

# Seroprevalence and risk factors for hepatitis B and C among health care workers

**Manal M. Anwar<sup>1</sup>, Doaa M. Ahmed<sup>2</sup>, Mostafa S. Sheemy<sup>2</sup>, Mohamed T. El-Tayeb<sup>3</sup>**

<sup>1</sup>Department of Public Health and Community Medicine,  
Faculty of Medicine, Beni-Suef University- Beni-Suef, Egypt

<sup>2</sup>Department of Medical Microbiology and Immunology, Faculty of Medicine,  
Beni-Suef University- Beni-Suef, Egypt

<sup>3</sup>Department of Clinical Pathology, Faculty of Medicine,  
Beni-Suef University - Beni-Suef, Egypt

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## Abstract

Health care workers (HCWs) are at high risk of exposure to hepatitis B virus (HBV) and hepatitis C virus (HCV) transmission due to injuries and frequency of exposure. We aimed to assess HBV/HCV seroprevalence among nurses and housekeepers in Beni-Suef University Hospital, and to identify possible risk factors.

A cross sectional study was conducted from March to July 2016 using a self-administered questionnaire. A blood sample was withdrawn from each participant and tested for hepatitis B surface antigen (HBsAg) and HCV antibodies. Enzyme-linked immunosorbent assay (ELISA) seropositivity to HCV was confirmed by polymerase chain reaction (PCR).

The study involved 175/255 participants with a response rate of 68.5%. Nurses constituted 76% and 24% were housekeepers. Overall prevalence of HCV seropositivity was 4.6%, detected by ELISA. Confirmatory PCR testing revealed positivity in 75% (6/8) of these. Cut injuries were a risk factor for HCV positivity (OR 4.388, 95% CI 0.859 - 22.4, P= 0.05). Previous training and use of gloves was a protective factor (OR 0.135, 95% CI .016- 1.118, P= 0.03 and OR 0.241, 95% CI 0.055- 1.04, P= 0.04 respectively). None of the participants was found to be HBV seropositive.

## Corresponding Author

Manal M. Anwar,

Associate Professor

Public Health and Community Medicine Department; Faculty of Medicine, Beni-Suef University- Egypt

Mohamed Hassan Street, Beni-Suef, Egypt. 6251

M\_anwarabdo@yahoo.com

Practices and behaviours posing risk for HCWs included needle stick injury (NSI) and cut injuries. Focus on improving safety training programs to HCWs and provision of infection prevention equipment is needed. In addition regular reporting, follow up and assessment of occupational exposures should be in place.

**Keywords:** Healthcare providers; hepatitis B virus; hepatitis C virus; prevalence; risk factors; occupational exposure, Egypt

## Introduction

Health care workers (HCWs) are at risk of exposure to occupational blood borne pathogens hazards. Hepatitis B virus (HBV) and hepatitis C virus (HCV) transmission has been related to injuries and frequency of exposure among HCWs with 40% worldwide prevalence.<sup>1</sup> In developing countries; lack of post exposure prophylaxis awareness and non-strict implementation of standard precautions in addition to suboptimal documentation of exposure is prevalent.<sup>2</sup>

Chronic HBV/HCV infections are a major health concern due to both their prevalence and the associated morbidity and mortality.<sup>3–5</sup> The Egyptian Demographic Health Survey (EDHS) in 2008, on a large nationally representative sample, reported a 14.7% HCV prevalence among the 15–59 year age group.<sup>6</sup> Egypt has the highest HCV prevalence in the world.<sup>7–9</sup> Complications of HCV infection are among the leading public health challenges in Egypt.<sup>10</sup>

In a study among HCWs from a 25% random sample of different health care facilities from two Egyptian regions (Nile Delta and Upper Egypt), including 1485 HCWs, 529 (35.6%) were exposed to  $\geq$  one needlestick injury (NSI) in a three month period, with an estimated annual rate of 4.9 NSIs per worker. Two-handed recapping was the most common behaviour associated with NSIs, and 64% had unsafe disposal of needles in nonpuncture-proof containers. Only 15.8% of HCWs reported prior vaccination with three doses of hepatitis B vaccine. Vaccination coverage was highest among professional staff (38%) and lowest among housekeeping staff (3.5%).<sup>11</sup>

The objectives of this study were to assess seroprevalence of HBV and HCV among HCWs in Beni-Suef University Hospital, and to identify possible risk factors for their infection.

