Assessing the Occupational and Environmental Health Hazards among Rag-Pickers: A Systematic Review

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Abstract

The vulnerability occupational health hazard of ragpickers has emerged as a serious public health threat and has had a tremendous impact on all spheres of the environment nearby landfill and other side of solid waste locations. Since 1970, large numbers of studies have been carried out on the impact of health conditions on ragpickers around the world, but no studies have been carried out on the scientific/systematic review on the impact of health due to their occupational impact at global level. This study aims to systematically assess the scientific review on the impact of occupation on ragpickers and their environmental conditions. For this study, total 339 studies were identified after rigorous review, and 134 studies met the criteria for the review. The literature was surveyed from Scopus, Google Scholar, Research gate, Web of Science, semantic scholar and the Google search engine. The results reveal that (i) most of the studies were carried out continent wise on: Asia, followed by Europe, Africa, and South America. About 69 (51.5%) of the total studies were surveyed from Asia, followed by Africa 32 (23.88%), South America 30 (22.39%), and Europe is only 3 (2.23%) has found in the open database on related to the topic. (ii) in the case of countries, the highest number of studies was performed on India (30.60%), followed by Brazil (19.40), South Africa (14%), Bangladesh (8%), Ghana (6%), Study results out that chemical, biological work place hazard are more risky environmental hazard in their occupations.

Introduction

Throughout the world, solid waste is one of the most serious environmental issue and handling of this waste entails a variety of hazards (Poulsen et al., 1995; Robazzi et al., 1997; Velloso et al., 1997; Kujjer et al., 2004; Da Silva et al., 2005) particularly to the ragpickers. Worldwide, 1.3 billion metric tons of municipal solid waste (MSW) is generated on an annual basis and is expected to increase to about 2.2 billion tons by 2025 (Hoornweg and Bhad Tada 2012). MSW generation is influenced by economic conditions, living standards, urbanization (Liu and Wu 2010; Saeed et al., 2009), and population (Chiemchaisri et al., 2007). With the increase in global population and rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. In Asia and Africa, rapid population growth in metropolitan areas is a common occurrence (UN, 2009), and the amount of MSW generated as a result rises substantially. India has made significant progress in terms of industrialization in last few Decades. Consequently, there has been an increase in urbanisation, living standards, consumption, and per capita waste generation (Ray et al., 2004). Here, the problem of solid waste management has become and has remained a serious problem, not only due to environmental and aesthetic considerations, but also due to the massive amounts generated each day. According to Central Pollution Control Board, India's 377 million urban residents (31% of the total population as per census of India, 2011) generate around 1,43,449 metric tonnes per day of MSW amounting to nearly 37 million tonnes annually (CPCB, 2014-15). According to another estimate about 0.2 to 0.5 kg of solid waste is generated per capita each day (Bhoyar et al., 1996). In addition to MSW, a significant amount of biomedical waste is deposited in garbage bins and landfills despite government regulations requiring biomedical waste to be disposed of separately (Patil and Shekdar, 2001). These figures increase each
day with increasing population. To compound the matter, the country’s total number of towns (statutory and census) climbed from 5,161 in 2001 to 7,936 in 2011 resulting in a 2,775 rise in municipal garbage generation in a decade.

High unemployment, along with rising levels of solid waste and a developing global market for recycled products, have paved the way for a rapid development of waste collection and disposal activity. Thousands of individuals rely on the collection of recyclable items for their livelihoods in most cities of developing countries (Steuer et al., 2018) and as per an estimate nearly 2% of the population in Asian and Latin American cities lives on rag picking income (Kashyap and Visvanathan, 2014). The United Nations Inter-Agency Task Force on Social and Solidarity Economy reported that International Labor Organization (ILO) has estimated approximately 15–20 million informal rag pickers worldwide generating a very low income, often living below the poverty level (UN, 2019).

Rag picking takes place in all stages along the waste management system that is source separation at household or place generating waste material. Here materials are reused, sold, or given away, for an instance, old newspapers are used for packing, and recover materials from waste to satisfy their needs. During collection, ragpickers sort out recyclable, repairable, and re used items either for themselves or to sale. Rag picking thus contributes to the reduction of the amount of solid waste to be disposed, provides valuable service to society in terms of environmental management and helps to save natural resources that lead to sustainable development. However, rag pickers are poorest of the poor and marginal to mainstream economy and society. Consequently, rag picking prompted concerns about the effects of insufficient collection and traditional waste disposal technologies on rag picker, public, and environmental health. The organic fraction of municipal solid waste has high potentially adverse impact upon health (Isomah et al., 2022). Inadequate solid waste management has a negative influence on people's health and quality of life, especially in poor countries. Isolation as a part of social exclusion leads societies of rag pickers to develop their own habits, customs, beliefs, and values. As a result of their marginalization, they are often a subject of harassment by the authorities and police and female rag pickers may be considered easy sexual targets. Due to their daily contact with garbage, rag pickers are usually associated with dirt, diseases, filth, and perceived as nuisance, a symbol of backwardness and even as criminals, and policies that erroneously discourage their job would result in even more misery for the population, as well as a larger waste disposal problem. Ragpickers survive in a hostile physical and social environment despite their contribution to significant economic growth and face discrimination because of their work, even though they play an important public health function (Porto MF, 2004). Rag picking represents an important survival strategy for the poor. They respond not only to environmental and health considerations but also to market demand. The underlying factors that cause people to become ragpickers are poverty resulting from under development, inability, or unwillingness of individuals to obtain other forms of employment, existence by waste dumps, income earned and recyclable industrial demand for inexpensive raw materials. Rag pickers despite the monthly income they make have faced problems of informality and vulnerability to diseases, hence they need government assistance.
Very little attention has been paid so far to this important aspect of public health. Although number of studies have been carried out world over, but still there is a need for a systematic review of the available studies to guide further research on this significant public health concern. Against this background, this study is undertaken to investigate the occupational health hazards of Ragpickers. The objectives of the present study are (1) review of the studies on investigating rag picking associated health hazards, (2) identification of health hazards in global Scenario, (3) recommendations for future research work on related field.

