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OCCUPATIONAL HEALTH HAZARDS IN MUNICIPAL SOLID WASTE COLLECTING WORKERS OF CHANDRAPUR CITY, CENTRAL INDIA

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Abstract

Solid waste management has important occupational health issues associated with it. Out of 204 solid waste collecting workers of Chandrapur Municipal Corporation, 20 workers were selected (10% of the population) as sample size (15 female and 5 male) and 10 individuals as control group (5 female and 5 male). The study was carried out from November 2015 to January 2016. Peak Expiratory Flow Rate analysis was carried out through Breath-o meter and identification and assessment of other occupational health hazards through interview schedule specially designed and developed for this study. The results of the study showed that, Peak Expiratory Flow Rate values were lower in exposed workers as compared with control group. These workers were exposed to a number of environmental and occupational hazards leading to musculoskeletal disorders (100%), respiratory problems (90%), headache (90%), dermatological problems (25%) and gastrointestinal problems (15%) during work. It was further observed that these workers were suffering from allergies (100%), stomach pain (50%), asthma and bronchitis lungs (45%), cough and cold (25%), vomiting (25%), hearing disorder (20%), fever (15%), typhoid (10%), malaria (5%) etc. after completion of work.

Keywords: Chandrapur, Environmental health, Municipal solid waste, Occupational health, Solid waste

Introduction

Different types of waste are generated in a city. It includes municipal solid waste, road dust, garbage etc. in addition to this hazardous waste are also being generated. These waste are being collected, treated and disposed of by municipal solid waste collecting workers which include manual scavengers, street sweeping women, drain and manhole cleaners, rag pickers and those engaged in incineration facilities. These workers are continuously being exposed to different types of contaminants from these solid and hazardous waste. Owing to their continuous exposure for prolonged period of time they are prone to suffer from different occupation related diseases (Tiwari, 2008).

Municipal solid waste handling and disposal is a growing environmental and public health concern. The collection of household waste is a difficult job, which involvels working on a vehicle that moves through traffic throughout the year. It also requires repeated heavy physical activities, such as the manual lifting and handling of heavy bins (Ray *et al*., 2005 and Yang *et al*., 2001).

Municipal solid waste collection workers or refuse collectors, generally exposed to number of work related health hazards and safety risks, notably allergic and other diseases of respiratory systems. Health impacts could also entail musculoskeletal, gastro-intestinal and infectious diseases as well as injuries caused by work related accidents (Wassim *et al.,* 2013). Waste collectors are exposed to a number of pathogens (bacteria, fungi, viruses, parasites and cysts), toxic substances (endotoxins and betaglucans), chemicals that come from waste itself and from its decomposition, as well as vehicle exhaust fumes, noise, extreme temperature and ultraviolet radiation. As a result of their exposure to multiple risk factors, municipal solid waste collecting workers suffer from high rates of occupational health problems (Lavoie *et al.,* 2006 and Poulsen *et al*., 1995).

Study area

Chandrapur formerly Chanda (19.57^{o} N latitude and 79.18^{o} E longitude) is a city and municipal corporation in Chandrapur district of Maharashtra state of India. The city is located at the confluence of Irai and Zarpat River. The city has higher elevation at north side whereas lower elevation at south side. The city is situated at an altitude of 189.90 m above

mean sea level and has an area of 70.02 sq km. The north-south length of the city is about 10.6 km, while the east-west is about 7.6 km. According to 2011 census, the city had a population of 3,75,000. In a 2011 state cabinet decision, Chandrapur Municipal Corporation was elevated to D grade Municipal Corporation. The city has 67 wards and divided into 3 zones.

Total 204 solid waste collecting workers work in Chandrapur Municipal Corporation. Total quantity of municipal solid waste generation rate in Chandrapur city is about 50 metric tons each day. In the city of Chandrapur mixed waste is being generated and collected from houses, commercial complexes, shops, banks, offices, road sweepings etc. The wet waste is collected from houses and vegetable markets separately. A typical municipal solid waste from Chandrapur city comprises of biodegradable, non-biodegradable and debris matter. Total numbers of community bins in the city were 751.

