

# Prevalence of Hepatitis C Antibodies among Health Care Workers at Benha Hospitals, Egypt

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## Abstract:

**Background :** HCV-infection is the main cause of chronic liver disease among Egyptians, the most commonly infected population with HCV genotype 4. The great risk of exposure to infection of health care workers (HCWs) has highlighted the urgent need for implementing an infection control program. Therefore, healthcare workers (HCWs) are the target population of the current study. **Aim:** The study evaluated the prevalence of viral hepatitis C (HCV) infection among healthcare workers (HCWs) in Benha University hospital and Benha Teaching Hospital. **Material and methods:** one thousand (1000) health care workers were included in the study at Benha University hospital and Benha Teaching Hospital, including 256 resident physicians, 644 nurses and 100 workers. HCV Ab in serum was detected by Enzyme Linked Immunosorbent Assay kits. **Result:** The result of this study showed that, out of 1000 studied HCWs, 90 cases (9%) were positive for hepatitis C antibody (HCV Ab). 53.70% of all (HCWs) exposed to needle sticks injury (NSI). **Conclusion:** These findings can be used to shape future HCV prevention policies in Egypt.

**Keywords:** hepatitis C. Benha hospitals, healthcare workers.

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## Introduction

Over 150 million people are infected with hepatitis C virus (HCV) worldwide (1). Egypt has the highest HCV seroprevalence, estimated at 14.7% in a study using a nationwide representative sample of the population aged

15–59 years (2,3). The origin of the epidemic is believed to be related to mass anti schistosomal parenteral treatment campaigns conducted in the 1960s–80s using insufficiently sterilized injection material (4).

Evidence of ongoing transmission of HCV that is associated with health-care settings has consistently accumulated over recent years (5,6). Therefore, healthcare workers (HCWs) in Egypt are at particular risk of HCV infection and other blood borne pathogens (7), with an estimated annual number of needle stick injuries of 4.9 per HCW (8), a high reservoir of HCV infection in the patient population and an estimated 66% of HCV infections being attributed to occupational exposures (9).

Egypt has been considered one of the most endemic countries for HCV infection. So, healthcare professionals who work in close contact with patients in Egypt are at increased risk of HCV infection and other blood borne pathogens (7), with an estimated annual number of 4.9 needle sticks per HCW (8). HCV infection may be presented either in acute form tending to be asymptomatic or chronic form. Progression to persistent or chronic infection occurred in about three quarters of cases with variable rates of the fibrosis progression (7).

Globally, two million health care workers suffer from accidental needle stick injury each year (8). In UK, a study showed that 37% needle stick injuries reported at some stage during their career. In Nepal a survey reported that needle stick injury among health care workers was 70.3% (10). In developing countries, where the prevalence of HIV infection is the highest in the world, the number

of needle stick injuries is also the highest. Additionally, African health care workers suffer an average of two to four needle stick injuries per year and physicians are much less likely to report a needle stick injury than other healthcare professionals (11).

Health care workers (HCWs) represent a high risk population for sharps injuries, needles, and scalpels during the execution of their health care duties. In addition, HCW's mucosa may be exposed to droplets or splashes of blood, saliva, and urine. These occupational exposure accidents carry an estimated risk of 2% HCV transmission (3,4). World Health Organization (WHO) estimates that each year more than 3 million health workers hurt themselves with an object/edge definitely contaminated with at least one HIV (~170,000 exposures), hepatitis B (~2,000,000 exposures), and hepatitis C (~900,000 exposures). As there is no available vaccination for HCV up till now, the use of standard precautions coupled with strict adherence to post-exposure prophylactic measures to HCV are the available measures for prevention (12).

This work aimed to study prevalence of HCV among health care personals at Benha University hospital and Benha Teaching Hospital. The study extended to cover acquisition of HCV infection in association with specific risk factors and employment duration.

## Subjects and Methods

This is a cross-sectional study was performed on one thousand (1000) health care workers at Benha University hospital and Benha Teaching Hospital during the period between February 2017 and August 2017. Informed written consent was obtained from all participants and this study was approved by Research Ethics committee.

Participants were selected by using simple random sampling technique from each department based on proportion until the required sample size obtained. Study population were subjected to: 1) Full history taking with special emphasis on

HCV risk factors at hospitals such as: needle stick injury, incidental blood exposure, body fluid splash, as well as, shared nail clipper,

tattoo, house hold contacts with HCV and visiting dental clinics. 2) Thorough clinical examination. 3) Laboratory investigations including: liver biochemical profile: (ALT,). Anti-HCV was detected by Enzyme Linked Immunosorbent Assay by (Prechek Bio, Inc) (USA).

