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ORIGINAL ARTICLE

SEROPREVALENCE OF HEPATITIS B AND C VIRUSES, AND ASSOCIATED FACTORS AMONG MEDICAL WASTE HANDLERS, NORTHEAST ETHIOPIA

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ABSTRACT

Background: *Medical waste handlers are at high risk of infections transmitted diseases (by blood, body fluids and sharp objects.) This study aimed to determine the seroprevalence of hepatitis B and C viruses, and associated risk factors among medical waste handlers in Dessie town, northeast Ethiopia.*

Method: *A cross-sectional study was conducted among medical waste handlers from March to June 2020 in government and private hospitals in Dessie town. Socio-demographic and occupational risk factors were collected using a questionnaire. Serum was tested for hepatitis B surface antigen and anti-hepatitis C antibody using an Enzyme Linked Immunosorbent Assay. The data were analyzed with SPSS version 20. Logistic regression was used to determine the association, and any variable with a p-value of < 0.05 which was considered statistically significant.*

Result: *The overall seroprevalence of hepatitis B virus a 6.04%, and hepatitis C virus cases were 1.13%. The infections were higher in females with 14 (6.7%) HBV and 3 (1.13%) HCV, and participants with multiple sexual behaviors had 10 (9.5%) HBV. The history of surgical procedures and family history of hepatitis infection were significantly associated factors (P< 0.05).*

Conclusion*: The prevalence of hepatitis B and C viruses was intermediate and low respectively. The history of surgery and a family history of hepatitis infections were independent factors. Aseptic surgical procedures, awareness of the transmission and implementation of prevention measures in risky settings including home with an infected family member helps to reduce burden of these infections.*

Key words*: Hepatitis, Medical waste handlers, Ethiopia*

INTRODUCTION

Viral hepatitis is an inflammatory disease of the liver mainly caused by Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) (1, 2). Hepatitis B and C viruses caused acute and chronic hepatitis, extensive liver scarring (cirrhosis), liver failure, liver cancer, and millions of people's deaths(3, 4). These viruses are contagious and easily transmitted by blood and body fluids, from mother to child, unprotected sexual intercourse, injection, drug use, transfusion, and other medical and surgical procedures (5, 6), and they are occupational hazards for medical waste handlers (MWHs) (7).

According to a World Health Organization (WHO) report, two billion people worldwide have been infected with HBV, and out of them, 240 million were chronic carriers and more than 780 000 died due to

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complications such as fulminant liver disease, liver cancer, and cirrhosis in 2012 (8). In addition, 170 million people are infected with HCV out of which 130-150 million chronic carriages, and over 700000 deaths (9). In Africa, medium endemic burden of HBV (>5%) (10) and HCV (1.6-3.8%) has been reported (11). Furthermore, there was about 32 million (5.3%) HCV infections with an exceptionally high prevalence in Egypt (12). Similarly, the burden in Ethiopia is 6-8% HBV (2, 13)] and 3.1% HCV (2). Likewise, on global level, there is 9% of HBV and 20% of HCV cases, and only 8% and 7%, respectively knew their status, and received treatment (14). Hepatitis B and C viruses contributed to 96% of deaths of HCC (470 000), and cirrhosis (720 000) (14).

Factors such as length of service, needle stick/sharp injury, a splash of blood on mucous membrane, unprotected blood contact, multiple sexual partners, blood transfusion, surgical procedure, tattooing, history of blood contact, inappropriate usage of personal protective equipment (PPE) predisposes to HBV and HCV infections (15). WHO focused on case detection as the basic tool to hepatitis elimination (14). In Ethiopia, lack of clear policy for waste management and lack of training, limited access to immunization, failure to adhere to standardized precautions are the basic constraints that facilitated the spread of these infections among MWHs (16). Researching up-to date evidence on the prevalence of these infections is mandatory to design preventive and control strategies, and its proper implementation. Studies on HBV and HCV burden among MWHs are limited in Ethiopia in general, and absent in Dessie town in particular. Hence, this study aimed to determine the prevalence and associated factors of HBV and HCV among MWH in Dessie town, Northeast Ethiopia.