Study population

Study population was selected from study area comprising of 20 solid waste collecting workers in the age group of 25-65 years working in this job for more than 10 years with daily exposure of 8-9 hours. Out of these 20 workers, 75 percent were female (15) and 25 percent were male (5) (Table 1). Ten healthy non exposed subjects in the same age group were selected as a control group who were non smoker and with no history of respiratory disease. It was confirmed that none of the control subject had respiratory tract symptoms such as cough & cold, wheezing during Breath-o metric testing for Peak Expiratory Flow Rate analysis.

Table 1: Gender disrtibution in solid waste collecting workers

Gender	Number (%)
Female	15 (75%)
Male	5 (25%)

Material and Method

Data pertaining to health conditions of study population was collected by using structured questionnaire especially designed and developed for this study. Peak Expiratory

Flow Rate (PEFR) analysis was carried out by Breath-o meter (Cipla, India, as per EU scale) by comparing it with standard chart prepare by Chest Research Foundation (CRF), Pune, India according to age and height of an individual. The study was conducted from November 2015 to January 2016.

Working environmental conditions of solid waste collecting workers were observed in the field to obtain first-hand information on occupational health, composition of municipal solid waste, types of tools used for its collection, uniform and other safety measures used.

Results

Results of the study are presented in Tables 2-6 and Figures 1-2. From the results it is observed that out of 20 solid waste collecting workers selected for the study, during work health related ailments reported by them includes musculoskeletal symptoms in all workers such as low back pain, elbow pain and wrist pain 18 (90%) workers had reported respiratory symptoms such as cough, phlegm, asphyxiate and wheezing and equal number of workers reported headache problem. Five (25%) workers were suffering from dermatological symptoms such as itching and rashes whereas, three (15%) had gastrointestinal symptoms (nausea and diarrhea) (Table 2).

Table 2: Health problems in solid waste collecting workers during work

Health probems	**Number (%)**
Musculoskeletal symptoms (Low back pain, elbow and wrist pain)	20 (100%)
Respiratory symptoms (Cough, phlegm, asphyxiate and wheezing)	18 (90%)
Headache	18 (90%)
Dermatological symptoms (Itching and rashes)	5 (25%)
Gastrointestinal symptoms (Nausea and diarrhoea)	3 (15%)

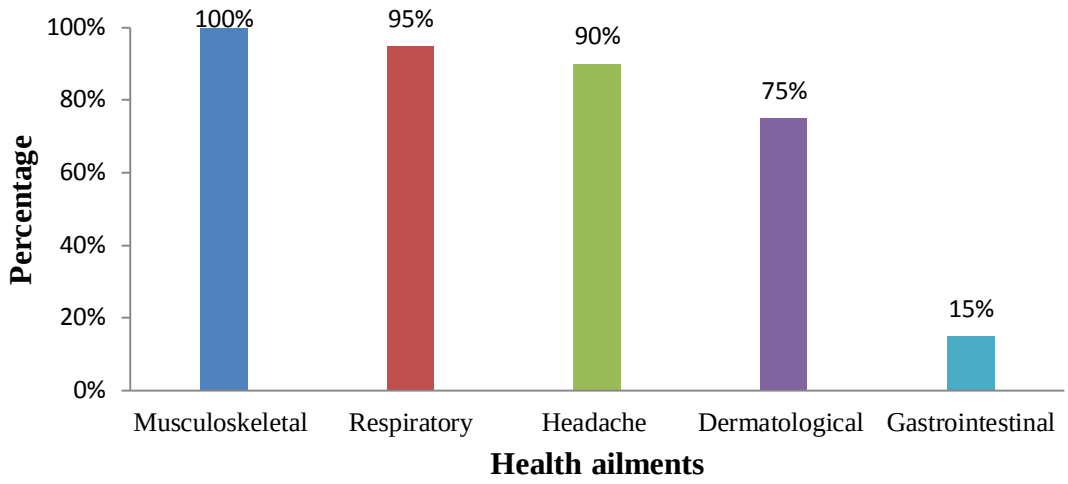

Figure 1: Health problems in solid waste collecting workers during work

Table 3: Health problem in solid waste collecting workers after completion of work

