

PREVALENCE OF HEPATITIS C INFECTION AMONG MUNICIPAL WASTE COLLECTORS IN FAISALABAD, PAKISTAN 2025

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Abstract

The problem of hepatitis C virus (HCV) infection deserves great attention not only to every section of the society but also to the susceptible population of the occupation type. Garbage collectors must cope with such harmful substances getting into their body without any protective mask or dressing which puts them at a risk of being infected with blood and other diseases including HCV. This study was intended to determine the prevalence of the Hepatitis C infection among the municipal workers working as waste collectors in Faisalabad town of Pakistan and establish the risk factors that lead to the infection. One municipality office was used in each of the two cities of Faisalabad in 2025 and a cross-sectional survey developed. The study involved two hundred providers of wastes serving municipal areas. A series of structured questionnaires was applied to determine the demographic (age, sex, level of education), occupational (duration of waste handling, the use of personal protective equipment) and health-related (family history of hepatitis C, the frequency of outdoors activities) data. Serological evidence of HCV status was demonstrated. The statistical analysis was performed with the use of SPSS (last version) and the chi-square tests helped to decide the statistically significant associations. Among the 200 respondents who took the survey of this case, the results showed that 18.8 percent of the respondents were found to have tested positive of Hepatitis C and the rest 81.2 were negative. It was determined that the age bracket 35-44 years was associated with the level of HCV infection ($p < 0.05$). No less interesting is that occupational exposure was just one of the risk factors because half of participants who tested positive in HCV population reported frequent contacts with medical waste and no use of gloves which also signifies the occupational exposure. In this study, a serious rate of HCV infection is observed among the people collecting garbage at the place referred to as Faisalabad. It has been found that there is slight variation between the prevalence rates in the workers at the municipal settings and the population and it is most likely because of the deficient training and enhancement of PPE use by the waste collectors that is still a threat of unconscious spread. The above information raises an alarm of caution since it implies that prevention policies are effective in order to secure the health of this group of people who are most likely to fall sick owing to the working space.

INTRODUCTION

Hepatitis C virus (HCV) is an international health-care burden with a role in acute and chronic liver illness, such as cirrhosis and hepatocellular carcinoma. It is a positive-sense, single-stranded RNA virus with an enveloped virus and is a single genus *Hepacivirus* of the family *Flaviviridae*, of which may cause severe systemic inflammation in humans (Kercher *et al.*, 2021; Latanova *et al.*, 2022). Worldwide, it is estimated that at any given time, there must be around 58 million individuals living with chronic HCV and about 1.5 million new cases reported annually whereby almost 290,000 individuals perish annually due to complications caused by HCV (Odebisi-Omokanye *et al.*, 2024) (Stroffolini & Stroffolini, 2024). The innovations in the treatment plans, especially the introduction of direct-acting antiviral agents (DAAs), have radically changed therapeutic results. DAA compared to the previously used treatment strategies like pegylated interferon and ribavirin exhibit greater efficacy, fewer side effects, and shorter treatment periods (Lee *et al.*, 2021) (Aboras *et al.*, 2022).

Nonetheless, HCV is a large public health problem in low- and middle-income nations where access to diagnostic and therapeutic centers demonstrates low levels. Pakistan has the second-highest burden of HCV in the world and therefore it is a center of focus in the elimination program (Qureshi *et al.*, 2024). At a national level, the National Hepatitis Strategic Framework (NHSF) 2017-2021 and the Prime Ministers Hepatitis Program have been trying to match local policies with the WHO global hepatitis elimination goals, and provide universal screening and treatment efforts (Zaman *et al.*, 2022) (Qureshi & Arif, 2024).

Parenteral exposure to contaminated blood is considered one of the major modes of infections by HCV. Unsafe blood transfusions, using dirty needles, poor sterilization of medical equipment should be eliminated as well as vertical mother-child transmission that has been indicated in Fig.1. Another risk that is also quite documented is the risk of occupational contamination especially to patients who routinely deal with the biomedical or the municipal wastes and who might, without their knowledge, be exposed to contaminated sharp scalpels

and so on (Farshadpour *et al.*, 2021). Waste handlers particularly the unprotected or less trained ones are prone to be infected since they handle improperly disposed syringes, blades and other sharp waste materials regularly (Ram *et al.*, 2023).

