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Hepatitis C virus infection among waste handlers in Sidama, Ethiopia

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ABSTRACT

Background: *An inflammation of the liver caused by hepatitis C virus (HCV) is a hepatitis C infection. Globally, data on the distribution of infection due to waste handling are rare, and work-related exposure (waste collection, transportation, and disposal of medical waste) to waste may result in HCV infection. Adequate information on the rate of prevalence and risk factors correlated with HCV is necessary for effective prevention. Few studies were conducted on HCV infection among high-risk groups such as waste handlers in Sidama, Ethiopia. The aim of this study was to determine the prevalence of HCV and its correlated risk factors among waste handlers in Sidama, Ethiopia.*

Methods: *A quantitative cross-sectional study with simple random sampling was conducted from October 2021 to 30 July 2022 in different public hospitals of Sidama region of Ethiopia. Two hundred and eighty-two waste handlers were selected for the study, and 5 ml of venous blood were collected from all sampled waste handlers and centrifuged, and the serum was analyzed for hepatitis C surface antigen using the instant hepatitis C surface antigen kit. Socio-demographic and risk factors information of waste handlers were gathered by pretested and well-structured questionnaires. Chi-square and Fisher exact tests were used to determine the risk of correlation. Multivariate logistic regression was conducted using SPSS version 20 set at 95% CI. Any value at P-value < 0.05 was declared statistically significant.*

Results: *From a total of 282 participating waste handlers, 16 (5.7%) were infected with HCV. Educational status of waste handlers was the significant demographic variable that was associated with HCV (AOR = 0.055; 95% CI = 0.012–0.248; P = 0.000). In both bivariate and multivariate analysis, sharp injury (AOR = 3.186; 95% CI = 1.099–9.236; P = 0.033), abortion (AOR = 9.763; 95% CI = 2.559–37.24; P = 0.001), contact with jaundiced patient (AOR = 11.324; 95% CI = 3.868–33.153; P = 0.000), needle prick injury (AOR = 6.121; 95% CI = 2.169–17.277; P = 0.001) and unprotected sex (AOR = 15.488; 95% CI = 4.770–50.2; P = 0.000) were statistically significant risk factors associated with HCV reactivity.*

Conclusions: *The study revealed that there was a high prevalence of HCV infection among waste handlers in Sidama, Ethiopia. Needle prick and contact with jaundice patients were significant risk factors for HCV infection. Thus, our findings suggested the necessity of personal protective equipment, and infection prevention measures, such as environmental hygiene, trained staff, and organizing continued medical education programs, should be considered to reduce the risk of HCV infection among waste handlers in Sidama, Ethiopia.*

Keywords: *Hepatitis C virus, risk factors, waste handlers, prevalence, Sidama Ethiopia*

Introduction

Inflammation of the liver caused by hepatitis C virus is hepatitis C infection. Acute and chronic forms of hepatitis C, ranging from mild sickness to severe, long-term infections including liver cirrhosis and cancer, are caused by this virus.[1] It can be transmitted via prenatal infection, skin and mucous membrane infections caused by contaminated blood or body fluid, sexual contact, and injection drug abuse. Additionally, skin art, ear/nose piercing, sharp injuries, and abortion can be the cause of infection. Hepatitis C is not transmitted via maternal milk, food, water, or casual contact such as hugging, kissing, and sharing food or drink with an infected individual.[2]

3.2 million youngsters and children were estimated to be infected with the chronic forms of hepatitis C. As WHO estimated, in 2019, approximately 290,000 individuals died because of hepatitis C. Although antiviral medicine can heal more than 95% of individuals with hepatitis C, access to diagnosis and treatment is very low. Currently, there is no vaccine for hepatitis C.[3]

Hepatitis C virus is a world health problem. In occupational

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situations, waste handlers are exposed to hazardous blood-borne pathogens (an organism causing disease to its host) such as HCV. The problems of HCV have been the seventh primary cause of death globally. It causes approximately 1.4 million deaths each year [4].HCV is a common cause of work-related infections passed from patients to waste handlers and the reverse and also to waste handlers' families. HCV infections can also be a cause for psychological and occupational diseases.[5]

