

Occupational health hazards among solid waste management workers- A Sociological Perspective

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Abstract

India has major environmental problems associated with the generation of waste, inadequate collection of waste as well as its transportation, treatment and disposal. The current system in India does not have the capability to cope with the volume of waste generated by the rapidly increasing urban population, and this negatively impacts public health and the environment. Collection of waste is considered one of the most dangerous jobs in the world as it exposes workers to biological, chemical, and physical hazards and increases risk of certain occupation associated morbidities. The major objective of the study was to find out the prevalence of the occupational related morbidities and associated factors among door-to-door collectors of waste in Bhadravati city of Shimoga district in Karnataka. A cross-sectional survey was taken involving 60 randomly selected door to door waste collectors working for the Bhadravati Municipal Corporation. A semi structured interview schedule was used for data collection and morbidities were assessed using operational definitions by the Occupational Safety and Health Authority guidelines. Results: Among the door-to-door waste handlers in Bhadravati taluk of Shimoga 77.7% reported injuries, 71% reported skeletomuscular problems, 62.3% respiratory problems, 39.3% gastrointestinal problems, 36.3 % eye problems and 30% skin disorders. Multiple logistic regression indicated major risk factors included workers being new to the job, workers being untrained, manual handlers, unhygienic and risky sorting of waste, not using protective equipments, part time workers, not following the protocol for waste handling and workers collecting less than two tons per day of household waste. The poor socio- economic conditions and poor hygienic behaviours, and the alcohol consumption habit aggravated the risk of morbidities. Female waste handlers faced a higher risk of gastrointestinal and skeletomuscular disorders. Significantly large number of door-to-door waste collectors in the Bhadravati Municipal Corporation suffered from injuries, skeletomuscular problems, respiratory problems and gastrointestinal problems as well as eye and skin disorders that seemed to be correlated with characteristics of their occupation.

Background

In developed countries, municipal solid waste workers had significant work associated hazards upto about three decades ago. However, these hazards were reduced to a great extent with the adoption of standard norms and practices, waste handling protocols, strict execution of occupation and safety laws as well as waste handling mechanisation which reduced direct handling of hazardous wastes by workers. Sorting of wastes at material recovery facilities were designed to have conveyance enclosure, dust suppression facilities and controlled ventilation in the work environment as well as appropriate personal safety equipment for the protection of workers. Strict regulations included covers of waste collection containers as well as specific weight and size of containers. Reduced contact with hazardous waste with workers was further facilitated by strict source segregation. Different types of wastes were separately managed with secure transport as well as processing and disposal facilities.

According to the US Bureau of Labour Statistics, the job of garbage collectors is considered the seventh most dangerous job in the world. Because of poor understanding of the magnitude of the problem and lack of financial resources, the risk is still improperly managed in developing countries such as India. On going through the available literature on the matter, it is clear that apart from injury caused by hard objects in solid waste; a lot of other factors play a role in the occupational safety and health of MSW workers. Work related health issues reported from developing countries are directly applicable to countries like India, but the risk levels can be multiplied in the latter because lack of implementation of protective measures in countries like India. Due to inadequate research data of the past in India, most literature surveys and citing of examples are from foreign authors. But in other countries, especially developed countries, they use the latest equipment in the handling of the solid wastes, working environment is better and climate is different than India. The scenario in India can be considered opposite to developed countries. So a study on risks of health related problems among door-to door waste handlers is more important and required in India. SWM project was very well implemented in the Bhadravati Municipal Corporation, Shimoga. But study related health problems among door-to-door handlers was still not done. These work-related hazards can certainly be prevented, if risk assessment and then risk management are properly implemented. The emphasis can be laid on the health of the worker, with is exposed to waste directly.

Estimating the characteristics and quantity of MSW in India and the forecasting of future waste generation is fundamental to the successful planning of waste management. The quantity of MSW that is generated depends on the living standards, the type and extent of commercial activity, the eating habits and the season. India generates about 133,760 tonnes of MSW per day. Of this amount, about 91,152 tonnes are being collected and about 25,884 tonnes are being treated. MSW generations per capita in India can vary from about 0.17 kg per person per day in small towns to about 0.62 kg per person per day in cities.

