

# HEALTH PROBLEMS OF SOLID WASTE COLLECTORS IN INDIA: A SYSTEMATIC REVIEW

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**Key words:** Health, Health problems, Solid waste collectors, Waste worker

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## ABSTRACT

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Solid waste collection is hazardous to the health of solid waste collectors. This paper reviews the scientific literature concerned with physical, occupational and psychological health problems of solid waste collectors in India in the past two decades. As per PRISMA guidelines, a scoping review was performed. Two databases, PubMed and Google Scholar were searched. 20 research articles were included in this study. Scoping review revealed that 8.1%-95% of solid waste collectors suffered from respiratory problems, 3.8%-33% from ophthalmological, 25%-76.6% from musculoskeletal and 4.5%-15% from gastrointestinal problems. Further, 43.5%-91.7% faced injuries during work while nearly 70% suffered from mild to severe depression and 55% from anxiety. The frequency of health problems was higher in solid waste collectors than in the control groups. Targeted health surveillance, provision of first aid kit and greater access to healthcare can help improve the health of solid waste collectors.

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## INTRODUCTION

Anthropogenic activities invariably produce solid waste, managing which is fundamental to the quality of the environment and urban regions (Saxena, et al., 2010). Solid waste is defined by the Environmental Protection Agency of the United States of America (USA), as 'any garbage or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and from community activities' (Agarwal, et al., 2015). Solid waste management is not only a global problem but also a major concern in India (Fazzo, et al., 2017; Kumar, et al., 2017). For the purpose of this paper, solid waste includes only municipal solid waste excluding a wide range of other solid wastes like construction, mining, electric waste, sludge etc. Municipal solid waste consists of compostable recyclables (paper, plastic, glass, metals, etc.), organic matter (fruit and vegetable peels, food waste), soiled waste (blood-stained cotton, sanitary napkins, disposable syringes) and toxic substances (paints, pesticides, used batteries, medicines) (Bhat, et al., 2018). In 2020-21, the total quantity of solid waste generated in India was 160038.9 Tonnes Per Day (TPD)

of which 152749.5 TPD of waste was collected, with the collection efficiency being 95.4% (CPCB, 2022). Municipal solid waste generally consists of waste generated by households and commercial entities within the municipal limits of a urban regions (Rajkumar, et al., 2010). According to the Census of India 2011, 377 million or 31.6% of the Indian population lived in urban areas, with a decadal growth rate of 31.8%. A significant amount of this population, around 42% lived in metropolitan cities (Ghosh, et al., 2014).

Much of the research with regard to solid waste management in India has been focussed on the composition, collection and management of municipal solid waste (Gupta, et al., 2015; Joshi, et al., 2016). Little research has been done with respect to the status and problems of solid waste collectors. In India, municipal solid waste collectors include government-employed sanitation workers, privately contracted door-to-door garbage collectors, informal waste pickers and rag pickers (Joardar, 2000). While there is no official data regarding the exact number of solid waste collectors, individual estimates suggest that there are more than five million solid waste collectors working in India (Lakshmi, et al., 2021). The occupation of waste collectors is defined

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as, 'a person or groups of persons informally engaged in collection and recovery of reusable and recyclable solid waste from the source of waste generation - the streets, bins, material recovery facilities, processing and waste disposal facilities for sale to recyclers directly or through intermediaries to earn their livelihood' (Solid Waste Management Rules, 2016). Studies have suggested that majority of the solid waste collectors are in the informal sector (Harriss-White, 2020; Joseph, 2006; Gupta, 2012). Solid waste collectors experience a wide range of problems that affect their well-being which are shaped by intersectional vulnerabilities that are rooted in caste, class, gender, place of origin, language, religion, nature and conditions of employment among others (Sharholly, et al., 2008; Rathi, 2006). They are also exposed to various occupational and chemical hazards, physical, biological, mental problems (Mishra, 2022). They also face problems in access to healthcare facilities and a lack of information regarding their rights (Koneti, 2023). A large number of solid waste collectors are daily wage earners and experience income insecurity (Sandhu, et al., 2017). Also, a significant number suffer from multiple morbidities and chronic illnesses (Jariwala, et al., 2023; Marelllo, et al., 2018). Overall, in the country, they are a socially and economically marginalized social group whose status directly and indirectly affects their health negatively (Swaminathan, 2018; Dias, 2016).

## MATERIALS AND METHODS

The method of systematic review has in the past few years, become an increasingly popular approach for the synthesis of evidence concerning a research topic (Mai Pham, et al., 2014; Armstrong, et al., 2011). However, it is a relatively novel approach used mainly for exploratory synthesis for which a universal definition or definitive procedure has not been established (Arksey, et al., 2005). The steps for this study included exploration of journal articles, followed by screening using predefined inclusion-exclusion criteria (Table 1). It was followed by another round of rigorous screening based on reading of the abstract of the selected articles and the final selection of the articles included in the study. This study is specifically concerned with a thorough examination and synthesis of the available research literature on the subject of physical, occupational and psychological health problems of solid waste collectors in India.