WHO estimation showed in 2019 that58 million people globally were living with hepatitis C, 1.5 million people were newly infected with chronic form hepatitis C, and 1.1 million deaths occurred because of this infection, and it is the source of liver cancer and cirrhosis.[6]HCV occurs in all regions including Eastern Mediterranean Region and European Region, with an estimated 12 million people chronically infected in each region. In African Region 9 million people are chronically infected, and 5 million people are infected in Region of the Americas. The estimated proportion of HCV in Ethiopia is ranging from <0.5% to 22%.[7]

Infection with HCV does not permanently need treatment since the immune system in some individuals will clear the infection. But, when the infection becomes chronic, treatment is needed. WHO recommends therapy with pan-genotypic direct-acting antivirals (DAAs), for those adults and children with age below 3 years and with a chronic form of hepatitis C infection, but this therapy may remain costly especially in low-income countries like Ethiopia. Thus, WHO recommends prevention using personal protective equipment and infection prevention measures.

Globally, data on the transmission of infection due to waste handling is scarce, and work-related exposure to waste may cause HCV infection. [8] For effective prevention, sufficient information on the proportion and associated risk factors of HCV is necessary. Very few studies have been conducted on HCV infection rates and risk factors for HCV among waste handlers in Sidama, Ethiopia. The aim of this study was to determine the infection rate of HCV and its correlated risk factors on waste handlers in Sidama, Ethiopia.

Methods and materials

Study design and setting

A quantitative cross-sectional study was used in five different governmental hospitals found in Sidama National and Regional State (SNRS), Ethiopia, from October 2021 to July 30, 2022.

Data gathering and quality control

Five medical laboratory technicians and five public health professionals collected the data including socio-demographic characteristics and risk factors from waste handlers using a pretested structured questionnaire. Collecting, aggregating, and analyzing of the responseswas established after inspecting different comparable studies and checking on 8% of the sample size working at hospitals that were not included in the study. The questionnaire was converted to local languages Sidamic and Amharic. In data gathering, the information was checked for completeness every day by supervisors and investigators after it was collected.

Blood sample

Expiry date and functionality of all materials were checked before taking the blood. Five ml of blood sample were taken by medical laboratory technicians after getting a written consent form from waste handlers. The blood samples were coded. Serum was separated by centrifugation and placed into Eppendorf tubes. The serological tests were done by hepatitis C surface antigen rapid test kit at the study sites (hospital's laboratories).

Sampling design

Stratified sampling was used as the sampling technique for data collection. Stratification was based on the topographical location of the hospitals, and the strata used for this study were hospitals in nominated cities of Sidama region administration.

Study subjects

The study subjects were waste handlers who clean medical and non-medical wastes from different public hospitals in SNRS. Involvement in the study was on a willing basis, and all participants gave informed written consent.

Sample size determination

The appropriate sample size used for this study was obtained using the following formula.[15]

$$n = \frac{\sum_{i=1}^{j} \frac{N_i^{\,2} P(1-P)}{W_i}}{\frac{N^2 d^2}{Z_{\alpha/2}} + NP(1-P)}$$

where n is the required total sample size, N is the total number of waste handlers in the study sites, Z is the standard normal cumulative distribution that corresponds to the 5% level of confidence (Z = 1.96), d is the level of precision (sampling error), and p is the probability of success. The probability of success is considered 0.2. The level of precision preferred for this study was 3%. The desired sample size from the target population was 256 study subjects. With an additional assumption of 10 percent non-response rate, the total sample size becomes 282.

Data processing and analysis

Data were presented using both descriptive and inferential statistics. Fisher exact tests were used to assess the risk of association. Variables with P-value less than 0.05 in the bivariate analysis were included in the multivariate analysis. Multivariate logistic regression analysis was employed at a 95% confidence interval to determine the presence of an association between risk factors and the prevalence of HCV. P-value < 0.05 at 95% CI was taken as statistically significant.

