Bibliometric analysis of actions in waste pickers' organizations during the Covid-19 pandemic

Claudenice Paulino da Silva
Discente, Universidade Federal de Pernambuco
tecclaudenice@hotmail.com

Maurício Motta Sobrinho
Professor Doutor, UFPE, Brasil
mauricio.motta@ufpe.br

Rodrigo Cândido Passos
Professor Doutor, UFPA, Brasil
rcpassos13@gmail.com

Flávio Leôncio Guedes
Discente, Universidade Federal de Pernambuco
f_l_guedes@hotmail.com

Análise bibliométrica das ações em organizações de catadores de resíduos durante a pandemia da Covid-19

RESUMO

Em dezembro de 2019, o alerta de um vírus contagioso (o coronavírus), na província de Hubei, China, trouxe inúmeros desafios para a população mundial. A doença nomeada de SARS-COV-2 ou Covid-19, se espalhou, gradativamente, por toda a população do globo, sendo o vírus transmitido, principalmente, entre seres humanos, por meio de gotículas respiratórias, vias de contato, entre outros. A principal maneira de proteção contra o vírus é através do uso de máscaras respiratórias, na maioria descartáveis, o que exigiu novas medidas e ações para o setor da reciclagem e para o manuseio dos resíduos das organizações de catadores. Este artigo analisa a produção científica de protocolos e ações direcionadas às organizações de catadores de materiais recicláveis para enfrentamento à pandemia da Covid-19. O estudo utilizou o método de análise bibliométrica, com auxílio do software livre R Studio – pacote Bibliometrix. O mapeamento dos artigos científicos ocorreu por meio do método Prima em quatro etapas: Identificação, Seleção, Elegibilidade e Inclusão. Os resultados apresentaram 21 artigos, sendo oito publicados em 2021. A pesquisa constatou que 38,09% das publicações possuem relação direta com a temática com base na consulta do título e nas palavras-chave. O percentual restante foi relacionado à gestão de resíduos, aos catadores de materiais recicláveis e às comunidades vulneráveis. Por fim, a análise sistemática indicou nenhuma publicação sobre protocolos e ações de enfretamento à Covid-19 em organizações de catadores no período do estudo.

PALAVRAS-CHAVE: Catadores. Resíduos. COVID-19.

Bibliometric analysis of actions in waste pickers' organizations during the Covid-19 pandemic

ABSTRACT

In December 2019, the warning of a contagious virus (coronavirus) in Hubei province, China, brought numerous challenges to the world's population. The disease SARS-COV-2, or COVID-19, spread gradually throughout the globe, being the virus transmitted mainly between humans through respiratory droplets and contact routes, among others. The primary way to protect against the virus is through using respiratory masks, mostly disposable, which require new measures and actions for the recycling sector and waste management of waste organizations. This article analyzes the scientific production of protocols and actions directed to organizations of waste pickers to cope with the COVID-19 pandemic. The study used the bibliometric analysis method with the help of the free software R Studio - Bibliometrix package. The mapping of scientific articles was performed through the Prima method in four steps: Identification, Selection, Eligibility, and Inclusion. The results presented 21 articles, of which eight were published in 2021. The survey found that 38.09% of publications directly relate to the theme based on the title query and keywords. The remaining percentage was related to waste management, pickers, and vulnerable communities. Finally, the systematic analysis indicated no publication on protocols and actions to combat COVID-19 in waste pickers' organizations during the study period.

KEYWORDS: Waste pickers. Waste. COVID-19.

Análisis bibliométrico de las acciones en organizaciones de recolectores de residuos durante la pandemia de Covid-19

RESUMEN

En diciembre de 2019, la alerta sobre un virus contagioso (el coronavirus) en la provincia de Hubei, China, planteó numerosos desafíos para la población mundial. La enfermedad, denominada SARS-COV-2 o Covid-19, se propagó gradualmente por toda la población global, siendo el virus transmitido principalmente entre seres humanos a través de gotículas respiratorias, vías de contacto, entre otros. La principal forma de protección contra el virus es el uso de mascarillas respiratorias, en su mayoría desechables, lo que exigió nuevas medidas y acciones para el sector de reciclaje y para el manejo de residuos en las organizaciones de recolectores. Este artículo analiza la producción científica de protocolos y acciones dirigidas a las organizaciones de recolectores de materiales reciclables para enfrentar la pandemia de Covid-19. El estudio empleó el método de análisis bibliométrico, con el apoyo del software libre R Studio – paquete Bibliometrix. El mapeo de los artículos científicos se realizó mediante el método PRISMA en cuatro etapas: Identificación, Selección, Elegibilidad e Inclusión. Los resultados presentaron 21 artículos, de los cuales ocho fueron publicados en 2021. La investigación constató que el 38,09% de las publicaciones tienen relación directa con la temática basada en la consulta del título y las palabras clave. El porcentaje restante se relacionó con la gestión de residuos, los recolectores de materiales reciclables y las comunidades vulnerables.