Statistical analysis: Data were analysis using SPSS software version 22. P value was considered significant at  $\leq 0.05$ .

Results:

### Socio demographic characteristics of study participants:

In this study, among the 1000 study participants, 18% were males and 82% were females, 64.4 % nurses, 25.6% physicians and 10% workers, with age range (19-55) and employment duration from 2 months to 38 years, table 1.

Table 1: Distribution of sociodemographic characteristics of healthcare workers at Benha Hospitals

	Number	Percentage %
<b>Sex</b>		
Male	180	18.0
Female	820	82.0
<b>Age</b>		
mean $\pm$ SD (range)	33.64 $\pm$ 8.57 (19-55)	
<b>Occupation</b>		
Physician	256	25.6
Nurses	644	64.4
Workers	100	10.0
<b>Employment duration</b>		
mean $\pm$ SD /y(range)	11.84 $\pm$ 8.94 (2m-38y)	

### Risk factors associated with HCV seropositivity

Incidence of positive cases among our HCWs was (9.0%). 53.7% of HCWs were exposed to needle stick injury and 46.3% not exposed to needle stick injury.

There was a highly statistically significant increase in percentage of nurses who exposed to needle stick injury compared to non-exposed to NSI, also the same in workers. But in physicians, there was a highly statistically significant increase in percentage of non-exposed to NSI compared to who exposed to NSI. Highly statistically significant increase in percentage of who exposed to NSI was found among workers comparing to physicians and nurses, table2.

There was a highly statistically significant increase in the incidence of NSI for HCWs compared to increase of employment duration.

There was a highly statistically significant increase in percentage of HCV Ab positive in workers comparing to physicians and nurses. There was a highly statistically significant increase in negative HCV Ab physicians than positive. According to nurses and workers also there was a highly statistically significant increase in negative HCV Ab than positive.

There was a highly statistically significant increase in percentage of HCV Ab positive HCWs who exposed to NSI compared to non-exposed to NSI.

There was a highly statistically significant increase in positive HCV Ab HCWs compared to increase of employment duration.

**Table2: Prevalence of percent positive anti-HCV antibody responses in all study groups**

HCV Ab Occupation	Positive (90)	Negative (910)	Z test	P value
Physicians (256)	2 (0.8%)	254 (99.2%)	11.23	<0.001**
Nurses (644)	62 (9.6%)	582 (90.4%)	15.94	<0.001**
Workers (100)	26 (26.0%)	74 (74.0%)	4.33	<0.001**

$X^2 = 56.8$

$P < 0.001$  \*\* = highly statistically significant

**Prevalence of HCV marker and ALT results**

There was a highly statistically significant increase in percentage of positive HCV Ab HCWs with elevated ALT comparing to negative HCV Ab.

Out of 1000 cases 20 cases were belonging to Sterilization department which represent 2% of all cases, out of these participants 6 cases were HCV Ab positive which represent 30% of Sterilization department participants and these represent 6.7% of all positive cases. 44 participants from dialysis unit which represent

4.4 % of all participants, 10 cases were positive which represent 22.73% of participant of this department. Out of 90 positive cases also 10 cases from emergency department those represent 17.24% of emergency department participants.

ALT is the main predictor for HCV Ab positive than other factors.

ALT sensitivity for HCV is 35.6% (false negative= 64.4%), specificity is 99.8% (false positive=0.2%), with diagnostic accuracy= 94%, table 3.

Table 3: Validity of ALT in prediction of positive HCV Ab.

ALT level	HCV Ab	Positive (90)	Negative	FET	P value
Elevated ALT ( $\geq 45$ IU/L)		32 (35.6%)	2 (0.2%)	300.7	<0.001**
Normal ALT (<45 IU/L)		58(64.4%)	908 (99.8%)		
AUC		0.98			
Cutoff point		45.0			
Sensitivity		35.6			
Specificity		99.8			
PPV		94.1			
NPV		94.0			
Accuracy		94.0			

AUC= area under the curve PPV= positive prediction value

NPV= negative prediction value P<0.001\*\*= highly statistically significant

## Discussion

In the hospital environment, there is a high risk of contact with biological agents and everyday contact with blood, biological fluids and potentially contaminated surgical or medical instruments (13).

