International Journal of Occupational and Environmental Safety

The use of new technologies in safety and health protection of waste pickers: a systematic review protocol

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Abstract

Solid waste production grows annually, reaching 2.2 billion tons per year in 2025. While in some developed countries more than 60% of the waste is sent to landfills, in developing countries the destination is still observed from waste to landfills or open burning, while concern about recycling remains without consolidated government actions or other mitigating actions. In countries such as Brazil, Colombia and Mexico, recycling is carried out by recyclers or urban recyclers, informal workers who take up this activity due to unemployment and poverty in these regions. Due to the problems involved in the entire collection and recycling process, it is essential to use technologies that favor the professional practice of collectors of recyclable materials, combining popular knowledge with scientific-technical knowledge, social organization and society participation, of better health and occupational conditions for this range of society. Thus, a systematic review is proposed to identify the use of technologies that contribute to the improvement of the health and safety conditions of solid waste handlers after their conventional disposal. So, following the preferential reporting items for systematic reviews and meta-analysis protocols (PRISMA-P), this systematic review protocol was developed with the objective of presenting suitable guidelines for the development of a research that can provide results to meet the goal sought. Five databases will be accessed (SCOPUS, PubMed, Science Direct, EBSCOhost and Web of Science) and a total of 9 keyword combinations will be used.

1. INTRODUCTION

According to data extracted from the United Nations Environment Program (UNEP) in 2013 were generated approximately 1.5 billion tons of municipal solid waste in the entire planet, and the forecast for the year 2025 is that this volume waste should grow to 2.2 billion tons (Schandl, 2018). Unsuitable solid waste management actions are factors that reduce the quality of life of the population damaging the quality of water, food and the environment and bringing problems with serious consequences for populations (Barreto, 2018).

Significant differences occur in different parts of the world. In Japan, for example, 80% of waste is incinerated (Gutberlet, 2011), as in other countries like Australia (Soares et al., 2014), China and Turkey, landfills are the final destination of more than 60% of this waste (Mannarino et al., 2016). In the case of developing countries, however, the situation may be even more drastic, observing the destination of waste to landfills or even open burning, while concern about the segregation and recycling of waste remains without actions consolidated government (Giusti, 2009, Sodré et al., 2017).

In countries such as Brazil, Colombia (Viloria et al., 2016), India (Matos et al., 2016) and Mexico (Jiménez, 2015), recycling happens to be made by the collectors of recyclable materials (waste pickers), who are informal workers that started to adopt this activity as a job, mainly due to the low employability and poverty in regions where they live. At the same time, recycling becomes an activity in constant growth due to the excessive consumption of products and consequently the high waste generation. At the same time, there is the

industrial demand for raw materials at low costs, which further favors the progressive increase of men and women living from the collection activity as a way of subsistence (Anastas, 2000; Araujo, 2012).

Waste pickers collect, sort and select all kind of material that can be recycled, selling what they separate, commonly operating in the following locations: in the streets, in dumps, in landfills, and in screening units or cooperatives. This process is commonly known as grooming, and this activity can fuel formally organized recycling companies, which use these discarded materials to manufacture new salable products with essential objective marketing of these products (Galon et al, 2016).

While contributing to the recycling market and to reduce the impact to the environment, the collectors often work in precarious conditions with a high degree of risk, and a great risk of accidents or illness without rights and without proper effective recognition by society and by the public power (Araujo, 2009).

Because of the problems involved in the whole process of collection and recycling, it becomes essential to use technologies that promote the professional practice of recyclable material collectors, combining popular knowledge with scientific expertise, social organization and participation of society, for purposes of better health and occupational conditions for this range of society (Lane, 2011; Oliveira, 2012).

Until now, no systematic review has been conducted based on the parameters listed here. The objective of the systematic review will be to identify the use of technologies that contribute to the improvement of the health and safety conditions of solid waste handlers after their conventional disposal.

2. METHODS

2.1. Research structure

This systematic review protocol follows the guidelines described in the preferred reporting items for systematic reviews and meta-analysis protocols (PRISMA-P) Statement (Shamseer et al., 2015, Moher et al., 2015).Type of interventions and comparators

2.2. Eligibility criteria

Type of studies

Initially only published and peer-reviewed articles will be used. The authors will include studies where information regarding the use of technologies that contribute to the improvement of health and safety conditions of solid waste handlers. Articles that do not contain relevant information will be excluded.

