HEALTH PROBLEMS OF SOLID WASTE COLLECTION WORKERS OF GREATER VISAKHAPATNAM MUNICIPAL CORPORATION, VISAKHAPATNAM

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ABSTRACT

Solid waste management encompasses the processes and actions necessary to effectively manage waste from inception to disposal. In this regard, this study observed and analyzed occupational health problems among GVMC solid waste collection workers. Numerous concerns have been expressed about waste's potential harm to the environment and the general public, but the risks and associated costs of occupational health problems in solid waste collection have received scant attention in the rush to adopt or adapt technologies such as composting. This study employs a mixed-methods approach that triangulates qualitative and quantitative research paradigms. The quantitative design examines the health problems of solid waste collectors through material component separation and measurements, as well as a questionnaire survey that elicits information about waste collection risks. The qualitative component of the study consists of interviews, open-ended questionnaires, and satisfaction ratings with the safety measures observed during waste collection observations. Occupational health problems occur at every stage of the municipal waste management process, from the time workers collect or recycle waste in the streets, bins, or dumping yards to the point of ultimate disposal. The study's key findings revealed that manual handling tasks dominate solid waste collection practices, resulting in a higher incidence of health problems such as musculoskeletal pain (low back pain, elbow pain, wrist pain, etc.), respiratory problems (cough, phlegm, asphyxiation, wheezing, etc.), headaches, skin problems (itching, rashes, etc.), and gastro-intestinal problems (nausea, diarrhea, etc.). Additionally, the majority of employees are satisfied with the GVMC's safety measures, which are unrelated to waste management.

Key words: Health issues, solid waste collection, and safety measures

INTRODUCTION

Anything discarded by an individual, household, or organization is considered waste. As a result, waste is a complex mixture of various substances, of which only a few are intrinsically hazardous to human health. The generation of waste and its collection, processing, transportation, and disposal - the 'waste management' process - are critical for public health, aesthetic beauty, and a hygienic environment (Rushton 2003). The population explosion, combined with an improved standard of living, is the primary reason for the increased generation of solid wastes in both urban and rural areas of the country. In India, as in other countries, there is a clear distinction between urban and rural solid waste. However, as urbanization continues to grow, the use-and-throw concept is rapidly adopted, and communication between urban and rural areas is equally rapid, the divide between the two is narrowing. Rural solid waste is more biodegradable, whereas urban solid waste contains more non-biodegradable

components such as plastics and packaging. 'Keeping garbage out of sight' is a universally accepted practice (Agarwal et al. 2015). Municipal solid waste management, a critical component of sustainable city or metropolitan development, entails segregating, storing, collecting, relocating, transporting, processing, and disposing of solid waste in order to minimize its negative impact on the urban environment (Joshi and Ahmed2016).

Municipal solid waste is produced as a byproduct of economic activity and consumption. This category of solid waste encompasses waste generated by households, commercial establishments, institutions, markets, and industries. Its handling and disposal are becoming an increasing source of concern for the environment and public health (Cointreau-Levine et al. 1998; Porta et al. 2008; Athanasios et al. 2010). Urban areas have accumulated an increasing amount of solid waste as a result of population growth and economic development (Cointreau-Levine 2006). Solid waste management encompasses a broad range of activities, including garbage collection, recycling, and the collection and processing of commercial and industrial waste (Cointreau-Levine et al. 1998). Risqué occur at every stage of the process, from collection at homes to transportation and recycling or disposal sites. Garbage collectors face occupational health and safety risks as a result of the materials they handle, the emissions produced by those materials, and the equipment they use (Cointreau-Levine 2006). Due to their exposure to multiple risk factors, they experience a disproportionate number of occupational health problems (Athanasiou et al. 2010). Municipal solid waste management is critical for the protection of human health and the environment. Workers in municipal solid waste management perform a variety of tasks, including street sweeping, manually loading waste into waste collection vehicles, and driving such vehicles. These activities expose these workers to a variety of occupational health risks due to the characteristics of the waste they handle, the waste collection methods used, and the working environment's condition. While the majority of studies on waste handling have found substantial evidence of respiratory complaints among waste handlers, those studies also indicated the need for additional research on other health problems associated with waste handling (Ncube 2017).