Finalmente, el análisis sistemático indicó que no se encontraron publicaciones sobre protocolos y acciones de enfrentamiento a la Covid-19 en organizaciones de recolectores durante el período del estudio.

PALABRAS CLAVE: Recolectores. Residuos. COVID-19.

1. INTRODUCTION

In December 2019, the warning about a contagious virus, the coronavirus, represented a significant challenge for the population and government entities worldwide. According to Pereira et al. (2020), by mid-May 2020, about 4.3 million people had been infected with Coronavirus or SARS-CoV-2 (ICRC, 2020)), with a balance of approximately 300,000 people killed.

The COVID-19 pandemic has brought a challenge that can be even greater than existing ones concerning solid waste handling due to virus contamination. This factor increases waste collection, sorting, and final disposal risk, representing a higher biological risk for recyclable material collectors and waste sorting operators in recycling cooperatives. The situation requires changes in workers' behavior in direct contact with waste contaminated by the COVID-19 virus, as well as implementation of public policies, not to mention support for workers in this field.
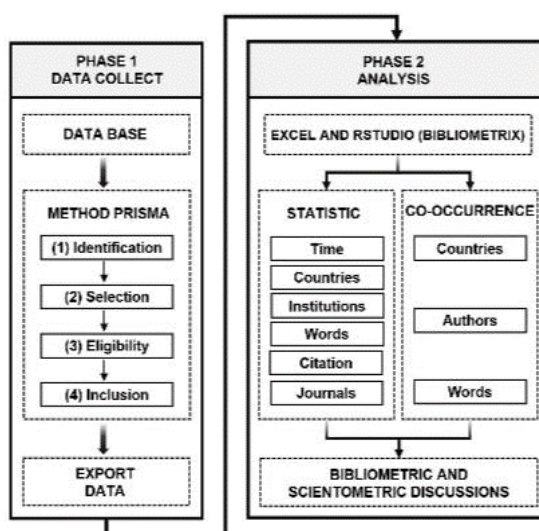
According to Rossi (2019), the amendment of the Sanitation Law (2007) and the approval of the National Solid Waste Policy (2010) included waste pickers in federal regulatory frameworks. However, solid waste management remains a challenge for Brazil, which has a deficit in the selective collection. Although waste separation occurs in some homes (condominiums), many municipalities lack sorting facilities or associated recycling cooperatives to ensure separate waste recycling.

This article presents a qualitative/quantitative analysis of research related to protocols and actions for coping with COVID-19 in the management of solid waste in waste pickers associations worldwide, using bibliometric analysis as a tool.

2. METHODOLOGY

The research is descriptive and quantitative; therefore, bibliometric methods were used to analyze the scientific production of actions to address waste pickers' organizations during the COVID-19 pandemic. The research was conducted in two stages: data collection and analysis (Figure 1).

Figure 1. Flowchart of bibliometric analysis

Source: Own elaboration, 2023.

2.1 Data Collection

To analyze bibliometric indicators, a search was conducted for scientific articles published on guiding actions in waste pickers' organizations during the COVID-19 pandemic. The aim was to investigate how the scientific community is addressing these issues. Data was collected in the first week of July 2023, covering publications from December 2019 to July 2023.

For data collection, the Scopus database was used, which, according to De Paula et al. (2017), is considered one of the largest databases of citations and abstracts of peer-reviewed scientific literature. It offers tools to track, analyze, and visualize research from various knowledge areas, providing a broad view of what is being published worldwide.

The Scopus platform annually encompasses a more significant number of bibliographic records, totaling more than 55 million records dating back to 1823, representing a consistent global source of scientific information (Mongeon & Paul-Hus, 2015).

The research was delimited through the systematization of four stages: Identification, Selection, Eligibility, and Inclusion, defined by the methodology known as Main Items to Report Systematic Reviews and Meta-analyses—PRISMA (Moher et al., 2010). According to Pacheco et al. (2018), PRISMA is widely used to analyze published studies in various segments of science.