Context

Eligible publications will include those that present investigations developed in companies specialized in waste collection, with waste recycling companies and with waste pickers.

Type of participants

The research will focus on waste collectors. The study will include female and male samples, without age limitation. There will be no further restrictions.

Interventions

Any kind of result related to occupational hazard within the above environments, connected to the collected waste, will be considered. Also considered are all types of studies analyzing methodologies and use of new technologies that reduce the risk to workers

Configuration

Any configuration in any country, in any kind of environmental context mentioned above, will be taken into account.

Language

The study will consider only articles written in English.

2.3. Information sources

The research will include the following electronic databases: SCOPUS, PubMed, Science Direct, EBSCOhost and Web of Science. It will be conducted in articles from 2014. The year range is set to get relevant and recent results.

However, the study will also examine the references of the collected articles to look for any additional relevant records that address the objectives of this review. Similarly, journals that appear frequently in searches will be analyzed in greater depth. This process will be repeated until no more related results can be found. In this case, publications older than the defined range can be used.

2.4. Search strategy

The first step will involve researching and sorting the literature with the use of keywords, which will be combined into sentences that will include Boolean terms (AND, OR), in addition to the inclusion and exclusion criteria already foreseen in the search.

Combinations of keywords will be formed as follows:

[("Waste collectors" OR "Waste pickers" OR "Garbage collectors" AND "Technology" OR "Occupational health" OR "Safety")]

The appropriate search engines will be used, which will display all titles. In each database, the search will be performed by entering each combination (separated by the operator "AND" and the operator "OR") and selecting, where possible, "article title, abstract, keywords". All qualified literature for inclusion based on the titles will be loaded into Endnote. This step will be faithfully reproduced for each of the selected databases.

The included articles will be selected by two independent reviewers by using the eligibility and exclusion criteria. First, titles, keywords and abstracts will be analyzed; secondly, in addition to titles, keywords, and summary again, introduction and completion will be analyzed; and in the third step, the full-texts will be read; then all the information found will be checked.

If divergences arise, a third reviewer will participate before a final decision is made. If important data for review is absent or unclear, an attempt will be made to contact the corresponding study author to resolve or clarify the problem. Two independent reviewers will collect data from the selected articles. Subsequently, the information retrieved will be crossed. Any disagreement will be discussed by the research team. The following data will be extracted and recorded in duplicate by two reviewers for each study: author; year of publication; country, encountered risks; technology used to minimize risks; relevant results and conclusion (s).

In the next step, as the selected articles will be analyzed, new potential keywords will be identified, and a new search will be conducted. Likewise, references will also be checked in order to find older articles that could provide supplementary information. This procedure will be repeated in the new identified articles until no more relevant results are obtained. In addition, other works developed by the authors of the primary studies included in the review will be consulted in order to find related investigations that meet the established inclusion criteria.

Finally, in the last step of the research, additional sources referenced in the articles analyzed will be identified and accessed.

2.5. Study records

Data management

After completing the search and registering the number of articles collected in Table 1 (see attachment), the selected articles from each database will be exported for duplicate sorting and removal. Title and abstracts will be reviewed. Then, after considering the established selection criteria, the full-text of the resulting studies will be retrieved and evaluated.

The number of articles resulting from each filter phase will be recorded in Table 1. This will allow keeping track of all studies of the first articles identified for the selected final publications along with the number of articles excluded from each applied criterion.

Records management will be done with "EndNote" software.

Selection process

As each combination is inserted, three phases of exclusion will be applied:

A. Though search filters, the following criteria will be considered:

   i. Date: Articles published from 2014. However, for the final stages mentioned earlier in the search process, no date constraints will be applied.
   ii. Document type: Peer reviewed articles.
   iii. Source Type: journal.
   iv. Language: English.

B. Repeated articles will be excluded.

Data Collection Process
From the final studies selected, the full-text will be retrieved in order to collect information of interest.
The extracted information will include:

   i. General information: Authors, year of publication, country.

   ii. Sample characteristics: job title, human sex ratio, risk.

   iii. Context Waste collection companies, waste recycling companies, autonomous waste pickers.
   iv. Study characteristics: objectives, risks considered, materials and equipment capable of producing risk, actions or technologies used to reduce risks, conclusions.
   v. Quality assessment: The Quality assessment will be based on the possible risk of bias (selection, decision and information bias) (Higgins et al., 2011)

2.6. Data items

Summary tables will be elaborated with information compiling the topics presented in the section above, mainly: Sample data (Age, gender, sample size, exercised function, and average age range) and Direct study-treated data (study objectives, assessed risks, used technologies, conclusions).