**Material And Method**

The focus of this research is on the snowball approach for picking high-quality research items for further investigation. In addition, keywords’ combinations of “Ragpickers” in conjunction with each of the following: waste pickers, scavengers, chiffonier, and occupational health hazards in different search engines namely Scopus, google scholar, semantic scholar, research gate and google search engine was done. The main search was run on Scopus and the search query was: (TITLE-ABS-KEY (ragpickers OR waste pickers OR scavengers OR chiffonier) AND (Occupational health hazards) AND (EXCLUDE (LANGUAGE,"Spanish"))). Similarly, the combination of these keywords was also used on other search engines (Fig. 1). Most of the articles were searched from Scopus (64) followed by Google Scholar (38), Research gate (17), Google search (09), and semantic scholar (6).

Once a relevant study was being identified, the references of the paper at hand were being scanned to find studies that had not been found throughout the initial searching procedure. In this stage, only journal papers were considered eligible. Non-English studies, chapters, as well as Master theses were excluded. The latest search was conducted on 30 May 2022. Subsequently, the abstract of each paper was being reviewed, while, at the next stage, the full text was being read to decide its appropriateness. Initially, 339 articles were selected, but then, in this study, an intensive review of the most relevant articles is presented for occupational health hazards associated with rag picking. This research article is divided into several sections. The first section deals with the introduction followed by material and method. Section 3- deals with results of the study, analysing patterns and trends of studies across world and India dealing with rag pickers occupational health hazard. Discussion is compiled in section 4. The last section presents a future road map for further scope and research opportunities on rag pickers occupation health hazards investigations. Table 1 depicting the geographical distribution of the 134 study areas mentioned in the literature database, its uncovers a critical land inclination in the considered territories, with most of the helplessness zonation in Asia followed by Africa, South America, and Europe.
Table 1
Distribution of literature across major continents (until 30th June 2022).

<table>
<thead>
<tr>
<th>Continents</th>
<th>Country</th>
<th>Number of Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>South America</td>
<td>Brazil (26), Colombia (1), Nicaragua (1), Paraguay (2)</td>
<td>30 (22.39%)</td>
</tr>
<tr>
<td>Asia</td>
<td>Bangladesh (8), India (41), Indonesia (5), Iran (3), Mongolia (2), Nepal (2), Pakistan (4), Palestine (1), South Korea (1), Sri Lanka (1), Thailand (1)</td>
<td>69 (51.5%)</td>
</tr>
<tr>
<td>Africa (6)</td>
<td>Botswana (1), Cameroon (1), Ethiopia (1), Ghana (6), Malawi (1), Nigeria (7), South Africa (14), Zimbabwe (1)</td>
<td>32 (23.88%)</td>
</tr>
<tr>
<td>Europe</td>
<td>Denmark (1), UK (2)</td>
<td>3 (2.23%)</td>
</tr>
</tbody>
</table>

Source: Compiled by author based on previous review literature

The data has been gathered in study region into subcategories. The 25 nations having study regions in the literature database are shown by no of articles published related to the topic. India has the leading country with 30% research studies have been done on related topics followed by Brazil (19%), South Africa (10%), Bangladesh (6%) and Nigeria (5%) (See Table 2).
Table 2
Country-Wide Distribution of the Literature across the World.