During the Identification stage, a search was conducted on the Scopus platform using Title – Abstract – Keywords, simultaneously applying the terms "Waste" and "pickers" and "COVID-19" to achieve a broader scope of studies related to actions in waste pickers' organizations. Subsequently, in the Selection stage, the following filters were applied: spatiotemporal (December 2019 to July 2023), periodical (scientific journals), scientific kind of production (research article), and language of the manuscript (English). Following this, during the Eligibility stage, titles and abstracts of articles were read to screen works directly related to the addressed theme. Finally, in the Inclusion stage, the articles were read in full, focusing solely on research relevant to the present study. Subsequently, the data containing information about the articles was exported in .bib format, which is readable by bibliometrics software, into xls format.

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2.2 Analysis

The bibliometric data of the scientific articles selected from the application of the systematization of the PRISMA methodology were used by Aragão Júnior and Oliveira Júnior (2021), who studied Internet of Things in solid waste management: systematic review with bibliometric analysis of the literature. Almeida, Guedes, Jucá, and Motta (2023) also used this methodology to analyze the scientific production of bioindicators in sanitary landfills through bibliometric indicators. According to Riera, Abreu, and Ciconelli (2013), the first meta-analysis was published in 1904, and at the end of the 1980s when systematic reviews and meta-analyses became relevant for health. Subsequently, they were exported and inserted in the data processing and bibliometric analysis stages of the collected data. Thus, the bibliometric survey was carried out with the help of the free software R Studio - Bibliometrix package, version (RStudio Desktop 1.4.1717). According to Geng et al. (2017),

this methodology is recognized as an established research mechanism in the area of information science, using analysis by quantitative, qualitative, and statistical methods to examine information from a data set.

Subsequently, the following steps were adopted: data processing and quantitative and textual/qualitative analysis. The procedure was possible due to the choice of a public-access database platform compatible with the algorithm used in the analysis and the decision to use R software. This open-source program offers greater flexibility in creating scripts and performing analyses, allowing the development of customized algorithms according to the study's objectives.
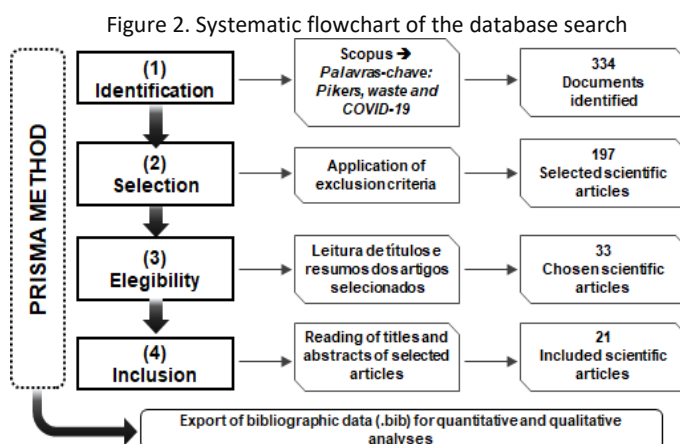
Thus, the Bibliometrix package was used in R Studio to analyze the collected data. Bibliometrix is a package developed specifically for R software. It automates the workflow and provides a wide set of quantitative tools for performing bibliometric analysis, which facilitates the construction of data through the graphs and images obtained.

After the data processing, graphs and tables were prepared with the aim of explaining the results and verifying whether the research addressing the topic presented data related to protocols and actions to combat COVID-19 for solid waste collectors. Addressing the temporal evolution of the publications, the distribution by countries and institutions, the dissemination of the topic under study, and the methodologies applied by the authors of the published articles.

3. RESULTS AND DISCUSSIONS

3.1 Search in the Database

Using the Scopus database and applying the PRISMA methodology (Figure 2), 334 publications were identified in the first stage (identification), of which 58.98% were selected in the second stage. After the publication's location, in the second stage (selection), the exclusion criteria of the initial sample were applied through filters, keeping only scientific articles of research published in English-language journals. Thus, the sample was reduced to 197 articles.

Figure 2. Systematic flowchart of the database search

Source: own elaboration, 2023.

