on recyclable waste management during the pandemic (Table 2). During the pandemic, it was the the National Council of Public Prosecutors that represented the Brazilian State in the development of a document on the recyclable waste management. In Brazil, in the absence of executive and legislative branches actions, the judiciary branch can act to guarantee the Fundamental Social Right to Health, in a mechanism known as judicial activism (Marques Júnior, 2020).

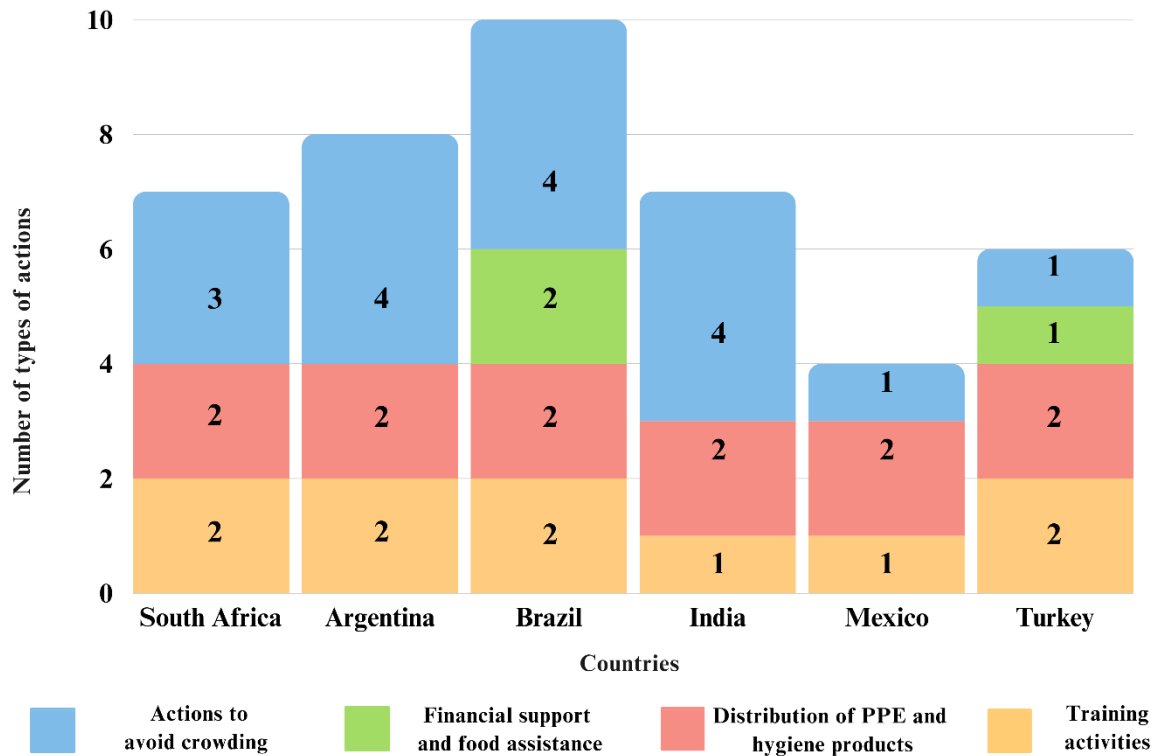
The denialist stance adopted by the head of the executive branch during the pandemic generated the need for judicial interference. The first Minister of Health in this period, Luiz Henrique Mandetta, took a public position in line with the policies established by the World Health Organization, which recommended isolation and quarantine. However, he was replaced about a month after the announcement of the pandemic, due to disagreements with the then President (Marques Júnior, 2020). His successor, Nelson Teich, left his position after 29 days because he didn't accept the Ministry of Health's recommendation for early medication treatment. Then, the General Eduardo Pazuello, who had no experience in public health, occupied the post for 10 months. Eduardo Pazuello openly supported the use of medications to "prevent" COVID-19, and caused delays in the negotiation of vaccines and in the intubation and oxygen kits distribution to hospitals (Teixeira; Santos, 2023). Given this situation, it was expected that the Brazilian executive would not be responsible for dealing with the issue of recyclable waste management.