The current study was conducted on 1000 of the health care workers at Benha University hospital and Benha Teaching Hospital ,256 were physicians, 644 were nurses and 100 were workers in 31 different department in hospitals.

According to the study conducted within this research, it was found that out of 1000 studied health staff 90 cases were HCV Ab positive which represent (9%).

A study carried out in 2018 in Alexandria university Hospital on HCWs founded that the prevalence of HCV Ab was 8.6% (14) , another study which conducted on 1770 HCWs in Egypt was 8% (15). Also, a study found the same prevalence in Ain Shams University Hospitals HCWs which were 8% (16).

In the other hand anti-HCV-positive was lower prevalence in other studies, among 194 HCWs anti HCV was positive in 5.2% of HCWs in Asuit General Surgery Department (17).

In Damascus Hospital all samples tested negative for anti-HCV antibodies (18) and 0%

prevalence among HCWs of the Najran region, Southwestern Saudi Arabia (19).

The overall prevalence of HCV infection was higher in study at Al-Azhar University Hospitals

which was 21.34% (20). A study carried out among Egyptian HCWs at a national liver disease referral center detected a prevalence of HCV-Ab to be 16.6% and 34.8% among HCWs at Zagazig University Hospitals (15).

As per this study 53.70% of all health care workers exposed to needle sticks injury (NSI) and 80% of HCV positive cases exposed to NSI.

Another study founded that out of 1010 participants, 580 (57.42%) showed a positive history of NSI (21), in tertiary care hospital in Delhi, 79.5% of the workers having received NSI in their career (22).

Prevalence of NSI in various countries was in Malawi (30.3%), Nigeria (23.1%), and India (30.1%) and lower than the studies done in Egypt (62.3%), Sarajevo, Bosnia and Herzegovina (61.1%), and Saudi Arabia (50.9%), (55.5% in Thailand, 57% in England, and 72.4% in Canada (23).

The exposure to (NSI) was lower than this study in other study in a teaching hospital in India which was around 10.81% (24). In Iran the prevalence of (NSI) ranged from 10.0% to 84.29% (25).

This difference may be due to the number of HCWs in the facility, different work environment, training, culture, availability of resources and uses of protective equipment.

Thus, efforts should be made to reduce the risk of occupational exposures by enhancing the HCWs' adherence to universal precautions and by introducing safer devices and techniques.

The results of this study indicate that the incidence of (NSI) among workers (74%) was more than the incidence of (NSI) among nurses (61.02%) was higher than that among doctors (27.34%).

A study found that the highest number of exposures to NSI is in dialysis work (26).

Another study indicate the incidence of (NSI) among nurses was (31.2%) which less than this study but also was higher than that among doctors (19.9%) (27). Also most NSI being reported among the nursing staff, 54%, followed by doctors (40%) (28).

As reported in other study NSI prevalence in nurses versus physician was (43% vs 16%), nurses versus health officer was (43% vs 16.7%), nurses versus laboratory was (43% vs 11.1%) (35). In Saudi Arabia, the nurses were commonly injured (NSI) group with which constituted 65.8%, but the incidence of physicians were 19.2% (29).

In developed countries like USA and UK, incidence of needle stick injury in nurses is respectively 16.3% & 48% (30).

Physicians also reported less occupational exposures to (NSI) than nurses and workers probably because they believe that they can estimate the transmission risk for infection themselves before they decide to report it (31).

In other study, doctors constituted the largest number (351 [73.7%]) of the reported incidents followed by nurses (19.1%) and these data correspond with several reports from India. However, other studies from India, Saudi Arabia, Ireland and the USA reported NSI being less frequent (19.2–28.5%) among doctors than nurses (32).

Most frequently, nurses and medical technicians have reported occupational exposures. This can be explained by the fact that this group of hospital workers is most frequently in contact with patients and uses objects during the medical treatment (31). Insufficient level of knowledge and the risks after exposure was observed expectedly more in hospital waste disposal staff as compared to physicians and nurses (32).

In this study, increasing employment duration was highly significant increasing the incidence of NSI.

A study in Ethiopia showed that participants with working experience of more than 10 years had higher rate of NSIs (which may help in transmission of infection) compared with those having less than 5 years of experience (33).

In against, as per other Study more than one-third of the NSIs were seen in less working staff (32). Other study also found the group which was not experienced NSIs had a higher mean year of working experience (34).

In our study the prevalence of HCV Ab has highly significant difference ( $P < 0.001$ ) according to sex which was higher in male, with the prevalence of (13.9%) of all male participants (25 out of 180) while prevalence of positive females was (7.9%) (65 out of 820).