<table>
<thead>
<tr>
<th>Continent</th>
<th>Country</th>
<th>Counts</th>
<th>% of Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>South America</td>
<td>Brazil</td>
<td>26</td>
<td>19.40</td>
</tr>
<tr>
<td></td>
<td>Cambodia</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Nicaragua</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Paraguay</td>
<td>2</td>
<td>1.49</td>
</tr>
<tr>
<td>Asia</td>
<td>Bangladesh</td>
<td>8</td>
<td>5.97</td>
</tr>
<tr>
<td></td>
<td>India</td>
<td>41</td>
<td>30.60</td>
</tr>
<tr>
<td></td>
<td>Indonesia</td>
<td>5</td>
<td>3.73</td>
</tr>
<tr>
<td></td>
<td>Iran</td>
<td>3</td>
<td>2.24</td>
</tr>
<tr>
<td></td>
<td>Mongolia</td>
<td>2</td>
<td>1.49</td>
</tr>
<tr>
<td></td>
<td>Nepal</td>
<td>2</td>
<td>1.49</td>
</tr>
<tr>
<td></td>
<td>Pakistan</td>
<td>4</td>
<td>2.99</td>
</tr>
<tr>
<td></td>
<td>Palestine</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>South Korea</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Srilanka</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Thailand</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td>Europe</td>
<td>Denmark</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
<td>2</td>
<td>1.49</td>
</tr>
<tr>
<td>Africa</td>
<td>Botswana</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Cameroon</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Ethiopia</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Ghana</td>
<td>6</td>
<td>4.48</td>
</tr>
<tr>
<td></td>
<td>Malawi</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Nigeria</td>
<td>7</td>
<td>5.22</td>
</tr>
<tr>
<td></td>
<td>South Africa</td>
<td>14</td>
<td>10.45</td>
</tr>
<tr>
<td></td>
<td>Zimbabwe</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>134</td>
<td>100.00</td>
</tr>
</tbody>
</table>
PRISMA - (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), is a standard that provides guidance for the reporting of Systematic Reviews. A minimum set of items for reporting a systematic review is provided by the PRISMA Proclamation. It comprises of a flow diagram and a list of elements that the review must contain. The following PRISMA flow diagram depicts the flow of information through the different phases of a Systematic Review. It maps out the number of records identified, included and excluded, and the reasons for exclusions. The out of 339 Research Articles 232 were identified from online database and 107 were additionally database identified through the other sources. Further process of identifying the getting final 134 research article for systematic review shown in the following figure (see. Figure 2).

**Results**

**Geographical Distribution and occupational health hazard Studies**

This study encompasses four continents: Asia, Europe, Africa, and South America. About 69 (51.5%) of the total studies were surveyed from Asia, followed by Africa 32 (23.88%), South America 30(22.39%), and Europe is only 3 (2.23%) has found in the open database on related to the topic. In the case of countries, the highest number of studies were surveyed from India (30.60%), followed by Brazil (19.40%), the South Africa (10.45%), Bangladesh (5.97%) and Nigeria (5.22%) (Fig. 3).

2. **Asian Countries Scenario**

From the overall studies surveyed, it was observed that the greatest number of studies on occupational health hazard was performed on Asian countries (50.8%). As per our literature survey, it is documented that about 32.76% of the research studies was identified from India, followed by Bangladesh (5.17%), Pakistan (3.45), Nepal, Iran, Indonesia (1.724% each), South Korea, Sri Lanka, Mongolia, Palestine, and Thailand (0.86%). In India, most of the studies were performed on large megacities or urban metropolis such as Delhi, Mumbai, Kolkata, Chennai, Bengaluru, Lucknow, Punjab, Bareilly, Guwahati, Kerala, Ahmedabad, Srinagar, Jaipur, Patna, Hyderabad, and Pune. About 26.31% of the studies were performed over Maharashtra. In Bangladesh, most of the studies were performed on large cities such as Dhaka and Sylhet.

**Literature on the occupational health hazard of Rag pickers in Asian countries.**

Hunt (1996) was analysis the 100 children (mainly girls) aged 4–15, 1/3rd waste pickers and 2/3rd non waste pickers were interviewed. Lymph node enlargement was common in waste picking children. Xerophthalmia (vitamin A deficiency) was also prevalent which was diet related. Ray et al., (2004) revels that, the ragpickers showed a higher prevalence of low haemoglobin, high circulating eosinophil and monocyte counts, unhealthy gums, frequent diarrhoea, and dermatitis when compared with controls. The
sputum of rag pickers showed an abundance of alveolar macrophages, siderophages and inflammatory cells, and a very high frequency of squamous metaplasia and dysplasia of bronchial epithelial cells, suggesting inflammation and cellular changes in the airways. Ray et al., 2004 assesses the Sputum samples from ragpickers had considerably higher levels of alveolar macrophages, neutrophils, eosinophils, and lymphocytes compared to controls, indicating airway inflammation. Additionally, there was a considerable increase in plasma levels of IL-8 and TNF, indicating enhanced trafficking of leukocytes from the circulation to the tissues. Suressh & Chary (2006) showed prevalence of infections and ill health in 150 randomly selected child ragpickers. Selvi et al., (2012) represent that the sputum cytological changes like metaplasia and dysplasia of airway epithelial cells indicate greater risk of cancer in MSW-exposed individuals and the ragpickers were found most vulnerable. Uplap and Bhathe, (2014) was conducted from October 2003 to April 2005 in Mumbai, at the field office of a nongovernmental organization working for women ragpickers. Morbidity was statistically significant among ragpickers who collected rags along dumpsite than street side and door to door waste collectors ($\chi^2 = 27.8; df = 2; P < 0.001$ significant). Devi et al.(2014) described the rag pickers of Greater Hyderabad Municipal Corporation (GHMC) showed that 82% of the surveyed ragpickers reported wounds or injuries, 6% body pains and 5% skin or lung diseases. Dr. Gogoi, (2015) in their study covers all households engaged in scavenging around the dump site making up of 80 respondents. 88% of the respondents reported eye irritation while 92% complained of cold and coughing. Singh and Chokhandre, (2015) has tries to determine the prevalence of musculoskeletal conditions (MSDs) and the effect that rubbish picking has on MSD complaints among waste pickers. 200 rubbish pickers employed for at least a year and a control group of 213 people chosen from the same villages or lived nearby were selected. Ravindra et al., (2016) discussed the major occupational health issues reported by various categories of waste workers were respiratory disorders, injuries and allergies having prevalence of 12.3–17.6%, 4.9–44.4% and 35.3–48.9% respectively. Chokhandre et al., (2017) was assessed and compared through a cross sectional survey between randomly selected 200 waste-pickers and a comparison group ($n = 103$) working for at least a year. The prevalence of respiratory symptoms was found to be significantly higher among the waste-pickers (28%) as against to 15% in comparison group. The prevalence of dyspnea (difficulty in breathing) and chronic cough were found to be higher. 