The Graph 1 shows an analysis of the main recommended actions for waste pickers in each country. Two actions related to training (training and preparation of guides), two actions related to material distribution (distribution of PPE and personal hygiene items), two actions related to support (food distribution and financial support), and four actions to avoid crowds (distancing, reduction of staff, quarantine of symptomatics and relocation of vulnerable groups) were selected for that analysis. Brazil was the country that recommended all the actions identified in the documents from the international organizations and the only one that recommended financial support. Even among international organizations, the provision of food and financial support was recommended by few organizations (4 and 3 organizations, respectively). Although Brazil recommended financial support for waste pickers, the implementation of this practice was isolated in some Brazilian municipalities. For example, São Paulo was one of the few municipalities that provided financial assistance for three months (Azevedo et al., 2022).



Graph 1. Recommended actions for collectors in the management of recyclable waste during the COVID-19 pandemic.

Recommended actions for waste pickers in recyclable waste management during the COVID-19 pandemic



Source: Research data

4 Conclusion

The first waves of the COVID-19 pandemic represented a major challenge for solid waste management. Initially, several studies indicated that the virus could persist on the surface of a variety of materials for several hours or even days. In this sense, solid waste workers constituted a category vulnerable to infection due to the possibility of being contaminated by contact with materials containing active virus. The protection of this category was a priority, and for this reason, in application of the precautionary principle, the collection, sorting and recovery of recyclable waste were suspended in many countries, directly affecting the majority of waste pickers and recyclable materials cooperatives. In addition to the risk associated with the pandemic, waste pickers comprised a socially vulnerable group whose loss of income could lead the majority of the category to extreme poverty.



Transmission via fomites, through the surface-active viruses, was a concern in the first coronavirus prevention and control guidelines. By the end of 2020, new studies showed that airborne transmission should be the primary concern for disease control, although the possibility of transmission through fomites was not excluded.

International organizations played an essential role in global governance, contributing to the development of standards, procedures, trade, economic transactions, and humanitarian aid. As the COVID-19 pandemic advanced, these organizations began to produce technical documents related to waste management to limit the spread of infection from potentially contaminated objects.

For this study, eleven important organizations related to public health, labour, development, environment areas and fourteen documents with waste management and worker protection instructions in the COVID-19 Pandemic were selected. The international reference documents, although prepared by organizations from different sectors, were directed to health and sanitation workers in general during the COVID-19 pandemic. Six of the 11 organizations did not mention the name "waste pickers" or "recycling workers" in their official documents, highlighting the invisibility of the category.

The main recommended actions focused on education of the population to separate recyclables and identify contaminated waste bags, training of workers to wash their hands, use PPE and disinfect surfaces. The category invisibility on those documents was also evident in the lack of recommendations related to financial and food support. Only three organizations recommended financial support and four organizations recommended food distribution. The fundamental right to human dignity, adequate nutrition and labor were relegated to this group.

The United Nations Environment Programme (UNEP), the International Solid Waste Association (ISWA) and Women in Informal Employment: Globalizing and Organizing (WIEGO) were the organizations that most recommended actions targeted at waste management workers. On the other hand, UNEP, WIEGO, and the ILO were the organizations that recommended direct support for waste pickers. As these organizations focused on labor, waste management and sustainability issues, it was expected that they would take a holistic approach in their recommendations.

The recyclable waste management is even more complex in emerging economies, where economic growth is accompanied by high levels of waste generation and inadequate waste handling. For this reason, six countries classified by the International Monetary Fund as emerging economies - South Africa, Argentina, Brazil, India, Mexico and Turkey - were



selected and documents produced by government agencies and organizations related to public health, waste management and development were examined. South Africa, Argentina, Brazil and Mexico mentioned that the guidelines also were addressed to waste pickers. However, the recommended actions also focused on training and the provision of safe and healthy working conditions. Only Brazil made recommendations regarding financial and nutritional support for this category. However, this was possible because the group that organized the document, which was developed by the National Council of Public Prosecutors, included members of the National Movement of Waste Pickers (MNCR).

