Egyptian Journal of Community Medicine

Hepatitis C Infection among Health Care Workers Screened by OraQuick Test in Asyut Governorate

Heba Gaafar Ali Omar[1] , Mohammad Hasan Qayed[1,] Ekram Mohamed Abdel Khalek[1,] Asmaa Mohamed Ahmed Soliman

[1]Public Health and Community Medicine, Faculty of Medicine, Assiut University.

Submission Date:
20-07-2021

Revision Date:
01-09-2021

Acceptance Date:
01-09-2021

Key Words:
Healthcare workers,
Hepatitis C,
Screening,
Risk Factors

A B S T R A C T

Background: Healthcare workers (HCWs) are at greater risk for infection by blood-borne pathogens, such as hepatitis B and C and human immunodeficiency viruses. Occupational exposure to needle stick injuries (NSIs) and blood and other body fluids (BBF) remained the main health problem in developing countries. **Objectives:** This study aimed to determine the prevalence and associated risk factors of hepatitis C virus (HCV) infection in HCWs in Asyut Governorate and treatment outcomes among true positive cases. **Methods:** A cross-sectional study was carried out among HCWs at the central office of Asyut Health Directorate, Abu-teeg, Al-Qusiyah, and Abnoub district hospitals. This study was done before national HCV screening initiative in Egypt. The study sites were randomly recruited from all eligible sites. Data were collected using a semi structured questionnaire. The questionnaire included inquiries about sociodemographic status and risk factors for HCV transmission, such as exposure to NSIs and BBF. **Results:** The prevalence of hepatitis C infection among HCWs in Asyut Governorate was 6.3% by polymerase chain reaction test. The important risk factors for HCV positivity included exposure to NSIs and BBFs. **Conclusion**: The HCV infection prevalence among HCWs is high, and significant predictors of HCV infection among HCWs include exposure to NSIs and BBFs and absence of training regarding infection control measures. Therefore, health education and training programs are regularly recommended for all HCWs regarding occupational exposure to NSIs and BBFs.

INTRODUCTION:

Globally, 71 million people have chronic hepatitis C virus (HCV) infection according to the World Health Organization (WHO) assessment[1], which mostly progress to cirrhosis or liver cancer.[2] According to the Centers for Disease Control and Prevention (CDC), approximately 60–70 out of 100 persons infected with HCV develop chronic liver disease, 5–20 will progress to cirrhosis within 20–30 years, and 1–5 will die from cirrhosis or hepatocellular carcinoma complications.[3] Over the past several years, Egypt remains to have a high prevalence of HCV, with an average prevalence of 10%, but the situation changed after the national screening program. Most HCV transmission modes in Egypt are caused by injections and medical procedures. Healthcare workers (HCWs) include a wide variety of professions and occupations,

Corresponding Author: Heba Gaafar Ali Omar, Department of Public Health and Community Medicine, Faculty of Medicine, Assiut University, Egypt. Email: heba_gaafar@aun.edu.eg DOI: 10.21608/ejcm.2021.86749.1184

delivering some type of healthcare services, including direct care practitioners as nurses and physicians, as was well as allied health professionals, such as laboratory technicians, dieticians, and social workers. They work in many locations, as in hospitals, healthcare centers, and other service delivery points, as well as in academic research, training, and administration.[4]

HCWs are considered a high-risk group for sharp injuries, scalpels, and needles while performing their daily health care duties. In addition, the mucosa of HCWs is susceptible to splashes or droplets of different body fluids as blood, saliva, and urine. These occupational exposures carry an average risk of 2% HCV transmission.[5] Occupational exposure of HCWs to HCV infection happens via percutaneous exposure (75%) or mucosal-cutaneous exposure (25%) from the patient's infected blood, body fluids, or blood products.[6] The WHO states that every year, >3 million HCWs harm themselves with a contaminated object/edge with at least one human immunodeficiency virus, hepatitis B, and hepatitis C.[7] The CDC states that every year 385,000 needle-sticks and sharps injuries (NSSIs) are sustained by the HCW, with an average of 1000 sharps injuries daily.[8]

The magnitude of the exposure to blood-borne pathogens among HCWs is lacking in Upper Egypt. This study aimed to determine the prevalence and associated risk factors for HCV infection among the HCWs in Asyut Governorate, as well as the treatment outcome among true positive cases.