Indira Aiyavoo, (2018) conclude that in the Ragpickers found to be highly vulnerable and exposed to injuries in forms of cuts and bruises, medical wastes, animals, air-borne diseases, chemical poisoning, and infectious diseases. Dongre & Kamble (2019) understanding the Peak expiratory flow rate (PEFR) values are found to be less than expected values. Other occupational health problems reported includes musculoskeletal disorder, dermatological problems, eyes problems, respiratory diseases, gastrointestinal problems, and various type of infections. Yadav et al.(2020) has conducted intensive field study Of the 120 chiffoniers surveyed, major health problems reported were as eye redness by 57.7%, infections by 75.8%, shortness in breathing (82.5%), cough (75.8%), Skin problems (64.47%), identity crises (99.2%), no job security (100%), harassment by police or other public authority (75%), by Kabari (47.5%), Physical abuse (87.5%), psychological (54.2%), verbal (70.8%) and sexual (44.2%), headache (45.0%), general body pain (59.2%) and cut and injuries were reported by 100.0% of the respondents. Kambekar et al.,
(2020) investigation was conducted taking 400 female rag-pickers. Due to the lack of a suitable location to replace sanitary napkins, 280 (70%) women reported difficulty during their menstrual cycle. Saha et al. (2021) explored morbidity status of rag pickers with special reference to respiratory health and to find the associated factors. Forced expiratory volume in one second (FEV1), Forced expiratory volume in 1st sec as the percentage of FVC (FEV1%), forced expiratory flow at 25–75% was calculated from the tracings. Most common symptoms complained by study subjects was backache suffered more by female subjects. Majeed et al. examine the cross-sectional study carried out for a group of scavengers living in huts was to highlight the socio-demographic characteristic, working conditions and occupational health risks with main emphasis on relation of infectious disease prevalence and waste picking activity. Sarawut et al. showed that most SWCs suffered from different types of occupational health symptoms such as musculoskeletal pain and injuries (59.7%), respiratory symptoms (23.4%), head, eyes, and ears symptoms (7.8%), skin symptoms (5.2%), and gastrointestinal symptoms (3.9%). Shibata et al. has found in their field study A total of 113 people from the landfill slum and 1184 people from the general population participated in face-to-face inter-views. A cross-sectional study design was employed in order to make comparisons between the landfill slum population and the local general population in terms of disease status and exposures.

Scenario From South American Countries

After Asia, the second highest number of studies came from South American countries contributing to 25% of the total studies. In this review, studies were collected from 4 countries with the highest number of studies on the Brazil (21.55%), followed by Paraguay (1.72%), Colombia, and Nicaragua (0.87). As per the literature survey, most of the studies were performed on cross-sectional approaches (more than 50% of the study). Almost in all studies ragpickers were found to be highly exposed and vulnerable to health hazards associated with their occupation. The details of the occupational health hazard are presented in the following section. While the distribution of studies is shown in Fig. 3.

Literature on the occupational health hazard of Rag pickers in South American countries.