### Eligibility Criteria

Studies were selected according to the criteria outlined below Table 1.

**Tab. 1.** Description of inclusion and exclusion criteria (Modified PICOTS method).

Criteria	Inclusion	Exclusion
Population	Solid waste collectors involved in the waste management sector	Solid waste workers not involved in the solid waste management sector or those aged $\leq 15$ years

Age group	Sample population aged $>15$ years	Sample population aged $\leq 15$ years
Control	Not restricted	Not applicable
Outcome	Studies that discussed health status, occupational injury, health suffering, Health problems of solid waste collectors	Studies that did not discuss health problems, health status, health hazards and risks, occupational injuries, or health suffering of solid waste collectors
Time	Originally researched journal articles published between 2000 and 2022 are included	Articles published before 2000
Nature	Studies of primary nature based on primary data collection	Studies based on secondary data, review papers or articles
Relevance	Studies published in peer-reviewed journals	Studies not published in peer-reviewed journals including those in grey literature, as books, book chapters, conference proceedings, thesis, working papers etc.
Language	Research article published in English	Research article published in languages other than English
Setting	Study area comprised within or of India	Study area out of India

### Database Information Sources

For the purpose of this study, two prominent global online databases namely, PubMed and Google Scholar were searched using specific search terms. Original research articles based on primary study published between January 2000 and December 2022 were considered for this study.

### Search Strategy

A comprehensive but not exhaustive list of the terms used for search in databases is presented in Table 2. The Boolean search method was employed for combining search terms so as to find literature more relevant to the subject matter of this study. The Boolean method was also used to find research articles with key terms including 'waste', 'health' and 'India' appearing in the title. A general search query is presented as follows: (TITLE-ABS-KEY (ragpickers OR waste pickers OR scavengers OR chiffonier) AND (health issue OR health problems OR diseases OR illness OR Occupational health hazards) AND (India) AND (EXCLUDE (LANGUAGE, "Spanish"))).

**Tab. 2.** Search terms used for systematic review.

Issue	Search terms
Population terms	Waste collector; Waste picker; Rag picker; Garbage collector; Waste handler; Waste recycler; Scavenger; Solid waste collector; Solid waste picker; Solid waste handler; Solid waste recycler.

Outcomes	Disease; Health hazard; Health effect; Health impact; Health impairment; Health issue; Health outcome; Health problem; Health risk; Illness; Occupational disease; Occupational health hazard; Occupational health risk; Occupational suffering; Occupational injury; Work-related diseases; Work disease.
Location	India

### Selection of Studies

A total of 18,146 search records were identified through the two databases searches (Google Scholar-17900, PubMed- 246). The search records were screened for research articles relevant to the subject of this study. Finally, 51 relevant articles were identified in Google Scholar and 9 in the PubMed database. Articles were excluded based on the exclusion criteria Table 1 and also if they were beyond the scope of this study. A few major criteria on which research articles were excluded are listed in Fig. 1. Books, book chapters, articles published in conference proceedings and other study published in languages other than English were also excluded from this study. Finally, 20 original research articles were included in this study.

### Data Items

Article characteristics, including, location of study, year of publication, and study characteristics, i.e., study design, author, sample size, sampling technique, outcome variable, physical health problems, psychological health problems and occupational health problems were abstracted as data items. Abstracted data was tabulated in Microsoft Excel and analysed using an iterative process.

### Critical Appraisal of Individual Sources of Evidence

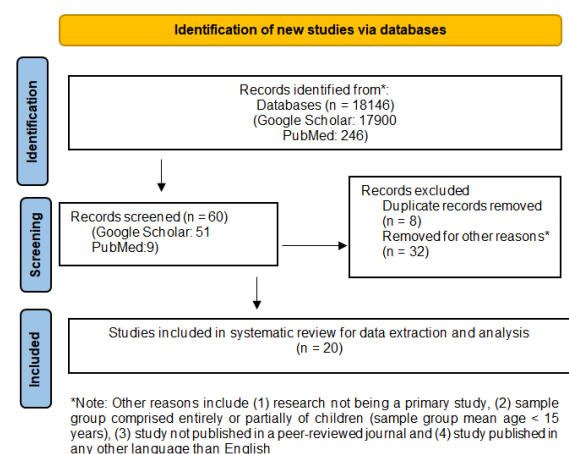
Three separate checklists were prepared for the appraisal of the quality of the included research articles. These checklists were prepared for cross-sectional study, case control study and mixed method study, which comprise the range of research articles included in this study. Each checklist consisted of 10 questions which is listed in Table 3. The questions in the checklists emphasised among others, on the methodology, data collection, and rigour of analysis. Each item on the checklist was answered with either 0, 0.5 or 1. If the research article had unsatisfactory processes, the score given was 0, if the procedure was fully satisfactory, it was marked 1, and the partial satisfactory techniques were marked 0.5. Further, articles were classified as follows: those with a score of less than 6 were classified as low quality, with 6–8 as medium quality, and greater than 8 were classified as good quality articles. This classification was adopted from a similar study on the health sufferings of child labourers in the south Indian context (Sara, et al., 2022). This classification presents a clear understanding of the overall methodological quality, rigour, precision, and applicability of the research articles included in this study. However, the score and appraisal technique were not used for excluding the articles during the screening process.