METHOD

A cross-sectional study was carried out among HCWs at the central office of Asyut Health Directorate (representing administrative and clerical staff) in addition to those affiliated to Abu-teeg, Al-Qusiyah, and Abnoub district hospitals (representing health care providers' staff) in Egypt, from January 2019 through October 2019. All HCWs in Asyut Governorate subjected to the OraQuick screening test for HCV infection were eligible as study participants. The idea of this study was formulated at the end of 2017 before the beginning of 100 Million Seha campaigns, based on a survey done by the Asyut directorate of health affairs to screen all HCWs in Asyut for HCV using the OraQuick test. Therefore, this study is not a part of the 100 Million Seha campaigns. The OraQuick HCV test depends on an indirect immunoassay technique to detect HCV antibodies in the blood or oral fluid. The OraQuick HCV is a rapid test to detect anti-HCV antibodies, which is used with oral fluid, serum, venous blood, and finger stick blood. An oral specimen is taken by swabbing a test device at the top and bottom gums; then the device is kept in a solution for processing. A control line occurs when the test has run properly, and a result line is visible in case of a positive result. Approximately 20–40 min should elapse between the specimen collection time and the interpretation.[9]

The OraQuick test increased the number of tested people, as the test is used and interpreted away from health facilities and in any remote area. This is especially valuable for people with limited access to health services. It is a quick technique than testing dried blood spot samples or venous blood samples for anti-HCV antibodies in a laboratory. It is a clean process, without the hazard of blood waste or spills.[10] This test is efficient, reliable, and simple to read as it has a similar technique to pregnancy tests and is used by non-professionals.[9] The test is performed at room temperature at the point of care, without specific storage or laboratory transport of samples, and an immediate result is obtained.[11] The sensitivity and specificity of the OraQuick test vary depending on the type of used sample. For example, its sensitivity and specificity for oral fluid are 90.8%–99.2% and 92.1%–100%, respectively, whereas higher in serum samples.[9] A total of 454 HCWs were screened by OraQuick in Asyut Health Directorate, wherein only 200 were recruited by systematic random sample; every second person was selected and recruited for participation.

HCWs in direct contact with the patients in Abu-teeg and Al-Quisyah District Hospital were chosen by simple random sample, which represents the western areas to the River Nile. Abnoub District Hospital was chosen to represent the eastern areas of the River Nile. Every second person was selected and recruited for participation by systematic random sampling from the HCWs lists at Abu-teeg (337), Al-Quisyah (331), and Abnoub District Hospital (320). Therefore, the sample size was 150 HCWs from each District Hospital and 200 from the Asyut Directorate of Health Affairs, yielding a total sample size of 650 HCWs. The sample size was calculated using OpenEpi version 3 based on the

prevalence of HCV infection of 10% according to the Egyptian Health Issues Survey (EHIS 2015) (12) using a margin of error of 1% with a 95% confidence level. The calculated sample size is 137 but was increased to represent the sample for all HCWs in Asyut Governorate and allow proper statistical analysis.

A pilot study was carried out on 10% of the sample from Al-Quisyah District Hospital to determine the administrative procedures needed for the research work and test the feasibility of conducting the study. No modification was made to the questionnaire; thus, the pretested questionnaires were included in the whole sample size.

Data were collected by a semi structured questionnaire by the researchers. The questionnaire included inquiries about sociodemographic status, risk factors for HCV transmission, such as exposure to needle stick injuries (NSIs) and blood & other body fluids (BBFs). The confirmed HCV cases by polymerase chain reaction (PCR) were asked about the type of treatment received, completion of the treatment regimen, and treatment outcome.

Statistical analysis: Data entry, cleaning, and analysis were done using the Statistical Package for Social Science version 22 (IBM Corp, Armonk, NY, USA). Descriptive statistics were calculated as the mean and standard deviation for continuous variables and as frequency and percentages for categorical variables. Chi-square ($\chi 2$) and Fisher's exact tests were used as the test of significance for categorical variables.

Multivariate analysis was applied to identify the different predictors of HCV infection among HCWs. The odds ratio was calculated as a measure of the association at the 95% confidence limit. Statistical significance level was considered when *P*-value is ≤0.05 for all statistical tests.