The rate of waste generation depends on factors like population density, level of commercial activity, economic status, culture and city/region. The data for MSW generation in different states indicated high waste generation in the state of Maharashtra at 115364–19204 tonnes per day, Uttar Pradesh, Tamil Nadu, West Bengal were at 11523–15363 tonnes per day; Andhra Pradesh and Kerala at 7683–11522 tonnes per day; and Madhya Pradesh, Gujarat, Rajasthan, Karnataka and Mizoram at 3842–7662 tonnes per day. Lower waste generation occurs in the states of Jammu and Kashmir, Jharkhand, Bihar, Orissa, Chhattisgarh, Goa, Arunachal Pradesh, Assam, Tripura, Meghalaya, Nagaland and Manipur at less than 3841 tonnes per day.

Bhadravati municipal corporation (door to door), solid waste collection project

Door to Door system is a point collection system in which workers collect the solid and semisolid household waste from each house in the city area. The collection point is where the garbage truck stops to collect waste. The collection system involves truck movement and there are many collection points for the truck. At the door to door waste collection system at Bhadravati, the household waste was collected from assigning societies or apartments or areas of BMC jurisdiction by waste collectors in the waste collection vehicles and transported to the appropriate transportation zone. The workers were also collecting waste from commercial areas. The first, door to door system was started on 1/4/2016. After the expansion of Bhadravati city, all the areas have been covered by this system. Three private companies have been given the contract for this door to door system. Total 64 workers are working in this system presently.

Objectives of study

- To study the prevalence of occupational related morbidities among the door to door solid waste collectors.
- To study the factors related to reported morbidities among door to door solid waste collectors.

Methodology

This was a cross-sectional study. The study was conducted about a solid waste management project in Bhadravati city, Shimoga district (Karnataka). 64 workers were engaged in this project. These solid waste workers collected household solid waste on a door to door basis. As per the Urban Paper 2006, the World Bank Group recorded prevalence of various morbidities. The lowest morbidities due to solid waste worker were skin problems which were around 30% in Mumbai dump site solid waste workers. These values were considered because of the absence of available data on morbidities among Door To Door solid waste collectors of the Bhadravati city of Shimoga district, Karnataka State. The simple random sampling procedure was adopted (60 out of 64 workers). Solid Waste Workers were defined as people who are engaged in the Door To Door solid waste collection. A job experience of minimum one year was considered mandatory. Data was collected from the participant by the interview method using the semi-structured interview schedule.

Data analysis and results

Considering the diversity of material coming under the heading of waste, there was considerable potential for hazardous exposure through waste management. High levels of contamination of water, soil and air in a few well publicized situations have created widespread unease about potential negative health effects of waste management processes, particularly in the communities living in close proximity to relevant sites. Overall, however, most of the literature does not generally support such concerns, particularly as related to the two most common methods, landfill disposal and incineration. There was also not enough evidence to implicate precise substance(s). Any emissions generated from waste management processes were likely to be a mixture of many substances with a toxicological unknown profile.

Many of the studies were hampered by a lack of information about exposure and the use of surrogate indirect measures which can cause exposure misclassification. The levels of most of the potential substances were expected to be extremely low, even with all exposure sources taken into account. Lack of specificity was also possible when defining health outcomes, particularly in self-reported cases. Many outcomes, such as cancers, could not be expected to occur until several years after exposure, requiring latency analysis which was lacking in several studies. Migration into and out of relevant areas was also usually ignored.

The greatest challenge, however, was the elimination of factors which could relate to both environmental exposure and health outcomes, such as age, gender, ethnicity, deprivation or socio-economic status, tobacco use or smoking, occupational history, and access to healthcare. Lack of adjustment for such confounders probably existed in many studies relating to waste management, particularly when using geographical designs. Studies have shown that minority groups or socio-economically disadvantaged populations may be disproportionately located around waste disposal sites⁴⁷.

