

Solid Waste Management Practice and Health Implication: A Case of Kathmandu Metropolitan City, Nepal

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Abstract

Waste handling practice in Kathmandu is labor intensive and disposal system does not meet environmental standard. Mixture of organic to inorganic and hazardous to non-hazardous wastes is the composition of municipal waste of Kathmandu. Waste management practice has severe health impact to municipal waste workers. Over the past several generations, people of specific castes (*Pode, Chyame*) have been working as municipal waste workers and are entitled '*kuchikar*' officially. This research examines occupational health problems of these waste workers. Findings are based on the survey of 61 waste workers of Kathmandu Metropolitan City.

Key words: Environmental problems, waste management, occupational health, waste workers, protective measures.

Introduction

Standards of waste handling practice in industrialized countries have reduced occupational health problems and environmental impacts significantly. Developed countries have established sanitary landfills and started to use sophisticated machineries to handle waste. Contrary to that, solid waste is one of the main problems for urban health in developing countries (Birley and Lock 1999, Pugh 2000, Hardoy et al. 2001, Atkinson 1999). In the cities of developing countries, waste collectors lift heavy loads often to higher loading location and at busy traffic with more dust and diesel exhausted pollution. In such working condition back and joint injuries, respiratory illness, infections can occur to waste worker (Cointreau-Levine n.d.). Over-population concentration in Kathmandu generate huge amount of waste. With the course of industrialization and modernization, proportion of non-biodegradable waste has significantly increased. As a result surrounding environment fail to maintain the balance between waste supply and waste degradation. At present, waste accumulated in Kathmandu is dumped either in open space or at the side of water bodies. Such improperly disposed wastes are creating various environmental and health problems.

In Kathmandu, waste is piled on the street corner or on the ground directly and it is either shoveled or picked up by bare hands by municipal solid waste workers (hereafter waste workers). Hazardous wastes are not separated. Waste handling and disposal practice do not meet environmental protection standards. Sanitary landfills are absent and collected wastes

are buried in riverbanks. It deteriorates air quality and pollutes rivers. Similarly, open sewerage, pile up garbage and open dumping sites, inadequate water supply and poor sanitation are other environmental problems of Kathmandu. These problems are causing serious health problems to Kathmanduities. However, the risks are the highest among waste workers, who are working for solid waste management in the city, since generations. Waste workers, though they perform essential tasks for city dwellers, remain an utterly neglected section in Kathmandu. Their work is traditionally regarded as 'degrading' and 'defiled'. The society has always kept them at a distance despite their ubiquity and the importance of the work they do.

In Nepal, there are no provisions for handling hazardous¹ wastes separately, and the country lacks worker protection system. Waste workers themselves are unaware and do not undertake protective measures. They live in proximity to the dumpsites and are exposed to potentially more harmful wastes such as toxic materials, gases and infectious microorganisms. In these circumstances, waste workers have to bare the highest health risks. However, no thorough studies have been carried out so far in this issue in Kathmandu. In this context, present study explores the existing health problems of waste workers of Kathmandu Metropolitan City (KMC). The first part of this paper introduces the problems, study area and methods used during the research. Middle part of the paper deals with the existing solid waste management practices and the health problems experienced by waste workers. Final part of the paper presents the conclusion.

The Study Area

Kathmandu (KMC), the capital city of Nepal covers an area of about 50.76 sq. km, which is the home for more than 671 thousand people excluding floating population (CBS 2002). It is prominent not only for population concentration, energy/resource consumption and economic activities but also for waste production and pollution. Despite the better health care facilities and economic condition than in countryside, the Kathmandu has a higher infant mortality rate of 66.78/1000 (KMC 2001) compared to the country's average of 64.1/1000 (CBS 2002). Many expert opine that it is due to air pollution (MOPE), poor coverage of water supply and sewerage (KMC 2001), degraded environmental conditions including huge amount of solid waste generation (about 315 metric tons daily: KVMP/KMC 2001), which is neither collected in time nor dumped in sanitary landfill site.