RESULTS

The mean age of the participating HCWs was 39.7 ± 9.9 years, where in 61.2 % were females and 38.8% were males. Approximately, half of the participants (48.2%) were nurses or technicians. In addition, 23.1% of participants were recruited from each district hospital and 30.7% were recruited from Asyut Health Directorate. Using the OraQuick test for HCV screening, 8.6% of the participants were hepatitis C positive, and

Table (1): OraQuick screening test results versus Polymerase chain reaction (PCR) results among health care workers, Asyut Governorate, 2019

Variables	No. (n = 650)	%
OraQuick results:		
Positive	56	8.6
Negative	594	91.4
Results of PCR test:(n = 56)		
Positive	41	73.2
Negative	15	26.8
Prevalence of hepatitis C infection	6.3	

73.2% were HCV positive after confirmatory PCR testing for those OraQuick positives. The prevalence of hepatitis C infection among HCWs in Asyut Governorate was 6.3% (41 positive cases by PCR among 650 participants) (Table 1).

Regarding the risk factors for HCV infection, male is significantly three times more susceptible for HCV infection occurrence among HCWs (OR = 3.7, p < 0.001). Living with HCV positive relative is significantly three times more susceptible for HCV infection occurrence (OR = 2.91, p = 0.003), and shaving by common tools at the barber shop is significantly 46 times more susceptible for HCV infection occurrence (OR = 46.7, p < 0.001). In addition, using a common scissor or nail cutter is significantly four times more susceptible for HCV infection occurrence (OR = 4.63, p < 0.001). Regarding the medical-related risks for HCV infection, undergoing previous surgery, receiving blood transfusion, and history of hospital admission have statistically significant association with HCV infection occurrence (OR = 6.02, p < 0.001, OR = 2.58, p = 0.027, and OR = 2.69, p = 0.002, respectively). Moreover, exposure to NSIs is significantly seven times more for HCV infection occurrence (OR = 7.15, p = <0.001) and exposure to BBF is significantly six times more susceptible for HCV infection occurrence (OR = 6.74, p <0.001) (Table 2). Regarding the predictors of HCV infection among HCWs, the male had seven times higher risk of being HCV positive than females (OR = 7.555, p < 0.001), and having a history of surgery was approximately six times higher risk of being HCV

Table (2a): Univariate analysis for risk factors associated with hepatitis C infection among health care workers, Asyut Governorate, 2019

Risk factors	PCR positive (n = 41)	Non-PCR positive § (n = 609)	*Total*	*P*-value	*COR (95%CI)*
Personal risk factors					
Sex					
Male	28 (11.1%)	224 (88.9%)	252	<0.001*	3.70 (1.8–7.3)
Female‡	13 (3.3%)	385 (96.7%)	398		
Work duration (years)					
≤5 ‡	12 (5%)	228 (95%)	240	0.294*	1.45 (0.7–2.9)
>5	29 (7.1%)	381 (92.9%)	410		
Job title					
Physician	2(4.7%)	41(95.3%)	43	< 0.025*	0.19 (0.04 –0.9)
Nurse	19(6.5%)	273(93.5%)	292	0.004†	0.27 (0.12–0.6)
Technician	3(14.3%)	18(85.7%)	21	0.741†	0.65 (0.16–2.6)
Administrative worker	7(2.9%)	238(97.1%)	245	< 0.001†	0.11 (0.04–0.32)
Manual worker‡	10(20.4%)	39(79.6%)	49		
Community risk factors					
Living with HCV positive relatives:					
Yes	11 (13.9%)	68 (86.1%)	79	0.003 †	2.91 (1.39 –6.08)
No‡	30 (5.3%)	541 (94.7%)	571		
History of shaving by common tools at barbershop:(n = 252)					
Yes	27 (5.0%)	82 (75.0%)	109		46.7 (6.2–350.5
No‡	1 (0.7%)	142 (99.3%)	143		
History of common scissor use or nail cutter					
Yes	27 (13.1%)	179 (86.9%)	206		4.63 (2.37–9.04)
No ‡	14 (3.25)	430 (96.8%)	444		