In the current study, with respect to the occupation differences, it was found that HCV positive workers had the highest prevalence among different job categories (26/100, 26%) followed by nurses (62/644, 9.63%) then physicians had prevalence about 0.78%.

This is in agree with other study which found that workers had the highest frequency of infection (51.1%), followed by nurses and technicians (32%) and lastly physicians (14.3%) (17) and other study said the prevalence of positive cases of workers was 16.5%, positive cases in nurse was 5.3% and in physicians was 2.5% (16).

The pre-service education of safe health care and prevention of blood-borne pathogen carried out targeting HCWs, may provide the explanation for the higher anti-HCV prevalence in workers in our study compared with nurses and physicians. This explanation may be

supported by the fact that anti-HCV was more prevalent in, HCWs with poor educational level and not usually involved in the pre-service education programs of safe health care.

Seroprevalence of HCV Ab among HCWs according to needle-stick injuries, was found to be (80%) of HCV Ab positive with history of NSI.

Occupational injuries with a needle or other sharps are common among health-care professionals. These injuries increase the risk of developing many blood-borne infectious diseases (32).

This is in agreement with other study which founded nearly 80% of the hepatitis infections in health workers are attributed to sharp injuries (35). In other study NSI among HCWs accounts for almost 40% of the HCV infections. The prevalence of HCV Ab positive increase with who had history of NSI (36).

HCV prevalence due to NSIs was lower in other studies as the risk of infections ranges from 3–10% (32) and 1.8% (26).

The multiplicity of risk factors related to their work at hospital that added to other risk factors outside the hospital might play a key role in the increased infection transmission as reported by (36).

It is difficult to establish whether the HCWs in the current study became positive by occupational exposure while being employed at

the hospital or not since there was no regular screening for HCV.

The distribution of cases according to duration of exposure to risk factors (Employment duration) was found to be at mean duration of  $11.84 \pm 8.94$  years of occupation. Positive cases had duration exposure of  $24.32 \pm 6.24$  years. Increasing employment duration is highly significant in positive HCV Ab cases.

This result was supported by a study which found that the infected individuals had significantly longer working experiences ( $14.4 \pm 9.1$  years) than non-infected individuals ( $8.2 \pm 7.3$ ) (17).

This was suggested by that with the increasing experience that results from the years of work in a hospital, HCWs usually perform tasks of greater risk. This may contribute to greater exposure for work accidents. In addition, the risk of work accidents increases with additional year in the job.

In addition, HCV Ab positive cases associated with elevated ALT were 32 cases (35.6%) in the present study, as Positive HCV Ab cases had high significantly higher levels of ALT than negative HCV Ab cases.

Another study reported that the evaluation of ALT levels in 107 of the samples showed that six (35%) of 17 samples were HCV RNA

positive with elevated ALT (37). Other study showed a significant difference in anti-HCV

prevalence according to ALT activity. Patients with elevated ALT had a 3.8 times higher prevalence than those with normal ALT, so ALT seems to be an appropriate warning sign of HCV infection (38).

ALT is a predictor for HCV infection but should not use alone because it may be elevated in other liver diseases, also not all HCV positive cases have elevated level of ALT.

The risk of infection by HCV in occupationally exposed HCWs is a problem of considerable attract. There is a high risk of contact with biological agents in the hospital environment. This is due to everyday contact with blood, biological fluids and potentially contaminated surgical or medical instruments as well as high prevalence of HCV by community acquired infection.

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## References

1. Hepatitis C. Fact sheet No. 164 [Internet]. World Health Organization. July 2013. (<http://www.who.int/mediacentre/factsheets/fs164/en/>, accessed 2 February 2015).
2. El-Zanaty F, Way A. Egypt Demographic and Health Survey 2008. Cairo: Ministry of Health, El-Zanaty and Associates, and Macro International; 2009.
3. Guerra J, Garenne M, Mohamed MK, Fontanet A. HCV burden of infection in Egypt: results from a nationwide survey. *J Viral Hepat.* 2012 Aug;19(8):560–7. Epub 2012 Feb 6 PMID:22762140
4. Frank C, Mohamed MK, Strickland GT, Lavanchy D, Arthur RR, Magder LS, et al. The role of parenteral antischistosomal therapy in the spread of hepatitis C