Today's any environmental problems faced by the inhabitants of the earth, and its causes are directly or indirectly linked to urban areas (WRI 1996-97). In this context, Kathmandu is probably the best place in Nepal to observe urban environmental crises. Though, the population of Nepal is still predominantly rural (about 86 percent), the country is facing rapid urban population growth of about 6 percent per year (CBS 2002). Due to the rapid population

¹ Special/hazardous wastes include wastes containing toxic, inflammatory, reactive, explosive material and infectious microorganisms like heavy metals in batteries, pesticides and infectious medical wastes.

growth, Kathmandu faces urban generated waste disposal problem, which has great impact on the health of urban residents. Urban Population Survey found unmanaged waste disposal as the main cause of the environmental problem in the urban areas of Nepal (Mishra and Kayastha 1998). Among the urban areas of Nepal, Kathmandu faces most critical situation of solid waste management.

Methods and Materials

KMC has about 2000 solid waste workers. However, only about 200 waste workers work directly under the administration of KMC Central Office. The rest are working under different wards² administration. In this study waste workers are categorized in three types namely: sweepers, collectors, and loaders based on the specific work they do. The findings of this study are primarily based on the information collected from 61 respondents (30 sweepers, 17 collectors and 14 loaders). All of them were working under direct administration of KMC Central Office. The number of surveyed sweeper is relatively higher than those of collectors and loaders.

Field survey was carried out in the months of June, July and August 2003, using questionnaire survey. Because of difficulties in drawing the boundaries between diseases, this study applied prototype categorization for diseases classification. After obtaining information, all information was entered in Statistical Package for Social Science (SPSS) database and percentile of respondents, experienced different health problems, were calculated. Simple statistical techniques and descriptive approach is widely used in this paper for the interpretation of data.

Waste Management Practice and the Waste Workers

Waste is a product of economic growth and consumption. Cointreau (1982) found that waste's amount increases with the increase in living standard and economy of the country. With the course of urbanization Kathmandu is experiencing changing waste composition (Pandey 2004) and increasing per capita waste generation (cf. KVMP/KMC 2001). Most recent estimation of KMC reveals that per capita waste generation in the Kathmandu Valley is 0.42 kg per day (KMC, Environment Department 2003).

Waste workers of KMC sweep streets, public utilities and collect accumulated wastes lying in streets and public spaces. Majority of male waste workers involve in uploading and unloading wastes in vehicles, pulling *rickshaw* and driving vehicles loaded with wastes. On the other hand, majority of women waste workers are involved in sweeping and collecting wastes. In households, hotels and institution level, solid waste is stored in plastic bags, plastic or metal bins or bamboo basket. Such wastes are collected either by cleaning staff of private sectors or by community waste workers, in big basket 'Doko/Thunche', handcarts, tractors, and

² Ward is the smallest administrative unit.

trucks from source of origin and transported to Teku (waste transfer depot). Privatized and community based waste management gave better result in some of its wards in KMC. Therefore, KMC has planned to privatize and emphasized on community based waste management. Waste collected at Teku are again loaded in trucks, compressors and sent to Balkhu (dumping site). Wastes at Balkhu are unloaded in ditches created alongside the Bagmati Riverbank and covered by a layer of soil.

Waste collection and sweeping profession has been traditionally allocated for certain castes like *Pode*, *Chyame* throughout Nepal. A person born under such caste is perceived as *Kuchikars* (sweeper) even though he or she is unemployed. Caste has been known as an element in the social structure of Nepal. Generally, neither the people from other castes work as waste worker nor the *Kuchikar* look other jobs. Castes are ranked endogamous divisions of society in which membership is hereditary and permanent (Berreman 1972) that is the typical feature of Nepalese caste system.

Ancient Kathmandu (around 700AD) was surrounded by a protective wall and the people belonging to lower castes called *achhut* (untouchable) like *Pode*, *Chyame*, *Kullu* and *Harahuru* were not allowed to live inside of then city wall. In the regime of Surendra Bikram Shah (1904-1938 BS) *Muluki Ain* (civil code) also strictly restricted these castes to reside inside the city wall. This way, *Kuchikars* have always been ranked as one of the lowest castes in the hierarchy of castes. From the long history, they are working as waste workers and making their housing near garbage dumping sites. Being poverty-stricken and working in the lowest paid jobs, city dwellers had a tradition to give waste workers the remaining food.