positive (OR = 5.850, p < 0.001). Further important risk factors for HCV positivity are exposure to NSIs and BBF, which was approximately four times higher risk of HCV infection (OR = 4.58, p = 0.010 and OR = 3.98, p = 0.006, respectively). Lack of training on issues related to infection control and working duration of >5 years had approximately three times higher risk for HCV infection (OR = 2.995, p = 0.018 and OR = 2.852, p = 0.038, respectively). This model explains 42.2 % of the risk factors of HCV infection among HCWs (Table 3). The majority (97.4%) of HCWs received treatment, wherein 62.5 % received the double regimen and 37.5% received the triple regimen. Patients with hepatitis C accounting for 82.5% completed the treatment course and 17.5% are still receiving the treatment. Recovery of HCV-positive HCWs who completed treatment regimen accounted for 97%, with 3% without recovery (Table 4).

DISCUSSION

According to the current study, 56 (8.6%) out of 650 participating HCWs had HCV antibodies positive by the OraQuick test. Another study conducted in Zagazig University Hospital in Egypt detecting the seroprevalence of HCV among HCWs using enzyme-linked immunosorbent assay (ELISA) and OraQuick test revealed that anti-HCV antibodies were 40.5% and 37.7%, respectively, compared to 34.8% by PCR (5). This high prevalence is explained by the small sample size in this study, which was only 69 HCWs in comparison to the participants in the current study (650 HCWs). This current prevalence is higher than that detected by the ELISA test in Aswan University Hospital and Assiut University Hospital, Egypt, and in Damascus Hospital,

Table (2b): Univariate analysis for risk factors associated with hepatitis C infection among health care workers, Asyut Governorate, 2019

Risk factors	PCR positive (n = 41)	Non-PCR positive § (n = 609)	*Total*	*P*-value	*COR (95%CI)*
Medical-related risk factors					
History of previous surgery:					
Yes	31 (13.0%)	207 (87.0%)	238	<0.001*	6.0 (2.9–12.5)
No‡	10 (2.4%)	402 (97.6%)	412		
History of blood transfusion:					
Yes	7 (13.5%)	45 (86.5%)	52	0.027†	2.6 (1.1–6.1)
No‡	34 (5.7%)	564 (94.3%)	598		
History of hospital admission:					
Yes	22 (10.7%)	183 (89.3%)	205	0.002*	2.7 (1.4–5.1)
No‡	19 (4.3%)	426 (95.7%)	445		
History of visiting dentist clinic:					
Yes	34 (7.3%)	433 (92.7)	467	0.103*	1.97 (0.859–4.53)
No‡	7 (3.8%)	176 (96.2)	183		
Exposure to NSIs (no. = 450)					
Yes	27 (14.4%)	161 (85.6%)	188	< 0.001*	7.15 (2.89–17.71)
No‡	6 (2.3%)	256 (97.7%)	262		
Exposure to BBF (no. = 450)					
Yes	23 (17.8%)	106 (82.2%)	129	< 0.001*	6.74 (3.11–14.63)
No‡	10 (3.1%)	311 (96.9%)	321		

** Chi-square test, † Fisher exact test, ‡ Reference category for each variable, § Non-PCR-positive include those who tested negative by PCR plus those who tested negative by OraQuick test (as only confirmatory PCR testing was done for positive cases by OraQuick test). Statistical significance level was considered when P-value of ≤0.05 for all statistical tests.*

Syria; where the prevalence was 6.8%, 5.2%, and 0% (where whole samples tested negative for anti-HCV antibodies among HCWs), respectively (13–15).

Confirmatory PCR test detects positivity in 73.2 % among positive HCWs by OraQuick test, which is slightly similar to a previous study conducted in Beni-Suef University Hospital, Egypt, where the result of confirmatory PCR testing revealed 75% positivity (16). According to this study which was done before national HCV screening initiative in Egypt, the prevalence of HCV infection by PCR among HCWs is 6.3%. An important implication for this finding includes regular application of training programs (pre-service and in-service) for all HCWs about hazards of exposure to NSSIs, protective measures, and sharp management training. Making a serological profile for every HCW for HCV before employment and regular check-up every 6 months is mandatory. In addition, teaching about standard procedures for universal infection and control measures should be included in the undergraduate nursing curriculum.