Robazzi et al. (1997) evaluate the occupational accidents (OA), and the coefficient of their frequency (CFOA) and intensity (CSOA). A total of 103 OA occurred over a period of 12 months among 81 workers. The CFOA was 527 and the CSOA was 6722 per 1,000,000 working man-hours. Da Silva et al. (2005) analysis a cross-sectional study involving subjects older than 17 years 455 ragpickers and 535 non-ragpickers who were residents of the same neighbourhood and of similar gender, age, and years of schooling. Study revealed that ragpickers were exposed to Ergonomic, chemical, safety, psychosocial and biological hazards. Da Silva et al., (2006) was conducted a study on Musculoskeletal Disorder (MSD) and showed higher prevalence of MPD among ragpickers and MPD was reported more in females, those of lower economic level, smokers, and alcoholics. The study concluded that rag pickers reported frequent MPD than controls living in the same neighbourhoods with many of the same life conditions. Cowing (2013) work on Waste pickers working with recyclable materials are exposed to cuts, maiming, fatal
accidents, contamination by heavy metals and dangerous wastes and are at risk of developing pulmonary diseases, HIV, and hepatitis C because of contact with sharp items and hazardous health waste. Marinho et al., (2014) has found that the overall prevalence of HBV infection (HBsAg- and/or anti-HBc-positive) was 12.8%. An age over 40 years and illicit drug use were associated with HBV infection. HBV DNA was detected in 2/3 HBsAg-positive samples and in 1/52 anti-HBc-positive/HBsAg-negative samples (an occult HBV infection rate of 1.9%), in which the genotypes/ subgenotypes A/A1, D/D3 and F/F2 were identified. Only 12.3% of the recyclable waste collectors had serological evidence of previous HBV vaccination. Gutberlet and Uddin, (2018) analysis the risk factors, hazards, and vulnerabilities of waste pickers in Brazil through a social and environmental justice perspective. Waste pickers are exposed more during collection and separation of recyclables items. Household waste, although not always per se toxic or hazardous, can become a hazard if not collected or inadequately managed. Waste pickers reported widespread exposure to pests, including rats, cockroaches, and pigeons, were serious health risk factors that urgently needed to be controlled. Vanessa et al., (2019) has done intensive field study and shows the prevalence of several communicable and non-communicable diseases and highlight the importance to address urgently the environmental, social and health impacts related to the management of solid waste in developing countries to protect these workers and their families. Romero et al., (2010) evaluates the respiratory symptoms, lung function, and exposure to airborne particles among 103 waste picking children at a dump in Managua, Nicaragua and 103 children who do not pick waste. Very high concentrations, exceeding standard values of particles, assessed as TSP, PM10, and PM2.5, were observed in working areas of the dump. Acute respiratory infections, asthma, wheeze, and cough have been associated with PM10 particle concentrations from biomass exposure as low as 65 µg/m. Martínez et al., (2019) analysis the gender differences along with characteristics that may be related to the likelihood that trash collectors may experience physical or mental illness taking census data of 3109 trash collectors. In Medellin, Colombia’s second-most populous city, trash collectors reported suffering lung infections (32%), bowel ailments (10%), chronic mental and physical disorders (47%), and 37% did not have access to health insurance.

Scenario In African Countries

In this review, eight countries were surveyed from Africa, with the highest percentage of studies on South Africa (7.76%), followed by Nigeria (6.034%), Ghana (4.31%), and others contributed to rest of the studies.