Health Problems

Health is ‘a state of complete physical, mental and social well-being’ (cf. Gatrell 2002). Health determines physical and mental ‘fitness’ and enables functioning effectively for the good of the society. Therefore, health is someone’s physical and mental situation that can be transformed into economy and welfare. *Structuralists* claim that underlying causes of diseases are embedded in political and economic system. Existing inequalities in society, social structure, human activities and access to health care affect health (Gatrell 2002).

Health depends on environmental conditions. According to WHO, poor environmental quality is estimated to be directly responsible for a quarter of preventable ill-health in the world today. Absence of basic infrastructures and services for sewers, drainage, drinking water and regular service of waste collection and its safe disposal create numbers of disease causing agents (Cointreau-Levine n.d.). Leach of uncollected waste seeps into the drinking water supply system that results in chronic health problems (Birley and Lock 1999). The waste workers suffer highly from neighborhood health problems since the hazardous sites are the only places where they can build or rent shelters. Moreover, their high health risky works expose them various work-place-related health hazards, since environment at work place is

often ignored in developing countries (Phoolchand 1995). In this background, waste workers of KMC are suffering from different health problems like physical injuries, poisoning, respiratory tract disease as well as gastrointestinal diseases.

Physical Injuries

Significantly high proportions of waste workers are experiencing varieties of physical injuries. Cuts, bruises and ruptures in the body, back pain, joint pain, elbow injury, wrist pain and other physical pains and aches are some examples of physical injuries. Unsorted inorganic wastes and labor-intensive waste handling practices are the leading causes of high rate of physical injuries. Poor protective measures and absence of first aid in time of injury is intensifying the problem. The problem differs among the waste workers by activity (Annex A). Collectors and loaders use their feet to push spade into the pile of garbage. Sometimes they wipe waste and put it in spade using feet or hand. While doing so, the probability of cut, bruises and ruptures is high. Falling of broken glass and metals on one hand can injure and the other hand uploading heavy load on trucks can develop dislocations and physical ache to loaders. Probably, this is why the highest proportion of loaders is suffering from the problems of cut, bruises and ruptures. Although the highest proportion of loaders are experiencing cuts, bruises and ruptures the weekly frequencies of each injury problems is relatively lower to them (Table 1).

Problems of physical injuries are not only the problems of the waste workers of Kathmandu but also the problem of other cities of the world. Problem of musculoskeletal disorder are found 4 times higher among the waste workers than among general laborer in US, (Poulsen et al. 1995b). Significant physical hazards such as wrist, elbow and back injuries and low back pain among waste workers is also found in Japan (Brosseau and Golden 2000, Koda et al. 1997). In Denmark by Poulsen et al. (1995a and b) identified muscle aches, joint pains and frequent occupational accident among waste collectors. The case of Kathmandu and examples provided in other studies indicate that waste workers have higher injury risks anywhere in the world.

Table 1. Frequency of Physical Injury Among Waste Workers

Work type	Weekly frequency of physical injuries			
	4 or more than 4 times	2-3 times	Once	Less than once
Sweepers	20 (67)	6 (20)	1 (3)	3 (10)
Collectors	11 (65)	0 (0)	2 (12)	2 (12)
Loaders	6 (42)	0 (0)	4 (29)	4 (29)
Total	37	6	7	11

Source: Field survey, 2003.

Figures within parenthesis indicate percentage

Allergies

Allergies are serious health problems among the waste workers in Kathmandu. Skin rashes, itching, irritations, swelling lips or eyelids, eye irritations are few of the allergies reported in the study (Annex A). Skin irritation and eye irritation in the waste collectors is also observed in Denmark (Poulsen et al. 1995a and b).

Table 2 shows annual suffering period for waste workers of allergic diseases. Some activity-wise differences are observed on the suffering duration. The highest proportion of collectors followed by sweepers and loaders are experiencing irritation problem for long period of time. Despite relatively lower proportion of loaders is experiencing the problem of swelling, they are experiencing for longer period than the others. Contrary to that, problem of eyelid burning is lasting for longer time among collectors.

Since human and animal excreta are always present in municipal waste of Kathmandu, handling such waste results in number of allergic reactions to waste workers. Leach of waste-tips dissolved in the water or disease vectors and pathogens transferred through clothes and body parts help to develop allergies.