Waste management activities such as collection, recycling, and recycling delivery have expanded rapidly in recent years as a result of increasing urbanization and high levels of consumption. Waste management techniques vary considerably, ranging from mechanized techniques used by some private companies and local governments to rudimentary techniques used by individual waste pickers. Waste collectors face the most difficulties, particularly in developing countries like India (Medina 2007). Workers who are directly involved in waste collection or recycling are frequently among the poorest and most vulnerable. They include the homeless, the elderly, women, children, substance abusers, and ethnic minorities (Comaru and Werna 2013). Waste collectors come into contact with hazardous, toxic, and contagious substances. They sift through rotting garbage in search of scraps of material that will provide them with a living (Dias and Alves 2008). Additionally, this activity involves dealing with broken glass, syringes, and other sharp objects. They also disassemble electronic devices using primitive methods in some cases, putting themselves at risk of being burned or poisoned by the hazardous substances they inhale. This situation results in a variety of health problems, including leptospirosis, diarrheal diseases, typhoid, salmonellosis, influenza, musculoskeletal disorders, hypertension, respiratory diseases, stress and mental health problems, stomach pain, and cardiac problems. Waste pickers in general face social stigma, verbal and psychological abuse, which has a detrimental effect on their health (Porto et al 2004; Grimberg 2007). Along with adult waste pickers, a large number of children work in waste picking. All of these waste pickers, particularly children, are exposed to a greater extent than adults due to their lack of knowledge about health risks. In India, a study discovered that children working as waste pickers on the streets face verbal and psychological abuse (Mathur 2009).

In India, urban local bodies, colloquially referred to as municipal corporations, are responsible for the management of public health activities. With growing public and political awareness, as well as new opportunities created by economic growth, solid waste management has become a critical task for municipal corporations in order to maintain regular garbage collection (Agarwal et al. 2015). In the majority of municipal corporations, employees who handle municipal solid waste are largely unregulated or unprotected by the corporation or state government. These workers constitute informal enterprise, and solid waste management activities pose a risk to either the worker directly involved or to the operators of informal enterprises. Risques exist at every stage of the process, from the point at which enterprise operators manage waste for collection or recycling in their facilities to the point of ultimate disposal (Bortoleto et al. 2012). The informal sector generates large amounts of waste, which may be harmful not only to the environment, but also to waste workers.

SOLID WASTE MANAGEMENT BY GVMC: AN OVERVIEW

The municipal solid waste comes from various sources. They are domestic households, commercial establishments, industrial establishments, hotels, star hotels, restaurants, dhabas, markets, temples, hospitals, function halls, cinema halls, parks, schools, colleges, universities, chicken, mutton, fish and beef shops, main roads and high ways. Of all these sources, residential, commercial, hotel, vegetable and non-vegetable establishments/shops are huge sources of waste generation and also sources of health problems for workers collecting waste and also for public moving in the surroundings of waste dumping bins. Among different wastes generated, wet waste with biological material is the main source of health problems and charger of the atmosphere with pathogenic fungi and bacteria (Table-1).

Table-1: Solid waste classification in GVMC jurisdiction

Source	Example	Example products
Residential	Single-family and multi-family dwellings/apartments	Newspapers, clothing, sanitary napkins, disposable tableware, food packaging, cans, bottles, food scraps, kitchen waste, e-waste and yard trimmings.
Commercial	Office buildings, retail and wholesale companies, restaurants, and movie theatres	Food scraps and garbage, office documents, disposable dinnerware, paper napkins, and yard clippings.
Institutional	Schools, libraries, hospitals, and jails	Garbage from cafeterias and restrooms, office papers, classroom waste, food leftovers, medical waste, and yard clippings etc.
Industrial	Packaging and administrative, un-processed waste	Corrugated boxes, plastic film, wood pallets, lunchroom rubbish, and office documents.