- virus in Egypt. *Lancet*. 2000 Mar 11;355(9207):887–91. PMID:10752705
5. Mohamoud YA, Mumtaz GR, Riome S, Miller D, Abu-Raddad LJ. The epidemiology of hepatitis C virus in Egypt: a systematic review and data synthesis. *BMC Infect Dis*. 2013;13:288. PMID:23799878
6. Mohsen A, Bernier A, LeFouler L, Delarocque-Astagneau E, El-Daly M, El-Kafrawy S et al. Hepatitis C virus acquisition among Egyptians: analysis of a 10-year surveillance of acute hepatitis C. *Trop Med Int Health*. 2015 Jan;20(1):89–97. PMID:25336067
7. Lee R. Occupational transmission of bloodborne diseases to healthcare workers in developing countries: meeting the challenges. *J Hosp Infect*. 2009 Aug;72(4):285–91. PMID:19443081
8. Talaat M, Kandeel A, El-Shoubary W, Bodenschatz C, Khairy I, Oun S, et al. Occupational exposure to needlestick injuries and hepatitis B vaccination coverage among health care workers in Egypt. *Am J Infect Control*. 2003 Dec;31(8):469–74. PMID:14647109
9. Pruss-Ustun A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med*. 2005 Dec;48(6):482–90. PMID:16299710
10. Singh B, Paudel B, Kc S. Knowledge and practice of health care workers regarding needle stick injuries in a tertiary care center of Nepal. *Kathmandu Univ Med J*. 2015;51(3):230–3.
11. Adejumo PO, Olatunji BT. Exposure to work-related sharp injuries among nurses in Nigeria. *J Nurs Educ Pract*. 2014;4(1):229. <https://doi.org/10.5430/jnep.v4n1p229>.
12. WHO, Healthcare worker safety. [Cited 2016 November 11]. Available from: [http://www.who.int/injection\\_safety/toolbox/en/AM\\_HCW\\_Safety\\_EN.pdf](http://www.who.int/injection_safety/toolbox/en/AM_HCW_Safety_EN.pdf). Accessed January 19, 2017.
13. Mauss, Berg, Rockstroh, Sarrazin, Wedemeyer (2017): *Hepatology 8th Edition, A clinical textbook, Hepatitis C: diagnostic tests*, page 106.
14. Seida Y., Moemen M., Moustafa M., Raouf M., Elshaer N. (2018): Hepatitis-C virus infection and exposure to blood and body fluids among nurses and paramedical personnel at the Alexandria university hospitals, Egypt, *Alexandria Journal of Medicine* 54 265–271.
15. El-Sokkary, R. H., Tash, R. M. E., Meawed, T. E., El Seifi, O. S., & Mortada, E. M. (2017). Detection of hepatitis C virus (HCV) among health care providers in an Egyptian university hospital: different diagnostic modalities. *Infection and Drug Resistance*, 10, 357–364.
16. Okasha O., Munier A., Delarocque E., El Houssinie M., Rafik M., Bassim H., Abdel Hamid M., Mohamed M.K. and Fontanet A. (2015): Hepatitis C virus infection and risk factors in health-care workers at Ain Shams University Hospitals, Cairo, Egypt, *EMHJ*, Volume 21 No. 3.
17. Zayet HH., Ezz El-Din AM., Ahmed SM. and El-Khayat MR. (2015): hepatitis B and C virus infection among health care workers in general surgery department, Assiut university hospitals..
18. Alhamoudia H., Nawras Alhalabia Mouhammed Zeina N. azir Ibrahim B. 2018: Hepatitis C virus antibodies are absent among high risk group of health care workers in Damascus Hospital, *Arab Journal of Gastroenterology*, Volume 19, Issue 2, June, Pages 80-83.
19. Alqahtani J. M., Abu-Eshy S. A., Mahfouz A. A., El-Mekki A. A., and Asaad A. M. (2014): “Seroprevalence of hepatitis B and C virus infections among health students and health care workers in the Najran region, southwestern Saudi Arabia: The need for national guidelines for health students,” *BMC Public Health*, vol. 14, no. 1, p. 577.
20. Abd Alla M., El-Dessouky Y., Abdel-Hamid M. And Zain El-Deen A. (2017): prevalence of hcv infection among health care employee at Al Azhar university hospitals in Cairo, Egypt. *Journal of the Egyptian Society of Parasitology*, December 2017 *J. Egypt. Soc. Parasitol. (JESP)*, 47(3), Volume 47, No. 3: p 459 – 466.
21. Joukar F., Ghanaei F., and Asgharnezhad M. (2018): Needlestick Injuries among Healthcare Workers: Why They Do Not Report their Incidence? *Iranian Journal of Nursing and Midwifery Research*, 23(5): 382-387.
22. Sharma, R., Rasania, S., Verma, A., & Singh, S. (2010): Study of Prevalence and Response to Needle Stick Injuries among Health Care Workers in a Tertiary Care Hospital in Delhi, India. *Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine*, 35(1), 74–77. doi:10.4103/0970-0218.62565
23. Adib-Hajbaghery M, Lotfi MS. (2013): Behavior of healthcare workers after injuries from sharp