The current prevalence is higher than that reported among the participating HCWs in the Alexandria University Hospitals (4.4%)(6). Perhaps, university hospitals have available personal protective equipment (PPE), better medical equipment, or safety measures than district hospitals, thus, the lower prevalence. Regarding the risk factors to HCV infection among HCWs, the current study concluded a significantly increased HCV prevalence rate among males compared to females (p = <0.001). This is consistent with the study conducted in Aswan university hospital, Egypt, and in Georgia, where males show higher rates of HCV infection compared to females (13,17). In addition, this result complies with another meta-analysis study (18). Males are more exposed to some blood-borne risk factors, such as shaving by common tools, multiple sexual partners, and drug abuse, and another possible

Table (3): Logistic regression analysis of predictors of HCV infection among HCWs, Asyut Governorate, 2019

Variables:	*P*-value	Adjusted OR (95% CI)
Sex (Ref. = Female**)**		
Male	<0.001	7.555 (2.660– 21.458)
History of previous surgery (Ref. =No**)**		
Yes	<0.001	5.850 (2.194 –15.597)
NSIs exposure (Ref.= No**)**		
Yes	0.010	4.587 (1.441–14.596)
Fluids exposure (Ref.= No**)**		
Yes	0.006	3.980 (1.487 –10.648)
Infection control training (Ref.= Yes**)**		
No	0.018	2.995 (1.21– 7.402)
Working duration (Ref. = ≤ 5 years**):**		
>5 years	0.038	2.852 (1.062–7.658)

Nagelkerke R Square = 0.422

explanation is males are less likely to follow the universal precautions for infection control compared to females.

As regards the occupational categories of HCWs, the current study concluded that HCV infection is more prevalent among manual workers followed by nurses/technicians than physicians (p = <0.001). The same result was detected in many studies conducted in Egypt in Aswan, Assiut, Benha, and Ain Shams university hospitals (13,14,19,20). El-Melligy et al. revealed no significant difference concerning the different occupational categories (p-value = 0.219) (21). The current study concluded a statistically significant association between hepatitis C infection and presence of relatives with hepatitis C infection, shaving by common tools, using a common scissor, history of previous surgery, receiving a blood transfusion, and hospital admission. Anwar et al. concluded that the presence of relatives with hepatitis C infection, using the same scissors to cut nails with your family, shaving by the barber's razor tools, receiving a blood transfusion, and history of operation were not associated with HCV infection occurrence (16). However, Okasha et al. revealed that only shaving with used razors at the barber's shop was significantly associated with HCV seropositivity (p = 0.03) (20). In the current study, exposure to NSIs is associated with HCV infection occurrence among HCWs (p = <0.001), this is in agreement with the study by Abdelrheem et al. and a previous meta-analysis study (13,18). Zayet et al. concluded no association between HCV infection and exposure to NSIs (14). This is explained by the seroconversion risk after exposure to BBF depending on

Table (4): Treatment outcomes among Hepatitis C positive health care workers, Asyut Governorate, 2019

Variables	N (41)	%
Received treatment:		
Yes	40	97.4
No	1	2.6
Treatment types:		
Double regimen (daclatasvir + sofosbuvir)	25	62.5
Triple regimen (daclatasvir+ sofosbuvir + ribavirin)	15	37.5
Completed treatment:		
Yes	33	82.5
Still receiving treatment	7	17.5
Recovery: (n = 33)		
Yes	32	97.0
No	1	3.0

factors, such as the type of injury, amount of infectious material transferred, and viral load in the source patient (17). In the present study, a statistically significant association between HCV infection and exposure to BBF (p = <0.001). This is inconsistent with the previous two studies conducted in Aswan and Assiut University hospital, where no association was found between the infection and exposure to BBF (13,14). This difference is explained by the frequency, amount of exposure to BBFs, and the use of PPE during exposure.

This current study concluded that 97% of infected HCWs recovered and only one patient (3%) did not (as

the daughter of this participant had a medical problem and she was overwhelmed by her treatment, thus, delay in receiving HCV treatment carries an increased risk for HCV transmission among her contacts, either in the family or in the working area.), this is slightly similar to a study conducted in the United States of America, where recovery rate was 95%, all patients completed treatment and two patients did not recover (22). In addition, this current result is in agreement with two studies conducted in Sharkeya Governorate and in National Liver Institute, Menoufia University, Egypt, where 96% and 98.1% of patients recovered, respectively (23) (24). Similarly, a study conducted in the Assiut hepatitis management center and Alrajhi University Hospital revealed that 94% of patients recovered, whereas 6% did not (25). This difference is explained by that 43.4% of patients in the study in Assiut Hepatitis Management Center and Alrajhi University Hospital aged >60 years, whereas in the current study all participants are aged <60 years, and old age is one of the predictors of nonresponse to oral direct-acting antiviral drugs.

