HEALTH RISK AMONG MUNICIPAL WASTE MANAGEMENT WORKERS: A CROSS SECTIONAL STUDY OF SRINAGAR CITY, UTTARAKHAND, INDIA

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Abstract:

In Srinagar, the net volume of Municipal Solid Waste (MSW) generated is 15 tonnes per day (TPD). As compared to 2011 the waste generation is 5 tonnes per day which has increased with the increasing population. This raises considerable concerns about the potential occupational health risks that MSW professionals may encounter. Due to rising occupational concerns, manual handling of municipal solid trash is a major source of worry as it is widely practiced among the workers in Srinagar city due to the lack of technology-based management of waste. In consideration of this, the health risks of municipal solid waste workers engaged in street sweeping, garbage collection, waste processing, and rag picking in Srinagar were assessed using an interview, schedule as a data collection method. After the collection of data, statistical tools like correlation and regression were used to find out the probability of occurrence of health risk in MSW workers. The findings suggest that the garbage handling profession is dominated by men, and they have a lower literacy rate. According to the age distribution 52% of waste handling workers are between the ages of 29 – 38 years. Waste employees earn between 300 and 1133 per day, depending on whether they work on a contract or a permanent basis. Due to their casual attitude and unavailability, it was discovered that 92% of waste collectors.., 89% of street sweepers, and 99% of rag pickers do not utilize any form of protective gear, resulting in numerous types of accidents. Respiratory diseases (36%), Cuts and lacerations (84%), Muscle and ligament Sprain (88%), Bruises Abrasion and Burns (53%), Skin/ Nail Infection (94%) , Eye Irritation (53%) , and water-borne diseases (20%) were the most common occupational health conditions reported by various groups of garbage workers. The Workers in the waste industry are susceptible to occupational health risks, and as a result, there is an urgent need to modernize the waste management system by adopting scientific waste management techniques.

Keywords: Disease, Health risk, Municipal solid waste, Waste workers, Srinagar

Introduction:

Amongst the most dangerous occupations in the world is municipal solid garbage collection. Workers are exposed to physical, biological, and chemical risks, as well as occupational morbidity. Workers who handle municipal solid waste (MSW) in developing countries are involved in a wide range of waste management activities, including waste collection, transportation, sorting, processing, and disposal (Ravindra et al., 2015). MSW generation is clearly linked to the city's population. The waste handling workers are exposed to a variety of environmental and

occupational hazards as a result of rising volumes, insufficient resources, and the introduction of certain hazardous waste streams into municipal trash streams. Manual garbage processing, a lack of personal protective equipment, a lack of awareness about health and sanitation issues, and poor environmental management at landfill sites put workers, as well as people living near dump sites, at risk of developing health problems.Manual handling of MSW is dangerous because it contains a range of contaminants, including hazardous elements from chemical and solvent residues, disease-causing flies, bugs, and other microbiological contaminants, as well as emissions from the breakdown of the organic part of MSW (Chandramohan et al., 2010; Mor et al., 2006a, 2006b, 2016; Ross, 2011).

Because of the necessity to lift, haul, drag, and push throughout the loading and unloading process, municipal solid waste labor has a variety of health consequences. There are risks at every stage of the process, from the point of collection at households to transportation and recycling or disposal locations. They are at risk for occupational health and accident because of the materials they handle, the emissions from those compounds, and the equipment they utilize. Refuse collectors are exposed to a wide range of risks in locations where infectious medical wastes and toxic industrial wastes are not separated from home waste. They have a high rate of occupational health problems as a result of their exposure to many risk factors (Tandon,1994). The majority of infections (water-borne, air-borne, and contact-borne) have exposure pathways, while the majority of injuries have contact pathways (hepatitis B virus [HBV], human immunodeficiency virus [HIV], Tetanus). The absence of protective equipment is one of the primary causes of occupational health concerns among municipal solid trash collectors in developing countries. This is mostly due to insufficient financial allocation for appropriate municipal solid trash collection. This exposes individuals to a variety of health issues, including the development of infections, exposure to hazardous pathogenic microbes, and musculoskeletal injuries, such as muscle damage, lacerations and cuts, and fractures. Increasing the containment of waste technologies, lowering pollutant emissions, and altering working conditions. Risks can be reduced by making waste technology more confined, minimizing pollutant emissions, modifying working practices to disrupt routes, and wearing protective apparel. Solid waste management in urban settings requires a well-organized programme, and institutional planning is the key to developing an appropriate and economical system.

