

Occupational and Public Health Risks among Urban Sanitation Workers in Lahore, Pakistan

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Urban sanitation workers face disproportionate occupational hazards, yet empirical evidence from Pakistan remains limited. This study aimed to quantify occupational health risks, ergonomic and working-condition challenges, safety measures, and social vulnerabilities among sanitation workers in Lahore. A quantitative cross-sectional survey was conducted among workers employed by the Lahore Waste Management Company and the Cantonment Board using simple random sampling. Data were collected through a structured questionnaire and analyzed in SPSS using descriptive statistics, Pearson correlation, Cronbach's alpha, and multiple linear regression. Overall, 81.5% of respondents reported poor working conditions and ergonomic strain, 84.8% reported occupational health risks, 84.4% indicated inadequate organizational safety measures, and 57.3% experienced social stigma or financial difficulties. Regression analysis identified occupational health risks ($\beta=0.564$, $p<0.001$) and working conditions ($\beta=0.401$, $p<0.001$) as the strongest predictors of overall occupational vulnerability, followed by social stigma/financial issues ($\beta=0.219$, $p<0.001$) and safety measures ($\beta=0.137$, $p=0.001$). Sanitation workers in Lahore experience substantial occupational and social vulnerabilities. Strengthening enforceable occupational health and safety policies, provision of personal protective equipment, structured training, and routine health surveillance are urgently needed.

Keywords: Sanitation workers, Occupational Health Risks, Ergonomics Challenges, Social Stigma, Safety Measures, Public Health, Workplace Safety



Introduction:

Sanitation is a key component of public health that promotes a safe and sustainable urban environment and prevents disease. The size and complexity of municipal solid waste and wastewater management have increased due to rapid urbanization and population growth in Pakistan's major cities, making sanitation work a crucial public service for maintaining the environment, public Health and city stability. Lahore is one of the largest metropolitan areas of Pakistan. The backbone of everyday urban hygiene is provided by sanitation workers, such as street sweepers, waste loaders/ collectors, drain cleaners, and sewer maintenance workers. However, this work is often done in environments that increase occupational risk while providing inadequate social security, protection, and recognition. According to national data, sanitation work in Pakistan is characterized by dangerous exposures, poor occupational safety and health (OSH) governance, and frequent deaths connected to toxic gases and confined space sewer entry, frequently in the absence of proper personal protective equipment and training.

A sustainability-oriented approach to occupational health for sanitation workers must take into account, besides environmental results (clean streets, improved waste collection coverage), and must also include the social and human dimensions of sustainable development: safe work, reduced inequalities, and dignified employment. According to recent rights-based analyses, sanitation workers in Pakistan often belong to marginalized communities and face systemic discrimination that increases workplace vulnerability and limits access to services, mobility, and social inclusion [1]. Evidence from Lahore in particular indicates that precarious hiring arrangements and limited representation shape sanitation work, with consequences of reporting culture, health access, and OSH compliance (Labour Research & Development Institute [LRDI] & Pakistan Workers Federation, 2024). Therefore, a comprehensive perspective that taken to account working conditions and economic exposure, pathways and health outcomes, safety measures and training systems, police and preventive measures, and socioeconomic constraints such as stigma and financial difficulty is require two examine occupational health risk in Lahore.

In Pakistan, approximately 80% of sanitation workers belong to Christian minority communities [2][3]. Sanitation workers in Lahore are regularly exposed to bacteria, toxic chemicals, and gases like methane, carbon monoxide, and hydrogen sulfide as a result of manual scavenging, such as desilting manholes [4][5]. In addition, Lahore sanitation workers deal with bad weather, like high heat, which can cause dehydration and heat stress. Furthermore, Pakistani sanitation worker not only expose with physical hazards but also face social stigma. Supporting this, a study on sanitation workers who face discrimination and stigmatization explains that sanitation workers reported that they didn't get enough respect due to their caste and were discriminated against in public, including while being segregated from food and eating utensils [1]. Workers faced chronic diseases, including respiratory issues, musculoskeletal disorders, skin infections, gastrointestinal issues, hepatitis, chronic headache, and psychological disorder has been reported [6]. Similarly, a qualitative study of Punjab reported that sanitation workers experienced burn eye, minor cuts from unsterilized syringes, blades, or sharp tools [7].