CONCLUSIONS AND RECOMMENDATIONS

Based present study results, the researchers concluded that the prevalence of HCV infection among HCWs is high. Exposure to NSIs, BBF, and lack of training on issues related to infection control measures are among the important predictors of HCV infection in HCWs. Therefore, health education and training programs about health hazards of occupational exposure to BBF and the importance of incident reporting are highly recommended for all HCWs. A follow-up study to estimate the new prevalence after mass treatment of HCV positive cases is highly recommended.

Ethical considerations

The approval was obtained from the ethical committee from the Assiut Faculty of Medicine to perform this study (IRB no: 17200127). Official permission was obtained to access the data from Asyut Health Directorate for lists of screened HCWs by OraQuick test at the Ministry of Health and Population Hospitals in Asyut Governorate as a tool for reaching the study population, and official permission was obtained from the undersecretary of Ministry of Health and Population in Asyut for data collection from selected hospitals and Asyut Directorate. In addition, official permission was obtained from the managers of selected hospitals to collect data. Explanations were given to participants before starting the data collection. Voluntary participation for each HCW was assured. Informed consent was obtained from all participants before study participation. Privacy and confidentiality of all data were assured.

Limitation of the study

Since participants were asked about previous exposure experience to NSIs and BBF, recall bias is present, and the cause-and-effect relationship is not established due to its cross-sectional study nature. This study was done before national HCV screening initiative in Egypt, so, the current HCV situation in Egypt needs to be reassessed after mass screening and treatment of positive cases.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

The authors are grateful to the participating health care workers for their cooperation.

References

1. World Health Organization (WHO). Hepatitis C fact sheet [Internet]. 2020. Available from: https://www.who.int/news-room/fact-sheets/detail/hepatitis-c. Accessed at 2021-01-02
2. Stasi C, Silvestri C, Voller F. Update on Hepatitis C Epidemiology : Unaware and Untreated Infected Population Could Be the Key to Elimination. SN Compr Clin Med. 2020;2(1):2808–15.
3. Centers for Disease Control and Prevention (CDC). Hepatitis C questions and answers for health professionals.2020 [Internet]. Available from: https://www.cdc.gov/hepatitis/hcv/hcvfaq.htm. Accessed at 2020-08-07
4. World Health Organization (WHO). The World Health Report 2006: working together for health. [Internet]. 2006. Available from: https://www.who.int/workforcealliance/knowledge/resources/whrepo rt_2006/en/ Accessed at 15 January 2021
5. El-Sokkary RH, Tash RM, Meawed TE, Seifi OS, Mortada EM. Detection of hepatitis C virus (HCV) among health care providers in an Egyptian university hospital: Different diagnostic modalities. Infect Drug Resist. 2017;10(1):357–64.
6. Seida YAM, Moemen MMH, Moustafa MSA, Raouf MM, Elshaer NSM. Hepatitis-C Virus Infection and Exposure to