Literature on the occupational health hazard of Rag pickers in African Countries

Tlotaleng et al. (2019) was identify the prevalence of acute respiratory symptoms and related risk factors among 361 waste recyclers at two landfills in Johannesburg that were chosen at random. To reduce the risks experienced by informal workers, it is crucial to increase understanding of occupational health and safety. Kistan et al., (2020) evaluates the availability of health care for these individuals in South Africa. In two landfill sites in Johannesburg, a cross-sectional study of informal garbage recyclers was conducted. In the unilabiate study, elements like gender, receiving good service at the clinic, and the
facility’s location were linked to health care use. Made et al., (2020) describe the relationships between sickness, clinic visits, and self-rated health. There was a cross-sectional study done. The ailments included chronic, infectious, and mental health conditions. Access to medical care included going to the doctor’s office within the previous year. To evaluate the connection, an ordinal logistic regression model was built. Wilson et al., (2021) was investigated health disparities between the sexes among informal waste collectors who are impacted by poverty and other environmental and occupational dangers. 361 garbage pickers in total took part in the poll. In comparison to the male rubbish pickers, the women interviewed made, on average, 22% less money each month. Uhunamure et al., (2021) was conducted a study among 114 waste pickers and results revealed significant associations between occupational health of the waste pickers and landfill exposure, number of days worked and age, and infectious and chronic diseases. It is unlikely that waste pickers will have a risk-free environment. Zolnikov et al. 2021 Ragpickers reported chronic diseases, because of working in the dump such as constant pain and indicated that they had experienced several conditions or ailments, including diabetes, chronic pain, high blood pressure, inflammation, stroke, kidney disease, spinal problems, headache, prostate problems, sinusitis, allergic rhinitis, polycystic ovary syndrome, and edema. Ali and Yusuf (2021) were looks on the ways rubbish pickers in Bauchi City, Northeastern Nigeria, manage their wounds after getting hurt on the job. Over the course of 80 waste pickers’ intermediary shops, 322 waste pickers in total were chosen at random. Isomah et al.(2022) investigated the health risk of rag pickers in Portharcourt, Rivers State, Nigeria by collecting sputum, nasal swap, and faeces samples from 80 rag pickers and 20 control subjects. These samples were inoculated on surface of dried agar yielding fungal and bacterial isolates. The study revealed that micro-organisms present in waste dumps were also found in the samples collected from the ragpickers, reflecting a relation between occupation and diseases. Owusu-Sekyere, (2014) examines the health implications associated with the occupation, using scavengers in Kumasi as a case study. The research is based on data collected through 10 key informant interviews with stakeholders in waste management and 30 personal interviews with waste scavengers drawn equally from the three largest solid waste dumpsites in the metropolis. The study utilizes qualitative data gathered from in-depth interviews and focus group discussions, under the broader umbrella of the participatory research approach. Fischer et al. (2020) evaluate the health effects of informal e-waste recycling. At the Agbogbloshie e-waste recycling facility, a questionnaire-based assessment of occupational information, medical history, and current symptoms and complaints, compared to the control group, e-waste employees experienced considerably higher work-related injuries, back pain, and red, irritated eyes. Acquah et al., (2021) was to compare e-waste workers at the largest informal e-waste dumpsite in West Africa to workers who were not involved in recycling e-waste to determine the prevalence and severity of self-reported musculoskeletal disorder (MSD) symptoms. By e-waste employment type, differences in MSD symptom incidence, location, and intensity point to specific occupational morbidity. Gwisai et al. (2014) was to examine the respiratory and common health ailments of scavengers and landfill employees in a Municipal Solid Waste (MSW) disposal site in Lobatse, Botswana. The results of the study revealed a high prevalence of respiratory symptoms and a wide range of occupational health problems among landfill employees and scavengers, and this could be due to lack of protective clothing. Jerie, (2016) study population for questionnaire surveys comprised all the 589
organised informal enterprises in Monomotapa high density suburb, Shamrock Park medium density suburb. Key findings from the study revealed that solid waste management practices are dominated by manual handling tasks hence the higher incidents of muscular-skeletal disorders were reported. Melaku and Tiruneh were to look into the occupational health conditions and contributing factors among Ethiopia’s Addis Ababa municipal solid waste collectors. 576 municipal solid waste collectors participated in a cross-sectional study that was conducted at the institution level. Kalina, and Tilley, aims to obtain knowledge about exposure to airborne endotoxin and microorganisms at species level at different collection frequencies of ECF, and whether an increase in waste sorted fractions means that each waste fraction is collected less frequently.

**Scenario In European Countries**

The lowest number of studies was performed on European countries. As per the literature survey, 1.72% of the total studies were collected from European countries. In this review, studies were collected from 2 countries in Europe with the equal number of studies on the UK and Denmark (0.86%). The details of the studies are presented in Fig. 3. Thomas et al. (2018) did a cohort study using Participatory Boddy Mapping as a risk assessment tool to identify the relationships between pain quantity and distribution, experienced by the workforce undertaking different collection systems in UK district council. The levels of Musculoskeletal Disorders (MSDS) using Participatory body mapping of staff at UK district council were collected in 2 years before and after the move from boxes and baskets to a wheeled bin recycling service. The study introduced the concept of Average Pain Count (APC). Findings revealed that wheeled bin-based services (APC 2.07 & 2.80) are associated with less MSD outcomes than services including boxes, baskets, and sacks (APC 4.02). However, wider study is required involving ill health absences and statistical analysis, comparison between ill health and APCs and effects of age and length of services.

**Discussion**

Occupational health hazard refers to any workplace condition that causes a risk to employee health. A study showed that there are many possible health hazards associated with rag picking. These include injuries from stepping on broken bottles or sharp objects in the waste, skin and blood infections, intestinal worms due to animal and human faeces and other diseases like typhoid fever, cholera, which may be transmitted to others (Isomah et al., 2022). The Occupational Safety and Health Administration (OSHA), the government organization in charge of keeping workers safe, has defined six main categories of occupational hazards namely 1) safety, which may include any condition, substance, or object that can injure a worker, like working from heights, spills on floors, machinery with moving parts, confined spaces, steep stairs, or exposed electrical wiring; 2) Chemical, there are many kinds of hazardous chemicals and toxins including environmental smoke, cleaning products, acids, pesticides, carbon monoxide and flammable liquids and people can become exposed; 3) Biological, workers can be exposed to biological health hazards like blood, fungi, mold, viruses, animal droppings, and insect bites. 4) Physical, workers can also become exposed to physical hazards present in the environment that can
harm body without touching it, like radiation, prolonged exposure to sunlight, extreme high or low temperatures, and loud noise; 5) Ergonomic, these hazards put strain on the workers body over a period. One just feels sore or cramped in the short term, but repeatedly sitting or standing in awkward positions or completing the same movements over and over, across a long period of time, can lead to long-term injury and illness; 6) Work organization hazards include workplace violence, discrimination, lack of respect, sexual harassment, and other conditions are hazardous to mental, emotional, and physical health. In the present study, we investigate various types of occupational hazards as illustrated in (Fig. 4).