It has been found that the main elements of enhancing the prevalence of HCV among municipal waste collectors are gap in knowledge and low occupational safety measures. Research has shown that job-related blood exposure poses an especial problem to janitorial and waste collection workers, most of whom remain poorly informed about the hazards of bloodborne infection and the preventatives that include gloves, puncture-proof containers or formal infection control practices (Kakodkar *et al.*, 2025). Additionally, low-skill level requirements typical of janitorial work in the developing countries serve to further reduce the availability of health education, protective equipment, and post-exposure prophylaxis, hence raising the exposure to infection (Tsovili *et al.*, 2014).

The number of municipal wastes to be produced worldwide is expected to surge and it has been estimated that an average individual urban citizen is likely to generate about 500kg of municipal waste every year. Out of this, much goes through recycling, which can be a risk to health when recyclable trash contains dirty sharps or biohazards waste (Madsen *et al.*, 2021). In this connection, municipal waste collectors carry a vital but neglected group of people who participate in public health studies. The evidence presented in Pakistan has a troubling tendency: the prevalence of HCV among waste collectors in the municipality is 3.3 percent, whereas 5 percent of the entire country does. But when the stratification is made along behavioral and occupational lines, we find deeper dangers. As an example, without the use of gloves, prevalence reaches 8 percent in workers who do not wear continuous protection gears in contrast to 2 percent in the case of those workers who always use protective gears (Zaman *et al.*, 2022).

Marital status, education level, and health literacy also are also contributing factors to the infection with married workers displaying a disproportionately larger degree of HCV positivity than unmarried members. Socioeconomic disadvantages together with poor

institutional support exacerbate occupational health risk among the janitorial personnel. The job of janitor has been underrated and received little formal training and little consideration to the public health safety practices (Ibelli-Bianco *et al.*, 2022). The targeted health-education, adequate disposal protocols, and the obligatory requirement of personal protective equipment (PPE) are urgently required interventions. To help combat the transmission, the World Health Organization has proposed the application of PPE and occupational health training, which is barely being followed in most developing parts of the world, including Pakistan (Warssamo, 2025).

It is in this light that it will be important to examine the magnitude of HCV infection among municipal waste collectors in Pakistan especially in high density urban centers like Faisalabad. Determining the most prominent risk factors among them, as well as their prevalence, will provide an idea of the dynamics of spreading HCV in the occupational setting and help design specific interventions to prevent the spread of the infection in this population group.

MATERIAL AND METHODS

2.1. Study Design and Area

In this cross-sectional study we estimated the prevalence of infection caused by Hepatitis C virus (HCV) among the municipal waste collectors in Faisalabad, Pakistan. During the data collection process, various field locations were used as viz. Canal Road and Khurrianwala Chowk because in these areas the municipal workers would be approached directly during their working hours. Also, liaisons with the Municipal Office of Faisalabad were a way through which target participants could be reached in specific zones.

2.2 Data Collection Tools and Procedure

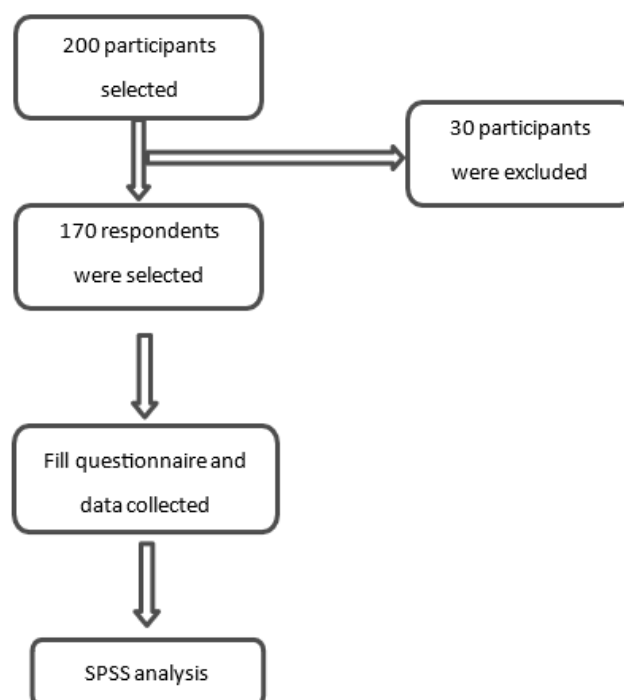
It has carried out the research within a duration of six months after getting approval of the research overview. Participants were recruited using simple random sampling technique. It was based on the eligibility criteria that 200 municipal waste collectors