Blood and Body Fluids among Nurses and Paramedical Personnel at the Alexandria University Hospitals, Egypt. Alexandria J Med. 2018;54(3):265–71.
7. World Health Organization (WHO). Healthcare worker safety. [Internet]. 2014. Available from: http://www.who.int/injection_safety/toolbox/en/AM_HCW_ Safety_EN.pdf. Accessed January19, 2020
8. Centers for Disease Control and Prevention (CDC). Workbook for Designing, Implementing and Evaluating a Sharps Injury Prevention Program [Internet]. 2008. p. 1–161. Available from: https://www.cdc.gov/sharpssafety/pdf/sharpsworkbook_2008.Accessed at 12 october 2020
9. National Institute for Health and care Excellence (NICE). 2015. The OraQuick HCV point-of-care test for rapid detection of hepatitis C virus antibodies. http://nice.org.uk/Guidance/Mib24. 2015;1–45.
10. Fish S. Hepatitis C point of care testing: What is its impact on testing and linkage to care? Can AIDS Treat Inf Exch. 2017;1–7.
11. Chevaliez S, Poiteau L, Rosa I, Soulier A, Roudot-Thoraval F, Laperche S et al. Prospective assessment of rapid diagnostic tests for the detection of antibodies to hepatitis C virus, a tool for improving access to care. Clin Microbiol Infect. 2016 May;22(5):459.e1-459.e6.
12. Ministry of Health and Population, El-Zanaty and Associates, DHS Program. Egypt: Health Issues Survey. 2015;1–234.
13. Abdelrheem SS, Saleh YY, Abdelatif H, Elbadry MM. Hepatitis C Infection among Health Care Workers in Aswan: Seroprevalence and Risk Factors. J High Inst Public Heal 2020. 2020;50(1):58–64.
14. Zayet HH, EzzEl-Din AM, Ahmed SM, El-Khayat MR. Hepatitis B And C Virus Infection Among Health Care Workers In General Surgery Department, Assiut University Hospitals. Egypt J Occup Med. 2015;39(1):85–104.
15. Alhamoudi H, Alhalabi N, Zein M, Ibrahim N. Hepatitis C virus antibodies are absent among high risk group of health care workers in Damascus Hospital. Arab J Gastroenterol. 2018;30(30):12–5.
16. Anwar MM, Ahmed DM, Sheemy MS, El-Tayeb MT. Seroprevalence and risk factors for hepatitis B and C among health care workers. Int J Infect Control. 2017;13(2):1–7.
17. Butsashvili M, Kamkamidze G, Kajaia M, Morse DL, Triner W, DeHovitz J, McNutt L-A. Occupational exposure to body fluids among health care workers in Georgia. Occup Med (Chic Ill). 2012 Dec 1;62(8):620–6.
18. Westermann C, Peters C, Lisiak B, Lamberti M, Nienhaus A. The prevalence of hepatitis C among healthcare workers : a systematic review and meta-analysis. 2015;880–8.
19. Ameen SG, Rageha IM, Essa EA, Farid EM. Prevalence of Hepatitis C Antibodies Among Health Care Workers at Benha Hospitals, Egypt. Benha Med J. 2019;20(20):1–9.
20. Okasha O, Munier A, Delarocque-astagneau E, Rafik M. Hepatitis C virus infection and risk factors in health-care workers at Ain Shams University Hospitals, Cairo, Egypt. East Mediterr Heal J EMHJ. 2015; 21(3):199–212.
21. El-Melligy DM, Hussein AS, Khalil SA. Occupational exposure to hepatitis infection among Egyptian healthcare workers and hepatitis B vaccination. J Arab Soc Med Res. 2016;11(1):14–21.
22. Norton BL, Fleming J, Bachhuber MA, Steinman M, Cunningham CO, Johnson N, Laraque F, Alain H. High HCV cure rates for people who use drugs treated with direct acting antiviral therapy at an urban primary care clinic. Int J Drug Policy. 2018;47:196–201.
23. Ossama AA, Safwat E, Khalifa MO, Elshafie AI, Fouad MHA, Salama MM, Naguib GG, Eltabbakh MM, Sherief AF, Abd-Elsalam S. Sofosbuvir Plus Daclatasvir in Treatment of Chronic Hepatitis C Genotype 4 Infection in a Cohort of Egyptian Patients : An Experiment the Size of Egyptian Village. Int J Hepatol. 2018;1(1):1–5.
24. Abozeid M, Alsebaey A, Abdelsameea E, Othman W. High efficacy of generic and brand direct acting antivirals in treatment of chronic hepatitis C. Int J Infect Dis. 2018;75:109–14.
25. Hassany SM, Hassan W, Abo-alam H, Khalaf M, Nafeh AM, Nasr-eldin E, Mostafa E. Direct-Acting Antiviral Drugs and Occurrence of Hepatocellular Carcinoma : Unjust or Oppressed. Infect Drug Resist. 2020;13:1873–80.

Cite this article as: Heba Gaafar Ali Omar[1] , Mohammad Hasan Qayed, et al. Hepatitis C Infection among Health Care Workers Screened by OraQuick Test in Asyut Governorate. *Egyptian Journal of Community Medicine*, 2022;40(2):156-163.
DOI: 10.21608/ejcm.2021.86749.1184