



Assessing Knowledge, Attitude and Practices (KAP) of Solid Waste Workers in Sindh: Implications for Occupational Safety and Waste Management Enhancement

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ABSTRACT

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Solid waste workers are exposed to health and safety hazards at workplace. As per estimates related to workers involved in waste management fields, over 213 million workers are exposed to non-fatal accidents. A cross-sectional quantitative study was carried out to explore the Knowledge, Attitude, and Practices (KAP) of solid waste workers of Sindh for the betterment of workers and solid waste management. Questionnaire adopted from study of Kasemy et al. [1] was used to collect from 384 solid waste workers (age mean = 38 years) working in the Sindh Solid Waste Management Board (SSWMB), district Hyderabad. Results revealed the gaps in knowledge, positive attitudes, and a mix of practices towards safety measures. Such results highlight the need for training to improve the KAP of solid waste workers.

1. Introduction

Solid waste collection is a daily global task, but the health risks that workers in this field face are a worldwide concern [2], [3]. In developing countries, occupational illnesses and injuries among solid waste collection workers and waste pickers are especially prevalent. The International Labor Organization emphasizes this pressing issue, estimating that approximately 250 million workers worldwide have been injured on the job [4]. Among these workers, an estimated 213 million are exposed to non-fatal accidents, some of which tragically result in fatalities, with a death toll reaching half a million in severe cases [1]. Limited financial resources and poorly managed occupational risk behaviors among waste collectors exacerbate the problem in many developing countries. Workplace fatalities affect not only organizations but also have broader economic consequences for countries [5].

Inadequate data collection systems for accidents in developing countries exacerbate the problem [6]. Furthermore, the situation in developing countries is worse, as workers in these regions have higher accident rates than their counterparts in developed countries [7], [8], [9].

The International Labor Organization emphasizes the importance of addressing gender disparities, low education levels, poverty, and skill deficits in order to make tangible progress toward achieving the United Nations Sustainable Development Goals, particularly Goal 8, which relates to decent work and economic growth. Key of success to contributing to this aim lie in promoting safer work policies [10]. While every occupation involves some level of risk, solid waste workers face a higher risk of injury and occupational hazards than industrial workers [11], [12]. This increased risk is due to the nature of their work, which exposes them to a variety of injuries and diseases [1]. The United Nations Environment Program highlights the hazardous conditions that municipal solid waste workers face, including severe musculoskeletal disorders, contact with sharp materials, heavy container lifting, wounds, chemical burns, and poisoning [13]. [14] contend that municipal solid waste workers face greater occupational health and safety risks than workers in other fields. Allergies, physical injuries, musculoskeletal complaints, diarrhea, fungal infections, respiratory tract infections, gastrointestinal diseases, skin and eye injuries, fractures, sharp backaches, dog and rat bites, lacerations, abrasions, and sprains are all possibilities. Fire burns are another common occurrence [15], [16].

These occupational accidents are frequently caused by the improper disposal of waste items such as broken needles, glass shards, sharp pins, and microbial contamination. This can result in the spread of bloodborne pathogens such as the Human Immunodeficiency Virus (HIV), tetanus, Hepatitis B (HBV), and Hepatitis C (HCV) [17], [18], [19], [20]. Furthermore, [21] emphasize that municipal waste workers are exposed to microbiological contaminants, toxic materials, solvents, chemicals, and vector-borne diseases.

Dengue virus, yellow fever, chikungunya virus, and other diseases are among them [17]. Risks associated with informal waste workers were studied in Kathmandu Valley, with a focus on risk mitigation strategies. The study used semi-structured interviews and focus group discussions with 67 informal waste workers. Physical injuries, the development of strategies to mitigate hazards, raising awareness about risks, and understanding the importance of using personal protective equipment (PPE) despite its high cost, limited availability, and inconvenience during work were identified as the main occupational risks for informal waste workers in the study. In contrast,

unprotected informal waste workers in Kathmandu Valley faced health and occupational hazards [22]. Data collected through questionnaires, convenience sampling, and snowball sampling from 1,228 informal waste workers revealed that older workers over the age of 55 had a lower perception of occupational risks. Despite this, 72 % of waste workers considered their job to be dangerous, with respiratory problems and physical injuries being the most common symptoms. Glass cuts accounted for 44.4 % of injuries, and 67 % of waste workers did not use personal protective equipment (PPE). Only 7.5 % of informal waste workers had hepatitis B vaccinations, and less than half had tetanus vaccinations.