were questioned initially, but data on 170 respondents went into the final data analysis, leaving 30 respondents out of the loop. The inclusion criteria involved municipal waste collectors who were aged 18 years or more, regardless of gender, actively involved in collection and transportation of wastes in Faisalabad, and who had no record of Hepatitis C vaccination, sets of medication on other diseases in the past. The exclusion criteria included anyone under the age of 18 years, expectant mothers, people with comorbidity, people who had recently been vaccinated against Hepatitis C, and non-municipal employees.

The information was gathered using a predesigned questionnaire that was designed with this study. The questionnaire was given both in hardcopy and soft copy format, with one section doing it via Google Form where users would be comfortable giving an online opinion. The questionnaire contained several sections, with the socio-demographic data, occupational practices, and awareness of the risks of contracting Hepatitis C included in them. Before the data were collected, a written informed consent was given to the participants, where the objective of the project, data confidentiality and voluntary nature of participation was explained. The Placement Bureau of The University of Faisalabad provided ethical clearance of the study.

2.3. Data analysis

A total of 170 eligible responses were processed and analyzed using the latest version of the Statistical Package for the Social Sciences (SPSS). Data were entered into SPSS software, and descriptive statistics were used to summarize demographic characteristics and prevalence rates. Results were presented in the form of tables and graphs to illustrate key findings. Differences in proportions were evaluated by Chi-square $PV < 0.05$ was considered to be statically significant. The odds ratio was used to measure the association's strength. The entire process adhered to ethical research standards, ensuring the privacy and anonymity of participants throughout the study as shown in Fig 1.

Figure 1. Flowchart of the study participants

RESULTS

There were 170 participants that were ready to be analyzed. Statistical analysis was carried out using SPSS (Statistical Package of the social sciences) the latest version and the results in the form of

descriptive and inferential statistics have been provided in order to reveal not only an overall prevalence of HCV but also its correlation with all the other demographical and occupational risk factors.

3.1. Work Area Wise Distribution of Waste Collectors

Table 1. Work Area Wise Distribution of Waste Collectors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Office	50	29.4	29.4	29.4
	canal road	70	41.2	41.2	70.6
	Khurrianwala Chowk	50	29.4	29.4	100.0
	Total	170	100.0	100.0	

The volume of frequency distribution of municipal wastes collector who were surveyed in three field areas in Faisalabad. The study involved 170 participants. Of them, the largest percentage (41.2%) of them were surveyed in Canal Road, representing 70 persons. The two sample sites consisted of the same number of respondents, that is, 50 respondents per site representing 29.4 percent of the overall respondents

at each of the sites. The cumulative percentage reveals that when the data of Canal Road and Office are included the cumulative percentage increased to 70.6 percent of the participants and the cumulative percentage rose to 100 percent after the addition of Khurrianwala Chowk. This allocation shows that most the data collecting was centered at Canal Road with other two points fairly represented as shown in table 1.