Word wide many studies are conducted to investigate multiple occupational health hazards in ragpickers (Da Silva et al., 2005; Al Khatib et al., 2020; Cruvinel et al., 2019; Robazzi et al. 1997; Kuijer et al., 2004; Da Silva et al., 2005; Suresh & Chary, 2006; Aiyavoo, 2018, Dongre and Kamble, 2019; Yadav et al., 2020). Most of these studies are based on cross-sectional approach, which reported prevalence of diseases in Ragpickers and where consideration is not giving on identifying the causes behind prevalent diseases or other health risks. This task has been accomplished by few like (Ray et al., 2004; Thomas et al., 2018; Isomah et al., 2022). Paulsen et al., (1995); Kuijer et al., (2004) showed that occupational accidents, musculoskeletal disorders, pulmonary, fatigue, respiratory, hearing complaints and gastrointestinal diseases are frequent in ragpickers because of their exposure to occupation. However, no empirical finding was devised. Zolnikov et al., (2021) identify and investigate all occupational hazards and health consequences linked with informal rag picking. Rag picking is a widespread way for individuals to make money, especially in low-income nations; nonetheless, rag picking relates to a number of occupational dangers and negative health outcomes. Physical, social, biological, chemical and safety, ergonomic and mechanic occupational hazards are mostly seen among them. Informal rag pickers or recyclers play an important role in achieving global sustainability, human health, and environmental health goals. Informal garbage workers have already had a positive impact on the economy, health, and ecology all around the world. It can be suggested if adequately organised and supported, this population has the power to improve urban health and environmentally sustain all nations. These studies suggest some safety measures to these complaints. The global analysis of the studies has shown that India accounted for highest number of studies (32.76) however, these were based on either cross-sectional approaches or clinical investigation. Wide disparity has been found in the studies as most of the studies were conducted using same methodologies and particularly for major urban agglomerations. In India, the Harijans are a cast of untouchables that deal with waste collection and recycling, which on an average collect 10–15 kg of waste per day (Yadav et al., 2020). They live in poor conditions and experiences social and economic exclusion.
Table 3 depicts about number of studies done on different types of health hazards of rag pickers. Chemical biological hazard, safety hazard, ergonomic and MSDs hazard, physical hazard, workplace hazards are types of health hazard on which a number of studies has been done. While working rag pickers come in contact with various types of dangerous and hazardous material which are very risky for their health. Out of all chemical and biological hazard hold a significant place and therefore more studies are done on them. Chemical and biological hazard can cause breathing problems, skin diseases, burns, cancer and can have adverse effect on health. When it comes to MSDs, rag pickers are one of the occupational categories most at risk. The longer working hours and physically demanding nature of rag pickers’ jobs, which involve lifting and pushing heavy loads and making long daily walks, may be the cause of the greater occurrence of musculoskeletal problems among them. We have 16 studies regarding to ergonomic and MSDs hazard. Studies related to physical and workplace hazard are also inculcated.

### Chemical And Biological Health Hazard

The chemical and biological health hazard researches have been taken place in developing countries. Among them majority of researches have been conducted in Brazil and India followed by South Africa. In the Middle East only, Iran has conducted this kind of research. In south Asia, India, Pakistan, Nepal, Bangladesh, and Sri Lanka have conducted the research on chemical and biological hazards. Majority of south East Asian countries have conducted the research on chemical and biological hazards. Great Britain is the only developed country which has taken the research on chemical and biological hazards (Fig. 5).

### Physical Health Hazard

The physical health hazard researches have been taken place mostly in developing countries. Among them majority of researches have been conducted in South African nation and south Asia. In the Middle
East only, Iran has conducted this kind of research. In South African nation, South African and their bordering countries have conducted the research on physical health hazards. Majority of south Asian countries like India, Pakistan, and Bangladesh have conducted the research on physical health hazards. Great Britain is the only developed country which has taken the research on physical health hazards. The highest number of research has been in India followed by West African countries (Fig. 6).

**Ergonomic And Msds Health Hazards**

The Ergonomic and MSDs Health hazard researches have been taken place in developing countries. Among them majority of researches have been conducted in Brazil and India followed by South Africa. In the Middle East only, Iran has conducted this kind of research. In south Asia, India, Pakistan, Nepal, Bangladesh, and Sri Lanka have conducted the research on Ergonomic and MSDs Health hazards. Great Britain is the only developed country which has taken the research on Ergonomic and MSDs Health hazards. The South African countries have also been good number of researches (Fig. 7).

**Workplace Health Hazard**

The Workplace health hazard researches have been taken place in developing countries. Among them majority of researches have been conducted in India, Bangladesh followed by Brazil. In the Middle East only, Iran has conducted this kind of research. In south Asia, India, Pakistan, Nepal, Bangladesh, and Sri Lanka have conducted the research Workplace health hazards. Majority of south East Asian countries have conducted the research on chemical and biological hazards. Great Britain is the only developed country which has taken the research on Workplace health hazards (Fig. 8).