Even though sanitation workers play a crucial role, there is still a clear need for integrated Lahore-focused research that links (1) ergonomics and working conditions, (2) occupational health risk, (3) safety measures and training systems, (4) policy and preventive measures, and (5) social stigma and financial constraints within a single analytical framework. Therefore, the current case study is in a position to provide evidence and practical suggestions in line with a sustainable approach that connects competency-based training, enforceable OSH governance, social protection interventions, and ergonomic redesign and mechanization. This paper attempts to develop a context-specific understanding of how hazards are created and

sustained in sanitation work in Lahore and how prevention can be improved through practical controls, based on recent empirical and rights-based evidence from Pakistan and Punjab. The purpose of this paper is to gain a context-specific understanding of how hazards are created and maintained in sanitation work in Lahore and how prevention can be enhanced through workable controls and policy reform that are sound, operationally feasible, and socially inclusive [8][1][9][10].

Working Conditions and Ergonomics:

Sanitation workers often face hazardous working conditions, including exposure to human waste, toxic gases, and unsafe infrastructure. This category also includes caretakers and toilet cleaners responsible for managing sewage and fecal waste treatment at disposal sites in domestic, institutional, and public settings [11]. Due to the lack of modern sewage cleaning equipment, workers often enter underground sewerage systems through manholes to remove blockages manually. The issues influencing the well-being and, hence, health-related quality of life of these workers are poor living conditions, a poor work environment, low earnings, a lack of preventive measures at work, chronic diseases, and social discrimination by society [12][6].

There is a very high prevalence (96.4%) of injuries and musculoskeletal discomfort among sanitary workers, largely due to poor ergonomics and low health risk awareness (6.8%). Most workers (75%) cope with pain and injuries through self-medication or drug abuse, indicating inadequate access to proper healthcare or ergonomic interventions. Barriers to adopting ergonomic engineering equipment include cost (26.3%) and fear of job loss (51%), which hinder improvements in workplace safety [13]. In another study shows that it was found that sanitation employees had a variety of health concerns, including musculoskeletal difficulties [14]. Musculoskeletal disorders (MSDs) are a significant ergonomic risk for sanitary workers due to inadequate ergonomic practices [15]. Despite fair knowledge and positive attitudes toward ergonomics, sanitary workers often do not implement proper ergonomic practices, increasing their risk of MSDs [15].

Occupational Health Risks:

The job of a sewer man includes several occupational risks that pose a serious threat to the worker's health and life. Accidental risks like gassing, injury, and immersion are common among sewer workers [14]. Participants reported experiencing mild skin allergies, burns, eye infections, respiratory illnesses, and minor cuts on their hands and other exposed body parts [9][16]. They may also have suffered from exposure to unsanitary circumstances, pathogenic microorganisms found in sewage, flies and mosquitoes, as well as leachate and wet waste, as well as unpleasant odors and toxic fumes from working 8-9 hours a day for a year in such settings. Infected cut wounds on sanitation workers were documented to be caused by bumping into sharp things, shattered glass, pins, sharp materials, and hazardous trash [14].

When compared to other employees, sanitation workers suffer a greater degree of exposure and risk to their health [14]. Each year, hundreds of workers in major cities across Pakistan and India lose their lives due to exposure to toxic gases and lack of oxygen while clearing sewage systems flushed with waste from millions of households, industries, and offices [6]. Occupational diseases among workers, including sanitary workers, are often chronic, progressive, and may have long latency periods before symptoms appear. Workplace risks contributing to occupational diseases include chemical, physical (such as noise), biological, and psychosocial factors [17]. However, the carcinogenic risk from exposure to these metals exceeds the local population's safe range, indicating a potential long-term cancer risk for sanitation workers [18].

Safety measures, Training, Policy & Preventive Measures:

Occupational health and safety (OHS) among sanitation workers have emerged as a critical global concern, given their heightened exposure to hazardous environments. There is a lack of personal protective equipment, water, and soap for washing, as well as restroom

services, which exacerbate the challenges encountered by sanitation employees [14]. Despite frequent exposure to occupational hazards and pathogenic microorganisms, most sanitary workers lack access to basic medical services [19].