Ethical consideration

Ethical clearance (IRBH/258/2022) was obtained from the Institutional Review Board at Hawassa University College of Medicine and Health Sciences. The reason and significance of the study were explained.

Results

Socio-demographic characteristics of waste handlers

282 medical waste handlers were included in the study, and blood samples were taken. Information on socio-demographic characteristics and risk factors for HCV was obtained from all study participants. The mean age was 37.13 years with a standard deviation of 14.42 and range of 18–65 years. The majority, 246 (87.2%), of waste handlers were female, and 170 (60.3%) of them had married. The average service years as waste handlers were 8 years, with range from 1 to 14 years, and 113 (40.1%) of them had high school level of educational status (Table 1).

Table 1 Socio-demographic characteristics of waste handlers in public hospitals in Sidama region, Ethiopia, 2022 (n = 282)

Variables	Category	Frequency	Percentage (%)
Age in years	18–28	106	37.6
	29–39	48	17.0
	40–50	65	23.0
	51 and above	63	22.3
Sex	Male	36	12.8
	Female	246	87.2
Educational level	Unable to read and write	5	1.8
	Elementary and less (1–8)	83	29.4
	High school (9–12)	113	40.1
	Certificate and above	81	28.7
Marital status	Single	60	21.3
	Married	170	60.3
	Widowed	40	14.2
	Divorced	12	4.3
Religion	Orthodox	73	25.9
	Catholic	23	8.2
	Protestant	144	51.1
	Muslim	20	7.1
	Other	22	7.8
Accommodation	Living alone	35	12.4
	Not alone	247	87.6

Among the 282 waste handlers tested, HCV was detected in 5.7%, and 17%, 24.1%, 19.5% and 17.4% of the study participants were experiencing sharp injury, abortion, unprotected sex and dental extraction at a health facility, respectively (Table 2).

Table 2 Distribution of risk factors for HCV among waste handlers in public hospitals in Sidama region, Ethiopia, 2022 (n = 282)

Variables	Category	Frequency	Percentage (%)
History of sexually transmitted disease	Yes	145	51.4
	No	128	45.4
Multiple sexual partners	Yes	37	13.1
	No	244	86.5
Sharp injury	Yes	48	17
	No	233	83
Abortion	Yes	68	24.1
	No	195	69.1
Dental extraction at health facility	Yes	49	17.4
	No	215	76.2
Circumcision	Yes	80	28.4
	No	183	64.9
Ear/nose piercing	Yes	149	52.8
	No	131	46.5
Tattooing on body/gum	Yes	76	27
	No	199	70.6
Contact with jaundiced patient	Yes	44	15.7
	No	237	84
History of surgery	Yes	40	14.2
	No	241	85.5
Needle prick injury	Yes	55	19.5
	No	226	80.1
Exposed to blood/other body fluid splash in nose and eye	Yes	50	17.7
	No	231	81.9
Unprotected sex	Yes	55	19.5
	No	226	80.1

50% of the medical waste handlers wore disposal gloves (OR = 1.082; 95% CI = 0.841–4.515; P = 0.267), 48.2% used face mask (OR = 0.758; 95% CI = 0.251–2.147; P = 0.142), 9% used protective eyewear (OR = 0.245; 95% CI = 0.110–1.894; P = 0.166), 4.96% used gown (OR = 0.832; 95% CI = 0.315–1.875; P = 0.547), and none of them were statistically significant (Table 3).