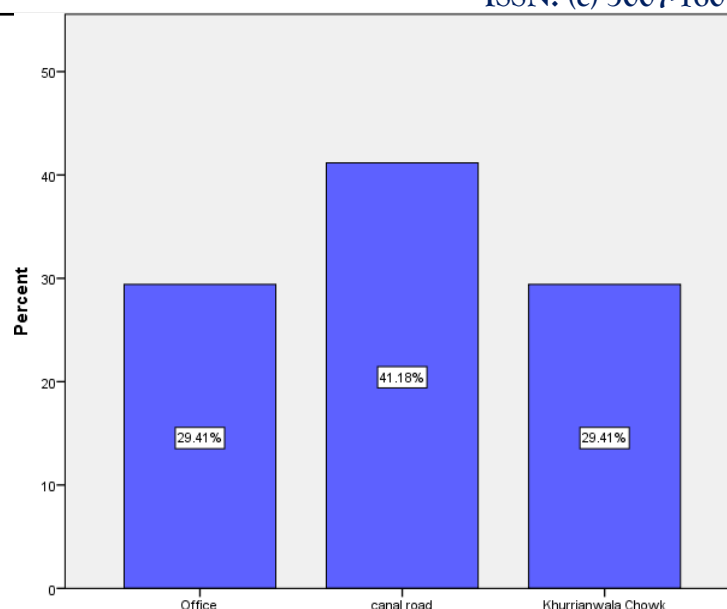


Figure 2. Bar chart of work area wise distribution of waste collectors

The bar graph indicates that out of the total number of participants of study, 41.18, 29.41 and 29.41 percent participants were recruited in Canal Road,

Office and Khurrianwala Chowk respectively. The Canal Road had the majority of participants as it was the highest proportion in the sample as shown in Fig 2.

3.2. Rate of HCV infection among waste collectors:

Table 2. Rate of HCV infection among waste collectors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	32	18.8	18.8	18.8
	NO	138	81.2	81.2	100.0
	Total	170	100.0	100.0	

Among 170 municipal waste collectors interviewed 32 (18.8%) of them were found to be infected with Hepatitis C and the other 138 people (81.2%) did not show any report of this disease. It shows that about 1 in every 5 of these workers was infected by the virus. The cumulative percentage will verify that the

participants have been all accounted, and the percentage of answers was 100. The findings are an indication of a significant rate of Hepatitis C among the participants of the study and this implies that there is an occupational health risk among them that needs to be addressed further and prevented as shown in table 2.

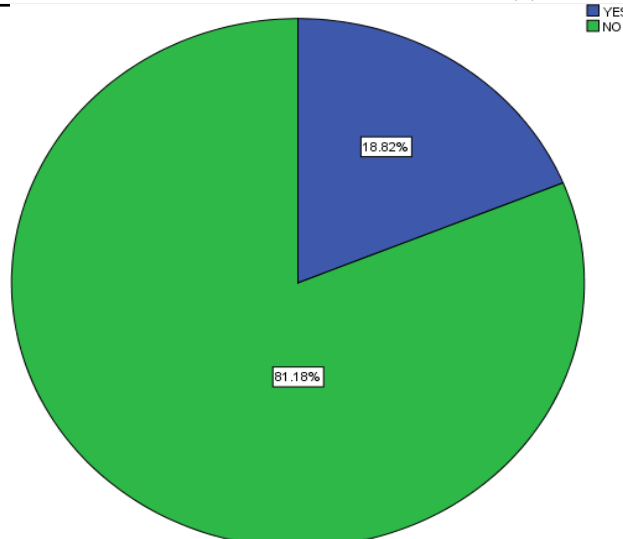


Figure 2: Pie chart of Rate of HCV infection among waste collectors

The Prevalence of Hepatitis C infection in municipal waste workers in Faisalabad-Pakistan (2025). Of the whole participants, 18.82 percent were positive of

Hepatitis C (YES) and 81.18 percent were negative (NO) which means that most workers were not infected, but a good number of them were infected as shown in Fig 2.