The health of these workers may be greatly improved by better work practices that include standard operating procedures, protection and safety measures, proper training, and preventative, promotional, and curative health care services [14]. a clear need for further quantification of occupational health risks faced by sanitation workers to improve the effectiveness of governmental policies and other efforts to mitigate these risks across the world, particularly in low-income countries [20]. All personnel must be educated in the use of technology following standard operating procedures, and measures to guarantee they are followed must be in place to minimize hazards. Another study showed that improved knowledge about occupational hazards is significantly associated with reduced biological, chemical, and psychological health problems [21]. Sanitation employees should be given vaccinations, have regular health checks, and be covered by insurance, according to the findings of this study. Improving OHS for sanitary workers requires providing PPE training and access, supplementary income sources, and making safety equipment more affordable [22][23]. As a result of this study, standard operating procedures and local-level sanitation standards may be established and approved at the city level. Training on occupational risks and the usage of personal protective equipment (PPE) is included, as well as safeguards for the employees' health and livelihoods. Monitoring of sanitation personnel's work and behavior is required to ensure that standard operating procedures are followed.

Social Stigma and Financial Issues:

Despite their crucial role in maintaining public health, sanitation workers often face neglect, discrimination, and even demonization, making them highly vulnerable to physical, psychological, emotional, and social harm [24]. It is well known that sanitation workers in Pakistan face social stigma and discrimination, which can affect how they are treated at work and in their personal lives [25]. Qualitative research specific to Lahore that focuses on female Christian sanitary workers revealed how exploitative work conditions are intertwined with discrimination, insecurity, and a lack of bargaining power. It also documents social exclusion in public spaces [8]. These factors can act as an occupational risk multiplier: when workers are socially devalued, unsafe behaviors may be accepted, underreported, or ignored; when workers fear losing their jobs or facing reprisals, they may take on dangerous tasks; and when workers have limited access to social safety nets or healthcare, early symptoms and injuries may go untreated and develop into disabilities. Moreover, they are often faced with challenges of insecurity in financial status and social issues, like social stigma and intergenerational discrimination [26].

Sanitation workers often receive insufficient and unstable pay, leading to financial insecurity. Informal and manual sanitation workers face more acute financial challenges due to a lack of legal protection and job stability [27]. Financial concerns among low-income workers, such as sanitary workers, can reduce their productivity and increase the likelihood of mistakes at work [28][29]. Sanitary workers face a lack of financial security, which contributes to their overall vulnerability. In addition to financial issues, sanitary workers experience mental and physical health problems due to workplace hazards [30]. Many governments in low- and middle-income countries do not adequately support the financial needs of sanitation workers, partly due to limited understanding of their challenges [27]. The negative impact of financial strain on productivity is especially significant for workers who are already financially constrained, suggesting that alleviating financial stress can have the greatest benefits for the most vulnerable [28]. Extra workload is sometimes compensated with money or leave if accepted voluntarily, but compulsory additional duties are frequently uncompensated, exacerbating financial issues for sanitary workers. Public health research and regulatory

guidelines have not adequately addressed the welfare and financial concerns of sanitary workers [30]. Providing timely wage payments or cash infusions helps workers' pay off debts and buy essentials, which reduces financial stress and improves their work performance.

This study provides one of the first quantitative, institution-comparative assessments of occupational, ergonomic, safety-policy, and stigma-related challenges among sanitation workers in Lahore, using reliability testing and multivariable regression to identify key predictors of overall worker challenges.

Objectives:

To describe the socio-demographic characteristics of sanitation workers in Lahore;

To estimate the prevalence of ergonomic/working-condition challenges, occupational health risks, inadequate safety measures, and social stigma/financial difficulties; to examine correlations among these domains;

To identify independent predictors of overall challenges using multiple regression.

Null Hypothesis (H_0): There is no significant relationship between working conditions, ergonomic challenges, safety measures, social stigma, and occupational health risks among sanitation workers.

Alternative Hypothesis (H_1): Poor working conditions, ergonomic challenges, inadequate safety measures, and social stigma significantly contribute to increased occupational health risks and financial difficulties among sanitation workers in Lahore.