METHOD

A cross-sectional study was conducted in three governmental and four private hospitals in Dessie town from March to June 2020. Dessie town is located 401km from Addis Ababa, the capital city of Ethiopia. The town has a population of 151,174(17).

All MWHs working in Dessie governmental and private hospitals during the study period were legible, but MWHs who had history of vaccination were excluded.

During the study period, there were 265 MWHs, and all were included in the study. Based on human resource records, 159 MWHs were from Government hospitals, and 106 MWHs were from private hospitals.

Data collection and analysis: socio-demographic and occupational variables were collected using a structured interviewer-administered questionnaire. A plain test tube was used to collect 5 ML of venous blood, and it was transported to Dessie blood bank in a cold box. In addition, serum was separated by centrifugation at 3000 revolutions per minute (RPM) for at least 10 minutes, and it was placed in Nunc tubes. Furthermore, the specimen was kept at 2-8^{o}c when the delay was unavoidable. Besides, all the necessary precautions were taken in handling of the specimen. As a result, the HBsAg and anti-HCV antibodies were detected using an Enzyme Linked Immuno Sorbent Assay (ELISA) (Beijing Onetie Biological Laboratories, co. Ltd, China) according to the manufacturer's instructions. Briefly, serum was added to wells, the HCV antigens and anti-HCV antibodies to check if it is present in the participants' serum formed complexes on the wells. Hence, the diluted HCV Ag•HRPO Conjugate was added to the well, and it formed the HCV-anti-HCV-HCV Ag•HRPO complex. The substrate

was added for color development with subsequent washing in each step. Similarly, for HBsAg detection, the specimen was incubated in antibody-coated wells. If the sample contains HBsAg, it binds to the antibody on the plate. After washing, we got anti-HBs conjugated to peroxidase was added and incubated. After a second incubation and subsequent washing, an enzyme substrate containing a chromogen was added. A blue color was developed in positive specimens, and the blue color changes to yellow after blocking the reaction with sulfuric acid.

Data from respondents was edited, cleaned, entered into Epi Info-7, and it was exported to SPSS-20. Descriptive statistics such as frequency and percentage were used to analyze and presented in tables. Binary logistic regression analysis was carried out to determine the Odds Ratio (OR) and p-value at 95% CI to see the association between independent and dependent variables. Variables with a p-value of less than 0.05 in multivariable analysis were considered as significantly associated.

Data and specimens were collected by a trained laboratory personnel**.** The validity of the questionnaire was tested using a pretest, and the data were checked for completeness with close supervision and assistance. Known positive and negative samples were analyzed in parallel with the participants' samples. All procedures were done based on standard operating procedures (SOPs) and the manufacturer's procedures.

RESULT

Socio demographic and occupational factors of study participants: This study included 265 (87%) from a total of 305 MWHs who were working in Dessie town hospitals. More than two third of study participants 208 (78.5%) were female, and 169 (63.8%) of them were above 30 years. In addition, 159 (60%) were from government hospitals from whom 164 (61.9%) had at least secondary educational background. Furthermore, 67 (25%), 54 (20.4%) and 101 (38.1%) of the participants had a history of needle stick injury, exposure to blood and/or body fluids, and had multiple sexual partners respectively. Likewise, eighteen (6.8%) and 45 (17%) had known hepatitis infected family members and history of surgery respectively.

In this study, the overall seroprevalence of HBV and HCV was 19 (7.2%) (95% CI: 4.2-10.6). Of these, HBV accounted for 16 (6.04%) (95% CI: 3.4-9.1) while HCV accounted for 3 (1.13%) (95% CI: 0.0 - 2.6) **(Table 1).**

The factors associated with HBV infections: The history of surgery in MWHs with 6(13.3%) (AOR-3.25; 95% CI; 1.07-9.87 and P-value= 0.038), and family history of hepatitis 4(22.2%) (AOR 6.0; 95% CI; 5.62-22.12, P-value =0.007***)** had statistically significant association with HBV infections. About 10% of the participants who have multiple sex partners (AOR -2.72 95%CI; 0.9-7.96, P-value = 0.07) had HBV, but it was not significantly associated. Higher proportion of HBV was detected in females 14(6.7%), married 12 (7%), aged between 31-40 years 8 (7.6%), and 5-10 year of service 8 (7.8%) with no statistically significant association **(Table 2).**