Diseases	**Number (%)**
Allergies	20 (100%)
Stomach pain	10 (50%)
Asthma and bronchitis lungs	9 (45%)
Cough and cold	5 (25%)
Vomiting	5 (25%)
Hearing disorder	4 (20%)
Fever	3 (15%)
Typhoid	2 (10%)
Malaria	1 (5%)

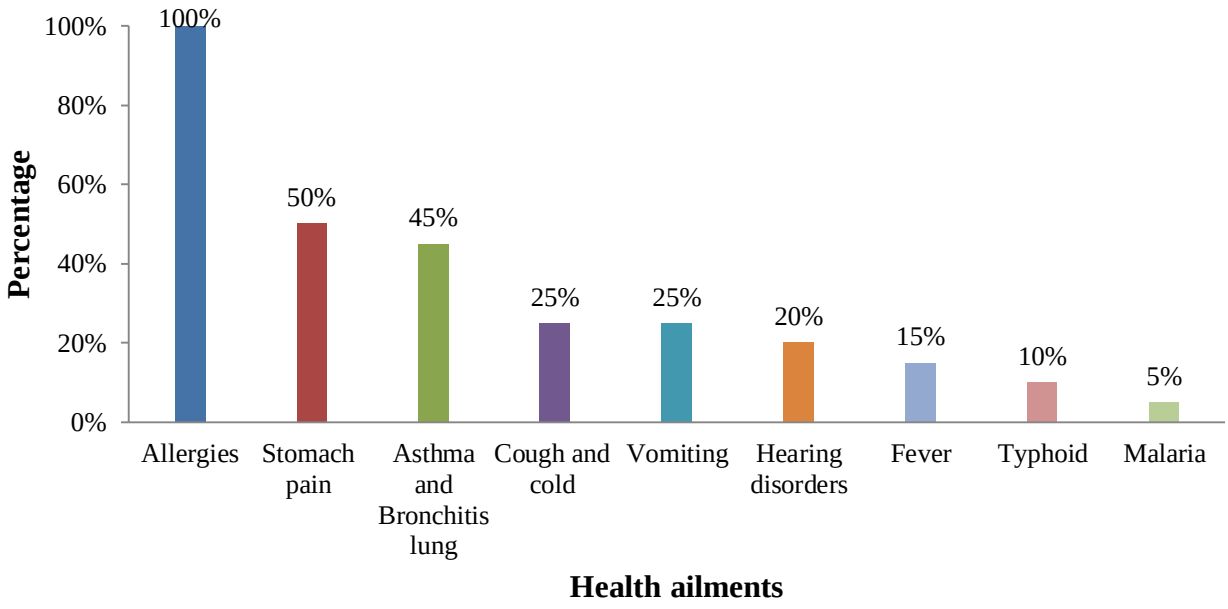

Figure 2: Health problems in solid waste collecting workers after completion of work

Table 4: PEFR values according to duration of exposure

Exposed groups	**Duration of exposure (Years), PEFR (L min^{-1})**					
	10-20		21-24		> 25	
	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.
Female	314	300	296	225	315	276
	326	312	294	200	286	198
	285	200	291	215	291	198
	303	295	315	226	315	200
	318	330	302	215	302	198
Total	n= 5		n= 5		n= 5	
Male	461	460	439	421	470	390
	466	458	443	443	-	-
Total	n=2		n= 2		n=1	

Exp.= Expected, Obs.= Observed

Table 5: PEFR values for control group

Control groups	**PEFR (L min^{-1})**	
	Expected	Observed
Female	314	350
	326	323
	285	280
	333	300
	324	345
Total	n= 5	
	466	460
Male	439	450
	458	500
	465	460
	439	500
Total	n=5	

Table 6: Comparison of PEFR between solid waste collecting workers and control group

Exposed group		**Duration of exposure (Years)**		
Gender		**10-20**	**21-24**	**>25**
		PEFR (L min^{-1})		
Female	Minimum	200	200	198
	Maximum	330	226	276
	Average	234.6	216.2	214
Male	Minimum	458	421	390
	Maximum	460	443	390