3.3. Type of Waste Managed by Municipal Workers:

Table 3. Type of Waste Managed by Municipal Workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Healthcare	84	49.4	49.4	49.4
	Household	65	38.2	38.2	87.6
	Industrial	21	12.4	12.4	100.0
	Total	170	100.0	100.0	

Among the 170 respondents of the municipal waste collectors, 84 (49.4%) people revealed that healthcare waste was the most frequently collected type of wastes handled by the respondents. The second most commonly managed was the house hold waste which 65 participants (38.2%) reported the dealing of, whereas the number of workers dealing with the industrial waste was 21(12.4%). The cumulative percentage ascertains that 87.6 percent of participants

were working either in the field of healthcare or household waste management, whereas the other, 12.4 percent were connecting to the industrial waste management. The results indicate that almost half of all the workers are at risk of being exposed to potentially dangerous healthcare wastes, so it is essential to take the required protective measures and health monitoring of the occupational population as shown in table 3.

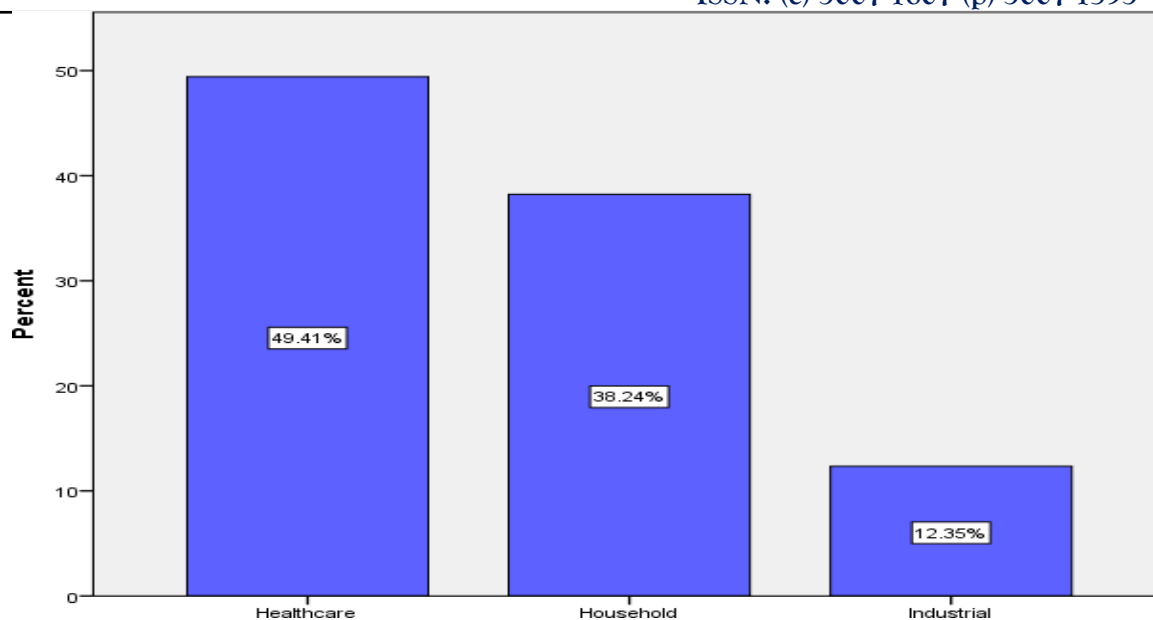


Figure 4. Type of Waste Managed by Municipal Workers

Proportion of wastes received by the municipal waste carriers in Faisalabad, Pakistan (2025). It is indicated on the chart that 49.41 percent of the participants worked with healthcare waste, 38.24 percent with household waste and only 12.35 percent with

industrial waste. Most workers were exposed to healthcare waste and domestic waste meaning that there is a possibility of occupational health risk especially brought about by biomedical waste as shown in Fig 4.

3.4. Association of HCV infection with working area:

Table 4. Association of HCV infection with working area

		Diagnosis of Hepatitis C infection among municipal waste collector workers		Total
		YES	NO	
Working area of participants	Office	8	42	50
	canal road	12	58	70
	Khurrianwala Chowk	12	38	50
Total		32	138	170

Prevalence of the Hepatitis C infection in Faisalabad employees collecting municipal waste on the basis of the area of work. Nearly one in five have tested positive to Hepatitis C; 32 out of the 170 tested positive. Of the number of individuals working in the office area, 8 out of the 50 people (16%) were positive. Among the Canal Road group, 12 out of 70 workers (17.1%) gave positive and in Khurrianwala Chowk 12

out of 50 workers (24 percent) gave positive results. Though the area of the Canal Road had the largest number of participants, the most affecting infection rate was experienced closest to Khurrianwala Chowk. Such results recommend the probable difference in the risk of exposure across the areas of work, indicating the demand toward the area-specific health and safety intervention as shown in table 4.