**Tab. 3.** Parameters for quality appraisal of research articles.

S.NO	Cross-sectional studies	Case control study	Mixed method study
1	Clearly described objective	Clearly described objective	Clearly described objective
2	Sample size adequate	Sample size adequate	Justification of mixed method study
3	Sampling technique random	Sampling technique random	Sample size adequate
4	Sample inclusion based on specific factors	Sample inclusion based on specific factors	Sampling technique random
5	Justification of measurements	Cases and control heterogeneity	Sample inclusion based on specific factors
6	Reported the method used	Reported the method used	Integration between quantitative and qualitative data
7	Rigorous data analysis	Rigorous data analysis	Rigorous data analysis
8	A clear statement of findings	A clear statement of findings	A clear statement of findings
9	Ethical issues addressed	Ethical issues addressed	Ethical issues addressed
10	How valuable is the research?	How valuable is the research?	How valuable is the research?

### Selection of Sources of Evidence

A modified Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist tool was used for the preparation of the progression of the manuscript (Moher, et al., 2009; Liberati, et al., 2009). A detailed methodological framework of the systematic review process in this study is depicted in Fig. 1.



**Fig. 1** PRISMA flow diagram for search and selection of research articles.

### Characteristics of Sources of Evidence

From 18,146 search records identified through the two databases searches (Google Scholar-17900, PubMed-246), 20 research articles were finally selected for systematic review based on the objective of this study (Table

4). Of these 20 research articles 18 were quantitative (10 cross-sectional and 8 case-control) and two were mixed method studies. 3 research articles had a sample consisting exclusively of female solid waste collectors, one had male-only sample, 12 research articles had aggregated sample consisting of both male and female solid waste collectors while four research articles did not specify the gender of the solid waste collectors in the sample. Of the research articles included in this study, the maximum number of studies had Mumbai (four research articles) as their study area. Lucknow and Chennai were the study area of two articles each. Two studies had more than one city as their study area: one study consisted of a sample of solid waste collectors from Hyderabad and Karimnagar in Telangana (Ramitha, et al., 2021) while another study studied the health problems of solid waste collectors across Shimla, Solan and Mandi in Himachal Pradesh (Thakur, et al., 2018). The location of the studies included is cartographically represented in Fig. 2.

**Table 4.** Study overview by publication date, study design and gender related reporting.

Descriptors	Frequency	Percent	Cumulative percent
<b>Study publication (by decade)</b>			
2000-2010	1	5	5
2011-2020	17	85	90
2021-2022	2	10	100
Total	20	100	100
<b>Study design</b>			
Cross-Sectional	10	50	50
Case control	8	40	90
Mixed method	2	10	100
Total	20	100	100
<b>Gender related reporting</b>			
Female only	3	15	15
Male only	2	10	25
Aggregated and gender specified	11	55	80
Gender not specified	4	20	100
Total	20	100	100



**Fig. 2** Map of study location with number of articles. Note: (●) 1; (●) 2; (●) 3-4;

## RESULTS AND DISCUSSION

The aim of this review paper is to document the current research on the various health problems and sufferings of solid waste collectors in India who are engaged in the activity of waste management in the cities. Three broad categories of health problems and suffering were identified through the review, namely, physical health problems, occupational health issues and psychological issues. The nature of the study, sample size, sampling design, exposure measurement and outcome variable are shown in (Supplementary Table 1) (Raje, et al., 2020; Ravindra, et al., 2016; Reddy, et al., 2015; Roopa, et al., 2013; Uplap, et al., 2014; Yadav, et al., 2020;)

20 journal articles met the inclusion criteria regarding health problems of solid waste collectors in India. A wide range of health problems faced by solid waste collectors was explored in the review. The health problems were classified into three broad groups.

1. Physical health problems.
2. Occupation health problems.
3. Psychological health problems.

As a form of convenience classification, based on a similar study in South Asian context. Nearly all the research articles, numbering 19 emphasized on the physical health problems of solid waste collectors. Occupational health problems were discussed in six research papers while two papers focussed on the psychological health problems.