Elmubarak et al. [23] also sought to identify and prevent occupational hazards and risks among municipal waste workers in Khartoum, Sudan. The study used structured questionnaires and observational checklists to survey 280 solid waste collectors. According to the findings, 82 % of respondents recognized injuries as hazards, and 84 % were aware of workplace health risks. However, none of the workers had been immunized against Hepatitis B, Hepatitis C, or tetanus. Furthermore, 67 % lacked personal protective equipment, resulting in injuries, and 76 % lacked education.

Municipal waste workers in developing countries such as Pakistan collect waste primarily by hand due to a lack of equipment and machinery for storage, collection, transportation, and final disposal in landfills [11]. Solid waste workers in these developing countries frequently work without adequate personal protective equipment, exposing them to significant health risks [24]. Extreme temperatures are common in Pakistan, with solid waste workers working in temperatures as high as 48-50 degrees Celsius in June and July. Inadequate PPE use and a complete lack of training exacerbate the risks [25].

Solid waste management is critical for public health and the environment, especially as economies and populations grow [26], [27]. To accomplish this, solid waste workers must have sufficient knowledge of the hazards inherent in solid waste management and be aware of the risks they face. Unfortunately, many municipal employees are unaware of workplace safety practices and occupational hazards [28], Similarly, study conducted in Ethiopia by [29] which revealed solid waste workers had inadequate knowledge, safety precaution lack of awareness and poor waste management.

Likewise, studies [1], [30], [31], [32], all have found a lack of knowledge about health hazards and best practices among solid waste workers, which is frequently accompanied by negative attitudes.

Furthermore, because of their low economic status and exposure to hazardous substances, solid waste collectors frequently work without adequate personal protective equipment (PPE), particularly in developing Asian countries [24], [33], [34]. Similarly, solid waste workers had poor awareness, knowledge, utilization and lack of information about PPE result in infection, diseases and death [35].

Given the critical need to address these issues, especially in developing countries, this study focuses on the knowledge, attitudes, and practices (KAP) of solid waste workers in Hyderabad, Pakistan, where waste collection is primarily done by hand. The purpose of this study is to investigate the KAP of solid waste workers employed by the Sindh Solid Waste Management Board (SSWMB) in Hyderabad in order to make recommendations and improvements for the benefit of workers and solid waste management practices.

2. Research Methods

A cross-sectional quantitative design was used to address the research objectives. Data for this study were gathered using a questionnaire adapted from a previous research project of Kasemy et al. [1]. Using convenience sampling, the survey was administered to 384 solid waste collectors affiliated with the Sindh Solid Waste Management Board (SSWMB) in Hyderabad.

3. Results

From August to December 2022, this research was carried out in Hyderabad, Pakistan's second largest city, which is located on the east bank of the Indus River and covers an area of approximately 993 square kilometers. With a population of around 2 million people, Hyderabad is divided into four talukas: Hyderabad city, Latifabad, Qasimabad, and Hyderabad urban, each with 20 union councils.

3.1. Reliability of Questions

The reliability of the questionnaire was tested in order to assess internal stability and consistency. Cronbach's alpha was 0.786 for the Knowledge, Attitude, and Practice questionnaire, and participants' responses were consistent and dependable, indicating that this study is reliable and accepted.

3.2. Socio-Demographic Characteristics

Here is an in-depth look at the socio-demographic characteristics of the 384 solid waste collectors who participated in the study. Males made up the entire participant group, accounting for 100 %

of the sample. In terms of age distribution, the majority of respondents were between the ages of 36 and 45, accounting for 38 % of the total, with the age group 26-35 accounting for 37.2 %.

3.3. Knowledge about Solid Waste Hazards

Table 1 displays information about respondents' knowledge of solid waste hazards and related practices. The data in Table 1 provide valuable insights into respondents' knowledge and awareness of solid waste management and associated hazards. It is clear that a significant proportion of respondents, approximately 44 %, claimed to be knowledgeable about solid waste management, while the majority, 55.7 %, admitted to being unaware, with a negligible 0.3 % remaining unsure. Furthermore, the survey found that 86.2 % of participants were aware of the dangers associated with solid waste, while 13.8 % were unaware.