Table 5. Chi square of HCV infection with working area

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.267 ^a	2	.531
Likelihood Ratio	1.227	2	.541
Linear-by-Linear Association	1.041	1	.308
N of Valid Cases	170		

Test of independence based on Chi-square was used to test associations between the working area of municipal waste collectors and prevalence of the Hepatitis C infection. The outcome revealed that the two variables were not statistically significant in a relationship as the Pearson Chi-Square value was 1.267 with two degrees of freedom and a p-value = 0.531 ($p > 0.05$). In the same bleeding, Likelihood

Ratio had a value of 1.227 and a p-value of 0.541 to support the same conclusion of no statistical significance. The linear-by-linear association was not significant too ($G^2 = 1.041$, $df = 1$, $p = 0.308$). Such findings indicate that the working location (Office, Canal Road, or Khurrianwala Chowk) cannot be considered a significant influence on the probability of the state of Hepatitis C infection in the waste collectors in this research as shown in table 5.

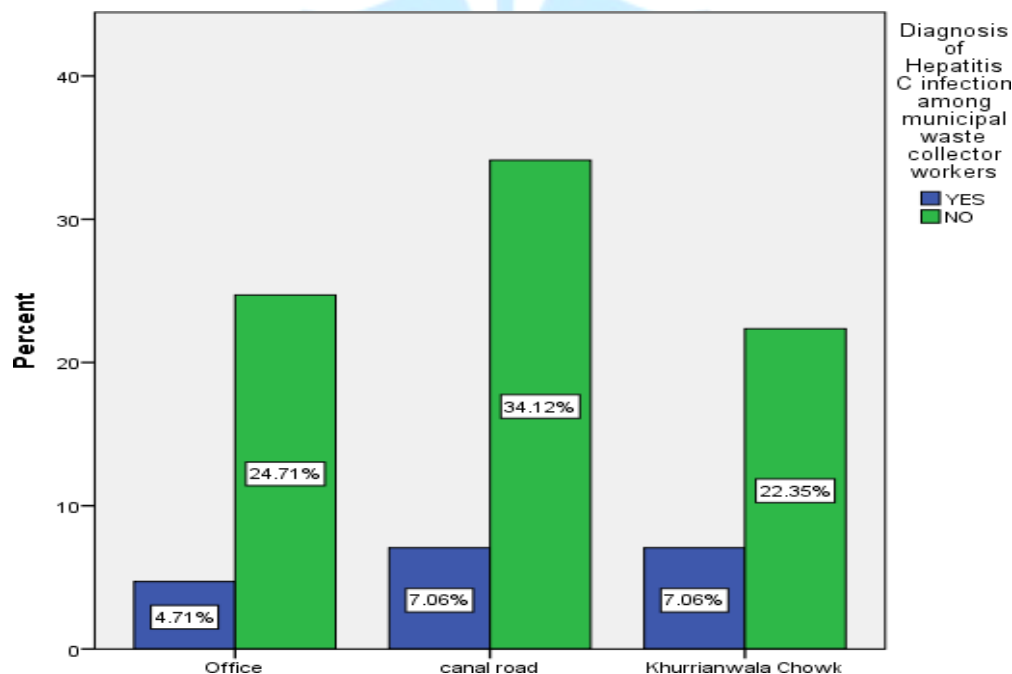


Figure 5. Bar chart of association of HCV infection with working area

The proportion of spread of Hepatitis C infection into municipal waste collectors of the working areas in Faisalabad, Pakistan (2025). With reference to the chart, the positive tests in the Office area comprised 4.71 percent and negative 24.71 percent; positive in the Canal Road area 7.06 percent and negative 34.12

percent; and positive in Khurrianwala Chowk area was 7.06 percent and negative 22.35 percent. Even though the Canal Road had tested the highest numbers of people, the highest percentage of positive cases was found in Khurrianwala Chowk. Yet, the correlation between working area and infection status was not decisive ($p > 0.05$) as shown in Fig 5.