After reading the titles and abstracts of the articles selected in the previous stage, there was
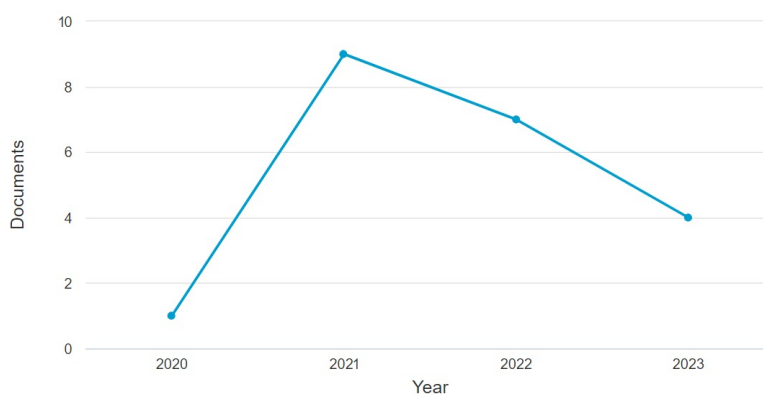
also, in the third stage (eligibility), a result of ineligibility of 83.24% of the scientific articles for not addressing the issues investigated in this study. Thus, the research continued, presenting a sample of 16.76% of the articles about the previous stage. Then, in the fourth stage (inclusion), 36.36% of the materials were removed after reading the articles because they were outside the central thematic axis of this research. Therefore, 63.63% of the scientific articles were included for analysis of scientific production, exporting the data in the formats (.Bib and .xls) read by Bibliometry software.

3.2 Temporal Evolution of Publications

(Chart 1) The number of publications related to the theme increased from 2019 to 2023. However, upward production behavior was noted from 2019 to 2020 and downward from 2021 to 2023. Among the articles obtained for 2020, 1 publication related to the research theme was found, which may reflect the lack of immediate management of solid waste recycling issues worldwide.

On the other hand, the increase in publications from 2021 indicates a strong potential, 8 (eight), corresponding to 38.09% of total publications, and can be associated with the year of the highest peak of the COVID-19 pandemic. One can also consider the low initial number of publications on the subject, with the time required to conduct the research until its publication. Regarding the year 2022, the number of publications addressing the theme was reduced to 7 (seven), while in 2023, 4 (four) publications were found, considering the fact possibly related to the decrease in cases of the virus in the world.

Figure 1. Evolution of the number of publications over the years from 2020 to 2023

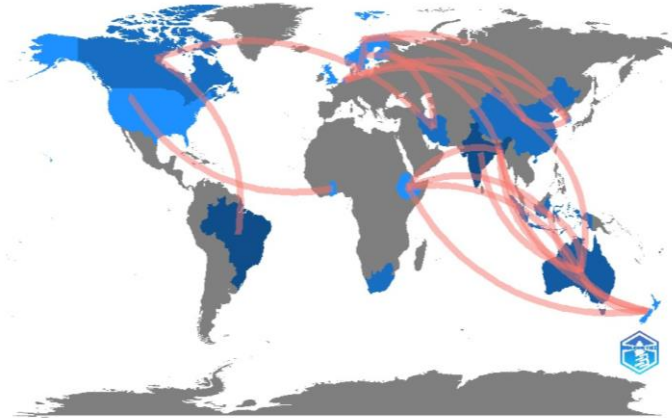Source: Self-made, 2023.

3.3 Distribution of Publications

Publications were concentrated in developing countries, represented by Brazil, Indonesia, Iran, Vietnam, China, and India, which accounted for 65% of the total. In the developed countries, the Netherlands and Australia, the percentage corresponds to 25% of the total, emphasizing Australia representing 50% of the publications (Figure 3). The study identified the remaining percentages in South Africa, an underdeveloped country.

According to the Brazilian Association of Public Cleaning and Special Waste Companies (ABRELPE, 2022), most of the collected MSW (61%) continues to be sent to landfills, with 46.4 million tons of environmentally suitable destinations in 2022. On the other hand, areas of inadequate disposal,

including dumps and controlled landfills, are still in operation in all regions of the country, receiving 39% of the total waste collected, which reaches 29.7 million tons with inadequate destinations.

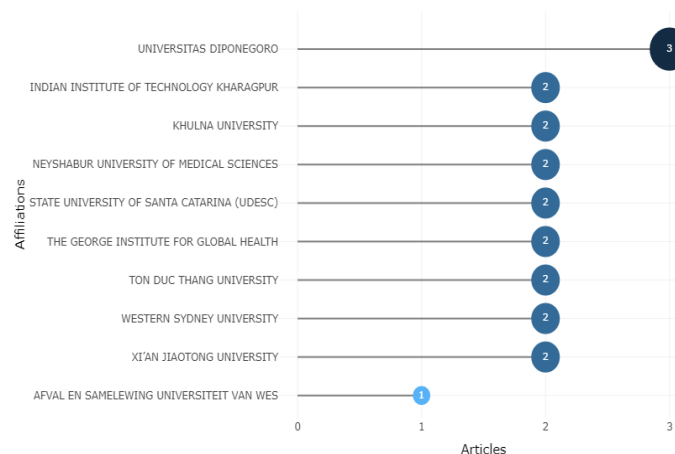Figure 3. Central countries with publications on the topic

Source: Own elaboration, 2023.