The size of the sample group in the selected studies ranged from 20-527. The mean sample size being 213.1 solid waste collectors while the median sample size was 190. Only eight of the 20 studies or 40 % studies selected had a control group, the size of which was in the range of 10-205. 17 of the 20 selected studies used questionnaire which were structured, semi-structured or self-designed. Two studies used Standardised Nordic Musculoskeletal Questionnaire to investigate musculoskeletal problems while one study focussing on mental health used the widely recognized General Health Questionnaire (GHQ-12). Two studies also additionally used the American Thoracic Society Division of Lung Disease questionnaire (ATS-DLD-78A) for examining respiratory health (Abbasi, et al., 2012; Comstock, et al., 1978). One study performed genotoxicity analysis to diagnose exposure to certain harmful chemicals while another study used Pre tested Food Frequency Questionnaire (FFQ) to assess the state of hunger of the solid waste collectors. Nine of the 20 studies performed some form of clinical assessment which included Pulmonary Function Tests (PFTs), haematological tests, X-ray test, serological test, Peak Expiratory Flow Rate (PEFR) test; blood sample tests and buccal cytome assay. Four of the 20 studies also additionally used in-depth interviews.

### Physical Health Problems

In this review, 19 of the 20 studies examined the physical

health problems among solid waste collectors in India. Six of the 19 studies used a control group for comparison of the physical health problems. 15 studies investigated respiratory health problems, eight investigated gastrointestinal problems, five investigated musculoskeletal problems, five examined dermatological while three papers investigated ophthalmological health problems.

15 studies examined respiratory health problems among solid waste collectors in India. The major respiratory morbidities reported by various studies included sinusitis, common cold and fever, frequent sneezing, cough with phlegm, breathlessness etc. Solid waste collectors suffering from respiratory problems ranged from 8.1% to 95%. It was the most investigated and frequently occurring morbidity among the workers. Two studies that used control group found that the frequency of respiratory health problems was higher in solid waste collectors than in the control group. One study reported that 18.8% collectors suffered from sinusitis (Ray, et al., 2008) while another study reported 11.64% collectors suffering from chronic bronchitis. It was also found that around one-tenth or 9.4% of collectors suffered from episodes of asthma (Salve, et al., 2019).

13 studies included in this paper examined the dermatological health problems and skin ailments of solid waste collectors. Nine of these studies presented the aggregated frequency of the occurrence of such problems. Two studies used a control group in the sample and the result revealed that solid waste collectors fared worse than the control group (Salve, et al., 2019; Selvi, et al., 2012). The studies suggested that 2%-90% of the solid waste collectors suffered from dermatological health problems. Major skin-related morbidities investigated included skin allergies, itching, rashes, irritation, pigmentation, dryness, fungal infections etc.

12 studies investigated ophthalmological problems of solid waste collectors, eight of which reported the aggregated frequency of suffering in percentage. Three of these studies used a control group and in each of the study, solid waste collectors had a higher rate of suffering than the control group. Various studies suggested that 3.8%-33% of solid waste collectors suffered from some form of ophthalmological health problems. Major vision related morbidities studied included blurred vision, redness, watering, soreness, swelling, itching etc. 17%-71% of solid waste collectors reported redness of eyes, 8.5%-19.8% had blurred vision. One study reported that the odds ratio of solid waste collectors suffering from vision related problems was lower than that of the control group (Jariwala, et al., 2013).

Of the 20 studies selected in this review paper, 11 studies examined the musculoskeletal health problems. Four of these studies presented aggregated data and reported 25%-76.6% of solid waste collectors faced musculoskeletal health problems. Major musculoskeletal morbidities studied included joint pain, neck pain, shoulder pain, elbow pain, wrist pain, upper back pain, lower back pain,

hip/ thighs pain, knees pain, ankle/feet pain, muscle and ligament pain etc. One study used a control group in which control group fared better than solid waste collectors.

Gastrointestinal health problems were examined in nine of the 20 selected studies in this paper. Various gastrointestinal morbidities investigated include diarrhoea, nausea, Gum infection, Palpable liver, Irregular bowel habit, Constipation, Diarrhoea, Palpable colon etc. Diarrhoea and nausea were the major morbidities investigated under gastrointestinal health problems. Two studies presented disaggregated data and reported that 4.5%-15% of solid waste collectors suffered from gastrointestinal problems. Collectors suffering from diarrhoea ranged from 16.6%-77%. Incidentally, one study reported that the solid waste collectors had a better odds ratio of not getting infected by gastrointestinal health problems as compared to the control group (Jariwala, et al., 2013).

Eight studies investigated infectious and other acute as well as chronic diseases. One study reported fever in 2.5%, headache in 12%, arthritis in 4%, anaemia in 13%, diabetes in 6%, hypertension in 10% and tuberculosis in 3% of solid waste collectors (Kandasamy, et al., 2013). Another study examined infectious diseases and reported malaria in 11.7%, typhoid in 5% dysentery in 9.2%, jaundice in 5.8%, viral fever in 13.3% and tuberculosis in 16.7% of the workers (Mote, et al., 2016). Solid waste collectors also suffered from viral fever, malaria, typhoid, dysentery apart from general health problems such as fever, cough and cold, headache, fatigue etc. On study examined disabilities among the solid waste collectors and reported that around 36% suffered from some kind of disability. The disabilities suffered by the solid waste collectors included disabilities in neck (5.5%), shoulder (15.5%), elbow (5%), wrist/ hand (13.9%), upper back (25%), lower back (30.5%), hip/ thigh (22.8%) and knee (2.2%) (Salve, et al., 2019) (Supplementary Table 2) (Fulwani, et al., 2020; Kavitha, et al., 2019; Prannoy, et al., 2018; Roopa, et al., 2013; Priyanka, et al., 2017).

