

# Sero-Prevalence and Determinants of Hepatitis C Virus Infection Among Healthcare Workers of a Private Tertiary Care Hospital in Karachi

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**Abstract:** Health care workers (HCWs) are at high risk of exposure to hepatitis B virus (HBV), hepatitis C virus (HCV) and HIV transmission due to occupational exposure to injuries, from sharp needles, and scalpels during the execution of their health care duties. We aimed to assess HCV sero-prevalence, and possible risk factors of HCV among HCWs of Kharadar General Hospital, Karachi. Total 300 HCWs were included in the study. Hepatitis C virus antibody was detected through rapid diagnostic test (RDT) then HCV-Ribo-nucleic Acid (RNA) was detected among RDT positive HCWs by using GeneXpert. Structure questionnaire was used for data collection. Data was analyzed by using SPSS 19. Correlation was seen between HCV determinants and positivity by using Pearson chi-square test. A p value of  $< 0.05$  were considered statistically significant. Total 300 HCWs were screened for HCV. Mean age of participants was  $30.19 \pm 10.55$  years and 179 (60%) were female. Both Sero-prevalence and Viraemic prevalence was reported 3 (1%) among study HCWs. Occupational exposure through needle stick injury (NSI) was reported among 172 (57%) HCWs and commonly seen in nursing staff 88 (68.7%), especially at ER 13 (72%). Other significant non-occupational risk factors were ear/nose piercing 175 (58%), dental and surgical procedures 166 (55%). Frequency of HCV among HCWs of study hospital was low, despite high occupational exposure of NSI. Study findings can be used for future prevention of occupational exposure of HCV among HCWs by developing and implementing standard operational procedures and policies.

**Keywords:** Hepatitis C, Healthcare Workers, Risk Factors, Sero-Prevalence, Viraemic Prevalence

## 1. Introduction

Hepatitis C virus (HCV) infection is a major public health concern worldwide and affecting millions of people each year [1, 2]. Hepatitis C virus infection can cause acute and chronic hepatitis and potentially leads to the development of liver cirrhosis, liver cancer, or death [2, 3]. In 2019, World Health Organization (WHO) estimated that globally, 58 million persons were chronically infected and living with hepatitis C and among them approximately 400 000 people were died, with a disproportionately high burden in low- and middle-income countries (LMICs) [4]. In Pakistan, according to the national prevalence survey, the

prevalence of hepatitis C virus infection was 4.8 % in the general population and HCV could affect nearly 10 million peoples in Pakistan [5, 6].

Common mode of transmission of HCV includes intravenous drug use, blood or its product transfusion, reuse of syringes or needles, unsterilized surgical equipment, dental procedures, piercing ear and nose, tattoos, transmission during sexual intercourse, vertical transmission from infected mother to newborn [7].

Healthcare workers (HCWs) are at higher risk of acquiring blood borne pathogens such as HBV, HCV and HIV as compared to any other occupational group [8]. This is because of occupational exposure to injuries, from sharp

needles, and scalpels during the execution of their health care duties. Globally, two million health care workers suffer from accidental needle stick injury (NSI) each year [9]. In Pakistan, around 49.7% of health care workers experienced NSI in the last one year [10]. Hassnain S et al reported that prevalence of NSI was found to be 85 (44%) in public and 51 (26.4%) in the private sector hospital of Lahore [11]. Another study reported that the NSI at ever in life, was 66% among HCWs in public sector hospitals of Karachi [12].

In 2007–2008, during the national hepatitis prevalence survey, 11 670 HCWs were screened for HCV in the whole province of Sindh. Out of the total screened HCWs for HCV, 713 (6.2%) were HCV antibody positive [13]. Other studies from Pakistan have also reported the HCV prevalence of 5 to 6 % among the HCWs [14, 15]. Most of the HCV prevalence studies among HCWs are being conducted in the public sector hospitals. There is a dearth of data that reports the burden of HCV infection among the HCWs of a private health care hospital. Furthermore, no study reports the viraemic prevalence of HCV among the RDT positive HCWs. Current study was aimed to estimate the sero-prevalence and associated risk factors of HCV among the HCWs of Kharadar General Hospital (KGH), a 250 bedded private tertiary care hospital, located in the old city area (Lyari town) of Karachi.