Although Brazil has surpassed other countries in the number and types of recommendations, it was the only country in the study in which the executive and legislative branches failed to formulate the public policies needed to maintain health during the pandemic. The Public Prosecutor had to play a leadership role due to the negligence of country's President at the time, who is known for his denialist stance. Additionally, the Brazilian Association of Sanitary and Environmental Engineering (ABES) and the Brazilian Association of Public Cleaning and Special Waste Companies (ABRELPE), non governmental organizations specializing in sanitation have contributed and continue to contribute to sanitation issues in the country, being pioneers in the development of guidelines for the recyclable waste management during the pandemic.

Among the 27 recommended actions to manage recyclable waste during the pandemic, 10 were considered essential for waste pickers, divided into four groups: training, material distribution for workers, containment of crowds, and financial/ food support. However, only Brazil recommended all types of measures. Regarding the containment of crowds, it was observed that the recommendation of distancing, quarantine of symptomatic individuals and relocation of vulnerable groups was not proposed by all countries, but only Brazil recommended all these measures. In case of new health emergencies, it is necessary to pay attention to these recommendations.

Finally, it is important to point out that the development of official recommendations is a first step in managing a public calamity, as during the COVID-19 pandemic. The recommendations should have been followed by public funding to provide the necessary support to waste pickers and enforcement actions during the pandemic. In India, for example, the recommendation to "wash hands" conflicted with the reality of lack of access to drinking water. In Brazil, São Paulo was one of the few municipalities to provide temporary financial



support to waste pickers. The federal government's support for waste pickers in Brazil was the same as for other workers.

5 Acknowledgments

The authors thank the Rio de Janeiro State Research Support Foundation (FAPERJ) that supported this research.

References

- AIW. ALLIANCE OF INDIAN WASTEPICKERS. **Waste-picker & informal waste collectors of India seek safety measures from Indian government to safeguard against COVID-19**. Destinatário: Shri Narendra Modi, Honourable Prime Minister of India. New Delhi, 23 mar. 2020. 1 carta. Retrieved from: <https://globalrec.org/2020/03/23/waste-picker-informal-waste-collectors-of-india-seek-safety-measures-from-indian-government-to-safeguard-against-covid-19/>.
- ADB. ASIAN DEVELOPMENT BANK. **Managing Infectious Medical Waste during the COVID-19 Pandemic**. Mandaluyong, Philipines: ADB, 2020. 2p. Retrieved from: <https://www.adb.org/publications/managing-medical-waste-covid19>.
- ADB. ASIAN DEVELOPMENT BANK. **Protecting the Safety and Well-Being of Workers and Communities from COVID-19**. Mandaluyong, Philipines: ADB, 2020. 9p. Retrieved from: <https://www.adb.org/publications/protecting-safety-and-well-being-workers-and-communities-covid-19>.
- ABES. ASSOCIAÇÃO BRASILEIRA DE ENGENHARIA SANITÁRIA E AMBIENTAL. **Recomendações para a gestão de resíduos em situação de pandemia por Coronavírus (COVID-19)**. Rio de janeiro, Brasil: ABES, 2020. 12p. Retrieved from: <https://abes-dn.org.br/coronavirus-e-gestao-de-residuos-baix-e-o-guia-de-recomendacoes-para-a-gestao-em-situacao-de-pandemia/>.
- ABRELPE. ASSOCIAÇÃO BRASILEIRA DE LIMPEZA PÚBLICA E RESÍDUOS ESPECIAIS. **Recomendações para a gestão de resíduos sólidos durante a pandemia de coronavírus (COVID-19)**. São Paulo, Brasil: ABRELPE, 2020. 5p. Retrieved from: <https://abrelpe.org.br/abrelpe-no-combate-a-covid-19/>.
- AZEVEDO, A. M. M.; GUTBERLET, J.; ARAÚJO, S. D.; DUARTE, F. H. Impactos da Covid-19 sobre catadores de materiais recicláveis organizados no Estado de São Paulo. **Ambiente & Sociedade**, São Paulo, v. 25, p. 1-23, 2022. DOI: <https://doi.org/10.1590/1809-4422asoc20210088r1vu2022L2OA>.
- BUI, T.; TSENG, J.; TSENG, M.; LIM, M. K. Opportunities and challenges for solid waste reuse and recycling in emerging economies: A hybrid analysis. **Resources, Conservation and Recycling**, v. 177, p. 1-19, 2022. DOI: <https://doi.org/10.1016/j.resconrec.2021.105968>.
- CCDC. CHINESE CENTER FOR DISEASE CONTROL AND PREVENTION. **Technical Guidelines for Disinfection of Special Sites for COVID-19**. Beijing, China: CCDC, 2020.