Analysis of the official data collected from GVMC regarding solid waste collected in April 2019 indicated that the GVMC is maintaining records separately for wet and dry waste collected by solid waste workers. For the month of April in 2019 alone, the total waste collected from household and roads of all wards of GVMC including Anakapalli and Bhimili was 13,131.762 tones out of which 10,234.492 tones were wet waste and 2,897.356 tonnes were dry waste (GVMC Handbook, 2020). The quantity of waste generated in each ward was found to be related to the number of residents and various establishments in that ward (Table-2). Residents have been told to separate wet and dry waste in separate bins by the GVMC. Residents, however, did not strictly follow this instruction, and there was a mixture of wet and dry waste at the source of the waste. Houses, commercial complexes, shops, banks, offices, and road sweeping all contributed to the collection of mixed waste. Wet waste was collected separately from homes and vegetable markets.

Table-2: Data on wet and dry solid waste collected during April 2019 by GVMC

Ward No.	Wet Waste (Kg)	Dry Waste (Kg)	Wet + Dry Waste (Kg)	Ward No.	Wet Waste (Kg)	Dry Waste (Kg)	Wet + Dry Waste (Kg)
1.	133506	38765	172271	39.	162432	42973	205405
2.	116409	32144	148553	40.	139685	39295	178980
3.	176332	45893	222225	41.	139393	41626	181019
4.	154702	42419	197121	42.	132890	39186	172076
5.	255745	67637	323382	43.	66624	19768	86392
6.	146553	39500	186053	44.	88113	25003	113116
7.	141059	40155	181214	45.	178719	47681	226400
8.	144785	43790	188575	46.	97437	27924	125361
9.	157577	41407	198984	47.	136294	37495	173789
10.	156651	44018	200669	48.	143690	40238	183928
11.	102153	28623	130776	49.	145706	38411	184117
12.	119173	36210	155383	50.	173771	47103	220874
13.	96275	28208	124483	51.	117692	32766	150458
14.	118274	36239	154513	52.	125656	34771	160427
15.	122192	35961	158153	53.	120397	36726	157123
16.	153785	41151	194936	54.	Data not available		
17.	147433	38434	185867	55.	108703	31045	139748
18.	86734	24844	111578	56.	164129	47429	211558
19.	145486	44147	189633	57.	131419	36388	167807
20.	120694	40455	161149	58.	113044	30883	143927
21.	99865	30718	130583	59.	93504	27175	120679
22.	100966	29206	130172	60.	151326	38885	190211
23.	110204	32901	143105	61.	174542	50123	224665
24.	87886	24969	112855	62.	129008	36197	165205
25.	97625	28677	126302	63.	131360	53957	185317
26.	129365	43329	172694	64.	138340	40824	179164
27	103632	31243	134875	65.	117608	37006	154614
28.	107195	31748	138943	66.	161705	42024	203729
29.	90070	27961	118031	67.	156694	44050	200744
30.	68323	23570	91893	68.	146360	40289	186649
31.	125968	39463	165431	69.	185273	51554	236827
32.	149770	43376	193146	70.	201787	54075	255862
33.	116337	31521	147858	71.	130869	36022	166891
34.	130177	36425	166602	72.	151805	43308	195113
35.	176193	47973	224166	73.	513904	127573	641477
36.	90311	28491	118802	74.	293583	77309	370892
37.	145759	39630	185389		10234492	2897356	13131762
38.	145866	39073	184939	Total (in tonnes)	10234.492	2897.356	13131.762