## 2. Material and Methods

### 2.1. Study Design, Setting and Duration

The cross-sectional study was conducted at Kharadar General Hospital (KGH), one of the private tertiary care hospital, located in the south, near costal line of Karachi, the provincial capital of Sindh. Study data was collected during the month of October 2022.

### 2.2. Study Population, Eligibility Criteria, Sample Size and Consent

Study participants were the health care workers (Doctors, Nurses, Technicians, and other workers) of KGH, who employed for the last 6 months, and willing to participate in the study. Study sample size was 300, based on universal sampling technique. Informed consent was taken. Purpose of study was explained to all the participants before enrollment into the study.

### 2.3. Data Collection Procedure, Laboratory Tests and Quality Control

Structure questionnaire was used for data collection. Detail demographic data (name, age, education, marital status, designation & work experience), occupational exposure data (NSI, posting place), and non-occupational exposure data (H/O injections use/ H/O blood transfusion/ previous surgeries/ dental procedure/ HCV infection in spouse/ piercing of ear or nose/ tattoo) were collected by the trained nursing students. Rapid diagnostic test (RDT) kit, manufactured by Abbott Company, was used for the

detection of anti HCV antibody. RDT positive cases were further confirmed for HCV infection through doing quantitative PCR by looking HCV-RNA. All PCR positive HCV cases were offered WHO recommended direct acting antivirals HCV treatment.

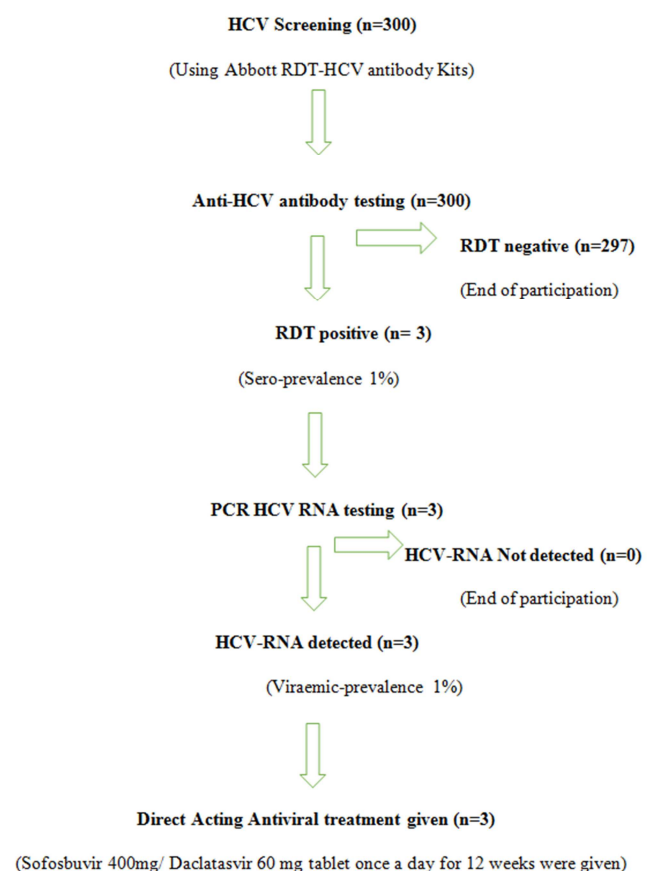
The confidentiality of data was ensured by proper coding and keeping it in a key and lock with limited access.

### 2.4. Data Entry and Statistical Analysis

Study data were entered in the excel sheet and analyzed by using statistical package for Social Science (SPSS) version 19. Frequency and percentage were calculated for categorical variables (gender/ H/O blood transfusion/ injection/ previous C/Section etc). Whereas mean and standard deviation were calculated for continuous variables (Age/ Experience in years). Correlation between HCV determinants variables (age, gender, years of work experience, H/O blood transfusion, Use of injection, previous surgeries, dental Procedures, piercing of ear or nose) and outcome variable (Presence of HCV) were determined by using persons chi square test. P-value < 0.05 were considered as statistically significant.