Methodology:

A quantitative, Cross-sectional descriptive research design to examine the working conditions, occupational health risks, safety measures, and social stigma & Financial issues faced by sanitary workers. This study was conducted in Lahore, Pakistan, and emphasizing on sanitary workers.

Study Population: The study population consisted of Sanitary workers of various organizations, such as Lahore Waste Management Company (LWMC) and the Cantonment Board.

Sampling Technique and Sample Size: The total population of the study was 211 sanitary workers selected as respondents by a simple random sampling method.

Data Collection: In this study, primary data collection methods were used.

Primary Data Collection: Using a structured questionnaire for data collection from sanitary workers.

Data Analysis: In the study, IBM SPSS was used for data analysis. The process included:

Descriptive Statistics: Frequency distribution, percentage, means, and standard deviation were computed to gather demographic information and key variables.

A correlation test is applied to assess the strength and direction of relationships between variables.

Reliability Test: This test is used to ensure the consistency and reliability of the measurement tools used in the study.

Regression was applied to examine the relationship between variables.

Ethical Considerations: All participants were informed of the study purpose, confidentiality precautions, and their rights, including the right to leave the study. Informed consent was obtained from all participants before data collection.

Flow of study:

Study design and data collection flow

Target population (LWMC + Cantonment Board sanitation workers)

Sampling frame and simple random sampling

Sample recruited (n = 211)

Structured questionnaire administration (primary data)

Data entry and cleaning

Statistical analysis in SPSS: descriptive stats → reliability (Cronbach's alpha) → correlation → regression

Interpretation and Reporting:

Rationale for analyses: Correlation analysis was used to quantify the strength and direction of associations between key continuous composite scores (working conditions and ergonomics challenges, occupational health risks, safety training and policy measures, and social stigma and financial issues). Multiple linear regression was then applied to estimate the independent contribution of each predictor to the outcome while adjusting for the other study constructs, thereby addressing potential confounding and identifying the most influential determinants of risk. These methods are appropriate for cross-sectional survey data when the objective is to examine relationships and relative effects among measured variables ($\alpha = 0.05$)

Table 1. Socio-Demographic characteristics of the respondents (working conditions or ergonomic challenges, occupational health risks, safety measures, and social stigma and financial issues faced by sanitation workers in Lahore)

Characteristics		Frequency	Percentage
Gender	Male	150	71.1
	Female	61	28.9
Age	15-30 years	63	29.9
	31-45 years	105	49.8
	46-60 years	42	19.9
	61 Above	1	.5
Education level	Primary	19	9.0
	Middle	61	28.9
	Matric	15	7.1
	No Education	116	55.0
What is your role?	Sweeping streets	151	71.6
	Lifting garbage manually	47	22.3
	Cleaning drains/sewers	6	2.8
	Driving a garbage vehicle	7	3.3
What is your Employment type?	Contract	188	89.1
	Permanent	23	10.9
How many years have you worked as a sanitation worker?	1 month - 5 years	77	36.5
	6-10 years	73	34.6
	11-15 years	8	3.8
	16- 20 years	11	5.2
	21-30 years	22	10.4
	Above 30 years	20	9.5
Average work hours per day?	12 hours	2	.9
	8 hours	205	97.2
	9 hours	4	1.9

Table 1. Shows demographic characteristics of respondents. Out of 211 respondents (sanitary workers), most of them 31-45 years age group (49.8%), 15-30 years age group (29.9%), and 46-60 years are 19.9% only few respondents (0.5%) are 61 years and above. The data indicate that a majority of the respondents were male (71.1%), while 28.9% were female. This shows a significant gender imbalance, with males forming more than two-thirds of the total participants. The data reveal that a majority (55.0%) of participants have no formal education, which indicates a high prevalence of illiteracy among the study population. About 28.9% of the respondents attained education up to the middle level, 9.0% completed primary