Regarding publications, the institution that most publicized the theme was the Diponegoro University in Indonesia, with 3 (three) placements (Figure 4). According to Putri 2020, Indonesia is the largest archipelago in the world, with a population of more than 240 million inhabitants and a low-middle-income economy. With the COVID-19 pandemic, Indonesia has felt the economic impacts strongly due to the continued increase in cases.

The other institutions launched between 1 (one) or 2 (two) articles. There were 2 publications by Brazilian institutions, made by the State University of Santa Catarina (UDSC).

Figure 4. Analysis of institutions with the highest numbers of citations.
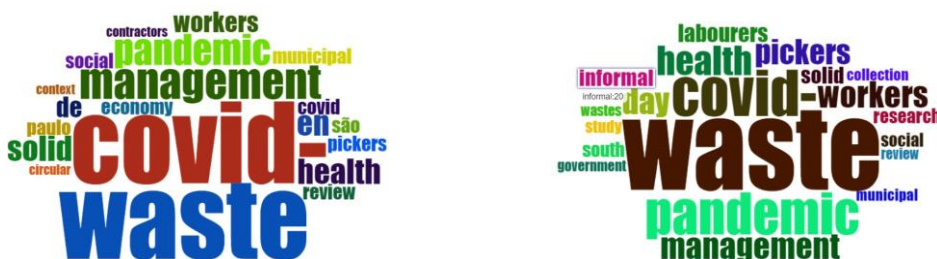

Source: Own elaboration, 2023.

3.4 Word Frequency

With the word cloud method, it is possible to obtain an indicator of the grouping and organization of the terms according to their frequency in the titles, abstracts, and keywords of the

articles published in the adopted period. The most frequent words were COVID and Waste (a), which are associated with the pandemic and waste (Figures 6 (a) and (b).

Figure 6. Word cloud formed from (a) titles and (b) abstracts.

Source: own elaboration, 2023.

3.5 Thematic Focus and Methodology of Publications

A systematic review of articles and publications related to bibliometric research was conducted, presenting authors, research titles, thematic focus, and methodology used for each of the 21 articles selected through the applied method, as shown in Table 1:

Panel 1: Articles obtained through systematic literature review after exclusion criteria

AUTORES	TÍTULO DA PESQUISA	ENFOQUE TEMÁTICO	METODOLOGIA UTILIZADA
Gutberlet et.al. (2023)	Social Movements in the context of crisis: waste picker organizations as collaborative public partners in the context of the COVID-19 pandemic	Public Policies	This field report adopts a qualitative approach to answering the research question: How has the work of waste pickers' organizations (WPOs) in the São Paulo metropolitan region been affected by the COVID-19 pandemic? What were the main challenges in this regard? What actions were implemented by different actors to deal with the situation?

AUTORES	TÍTULO DA PESQUISA	ENFOQUE TEMÁTICO	METODOLOGIA UTILIZADA
Barzoki & Abbasi (2022)	Political Psychological and Sociocultural Determinants of Compliance with COVID-19 Emergency Measures Among Waste Pickers in an Iranian Sub-urban Slum Community	Public Policies	This study employed a quasi-experimental design with pre- and post-COVID-19 test measures and included experimental and control groups. The target population for this study included all first-year female high school students in Selseleh County, Lorestan Province, Iran, during the academic year 2017-2018. Two out of four districts in the city were randomly selected, and then three high schools were chosen in each of these districts. Within each high school, two classrooms were randomly chosen. In total, 190 students were randomly selected based on an alphabetical list.
Jie Han et al. (2022)	Municipal solid waste, an overlooked route of transmission for the severe acute respiratory syndrome coronavirus 2: A review	Environmental Management	In this review, we provide a retrospective analysis of municipal solid waste management challenges, policies, and practices during the current pandemic and also examine recent case reports on the transmission of the 2019 Coronavirus disease (COVID-19) by municipal solid waste. We found abrupt changes in the amount and composition of municipal solid waste during COVID-19.
Kazemi et al. (2023)	The Effect of Cognitive-behavioral Therapy on Communication Skills and Eating Disorders among Adolescents with Eating Disorders	Public Health	It used a quasi-experimental design consisting of a pre-test and post-test in experimental and control groups. A total of 40 students were selected and randomly assigned to the experimental (n=20) and control (n=20) groups through a multi-stage cluster sampling method. Cognitive-behavioral therapy was conducted in nine 60-minute sessions for the experimental group, while the control group received no intervention. The Queendom Communication Skills Inventory (2004) and the Garner Eating Disorder Inventory (Garner, 1979) were used to collect data. All statistical analyses were performed using SPSS 24.0 for Windows (SPSS Inc.), and $P<0.05$ was considered statistically significant.
Do Nascimento e Barros (2020)	Waste management, COVID-19 and occupational safety and health: Challenges, insights, and evidence.	Public Policies	From March 2020 to March 2021, the Pearson correlation coefficient (r) was used to analyze the correlation between the number of COVID-19 cases among solid waste collectors in the city of São Paulo. The study considered the sub-districts where COVID-19 patients reside and the routes of solid waste collectors. The results indicate a positive and moderate correlation ($r = 0.59$) between the total number of COVID-19 cases and the garbage collection routes and the number of workers infected with COVID-19 on their garbage collection routes.