## Subjects and Methods

This was a cross sectional analytical observational study.

### Study methods

Data were collected from March to July 2016 using a self-administered questionnaire prepared in Arabic, previously tested by a pilot study during March 2016. It was tested on 30 nurses and 20 housekeepers working in Beni-Suef University Hospital to ensure the clarity and ease of understanding of the questions. It was addressed to 255 nurses and housekeepers. Participants were recruited from different hospital departments after a formal hospital administration approval.

### Blood sample testing

Under complete aseptic conditions a 5 ml of venous blood was withdrawn from each participant for detection of hepatitis B surface antigen (HBsAg) and anti-HCV antibodies. PCR was done for seropositive cases to confirm HCV.

### Questionnaire items included

- I. Personal information: age, residence, educational level, marital status and contact information.
- II. Profession characteristics: position, years in service, current work department, and change in department.
- III. Possible risk factors for exposure to infection in relation to occupation: frequency of conducted medical procedures, occupational behaviour (e.g. recapping of used needles, frequency of gloves use), frequency and circumstances of contact with blood and body fluids; use of personal protective equipment (e.g.: gloves, masks and eyeglasses), hepatitis B vaccination status, and previous training in infection prevention and control.

- IV. Possible risk factors for exposure to infection not related to occupation:  
e.g.: use of sharp objects or personal instruments.
- V. Medical history: history of previous surgery, blood transfusion and chronic diseases.

### Study procedure

Participants' data were kept confidential by a different study number, and were secured in electronic and physical filing systems. Participants' key record identification was made available only to the investigator responsible for results interpretation. A report of overall HBV/HCV infection prevalence rate was delivered to the hospital management to inform infection control authority.

Following HBV/HCV testing, participants were informed of their test results on an individual basis, electronically for negative results or strictly in-person for positive results. Those tested positive were advised to seek medical guidance for follow-up.

### Collection and processing of samples

For each study participant, 5 mL of venous blood was withdrawn by a trained nurse under strict aseptic technique. Each sample was centrifuged within six hours of collection and divided into four serum aliquots for storage at  $-80^{\circ}\text{C}$  for further testing. Serological testing for HBV and HCV antibodies was done. Third generation enzyme-linked immunosorbent assay (ELISA) testing (Prechek Bio Inc., Taiwan) was used to determine HBsAg and anti-HCV status. ELISA seropositivity to HCV was confirmed by polymerase chain reaction (PCR).

### Ethical considerations

To ensure privacy, dignity and integrity, the questionnaire was anonymous. The questionnaire included explanations about the purpose of the study, confirmation of confidentiality of data, and assurance that data will never be used for purposes other than scientific research. Participants were recruited from hospital departments after formal approval by hospital administration and the head of the infection-control unit. Informed consent was obtained from study participants.

### Statistical analysis

Qualitative data were presented as frequency distributions with percentages, while quantitative data

were presented as means and standard deviation. Odds ratios and 95% confidence limits were presented in addition to p-values for the Chi-square test. p-values of  $<0.05$  were considered as statistically significant. Analysis was performed using Statistical Package for Social Science (SPSS) version 19 (IBM, Armonk NY).