### Occupational Health Problems

In this review, only occupational injuries have been included under the category of occupational health problems. Occupational injury is defined as 'personal injury, disease, or death resulting from an accident during work' by the International Labour Organization (ILO, 1998). It is different from occupational diseases, which are generally contracted as a consequence of the exposure to certain occupational risk factors during work activity and may have long incubation period (LaDou, 2003). Hence, occupational diseases are difficult to diagnose in a case-control or cross-sectional study (Table 5). In this review, occupational health problems included injuries (bruises, abrasion and burns, laceration, fracture, contusion), bites (dog bites, snake bites and insect bites), health problems by chemical exposure (dizziness and nausea, skin irritation or allergy, itching, redness of eyes, eye irritation, watering of eyes and itching in eyes), wa-

ter-borne and mosquito-borne diseases and morbidities. The selected studies that examined occupational health problems were conducted in 2013, 2016, 2018, 2019 and 2022. Only one research paper included in this study investigated occupational health problems of solid waste collectors in comparison to a control group. All the studies were cross-sectional in nature. One study assessed occupational health problems across two cities, Solan and Mandi in Himachal Pradesh (Thakur, et al., 2018). Two studies reported that 22%-23% solid waste collectors were affected by road accidents. Three studies reported that injuries during work, bruises, cuts and lacerations occurred between 43.5% to 91.7% solid waste collectors. 9.6% to 16.5% of workers were affected by animal bites during their work. Only one study reported on snake biting, which found that 2.6% of workers were affected by this health problem (Mote, et al., 2016). Two studies found that more than 70% of the solid waste collectors suffered from injury by sharp objects (Jayakrishnan, et al., 2013; Mote, et al., 2016), metal and glass while one study reported this figure to be 36.6% (Salve, et al., 2019). One study reported on the problem of frost bite among workers, 32.5% of the workers faced this problem (Kumari, et al., 2022). One study investigated the health problems due to chemical exposure and found that 19.5% solid waste collectors suffered from dizziness and nausea, 22% from skin irritation and allergy, 36% from eye irritation and 19% from asthma, among others (Kumari,

et al., 2022). Only one study used the control group for comparison and it revealed that the frequency of occupational health problems among solid waste collectors was higher compared to the control group. Overall, bruises, cuts, injuries from sharps, road accidents and animal bites were the major occupational health problems faced by the solid waste collectors in India.

### Psychological Health Problems

Psychological health problems of solid waste collectors have not been extensively researched in India. In this review, only two of the 20 studies selected examined the psychological health problems among solid waste collectors in India. These studies were conducted in 2016 and 2017 and incidentally, both were based in Mumbai (Table 6). One study used a structured questionnaire while another used the standard General Health Questionnaire (GHQ-12) designed by (Goldberg, et al., 1988). None of the two studies had a control group for comparison. One study reported that nearly 70% of the solid waste collectors suffered from mild to severe depression and 55% of them were affected by mild to severe anxiety (Mote, et al., 2016). Another study reported that nearly 25% of the solid waste collectors felt constantly under strain, 39.5% felt unhappy and depressed, 40% suffered from loss of sleep and faced loss of concentration (Chokhandre, et al., 2017; Dongre, et al., 2019);

**Table 5.** Occupational health problems among solid waste collectors in India.

Author	Type of problem	Frequency of occupational health problems (in %)		Statistical significance
		Solid waste collector	Control group	
<b>Reported morbidity (after entry in service)</b>				
1. (Jayakrishnan, Jeeja, and Rao, 2013)	Road accidents	22	-	-
	Falls	63.6	-	-
	Injury with sharps	73.2	-	-
	Animal bites	9.6	-	-
	Fire burns	1.6	-	-
	Chemical injury	2.6	-	-
	Water-borne disease	5.5	-	-
	Mosquito-borne disease	0.6	-	-
2. (Mote, et al., 2016)	Injury during work	91.7	-	-
	Glass and metal injury	73.3	-	-
	Dog Bite	14.2	-	-
	Snake bite	2.5	-	-
	General illness episodes in last month	71.7	-	-
3. (Ravindra, Kaur, and Mor, 2016)	Bruises, abrasion and burns (Waste Collectors)	44.4	-	-
	Bruises, abrasion and burns (Street Sweepers)	4.9	-	-
	Bruises, abrasion and burns (Ragpickers)	10.6	-	-
		<b>Solan</b>	<b>Mandi</b>	-
4. (Thakur, Ganguly, and Dhulia, 2018)	Cuts and lacerations (Waste collectors)	44.16	41.38	-
	Cuts and lacerations (Ragpickers)	30	100	-
	Cuts and lacerations (Street sweepers)	67.95	33.33	-