The GVMC has specified the work schedule for sanitary workers involved in road sweeping and drain cleaning. Daytime workers work during 0600-1100 h and 1400-1700 h for road sweeping, waste collection and drain cleaning. Night time workers work during 2200-0500 h for road sweeping and waste collection. In case of Anakapalli and Bhimili, road sweeping and waste collection was done during nighttime. Individual workers work for 8 hours daily. Total staff engaged for the collection of waste from all 72 wards, Anakapalli and Bhimili is 6,250. Of the total staff, regular workers are 1,026 (16%) while outsourcing workers are 5,224 (84%). Regular workers are highly paid as they are employees of GVMC while outsourcing workers are paid very minimal amount as they are contract labor hired by a contractor who has a tie-up with GVMC to supply this labor. Regular workers work during daytime only while outsourcing workers work during daytime and nighttime. Among regular workers, 60% are male and 40%

female. Among outsourcing workers, 54% are male and 46% female. Among daytime workers, 55% are male and 45% female. Among nighttime workers, 47% are male and 53% female (Table 3). Of all the six zones of GVMC, only 2, 3, 4 zones have sufficient regular staff for sanitary work. The sanitation work in the other three zones (1, 5, and 6) is done mostly by outsourcing workers. In case of outsourcing staff, the age varied from 24 from 54 years with an experience of 5-10 years. Many of them are married but literates are few whose educational qualification has not crossed even 5th class. Outsourcing staff and regular staff have different uniform coats and accordingly they can be identified. All outsourcing staff belongs to lower castes of the society such as BC SC and ST; they all belong to Hindu as per the records although a few practice Christianity in reality. There is not even a single person from the upper caste. The monthly wages paid ranged from Rs. 6,000 to 10,000/- only but they are not paid regularly and also not given any life insurance coverage.   The solid waste collection in GVMC is largely dependent on outsourcing staff who are paid minimal wages.

NEED AND SIGNIFICANCE OF THE STUDY

Solid waste management is critical in every community, primarily because it protects households from the hazardous effects of solid waste material. Proper solid waste collection is critical for public health, safety, and environmental quality protection. It is a labor-intensive activity that consumes roughly three-quarters of the total cost of solid waste management. While public employees are frequently assigned to the task, it is occasionally more cost effective for private companies to perform the work on a contract basis with the municipality or for private collectors to be compensated by individual home owners. Municipalities have adopted solid waste management in this regard as a national policy. Proper waste collection is critical not only for public health, safety, and environmental quality, but also for the creation of jobs for the unskilled labor force. Numerous concerns have been expressed about the potential harm that waste could cause to the environment and general public, but the risks and associated costs associated with occupational problems in waste management have received scant attention in the rush to adopt or adapt technologies such as composting (Jerie 2016). Municipal workers face health risks and even serious injury in this regard, as their work entails cleaning trash, debris, hazardous materials, and other health hazards. In this case, the person disposing of the hazardous material may be unaware of the proper disposal and packaging procedures required by law, exposing municipal workers to risk (Sekhon and Karthigesu 2017). As a result, this paper, titled 'Health Concerns of GVMC Solid Waste Collection Workers,' has the following objectives.

OBJECTIVES

1. To study the importance of the solid-waste management in municipalities
2. To study the health problems of municipality workers in collection of solid waste
3. To study the satisfaction levels of municipality workers in safety measured followed by municipality in collection of solid waste

Hypothesis

1. There is no significant relationship between demographic profile of GVMC workers and the level of health problems in solid waste collection
2. There is no significant relationship between demographic profile of GVMC workers and the level of satisfaction with safety measures in solid waste collection.

Methodology

The study draws data from both primary and secondary sources. The study is proposed to be organized through the development of a well-structured schedule covering socioeconomic aspects such as gender, social classification, literacy levels, family size, family type, and household facilities. Additionally, the questionnaire is designed to collect data on health, hygiene, and sanitation. Additionally, secondary data on health, hygiene, and sanitation are derived from Government Reports and GVMC's Statistical Abstracts. The Chief Planning Office has published a Distract Handbook of Statistics for the Visakhapatnam District. Journals and periodicals serve as secondary data sources, as does access to various websites on the web.