AUTORES	TÍTULO DA PESQUISA	ENFOQUE TEMÁTICO	METODOLOGIA UTILIZADA
Huda et al. (2022)	Medical waste management-related factors affecting health and experiences of health risks among medical waste handlers in low and middle-income countries: a systematic review protocol of qualitative studies	Public Health	This systematic review was proposed in this research to provide a comprehensive synthesis of evidence on factors related to Medical Waste Management (MWM) at the individual, system, and policy levels that affect the health of Medical Waste Handlers (MWHs) and their health risk experiences in Low and Middle-Income Countries (LMICs). Seven specific electronic databases will be searched, including Scopus, Ovid MEDLINE, EMBASE, Global Health, CINAHL, ProQuest, and PsycINFO.
Budihardjo et al. (2022)	Indonesian efforts to overcome covid-19's effects on its municipal solid waste management: a review	Environmental Management	The study searched relevant literature on websites such as Scopus and Google Scholar. The literature used in this study was published from 2014 to 2021 in English or Indonesian. Data were also collected from local government websites, Indonesian waste authorities, and news sources, primarily in the Indonesian language. The data included the amount of waste generated, waste composition, the current state of municipal waste management, and issues related to municipal waste management during pandemic conditions in the six most populous cities in Indonesia, namely Jakarta, Bandung, Surabaya, Semarang, Denpasar, and Medan.
Azevedo et. al. (2022)	Impacts of COVID-19 on organized waste pickers in selected municipalities in the State of São Paulo.	Environmental Management	The case study employed a qualitative approach grounded in participatory research developed by an interdisciplinary team. The studied groups showcase the diversity of waste pickers organized in the state of São Paulo in terms of group size (10 or fewer and over 128 members), infrastructure (with or without access to equipment and trucks), size of municipalities (between 17 thousand and 12.2 million inhabitants), level of support received, and participation in waste pickers' networks. The perspective of waste pickers was adopted through direct contact (phone) or online (social media) without consulting the government, companies, or civil society organizations. The actions of these actors were revealed through literature research, documentary analysis, and interviews with waste pickers' representatives.

AUTORES	TÍTULO DA PESQUISA	ENFOQUE TEMÁTICO	METODOLOGIA UTILIZADA
Hartmann; Hegel & Boampong (2022)	The forgotten essential workers in the circular economy? Waste picker precarity and resilience amidst the COVID-19 pandemic	Public Policies	The study was designed by WIEGO (Women in Informal Economy: Globalizing and Organizing) to assess the socioeconomic impacts of the COVID-19 pandemic and associated lockdowns on waste pickers globally. Additionally, the study investigated the occupational health challenges faced by waste pickers and the responses from local governments and non-governmental organizations. Between June and July 2020, local research teams interviewed 499 waste pickers in nine cities across eight countries.
Dey; Chatterjee (2022)	Covid Waste Management Using IoT: A Smart Framework	Environmental Management	An intelligent framework based on the Internet of Things (IoT) was presented for managing COVID-19 waste. Two types of intelligent bins were proposed for COVID-19 waste: one for collecting waste from isolated patients at home and another for COVID-19 medical waste generated in hospitals/nursing homes, et al. These intelligent bins can automatically capture waste information through attached sensors. The collected data is wirelessly transmitted to the municipality's remote server for further analysis.
Haque et al. (2022)	Mental health Status of informal waste workers during the COVID-19 pandemic in Bangladesh	Public Health	This study was a secondary analysis of data from a study titled 'Immediate Impact of Coronavirus on Waste Workers in 10 Municipal Corporations in Bangladesh,' a cross-sectional study conducted among informal waste workers in nine municipalities across eight administrative districts: Cumilla, Magura, Meherpur, Rajbari, Faridpur, Bagerhat, Barguna, Satkhira, and one Municipal Corporation in the Gazipur district, Bangladesh.
Sharma et al. (2021)	The circular economy approach in solid waste management system to achieve UN-SDGs: Solutions for post-COVID recovery	Environmental Management	The article investigated the impact of COVID-19 on the progress of the SDGs and offered insights into how a green recovery stimulus driven by a circular economy (CE) based on solid waste management (SWM) can assist in achieving the intended goals of the UN SDGs.