	Average	459	432	390
Control group				
Gender		**PEFR (L min^{-1})**		
Female	Minimum	280	-	-
	Maximum	350	-	-
	Average	319.6	-	-
Male	Minimum	450	-	-
	Maximum	500	-	-
	Average	474	-	-

PEFR = Peak Expiratory Flow Rate

Various health ailments reported after completion of work includes allergies by all workers, stomach pain in 10 (50%), asthma and bronchitis lungs in 9 (45%), cough & cold in 5 (25%) workers. Five (25%) workers reported vomiting problem, whereas hearing disorder was reported by 4 (20%) workers, which may be due to exposure to obnoxous odour, road dust and traffic noise. Three (15%) workers were suffering from fever, two (10%) from malaria whereas one (5%) from typhoid (Table 3). Exposure to pathogens, disease causing agents and unhygenic conditions due to municipal solid waste may be responsible factors for these occupational diseases in these workers.

Tables 4 and 5 depicts Peak Expiratory Flow Rate (PEFR) in solid waste collecting workers with exposure period of 10-20 years, 21-24 years, >25 years and control group respectively. From the results it is observed that solid waste collecting workers had lower PEFR than expected values with increase in exposure period due to road dust and other occupational conditions. Moreover, PEFR values decline with increasing years of exposure of workers. In case of control group (n = 10), observed PEFR values were near to expected values or sometimes more than that. These observations highlights that, these workers owing to the exposure to vehicular exhaust, road dust, pathogenic bacteria from municipal solid waste, pulling of heavy vehicle filled with solid waste and lifting of waste container bins may have reduced their lung capacity and thus decreased their PEFR values as compared with

expected ones. These obsrvations shows that lung capacity these workers had reduced and they are suffring from asthma, bronchitis and other lung problems. More than 80% of the workers engaged in this occupation belong to socio-economically weaker section of the society and perhaps it may be additional reason for their health status. As they can't affort balanced diet and regualr visit to private hopital for health realated ailements.

About 45% workers were provided with protective equipments while 55% workers were deprived of them. Duration of solid waste collecting workers is 8-9 hours each day. Most of the workers were aware of the importance and timing of hand washing and hygiene practices. Neverthless, no convenient washing facilities (soap and water) were made available near collection points, work station in dumping yard, or for those working on street. All the workers wash their hands before eating while 18 (90%) before drinking. These workers abuse substances like tobacco 2 (10%) and *ghutka* 18 (90%). The results of the study are in accordance with Athanasiou *et al*., 2010; Ajay *et al*., 2014, Lavoie and Dunkerley 2002, Nayera *et al*., 2015, Sabde and Zodpe 2008, Shrinivasan *et al.*, 2012, Stambuli 2012, Wassim *et al.*, 2013.

Comparative analysis of PEFR values between municipal solid waste collecting workers and control group is presented in Table 6. Minimum, maximum and average PEFR values of male and female workers for exposure period of 10-20 years, 21-24 years and >25 years shows that average PEFR values in female decreases as the exposure period increases. Similar observations were recorded in male workers also. As the duration of exposure increases in male workers (in all the three groups) minimum, maximum and average PEFR values decreases significantly. Figure 3 depicts average PEFR values for female and male solid waste collecting workers in different exposure years.