Study design:

The present study is a case study of the Greater Visakhapatnam Municipal Corporation (GVMC) in the state of Andhra Pradesh; the GVMC was purposefully chosen for study after a thorough examination of several of its wards. According to Google's sample size calculator, the respected sample size is 362 out of 6250 municipal workers in GVMC's sanitary department. These are divided into six zones and include the municipalities of Bheemili and Anakapalli (See Table-3). Additionally, 5% of respondents in the first three Zones of GVMC (32+53+51) are chosen for detailed analysis using a simple random sampling technique. 76 of the 136 sanitary workers sampled are male,

while 60 are female. After conducting the final study, a well-structured questionnaire is created with an emphasis on group discussions. To accomplish the study's objectives, simple tools such as percentages, mean, and standard deviations on perceptive scores are used. The mean and standard deviation were used to calculate the levels of health problems and satisfaction with safety measures at the high, medium, and low levels. Additionally, Chi-square tests for attribute independence are used to examine the relationship between demographic variables and health problems and safety measures.

Table-3: Zone-wise distribution of male and female sanitary workers of GVMC

| Zone | Type of workers | | | | | | | | | Total staff |
| | Day-time workers | | | Night-time workers | | | Regular workers | | | |
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
I - (Wards 1-6)	304	280	584	21	13	34	12	19	31	649
II - (Wards 7-18)	324	306	630	204	66	270	100	69	169	1069
III - (Wards 19-30)	213	198	411	37	179	216	235	152	387	1014
IV - (Wards 31-49)	442	343	785	58	151	209	125	75	200	1194
V - (Wards 50-65)	605	512	1117	42	18	60	46	12	58	1235
VI - (Wards 66-72)	351	298	649	26	17	43	17	6	23	715
Anakapalli	98	7	105	--	--	--	65	61	126	231
Bhimili	79	32	111	--	--	--	20	12	32	143
Total	**2416**	**1976**	**4392**	**388**	**444**	**832**	**620**	**406**	**1026**	**6250**

Road sweeping is mostly done manually by both regular and outsourcing workers. Further, sweeper vehicles are also used for sweeping main and lane roads. While sweeping the roads, the workers do not use any gloves or nose-masks to avoid health problems, especially those relating to eye and respiratory problems.

Waste collection is collected mostly manually. While collecting waste from road sweeping and waste bins, the workers do not use any safety globes or face or nose-marks to avoid exposure to various health problems caused by the airborne pathogenic bacteria and fungi disseminated, especially from wet waste.

Different types of carts, vehicles and machines used for the collection, transportation and dumping the waste collected from all the wards of GVMC. The carts used include pushcarts, 1 or 2 tub wheel barrows, compactor bins and dumper bins. The vehicles and machines used are Tata Aces, Bob-cat machines, Mini-Tippers, Big-Tippers, JCB's, Tractors, Sweeping Machine, Small Compactors and Big Compactors.

The waste collected is transported in tippers and tractors without any cover on it. It is transported during daytime as well as night time. Waste transportation during day time was found to be a big menace and exposing road users to stinking smell and airborne pathogenic bacteria and fungi released from wet waste. Further, dust and particulate waste from dry waste was found to be flying during transportation. This flying waste was found to be creating health problems, road accidents and traffic congestion. Waste transportation during night time was found to be good because of empty roads or few users of roads at that time.

In residential areas and also in certain public areas, partitioned dumping bins were placed to dump wet and dry waste separately. Visits to residential areas and also to some public areas showed that many households are not segregating wet and dry waste but they are mixing both and then dumping in dumping bins. Further, waste collection workers are also mixing both wet and dry waste and finally dumping into compaction machine at the Waste Compaction Station. This practice is found to be useless even if the wet and dry wastes are collected separately from the waste generation places. After compaction of both wet and dry waste, it is transported to compost facilities, especially at Kapuluppada for making compost which is a mixture of both wet and dry waste.