AUTORES	TÍTULO DA PESQUISA	ENFOQUE TEMÁTICO	METODOLOGIA UTILIZADA
Blaauw, Yu e Schenck (2021)	COVID-19 and day laborers in the South African economy: The impact on their lives and livelihoods	Occupational Health and Safety	A two-phase methodology was utilized. Firstly, the only nationally representative Database available from a study by Blaauw (2010) on the activities of daily workers in South Africa was used as a summarized starting point regarding the socioeconomic position of daily workers. Secondly, in the second part of the analysis, the most recent information available on changes in the daily labor market was used to identify factors that alter the socioeconomic conditions of daily workers in South Africa over the past decade. The potential short--, medium---, and long-term impact of the COVID-19 pandemic was discussed in this context.
May et al. (2021)	'Stressed, uncomfortable, vulnerable, neglected': a qualitative study of the psychological and social impact of the COVID-19 pandemic on UK frontline key workers	Public Health	In-depth qualitative interviews were conducted and analyzed using reflexive thematic analysis to explore the impact of the pandemic on the professional lives, mental health, and well-being of non-healthcare professionals in the United Kingdom. The interviews were conducted via phone or video call in the UK between September 2020 and January 2021. The participants included 23 individuals aged between 26 and 61 years (average age = 47.2 years) employed in various non-healthcare professional occupations, including transportation, retail, education, postal services, police and firefighters, waste collection, finance, and religious services.
Rene et. al. (2021)	Electronic waste generation, recycling, and resource recovery: Technological perspectives and trends	Environmental Management	A literature review was conducted on electronic waste, considering the rapid changes or updates in technologies, the IT needs for remote work or learning during COVID-19, the release of new electronic devices by manufacturers to meet consumer comfort, and a decrease in services contributing to an increase in the generation rates of e-waste or Waste Electrical and Electronic Equipment (WEEE).
Das et al. (2021)	COVID-19 pandemic and Healthcare Solid Waste Management Strategy - A mini-review	Public Policies	Research was conducted on academic websites, including Scopus and Web of Science. The search keywords used were 'healthcare waste,' 'COVID-19', 'pandemic,' 'novel coronavirus,' 'SARS-CoV-2', 'types of healthcare waste,' and 'healthcare waste management.' The literature obtained was then screened based on language, with only articles in English selected for this review. Finally, the selected articles were analyzed concerning the chosen keywords.

AUTORES	TÍTULO DA PESQUISA	ENFOQUE TEMÁTICO	METODOLOGIA UTILIZADA
Josyula et al. (2021)	Isolation in COVID, and COVID in Isolation—Exacerbated Shortfalls in Provision for Women's Health and Well-Being Among Marginalized Urban Communities in India	Occupational Health and Safety	Case studies were conducted on the experiences of women waste pickers in managing health and healthcare resources, originating from two states in India. Topics explored in discussions and observations included the current intra-COVID-19 situation of family and social support, engagement with civil society organizations, and knowledge of government health services; how the intra-COVID-19 situation differed from the pre-COVID-19 situation in terms of policy, implementation, provision, financial and social support; the impact on work and income; and the needs - met and unmet - related to services, amenities, safety, and equity.
Mufamadi e Koen (2021)	Independent contractors and Covid-19 relief: Tax and social insurance legislative reform to extend protection to independent contractors(Article)	Environmental Management	The Department of Labour has created the TERS system (Temporary Employee/Employer Relief Scheme), aimed at providing support to employers if the business, due to the pandemic, finds that they need to retrench staff or close their business altogether in the foreseeable future. TERS is aimed at helping employers avoid these measures. However, the keyword in all of these measures is "employees." Who is an employee? There are some key differences between employees and independent contractors, the latter falling outside the scope of the support structures above.
Brito et al. (2021)	The development of an Integration Methodology for project management in an adapted online environment	Environmental Management	The inputs necessary for the development of the integration methodology were gathered through informal alignment meetings with the four main stakeholders: representatives from PSP2, PSP3, PSP5, PSP8, and the overall project coordinator of Mobile Education. After understanding the requirements, the integration team conducted a brainstorming session to discuss how to build the monitoring framework, which were the best tools to be used, and how to provide communication among the teams.
Penteado e Castro (2021)	Making the circular economy work for human development	Environmental Management	An integrative conceptual framework of EC and DH was developed. This framework includes socioeconomic elements of transitioning from linear to circular economic models, combined with DH from social sciences and development studies. Being complemented, the EC model, which is focused on technology and material and primarily based on industrial ecology and engineering principles. We utilized the existing concept of the "circular human sphere" to articulate the incorporation of DH in the