Study area:
Srinagar is on the left bank of the Alaknanda River, at 30.22°N 78.78°E. It has a 560-meter average elevation (1,837 feet). It is the Garhwal Hills' largest town. Srinagar has a population of 20,115 people according to the 2011 census. Males comprised 52% of the population, while females constituted 48%. In the Garhwal highlands, Srinagar is the major city. Due to its low elevation of 560 meters, Srinagar is the hottest area in the Garhwal Hills during the summer. From May to July, the temperature might reach 44 degrees Celsius on some days. Winters are cold, with temperatures as low as 2 degrees Celsius in December and January. The fact that it is a valley account for the temperature variance. Srinagar has a literacy rate of 92.03 percent, which is higher than the state

average of 78.82 percent. Male literacy in Srinagar is at 94.22 percent, while female literacy is around 89.51 percent (as per the 2011 census).

Fig 1. Location map of the study area
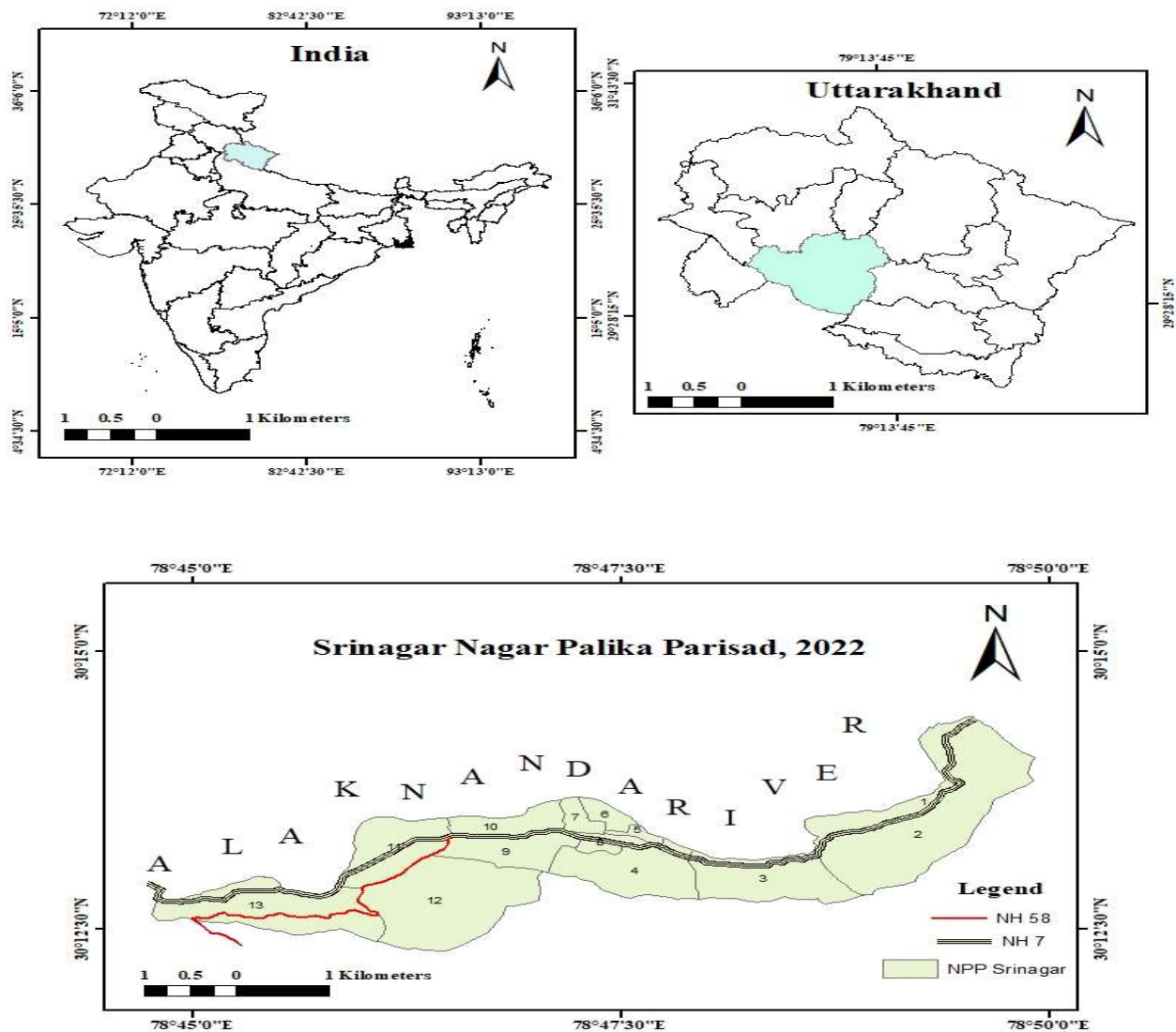
Objective:

- To assess the occupational health risk among the municipal solid waste management workers.

Material and Methods

Waste workers involved in the management and processing activities like collection, transportation, segregation, and processing of MSW were studied in Srinagar city, Uttarakhand. With a population of 33449 people, Srinagar generates 15 tonnes of garbage per day (TPD). Table 1 summarizes the various groups of workers who participated in the process. The employer-provided the number of street sweepers and trash processors. Based on interviews with the

supervisor of the workers, the population of waste collectors, sweepers, waste segregators, waste transporter, and workers at the disposal site was approximated. A schedule was employed to obtain data about their work culture, socioeconomic conditions, general awareness of occupational health risks, and linked occupational health hazards associated with the work they were doing. After the collection of data Excel 2013 software was used to analyze the data. During the analysis of the data, various statistical methods like percentage, correlation, and logistic regression were used between the selected independent and dependent variables.

Table 1: Detailed description of Waste workers occupation and work status.

Categories of waste workers	Nature of work done	Type of work	Total number of workers	Number of Workers interviewed
Street Sweeper	• sweeping the road • Waste pickup from the streets and transportation to collection points	Regular	12	**19**
		Contractual	7	
Waste Collector	• Door to door Collection of waste • Waste transportation	Regular	3	**9**
		Contractual	6	
Waste Segregator	• Segregation of waste into wet and dry waste	Regular	4	**14**
		Contractual	10	
Waste Processor	• Separate the huge waste fraction from the rubbish dump. • Control the flow of garbage into conveyor belts and other machinery.	Regular	9	**17**
		Contractual	8	

Waste Transporter	• Transport the waste to the processing unit and the disposal site.	Regular		5
			3	
		Contractual	2	

Source: Nagar Palika Pareshad, Srinagar

Results and Discussion:
A) Demographic profile and work culture:

According to the results of the questionnaire study, men (86%) outnumber women (14%) in all categories of trash employees. In Srinagar, MSW employees were predominantly between the ages of 29–38 years (53%), since private employers preferred to hire workers in this age range. The workers at the study site had a wide range of educational backgrounds. The major proportion of the waste workers were found educated up to secondary (39%) or high school (22%) level. Waste employees earn between 300 and 1133 per day, depending on whether they work on a contract or a permanent basis. (Table 2)

Street sweepers gather and transport garbage to the nearest disposal location, with roughly half of them relying on cycle carts as their primary means of transportation. Furthermore, garbage collectors do door-to-door collections, which are subsequently carried to the dumpsite by various modes of conveyance. Daily shifts are worked by street sweepers, waste collectors, waste segregator, waste transporter, and waste processors. Day shifts are now implemented in two-hour intervals, with the first shift running from 6 a.m. to 11 a.m. and the second shift running from 3 p.m. to 6 p.m.

