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Occupational Health Hazard Exposure among municipal solid waste workers in Himachal Pradesh, India

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ABSTRACT

The net volume of Municipal Solid Waste (MSW) generated in Himachal Pradesh is 350 tons per day (TPD) with an annual growth rate varying between 1 and 1.33%. This leads to serious considerations regarding potential occupational health hazards of workers associated with MSW. The study generated from non-engineered landfill sites was carried out at three locations- Shimla, Solan, and Mandi in Himachal Pradesh, India. . The main aim of this study was to determine existing occupational hazards in relation to MSW management at these locations, to coordinate with the different municipalities and suggest suitable remedial measures for our study locations. In particular, the exposure assessment to the work force comprising of street sweeping, waste collection, waste processing, and rag picking were assessed using an interview scheduling technique. A questionnaire survey was carried out on these workers with the questions asked related to their work culture, socio-economic conditions, general awareness of occupational health risks and related occupational health hazards associated with the work being performed by them. The results showed that the workforce mainly comprised of males with a low percentage of literacy rates. The age distribution showed that majority of waste collectors and street sweepers were above 30 years of age (67%) and that the rag pickers in Mandi town were below 20 years of age. Income variation between casual and regular workers was highly significant with regular workers (INR 600–1200; USD 9–18) getting almost six times the payment of the casual workers (INR 100–200; USD 3–7.5). From the studies conducted the study deduced that about 64% of waste collectors, 80% of street sweepers and 10% of rag pickers in Solan and about 6.67% street sweepers, 57.47% waste collectors and 100% of rag pickers in Mandi were not provided with any protective equipment. Interestingly, in the capital city of Shimla a small fraction of the street sweepers (28%) and waste collector (6%) confirmed that they were given protective equipment twice in a year. The lack of provisions of protective equipment along with the ignorance of the workers results in occupational health hazards due to different types of external injuries. The major occupational health issues reported by various categories of waste workers were muscle and ligament sprain, cuts and lacerations and different allergies varying between 1.97 and 66.67% [for e.g. in Solan it varies from 32.47–66.67%; Shimla 1.97–10.16% and in Mandi 9.52–16.67%], 6.36–67.95% and 5.77–42.86%, respectively. From this study, it was observed that such workers are ill-protected against such occupational health hazards new laws and policies are needed to be introduced for their protection.

1. Introduction

Increased industrialization along with urbanization has led to increased growth of waste hence proper management of MSW generated in developing countries like India is of serious concern (Rana et al., 2017; Afon 2012). In developing countries like India, due to cheap availability of laborers due to high illiteracy rates (Giusti 2009) they are associated with different aspects of waste handling including waste collection, sorting, transportation, processing and disposal of waste (Athanasiou et al., 2010; Ewis et al., 2013, El-Wahab et al., 2014). The overall generation of Municipal Solid Waste in India is 350 TPD with an expected growth rate of 1–1.33% (Sharma et al., 2018). In such scenario, municipal solid waste workers are subjected to different types of occupational risks like exposure to toxic materials from the residues of chemicals, solvents, disease-causing flies and pests, other microbiological contaminants and emissions from the degradation of the organic fraction (Majumdar and Srivastava, 2012) along with musculoskeletal problems due heavy load handling of MSW generated

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(Ewis et al., 2013; Bastani et al., 2016; Khaiwal et al., 2016; Chandramohan et al., 2010). Some studies have also reported being exposed to emissions from transportation vehicles of MSW (Bogale et al, 2014, Majumdar et al, 2014). In particular, laborers working as waste collectors, such exposures can be classified as primarily fatal and non-fatal exposures with musculoskeletal problems being the most common amongst non fatal injuries (Patil and Kamble, 2017, Reddy and Yasobant, 2015; Ross, 2011; Poulsen et al., 1995). A certain percentage of the workers reported that they did not suffer from any external injuries but suffered from allergies, nausea and headaches frequently. From the questionnaire survey carried out, the proportion of respondents varied between 5.77 and 42.86%. The lowest values and highest values were reported by street sweepers in Shimla and drivers in Mandi.

Musculoskeletal problems (MSP) are of significant importance as they affect the quality of life as well as increased economic burden due to productivity and job losses (Yasobant and Rajkumar, 2014; Jerie, 2016). Further, such problems account for majority of related treatment costs and the susceptibility of such groups are of significant concern. It has been observed that even though this is widespread issue in both developed and developing countries, recently some studies associated with these exposed MSW workers have been reported (El-Wahab et al., 2014; Majumdar et al., 2014).