education, and only 7.1% reached the matriculation level. A large majority of participants 89.1% are employed on a contract basis, while only 10.9% hold permanent positions. Most (71.6%) of sanitary workers' job task is sweeping (151), (47) 22.3% lifting garbage, only a few (6) respondents 2.8% cleaning drains, and a few 7 driving garbage vehicles (3.3%). The majority of respondents, 36.5%, have 1 month to 5 years of experience, followed closely by 34.6% who have worked for 6 to 10 years. A smaller proportion 10.4% have 21 to 30 years of experience, while 9.5% reported working for more than 30 years. Only a few respondents have 11 to 15 years (3.8%) or 16 to 20 years (5.2%) of experience. The results show that the vast majority of respondents 97.2% work for 8 hours per day, which aligns with the standard full-time work schedule. A small proportion of workers 1.9% reported working for 9 hours daily, while only 0.9% indicated that they work for 12 hours a day.

Table 2. Perception of working conditions or ergonomic challenges, occupational health risks, safety measures, social stigma, and financial issues faced by sanitation workers in Lahore.)

Response		Frequency	Percentage
Do sanitary workers face Occupational health risks at their job?	Yes	179	84.8
	No	32	15.2
Do organizations have adequate safety measures, training, and preventive policies to protect workers from health hazards?	Yes	33	15.9
	No	178	84.4
Do sanitary workers face social stigma and financial difficulties due to the nature of their work?	Yes	121	57.3
	No	90	42.7
Working Conditions & Ergonomic Challenges faced by sanitary workers	Yes	172	81.5
	No	39	18.5

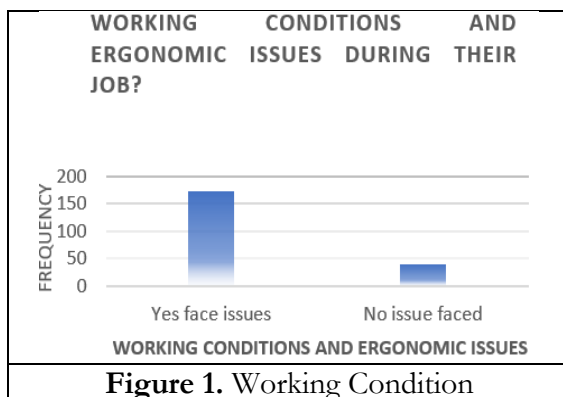


Figure 1. Working Condition

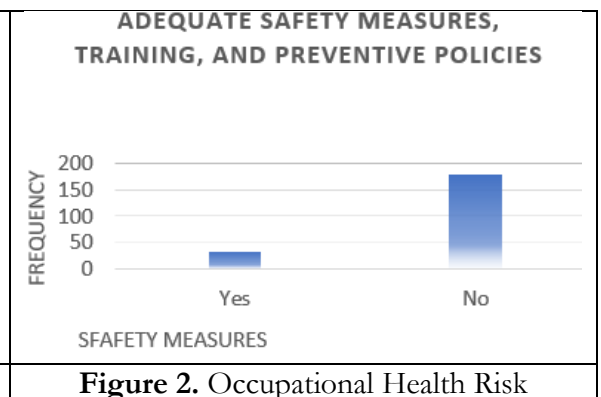


Figure 2. Occupational Health Risk

Figure 1: The data presented in the graph indicate that a significant majority of the respondents 81.5% reported facing issues related to working conditions and ergonomics challenges in their daily job activities. In contrast, only 18.5% stated that they do not encounter such problems. This finding highlights that poor working environments and inadequate ergonomics arrangements are prevalent among sanitation workers. The high percentages of respondents facing difficulties suggest that most workers are exposed to physically demanding tasks, uncomfortable postures, and unsafe or unhygienic working conditions. These challenges may contribute to musculoskeletal disorders, fatigue, and occupational health problems, underscoring the urgent need for improved workplace design, provision of appropriate tools, and implementation of ergonomics training programs to enhance worker wellbeing and efficiency.

In Figure 2 the results indicate that 84.8% of respondents acknowledged occupational health risks in the course of their work, while 15.2% reported not experiencing such risks. This

clearly demonstrates that occupational health hazards are a widespread issue among sanitary workers. The findings suggest that most workers are exposed to hazardous substances, biological waste, infections, and an unsafe working environment, which can lead to respiratory problems, skin infections, musculoskeletal disorders, and other health-related issues. The high proportions of affected workers highlight a critical gap in occupational safety standards and the urgent need for effective preventive and protective measures. Regular health checkups, safety training, and the provision of personal protective equipment can play a vital role in minimizing these health risks and ensuring a safer working environment for sanitation workers.