Notably, 92.2 % of respondents expressed concern about needle stick or sharp injury caused by solid waste, emphasizing the importance of safety measures. In terms of safety precautions, 98.7 % of respondents agreed that wearing personal protective equipment (PPE) such as gloves, masks, boots, and aprons reduces the risk of infection. In comparison, only 1.3 % agreed with this statement. Furthermore, respondents' perceptions of whether all solid wastes are hazardous varied, with approximately 79.7 % believing they are hazardous, while the remaining 20.3 % disagreed. In comparison, only 1.3 % agreed with this statement. Furthermore, respondents' perceptions of whether all solid wastes are hazardous varied, with approximately 79.7 % believing they are hazardous, while the remaining 20.3 % disagreed.

The understanding of color coding for solid waste segregation emerged as a significant knowledge gap, with only 8.6 % of respondents familiar with the concept, leaving 91.4 % in the dark. A significant 75.5 % agreed with the practice of labeling infectious waste containers with a biohazard symbol, while 24.5 % disagreed. Similarly, 75.5 % agreed that solid waste should be separated at the source, while 24.2 % disagreed, and 0.3 % expressed uncertainty.

Regarding the effectiveness of disinfection in reducing infection transmission, 75 % of respondents agreed, while 25 % disagreed. In contrast, views on the necessity of closing solid waste containers during transportation were more evenly divided, with 79.2 % favoring closure and 20.8 % opposing it. Finally, the survey revealed a lack of knowledge among respondents regarding solid waste disposal methods, with only 38.8 % reporting being informed, while the majority, comprising 61.2 %, admitting to being unaware.

Finally, the findings highlight the importance of targeted educational initiatives and awareness campaigns to bridge knowledge gaps and promote safe solid waste management practices, particularly in areas such as color coding, waste segregation, and disposal methods. The survey findings provide a solid foundation for improving safety measures and knowledge dissemination in this critical domain.

Table 1: Knowledge about the Solid waste Hazards

S #	Question(s)	Yes		No		Not sure	
		n*	%	n*	%	n*	%
1	Do you have idea about solid waste management?	169	44	214	55.7	1	0.3
2	Is there any hazard associated with solid wastes?	331	86.2	53	13.8		
3	Is needle stick/sharp injury a concern?	354	92.2	30	7.8		
4	Does wearing personal protective equipment (gloves, masks, boots, and aprons) reduce the risk of infection	379	98.7	5	1.3		
5	Are all solid wastes hazardous?	306	79.7	78	20.3		
6	Do you know color coding segregation of solid wastes?	33	8.6	351	91.4		
7	Should infections waste containers be a label with biohazard symbol?	290	75.5	94	24.5		
8	Should solid wastes be segregated at the source?	290	75.5	93	24.2	1	0.3
9	Does disinfection of solid wastes decrease infection transmission?	288	75	96	25		
10	Do we need to close solid care waste containers while in transport?	304	79.2	80	20.8		
11	Do you know about solid care waste disposal methods?	149	38.8	235	61.2		

* number of respondents

3.4. Attitude towards Solid Waste Hazards

Table 2 shows respondents' attitudes toward solid waste hazards in the context of their jobs. This table provides useful information about workers' perceptions and attitudes toward safety precautions, the role of solid waste management, and their understanding of infectious disease transmission through waste.

The majority of respondents were positive about wearing PPE. Wearing gloves can reduce hand damage, wearing masks can protect respiratory organs, wearing rubber boots can reduce foot damage, and wearing an apron can reduce physical damage to the body.

These high percentages indicate a strong understanding of the importance of PPE in injury prevention. The respondents also expressed favorable attitudes toward hygiene and health. A whopping 97.4% agreed that taking a shower after work can help reduce diarrheal diseases and refresh the mind. Furthermore, 97.9 % believed that wearing clean clothes can help prevent dermal diseases. These responses demonstrate a thorough understanding of the role of personal hygiene in the prevention of health problems.

The majority of respondents recognized the importance of proper solid waste management. A sizable 95.3 % thought it was a problem, and 98.7 % thought safe solid waste management necessitated collaboration. Furthermore, 93.8 % agreed that solid waste should be segregated at the source, and 89.6 % believed that segregation facilitates safe handling. These responses indicate a favorable attitude toward environmentally responsible waste management practices. Respondents demonstrated varying levels of knowledge and attitudes toward disease transmission via solid waste. While 81.8 % were aware that HIV can be transmitted through solid waste, only 69.8 % were aware that HBV could be transmitted through solid waste. Surprisingly, 49.2 % believed that solid waste did not spread infectious diseases. This finding emphasizes the importance of educating and raising awareness about the potential health risks associated with solid waste.