### Results

The study involved 175/255 participants with a response rate of 68.5%; 133 (76%) were nurses, and 42 (24%) housekeepers. Females constituted 87.4% compared to 12.6% male participants. Sixty-two percent of the participants were between  $20 \leq 30$  years; 56% held a secondary degree, while 22.8% were university/college graduates. Employment by their current hospital for  $< 10$  years was reported by 77.1%. None of the participants was found to be HBV seropositive. Only eight HCWs were found to be HCV seropositive by ELISA, among whom six were confirmed positive by PCR.

There was a statistically significant difference in age group between HCV seropositive and seronegative HCWs ( $p=0.001$ ). Among the positive HCWs seven were females and one was male (OR 0.993, 95% CI 0.116 - 8.481,  $p=0.995$ ), and three were nurses and five were housekeepers (OR 0.171, 95% CI 0.039 - 0.748,  $p=0.009$ ) (Table I).

Risk factors among the studied population showed that cut injuries were a risk factor associated with positive HCV status (OR 4.388, 95% CI 0.859 - 22.4,  $p=0.05$ ). Previous training and using of gloves were both protective factors (OR 0.135, 95% CI 0.016-1.118,  $p=0.03$ ; and OR 0.241, 95% CI 0.055-1.04,  $p=0.04$ , respectively) (Table II).

### Discussion

In the current study, the prevalence of HCV infection among HCWs was 4.6%, similar to the 5% HCV prevalence reported in Georgia among 1600 HCWs<sup>12</sup> and higher than those reported by similar studies conducted in developed as well as developing countries<sup>13-18</sup> which range from 0.6%-3%. This may reflect inadequate adherence of the current study's HCWs to infection control standards. Age groups of  $20 \leq 30$  and  $> 40 \leq 50$  years had the highest prevalence of infection, which was similar to Khan *et al.*<sup>14</sup> but not to others.<sup>20-22</sup>

**Table I. Demographic profile and HCV serological marker of the health care workers**

Characteristic	HCV antibody by "ELISA"				Chi Square	P value	OR (CI)	
	-ve		+ve					
	No.	%	No.	%				
Age	20-≤ 30 years	106	63.5%	3	37.5%	27.6	0.001	-
	> 30-≤ 40 years	45	26.6%	1	12.5%			
	>40-≤ 50 years	16	9.6%	3	37.5%			
	>50 years	0	0%	1	12.5%			
Sex	Male	21	12.6%	1	12.5%	0.800	0.99	0.993 (0.116 - 8.481)
	Female	146	87.4%	7	87.5%			
Residency	Rural	77	46.1%	5	62.5%	0.82	0.36	1.948 (0.45-8.41)
	Urban	90	53.9%	3	37.5%			
Marital status	Single	38	22.8%	0	0%	2.92	0.40	-
	Married	122	73.1%	8	100%			
	Separated	6	3.6%	0	0%			
	widowed	1	0.6%	0	0%			
Educational Level	Illiterate	20	12%	4	50%	10.6	0.06	-
	Primary	4	2.4%	0	0%			
	Preparatory	6	3.6%	0	0%			
	Secondary	94	56.3%	4	50%			
	University	40	24%	0	0%			
	Master degree	3	1.8%	0	0%			
Years in service	< 10 years	129	77.2%	6	75%	0.34	0.84	-
	10-20 years	33	19.8%	2	25%			
	20+ years	5	3.0%	0	0%			
Job	Staff Nurse	133	76%	3	37.5	6.88	0.009	0.171 (0.039- 0.748)
	Housekeeper	42	24%	5	62.5%			

-ve= Negative , +ve= Positive , OR= Odds Ratio , CI = Confidence Interval

There was statistically significant association between HCV seropositivity and cut injury ( $p=0.05$ ), deficient usage of gloves ( $p= 0.02$ ) and lack of previous training in infection prevention and control ( $p=0.03$ ). This study revealed that occupational cut injury occurred in 75% of HCWs. This is higher than similar studies in the University Hospital of the West Indies and Georgia (occupational cut injury prevalences of 43.5%<sup>22</sup> and 38%<sup>12</sup> respectively), and is higher than that reported from eight major health facilities in Kampala, Uganda<sup>23</sup>

and in a tertiary care academic health organization of North India<sup>24</sup> (prevalence of 17% and 9.9% respectively). This finding could be attributed to the fact that being a tertiary care hospital there is a high workload. Other possible explanations include a shortage in nurses' number, lack of specific program measures to address occupational challenges such as reassembling and handing devices to a workmate, lack of safer sharp devices, lack of information and suboptimal standard precaution compliance.