Table2: Demographic profile of the workers.

1) Age	Number of workers	Percentage (%)
19-28 years	16	25
29-38 years	34	53
39-48 years	8	13
49-57 years	6	9
2) Literacy		
Illiterate	5	8
Primary	13	20
Secondary	25	39
High School	14	22
Inter or Above	7	11
3) Gender		
Male	55	86
Female	9	14

4) Income		
Regular worker	31 (1133 Rs.)	48
Contractual worker	33 (300 Rs.)	52

B) Occupation health risk:

Correlation were computed between health risk (dependent variable) and various independent variables like awareness, education, occupation, protective gears and age of workers. The values obtained were depicted in the table 3. When significant correlation were obtained between the variables then logistic regression is applied to the respective variables.

Table 3: Correlation between health risk and different variables

Dependent variable	Independent variable	Pearson correlation value
Health risk	Awareness	**-0.48**
Health risk	Education	**-0.27**
Health risk	Occupation	**0.73**
Health risk	Protective gear	**-0.39**
Health risk	Age	**0.72**

The results of binary logistic regression depicts that the municipal workers in the age group of 39-48 years have 3.60 times (1.03-12.04) higher probability of getting health risk with 95% confidence interval. The workers having work experience between 11-16 years and > 16 years are at higher health risk compared to workers working for <5 years. Also the workers who never uses protective gears have 6.4 (1.27,2.62) times more probable chances of health risk in comparison to those who every time uses protective gears while handling the municipal waste. The workers who are not aware of the health risk related to their profession have more odds of getting health risk 1.29 (0.86, 1.74) due to their casual attitude in waste handling. (Table 4)

Table 4: Probability of occurrence of Health risk in relation to different variables

Variables	Total number	Health Risk (No) (Number)	(%)	Health Risk (Yes) (Number)	(%)	Higher Probability of occurrence of health risk	95% CI
Age (years)							
19-28®	16	14	87.5	2	12.5	1.0	-
29-38	34	4	11.8	30	88.2	1.0	1.76-1.0
39-48	8	1	12.5	7	87.5	3.60	**1.03-12.04**[*]
49-57	6	2	33.3	4	66.7	2.8	0.74-7.18

Working years							
<5 [®]	8	7	87.5	1	12.5	1.0	-
5-10	17	9	52.9	8	47.1	3.04	2.18-4.23
11-16	26	3	11.5	23	88.5	6.97	**3.42-11.78***
>16	13	2	15.4	11	84.6	6.33	**1.12-2.69***
Frequency of protective gears usage							
Never	26	5	19.2	21	80.8	6.4	**1.27-2.62***
Sometimes	28	7	25	21	75	2.7	2.38-6.32
Every time®	10	9	90	1	10	1.0	-
Awareness Level							
Yes[®]	21	8	38.1	13	69.1	1.0	-
No	43	13	30.2	30	69.8	1.29	**0.86-1.74***

® = Reference category

P value <0.05

CI = confidence interval

Table 5 represents the total number of workers engaged in different type of work during management of waste like street sweeping (19), waste collector (9), waste segregator (14), waste processor (17) and waste transporter (5). After the application of logistic regression it was computed that waste segregators 4.3 (1.98, 2.67) and waste processor 1.86 (1.27, 2.62) are having higher chances of getting health risk in comparison to other workers due to their direct exposure and handling of waste without the use of protective gears.