Most respondents (96.1 %) agreed that proper solid waste disposal can prevent infection transmission, and 93.5 % believed that solid waste disinfection can reduce the chances of contracting infections. In terms of government initiatives, only 6% thought the government was doing enough to protect and protect workers' health, while the vast majority (94%) disagreed.

This reflects a widespread belief among workers that the government should do more to protect their health and well-being. 94.3 % of respondents agreed that solid waste management adds an additional burden of work. This indicates that employees are aware of the additional responsibilities associated with proper waste management, but they may be overwhelmed by the workload.

In conclusion, Table 2 provides valuable insights into workers' attitudes and perceptions of solid waste hazards and management. While the importance of PPE, hygiene, and proper waste

management is widely acknowledged, there are gaps in knowledge regarding disease transmission through waste. Respondents also expressed a desire for more government assistance in safeguarding their health and safety. These findings can be used to develop targeted interventions and training programs to improve workers' knowledge and attitudes about solid waste management and safety.

3.5. Practices of Safety Measures toward Solid Waste Hazards

Table 3 provides valuable insights into the respondents' hygiene practices, safety measures, and workplace behaviors. These practices are critical for ensuring workers' health and well-being, especially in environments where hazards are present.

According to the Table 3, the vast majority of respondents prioritize hygiene. An impressive 99.2 % of them reported using soap to wash their hands after work, demonstrating a strong commitment to cleanliness. Similarly, 99.7 % said they take a shower after work, highlighting the importance of personal hygiene in their routine. Furthermore, 97.9 % change their work clothes after work, indicating a deliberate effort to limit the spread of contaminants. The high proportion (99.2 %) of those who wash their work clothes after use demonstrates their commitment to hygiene. A notable finding is that 75% of respondents share work clothes with their coworkers, while the remaining 25% do not. Sharing work clothes can have an impact on hygiene, potentially increasing the risk of contamination among employees. This aspect should be given more thought to workplace safety policies.

According to the data, a sizable proportion (97.1 %) of respondents consume food at work. This practice has implications for food safety and hygiene standards, emphasizing the need for strict guidelines and monitoring to ensure worker safety. Pre-employment training was reported by nearly all respondents (98.7 %). This training most likely covers various aspects of workplace safety and hygiene, which contributes to the respondents' positive hygiene practices. It is critical to continue providing such training in order to maintain and improve workplace safety.

Table 2: Attitude towards solid waste hazards.

S #	Question	Yes		No		Not sure	
		n	%	n	%	n	%
1	Do you know wearing glove can reduce damage to your hand?	379	98.7	5	1.3		
2	Do you wearing mask can reduce damage to respiratory organs?	380	99	4	1		
3	Do you aware wearing rubber boots can reduce damage to feet?	376	97.9	8	2.1		
4	Do you know wearing apron can reduce physical damage to body?	369	96.1	14	3.6	1	0.3
5	Having shower after work reduce diarrheal diseases?	374	97.4	10	2.6		
6	Having shower after work help to refresh mind?	374	97.4	10	2.6		
7	Do you aware working with clean cloth can prevent dermal diseases?	376	97.9	8	2.1		
8	Do you agree changing cloth after work gives you aesthetical satisfaction?	377	98.2	7	1.8		
9	Does proper solid waste handling is an issue?	366	95.3	18	4.7		
10	Does safe solid waste management need a teamwork?	379	98.7	5	1.3		
11	Do You aware, HIV can be transmitted through solid wastes?	314	81.8	69	18	1	0.3
12	Do you aware HBV can be transmitted through solid wastes?	268	69.8	116	30.2		
13	Does solid wastes do not transmit any infection diseases?	189	49.2	195	50.8		
14	Do you agree solid waste should be segregation at the point of generation?	360	93.8	24	6.3		
15	Do you agree solid waste segregation can facilitate safe handling	344	89.6	40	10.4		
16	Do you agree proper solid wastes disposal can prevent infection transmission?	369	96.1	15	3.9		
17	Do you know sold waste disinfections can reduce the chance of contracting the infections?	359	93.5	25	6.5		
18	Do you agree solid waste management add the extra burden of work?	362	94.3	22	5.7		
19	Do you agree infections medical waste should be disinfections before disposal?	355	92.4	29	7.6		
20	Do you feel that Government is doing enough towards workers protection and health?	23	6	361	94		