Table 3 Use of personal protective equipment (PPE) among male & female medical waste handlers in public hospitals in Sidama region, Ethiopia, 2022 (n = 282)

PPE equipment	Male (%)	Female (%)	Total (%)	OR(95% CI)	P-value
Glove	20(7)	121(42.9)	141(50)	1.082(0.841–4.515)	0.267
Masks	6(2)	112(39.7)	118(48.2)	0.758(0.251–2.147)	0.142
Protective eyewear	0(0)	9(3)	9(9)	0.245(0.110–1.894)	0.166
Gown	10(3.5)	4(1.41)	14(4.96)	0.832(0.315–1.875)	0.547

Socio-demographic characteristics of waste handlers and their association with HCV are shown in Table 4. As indicated, not statistically significant associations of HCV were detected in age (OR = 1.892; 95% CI = 0.064–5.595; P = 0.182), gender (OR = 1.41; 95% CI = 0.125–1.349; P = 0.132), marital status (OR = 2.051, 95% CI =0.644–6.527; P = 0.295), accommodation (OR = 0.396; 95% CI = 0.12–1.303; P = 0.122), total family size (OR = 1.778; 95% CI = 0.281–2.150; P = 0.798), residence (OR = 2.833; 95% CI = 0.856–9.383), and years of experience (OR = 1.667; 95% CI = 0.236–1.887; P =0.607) among medical waste handlers, and a significant association was identified in educational level (OR = 0.055; 95% CI = 0.012–0.248; P = 0.001). Female waste handlers were 1.41 times more susceptible to HCV than male waste handlers and married individuals were 2.051 times more exposed to HCV than singles (Table 1).

Table 4 Socio-demographic characteristics of medical waste handlers and their association with HCV in public hospitals in Sidama region, Ethiopia, 2022 (n = 282)

Variables	Categories	Hepatitis C surface antigen status		OR(95% CI)	P-value
		Positive n(%)	Negative n(%)		
Age	≥37	5(31.2)	123(46.2)	1	0.182
	<37	11(68.8)	143(53.8)	1.892(0.064–5.595)	
Gender	Male	4(25)	32(12)	1	0.132
	Female	12(75)	234(88)	1.41(0.125–1.349)	
Educational level	Elementary and below	14(87.5)	74(27.8)	1	0.000*
	Secondary and above	2(12.5)	192(72.2)	0.055(0.012–0.248)	
Marital status	Single	4(25)	108(40.6)	1	0.295
	Married	12(75)	158(59.4)	2.051(0.644–6.527)	
Accommodation	Living alone	4(25)	31(11.7)	1	0.122
	Not alone	12(75)	235(88.3)	0.396(0.12–1.303)	
Total family size	Less than 5	9(56.2)	133(50)	1	0.798
	≥5	7(43.8)	133(50)	1.778(0.281–2.150)	
Residence	Urban	12(75)	238(89.5)	1	0.093
	Rural	4(25)	28(10.5)	2.833(0.856–9.383)	
Years of experience	≥8	10(62.5)	140(52.6)	1	0.607
	<8	6(37.5)	126(47.4)	1.667(0.236–1.887)	

Waste handlers in hospitals are exposed to different job-related plus non-job-related risk factors such as history of sexually transmitted disease, multiple sexual partners, sharp injury, contact with jaundiced patients, unprotected sex, blood contact with skin during work and others. These risk factors are shown in Table 5. As indicated, significantly associated risk factors were detected in sharp injury (OR = 3.14; 95% CI = 0.108–0.910; P = 0.037), abortion (OR = 1.02; 95% CI = 0.027–0.391; P = 0.001), circumcision (OR = 2.71; 95% CI = 0.221–0.332; P = 0.000), contact with jaundiced patient (OR = 1.08; 95% CI = 0.03–0.259; P = 0.000), and unprotected sex (OR = 6.55; 95% CI =0.020–0.210; P = 0.000). Family history of HCV infection (OR = 3.58; 95% CI = 0.112–1.138; P = 0.71), multiple sexual partners (OR = 4.27; 95% CI = 0.13–1.401; P = 0.144), dental extraction at health facility (OR = 4.75; 95% CI = 0.157–1.434; P = 0.154), ear/nose piercing (OR = 1.146; 95% CI = 0.418–3.145; P = 0.495), tattooing on body/gum (OR = 6.17; 95% CI = 0.216–1.762; P = 0.260), and history of surgery (OR = 1.73; 95% CI = 0.191–2.587; P = 0.405) were found to be not significantly associated with HCV. Waste handlers who had sharp injury during work were 3.14 times more exposed to HCV than the counterpart, and those who experienced unprotected sex were 6.55 times more exposed to HCV than those who did not (Table 5).