**Safety Health Hazard**

The Safety health hazard researches have been taken place in developing countries. Among them majority of researches have been conducted in Brazil and India followed by South Africa. In the Middle East only, Iran has conducted this kind of research. In south Asia, India, Pakistan, Nepal, Bangladesh, and Sri Lanka have conducted the research on Safety health hazards. Majority of south East Asian countries have conducted the research on chemical and biological hazards. The South African countries have also been good number of researches on safety health hazards. Great Britain is the only developed country which has taken the research on Safety health hazards (Fig. 9).

Figure 10 shows the country wise scenario of the various health hazards related studies in the worldwide. India has the leading country in the focused on all related health hazard issue on rag pickers.

Numerous research studies have been conducted on various health hazards faced by rag pickers across the world. (Fig. 11) shows that a majority of the research has focused on chemical and biological hazards, likely due to the immediate health impacts caused by these hazards.
We can't ignore ergonomic and MSDs hazard related studies, these studies also have a good number. These have been done in the developing countries such as Brazil, India, Iran, Bangladesh, Sri Lanka etc. Studies can also be found on physical and work place hazard in some of the developing countries around the world. There number is less as compared to other given hazard studies.

**Conclusion And Suggestions**

Rag pickers are informal workers who collect recyclable materials to earn a small wage on daily basis. Their life and working conditions are extremely difficult. Several studies including the present study have highlighted that waste-pickers are at a high risk of developing occupational morbidities particularly injuries, respiratory illness, eye infection, stomach problems, typhoid, diarrhea, and musculoskeletal disorders. To improve the overall well-being of rag pickers, ergonomics and safe practices must be established to reduce work-related vulnerabilities. Although the concepts of safety/health and good ergonomic practices are introduced in all industries, in the unorganized sector, these practices are always pushed to the back of the workers’ minds. Rag picking has posed a great threat to the society at large, I therefore make the following recommendations:

- Indiscriminate dumping of waste around residential areas should be stopped. There should be adequate political will and policies in this regard.
- Funds should be adequate to encourage modern waste disposal technologies.
- The populace should be enlightened on the hazards of indiscriminate dumping of waste; hence, they should learn to minimize waste at source.
- At household level proper segregation of waste must be done and it should be ensured that all organic matter is kept aside for composting so as to be used as fertilizer.

**Declarations**

**Ethical Statement**

The present study was approved by the Departmental Research Ethics Committee of Delhi School of Public Health, Institution of Eminence, University of Delhi. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee. Additionally, no other ethics approval or consent was required from any other parties besides the authors.

**Consent to participate**

Not Applicable.

**Data availability statement**
This research is based on secondary dataset, which is publicly available through the open sources databased and it is cited in the references section.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper. All authors declare that they have no conflicts of interest.

**Competing Interests**

The authors declare that they have no competing interests.

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**Author's Contribution**

The authors confirm contribution statement of manuscript as follows:

Manuscript conception and design, data collection, writing the Manuscript by Dr. Usha Rani and Harish Kumar, prepared the maps, graph, figures and tables by Harish Kumar and Dr. Usha Rani. analysis of manuscript and interpretation of results by Professor B.W. Pandey and Professor Subhash Anand. Correction and Proofreading by Professor Daman Saluja and Professor Subhash Anand. All authors reviewed the results and approved the final version of the manuscript.

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Figures
Figure 1

Methodology Flow Chart

To proposed outcomes of the study was to investigate occupation health hazards in Ragpickers with global perspective.

A systematic review was conducted in this study to drive some understanding on the occupational health hazards in the world scenario.

To find the relevant studies, some key words like ragpickers, occupations, health hazards, developed and developing countries etc. were used. The relevant literature was extracted from various research platform such as, Google scholar, scopus, science direct, web of science, research gate, JSTOR etc.

**Inclusion Criteria**
1. Studies originality in nature
2. Consider only English language publications.
3. Journals research paper only

**Exclusion Criteria**
1. Studies published after May 2022 were not included
2. Studies written in other languages
3. Offline database research were not included
Figure 2. PRISMA flow chart flow diagram for systematic literature review

Figure 2

PRISMA flow chart flow diagram for systematic literature review
Figure 3

Global scenario of Occupational health hazard studies
Source: Compiled by author based on previous review literature

**Figure 4: Worldwide Major Health Hazards of Ragpickers**

**Figure 4**

Worldwide Major Health Hazards of Ragpickers
Figure 5: Studies done on Chemical and Biological Health Hazard

Figure 5

Studies done on Chemical and Biological Health Hazard
Figure 6: Studies done on Physical Health Hazard

Studies done on Physical Health Hazard
Figure: 7 Studies done on Ergonomic and MSDs Health hazard

Figure 7

Studies done on Ergonomic and MSDs Health hazard

Figure: 8 Studies done on work place Hazard
Figure 8

Studies done on workplace Hazard

Figure: 9 Studies done on safety Health Hazard

Figure 9

Studies done on safety Health Hazard
Figure 10

Country wise Studies on Various Health Hazards
Source: Compiled by author based on previous review literature

**Figure 11: Research Studies on Various Health Hazards**

Research Studies on Various Health Hazards