3.5 Association of HCV infection with types of waste collected:

Table 6. Association of HCV infection with types of waste collected

		Diagnosis of Hepatitis C infection among municipal waste collector workers		Total
		YES	NO	
Types of waste participants collect	Healthcare	15	69	84
	Household	14	51	65
	Industrial	3	18	21
Total		32	138	170

Hepatitis C infection among the municipal waste collectors depending on the kind of waste they collect. In a study made on 170 participants, 84 of them were engaged in picking up healthcare waste of which 15 (17.9%) were found to be positive with respect to Hepatitis C. Out of 65 people collecting household waste 14 (21.5%) people were found to be positive as

opposed to only 3 (14.3) of the 21 people who participated in the industrial collection of waste being diagnosed with Hepatitis C. Even though the largest group of healthcare waste collectors had the largest number of positive cases (15), the highest number of infections was noted in individuals who were taking care of household waste as shown in table 6.

Table 7. Chi square of HCV infection with types of waste collected

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.648 ^a	2	.723
Likelihood Ratio	.658	2	.720
Linear-by-Linear Association	.002	1	.968
N of Valid Cases	170		

To analyze the correlation between type of waste collected and prevalence of Hepatitis C infection among the municipal waste collectors a Chi-square test of independence was carried out. It was ascertained that there was no significant correlation between the type of waste processed (health care, household, or industrial) and the condition of Hepatitis C. It can be confirmed by the Pearson Chi-Square of 0.648, 2 degrees of freedom and p value of

0.723 ($p > 0.05$). Likewise, Likelihood Ratio test too expressed a non-significance (Chi-square = 0.658, DF = 2, $p = 0.720$). There was also the Linear-by-Linear Association of 0.002 and a p-value of 0.968 which implies that there was no linear trend. Thus, it may be concluded that the kind of waste collected did not play an important role as to whether the sample (170 workers) would likely contract Hepatitis C as shown in table 7.

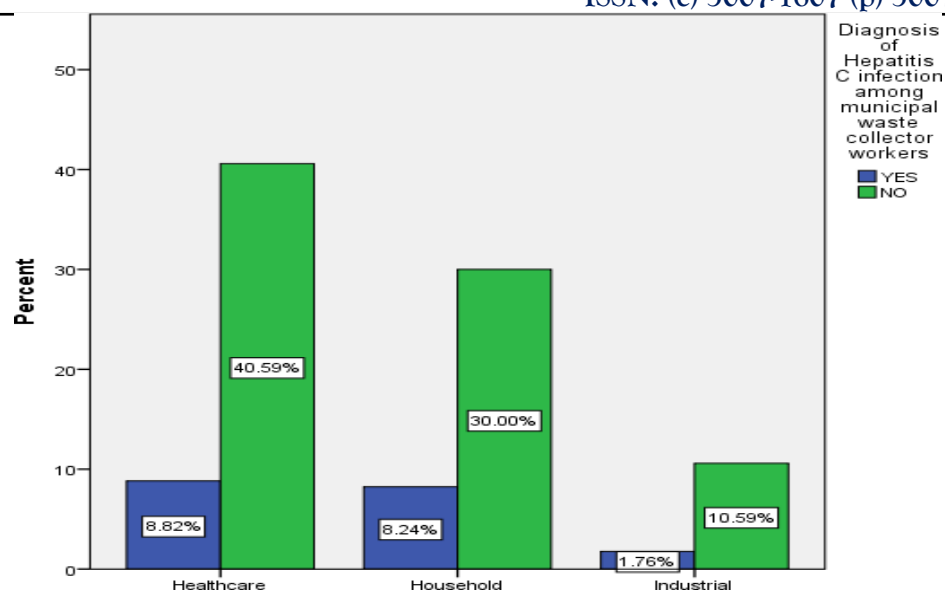


Figure 6. Bar chart of association of HCV infection with types of waste collected