Individual-based studies rather than community-based studies are perhaps the way for future evaluations of potential health effects pertaining to waste management. However, all the limitations described above need to be addressed. Epidemiology has been increasingly making use of the developing biomarker technology for estimating the internal dose (exposure) and biological response (effect). This would be especially relevant where one or two specific substances are the concern (either because of the health effects the substance may cause or high levels of exposure), but may be less relevant to investigating more general exposures from waste management processes, which often tend to be a heterogeneous nature. In addition to the potential reduction of misclassification, biomarkers offer the possibility of identification of the total burden of exposure and lower level exposures, identification of health events early in the natural history of clinical disease and insight into the mechanisms related to exposure and consequent disease. However, care is needed to ensure proper choosing of biomarkers to ensure they are appropriate to the epidemiological design. For example, the use of urinary cotinine levels confirms whether a person is currently smoking or is exposed to environmental tobacco smoke, but would not be able to aid the assessment of long-term exposure. In contrast, genetic susceptibility biomarkers are valuable for use in studies of chronic disease. The field of molecular epidemiology offers the opportunity to

combine molecular toxicology with epidemiology to investigate interactions between environmental factors and genetic factors in causing disease and identify high-risk groups.

The cross sectional survey was carried off door to door, solid waste collectors who were part of a solid waste management project in the Bhadravati Municipal Corporation (SMC) from 1st May to end of June 2017. Sixty workers (out of a total 64) were part of the survey. The nature of the work of the waste collectors was that they collected waste from assigned areas, sorted the waste and emptied the waste collection vehicle at the dumping site (which was referred as transportation) of each zone.

Demographic Characteristics of the Respondents

The average age of the sample population was 30.67 years. Out of the total 60 participants, 80.3% were men and 19.7% were women. Among the study population workers 90.8% belonged to Bhadravati city and 9.2% belonged to Shimoga district. The majority of the workers lived in slum areas and small groups were from non-slum areas. 86.1% of male workers and 82.8% of female workers were slum dwellers.

Socio-Economic characteristics of the sample population

Greater than one third of the waste collection workers had no formal education and less than one in five attended secondary school or above. The majority of female workers (86.2%) had no formal education as well as 33% among male workers. The mean income of the sample population was Rupees 4520.83 per month. The maximum income reported was Rupees 8000 per month and the minimum reported was Rupees 6800 per month. The income of male and female workers showed considerable disparity. The mean income of males per month was Rupees 6468 as compared to females who had Rupee 5344 per month. The maximum income of males was Rupees 8000 month and that of females was Rupees 6000 per month.

Occupational Health Hazards and their Associated Risks

The study identified several effects common to most of the waste management processes. Though all were not strictly health effects, they were none the less important, especially when health was seen as a state of complete physical, mental and social well-being, not merely the absence of infirmity or disease. Odour was considered unlikely to present a health hazard; but it could influence the community's perception of risk leading to stress which is an occupational hazard. Dust particles can exacerbate respiratory conditions such as asthma and various allergies. Gaseous emissions or smoke, fumes may have putative effects on individuals and can lead to congenital malformations.

Use of tobacco and alcohol among the workers

The use of tobacco among the waste management workers was noted to be 75%. The majority of the workers (86%) were tobacco chewers, 10% had the smoking habit, and 3% of the workers used both. Only less than 1% had ever used snuff. The prevalence of tobacco use was very high among the workers at 73.0%. Among the current users, the number of tobacco chewers was very high (88%) while 9% were smokers and only 2% consumed both. Only 2 workers had the habit of snuff use. Out of the 9 (of 21) female workers, 42% currently used tobacco in contrast to approximately 80% of the males. Among current female tobacco users, 78% used tobacco in the chewing form and 22% in the snuff form.

About one in three of the respondents reported the habit of alcohol consumption. All the workers consuming alcohol were male and almost all (97%) consumed locally-brewed liquor. More than 50% of those who consumed alcohol drank on a daily basis. About 42% consumed alcohol often, about 47% consumed alcohol one to three days per month, about one in three consumed alcohol one to four days a week and about one in five consumed alcohol once in a month.

Duration of work in door to door waste collection

The respondents were asked about the duration of work in door to door waste collection, the number of years in door to door collection system of SMC, the hours spend in the solid waste collection vehicle, the hours taken to complete routinely assigned jobs, and the number of working days in a week and total number of hours worked per week. Workers with greater than five years of experience were about one in five. About 42% of the workers were relatively new to waste handling and only had one to two years of service. Almost all workers did waste handling for the first time as part of their current job in the SMC.