4p. Retrieved from:

<https://weekly.chinacdc.cn/fileCCDCW/journal/article/ccdcw/2020/19/PDF/Annex-4.pdf>.

CNMP. CONSELHO NACIONAL DO MINISTÉRIO PÚBLICO. **Nota Técnica N° 02/2020 – CMA, 15 de maio de 2020**. Nota Técnica referente à atuação dos membros do Ministério Público brasileiro para a prevenção da disseminação da COVID-19 na coleta seletiva e nas atividades exercidas pelas associações e cooperativas de catadores de materiais reutilizáveis e recicláveis. Brasília: CNMP, 2020. 11p. Retrieved from:

https://www.cnmp.mp.br/portal/images/Comissoes/CMA/Nota_t%C3%A9cnica_2-2020.Covid_e_Catadores.portal.pdf.

CNMP. CONSELHO NACIONAL DO MINISTÉRIO PÚBLICO. **Diretrizes técnicas e jurídicas para a coleta seletiva e triagem de materiais descartáveis durante a pandemia de COVID-19**. Brasília, CNMP, 2020. 92p. Retrieved from:

https://www.cnmp.mp.br/portal/images/noticias/2020/maio/26-05_DIRETRIZES_COLETA_SELETIVA_E_COVID_FINAL_1.pdf.

CPCB. Central Pollution Control Board. **Guidelines for Handling, Treatment and Disposal of Waste Generated during Treatment/Diagnosis/ Quarantine of COVID-19 Patients – Revision 2**. New Delhi, India, 2020. 8p. Retrieved from:

https://www.dpcc.delhigovt.nic.in/uploads/sitedata/Guidelines_WasteHandling_COVID19.pdf.

CPCB. Central Pollution Control Board. **Guidelines for Handling, Treatment and Disposal of Waste Generated during Treatment/Diagnosis/ Quarantine of COVID-19 Patients – Revision 4**. New Delhi, India, 2020. 11p. Retrieved from:

https://cpcb.nic.in/uploads/Projects/Bio-Medical-Waste/BMW-GUIDELINES-COVID_1.pdf

DEFF. Department of Environment, Forestry and Fisheries. **Disaster Management Act: Directions: Measures to address, prevent and combat the spread of Coronavirus COVID-19 in relation to recycling of waste**. Pretoria, South Africa, 2020. 8p. Retrieved from: https://www.gov.za/sites/default/files/gcis_document/202005/43325gon539.pdf.

DUTTAGUPTA, R.; PAZARBASIOGLU, C. Emerging markets must balance overcoming the pandemic, returning to more normal policies, and rebuilding their economies. **Finance & Development**, p. 5-9, jun. 2021. Retrieved from: <https://www.imf.org/external/pubs/ft/fandd/2021/06/pdf/the-future-of-emerging-markets-dutttagupta-and-pazarbasioглу.pdf>.