The data collected using questionnaire by personal interaction showed that the waste collection workers are experiencing various health problems during work and after work. During work hours, the health problems reported were musculoskeletal symptoms, respiratory symptoms, head ache, skin symptoms, gastro-intestinal symptoms. Low back pain, elbow pain, and wrist pain were the musculoskeletal symptoms. Cough, phlegm, asphyxiation, and wheezing were all respiratory symptoms. Head Ache is a prominent symptom. Skin symptoms were itching and rashes. Gastro-intestinal symptoms were nausea and diarrhea. Of the total health problems reported, 56% workers had reported musculoskeletal symptoms, 38% respiratory symptoms, 49% head Ache problem, 27% skin symptoms and 6% Gastro-intestinal symptoms. Many workers reported multiple health symptoms (Table 4).

In addition to the health problems during and after waste collection, the solid waste workers were found to be suffering from nail infections of fingers and toes. Many participants in this study reported nail infections. Further, they also reported the problem of scorpions in and around roadside municipal garbage bins. Further, some participants reported that the drivers of tipper trucks drive them in drunken state very often, especially during night time, and in effect, they meet with accidents. Most of the night time workers irrespective their gender status reported that they have sleeping disorders which is affecting their biological clock, health and work efficiency.

Table-4: Health problems in solid waste collection workers of GVMC during job

S. No.	Type of Health problem	Number of workers (136)	Percentage
1.	Musculoskeletal problems (Low back pain, Elbow pain, Wrist pain)	95	69.9
2.	Respiratory problems (Cough, Phlegm, Asphyxiate, Wheezing)	78	57.4
3.	Head ache	86	63.3
4.	Skin related problems (Itching, Rashes)	56	41.2
5.	Gastro-intestinal problems (Nausea, Diarrhea, etc.)	15	11.0

The data collected using questionnaire by personal interaction showed that the waste collection workers are experiencing various health problems after work hours also. They were allergy, stomach pain, asthma and bronchitis, cough and cold, vomiting, hearing disorder and malaria. Of the total health problems reported, 63% had allergy, 29% cough and cold, 23% asthma and bronchitis, 5% stomach pain, 4% hearing disorder, 3% malaria and 1% vomiting (Table 5). The study indicated that allergy is the most common health problem followed by cough and cold, and asthma and bronchitis. Wet waste in particular is a good breeding center for mosquitoes and hence is the source for malaria. Further, it also indicates that waste collection workers suffer from various health problems during and after work. In other words, they continuously suffer from different health problems indicating their health as well as life is at risk. With minimal wages, they are unable to go to doctors for treatment. Added to this problem is that wages are not paid every month and payment of wages is uncertain. Certain times, they go on protest by not attending to the work thereby creating unhygienic problems in and around the waste collection spots at homes and waste dumping bins. As there is no other option for them to choose another livelihood source, they are working as waste collection workers despite being aware of the health risks associated with sweeping and waste collection activity.

Table-5: Type of health problems experienced by solid waste collection workers of GVMC after job (multiple responses)

S. No.	Type of Health problem	Number of workers (136)	Percentage
1.	Allergy	78	57.4
2.	Stomach pain	25	18.4
3.	Asthma & bronchitis	34	25.0
4.	Cough and cold	47	34.6
5.	Vomiting	13	9.6
6.	Hearing disorder	5	3.4
7.	Typhoid	-	-
8.	Malaria	3	2.2

Field visits to 30 wards of Zone-1, Zone-2 and Zopne-3 of GVMC indicated that there is an increasing growth in residential houses/apartments, commercial establishments, hotels, shopping complexes and vehicles. Accordingly, there is an increasing growth in population in all wards. Increasing growth in population, life style, establishments and increased use of resources, biological and non-biological leads to an increase in waste generation. As a result, solid waste management problems will be increased and among them, the most of vital problem is health problems to waste collectors as well as residents or public living in the limits of GVMC.