Figure 3. Safety Measures

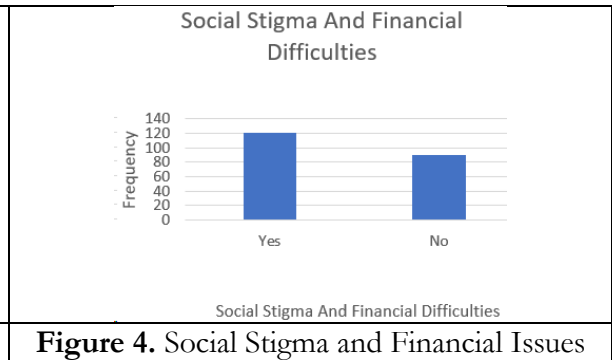


Figure 4. Social Stigma and Financial Issues

Figure 3: The data shows that an overwhelming majority of respondent 84.8% stated that their organization does not have adequate safety measures, training programs, or preventive policies to safeguard workers from occupational health hazards. Only 15.2% of the respondents reported the presence of such provisions. This finding underscores a serious deficiency in institutional safety management and reflects the lack of organizational commitment towards worker protection and health promotion. The absence of structured safety training, proper equipment, and preventive strategies leaves sanitation workers highly vulnerable to workplace accidents, infections, and long-term health issues. The results emphasize the urgent need for policy-level interventions and organizational reforms to ensure the implementation of comprehensive health and safety programs, including regular training sessions, provision of PPEs, and monitoring of compliance with occupational health standards.

Figure 4. The results indicate that 57.3% of respondents experience social stigma and financial difficulties due to the nature of their work, whereas 42.7% reported that they do not face such challenges. This shows that more than half of the sanitation workers encounter social discrimination, marginalization, and economic instability linked to their profession. The prevalence of stigma suggests that sanitation work is still viewed as a socially devalued occupation, leading to psychological stress, low esteem and limited inclusion among workers. Additionally, financial hardships further exacerbate their vulnerability, as many receive low wages and lack access to stable employment benefits. These findings highlight the need for public awareness campaigns, social inclusion programs, and fair wage policies to improve the dignity, livelihood, and overall well-being of sanitation workers in Pakistan.

Table 1. Correlation Matrix of challenges faced by sanitation workers in Lahore

Variables	1	2	3	4
Do sanitary workers face social stigma and financial difficulties due to the nature of their work?	.393**	--		
Organization has adequate safety measures, training, and preventive policies to protect workers from health hazards?	0.074	-0.088	--	
Occupational Health Risks faced by sanitary workers	.654**	.143*	-0.041	--

Working Conditions & Ergonomic Challenges faced by sanitary workers	.534**	.157*	-.138*	.207**
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The results show that a moderate positive correlation was seen between social stigma and financial difficulties and occupational health risks ($r=.654$, $p<.01$). So, it suggests that sanitary workers who experience greater social stigma and economic difficulties have a high risk of facing occupational health risks while performing their work activities. Similarly, social stigma and financial difficulties also correlate moderately with working conditions and ergonomic challenges ($r=.534$, $p<.01$), suggesting that poor workplace conditions intensify the psychological pressure faced by sanitary workers.

In addition, findings also show that a weak but significantly positive correlation exists between organizational safety measures and occupational health risks ($r=.143$, $p<0.05$), and that implicit safety policy is not properly implemented. Similarly, organizational safety measures show a weak positive correlation with working conditions and ergonomic challenges ($r=.157$, $p<.05$).

There is a small negative correlation have seen between working conditions and safety policies ($r=-.138$, $p<.05$) highlight that a lack of safety precautions may lead to poor working conditions. Lastly, occupational health risks and working conditions show a weakly significant positive correlation ($r=.207$, $p<.01$), which means a poor working environment raises health risk levels.

