



## Hepatitis C virus infection in garbage pickers of different districts of Khyber Pakhtunkhwa, Pakistan

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### ABSTRACT

Hepatitis C Virus (HCV) is a significant health problem worldwide, especially in developing countries. Medical municipal waste pickers are at higher risk of exposure to infectious viral diseases. The current study aimed to explore HCV infection in different waste collectors. The objective of the current study was to investigate the incidence of HCV infection and associated risks among the waste collectors of five districts of Malakand Divisions and Bajaur district (old Bajaur agency) Khyber Pakhtunkhwa, Pakistan. During the study period (May–December 2017), blood samples were collected from 300 waste handlers and tested for anti-HCV antibodies using the ICT method. The results obtained from the data were analyzed statistically using SPSS 20 version. In this study, we included 300 males aged 9 to 76 years, which means  $27.31 \pm 11.9$  years. The prevalence of HCV was 3.3% (10/300). Among the positive cases, HCV infection was slightly higher in married persons than in unmarried (3% vs. 0.33%,  $P < 0.01$ , odds ratio 4.73, 95% CI = 2.2–9.8). A high infection rate was reported in waste scavengers from the district Swat, followed by those in the Bajaur district. Needle prick injuries and barehanded practices were the significant risk factors for infected cases. Our findings highlight the need for personal protective equipment. It is suggested that all garbage collectors should be trained in handling waste to reduce infection.

### 1. Introduction

Hepatitis C Virus infection is one of the world's major health problems. The HCV causes liver inflammation and leads to acute and chronic hepatitis caused by the virus. Worldwide, an estimated 58 million people are infected with the HCV, with around 1.5 million new infections occurring yearly. According to the World Health Organization (WHO), almost 290,000 individuals died from HCV in 2019; most of them died from cirrhosis and hepatocellular carcinoma [1]. Antiviral drugs can cure more than 95% of hepatitis C patients, but access to diagnosis and therapy is limited, and currently, no vaccine is available to prevent hepatitis [2]. Pakistan has the second-highest prevalence of HCV infection [3]. Realizing the gravity of the situation, Pakistan's government released its first National Hepatitis Strategic Framework (NHSF) for the years 2017–21, which closely follows the WHO global health sector strategy on viral hepatitis while taking into account Pakistan's limited resources and disease burden [1]. HCV is transmitted mainly by parenteral exposure to infectious blood or blood-

containing bodily fluids. Injection drug use is one possible exposure (currently the most common mode of HCV transmission in the United States) [4]. Other sources of HCV transmission are HCV-infected mother breastfeeding and sexual contact with someone having the HCV infection, which increases the chance of transmission. Sharing razors or toothbrushes that have been contaminated with infected blood. HCV has also been reported in surgery patients, which can be transmitted to healthy individuals during surgery [5]. Invasive medical procedures, such as [1] injections, are another example (usually recognized in the context of outbreaks). Tattooing is unregulated [6]. Viruses transmit different sources, including blood and body fluids. Pakistan's government has announced the Prime Minister's Hepatitis Program, which aims to eradicate viral hepatitis B and C infections by 2030. Based on genetic differences between HCV isolates, it has been classified into six genotypes with several subtypes within each genotype, and the prevalence rate of these genotypes varies worldwide [7]. Genotype 3a is the predominant genotype in Pakistan and is sensitive to antiviral drugs [8]. As a result, these infected carriers can transmit

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this infection through direct or indirect contact with their blood and body fluid and contaminated medical equipment's [2]. The collection of waste by garbage collectors is a typical practice in many countries like Pakistan, which produces over 49.6 million tons of solid garbage annually, and this number is rising by more than 2.4% a year. According to the Pakistani government (GOP), 87,000 tons of solid trash are produced per week [9]. Medical and municipal waste handlers are predominantly susceptible to viral diseases because of contaminated waste materials. Municipal waste pickers are exposed to many occupational hazards [10].