The overall prevalence of HCV infection was 3 (1.4%) and all of them were females, and they served in the hospitals for more than five years. These HCV infected participants remember that they had history of sharp injury **(Table 3).**

Table-1: Socio-demographic characteristics of MWHs at Dessie town governmental and private hospitals, Northeast Ethiopia, 2020

Variables		Frequency (%)	Variable		Frequency (%)
Sex	Male	57 (21.5%)	Sharp injury	Yes	67(25.3)
	Female	208(78.5)		No	198(74.7)
Age group	20-30 years	96(36.2)	Exposure to body fluids	Yes	54(20.4)
	31 and above	169(63.8)		No	211(79.6)
Marital status	Single	45(17.0)	Multiple sex partners	Yes	101(38.1)
	Married	172(64.9)		No	164(61.9)
	Divorced	31(11.7)	History of transfusion	Yes	43(16.2)
	Widowed	17(7.9)		No	222(83.8)
Education	Primary school	101(38.1)	Family history of hepatitis	Yes	18(6.6)
	Secondary & above	164(61.9)		No	247(93.2)
	Below 1 years	29(10.9)	Body tattooing	Yes	69(26.0)
Service year	1-5 years	102(38.5)		No	196(74.0)
	5-10 years	98(37)	History of surgery	Yes	45(17.0)
	Above 10 years	36(13.6)		No	220(83.0)
Working hospital	Governmental	159(60)	Tooth extraction	Yes	50(18.9)
	Nongovernmental	106(40)		No	215(81.1)
Working sites	Laboratory	51(19.2)	IV[3] drug use	Yes	15(5.7)
	Delivery	40(15.1)		No	250(94.3)
	Pharmacy	31(11.7)	Use of PPE[4]	Yes	160(60.4)
	OPD[1]	48(18.1)		No	105(39.6)
	OR[2] class	31(12.1)	Training on WH[5]	Yes	153(57.7)
	Laundry	36(13.6)		No	112(42.3)
	Others	28(10.3)	Color-coding segregation	Yes	138(52.1)
Infection status	HBV	16(6.04)		No	127(47.9)
	HCV	3(1.13)			
	Negative	246(92.83)			

Table 2: The factors associated with HBV among MWHs in Dessie town governmental and private hospitals, Northeast Ethiopia, 2020

Variables		HBV infection		COR (95% CI)	P-value	AOR (95% CI)	P-value
		Positive N (%)	Negative N (%)				
Sex	Male	2(3.5)	55(96.5)	1			
	Female	14(6.7)	194(93.3)	1.99(0.4-9.0)	0.37		
Age group	20-30 years	6(6.2)	90(93.8)	1.06(0.4-3.0)	0.91		
	≥31 years	10(5.9)	159(94.1)	1			
Education	Primary	4(4.0)	97(96.7)	0.52(0.2-1.7)	0.27		
	Secondary & above	12(7.3)	152(92.7)	1			
Year of service	≤5 years	10(7.6)	121(92.2)	1			
	> 5 years	6(4.5)	128(95.5)	0.57(0.2-1.6)	0.28		
Sharp injury	Yes	4(6)	63(94)	0.98(0.3-3.2)	0.98		
	No	12(6.1)	186(93.9)	1			
PEP[6]	Yes	2(4.4)	43(95.6)	0.68(0.2-3.1)	0.62		
	No	14(6.4)	206(93.6)	1			
Exposure to body fluid	Yes	2(3.7)	52(96.3)	0.54(0.1-2.5)	0.46		
	No	14(6.6)	197(93.4)	1			
Multiple sex partner	Yes	10(9.9)	91(90.1)	2.89(1.02-8.2)	0.04	2.72(0.9-7.96)	0.07
	No	6(3.7)	158(96.3)	1		1	
Tattooing	Yes	6(8.7)	63(91.3)	1.77(0.6-5.1)	0.29		
	No	10(5.1)	186(94.9)	1			
History of Surgery	Yes	6(13.3)	39(86.7)	3.23(1.1-9.4)	0.03	3.3(1.07-9.87)	0.038
	No	10(4.5)	210(95.5)	1		1	
History of transfusion	Yes	3(7)	40(93)	1.2(0.3-4.4)	0.78		
	No	13(5.9)	209(94.1)	1			
History of IV[5] drug use	Yes	2(11.8)	15(88.2)	2.23(0.5-10.7)	0.32		
	No	14(5.6)	234(94.4)	1			
Family history hepatitis	Yes	4(22.2)	14(77.8)	5.6(1.6-19.6)	0.007	6(5.62-22.12)	0.007
	No	12(4.9)	235(95.1)	1		1	
Use of PPE[4]	Yes	10(6.2)	150(93.8)	1			
	No	6(5.7)	99(94.3)	0.91(0.3-2.6)	0.86		
Training on waste handling	Yes	12(7.8)	141(92.2)	1			
	No	4(3.6)	108(96.4)	0.44(0.1-1.4)	0.16		
color-coded segregation	Yes	7(5.1)	131(94.9)	1			
	No	9(7.1)	118(92.9)	0.1.4(0.5-3.9)	0.5		