A similar such study was carried out in Chandigarh (Khaiwal et al., 2016) which is very nearby to the selected state (Himachal Pradesh) wherein the present study locations are situated. It is expected that this study will serve as a comparison to the reported study of Chandigarh (a Tier-II city) with the other selected study areas of Solan (Tier-III/IV city), Shimla (Tier-II city) and Mandi (Tier-III/IV city) in Himachal Pradesh (HP). The present study reports the occupational health risks experienced by the municipal solid waste laborers for three different study locations in Himachal Pradesh (non-engineered landfill site) and suggests suitable remedial measures for better management of the workers to prevent such health related problems.

2. Materials and methods

This study was conducted on the workers associated with working in three major non-engineered landfill sites catering to three major cities of Solan, Shimla and Mandi in Himachal Pradesh (HP). The waste generated in Solan, Shimla and Mandi are 22, 100 and 21 Tons per day (TPD) with an average population of 39256, 1.7 lakhs and 26,422 as per the last population Census (Census 2011). In principle, the workers are associated with the activities of collection, transportation, segregation and processing for management of MSW. Further, each of these activities are further subdivided amongst the workers with collection and transportation of MSW being carried out by street sweepers and waste collectors whereas rag pickers and waste processors carry out the process of segregation and processing. The different categories of the workers involved in the process have been summarized in Table 1.

For example, street sweepers are associated with road sweeping and transfer the collected wastes from the streets to the collection point. However, rag pickers search for the recyclable fractions from the mixed fraction of the waste from both the collection points and dumping site. Details of the registered workers (street sweepers and waste collectors) were accrued from the municipalities of the three cities and the rag pickers from the private contractors wherever applicable.

A questionnaire survey was conducted on these workers with the questions asked being related to their work culture, socio-economic conditions, general awareness of occupational health risks and related occupational health hazards associated with the work being performed by them. The data has been analyzed using Epi Info software as has been utilized and reported in another study (Khaiwal et al., 2016). The questionnaire used for the study has been provided as a supplementary material.

3. Results and discussions

3.1. Socio-economic status

3.1.1. Gender and age distribution

The questionnaire survey showed that all categories of waste workers are dominated by male workers at all the study locations. In particular, it was observed that in Solan sweepers were primarily between the age groups of 30–40 years (45.45%) and above 40 years (38.46%) as private organizations preferred to hire such workers within this age group. Similar such observations were made in Mandi wherein sweepers belonging to age group of greater than 40 years accounted for 43.33% of the work force. In comparison, Shimla reported that sweepers belonging to the age group of 30–40 years accounted for 13.86% and greater than 40 years (13.39%) were significantly less than the other two study locations.

Rag pickers accounted for equal percentages between the age groups of 30 to 40 and greater than 40 years being observed at 20% for Solan. In comparison, Mandi reported the highest percentages of rag pickers below the age of 20 years accounting for 66.67%, followed by workers within the age group of 20–40 years as 33.33%

Waste collectors in Solan city between the age groups of 20 to 30 years were significantly high accounting for 83.33% whereas those below 20 years of age comprised 12.99% of the workforce. Similarly, a high percentage of waste collector were observed in the age groups of 30–40 years (97.24%) whereas, in Mandi, the age of waste collectors was observed between 30 and 40 years accounted for 40.33% of the workforce. Similar such results were reported for Chandigarh (Khaiwal et al., 2016)

3.1.2. Educational qualification

The educational qualification of the workers in the study location varied with the part of the MSW management work they were involved in. For example, in Solan, the highest illiteracy rate existed amongst the street sweepers (58.97%) followed by waste collectors (32.47%). In a reported study for Chandigarh (Khaiwal et al., 2016), the illiteracy rate amongst street sweepers (56.8%) were almost similar to those observed in Solan but illiteracy rate amongst waste collectors were significantly greater (58%) than our study locations. A certain proportion of rag pickers (30%) and waste processors (33.33%) were educated only up to a primary level. In Shimla, high illiteracy rate (10.38%) was found among street sweeper, followed by the waste collector (4.71%) and educated up to primary level. In Mandi the highest illiteracy rate (100%) was seen among rag pickers, followed by waste collectors (26.44%). In contrast, street sweepers (30%), were found to be educated up to a primary level.

3.1.3. Income

The income of the different groups of the municipal waste workers varied widely with the work they were associated with. For example, the income of the rag pickers is decided based on the amount of recyclables collected by them on a daily basis. From the survey conducted it was observed that for Solan majority of the waste collectors (66.7%) earn around INR 200 (USD 3) per day in two ways, firstly by selling the recyclables and also charging a monthly tipping fee from the residents. The street sweepers and waste processors in Solan city are regular workers and major frac-