5. (Salve, Chokhandre, and Bansod, 2019)	Injuries/accident	43.3	-	8.3	p=0.000
	Fracture	15.6	-	1.1	p=0.000
	Laceration needles/glass	36.6	-	2.8	p=0.000
	Contusion on job	14.4	-	5.6	p=0.005
6. (Kumari and Kiran, 2022)	<b>Occupational problems</b>				
	Animal bite	16.5		-	-
	Frost bite	32.5		-	-
	Road accidents	23		-	-
	Injuries	60.5		-	-
	<b>Health problems by chemical exposure</b>				
	Dizziness and nausea	19.5		-	-
	Skin Irritation or allergy	22		-	-
	Itching	39		-	-
	Redness of eyes	26.5		-	-
	Eye Irritation	36		-	-
	Watering of eyes	40		-	-
	Itching in eyes	29		-	-
	Asthama and loss of breathing	19		-	-

**Table 6.** Psychological health problems among solid waste collectors in India.

Authors	Type of problem	Frequency of psychological health problems (in %)		Statistical significance
		Solid waste collector	Control group	
1. (Mote, et al., 2016)	<b>Mental health disorder</b>		-	-
	Mild depression	48.3	-	-
	Moderate depression	10	-	-
	Moderate to severe depression	1.7	-	-
	Anxiety		-	-
	Mild	46.7	-	-
	Moderate	5	-	-
	Severe	3.3	-	-
2. (Chokhandre and Kashyap, 2017)	<b>GHQ-12 items</b>		-	-
	Unable to concentrate	39.5	-	-
	Loss of sleep over worry	40	-	-
	Incapable of making decisions	14	-	-
	Felt constantly under strain	24.5	-	-
	Couldn't overcome difficulties	19	-	-
	Unable to enjoy day-to-day activities	34	-	-
	Unable to face problems	26.5	-	-
	Losing confidence	31.5	-	-
	Feeling unhappy and depressed	39.5	-	-
	Thinking of self as worthless	15.5	-	-
Not feeling reasonably happy	28	-	-	

## CONCLUSION

Solid waste collectors in India suffer from a myriad of health problems. These health problems lead to physical, occupational and psychological morbidities. Little research has been done regarding the overall health problems of solid waste collectors in India. To our knowledge, this review paper is unique and novel in the sense that it presents a systematic review of a wide range of health problems faced by solid waste collectors. This review found that among

### Physical Health Problems

2%-90% of the solid waste collectors suffered from dermatological health problems, 8.1% to 95% from respiratory problems, 3.8%-33% from different types of ophthalmological

health problems, 25%-76.6% from musculoskeletal health problems and 4.5%-15% from gastrointestinal problems. 3%-16% solid waste workers were affected by tuberculosis while 2.5%-83.3% by viral fever;

### Occupational Health Problems

43.5%-91.7% solid waste collectors faced injuries during work, bruises, cuts and lacerations, 9.6%-16.5% were affected by animal bites, and more than 70% suffered from injury by sharp objects; and

### Psychological Health Problems

70% of the solid waste collectors suffered from mild to severe depression and 55% of them were affected by mild to severe anxiety 25% of the solid waste collectors felt constantly under strain, 39.5% felt unhappy and de-

pressed, 40% suffered from loss of sleep and faced loss of concentration.

Nearly all studies that used a control group revealed that health problems were more frequent among solid waste collectors as compared to the control group. Targeted health surveillance and greater access to healthcare could help improve the state of health of solid waste collectors. Additionally, they should be provided with first aid kit, safety equipment to guard against animal attacks and regular counseling for psychological well-being. Hence, there is a need for greater emphasis on the state of health and health problems of solid waste collectors.

### CONFLICT OF INTEREST

None to report.

### DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable.

### INFORMED CONSENT STATEMENT

Not applicable.

### DATA AVAILABILITY STATEMENT

Not applicable.

The results produced in this work can be made available after a special request to the corresponding author.

### REFERENCES

Saxena S, Srivastava RK and Samaddar AB. 2010. Sustainable waste management issues in india. *Journal of Soil and Water Sciences*. 3(1): 72-90.

Agarwal R, Chaudhary M and Singh J. 2015. Waste management initiatives in india for human well being. *European Scientific Journal*. 105-128.

Fazzo L, Minichilli F, Santoro M, Ceccarini A, Seta MD, Bianchi F and Martuzzi M. 2017. Hazardous waste and health impact: a systematic review of the scientific literature. *Environ Health*. 16(1):

Kumar S, Smith SR, Fowler G, Velis C, Kumar SJ, Arya S and Cheeseman C. 2017. Challenges and opportunities associated with waste management in India. *R Soc Open Sci*. 4(3):1-11. doi:10.1098/rsos.160764

Bhat RA, Dar SA, Dar DA and Dar G. 2018. Municipal solid waste generation and current scenario of its management in india. *International Journal of Advance Research in Science and Engineering*.7(2): 419-431.