Key: *[1]-Outpatient department, [2]-Operating room, [3]-Intravenous, [4]-PPE-Personal protective Equipment, [5]waste handling, [6]-PEP-post exposure prophylaxis*

Table 3: The frequency of hepatitis C virus infection among MWHs in Dessie town governmental and private hospitals, Northeast Ethiopia, 2020

Variables		HCV infection	
		Positive N (%)	**Negative N (%)**
Sex	Male	0	57(96.5)
	Female	3(6.7)	205(93.3)
Age group	20-30 years	1(1)	95(99)
	≥31 years	2(1.2)	167(98.8)
Education	Primary	1(1.0)	100(99.0)
	Secondary & above	2(1.2)	162(98.8)
Year of service	Up to 5 years	0	131(100)
	> 5 years	3(2.2)	131(97.8)
History of sharp injury	Yes	3(4.5)	64(95.5)
	No	0	198(100)
History of PEP[6]	Yes	3(6.7)	42(93.3)
	No	0	220(100)
Exposure to body fluid	Yes	1(1.9)	53(98.1)
	No	2(0.9)	209(99.1)
Multiple sex partner	Yes	1(1)	100(99)
	No	2(1.2)	162(98.8)
Tattooing	Yes	1(1.4)	68(98.6)
	No	2(1)	194(99)
History of Surgery	Yes	0	45(100)
	No	3(1.4)	217(98.6)
History of transfusion	Yes	2(4.7)	41(95.3)
	No	1(0.5)	221(99.5)
History of IV[3] drug use	Yes	0	17(100)
	No	3(1.2)	245(98.8)
Family history hepatitis	Yes	0	18(100)
	No	3(1.2)	244(98.8)
Use of PPE[4]	Yes	2(1.2)	158(98.8)
	No	1(1)	104(99)
Training on waste handling	Yes	2(1.3)	151(98.7)
	No	1(0.9)	111(99.1)
color-coded segregation	Yes	0	3(2.4)
	No	138(100)	124(97.6)

DISCUSSION

The overall seroprevalence of HBV and HCV was 7.2%. The majority of infected MWHs were HBV patients (6.04%) and (1.13%) were infected by HCV. This result was in line with the results obtained from similar studies conducted in Gondar 6% HBV and 1% HCV (18), Bahir Dar 2.5% (19), Addis Ababa 6.3% (16), Kenya 2.7% (20), Sudan 5.7% (21) and Bangladesh 6.3% HBV and 1% HCV (22). On the other hand, the prevalence of HBV was higher than reports from southern Ethiopia 1.3% (23), Libya 2.3% (24). The prevalence of HBV was lower compared to reports in Brazil 9.8% (25). Moreover, the prevalence of HCV in this study 3(1.1%) was lower compared to the findings reported from different areas such as Brazil 3.3% (25), Tripoli, Libya 2.7% (24), Turkey 4.5% (26).Furthermore, comparable HCV results have also been reported from Brazil 1.6% (27), Sudan 0.3% (21), and Addis Ababa 2% (28). The differences may be due to geographic, methodology, sample size, lifestyle variations, access to immunization, level of awareness and commitment for prevention and control.