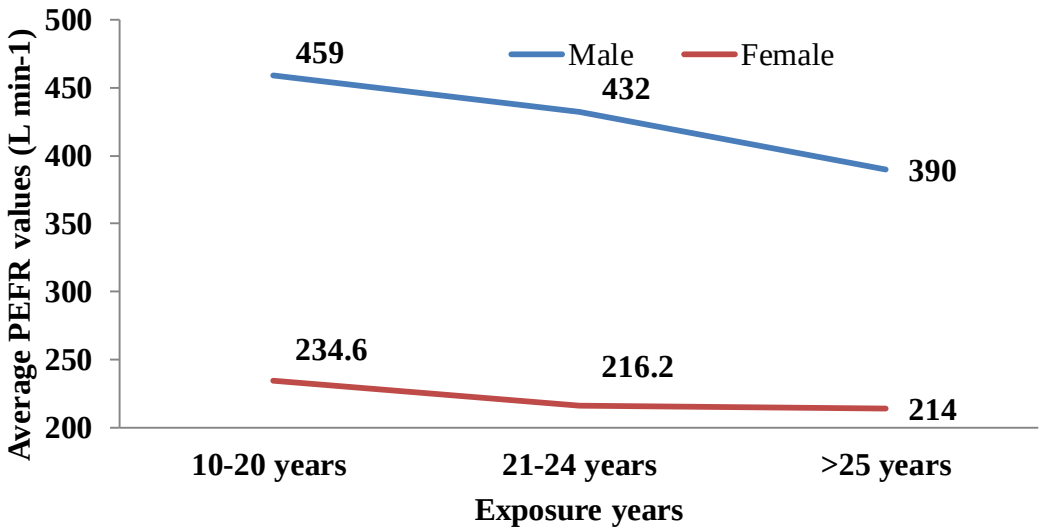

Figure 3: Comparative analysis of average PEFR values and exposure years

From the figure it can be observed that as the exposure duration increases PEFR values decreases. Minimum PEFR values were observed in the exposure period of >25 years in female (214 L min^{-1}) and male (390 L min^{-1}) workers.

On comparison of PEFR values of exposed group and control group, it was observed that control group members (both female and male) had significantly higher PEFR values. The plausible reasons to these observations can be assigned to exposure of these workers to dust and other airborne particles whereas control group were not exposed to such kinds of contaminants.

According to Athanasiou *et al.*, (2010), prevalence of all respiratory symptoms were higher in municipal solid waste collecting workers headache (36%), sore throat (17%) and rhinitis (33%), than in control group. Ajay *et al.*, 2014 reported that Peak Expiratory Flow Rate decreased with increase in duration of sweeping as compared to control group. There was statistically decrease in the level of PEFR in sweepers compared to control group. Lavoie and Dunkerley (2002) observed that household waste collectors were exposed to airborne biological agents. According to Nayera *et al.*, (2015) reduced Peak Expiratory Flow Rate was higher in street sweepers than in the control group.

Sabde and Zodpe (2008) found upper respiratory tract infections (7.3%) and chronic bronchitis (5.9%) in street sweepers. Shrinivasan *et al.*, (2012) reported Peak Expiratory

Flow Rate analysis had lower observed value than their own predicted value; females had lower pulmonary function than males. Stambuli (2012) observed that prevalence of respiratory health symptoms was higher among exposed than unexposed group viz. cough (54.9%), phlegm (39.85), wheezing (32.4%), nose irritating (35.8%) and sneezing (63.7%). Wassim *et al*., (2013), found that gastrointestinal problems (25.5%) and musculoskeletal problems such as low back pain, elbow pain and wrist pain (17.3%) were higher in municipal solid waste collecting workers.

Conclusion

The finds of the study provide evidence that, solid waste collecting workers were suffering from number of health ailments such as musculoskeletal, respiratory, headache dermatological and gastrointestinal during work and allergies, stomach pain, asthma & bronchitis lungs, cough & cold, vomiting, hearing disorder, fever, typhoid and malaria after completion of work. Waste collection is a task which requires repeated heavy physical activities such as heavy lifting, carrying, pulling or pushing of bins and containers that involve static muscle contraction and hence increases the risk of musculoskeletal problems. Further, exposure to unhygienic conditions, pathogenic microorganisms in solid waste, flies and mosquitoes, solid waste leachate, wet waste, obnoxious odour, continuous working for 8-9 hours a day through a year, uncovered dust bins in the cart, road dust, traffic noise, inadequate personal protective equipments, no personal cleaning facilities like water and soap and no restroom amenities leads to these different types of health ailments.

Workers must be made alert and aware of potential health risk and symptoms arising from their work. Reducing the exposure and use of personal protective equipment should be encouraged in these workers. Along with this regular health check up and providing medical insurance is the need of the hour. Mechanization of municipal solid waste collection should be encouraged by municipal council.

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