Table 5 Risk factors and their association with HCV toward waste handlers in public hospitals in Sidama region, Ethiopia, 2022 (n = 282)

Variables	Response	Hepatitis C surface antigen status		Fisher's Exact Test	OR(95% CI)	P-value
		Positive n(%)	Negative n(%)			
Family history of HCV infection	No	12(75)	133(51.8)	0.077	1	0.71
	Yes	4(25)	124(48.2)		3.58(0.112–1.138)	

Multiple sexual partners	No	4(25)	33(12.5)	0.242	1	0.144
	Yes	12(75)	232(87.5)		4.27(0.13–1.401)	
Sharp injury	No	6(37.5)	42(15.8)	0.037	1	0.037*
	Yes	10(63.5)	223(84.2)		3.14(0.108–0.910)	
Abortion	No	9(75)	59(23.5)	0.000	1	0.001*
	Yes	3(25)	192(76.5)		1.02(0.027–0.391)	
Dental extraction at health facility	No	5(31.2)	44(17.7)	0.118	1	0.154
	Yes	11(68.8)	204(82.3)		4.75(0.157–1.434)	
Circumcision	No	12(100)	68(27.1)	0.000	1	0.000*
	Yes	0(0)	183(72.9)		2.71(0.221–0.332)	
Ear/nose piercing	No	8(50)	141(53.4)	0.803	1	0.495
	Yes	8(50)	123()46.6		1.146(0.418–3.145)	
Tattooing on body/gum	No	6(37.5)	70(27.0)	0.392	1	0.260
	Yes	10(62.5)	189(73.0)		6.17(0.216–1.762)	
Contact with jaundiced patient without PPE	No	10(62.5)	34(12.8)	0.000	1	0.000*
	Yes	6(37.5)	231(87.2)		1.08(0.03–0.259)	
History of surgery	No	3(8.8)	37(14.0)	0.710	1	0.405
	Yes	13(81.2)	228(86.0)		1.73(0.191–2.587)	
Needle prick injury	No	9(56.2)	46(17.4)	0.001	1	0.001*
	Yes	7(43.8)	219(82.6)		10.63(0.058–0.461)	
Blood contact with skin	No	16(100)	34(12.8)	78.383	1	0.000*
	Yes	0(0)	231(87.2)		1.28(0.094–0.176)	
Unprotected sex	No	12(75)	43(16.2)	0.000	1	0.000*
	Yes	4(25)	222(83.8)		6.55(0.020–0.210)	

The practices of waste handlers to prevent infection and their association with HCV infection are shown in Table 6. As indicated, 114 (40.4%) of respondents change gloves during waste collection, and 7 (43.8%) of them are reactive for HCV (OR = 1.148; 95% CI = 0.415–3.178; P = 0.492), which was not statistically significant. 221 (78.4%) of the respondents faced needle stick injury during waste collection, and 9 (64.28%) detected as HCV positive (OR = 0.774; CI = 0.725–0.826; P = 0.019), which was statistically significant.

Table 6 Association of practices to prevent HCV infection and its prevalence among waste handlers in public hospitals in Sidama region, Ethiopia, 2022 (n = 282)

Variables	Response	Frequency (%)	Hepatitis C surface antigen status		Fisher's Exact Test	OR [95%, CI]	P-value
			Positive n(%)	Negative n(%)			
Do you always change gloves during waste collection?	Yes	114(40.4)	7(43.8)	107(40.4)	0.798	1	0.492
	No	167(59.2)	9(56.2)	158(59.6)		1.148(0.415–3.178)	
Have you ever faced needle stick injury?	Yes	221(78.4)	9(64.28)	60(22.6)	.028	1	.019
	No	60(21.3)	5(35.71)	205(77.4)		0.774(0.725–0.826)	
Have you ever exposed to blood?	Yes	200(70.9)	0(0)	80(30.2)	0.008	1	0.004
	No	81(28.7)	16(100)	185(69.8)		0.698(0.645–0.756)	
Do you take immediate action after blood exposure accidents (soap washing, disinfection)	Yes	141(50)	13(81.2)	138(54.3)	0.008	1	0.005
	No	129(45.8)	3(18.8)	116(45.7)		0.194(0.054–0.697)	