Most scavengers are young; they have more chances of acquiring a risk of viral infections [11]. More than 35,000 garbage scavengers are in the country; the more significant are children and young people. These people collect garbage from bigger cities in Pakistan, like Karachi [12]. However, these people are poor and jobless, so they are involved in this business [12,13]. When collecting, transporting, and disposing of medical waste in healthcare facilities, medical waste handlers run a high risk of occupational exposure to blood and other bodily fluids contaminated with blood-borne viruses like HBV, HCV or HIV. The present study concerns that the incidence of hepatitis C among medical and non-medical waste (no collecting from hospital waste) collectors is rare in Pakistan. Our present study aimed to determine the incidence of HCV in medical and municipal waste buyers and collectors in Malakand Division and Bajaur Agency that may produce consciousness to protect from such infections.

## 2. Methodology

### 2.1. Study design and area

A cross-sectional study was conducted at the Department of Biotechnology and Microbiology (CBM) University of Swat (UOS), Pakistan, from May 2017 to December 2017. The study participants were recruited from districts of Malakand Division, including District Swat, district Dir, district Buner, District Malakand and District Bajaur, located in Khyber Pakhtunkhwa (KP) Province of Pakistan [14], and shows the areas and the person handling (collecting) wastes. The study sites have also been shown in Fig. 1.



Fig. 1. The map shows the main business centers of districts of Malakand Division and Bajour districts. These sampling sites are enclosed in red line.

### 2.2. Study subjects

A total of 450 waste collectors are calling for data and blood collection. One hundred and fifty participants were excluded from this study due to not meeting eligibility criteria or not being willing to take part in this study. Only three hundred (300) medical and municipal waste collectors were included in the study Fig. 2. Participation in this study was voluntary, and all people gave informed written consent. Participants with a previous history of HCV infection were excluded from the study. Those individuals identified as positive during the study were referred to the reference research centre for more diagnosis. The questionnaire obtained information on age, gender, marital status, education gender, age, marital status, and education level, previous history of infection, knowledge of HCV and their route transmission, and wearing gloves, boots, and masks for each individual. All subjects were informed about the purpose of this study.

### 2.3. Ethical approval

The study was conducted after obtaining ethical clearance from Ethical Research Committee (Ref. No. UoS/ORIC/2022/11). Information about the study was given to all waste handlers. The participants were assured about the confidentiality, protection and anonymity of data. Participation in the study was fully voluntary and informed written consent was obtained. All laboratory testing was free, and individuals positive for anti-HCV were informed. Furthermore, on-site verbal training was given to the participant on handling medical waste to protect itself from infection.

### 2.4. Blood sample collection and processing

After obtaining informed consent, 4 ml of venous blood was drawn under aseptic conditions from all persons selected for this study and immediately put in vacutainer tubes containing a suitable EDTA. These tubes were numbered and processed at the time of collection. All samples collected from these participants were transported to Laboratory using a cold box. The blood samples taken from the persons were centrifuged at 3000 rpm (RPM) for at least 5 min at room temperature. The plasma was separated and placed in Eppendorf tubes until the investigation.



Fig. 2. The figure shows the photos of waste medical waste collector during data collection for the current study.

### 2.5. Laboratory investigations

All the plasma samples were tested for anti-HCV antibodies using rapid diagnostic kits, which work in the rapid immuno-chromatography assay (ICT) manufactured by Abon Biopharma Hangzhou, China) reported anti-HCV antibody detection with 86% specificity and 100% sensitivity[16]. Anti-HCV antibodies were screened using the ICT technique. Samples positive for HCV were confirmed by the real-time PCR method and were considered positive. The persons positive for HCV were advised for treatment. Unused plasma samples were placed in Eppendorf tubes and stored at  $-20^{\circ}\text{C}$ .