Table–6: Level of health problems experienced by various demographic group GVMC workers in solid waste collection

Variables	Groups	Level of Health Problems			Total	Chi-Sqr Value
		High	Low	Medium		
Gender	Male	25 (18.4)	18 (13.3)	33 (24.3)	76 (55.8)	6.46*
	Female	30 (22.0)	16 (11.7)	14 (10.3)	60 (44.1)	
Education	Illiterate	28 (20.5)	14 (10.3)	23 (16.9)	65 (47.8)	14.04*
	Primary	18 (13.2)	8 (5.8)	8 (5.8)	34 (25.0)	
	Upper Primary	7 (5.2)	5 (3.7)	3 (2.3)	15 (11.0)	
	Secondary & above	2 (1.5)	7 (5.2)	13 (9.6)	22 (16.2)	
Social Status	Scheduled Caste	16 (11.7)	15 (11.0)	23 (16.9)	54 (39.7)	12.61*
	Scheduled Tribe	11 (8.1)	4 (2.9)	13 (9.6)	28 (20.6)	
	Backward Caste	17 (12.5)	12 (8.8)	8 (5.9)	37 (27.2)	
	Other Communities	11 (8.1)	3 (2.3)	3 (2.2)	17 (12.5)	
	Total	55 (40.4)	34 (25.0)	47 (34.6)	136 (100)	

The level of health problems experience by various demographic group GVMC workers in solid waste collection is presented in the Table – 6. Hence, the experience of health problems by the respondents are classified in to three levels, i.e. High, Low and Medium according the scores of individual perceptions on various health problems they experience during the time of solid waste collection. Thus the level of health problems experienced by various demographic group respondents indicate that while a dominated group of 24.3 percent male workers experienced medium health problems, a predominant group of 22.0 percent female workers experienced high level of health problems. With this kind of health hazard distribution between male and female respondents the calculated chi-square value 6.46 found significant at 5 percent level. Therefore, it reveals that health problems are found significantly difference between genders. Whereas, the experience of health problems levels among various education qualification groups found that the highest group of 20.5 percent illiterates experience the high level of health problems followed by 16.9 percent illiterates experienced medium, 13.2 percent primary education group experienced high and from the rest the lowest of 1.5 percent secondary and above qualified group experienced high level and 2.3 percent upper primary group observed medium. Hence, this kind of distribution indicates 5 percent significant with 14.04 chi-square value. This shows that health problems of the solid waste collecting GVMC workers influenced by their education qualification, where lesser education groups are experienced higher than the more education groups. But, it is found the level of health problems among various social status groups indicate that a dominated group of scheduled caste (16.9%) and scheduled tribes (9.6%) solid collection workers in GVMC experienced medium level of health problems, where as a predominant group of workers from backward castes (12.5%) and other communities (8.1%) experienced high level of health problems. With these distributions of samples the calculated chi-square value 12.61 indicates significant at 5 percent level. Thus, there is a significant relation between social status of workers in GVMC and the level of health problems in solid waste collection.

Hence, the analysis on level of health problems among various demographic solid waste collecting GVMC workers shows that it is found significant difference between male and female groups, various education qualification groups and various social category groups. Thus, the hypothesis is rejected.

Table–7: Satisfaction levels of various demographic group GVMC workers on safety measures followed in solid waste collection

Variables	Groups	Safety measures followed by GVMC			Total	Chi-Sqr Value
		High	Low	Medium		
Gender	Male	18 (13.2)	23 (16.9)	35 (25.7)	76 (55.8)	15.59*
	Female	14 (10.3)	36 (26.5)	10 (7.3)	60 (44.1)	
Education	Illiterate	31 (22.7)	13 (9.6)	21 (15.4)	65 (47.7)	6.90*
	Primary	12 (8.8)	8 (5.8)	14 (1.3)	34 (25.0)	
	Upper Primary	5 (3.7)	7 (5.2)	3 (2.1)	15 (11.1)	
	Secondary & above	7 (5.2)	6 (4.4)	9 (6.6)	22 (16.2)	
Social Status	Scheduled Caste	19 (13.9)	21 (15.4)	14 (10.3)	54 (39.7)	12.78*
	Scheduled Tribe	12 (8.8)	6 (4.4)	10 (7.4)	28 (20.6)	
	Backward Caste	14 (10.3)	5 (3.7)	18 (13.2)	37 (27.2)	
	Other Communities	10 (7.4)	2 (1.5)	5 (3.6)	17 (12.5)	
	Total	55 (40.4)	34 (25.0)	47 (34.5)	136 (100.0)	