EC. EUROPEAN COMMISSION. **Waste management in the context of the coronavirus crisis**. Brussels, Belgium: EC, 2020. 5p. Retrieved from: <https://projects2014-2020.interregeurope.eu/smartwaste/news/news-article/8320/waste-management-in-the-context-of-covid-19-crisis/.pdf>.

GUTBERLET, J.; AZEVEDO, A. M. M.; MORAIS, L.; BACIC, M. J.; MESQUITA, M. S. Social movements in the context of crisis: waste picker organizations as collaborative public partners in the context of the COVID-19 pandemic. **Environment and Urbanization**, v. 35, n. 1, p. 255–274. 2023. DOI: <https://doi.org/10.1177/09562478221151110>.

HARTMANN, C; HEGEL, C.; BOAMPONG, O. The forgotten essential workers in the circular economy? Waste picker precarity and resilience amidst the COVID-19 pandemic. **Local Environment**, v. 27, n. 10-11, p. 1272-1286. 2022. Retrieved from:

<https://www.tandfonline.com/doi/abs/10.1080/13549839.2022.2040464>.



ILO. INTERNATIONAL LABOR ORGANIZATION. COVID-19 crisis and the informal economy. Immediate responses and policy challenges. **ILO Brief**, p. 1-9, mai. 2020.

Retrieved from:

https://www.ilo.org/wcmsp5/groups/public/@ed_protect/@protrav/@travail/documents/briefingnote/wcms_743623.pdf.

ILO. INTERNATIONAL LABOR ORGANIZATION. Social protection responses to the COVID-19 pandemic in developing countries: Strengthening resilience by building universal social protection. **ILO Brief**, p. 1-14, mai. 2020. Retrieved from:

https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---soc_sec/documents/publication/wcms_744612.pdf.

ILO. INTERNATIONAL LABOR ORGANIZATION. Extending social protection to informal workers in the COVID-19 crisis: country responses and policy considerations. **ILO Brief**, p. 1-10, set. 2020. 10p. Retrieved from: https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---soc_sec/documents/publication/wcms_754731.pdf.

IMF. INTERNATIONAL MONETARY FUND. **Fiscal Monitor: Strengthening the Credibility of Public Finances**. Washington, D.C., USA: IMF, out. 2021. 114p. Retrieved from: <https://www.imf.org/en/Publications/FM/Issues/2021/10/13/fiscal-monitor-october-2021>.

ISWA. INTERNATIONAL SOLID WASTE ASSOCIATION. **Waste Management during the Covid-19 pandemic ISWA's recommendations**. Rotterdam, Netherlands: ISWA, 2020. 12p. Retrieved from:

https://www.humanitarianlibrary.org/sites/default/files/2020/07/ISWA_Waste_Management_During_COVID-19.pdf.

IICPSD. ISTANBUL INTERNATIONAL CENTRE FOR PRIVATE SECTOR IN DEVELOPMENT; UNDP. UNITED NATIONS DEVELOPMENT PROGRAMME. **COVID-19 Response and Recovery Medical Waste Ecosystem in Turkey During COVID-19**. Turkey: UNDP, 2021. 12p. Retrieved from: <https://www.undp.org/policy-centre/istanbul/publications/covid-19-response-and-recovery-medical-waste-ecosystem-turkey-during-covid-19#>.

KOTHARI, R.; SAHAB, S.; SINGH, H. M.; SINGH, R. P.; SINGH, B.; PATHANIA, D.; SINGH, A.; YADAV, S.; ALLEN, T.; SINGH, S.; TYAGI, V. V. COVID-19 and waste management in Indian scenario: challenges and possible solutions. **Environmental Science and Pollution Research**, v. 28, n. 38, p. 52702–52723. 2021. DOI: <https://doi.org/10.1007/s11356-021-15028-5>.

KULKARNI, B. N.; ANANTHARAMA, V. Repercussions of COVID-19 pandemic on municipal solid waste management: Challenges and opportunities. **Science of The Total Environment**, v. 743, [s. n.], p. 1-8. 2020. Retrieved from: <https://www.sciencedirect.com/science/article/pii/S0048969720342157>.