### 2.6. Data analysis

Data were entered and employed using the SPSS software package (Version 20). Data were presented in the form of tables and graphs. Descriptive statistics were presented with a frequency table. Differences in proportions were evaluated by Chi-square and Fisher exact tests;  $PV < 0.05$  was considered to be statically significant. The odds ratio was used to measure the association's strength. The sampling method and data collection process were performed very carefully.

## 3. Results

### 3.1. Socio-demographic characteristics of waste pickers

Table 1 shows that all participants (100%) in our study were male (there was no female waste collector). In this study, all participants were

Table 1  
Risk factors associated with incidence of HCV infection in waste collectors.

Risk factor	HCV Positive/Total	%	OR (95% CI)	PV
<b>Family History of HCV Infection</b>				
Yes	7/37	18.9	20.22	<b>0.000</b>
No	3/263	1.14	(4.965–82.359)	
<b>Age group (year)</b>				
$\leq 40$	6/262	2.29	0.199(0.053–0.742)	<b>0.02</b>
$>40$	4/38	10.52		
<b>Use of gloves</b>				
Yes	8/287	2.78	0.158(0.030–0.832)	<b>0.058</b>
No	2/11	18.18		
<b>Sharps accidents (times)</b>				
$<5$	2/105	1.9	0.454(0.095–2.177)	<b>0.5</b>
$>5$	8/195	4.1		
<b>Blood transfusion</b>				
Yes	7/251	2.78	0.363(0.090–1.461)	<b>0.11</b>
No	3/39	2.56		
<b>Marital status</b>				
Married	9/191	4.71	4.6(0.583–37.347)	<b>0.08</b>
Single	1/99	1.0		
<b>Awareness</b>				
Yes	8/273	2.84	0.249(0.049–1.265)	<b>0.70</b>
No	2/17	10.52		

Table 2

Association of HCV infection with marital status of selected patients.

Group	HCV positive	HCV Negative	Total	Odds ratio	PV
Married	9(3%)	191(63.67%)	200	4.7	<b>0.001</b>
Unmarried	1(0.33%)	99(33%)	100	95% CI (2.2–9.8)	
Total	10(3.3)	290(96.67)	300		

males ages 9 to 76, with a mean of 27.31 years and a standard deviation of 11.903. Most (90%) of persons were shaving in barber shops, and (100%) had accidents or sharps injuries. Most HCV-positive patients (80%) showed no signs and symptoms of chronic hepatitis C.

### 3.2. The association of incidence of HCV infection in waste collectors with marital status

Table 2 shows that out of 300 individuals, 10 (3.3%) were positive for anti-HCV antibodies. In this study, 200 and 100 were married and unmarried, respectively. Positive anti-HCV antibodies were detected in 9 (3) married persons, and 1 (0.33%) HCV infection was investigated in unmarried persons. Out of 200 married people, 191 (63.67%) were uninfected, while in 100 unmarried people, one was infected, and 99 (33) were uninfected with HCV. In total HCV-positive cases, the infection rate was high in married persons than in unmarried (3 vs. 0.44%,  $PV < 0.01$ , odds ratio (OR) = 4.7, 95% = 2.2–9.8). (See Table 3.)

### 3.3. The rate of HCV infections in different districts of Malakand Division and Bajaur District

Fig. 3 shows the map of the Malakand division for the collection of data and blood samples. HCV infection rate was investigated in Malakand Division and Bajaur district (former Bajour Agency) [19]. The highest rate was shown in Swat at 1.33% (4/300), followed by Bajaur District at 1% (3/300), and the lowest rates were found in Buner, Malakand, and Dir at 0.33% (1/300). Each is shown in Fig. 3.

### 3.4. Rate of HCV infection in a patient with education

HCV infection was also investigated in garbage pickers with different education levels. The patients were divided into three groups (illiterate, primary, matric and above). The highest HCV-positive rate of infection was found in persons with primary 1.67% (5/300), followed by illiterate 1.33% (4/300), 0.33% (1/300) matric and above 1/24 (4.17%), and the lowest rate was observed in illiterate 4/187 (2.14%), as shown in Fig. 4.