Hours spend in a solid waste vehicle and hours complete to assign a job

The mean number of hours spent in the solid waste collection vehicle and time taken to complete the assigned task was approximately eight and a half hours per day. The door to door waste collectors on an average spent about eight to twelve hours per day in the solid waste collecting vehicle to complete their daily assigned jobs. It was noted that approximately 90% of the workers spent eight hours in the vehicle to complete their daily assigned job, while around 10% had spent 12 hours. During these job hours, they collected waste from their assigned areas, sorted the waste and emptied the vehicle at the dumping site (referred to as transportation) of each zone. Most waste collectors worked seven days a week. It was found that about 90% of workers spent about 56 hours and approximately 10% worked for 84 hours per week.

Job related factors

Under this heading, the details discussed were –training before joining job, nature of employment, type of waste collected, availability of protocol for handling waste at work place, the waste collected per day, waste collecting methods, the manual sorting of waste, supervision of the usage personal protective equipment (PPE), awareness about personal protective equipment, usage of personal protective equipment, incentive to use protective equipments, job rotations, and personal hygiene during the working hours.

Nature of employment

Among the respondents, about three fourth of workers were permanent employees. Permanent employees were given fixed routes, higher pay and better facilities like protective equipments and training as compared to about one third of the temporary workers. It was found that about three fourths of female workers were temporary workers and approximately one in three of the males were temporary workers.

Type of waste collected

Out of 60 door to door waste collectors, 77% collected waste from houses and 23% collected waste from houses as well as commercial sites (mixed waste). The mean quantity of waste collection per day by a worker was 1 ton. About 55% of door to door waste handlers collected one to two tonnes per day, 40% collected one to three tonnes per day, and only 5% waste collectors collected more than 3 tonnes per day. Among the respondents, 92% of the waste handlers collected manually collected the waste and 8% used equipment like spades, fork lifts, etc. which were provided by their employers.

Sorting of wastes

The corporation instructed workers to sort waste into wet and dry biodegradable waste and also into non-biodegradable waste at the source of collection. Majority of waste collectors (92%) who sorted the waste according to this direction were involved in risky practices like sorting the waste for sellable, usable and eatables for their personal use. Nine percent of workers who did not indulge in these risky practices had received training before joining job. In sample population, 77.7% reported some kind injury during the past three months. Among those who reported injuries, 63.2% had a single injury while 36.8% sustained multiple injuries which included cuts, bruises, punctured wounds, cut-lacerated wounds (CLW).

Among the reported injuries, 42.30% were cutting injuries, 4.30% were punctured wounds, 6.40% bruises, 2.56% fractures, 0.40% contusion, 2.13% were CLW, strains/sprains and dog bites, and 0.85% burns. Nearly one third of all the injuries (28.20%) were infected and had pus/ slough. The reason cited for having sustained injuries according to the workers were the nature of work (59%), improper garbage disposal by residents (52%),

lack of personal protective equipment (22.2%), throwing of waste by resident while they are at work (21%), careless passing of vehicles while working during busy traffic (4%), lack of visibility of the driver of the waste truck due to its unique shape (3%), lack of training and nonobservance safety procedures (2%).

Among the respondents, 62.3% reported some kind of respiratory disorders in past three months. The main respiratory symptoms included cough with phlegm (77%), chest tightness (47%), wheeze with breathlessness (29%), running nose (23%), sneezing (21%), dry cough (12 %), itching of the nose (about 19%) and sore throat (6%).

Safety Precaution

Empowerment means improving an individual's capacity to make choices and the translation these choices into preferred actions and positive outcomes. The transforming of choices into the desired actions is influenced by the availability of certain factors and the opportunities. The study has established that the management of solid wastes exposes the individual worker to a hazardous and risky environment. Therefore the workers in the sector must be empowered to take precautionary measures and make rational decisions. However the study shows that majority of those working in this sector do not use protective equipment or garments. Gloves are envisaged as a useful safety precaution to protect the hands from cuts and other hazardous materials such as lead from leaking batteries. Overalls may be able to protect the body from injuries and waste material spillovers because of the hardness of the garment when compared to normal clothing. Safety boots may be able to protect worker's feet from cuts due to broken glasses, metals, timber and other harmful substance; and also inhaler masks may prevent the body from inhaling poisonous substances from the air that could have some negative effects on body metabolism. Of note, there are many precautionary measures that may be undertaken in this sector; however, this study only enquired about the listed basic precautionary measures. The study shows the respondents' adherence to safety measures depending on the type of waste they collect.