Risk factors that were identified significant in univariate analysis were included in the multivariate analysis and resulted in Table 7. As indicated, unprotected sex (AOR = 15.488; 95% CI = 4.770–50.2; P = 0.000), sharp injury (AOR = 3.186; 95% CI = 1.099–9.236; P = 0.033), abortion (AOR = 9.763; 95% CI = 2.559–37.24; P = 0.001), contact with jaundice patient (AOR = 11.324; 95% CI = 3.868–33.153; P = 0.000), and needle prick injury (AOR = 6.121; 95% CI = 2.169–17.277; P = 0.001) were statistically significant risk factors for HCV (Table 7). The odds of being HCV reactive were almost 16 times higher (AOR = 15.488; 95%CI = 4.770–50.2; P = 0.000) in participants who had unprotected sex, and the odds of being HCV reactive were almost 10 times higher (AOR = 9.763; 95%CI = 2.559–37.24; P = 0.001) among medical waste handlers who had an abortion compared with the counterpart (Table 7).

Table 7 Multivariate analysis of significant predictors of HCV in bivariate analysis of medical waste handlers at Sidama, Ethiopia, 2022 (n = 282)

Variable	Category	AOR (95%CI)	P-Value
Unprotected sex	Yes	15.488 (4.770–50.2)	0.000
	No	1	
Sharp injury	Yes	3.186 (1.099–9.236)	0.033
	No	1	
Abortion	Yes	9.763 (2.559–37.24)	0.001
	No	1	
Circumcision	Yes	UD	0.995
	No		
Contact with jaundice patient	Yes	11.324 (3.868–33.153)	0.000
	No	1	
Needle prick injury	Yes	6.121(2.169–17.277)	0.001
	No	1	
Blood contact with skin without glove	Yes	UD	0.994
	No	1	

UD = undefined

Discussion

Among the most common work-related risks for healthcare workers including waste handlers is HCV infection. This infection may be transmitted in hospitals via needle prink injuries from infected needles, contact with jaundice patients without personal protective instrument (PPE), and blood-to-blood contact.[9] Hepatitis C virus may result in lifetime sickness including liver cirrhosis and cancer.[10]In Sidama region, Ethiopia, data about HCV infection among high-risk groups such as waste handlers and risk factors for HCV in hospitals are scarce. Hence, the present study provided the rate of HCV infection and associated risk factors among the targeted group.

Our study showed that HCV infection among waste handlers was 5.7%, which was higher as compared with other studies that stated HCV prevalence as 2.0%[11] and 4.0%[12] and lower as compared with other studies done in Karachi, Pakistan which stated (8.5%).[13] The proportion of HCV in medical waste handlers in Tripoli and Palestinian showed 2.7%[14] and 1.59%[10] respectively, which were lower as compared with our study. The difference may be because there is a weak law that forces waste handlers to use PPE during waste collection. Even if a straight comparison is problematic due to methodological, sample size and study participant differences, the higher prevalence of 5.7% of HCV was detected in our study as compared with general population in Ethiopia (0%) without any risk for infection.[10] The reason for this difference may be because waste handlers are more likely to be exposed to risk factors for HCV than the general population. A comparable study in India has shown the prevalence of HCV in patients with chronic liver disease was 25.8%[16], 6% in India[18], and 75.5% in Egypt.[19]These are higher compared to our results of 5.7%. The present study showed the highest prevalence of HCV as compared to the studies done in Northeast Ethiopia 0.7%.[10]This difference may be due to the fact that the level of awareness and practice of standard precautions among waste handlers and medical students were different. The prevalence of HCV among dental workers in Sana'a city was reported as 5% [20], which is smaller compared to the present study, and this difference might be due to methodological, sample size, and study subject differences. Our result showed lower prevalence of HCV as compared with the same group in BeniSuef which was 18.1% [8], in Alexandria 8.4% [21], in Pakistan (8.5%)[13], and in Brazil (12.4%).[22]