### 2.5. Ethical Consideration

Study approval was taken from the Ethics Review Committee (ERC) of Kharadar General Hospital.



**Figure 1.** Flow diagram of HCV screening among HCWs of KGH, Karachi.

### 3. Results

#### 3.1. Socio-Demographic Characteristics of Participants

Total 300 HCWs of Kharadar General Hospital have been screened for HCV infection through RDT-HCV antibody kit. Mean age of participants was  $30.19 \pm 10.55$  years with majority of female 179 (60%) participants. Male to female ratio was 1:1.5. Less than half of participants 131 (43.7) were married. Of total HCWs, majority were nurses 128 (42.7 %), followed by technicians 59 (19.7%), doctors 37 (12.3 %), housekeeping staff 37 (12.3), security guards 20 (6.7%) and porter 19 (6.3%). Mean work experience of participants was  $5.23 \pm 5.98$  years (See table 1).

#### 3.2. Sero and Viraemic Prevalence of HCV Among HCWs

Of total 300 study participants, 3 (1%) were RDT-HCV antibody positive (Sero-prevalence). All 3 (1%) RDT positive cases were also positive on GeneXpert, for the presence of HCV RNA (Viraemic prevalence) with 100% positivity. (See Figure 1).

#### 3.3. Determinants of HCV Among HCWs

Needle stick injury (NSI) among HCWs, was reported in 172 (57%) participants. Within last one year, positivity of

NSI was 138 (46%). (see table 2). Needle stick injury was commonly seen in nursing staff 88 (68.7%), followed by technicians 36 (61%), doctors 16 (43%) and others 32 (42%). Highest proportion of NSI was seen at ER (72%), followed by Laboratory (68%), OPD (62%), NICU (58%), wards (56%), O. T (48%) and labour room (30%) (See table 3). Other non-occupational risk factors of HCV were also seen among study HCWs as ear and/or nose piercing 175 (58%), history of dental procedure 90 (30%), history of surgical procedure 76 (25%), history of injection use 54 (18%), blood transfusion 32 (11%), HCV in Spouse 11 (3.7 %) and history of tattoo 13 (4%). (See table 2).

#### 3.4. Characteristics and Correlation of HCV Positive Cases

All three diagnosed HCV positive cases were coming out from the indirectly expose (Housekeeping staff/ security guard) population. (See table 1). Of three HCV positive patients, two were posted in ward and one in the OPD. (See table 1). All 3 HCV positive patient's mean age was  $45.33 \pm 3.51$  years, having two male and a female, with average 8 years of work experience. For the presence of HCV risk factors among HCV positive patients, two have previous history of surgery, one has history of NSI within last one year and a female HCV positive patient has history of ear/nose piercing. (See tables 1 & 2).

**Table 1.** Demographic information of the study Health Care Workers (N=300).

Characteristic	HCV Non-reactive N (%)	HCV Reactive N (%)	Total	P Value
Age categories				
18-30 years	204 (68.0)	0 (0.0)	204 (68.0)	0.000
31-40 years	47 (15.7)	0 (0.0)	47 (15.7)	
41-50 years	29 (9.7)	3 (1.0)	32 (10.7)	
≥ 51 years	17 (5.6)	0 (0.0)	17 (5.6)	
Gender				
Male	119 (39.6)	2 (0.7)	121 (40.3)	0.350
Female	178 (59.4)	1 (0.3)	179 (59.7)	
Marital Status				
Married	128 (42.7)	3 (1.0)	131 (43.7)	0.048
Single	169 (56.3)	0 (0.0)	169 (56.3)	
Occupation				
Doctors	37	0	37 (12.3)	0.001
Nurses	128	0	128 (42.7)	
Technicians (Lab/OT/NICU)	59	0	59 (19.7)	
Housekeeping staff	36	1	37 (12.3)	
Security Guards	18	2	20 (6.7)	
Porter	19	0	19 (6.3)	
Place of work				
OPD	31	1	32 (10.7)	0.805
ER	18	0	18 (6.0)	
Wards	137	2	139 (46.3)	
NICU	36	0	36 (12.0)	
O. T	31	0	31 (10.3)	
Labour Room	13	0	13 (4.3)	
Laboratory	31	0	31 (10.3)	
Work Experience categories				
1-2 years	132 (44.0)	0 (0.0)	132 (44.0)	0.213
3-5 years	80 (26.6)	2 (0.7)	82 (27.3)	
6-10 ears	47 (15.7)	0 (0.0)	47 (15.7)	
≥ 11 years	38 (12.7)	1 (0.3)	39 (13.0)	