Table 2. Duration of Allergic Problems Lasting to Waste Workers

Respondent	Alergic Problems	Duration (one year)			
		A week	1 month	3 months	Half year
Sweepers	Skin rashes	6 (20)	3 (10)	6 (20)	1 (3)
	Irritation	1 (3)	4 (13)	5 (17)	6 (20)
	Swelling	10 (33)	3 (10)	0 (0)	0 (0)
	Eyelid burning	2 (7)	6 (20)	6 (20)	1 (3)
Collectors	Skin rashes	6 (36)	0 (0)	0 (0)	3 (18)
	Irritation	4 (24)	2 (12)	0 (0)	5 (29)
	Swelling	2 (13)	0 (0)	0 (0)	0 (0)
	Eyelid burning	1 (6)	1 (6)	2 (12)	3 (18)
Loaders	Skin rashes	1 (7)	3 (21)	0 (0)	2 (14)
	Irritation	1 (7)	5 (5)	0 (0)	2 (14)
	Swelling	0 (0)	1 (7)	0 (0)	1 (7)
	Eyelid burning	4 (28)	2 (14)	1 (7)	1 (7)

Source: Field survey, 2003.

Figures within parenthesis indicate percentage

Allergic diseases are intense due to poor protective measures, lack of enough water for proper sanitation and personal hygiene. Out of the total (61) respondents, only 11 percent waste workers bathe daily and none of them change their clothes daily (Table 3). Diseases like eye and ear infections, skin diseases, scabies, lice and fleas are very difficult to control

without adequate supply of water (Hardoy et al. 2001). Water scarcity is a serious problem of Kathmandu. The waste workers who live in poor service areas are compelled to use either groundwater or water from streams for bathing and washing (sometimes even for cooking and drinking too). Use of very low quality of water causes bad personal hygiene.

Table 3. Habit Among Waste Workers

S. No.	Frequency of Involvement	No. of Respondents by Habits	
		Cloth Change	Bathing
1	Weekly	45 (74)	4 (7)
2	2 Times a Week	6 (10)	15 (25)
3	3 Times a Week	5 (8)	25 (41)
4	4 Times a Week	5 (8)	10 (16)
5	Daily	0 (0)	7 (11)
6	Total	61 (100)	61 (100)

Source: Field survey, 2003.

Figures within parenthesis indicate percentage

Poisoning

Numbers of poisoning problems can occur while handling rotten wastes. Although the problems like headache, nausea, fatigues and fits might be the outcome of other factors, they are perceived as symptoms of poisoning in this study, because the respondents claim that when they go away from working sites, they feel normal again. Some waste workers also believe that headaches are caused by intense heat during the sunny days and nausea and fatigue are due to weakness.

Dumping site conflict, waste workers' strikes and other political issues frequently disrupts organized collection of garbage in Kathmandu. Garbage waiting for collection and wastes dumped in non-sanitary dumping emit poisonous gases. Methane emitted from dumping site can cause poisoning (Birley and Lock 1999). Not separating toxic materials and container of poisonous gases from wastes also create poisoning problems. The use of mask might help to reduce the poisoning problems. But waste workers do not do so. Among different poisoning problems, headache and nausea are found more intense among sweepers (Annex A).

Respiratory Tract Diseases

In Kathmandu, vehicular emission exceeded the minimum standard. Plying such vehicles in dusty roads makes air quality very bad. The concentration of total suspended particles (TSP) and particulate matters of 10 micrometer (PM10) are the major causes of air pollution in Kathmandu (Pandey 1997). Because of poor air quality urbanities of Kathmandu are experiencing number of respiratory problems. However, situation of waste workers was observed very bad, because they expose daily to poor air quality and come to contact with numbers of pathogenic and nonpathogenic microorganism. Symptoms of respiratory tract

diseases are observed on very high proportion of waste workers (Annex A). Breathlessness, chest pain, cough, fever and sputum with sneezing, headache, running nose, and nasal congestion are few of the associated symptoms of respiratory tract ailments in waste workers. *Rhinitis/sinusitis, pharyngitis, tonsillitis, bronchitis, pneumonia, tuberculosis, Chronic Obstructive Pulmonary Disorder (COPD)* and *asthma* are some respiratory tract diseases those identified in waste workers of Kathmandu. However, being common symptoms of number of respiratory tract diseases, it is difficult to draw clear boundary among different respiratory tract problem without clinical examination and laboratory test.