CPCB. 2022. Annual report 2020-21 on implementation

of solid waste management rules. 2016. New delhi: central pollution control board.

Rajkumar N, Subramani T and Elango L. 2010. Ground-water contamination due to municipal solid waste disposal - a gis based study in erode city. *International Journal on Environmental Sciences*. 4(1): 39-55.

Ghosh R and Kansal A. 2014. Urban challenges in india and the mission for a sustainable habitat. *Interdisciplinaria*. 2(2): 281-304.

Gupta N, Yadav KK and Kumar V. 2015. A review on current status of municipal solid waste management in india. *J Environ Sci*. 37:206-217.

Joshi R and Ahmed S. 2016. Status and challenges of municipal solid waste management in India: A review. *Cogent Environmental Science*. 2(1): 1-18.

Joardar SD. 2000. Urban residential solid waste management in india: issues related to institutional arrangements. *Public Works Management and Policy*. 4(4): 319-330.

Lakshmi JK, Nakkeeran B, Whittaker L, Ramanamurthi B, Sai V, Saligram PS, Garimella S. 2021. Health and well-being of waste workers in India. Georgia: The Georgia Institute for Global Health.

Solid waste management rules,2016. New Delhi, India: Government of India, Ministry of Environment and Forests.

Harriss-White B. 2020. Waste, social order, and physical disorder in India. *The Journal of Development Studies*. 56(2): 239-258.

Joseph K. 2006. Stakeholder participation for sustainable waste management. *Habitat International*. 30(4): 863-871.

Gupta SK. 2012. Integrating the informal sector for improved waste management. *Private Sector and Development*. 15:12-17.

Sharholly M, Ahmad K, Mahmood G and Trivedi R. 2008. Municipal solid waste management in Indian cities - A review. *Waste Manag*. 28(2): 459-467.

Rathi S. 2006. Alternative approaches for better municipal solid waste management in Mumbai, India. *Waste Manag*. 26(10): 1192-1200.

Mishra A. 2022. Impact of solid waste and the health effects during extreme floods. A case study from kerala (india). PhD Thesis Enschede.

Koneti LR. 2023. Solid waste workers in india and the covid-19 pandemic: a review of intersecting challenges. *International Journal of Occupational Safety and Health*. 13(1): 126-139.

Sandhu K, Burton P and Dedekorkut-Howes A. 2017. Between hype and veracity; privatization of municipal solid waste management and its impacts on the infor-