Table 5: Probability of health risk occurrence according to occupation

Occupation	Total number	Health Risk (No) (Number)	(%)	Health Risk (Yes) (Number)	(%)	Probability of higher health risk	95% CI
Street sweeper	19	14	73.7	5	26.3	1.64	0.52-5.45
Waste collector	9	3	33.3	6	66.7	8.7	0.57-5.81
Waste segregator	14	1	7.1	13	92.9	4.3	**1.98-2.67***

Waste processor	17	2	11.8	15	88.2	1.86	**1.27-2.62***
Waste transporter®	5	3	60	2	40	1.0	-
Total	64	23	35.9	41	64.1	-	-

® = Reference category

P value <0.05

CI = confidence interval

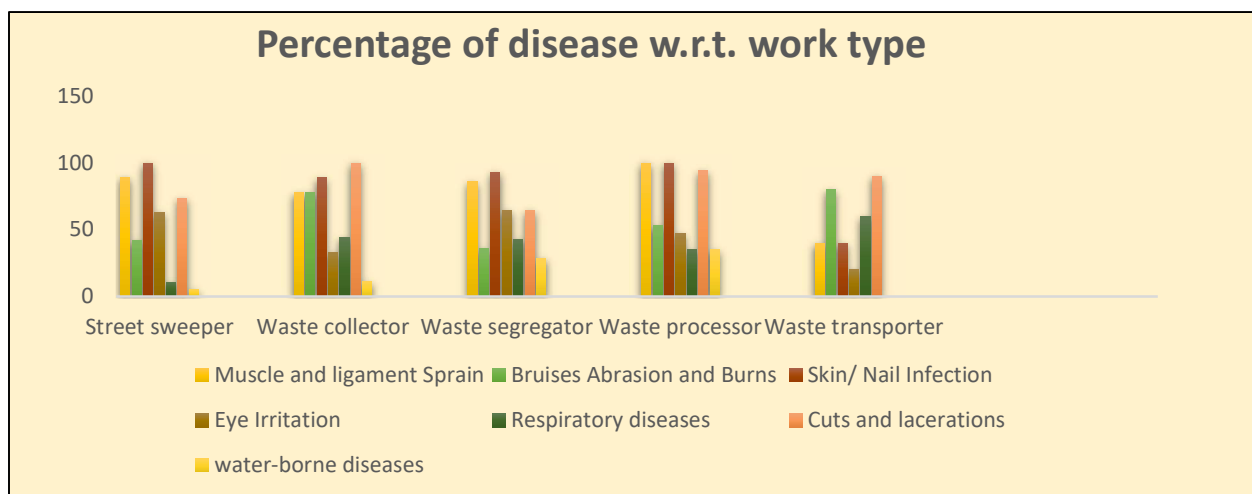Plate 1: Waste collector collecting waste without using protective gears

Table 6 represent the percentage of disease suffered by waste management workers according to the type of work they perform. It has been found that the street sweeper mainly suffer from muscle and ligament sprain (89.47%), skin/nail infection (100%) and cuts and lacerations (73.68%). Majority of waste collector suffer from skin/nail infection (88.88%) and cuts and lacerations (100%) respectively. Survey data shows that nail infection, and muscle and ligament sprain is very common among waste segregator. The waste processor and waste transporter usually suffer from cuts and laceration problem while handling the waste.

Table 6: Percentage of different diseases suffered by workers based on occupation

Type of work ↓	Type of disease	Muscle and ligament Sprain (%)	Bruises Abrasion and Burns (%)	Skin/ Nail Infection (%)	Eye Irritation (%)	Respiratory diseases (%)	Cuts and lacerations (%)	water-borne diseases (%)
Street sweeper (n=19)→		89.47	42.10	**100**	63.15	10.52	73.68	5.26
Waste collector (n=9)		77.77	77.77	88.88	33.33	44.44	**100**	11.11

Waste segregator (n=14)	85.71	35.71	**92.85**	64.28	42.85	64.28	28.57
Waste processor (n=17)	100	52.94	**100**	47.05	35.29	**94.11**	35.29
Waste transporter (n=5)	40	80	40	20	60	**90**	-