Respiratory tract diseases are not typical only in the waste workers of Kathmandu. The studies of Poulsen et al (1995 b) in Geneva and Denmark, and Roy et al in USA present some example of respiratory tract related disease even in the developing countries.

Annex A provide evidences of waste workers experience about the symptoms of respiratory tract diseases. Activity-wise differences are clearly observed in the proportions of suffering respondents especially of *tuberculosis, COPD* and *asthma*. Symptoms of these diseases are found only in sweepers. It might be because of their higher exposure to dust and vehicular emission while sweeping streets. Activities wise differences are noted not only in the proportion of respondents experiencing the symptoms but also in the annual suffering period of respondents from different respiratory tract diseases. Annual suffering period from all types of respiratory tract diseases are found longest in loaders (Table 4). Symptoms of some respiratory tract diseases namely: *tuberculosis, COPD, and asthma* traced at lower occurrence on the respondents because symptoms of these diseases develop slowly and have long-term impact. It needs clinical examination and laboratory testes to identify them categorically.

Respiratory problems to sweepers, who generally are female, have higher respiratory problems. It is probably due to their responsibility of household cooking in poorly ventilated house and spending significant time in kitchen, sweeping in dusty and smokey streets.

Gastrointestinal Diseases

Gastro intestinal diseases are the product of parasitic infection and pathogenic microorganisms (Birley & Lock 1999). Gastrointestinal diseases are common to almost all urban poor of Kathmandu. The waste workers, who have to spent longer durations to handle waste, have serious gastrointestinal problems, because of their exposure to number of diseases vectors. Since qualities of urban basic services provided by authorities are of very low quality and the waste workers cannot afford the services provided by private sectors, they suffer the most. Diseases like *dysphagia, heartburn, regurgitation, dyspepsia, flatulence, vomiting, water brash, anorexia, gastritis, peptic ulcer, food poisoning, giardiasis, worm infestation, ameobiasis, dysentery, cholera, typhoid, and diarrhoea* are some of the gastrointestinal diseases reported by waste workers. Among these diseases, the symptoms of *diarrhoea, ameobiasis, dysentery, giasdiasis* and food poisoning are found among significant proportions of respondents (Annex A).

Table 4. Percentage of Waste Workers Suffering from Respiratory Tract Diseases and Its duration

Diseases	Percentage of Suffered Waste Workers			
	Annual Suffering Period	No. of Sweepers(30)	No. of Collectors (17)	No. of Loaders (14)
Rhinitis/Sinusitis	1 week	3	6	1
	2 weeks	0	12	0
	3 weeks	20	12	14
	1 month	54	41	14
	3 months	3	0	0
	6 months	3	0	14
Pharyngitis	1 week	10	0	0
	2 weeks	30	18	7
	3 weeks	13	6	0
	1 month	27	18	42
	3 months	0	0	7
Tonsillitis	1 week	20	12	0
	2 weeks	23	35	21
	3 weeks	0	12	7
	1 month	0	0	7
	3 months	0	0	7
Bronchitis	1 week	13	0	0
	2 weeks	13	12	29
	3 weeks	10	12	21
	1 month	0	0	7

Source: Field survey, 2003.

Numbers in parenthesis are total number of respondents

Gastrointestinal diseases are acute among sweepers than those of collectors and loaders. The highest proportions of sweepers are experiencing the symptoms of *heartburn*, *regurgitation/water brash*, *dyspepsia/anorexia/vomiting*, *cholera*, and *flatulence*. The highest proportions of loaders are experiencing the symptoms of *gastritis*, *giardiasis*, *worm infestation*, *ameobiasis* and *typhoid*. Symptoms of *worm infestation* are found only in loaders, the symptoms of *flatulence* are found only in sweepers. Among these three sub-groups, sweepers are the most suffering group followed by loaders and collectors (Annex B).

Parasitic infections are most serious problem among the solid waste workers of third world cities. A study made during the 1970s in 33 Indian cities showed 98 percent of solid waste collectors had positive symptoms of parasitic infection. Poulsen (Poulsen et al. 1995a and b) pointed frequent gastrointestinal problems like *diarrhea* and *dyspnoea* among waste collectors of Denmark. Hordoy (Hardoy et al. 2001), Sandra (Cointreau-Levine n.d.) and Stephens

(1999) found that numbers of waste workers of different cities of the world are experiencing serious gastrointestinal problems.