**Table 2.** Determinants of HCV infection among Health Care Workers (N=300).

Risk Factors	HCV Non-reactive N (%)	HCV Reactive N (%)	Total	P Value
Needle stick injury (NSI)				
Yes	171 (57.0)	1 (0.3)	172 (57.3)	0.398
No	126 (42.0)	2 (0.7)	128 (42.7)	
NSI within a year				
Yes	137 (45.7)	1 (0.3)	138 (46.0)	0.658
No	160 (53.3)	2 (0.7)	162 (54.0)	
H/o Blood transfusion				
Yes	32	0 (0.0)	32 (10.7)	0.547
No	265	3 (1.0)	268 (89.3)	
H/o Injection use				
Yes	54 (18.0)	0 (0.0)	54 (18.0)	0.415
No	243 (81.0)	3 (1.0)	246 (82.0)	
H/o HCV in Spouse				
Yes	11 (3.7)	0 (0.0)	11 (3.7)	0.734
No	286 (95.3)	3 (1.0)	289 (96.3)	
H/o Previous surgery				
Yes	74 (24.7)	2 (0.7)	76 (25.3)	0.098
No	223 (74.4)	1 (0.3)	224 (74.7)	
H/o any dental Procedure				
Yes	90 (30.0)	0 (0.0)	90 (30.0)	0.254
No	207 (69.0)	3 (1.0)	210 (70.0)	
H/o piercing Ear and/or Nose				
Yes	174 (58.0)	1 (0.3)	175 (58.3)	0.377
No	123 (41.0)	2 (0.7)	125 (41.7)	
H/o Tattooing				
Yes	13 (4.3)	0 (0.0)	13 (4.3)	0.711
No	284 (94.7)	3 (1.0)	287 (95.7)	

**Table 3.** Needle Stick Injury (NSI) among HCWs at different places of the study Hospital (N=172).

S No.	NSI among HCWS at different places (N=300)	Doctors (n=37)	Nurses (n=128)	Technicians (n=59)	Others (n=76)	Total
1	OPD (n=32)	1	11	0	8	20 (62.5)
2	ER (n=18)	2	8	2	1	13 (72.2)
3	Wards (n=139)	8	53	1	16	78 (56.1)
4	NICU (n=36)	2	14	4	1	21 (58.3)
5	O. T (n=31)	2	1	10	2	15 (48.3)
6	Labour Room (n=13)	1	1	0	0	4 (30.7)
7	Laboratory (n=31)	0	0	19	4	21 (67.7)
	Total	16 (43.2)	88 (68.7)	36 (61.0)	32 (42.1)	172

## 4. Discussion

The main finding of this study was low sero-prevalence (1%) and high needle stick injury (57%) as occupational exposure, at a private tertiary care hospital, which continuously pose a threat to increase HCV spread among HCWs. Study hospital mainly deals with gynae and pediatric patients. All the pregnant women who came for delivery already screened for HBV and HCV infection during the ANC visits. Those women who were positive for HBV or HCV, must be labeled in their hospital records, which was available for all the relevant healthcare workers. Seeing patient records, all HCWs were vigilant while doing any intervention like intra-venous cannulation, injections, blood transfusion or any surgical procedure. Whereas Paediatric population may have less chance of HCV infection because of low prevalence of HCV in children as compare to adult population [16]. Furthermore, in children HCV may occur mainly through vertical transmission from their mother. A study reported that chance of vertical transmission from

mother to child was less than 5% [17].