Percentage of disease w.r.t. work type

Street sweeper · Waste collector · Waste segregator · Waste processor · Waste transporter

■ Muscle and ligament Sprain ■ Bruises Abrasion and Burns ■ Skin/ Nail Infection
■ Eye Irritation ■ Respiratory diseases ■ Cuts and lacerations
■ water-borne diseases

Conclusion:

The mass of the workers in the research areas was male and in the age groups of 29–38, according to the questionnaire survey. The majority of the workforce is illiterate, with only a small percentage having completed primary school. Regular and contractual workers are the two main categories of workers. Regular workers had more job experience and earned better salaries. According to the study, the usage of any protective equipment by garbage workers is uncommon. Only use of protective equipment to an extent during special visits or occasions. More than 90% of all trash workers suffer from injuries, including muscle and ligament sprains, Respiratory diseases, Cuts and lacerations, Bruises Abrasion and Burns, Skin/ Nail Infection , Eye Irritation , and water-borne diseases. This could be due to a lack of protective equipment and a casual attitude when handling MSW. Waste collectors and waste segregators are more susceptible to risks and do not receive financial assistance for medical care. As a result, the Municipal Corporation, in collaboration with medical institutions, should hold frequent free medical camps to ameliorate garbage workers' casual attitude and raise awareness of occupational disorders and encourage healthy habits. Waste handlers' working conditions must be improved by assuring the availability of protective gear, clean drinking water, and washing and sanitation facilities throughout working hours. Furthermore, the study advocates for the protection of trash workers through the development of

new rules and the provision of appropriate training and awareness initiatives as part of the Clean India Mission.

Reference:

Athanasiou M, Makrynos G, Dounias G. (2010). Respiratory health of municipal solid waste workers. Occup Med (Lond). 60:618-23.

Bundela, P.S., Gautam, S.P., Pandey, A.K., Awasthi, M.K., and Sarsaiya, S. (2010). Municipal solid waste management in Indian cities – a review. International Journal of Environmental Sciences. 1 (4): 591–606.

Chandramohan A, Ravichandran C and Sivasankar V. (2010). Solid waste, its health impairments and role of rag pickers in Tiruchirappalli city, Tamil Nadu, Southern India. Waste Management & Research 28: 951–958.

Cimino JA. Health and safety in the solid waste industry. (1975). Am J Public Health. 65:38-46.

Cointreau-Levine S. (2006). Occupational and Environmental Health Issues of Solid Waste Management. Special Emphasis on Middle-And Lower-Income Countries. Urban papers. Washington D.C: World Bank Group, Urban Sector Board.

Giusti L. (2009). A review of waste management practices and their impact on human health. Waste Management 29: 2227–2239.

Kaur K, Ravindra K and Mor S. (2015). A glance at the world – Waste management policies in India: Can we address the implementation challenges? Waste Management 37: I–II

Mor S, Kaur K and Ravindra K. (2016).SWOT analysis of waste management practices in Chandigarh, India and prospects for sustainable cities. Journal of Environmental Biology 37: 327–332.

Nath KJ. (1999). Socio-economic and health aspects of recycling of urban solid wastes through scavenging, Calcutta. All India Institute of Hygiene and Public Health. Sponsored by the World Health Organization, Regional Office for South East Asia, New Delhi, India.

Reddy EM and Yasobant S. (2015). Musculoskeletal disorders among municipal solid waste workers in India: A cross-sectional risk assessment. Journal of Family Medicine and Primary Care 4: 519.

Ross DE. (2011). Safeguarding public health, the core reason for solid waste management. Waste Management & Research 29: 779.

Tandon R. (1994). A study on the working conditions and occupation hazards at the dumping sites of Bombay. Occup Environ Health. 1:9-17.

Van Eerd M. (1997). The Occupational Health Aspects of Waste Collection and Recycling an Inventory Study in India. UWEP Working Document. Part II. Gouda, Netherland: WASTE. 25-30.