High percentage of HCV was detected in the younger group (68.8%), females (75%), married persons (75%), and experienced waste handlers (62.5%), and none of these demographic variables were statistically associated with hepatitis C infection; these findings are in line with the study[23] and Wanjari and other studies.[24,25] The present study showed that the odds of exposure to HCV in female waste handlers were 1.41 times higher than males, and 4.26% of females were infected with HCV which was higher compared with male waste handlers (1.44%); this variation may be due to the fact that the majority of the respondents were female (87.2%). An inconsistent result obtained in Libya showed 0% of HCV reactivity in female waste handlers and 2.9% reactivity in males.[14] The present study revealed that the educational status of the respondents (OR = 0.055; 95%CI = (0.012–0.248; P = 0.000) was significantly associated with HCV infection. This result was supported by results obtained in Libya.[14]The present study showed that HCV infections were detected in 4.26% of married waste collectors and 1.42% of single waste collectors, which were not statistically significant. Some of our results were supported by results reported from Yemen. They reported 5.41% HCV infection in married and 4.35% in single waste collectors, which were not statistically significant.[26] Most waste collectors in our study were people with elementary and below education level (87.5%), and the highest rate (4.96%) of HCV infection was detected compared to those in secondary and above level of education (0.71%). Our result was supported by other studies, with higher rate of HCV infection in people with primary education than in other categories.[27] Other studies reported a high rate of HCV in solid waste handlers having secondary education in India [25]which was inconsistent with our findings. Our study found that 238 (4.26%) versus 28 (1.42%) of HCV reactive waste handlers were from urban and rural areas respectively, as compared to 89.5% participation of urban residents from the whole study group. This result was in line with.[28]

Almost 141 (50%) of the waste handlers used disposal gloves, 118 (48.2%) face masks, 9 (9%) boots, and 14 (4.96%) used protective gowns. This finding is in line with other studies.[29] Odds of using disposal gloves among male waste handlers were 1.082 times higher than female waste handlers (OR = 1.082; 95% CI = 0.841–4.515; P = 0.267), which were not statistically significant. This finding was consistent with.[13]Our study showed that 50% of medical waste handlers use PPE (gloves). 0% of waste handlers use PPE (gloves) in similar studies in Nagpur by [30], and Dhaka (Bangladesh) by.[31]

In our study, exposure to sharp injury in the workplace accounts for 2.13% of infections with HCV, which is inconsistent with the WHO estimate that exposure to sharps in the workplace accounts for 40% infection with HCV. This variation may be due to sample size difference. The present study showed that 55% and 48% of waste handlers had needle stick and sharp injuries

respectively, while handling waste. This finding was consistent with findings on the global burden of needle stick injuries among healthcare workers [32] and was inconsistent with the study in Gonder town, Northwest Ethiopia.[10] The present study found a 4.25% positive HCV infection rate among waste handlers with a family history of HCV infection. Almost similar results were obtained in Yemen[26], which reported a 5.66% positive infection with a family history of hepatitis C. 17.7% of waste handlers in this study were exposed to blood and other body fluid splashes in the nose and eyes. These results were inconsistent with the study done in Sudan which showed that more than 68.8% of respondents are exposed to blood and other body fluid splashes in the nose and eyes.[13]This difference may be due to the fact that almost 87.01% of respondents in our study used a different type of personal protective equipment. The present study showed 22.8% and 48.9% had a history of surgery and dental extraction respectively. This was comparable with the study done in Egypt.[33] Binary analysis of our results revealed family history of HCV infection (OR = 0.358; 95% CI = 0.112-1.138; P = 0.71) and dental extraction (OR = 0.475; 95% CI = 0.157–1.434; P = 0.154) were insignificant factors for HCV infection. These results were in line with the study.[34]Our study suggested that sharp injury, abortion, circumcision, contact with jaundiced patients, needle prick injury, contaminated blood contact with skin, and unprotected sex were a possible pathway for HCV transmission among waste handlers. Some of these findings corroborated the study from Egypt.[35] Studies showed that HCV can be acquired from mis-used methods during surgery or skin art that may cause cross-contamination of medical equipment and devices.[36] Our study showed that the odds of infection with HCV of waste handlers who had made tattooing on body/gum were 6.17 times higher than the counterpart. This was supported by.[37] Abortion and multiple sexual partners play a significant role in the transmission of HCV.[38]The present study showed that the odds of exposure for HCV were 4.27 times higher in waste handlers that had many sexual partners than those who had none. These findings were supported by studies conducted in Tigray Ethiopia[39], North West Ethiopia[40], Slovakia.[41]