### 3.5. Association of HCV infection and the age of garbage collector

Table 4 describes the association of HCV infection with the age of the two groups. Waste collectors with ages less than 40 years showed a high rate of 2.33% (7/300) of HCV infection compared with waste pickers of more than 40 years 1% (3/300). A significant difference was observed in the two groups (OR = 20, 95% 5.1–73,  $PV < 0001$ ).

### 3.6. The effect of family history of HCV infection and use of gloves HCV prevalence in waste pickers

Currently, we investigated 2.33% (7/300) HCV infection individuals and 10% (30/300) infection with a history of HCV infection. Similarly, a person

Table 3  
Association of HCV infection and the age of garbage collector.

Group	HCV positive	HCV Negative	Total	Odds ratio	PV
$<40$ year	7(2.33%)	30(10%)	200	20	<b>0.001</b>
$>40$ years	3(2.67%)	260(86.67%)	100	95% CI (5.1–73)	
Total	10	290	300		

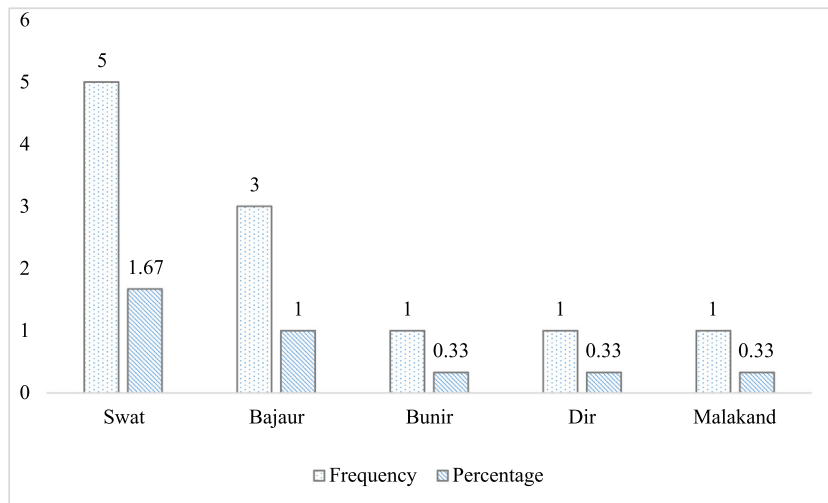


Fig. 3. District wise HCV infection rates in studied persons.

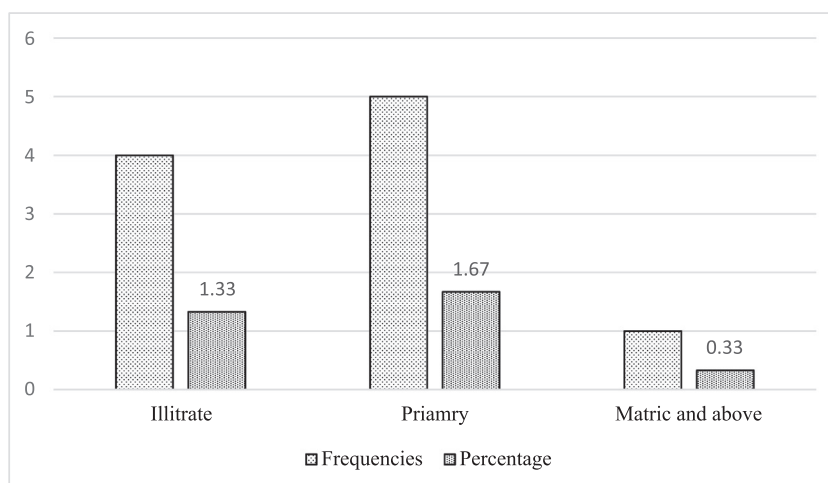


Fig. 4. Frequency of HCV infected patients at different levels of education.