Conclusion

Waste workers are waste workers by birth in Nepalese social structure. Certain castes like *Podes*, *Chyames* have the responsibility of handling waste throughout Nepal, which is typical feature of Nepalese caste system. For survival, since long past, *Podes* and *Chyames* are working as waste workers in health threatening environment. They are experiencing numerous health problems. Mixture of inorganic and special wastes in municipal waste and labor-intensive waste handling practice are the leading causes of health problems. Just by separating inorganic waste and sharp objects from municipal waste, by establishing separate provision for hospital and other hazardous waste management, and by mechanization of waste handling practice, health problems of waste workers can be reduced in significant level. In the same manner, establishment of waste workers welfare (under KMC), making waste workers aware of health impact and encourage them to use protective measures properly, making trained waste workers to handle hazardous waste, regular monitoring of waste workers' health status and providing them necessary treatment could bring remarkable change in waste workers' health.

Health has significant impact on a person's economy. In existing waste management practice, waste workers of Kathmandu are losing numbers of working days because of their poor health. This has reduced daily income on the one hand and has increased daily expense on the other. If this situation is not controlled, they could not come out of the poverty trap.

Solid waste management in Kathmandu is very complex because of 'the politics' in waste management. Kathmandu gets higher amount of waste for disposal because of non-institutionalized material recovery system and lack of compost plant. The conflict among different interest groups has shelved a sanitary landfill site proposed a decade earlier. Policies in separate management of hazardous waste, waste separation provision, and working environment are inadequate and there is a wide gap between policy and practices. Therefore, policies for separate handling of hazardous waste and its immediate implementation, institutionalization of material recovery, establishment of compost plant, and development and use of proposed sanitary landfill site are immediate needs to improve waste workers' health, to make working environment healthier, and to reduce wide environmental implication of solid waste management in Kathmandu. These practices further increase working capacity of waste workers and help them to secure their livelihood earnings.

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Annex A. Health Problems Among Waste Workers

Diseases	Collectors (17)	Loaders (14)	Sweepers (30)	Waste workers
<i>Physical Injuries</i>	No	No	No	Total
Back and waist pain	13 (76)	12 (86)	29 (97)	54 (89)
Elbow injury	11 (65)	6 (43)	27 (90)	44 (72)
Wrist injury	13 (76)	8 (57)	26 (87)	47 (77)
Cuts, bruises and ruptures	13 (76)	12 (86)	14 (47)	39 (64)
Joint pain	11 (65)	10 (71)	21 (70)	42 (69)
Allergies				
Skin rashes	9 (53)	6 (43)	16 (53)	31 (51)
Irritation	11 (65)	8 (57)	16 (53)	35 (57)
Swelling	2 (12)	2 (14)	13 (43)	17 (28)
Eyelid burning	7 (12)	8 (57)	15 (50)	30 (49)
Poisoning				
Headache	13 (76)	12 (86)	30 (100)	55 (90)
Nausea	9 (53)	12 (86)	30 (100)	51 (84)
Faintingness	6 (35)	4 (29)	13 (43)	23 (38)
Fits	4 (24)	4 (29)	6 (20)	14 (23)
Respiratory Tract Diseases				
Rhinitis/ Sinusitis	12 (71)	6 (43)	25 (83)	43 (70)
Pharyngitis	7 (41)	8 (57)	24 (80)	39 (64)
Tonsillitis	10 (59)	6 (43)	13 (43)	29 (48)
Bronchitis	4 (24)	8 (57)	11 (37)	23 (38)
Pneumonia	0 (0)	0 (0)	0 (0)	0 (0)
TB	0 (0)	0 (0)	2 (7)	2 (3)
COPD	0 (0)	0 (0)	2 (7)	2 (3)
Asthma	0 (0)	0 (0)	9 (30)	9 (15)
Gastrointestinal Diseases				
Dysphagia	4 (24)	2 (14)	4 (13)	10 (16)
Heart burn	9 (53)	4 (29)	20 (67)	33 (54)
Regurgitation/Water brash	8 (47)	10 (71)	25 (83)	43 (70)
Dyspepsia/Anorexia/ Vomiting	8 (47)	7 (50)	25 (83)	40 (66)
Flatulence	0 (0)	0 (0)	10 (33)	10 (16)
Gastritis	7 (41)	8 (57)	13 (43)	28 (46)
Food poisoning/Diarrhea	12 (71)	9 (64)	28 (93)	49 (80)
Giardiasis	3 (18)	4 (29)	8 (27)	15 (15)
Worm infestation	0 (0)	2 (14)	0 (0)	2 (3)
Ameobiasis	2 (12)	4 (29)	7 (23)	13 (21)
Dysentery	0 (0)	6 (43)	5 (17)	11 (18)
Cholera	3 (18)	2 (14)	12 (40)	17 (28)
Typhoid	2 (12)	4 (29)	3 (10)	9 (15)