The difference in low prevalence rate in this study and high prevalence in previously published studies from Pakistan were mainly from multiple possible reasons. Firstly, HCV prevalence survey among HCWs were mostly conducted in public sector tertiary care hospitals which reported the HCV prevalence from 3.2 % to 5.6% [18-22]. Whereas current study was conducted at a private tertiary care hospital, where standard practice of care was comparatively better. The main difference of care was the handling of the HCV risk factors at workplace differently at public and private hospitals. In study private hospital, the screening of HCV among admitted patients were mandatory before undergoing any invasive procedures (surgery or caesarean section delivery) or even during emergency caesarian section. Furthermore, before blood transfusion, all the donors or donated blood must be screened for HCV. These standard practices of care would alert the HCWs to take appropriate personal protective measures before handling the any HCV infected patients. Secondly, in Pakistan previous HCV prevalence surveys were mostly

conducted more than a decade ago. For instance, national hepatitis prevalence survey was carried out in 2008, and it reported prevalence of HCV was 4.8% in general population [14]. Only a single study conducted at tehsil headquarter hospital, Hasilpur in 2018, in last 5 years, which reported the HCV prevalence of 5.2%. [21]. With the passage of time awareness about HCV risk factors, transmission, diagnosis and treatment were raised, which impact on decrease transmission rate among HCWs. Thirdly, literatures revealed that there was the variation in the distribution of HCV within the different geographical regions of Pakistan. Rural area has more prevalence of HCV as compared to urban cities [13]. Similar finding to current study, was reported from PIMS hospital, Islamabad in 2010, which reported the low prevalence (1.6%) of HCV among HCWs which may be due to less work experience of HCWs (41% of HCWs had service length between 1-5 years) [23].

Nearly 80% of the hepatitis infections in health care workers are attributed to sharp injuries [24]. Current study reported the frequency of NSI (57%) among HCWs was lower than reported from the public sector tertiary care hospitals of Karachi (66%) [12]. This difference may be due to the shortage of HCWs in the facility, different work environment, training, availability of resources and use of personal protective equipment. Contrary to current study, the prevalence of needle-stick injuries was reported low (26.4%) by a study conducted at a tertiary care private hospital in Lahore. [11]. Efforts should be made to reduce the risk of occupational exposures (NSI) by enhancing the capacity of HCWs to follow the standard practice of care and universal precautions by introducing safer devices and techniques.

## 5. Limitation and Strength

Study sample was small due to single center study followed by only offered to those HCWs who did show willingness to participate. Strength of the study was all the identified RDT-HCV positive HCWs further evaluated and confirmed HCV diagnosis through GeneXpert by looking presence of HCV-RNA. All HCV positive HCWs were provided direct acting antiviral treatment free of cost.

## 6. Conclusion & Recommendation

This study reported the low sero-prevalence and high occupational exposure of needle stick injuries among HCWs. There is a need to raise HCWs awareness, effective implementation of infection control programs, adherence to universal precautions on safe practice, and proper training to reduce HCV infection among HCWs.

## Acronyms and Abbreviations

HCWs: Health Care Workers; HBV: Hepatitis B Virus; HCV: Hepatitis C Virus; RDT: Rapid Diagnostic Test; KGH: Kharadar General Hospital; RNA: Ribo-Nucleic Acid; WHO: World Health Organization; LMICs: Low- and Middle-

Income Countries, NSI: Needle Stick Injuries; PCR: Polymerase Chain Reaction; SPSS: Statistical Package for Social Science; ERC: Ethics Review Committee; N: Sample Size; ER: Emergency Room; OPD: Outpatient Department; NICU: Neonatal Intensive Care Unit; OT: Operation theater; ANC: Antenatal Care; PIMS: Pakistan Institute of Medical Sciences.

## Author's Contributions

MA: Designed the study, analyzed the data and wrote the manuscript.

TPS: Conceived, Responsible for data collection, result validation, & reporting.

MS: Organized field HCV testing and data collection, field editing, data cleaning.

KI: Designed flow chart, diagnostic algorithm, revised manuscript and final approval of the manuscript to be published.

## Competing Interests

The authors declared that they have no competing interests.

## Availability of Data and Supplemental Materials

The original data and supportive materials for the study are available from the corresponding author.

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