AUTORES	TÍTULO DA PESQUISA	ENFOQUE TEMÁTICO	METODOLOGIA UTILIZADA
			discussion on EC.
Chakraborty s (2020).	COVID-19 and women informal sector workers in India(Review)	Public Policies	Data from the Periodic Labour Force Survey (2018-19) are used to examine women informal workers. Data from a series of rapid assessment studies are also used to capture the gender experiences of informal workers during the lockdown period.

Source: Self-made, 2023.

The research observed that among the 21 articles of bibliometric analysis referring to the theme under study and the keywords, 8 of them have a direct relationship with the theme, corresponding to 38.09% of the total publications. The others, 61.91%, have themes on solid waste, waste pickers, and vulnerable communities.

While 42.85% of the articles have themes focused on Environmental Management, equivalent to 9 publications, in addition, it was noted that, among the articles addressing the theme under analysis, the research methods are similar, focusing on the management of municipal solid waste, according to the authors Jie Han et al. (2022), Budihardjo et al. (2022), Azevedo et al. (2022), Sharma et al. (2021). The other publications on Environmental Management present the themes of health and technological waste management.

Regarding the theme of protocols and actions to deal with COVID-19, the issue of solid waste handling in waste pickers associations was not found in any of the publications on bibliometric analysis, and there were no similar research methods.

Gutberlet el.al. (2023) reported that in front of publications that address the theme of protocols and actions for waste pickers' recyclable solids, there is a need for public policies to narrow communication between workers and researchers.

In their research, Hartmann, Hegel, and Boampong (2022) highlighted that 1) the pandemic exacerbated the already precarious economic condition of waste pickers; 2) there was a high risk of occupational exposure and a lack of personal protective equipment (PPE), resulting in varied use of PPE, and 3) the unequal and limited distribution of economic assistance and support by non-governmental organizations (NGOs) and local governments in support of waste pickers as essential workers.

The present study also highlights that the lack of public policy planning for waste collectors in Brazil, as well as the lack of commitment Fór the City Halls in the registration Pf cooperatives, including the absence of support in their monitoring, may contribute to the occurrence of diseases and accidents at work in the performance of this profession, being even more reflected in periods such as the COVID-19 pandemic. In addition, it shows a discredit in the relevant environmental contribution of

Periódico Eletrônico Fórum Ambiental da Alta Paulista
Electronic Journal Environmental Forum of Alta Paulista
ISSN 2966-2931 Suporte Online / *Online Support* - ISSN 1980-0827 Suporte CD-ROM / *CD-ROM Support*

Edição em Português e Inglês / *Edition in Portuguese and English* - v. 20, n. 4, 2024

waste pickers in solid waste management.

4.CONCLUSIONS

The bibliometric analysis showed the fragility of policies aimed at reducing waste collection and the lack of direct communication between the scientific community and workers in the recycling area.

The selected articles in the bibliometric analysis showed that 38.09% of the total publications are directly related to the theme, while the remaining 61.91% focus on solid waste, waste pickers, and vulnerable communities.

It became evident that during the pandemic, there were no records of protocols and actions to cope with COVID-19 aimed at waste pickers, and there were no actions to minimize the risks of contamination by biological agents to maintain the physical integrity of these professionals' activities.

The study recommends that a practical safety manual for waste pickers be adopted in a clear and objective format. It should contain collective and individual protection measures to carry out activities that cover emergencies, such as the COVID-19 pandemic.

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