Although the study conducted on the same study subjects in Sidama, Ethiopia showed, waste handlers had optimal level of knowledge, attitude and practice on several aspects of HCV,[42] the infection rate of HCV among same group was high(5.7%). This controversy may be due to the fact that therules in the hospitals about color-coding segregation of medical wastes were very weak.

Limitations of the study

We used a rapid test without confirmatory conventional immunoassays which limited the study to categorize the infection as acute and chronic. The study was conducted in randomly selected hospitals in Sidama region, which may have recall bias, and screening for HCV was not conducted during employment and this made it difficult to identify whether the observed infection was before or after employment as waste handlers.

Conclusions

Compared with other studies in similar subjects, there was a high rate of HCV infection among waste handlers, concluding that waste collectors were susceptible to HCV infection. Unprotected sex, sharp injury, abortion, contact with jaundice patients without PPE, and needle prick injury were significant risk factors that were associated with HCV infection among waste handlers. Married individuals are more likely than unmarried individuals and females were more likely than males to acquire HCV infection. It is suggested that individuals with a family history of HCV infection and living with others in the same room had a high rate of HCV infection. Furthermore, the study suggested that those waste collectors who did not take immediate action after blood exposure like soap washing and disinfection were at greater risk for infection and the study recommended that hospitals should create awareness and work-related exposure prevention should be the first plan to reduce the risk of HCV among waste handlers. Due to sharp injury, contact with jaundice patients without PPE, needle prick injury, and others, waste handlers were getting HCV infection. Thus, it is recommended to value these waste handlers and respect their work and the government should provide all personal protective equipment, and waste handlers should properly use personal protective equipment and go for routine health check-ups so that the infection may be reduced. The significant demographic variable that was correlated with HCV infection was educational level of waste handlers, and other demographic variables like age, gender, marital status, accommodation, total family size, residence, and years of experience were not statistically correlated with HCV infection. Medical waste handlers are exposed to sharp injury, contact with jaundiced patients, needle prick injury, and contaminated blood which were statistically significant risk factors for HCV and were the cause for high prevalence of HCV among waste collectors.

Our results suggested the necessity of updating the working environment of waste handlers on the establishment of the profession of precautions and development of waste handlers' health awareness, attitudes, and behavior. Protective measures such as avoiding direct contact with people's blood, avoiding sharing of items that could have had other people's blood on them and extensive training and supervision for waste handlers with appropriate use of PPE may reduce the infection rate of HCV.

Authors' contributions

BB came up with the study, made the proposal, and contributed substantially to the study design and preparation of the information gathering checklist. DB prepared the manuscript and wrote and corrected the manuscript. All authors read the manuscript and accepted it.

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Accessibility of data and materials

The full data is obtainable from the corresponding author upon reasonable request.

Ethics approval and consent to participate

The study protocol was approved by the Institutional Health Research Ethics Review Committee (IHRERC) of Hawassa University, College of Health and Medical Sciences (CHMS) (Reference number: IHRERC/127/2021) and permission for proceeding with the study was accepted by the respective health institutions. All methods were carried out in accordance with the relevant guidelines and regulations of Hawassa University. Thus, informed, written and signed consent was obtained from each respondent.

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