**Table II. Risk factors for HCV infection among health care workers**

Risk Factors	HCV antibody by "ELISA"					P value	OR	CI
	-ve		+ve					
	No.	%	No.	%				
Needle stick injury	Yes	112	67.9%	5	62.5%	0.78	0.789	0.182 - 3.42
	No	53	32.1%	3	37.5%			
Cut injury	Yes	67	40.6%	6	75%	0.05	4.388	0.859 - 22.4
	No	98	59.4%	2	25%			
Use gloves	Sufficient	77	46.1%	5	62.5%	0.82	0.36	0.055 - 1.04
	Not sufficient	90	53.9%	3	37.5%			
Trained in infection prevention	Yes	85	50.9%	1	12.5%	0.03	0.135	0.016 - 1.118
	No	82	49.1%	7	87.5%			
Taking medications by injection constantly	Yes	28	17%	3	37.5%	0.139	2.936	0.663 - 12.999
	No	137	83%	5	62.5%			
Take blood transfusion	Yes	5	3%	1	12.5%	0.15	4.571	0.469 - 44.53
	No	160	97%	7	87.5%			
Operation	Yes	81	49.1%	5	62.5%	0.45	1.728	0.400 - 7.469
	No	84	50.9%	3	37.5%			
Sutures for injuries	Yes	75	45.5%	5	62.5%	0.35	2.00	0.4630 - 8.645
	No	90	54.5%	3	37.5%			
Tattooing	Yes	7	4.2%	0	0%	0.55	1.051	1.015 - 1.087
	No	158	95.8%	8	100%			
Using the same razor that others use	Yes	1	0.6%	0	0%	0.82	1.049	1.015 - 1.084
	No	164	99.4%	8	100%			
Using the barber's razor tools	Yes	10	6.1%	0	0%	0.47	1.052	1.016 - 1.089
	No	155	93.9%	8	100%			
Sharing your family using the same scissors to cut your nails	Yes	115	69.7%	6	75%	0.74	1.304	0.254 - 6.686
	No	50	30.3%	2	25%			
Dealing with anyone infected with HCV	Yes	108	65.5%	3	37.5%	0.107	0.317	0.073 - 1.373
	No	57	34.5%	5	62.5%			
Positive HCV infection for a family members	Yes	44	26.7%	1	12.5%	0.37	0.393	0.047 - 3.284
	No	121	73.3%	7	87.5%			
Previous serological testing for HCV	Yes	35	21.2%	1	12.5%	0.55	0.531	0.063 - 4.457
	No	130	78.8%	7	87.5%			

-ve= Negative , +ve= Positive , CI = Confidence Interval



The percentage of HCWs always using gloves during medical procedures was 37.5%. This is consistent with result from another study which reported 32% proportion of HCWs that always use gloves during medical procedures.<sup>12</sup>

Current participants' infection control training was only reported by 12.5%, which is lower than that reported in India (36%).<sup>25</sup> In spite of the fact that training was not proven to be protective against occupational exposure, continuous effective training is encouraged to improve infection prevention.<sup>26-29</sup>

Practices and behaviours that pose a risk for HCWs include cut injuries, deficient use of gloves and lack of training in infection prevention and control in Beni-Suef University Hospital. This necessitates raising HCWs awareness, effective implementation of regular infection control programs, adherence to universal precautions, and proper training in order to reduce HCV infection.

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