The diagnosis of Hepatitis C infection in the workers of the municipal waste collectors according to the waste they collect healthcare, household and industrial. It is the comparison of the percentage of workers who tested positive ("YES") and who tested negative ("NO") of the infection. The most infection rate of Hepatitis C is among the workers who handle the healthcare waste at 8.82 per cent closely followed by those who handle household waste at 8.24 per cent. On the contrary, workers appear least infected with only 1.76 percent of the infected workers being exposed to industrial waste. Most of the workers in all categories gave a negative result in terms of Hepatitis C infection and the highest number was observed in the healthcare waste category of 40.59%. These results indicate that the Municipal workers on healthcare waste have higher chances of getting infected by Hepatitis C compared to those on household or industrial waste as shown in Fig 6.

DISCUSSION

Hepatitis C Virus (HCV) poses a serious health risk to the patients in Pakistan with occupational susceptible groups such as the waste collectors readily exposed to such contaminated materials. There was an evaluation of the presence of HCV, between municipal waste workers in Faisalabad and also the association of the level of infection with factors, like type of waste handled and working place.

In our study, the prevalence rate of HCV was overall 18.8 percent (18, 8), way above the rates of 3.3 percent (Zaman *et al.*, 2022) in a similar occupational group, taking place in Khyber Pakhtunkhwa, as well as of the general population of Pakistan, serious, which stands at 5 percent (Zaman *et al.*, 2022). Nevertheless, it is still smaller than the 21.6% rate of complications in solid waste workers in Egypt (Elkhateeb *et al.*, 2019). The above differences could be explained by the regional disparities in the waste management system, the availability of protective gear, and healthcare facilities.

There was great transaction between the collection type of waste and HCV prevalence. The rate of infection was much more prominent in workers who dealt with hospital and clinical waste such as syringes, gauze and blood-contaminated objects than among workers handling household and commercial garbage. This correlates with the international statistics that insufficient management of the biomedical waste poses a massive risk of getting infections through the blood (Ayele *et al.*, 2023). These results support the importance of stringent precautionary measures against the spread of contagion and the frequent deployment of personal protective equipment (PPE) toward collection and disposal.

The work area has also been to become a significant factor that predisposes infection. The collectors of waste who served areas close to healthcare and high

population urban areas had a high level of HCV, possibly because they were exposed to more intense hazardous waste and had lower compliance with the safety measures. The same trends were noticed in other research projects when central puritan areas were determined as risky spots because of uncontrolled dumping and poor municipal control (Zaman *et al.*, 2022).

Besides, area-wise distribution of work areas revealed that poorly developed and inconsistently structured municipal zones were associated with a larger concentration of workers who were positive with HCV. These results indicate the direct relationship between exposure risks and environmental and administrative factors. Strategic mapping of the high-risk sites, as conducted in this study, can assist the targeted interventions. Partially, our findings align with (Zaman *et al.*, 2022) according to whom the low level of education was also tied with the occurrence of HCV in a strong correlation, as the employees the least conscious of the hygiene and safety-related aspects present an increased risk of being infected. Although they found a little variation in the rates of infection by marital status and family history, our data had specifically narrowed down to occupational exposures and the geographical determinants.

The limitation of this study is that it was cross-sectional and no causal inferences could be made. On top of that, they included only male workers engaged in waste activity, as this occupation does not include any females in the area, which also is a cultural and social norm that is reported by (Zaman *et al.*, 2022).

CONCLUSION

This research showed that our null hypothesis is acceptable as there is no noticeable difference in the prevalence of Hepatitis C infection between the municipal waste collectors of Faisalabad, Pakistan, and general residents of Faisalabad. But Collection of waste by untrained municipal workers play crucial role in spreading Hepatitis C infection. The increasing incidence and prevalence of Hepatitis C infection emphasizes modern approaches to manage and to prevent the infection by using PPEs and giving proper training to municipal workers on how to collect waste.

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