- mal waste sector. *Waste Manag.* 59: 545-556.
- Jariwala N and Christian RA. 2023. Respiratory disease risk assessment among solid waste workers using a fuzzy rule based system approach. R. S. Boris Faybishenko, *Fuzzy System Modelling in Environmental and Health Risk Assessment.* 133-138.
- Marello M and Helwege A. 2018. Solid waste management and social inclusion of wastepickers: opportunities and challenges. *Latin American Perspectives.* 45(1): 108-129.
- Swaminathan M. 2018. how can india's waste problem see a systemic change? *economic and political weekly.* 53(16): 1-19.
- Dias SM. 2016. Waste pickers and cities. *Environment and urbanization.* 28(2): 375-390.
- Mai T Pham, Greig JD, Sargeant JM, Papadopoulos A and McEwen S A. 2014. A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Res Synth Methods.* 5(4): 371-385.
- Armstrong R, Hall BJ, Doyle J and Waters E. 2011. 'Scoping the scope' of a cochrane review. *Journal of Public Health.* 147-150.
- Arksey H and O'Malley L. 2005. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology.* 8(1):19-32.
- Sara H H, Bayazid AR and Quayyum Z. 2022. Occupational health sufferings of child waste workers in south asia: a scoping review. *Int J Environ Res Public Health.* 8:1-24.
- Moher D, Liberati A, Tetzlaff J, Altman DG and Group P. 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med.* 6(7): 1-7.
- Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gotzsche PC, Ioannidis JP and Moher D. 2009. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *British Medical Journal.* 1-27.
- Ramitha K, Ankitha T, Alankrutha RV and Anitha C. 2021. A cross-sectional study on occupational health and safety of municipal solid waste workers in Telangana, India. *Indian J Occup Environ Med.* 25(3): 169-177.
- Thakur P, Ganguly R and Dhulia A. 2018. Occupational health hazard exposure among municipal solid waste workers in himachal pradesh, india. *Waste Manag.* 78: 483-489.
- Raje SS and Patil T. 2020. Identifying risk factors of health of solid waste collectors: a cross sectional study. *National Journal of Community Medicine.* 11(9): 367-370.
- Ravindra K, Kaur K and Mor S. 2016. Occupational exposure to the municipal solid waste workers in chandigarh, india. *Waste Manag Res.* 34(11): 1-4.
- Reddy EM and Yasobant S. 2015. Musculoskeletal disorders among municipal solid waste workers in India: A cross-sectional risk assessment. *J Family Med Prim Care.* 4(4):519-524.
- Roopa S, Padmavathi R, Akolkar A, Sankar S, Ravishankar P, Vijayalakshmi Tand Kalpana B. 2013. Respiratory functions of conservancy workers working in solid waste management sector of Chennai, India. *F1000Research.* 1(67): 1-9.
- Uplap PA and Bhate K. 2014. Health profile of women ragpicker members of a nongovernmental organization in Mumbai, India. *Indian J Occup Environ Med.* 18(3): 140-144.
- Yadav S, Agarwal S and Sharmila K. 2020. Assess the health hazards of the chiffoniers in lucknow city. *Journal of Ecophysiology and Occupational Health.* 20(3 and 4): 128-133.
- Abbasi IN, Ahsan A and Nafees AA. 2012. Correlation of respiratory symptoms and spirometric lung patterns in a rural community setting, Sindh, Pakistan: a cross sectional survey. *BMC Pulmonary Medicine.* 12(81):1-9.
- Comstock GW, Tockman MS, Helsing KJ and Hennesy KM. 1978. Standardized respiratory questionnaires comparison of the old with the new. *Am Rev Respir Dis.* 119(1): 45-53.
- Ray MR, Roychoudhury S, Mukherjee G, Roy S and Lahiri T. 2008. Respiratory and general health impairments of workers employed in a municipal solid waste disposal at an open landfill site in Delhi. *Int J Hyg Environ Health.* 208(4): 255-262.
- Salve PS, Chokhandre P and Bansod DW. 2019. Multiple morbidities and health conditions of waste-loaders in Mumbai: A study of the burden of disease and health expenditure. *Arch Environ Occup Health.* 75(2): 79-87.
- Selvi P, Akolkar AB and Saranya P. 2012. Occupational health hazards of the working group associated with municipal solid waste management at Kolkata in eastern India. *International Journal of Environment and Health.* 6(2): 141-154.
- Jariwala ND and Christian RA. 2013. A study of prevalence of morbities in door to door waste collecting workers of surat city, Gujarat. *Indian Journal of Public Health Research and Development.* 4(4): 123-127.
- Kandasamy SP, Akolkar AB, Manoharan A and Paranj S. 2013. Municipal solid waste management at Chennai in southern India- an occupational health perspective. *International Journal of Health Promotion and Education.* 51(1): 50-61. doi:10.1080/14635240.2012.750068
- Mote BN, Kadam SB, Kalaskar SK, Thakare BS, Adhav AS and Muthuvel T. 2016. Occupational and environmental health hazards (physical and mental) among

- rag-pickers in Mumbai slums: A cross-sectional study. *Science Journal of Public Health*. 4(1): 1-10.
- Fulwani D, Banda D, Shah H and Chandel D. 2020. Women rag pickers at a dump in Ahmedabad: Genotoxicity and oxidative stress. *Mutat Res Genet Toxicol Environ Mutagen*. 858-860:1-5.
- Kavitha M and Mohan A. 2019. Vulnerability of the solid waste collectors' (household waste collectors) good health and well-being: with reference to bengaluru city, karnataka, india. *International Journal of Applied Social Science*. 6(4): 817-823.
- Prannoy T, Ganguly R and Dhulia A. 2018. Occupational health hazard exposure among municipal solid waste workers in himachal pradesh, india. *Waste Management*. 78: 483-489.
- Priyanka VP and Kamble RK. 2017. Occupational health hazards in street sweepers of Chandrapur city, central India. *International Journal of Environment*. 6(2): 9-18.
- ILO. 1998. Resolution concerning statistics of occupational injuries (resulting from occupational accidents). *Proceedings of the Sixteenth International Conference of Labour Statisticians*. Geneva: International Labour Organization.
- LaDou J. 2003. international occupational health. *International journal of hygiene and environmental health*. 206: 1-11.
- Jayakrishnan T, Jeeja MC and RB. 2013. Occupational health problems of municipal solid waste management workers in India. *Int J Env Health Eng*. 2(42).
- Kumari S and Kiran U. 2022. Prevalence of health problems of rag pickers due to various hazards at Lucknow city. *Human Factors in Healthcare*. 2:1-8.
- Goldberg DP and Williams P. 1988. *A user's guide to the general health questionnaire*. London, United Kingdom: NFER-NELSON.
- Chokhandre P and Kashyap GC. 2017. Research article assessment of psychological well-being of waste-pickers of mumbai, india. *Asian Journal of Epidemiology*. 10: 138-143.
- Dongre PB and Kamble RK. 2019. Rag pickers occupational health assessment in Chandrapur City, Central India. *International Journal of Basic and Applied Physiology*. 8(1): 87-92.