Table 3: Practices of safety measures towards solid waste hazards

S #	Question	Yes		No		Not sure	
		n	%	n	%	n	%
1	Do you wash hand with soap after work?	381	99.2	3	0.8		
2	Do you take a shower after work?	383	99.7	1	0.3		
3	Do you change work clothes after work?	376	97.9	8	2.1		
4	Do you wash work clothe after work?	381	99.2	3	0.8		
5	Do you share work clothes with colleague?	288	75	96	25		
6	Do you Eating food at workplace?	273	97.1	11	2.9		
7	Do you Received pre-employment training?	379	98.7	5	1.3		
8	Do you frequently use of personal protective equipment?	164	42.7	220	57.3		

Surprisingly, only 42.7 % of respondents reported using personal protective equipment on a regular basis (PPE). This finding raises concerns about workplace safety and the importance of promoting consistent PPE use in order to reduce the risk of occupational hazards. Employers should prioritize worker safety by encouraging them to wear PPE on a regular basis.

Finally, Table 3 highlights respondents' positive hygiene practices, particularly handwashing, showering, and changing work clothes. However, the practice of sharing work clothes and eating at the workplace raises important hygiene and safety concerns. Pre-employment training appears to be critical in promoting these positive behaviors. The lower percentage of respondents who frequently use PPE emphasizes the importance of reinforcing workplace safety measures. Overall, these findings highlight the importance of ongoing efforts to maintain and improve worker hygiene and safety standards in order to protect their health and well-being.

4. Discussions

The discussion section of this research paper will synthesize and analyze the findings from all three tables: Table 1, which focused on solid waste hazards knowledge; Table 2, which examined attitudes toward solid waste hazards; and Table 3, which looked at worker hygiene practices and

safety measures. These tables provide a comprehensive overview of workers' awareness, attitudes, and behaviors regarding solid waste management and workplace safety.

The findings related to knowledge and awareness of solid waste hazards show that respondents had a mix of knowledge and misconceptions. Notably, a sizable proportion of workers were aware of the dangers of solid waste, needle stick injuries, and the importance of personal protective equipment (PPE). However, a sizable proportion were unaware of color coding for waste segregation and complex waste disposal methods. The lack of awareness about color coding and waste segregation is concerning, because proper waste segregation is critical to safe waste management practices. This knowledge gap may result in improper handling of hazardous waste materials, putting workers' and the community's health at risk.

In addition, results related to attitude towards the solid waste hazards, the data show that workers have positive attitudes toward the effectiveness of PPE in reducing physical harm. However, there are mixed feelings about other aspects of waste management, such as whether it adds an additional burden of work. The majority of workers recognize the value of collaboration in waste management.

One notable finding is that workers are aware of the potential transmission of diseases such as HIV and HBV through solid waste. Some respondents, however, continue to believe that solid waste does not spread infectious diseases. This highlights the importance of ongoing education and awareness programs to dispel myths and reinforce correct information.

Moreover, outcomes related to hygiene practices and safety measures are generally positive, with a high percentage of workers washing their hands, showering after work, and changing their work clothes. This demonstrates a commendable dedication to personal hygiene.

However, the data also reveals areas of concern, such as worker sharing of work clothes and food consumption at the workplace. These practices may increase contamination risks and should be addressed through workplace policies and training. Furthermore, the relatively low percentage of workers who frequently use personal protective equipment (PPE) raises concerns about workplace safety. Employers should make consistent PPE use a priority in order to reduce occupational hazards.

5. Conclusion

This research paper provides a thorough examination of workers' solid waste management and workplace safety knowledge, attitudes, and practices. The research reveals a diverse landscape,

with workers displaying varying levels of awareness and comprehension. While many people are aware of general hazards, needle stick injuries, and the importance of personal protective equipment (PPE), there are significant gaps, particularly in waste segregation and complex disposal methods. Workers are generally positive about the effectiveness of PPE, but they are concerned about the additional workload associated with solid waste management. There is a growing awareness of the potential transmission of infectious diseases through solid waste, which is encouraging. Although the study highlights commendable hygiene practices such as handwashing, showering, and changing work clothes, it does raise some concerns about sharing clothes among colleagues and workplace food consumption. To address these findings, recommendations emphasizing education and training, consistent PPE use, policy development, awareness campaigns, and government involvement are proposed. In essence, this study emphasizes the importance of bridging knowledge gaps and improving safety practices in order to create a safer and healthier environment for solid waste management workers, benefiting both the workforce and the larger community.

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Ethical Standard

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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