The history of surgery and family history of hepatitis infection were significantly associated with HBV infection. Participants with a history of surgery were 3.25 times at higher risk to HBV infection than those who had not. This was supported by a study conducted in Bahir Dar, Ethiopia (29). The rate of HBV infection among MWHs who have infected family members was six times greater than their counterparts. History of surgery and living in a family of HBV infected people increase the risk because contact with contaminated sharps or body fluids of infected family members without PPE may occur and cross-transmit the infections. Although not significantly associated, the rate of HBV infection was higher among participants who have multiple sexual partners. In addition, a higher prevalence of HBV 6.7% and HCV 1.4% was observed among females compared to 2.6% in males. This is in agreement with a study conducted in Gondar (18), but it varies from results reported in Addis Ababa (16) and Libya where none of female MWHs and 2.9% males were HBV infected (24) in which the majority of study participants were male while most of the study participants in our study were females and could be the possible source of the differences.

In the present study, significant differences in prevalence of HBV and HCV infections were not observed between MWHs who use PPE and those who did not use PPE. This may be due to sample size or infection prior to employment in the hospitals. About 6% and 5% of MWHs with history of needle stick injury were positive for HBV and HCV respectively. This was similar to reports in Dhaka, Bangladesh (22) and Libya (24). Furthermore, HBV infections from exposed to splash of body fluids was 8(7.7%) while infection among non-exposed was 8(5%) with no significant association. In fact, exposure to body fluids is supposed to increase the risk of acquisition of HBV and HCV, and the proportion of HBV among exposed participants was greater than their counterparts. The small frequency of cases might be responsible for the absence of significant association. Similar results have been reported in Dhaka, Bangladesh 7.2% (22), Egypt 5.3% (30), Nigeria 5.3% HBV (31) and Italy 8.1% HBV and 1.6% HCV infections (32). Overall, more than 39% of participants had history of exposure to body fluids which implies poor standards of occupational safety practices, and underutilization of the PPE. Lack of training, inadequate supply of PPE, poor waste segregation, and unsafe disposal, lack of definite standards and policies for waste management, infrastructures (33) and limited availability of HBV vaccines (only 20% health care workers were vaccinated) and absence of HCV vaccines are real problems seen in Ethiopia (34).

As limitation, only serologic tests were performed which could not differentiate between active infection and previous infection. We could not assure whether the infected participants acquire the infection before or after they begun this occupation. The study didn't include other health workers.

In conclusion, the overall prevalence rates of hepatitis B and C viruses among MWHs were intermediate, and low respectively. History of surgical procedures and having family history of hepatitis were significantly associated with the risk of HBV infections. Screening of employees and treatment of infected people including family members and regular training about transmission and prevention methods is mandatory.

Abbreviations:

PPE- personal protective equipment
HBV-Hepatitis B virus
HCV-Hepatitis C virus
MWHs-Medical Waste Handlers
WHO-World Health Organization
SOP-Standard operating procedures

Declaration

Ethical clearance and consent: The study was conducted after obtaining of ethical clearance from the Ethical Review Committee of School of Biomedical and Laboratory Sciences, College of Medicine and Health Sciences, University of Gondar. Written informed consent was taken from each study participants. Positive cases were attached to the physicians for treatment and follow-up. The study was conducted respecting the declaration of Helsinki on human participants.

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Availability of data and materials: All data generated and analyzed during this study are included in this manuscript. All the findings reported in this research can be freely available for any researchers or scientists throughout the globe to use them for none commercial purposes.

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Authors' contribution: SM: conception, and design of research idea, data collection, clearance, entry, analysis and interpretation of the findings and drafting the manuscript. DK: conception, and design the research idea, data collection, supervision, clearance, entry, analysis and interpretation of the findings and final manuscript write-up. YW: conception, and design of research idea, data collection, clearance and drafting the manuscript.

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