The Table-7 describes about the satisfaction levels of various demographic group works towards safety measures followed by the GVMC during solid waste collection. Here the satisfaction levels on safety measures followed by the GVMC have been categorized by high low and medium. Thus the distribution of various demographic group respondents by their satisfaction levels on safety measures followed by GVMC during solid waste collection indicate that the highest group of 25.7 percent male achieved medium satisfaction while a dominated group of 26.5 percent female achieved low satisfaction. According to their distribution of satisfaction levels of male and female workers towards safety measured followed by the GVMC, the calculated chi-square value 15.59 indicate significant at 1 percent level. So, there is a significant relation between gender and satisfaction levels of GVMC workers towards safety measures in solid waste collection. On the other hand the satisfaction levels of safety measures among various education qualification group GVMC workers found that the highest group of 22.7 percent illiterates experience the high level of satisfaction followed by 15.4 percent illiterates experienced medium, 8.8 percent primary education group experienced high and from the rest the lowest group of 1.3 percent primary qualified group and 2.1 percent upper primary group observed medium. Hence, this kind of distribution indicates 5 percent significant with 6.90 chi-square value. This shows that satisfaction levels of GVMC workers towards safety measures followed in solid waste collection differentiate with their education qualifications, where lesser education groups are experienced higher satisfaction and higher education qualification groups experience lesser satisfaction. Whereas, the level of satisfaction in safety measures in solid waste collection by various social status group GVMC workers indicate that a dominated group of scheduled caste (15.4%) solid collection workers in GVMC experienced medium level of satisfaction, but a predominant group of and scheduled tribes (8.8%) experienced high level of satisfaction, whereas a major group of workers from backward castes (13.2%) and other communities (8.1%) experienced high level of health problems. With these distributions of samples the calculated chi-square value 12.61 indicates significant at 5 percent level. Thus, there is a significant relation between social status of workers in GVMC and the level of health problems in solid waste collection. Hence, the analysis on level of satisfaction among various demographic group solid waste collecting workers in safety measures followed by GVMC indicate that there is

significant difference found between male and female groups, various education qualification groups and various social category groups. Thus, the hypothesis is rejected.

CONCLUSIONS

The occupational health problems among workers in the GVMC associated with solid waste collection practices were observed and analyzed in this study. Many people are concerned about the impact of waste on the environment and the general public, but in the rush to adopt or adapt technologies like composting, the risks and costs of occupational health problems in solid waste collection have gotten little attention. This study employs a multi-methods research design that triangulates qualitative and quantitative research paradigms. Through material component separation and measurements, as well as a questionnaire survey that investigates the risks associated with waste collection, the quantitative design investigates the health problems of the solid waste collecting work group. Interviews, open-ended questionnaires, and satisfaction levels with waste collection safety measures are all part of the qualitative component. Occupational health issues arise at every stage of the municipal waste management process, from the point where workers handle waste in the streets, bins, dumping yards, and other locations for collection or recycling to the final disposal. The study's key findings revealed that manual handling tasks dominate solid waste collection practices, leading to an increase in health problems such as musculoskeletal pain (low back pain, elbow pain, wrist pain, etc.), respiratory problems (cough, phlegm, asphyxiation, wheezing, etc.), head ache, skin problems (itching, rashes, etc.), and gastro-intestinal problems (nausea, diarrhea, etc). Furthermore, the majority of employees are satisfied with the GVMC's safety measures, which are unrelated to waste management.

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