instruments. *Trauma Mon.* ;18(2):75–80. doi: 10.5812/traumamon.12779.

**24** Sriram (2019): Study of needle stick injuries among healthcare providers: Evidence from a teaching hospital in India, *Journal of Family Medicine and Primary Care*, Volume 8: Issue 2

**25** Fereidouni, Morandini M., Dehghan A., Jamshidi N., Kalyani M. (2018): The Prevalence of Needlestick Injuries and Exposure to Blood and Body Fluids Among Iranian Healthcare Workers: A Systematic Review, *Int J Med Rev* ;5(1):35-40.

**26** Westermann C., Peters C., Lisiak B. (2015): The prevalence of hepatitis C among healthcare workers: a systematic review and meta-analysis, *Occup. Environ Med*; 72:880–888.

**27** Cui Z., Zhu J., Zhang X., Wang B. and Li Z. (2018): Sharp injuries: a cross-sectional study among health care workers in a provincial teaching hospital in China, *Environmental Health and Preventive Medicine* 23:2.

**28** Ghauri AJ, Amissah-Arthur KN, Rashid A, Mushtaq B, Nessim M, Elsherbiny S. (2011): Sharps injuries in ophthalmic practice. *Eye (Lond)*; 25:443–8.

**29** Jahan (2010): Epidemiology of needlestick injuries among health care workers in a secondary care hospital in Saudi Arabia, *Ann Saudi Med* 25 (3).

**30** Goniewicz M., Wloszczak-Szubzda A., Niemcewicz M., Witt M., Marciniak-Niemcewicz, A., (2012): Injuries caused by sharp instruments among healthcare workers--international and Po-lish perspectives. *Ann. Agric. Environ. Med.* 19: 523-7.

**31** Serdar T., Đerek L., Unić A., Marijančević D., Marković D. (2013): occupational exposures in healthcare workers in university hospital Dubrava – 10year follow-up study, *Cent Eur J Public Health* 2013; 21 (3): 150–154.

**32** Goel, Dinesh Kumar, Raghavendra Lingaiah, Sarman Singh (2017): Occurrence of needlestick and injuries among health-care workers of a tertiary care teaching hospital in North India, volume 9, issue 1, Page : 20-25.

**33** WHO, (2017): World Health Organization classification of health workforce statistics, Mapping occupations to the international standard classification.

**34** Priyangani y., Dharmaratne G. & Sridharan S. (2017): Factors Associated and Response to Needle Stick Injuries among Nursing Officers in District General Hospitals of Sri Lanka, *Global Journal of Health Science*; Vol. 9, No. 8.

**35** Gorar, Z. A., Butt, Z. A., & Aziz, I. (2014): Risk factors for bloodborne viral hepatitis in healthcare workers of Pakistan: a population based case-control study. *BMJ open*, 4(7), e004767. doi:10.1136/bmjopen-2013-004767

**36** Uddin, M., Islam, M., Hossain, M., Sarker, M., Salimullah, A., Begum, F., Ahmed, D., Alam, A., Roy, P., & Raihan, A. (2009). Seroprevalence of Hepatitis C Virus among Health Care Workers. *Journal of Dhaka Medical College*, 18(1), 70-74.

**37** Allain, Patrick J. Coghlan, Kenneth G. Kenrick, Kenneth Whitson, Anthony Keller, Gregory J. Cooper, David S. Vallari, Stephen R. Delaney, and Mary C. Kuhns 1991: Prediction of Hepatitis C Virus Infectivity in Seropositive Australian Blood Donors by Supplemental Immunoassays and Detection of Viral RNA, *Blood*, Vol78, No 9 (November 1): pp 2462-2468.

**38** Urbánek P., Kristian P., Makara M., Hunyady B., Tomaszewicz K. (2016): Epidemiology of HCV infection in the Central European region, *Clin Exp HEPATOL* ; 2, 1: 2–6

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