LUHAR, I.; LUHAR, S.; ABDULLAH, M. M. A. B. Challenges and Impacts of COVID-19 Pandemic on Global Waste Management Systems: A Review. **Journal of Composites Science**, v. 6, n. 9. p. 1-30. 2022. DOI: <https://doi.org/10.3390/jcs6090271>.

MARQUES JÚNIOR, W. P. Modulação de políticas públicas sanitárias do Poder Executivo pelo Supremo Tribunal Federal no contexto do quadro pandêmico causado pelo coronavírus (covid-19): enfrentamento de paradoxos. **Revista de Direitos Sociais, Seguridade e**



Previdência Social, v. 6, n. 1, p. 76-100. 2020. DOI:

<http://dx.doi.org/10.26668/IndexLawJournals/2525-9865/2020.v6i1.6617>.

MINCYT. MINISTERIO DE CIENCIA, TECNOLOGÍA E INNOVACIÓN; MAYDS. MINISTERIO DE AMBIENTE Y DESARROLLO SOSTENIBLE; MINSAL. MINISTERIO DE SALUD; CONICET. CONSEJO NACIONAL DE INVESTIGACIONES CIENTÍFICAS Y TÉCNICAS; FACCYR. FEDERACIÓN ARGENTINA DE CARTONEROS, CARREROS Y RECICLADORES. **Recomendaciones para la gestión de residuos reciclables en contexto de COVID-19**. Buenos Aires, Argentina: Argentina Presidencia, 2020. 20p. Retrieved from: <https://bancos.salud.gob.ar/recurso/recomendaciones-para-la-gestion-de-residuos-reciclables-en-contexto-de-covid-19>.

MINISTRY OF HEALTH. **Turkey emergency COVID-19 health project (P173988)**.

Environmental and social management framework. Ankara, Turkey: Ministry of Health, abr. 2021. 97p. Retrieved from:

<https://documents1.worldbank.org/curated/en/791661619146168857/pdf/Environmental-and-Social-Management-Framework-ESMF-Turkey-Emergency-COVID-19-Health-Project-P173988.pdf>.

MOGHADDAM, V. K.; WALKER, T. R.; PAKDEL, M.; AHMADINEJAD, P.; MOHAMMADI, A. A. Waste Workers and Pickers: Neglected Highrisk Groups in Developing Countries During the COVID-19 Pandemic. **Journal of Health Sciences & Surveillance System**, v. 11, n. 1. p. 252-259. 2023. Retrieved from: <https://doi.org/10.30476/jhsss.2021.93040.1410>.

NDH. NATIONAL DEPARTMENT OF HEALTH. **COVID-19: Environmental Health Guidelines**. Pretoria, South África: NDH, 2020. 7p. Retrieved from:

<https://j9z5g3w2.stackpathcdn.com/wp-content/uploads/2020/04/COVID-19-ENVIRONMENTAL-HEALTH-GUIDELINE-1-3.pdf>.

OLIVEIRA, M. C. V.; KLAFKE, R.; CHAERKI, S. F. The Challenge of Urban Solid Waste Management in Brazil. **Economía, Sociedad y Territorio**, v. 22, n. 68, p. 177-206, abr. 2022. DOI: <https://doi.org/10.22136/est20221738>.

OSHA. UNITED STATES OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION. **Solid Waste and Wastewater Management Workers and Employers**. Washington, D.C., USA: OSHA, 2020. 2p. Retrieved from:

<https://www.osha.gov/coronavirus/control-prevention/solid-waste-wastewatermgmt>.

OECD. ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT. Environmental health and strengthening resilience to pandemics. **Browse OECD Contributions**, p. 1-14, abr. 2020. Retrieved from: https://read.oecd-ilibrary.org/view/?ref=129_129937-jm4ul2jun9&title=Environmental-health-and-strengthening-resilience-to-pandemics.