Source: Field Survey, 2003. Figures within parenthesis indicate percentage

Annex B. Percentage and Annual Frequency of Waste Workers Suffering from Gastrointestinal Disease

Disease	Annual Frequencies							
	1	2	3	4	5-12 times	13-24 times	25-50 times	More than 50 times
Sweepers (30)	%	%	%	%	%	%	%	%
Dysphagia	0	2	7	0	0	0	0	0
Heart burn	0	10	13	7	26	10	0	0
Regurgitation/Water brash	7	13	13	0	40	10	0	0
Dyspepsia/Anorexia/Vomiting	10	13	27	0	27	6	0	0
Flatulence	0	10	7	10	6	0	0	0
Ameobiasis	0	7	10	7	0	0	0	0
Gastritis	0	13	17	10	3	0	0	0
Food poisoning/ Diarrhea	7	43	43	0	0	0	0	0
Giardiasis	0	7	7	10	3	0	0	0
Worm infestation	0	0	0	0	0	0	0	0
Dysentery	0	10	7	0	0	0	0	0
Cholera	27	13	0	0	0	0	0	0
Typhoid	10	0	0	0	0	0	0	0
Collectors (17)								
Dysphagia	0	18	0	0	0	0	0	0
Heart burn	6	18	12	12	12	0	6	6
Regurgitation/Water brash	0	0	18	12	17	0	0	0
Dyspepsia/Anorexia/Vomiting	0	0	6	12	12	0	11	6
Flatulence	0	0	0	0	0	0	0	0
Ameobiasis	0	0	0	0	0	0	6	6
Gastritis	6	12	0	6	6	0	6	6
Food poisoning/ Diarrhea	0	41	6	12	12	0	0	0
Giardiasis	12	6	0	0	0	0	0	0
Worm infestation	0	0	0	0	0	0	0	0
Dysentery	0	0	0	0	0	0	0	0
Cholera	6	0	12	0	0	0	0	0
Typhoid	0	0	0	0	0	0	0	0
Loaders (14)								
Dysphagia	0	0	14	0	0	0	0	0
Heart burn	0	0	0	14	14	0	0	0
Regurgitation/Water brash	0	14	29	14	14	0	0	0
Dyspepsia/Anorexia/Vomiting	0	21	0	8	14	7	0	0
Flatulence	0	0	0	0	0	0	0	0
Ameobiasis	14	7	7	0	0	0	0	0
Gastritis	0	14	0	7	36	0	0	0
Food poisoning/ Diarrhea	57	0	0	0	0	0	7	0
Giardiasis	0	14	7	0	7	0	0	0
Worm infestation	7	7	0	0	0	0	0	0
Dysentery	0	29	7	0	7	0	0	0
Cholera	14	0	0	0	0	0	0	0
Typhoid	7	7	0	0	14	0	0	0

Source: Field Survey, 2003. Figures within parenthesis indicated total number of respondents.

Annex C. Pictures Associated with Waste Management Practice in KMC



Plate 1. Teku, waste transfer depot



Plate 2. Household waste collector carrying waste in rickshaw



Plate 3. Sweeper collecting waste in rickshaw at Jamal (experiencing irritation)



Plate 4. Sweeper at work



Plate 5. Bagmati River, ditch making at the bank and pile of waste ready to bury



Plate 6. Ditch filled by waste at Balkhu