The study shows 67.2% of respondents did not use gloves to protect their hands from the waste. Fifty percent of the workers involved with garbage collection stated that they were using the gloves to protect their hands, followed by 40% of scrap metal collectors, 29% of waste paper collectors and 21% of plastic collectors. This is a possible reason why most respondents complained of sustaining cuts while searching for saleable items. The majority (68.7%) of respondents stated that they did not use overalls in their work. In the scrap metal category, only 34.5% of respondents used overalls as a safety measure, 26.4% of plastic metal collectors, 35.3% of garbage collectors and 32.3% of paper collectors stated they were using overalls as protective clothing in their work. This indicates that the solid waste workers are not enlightened regarding their safety and there is certainly a need to change their attitudes toward overalls as part of safety precautions.

In the analysis of interview schedules it was noted that 79.7% of respondents were not using safety boots or gumboots as part of safety measures; and 88.9% of plastic collectors, 87.1% of paper collectors, 76.4% of scrap metal collectors and 58.8% of the garbage collector stated that they were not using any kind of protective boots for their feet. Due to the nature of the materials involved, the need to use safety boots was perceived from this study as very high in the garbage category followed by scrap metals which are also very risky. The papers and plastics were less risky and therefore usage of safety boots was very limited. The table also notes that 70.3% of respondents did not use the inhaler masks in their duties as a safety precaution; and 81.9% of plastic collectors, 69.1% of scrap metal collectors, 64.5% of paper collectors and 52.9% of the garbage collectors did not use the inhaler mask during their work. The cost of the inhaler masks and lack of adequate knowledge can be cited as some of the reasons for low usage of masks.

Conclusion

The prevalence of dermatological, respiratory, musculoskeletal problems, eye problems and injury were reported as high among municipal solid waste handlers. Since our study was a cross-sectional study temporality, health outcomes causation were not proved and the recording of actual incidences could not be done. As with any kind of occupational health study due to the "healthy worker effect," workers with severe morbidity may leave their job resulting in under reporting. Measures are certainly needed to improve the working environment of waste handlers including ensuring availability protective gear, clean drinking water, washing and sanitation facilities during the working hours. More ergonomic principles need to be incorporated. A system of routine surveillance and health recording among solid waste workers needs to be implemented. Occupational health institutes and local medical schools should be encouraged to study the health of solid waste workers in comparison with appropriate baseline control populations due to the significant deficiency of available epidemiological data in this sector along with further follow-up studies.

There is considerable morbidity among the door to door solid waste collectors which could be due to the exposure to the physical, chemical or biological toxins as part of their work and their work characteristics. Use of personal protective equipment as well as risky personal habits like smoking and alcohol consumption were factors that were common to most morbidities. Manual sorting of wastes that workers were engaged in predisposed them to significantly higher morbidity levels. Additional research is needed to further characterise the exposures and establish the health effects from various exposures and the work practices of the door to door waste handlers.

Solid waste management remains a most urgent concern in the task of urbanizing towns. The challenge confronting the city and many booming towns in the country was to create a proper equilibrium between the environment and development. Toward this end, communication strategies regarding environmental protection becomes crucial. Particularly in solid waste management, turning the good intention to desirable behavior and

creating favourable social and political environments should not be only the concern of local officials but also of residents as well.

Although the possible physical health effects arising from the waste management processes have been addressed, there has been little research into the socio-economic impacts of waste-management options. Public perceptions of the relative health risks reflect not only differences in understanding, but also underlying social values. The development of effective participatory programmes are essential to ensure the public right and responsibility to be involved with the assessment and management of hazards within their communities leading hopefully to further improved assessments and management strategies.

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