Table 2. Reliability Analysis of Study Variables (challenges faced by sanitary workers)

Construct	Items (N)	Cronbach's Alpha (α)
Working Conditions & Ergonomic Challenges	5	0.743
Occupational Health Risks	4	0.753
Safety Measures	4	0.759
Social Stigma and Financial Issues	4	0.750
Challenges Faced by Sanitary Workers	2	0.748

The reliability analysis was conducted to assess the internal consistency of the study constructs related to the challenges faced by sanitary workers. Cronbach's Alpha values for all variables met the recommended threshold of 0.70 or above, indicating that the scales used in this study were reliable and suitable for further statistical analysis. The construct working condition and ergonomics challenges demonstrated an acceptable reliability score of $\alpha = .743$, which reflects the consistent measurement across its five items. Similarly, the construct occupational health risks showed a reliability coefficient of $\alpha = .753$, which shows satisfactory internal consistency. The four items measuring safety measures also yielded a reliable alpha value of $.759$ suggests that the scale appropriately captures how sanitary workers perceive the availability and adequacy of safety provision.

The construct of social stigma and financial issues reported a Cronbach's Alpha of $.750$, which confirms that the items coherently represent the social and financial challenges associated with sanitation work. Lastly, the overarching variable challenges faced by sanitary workers, comprising two items, demonstrated a reliability score of $\alpha = .748$, which is acceptable for constructs with fewer items.

Table 3: Regression Analysis of challenges faced by sanitary workers

Variables	Unstandardized Beta Coefficient β	Std. Error	Standardized Beta Coefficient β	t	p-value
Constant	-.613	.147		-4.171	.000
Working Conditions & Ergonomics	.375	.040	.401	9.459	.000
Occupational Health Risks Faced by Sanitary Workers	.571	.043	.564	13.267	.000

Safety Measures	.035	.011	.137	3.263	.001
Social Stigma and Financial Issues	.073	.014	.219	5.196	.000

The regression analysis was conducted to examine the impact of working conditions and ergonomics challenges, occupational health risks, safety measures, social stigma, and financial issues on the overall challenges faced by sanitary workers. The standardized beta coefficient is 0.401 ($p < 0.001$), which indicates a strong positive relationship with challenges faced by workers. This means that poorer working conditions and ergonomic issues significantly increase the challenges experienced by sanitation workers. This variable has the highest beta value of 0.564 ($p < 0.001$), suggesting that it is the most influential predictor of challenges. Workers exposed to health risks are considerably more likely to face difficulties in their work. With a beta of 0.137 ($p = 0.001$), safety measures also positively influence challenges. Interestingly, even the presence of some safety measures is associated with reporting challenges, which may reflect inadequate or partial implementation. The standardized beta is 0.219 ($p < 0.001$), which indicates that social and financial pressures significantly contribute to the challenges workers face.

Discussion:

One of the main causes of occupational stress in sanitation work is still ergonomic design. The majority of respondents acknowledged being exposed to dangerous working conditions, and occupational health risks were found to be a major concern. Infectious diseases, respiratory disorders, skin disorders, and work-related injuries are all made more likely by the frequent exposure of sanitation workers to biological waste, contaminated materials, sharp objects, and chemical residues.

Due in large part to prolonged exposure to hazardous environments, global syntheses of evidence show that sanitation workers consistently have worse health outcomes than the general working population [31]. High rates of occupational illness and injury among sanitation workers are also documented in recent studies from Pakistan, especially in the absence of effective preventive health measures. [32]. This study's findings about the correlation between poor working conditions and occupational health risk emphasize the combined impact of physical and environmental risks.

The results also show serious shortcomings in organizational safety protocols. The vast majority of respondents stated that their employers did not consistently provide personal protective equipment, preventive policies, and sufficient safety training. Recent studies from Punjab and other parts of Pakistan have shown similar institutional gaps, with sanitation workers reporting poor enforcement of occupational health regulations and a lack of safety orientation. Research from comparable low- and middle-income countries indicates that even in cases where safety frameworks are in place, their efficacy is compromised by inadequate oversight and poor execution. Therefore, partial or ineffective safety practices, rather than significant risk reduction, may be the cause of the weak statistical relationship between safety measures and decreased occupational risks found in the study.