PAHO. PAN AMERICAN HEALTH ORGANIZATION. **Recommendations for the Management of Solid Waste**. Washington, D.C.: PAHO, 2020. 4p. Retrieved from:

<https://www.paho.org/en/documents/recommendations-management-solid-waste>.

PENTEADO, C. S. G; CASTRO, M. A. S. Covid-19 effects on municipal solid waste management: What can effectively be done in the Brazilian scenario? **Resources, Conservation and Recycling**, v. 164, [s. n.], p. 1-9. 2021. DOI:

<https://doi.org/10.1016/j.resconrec.2020.105152>.



PROTÁSIO, J. R. **Impactos da pandemia da Covid-19 da gestão de resíduos recicláveis nos municípios de Belo Horizonte (MG), Curitiba (PR) e São Paulo (SP)**. 2022. 103 p. Dissertation (Master at Urban Engineering) - Universidade Federal De São Carlos, São Paulo. Retrieved from: <https://repositorio.ufscar.br/handle/ufscar/16622>.

SMARN. SECRETARÍA DE MEDIO AMBIENTE Y RECURSOS NATURALES; SS. SECRETARÍA DE SALUD; CNCT. CONSEJO NACIONAL DE CIENCIA Y TECNOLOGÍA. **Cartilla de Mejores Prácticas para la Prevención del COVID-19 en el Manejo de los Residuos Sólidos Urbanos (RSU)**. Primera edición. Ciudad de México, México: SMARN, abr. 2020. 20 p. Retrieved from: https://www.gob.mx/cms/uploads/attachment/file/545891/Cartilla_de_Mejores_Practicas_para_la_Prevencion_del_COVID-19.pdf.

TEIXEIRA, C. F.; SANTOS, J. S. Análise estratégica da atuação do governo federal brasileiro na pandemia de COVID-19: 2020-2021. **Ciência & Saúde Coletiva**, v. 28, p. 1277-1286. 2023. DOI: <https://doi.org/10.1590/1413-81232023285.10502022>.

UNEP. UNITED NATIONS ENVIRONMENTAL PROGRAMME. **COVID-19 Waste management Factsheets**. 2020. Retrieved from: <https://www.unep.org/resources/factsheet/covid-19-waste-management-factsheets>.

TEYMOURIAN, T.; TEYMOORIAN, T.; KOWSARI, E.; RAMAKRISHNA, S. Challenges, Strategies, and Recommendations for the Huge Surge in Plastic and Medical Waste during the Global COVID-19 Pandemic with Circular Economy Approach. **Materials Circular Economy**, v. 3, n. 6., p. 1-14. 2021. DOI: <https://doi.org/10.1007/s42824-021-00020-8>

UNEP. UNITED NATIONS ENVIRONMENTAL PROGRAMME. **Waste Management during the COVID-19 Pandemic From Response to Recovery**. Nairobi, Kenya: UNEP, 2020. 60p. Retrieved from: <https://wedocs.unep.org/bitstream/handle/20.500.11822/33416/WMC-19.pdf?sequence=1&isAllowed=y>.

WHO. WORLD HEALTH ORGANIZATION. **Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19: interim guidance**. Geneva, Switzerland: WHO, 2020. 11p. Retrieved from: <https://apps.who.int/iris/handle/10665/333560>.

WIEGO. WOMEN IN INFORMAL EMPLOYMENT: GLOBALIZING AND ORGANIZING. **Recommendations for the prevention of the spread of Coronavirus disease (COVID-19) among solid waste workers**. Manchester, United Kingdom, 2020. 4p. Retrieved from: https://www.wiego.org/sites/default/files/resources/file/COVID-19_Technical_Note_Waste_Pickers_WIEGO_2020_web.pdf.

YUAN, X.; WANG, X.; SARKAR, B.; SIK OK, Y. The COVID-19 pandemic necessitates a shift to a plastic circular economy. **Nature Reviews Earth & Environment**, v. 2, [s. n.], p. 659–660. 2021. Retrieved from: <https://doi.org/10.1038/s43017-021-00223-2>.