2.7. Outcomes and prioritisation

The main result of this research will be verifying which are the most common risks that the workers are exposed to the handling waste and the technologies used to reduce this risk.

2.8. Risk of bias in individual studies

For this systematic review, the risk of bias will be assessed individually. Two phases will take place throughout the evaluation. First, the general characteristics of each study will be identified and analyzed according to the intended objectives of this review. The parameters considered will include goals and objectives, evaluated variables, applied methods.

Subsequently, using the Cochrane collaboration tool (Higgins et al., 2011) to assess bias risk (Table 2), methodological issues will be addressed; compliance with ethical standards, justification of the sample, clear description of the experimental procedure and practical difficulties.

Each of the determined topics (Table 2) will be varied by "yes", "no" or "not aplicable", the latter indicating that there is insufficient information to determine compliance with the criteria.

Studies that present more positive responses to the established criteria will be considered the most adequate and reliable for the purposes of this review.

2.9. Data synthesis of the results

The data synthesis will be carried out through a narrative synthesis, based on the data assembled tables (with information from the eligible documents). With this perspective, the bias will also be taken into consideration in the analysis of the data.

Authors' contributions

Design and development of the study: TFBXS. HC. MR.

Title and abstract selection: TFBXS. HC. MR.

Full-text screening: TFBXS. HC. MR.

Data extraction: TFBXS. HC. MR.

Critical Rating: TFBXS. HC. MR.

Analysis and interpretation of the data: TFBXS.

Draft protocol: TFBXS.

Support in project development: TFBXS.

All authors read and approved the final version of the protocol.

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ANNEXES

Table 1. Form sheet summarizing the proposed rejection criteria

Summary of collected articles	Summary of selected articles	Summary of rejected articles	Summary of Total Rejected Items						Database	nº of selected articles	nº of collected articles	nº of articles included after criteria					
			Date	Type of document	Source type	Language	Other	Out of topic				Date	Type of document	Source type	Language	Other	Out of topic
0	0	0	0	0	0	0	0	0	Total	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	SCOPUS	0							
0	0	0	0	0	0	0	0	0	PUBMED	0							
0	0	0	0	0	0	0	0	0	SCIENCE DIRECT	0							
0	0	0	0	0	0	0	0	0	ACADEMIC SEARCH COMPLETE	0							
0	0	0	0	0	0	0	0	0	WEB OF SCIENCE	0							

Table 2. The Cochrane collaboration tool to assess the risk of bias.

Domain	Support for judgement	Review authors' judgement
Selection bias.		
Random sequence generation.	Describe the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.	Selection bias (biased allocation to interventions) due to inadequate generation of a randomized sequence.
Allocation concealment.	Describe the method used to conceal the allocation sequence in sufficient detail to determine whether intervention allocations could have been foreseen in advance of, or during, enrolment.	Selection bias (biased allocation to interventions) due to inadequate concealment of allocations prior to assignment.
Performance bias.		
Blinding of participants and personnel *Assessments should be made for each main outcome (or class of outcomes).*	Describe all measures used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. Provide any information relating to whether the intended blinding was effective.	Performance bias due to knowledge of the allocated interventions by participants and personnel during the study.
Detection bias.		
Blinding of outcome assessment *Assessments should be made for each main outcome (or class of outcomes).*	Describe all measures used, if any, to blind outcome assessors from knowledge of which intervention a participant received. Provide any information relating to whether the intended blinding was effective.	Detection bias due to knowledge of the allocated interventions by outcome assessors.
Attrition bias.		
Incomplete outcome data *Assessments should be made for each main outcome (or class of outcomes).*	Describe the completeness of outcome data for each main outcome, including attrition and exclusions from the analysis. State whether attrition and exclusions were reported, the numbers in each intervention group (compared with total randomized participants), reasons for attrition/exclusions where reported, and any re-inclusions in analyses performed by the review authors.	Attrition bias due to amount, nature or handling of incomplete outcome data.
Reporting bias.		
Selective reporting.	State how the possibility of selective outcome reporting was examined by the review authors, and what was found.	Reporting bias due to selective outcome reporting.
Other bias.		
Other sources of bias.	State any important concerns about bias not addressed in the other domains in the tool. If questions/entries were pre-specified in the review's protocol, responses should be provided for each question/entry.	Bias due to problems not covered elsewhere in the table.