Two major non-physical issues that sanitation workers face are social stigma and financial instability. Due to the nature of their jobs, over half of the respondents said they had experienced economic hardship and social discrimination. Many people considered sanitation work to be socially undesirable, which frequently leads to social exclusion, a lower social standing, and psychological distress. Recent research from Lahore sanitation workers, especially those from minority communities, are excluded from public areas and social interactions, which reinforces occupational marginalization. [8]. According to more extensive sociological research, the stigma attached to cleaning and sanitation jobs combines with job insecurity to exacerbate psychological stress and financial instability [2]. Psychosocial stressors may indirectly worsen health outcomes by raising stress levels and restricting access to coping

resources, according to the positive correlation found between stigma, financial hardship, and occupational health risks.

Efficacy of results in the real world:

Rather than only describing frequencies, these findings point to criminal occupational-health priorities. High ergonomic strain and regular injury symptoms imply a need for mechanized tools, task revolution, and supervisor-enforced safe-lifting practices, because repetitive manual handling is a preventable driver of musculoskeletal disorders. Relations between inadequate safety training/PPE and higher risk scores suggest that routine induction, refresher training, and consistent PPE supply chains can reduce revelation in the short term. Social stigma and financial insecurity can also worsen health outcomes by discouraging reporting, limiting healthcare seeking, and reinforcing unsafe informal work arrangements; therefore, municipal policy should combine workplace safety regulation with anti-discrimination messaging and employment protections. Overall, the results support integrating sanitation workers into formal occupational health services (screening, vaccination, and compensation) and strengthening compliance monitoring through city-level OHS audits.

In conclusion, the findings demonstrate the critical need for a comprehensive and long-term strategy to enhance the occupational health of Pakistani sanitation workers. Improving health outcomes and occupational dignity requires addressing ergonomic risks, bolstering institutional safety measures, guaranteeing job stability, and lowering social stigma. Sanitation workers will continue to face avoidable risks and systemic marginalization in the absence of coordinated policy enforcement and organizational commitment, undermining more general public health and social equity goals.

Conclusion:

This study concludes that sanitation workers in Lahore face severe occupational health risks, ergonomics challenges, and social stigmatization, compounded by poor working conditions and institutional neglect. The regression results confirmed that occupational hazards and ergonomic difficulties are the most influential predictors of overall challenges, followed by social and financial pressures.

The study underscores the pressing need for a sustainable policy framework that ensures occupational safety, social inclusion, and ergonomic stability for sanitation workers. Improving their working conditions is not merely a labor issue but a public health imperative aligned with Sustainable Development Goals (SDGs 3,6 and 8).

Recommendations:

Implementation of comprehensive occupational safety policies: Municipal and provincial governments should establish enforceable occupational safety regulations specifically for sanitation workers.

Ergonomic and health training: Conduct periodic workshops on safe lifting, posture correction, and preventive health practices.

Provision of personal protective equipment: Regular and adequate distribution of gloves, masks, boots, and uniforms should be mandatory.

Health surveillance and insurance coverage: Introduce medical screening programs, vaccination drives, and affordable health insurance plans.

Job formalization and security: Gradually transition contract workers to permanent positions, with fair wages and social benefits.

Reducing social stigma: Launch awareness campaigns that recognize sanitation workers as essential public health professionals.

Policy integration and collaboration: Encourage partnerships among government agencies, NGOs, and international organizations like the WHO and the ILO.

Sustainable waste management systems: Promote mechanization and improved waste-handling technologies to reduce manual exposure.

Limitation and Future Directions:

Although this study provides significant insights, it is limited to one city (Lahore), restricting the generalizability of findings to other regions. Future research should include comparative studies across provinces to develop a broader national understanding.

Secondly, data were self-reported, which may include response bias. Future studies could use mixed-method designs combining surveys, interviews, and field observations for deeper insights.

Thirdly, the study didn't explore longitudinal effects or mental health dimensions; future research should examine psychological stress, coping mechanisms, and long-term effects of occupational exposure.

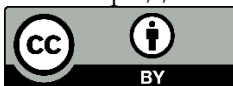
Lastly, due to time constraints, policy enforcement and institutional accountability were not assessed in depth. Future work should evaluate the implementation and effectiveness of existing safety laws and reforms.

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