with no history of HCV infection showed 1% (3/300) positive infection, and 86.67% (260/300) showed no infection. Similarly, persons with a family history of HCV infection also showed a significantly higher rate of HCV infection than those with no history  $PV = 0.000$ ,  $OR = 20$ , 5.1–73, as shown in Table 4. Waste pickers collecting waste material with bare hands showed 2.67% (8/300) than those who did not use gloves during collection 0.66% (2/300). A high rate of HCV infection was found in persons not using gloves for use materials from waste, but the difference was non-significant ( $PV = 0.064$ ,  $OR = 0.158$ (95% CI = 0.294–0.8183 as shown in Table 5.

#### 4. Discussion

Hepatitis C is an emerging viral infection that is a major health problem. HCV is responsible for liver diseases. The HCV prevalence rate (3.3%) in

**Table 4**  
Association between family history of chronic hepatitis C and HCV infection in waste scavengers.

Family history	HCV results		Odds ratio	P values
	Positive	Negative		
Yes	7(2.33%)	30(10%)	105	<b>0.000</b>
No	3(1%)	260(86.67%)	195	
<b>Total</b>	<b>10</b>	<b>290</b>	<b>300</b>	

our study is slightly lower than the current prevalence rate (5%) in the general population of Pakistan [1]. The rate is also lower than the HCV infection reported by other researchers on solid waste handlers [15]. Our results are not supported by a recently reported by researchers from Egypt in 2022 [10]; they reported 21.6% infection. In our present study, we found a high rate of HCV infection in young people ( $\leq 40$  years) than in aged persons, which is in agreement with Wanjari and other studies [10,15] stating that the majority of respondents are between 18 and 39 years. Also, another study from India published data from most young people [16].

Our study found a 2.33% positive HCV infection rate with a family history of HCV infection. A 1% HCV-positive infection was observed in collectors with a history of HCV infection. Our findings are not supported by a recent study conducted in Yemen [17], which reported a 5.66% positive

**Table 5**  
Association of HCV infection with the use protective gloves.

Category	HCV Results		Odds ratio	P values
	Positive	Negative		
Gloves use				<b>0.064</b>
Bare handed	8(2.67%)	279(93%)	287	
No	2(0.66%)	11(3.67%)	13	
<b>Total</b>	<b>10</b>	<b>290</b>	<b>300</b>	



infection with no history of hepatitis C. We have included only male waste collectors in our study because no females are involved in this business in study areas. The study conducted by Edrees and his colleagues does not agree with our study; they reported 5% HCV infection in males and no in females [17]. Our current research found a significantly different between HCV infections in married and single waste collectors. Our results are different from the results reported currently from Yemen. They present 5.41% HCV infection in Married and 4.35% in unmarried waste collectors [17].

Most waste collectors in this study were people with primary education (1.67%), followed by illiterate 1.33% and matric or above showed a 0.33% rate. Another study also reported a higher rate (38.8) of HCV infection in people with primary education than in other categories. Our results for other education categories do not agree with this study [16]. Other studies also reported a high rate of HCV in solid waste collectors having secondary education from India [15].

In this study, we collected blood samples and data from male waste pickers because there are no female handlers of such types of materials in rural areas of Khyber Pakhtunkhwa. Wajari and his group have found similar results in both males and females. However, the HCV infection rate was high (60%) in males than in females (40%).

## 5. Conclusion

The findings of our study support waste material collectors' susceptibility to HCV infection. The current study also concludes that individuals with a history of HCV infection have a high rate of HCV infection. It also suggests that married people are more likely than single people to have HCV infection. Furthermore, the study concludes that those who handle waste with bare hands are also at greater risk. For these persons, our study suggests appropriate training.

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## Declaration of Competing Interest

The authors have no conflicts of interest to declare for this study.

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