Risk Factors for Hepatitis C Infection in a National Adult Population: Evidence from the 2008 Egypt DHS

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Abstract

Objective: To provide an estimate of the prevalence of hepatitis C in a nationally representative sample of men and women and to determine the underlying risk factors associated with hepatitis C infection.

Methods: A total of 11,126 blood samples were collected from men and women age 15-59 years who took part in the adult health component of the 2008 Egypt Demographic and Health Survey (EDHS) and were tested for the hepatitis C virus (HCV).

Findings: The results indicate that one in ten Egyptians age 15-59 have an active hepatitis C infection. Multivariate logistic regression analysis revealed that, independent of other factors, having received an injection to treat schistosomiasis was a key risk factor for hepatitis C infection. Having had a blood transfusion or surgery are also associated with higher infection risks.

Introduction

Egypt has the highest prevalence of hepatitis C in the world. Studies have found widely varying levels (10%-50%) of the prevalence of hepatitis C, depending on the populations covered; overall, estimates of the HCV rate in the general population have range between 10 and 20 percent (Deuffie-Burban et al., 2006; Aziz et al., 2000). Geographically, the hepatitis C prevalence has been shown to be higher in Lower Egypt (Nile delta) than in Upper Egypt and lower in urban compared to rural areas (Mohamed, 2004).

In Egypt, use of contaminated needles/syringes during mass schistosomiasis treatment campaigns during the 1960s-1980s has been identified as a key mode of transmission for HCV infection (Frank et al., 2000). Suggesting the continuing role for parenteral exposure, Mohamed (2004) found medical interventions including surgery, blood transfusion, dental treatment, and use of shared needles to be associated with increased risks of HCV infection in a study of hepatitis C infection among Egyptian workers in the 1990s. Evidence of high interfamilial HCV transmission was found in a study in a rural community in the Nile Delta also in the 1990s (Aziz et al., 2000; Mohamed et al., 2005) although the exact modes of transmission were not identified.

In this study, we present information on current levels of HCV infection among adults age 15-59 years in Egypt. We also explore the risk factors associated with HCV exposure in Egypt. Since there is no vaccine for HCV and it takes up to almost 20 years for a person to develop serious complications, preventing exposure to HCV or modifying people's behavior may help reduce the burden of disease in Egypt.

Data and methods

Data

The 2008 Egypt Demographic and Health Survey (DHS) was conducted in a nationally representative sample of 19,500 households in all governorates of Egypt (El-Zanaty and Way, 2009). A special adult health survey was conducted with all women and men age 15-59 in a subsample of one-quarter of the households surveyed in the 2008 Egypt DHS. During the survey interviews, eligible women and men were asked to provide information on level of awareness on modes of transmission and prevention of HCV infection, potential risk factors for HCV infection, and prior diagnosis and treatment of hepatitis C or liver disease.

All respondents eligible for the adult health survey were asked for their voluntary consent prior to collection of the venous blood samples for hepatitis C testing. In case of never-married adolescents age 15-17 years, consent was first requested from the parent and then from the adolescent. After collection of venous blood in the field, the blood samples were centrifuged to harvest serum and stored in dry-shippers containing liquid nitrogen until they were transferred to the Ministry of Health and Population's (MOHP) Central Laboratory in Cairo on dry ice.

At the time of the survey interview, all eligible respondents were provided with a brochure describing the causes and consequences of hepatitis C and the hepatitis C testing procedure. Results were returned to respondents who gave samples for testing during callback visits after the Egypt DHS fieldwork had ended; all but 12 respondents were contacted during the callback phase. Since some individuals clear the virus and HCV RNA levels may fluctuate for up to a year after infection, all the respondents who tested positive for HCV were given a referral to nearest the national liver hospitals/centers for further follow-up and counseling.

Laboratory Tests

The Central Laboratory of the Ministry of Health carried out the hepatitis C testing. All of the samples were screened to determine the presence of HCV antibodies, using a third-generation Enzyme Linked Immuno-Sorbent Assay (ELISA) the EIAgen HCV Ab test. All positive samples and a proportion of negative samples were re-tested using Chemiluminescent Immuno-assay (CIA), Architect System. The ELISA and CIA assays were again repeated on any discordant samples from the first screening tests. Positive samples and any discordant samples from the repeat tests were further tested by Real Time (RT) PCR, Applied Biosystems.

ELISA and CIA do not differentiate between the past or present exposure to HCV. Presence of HCV RNA by RT-PCR indicates an active HCV infection.

Methods

Bivariate methods are used first to examine associations for all respondents between hepatitis C infection and a number of factors potentially associated with HCV infection including social, economic

and demographic characteristics and history of medical interventions. In addition, a risk-factor analysis using logistic regression is performed with presence of infection (current) as the dependent variable and the various risk factors. The statistical significance of the associations was assessed through likelihood ratio tests based on a P value < 0.05.

Results and Discussion

Among the defacto population of women and men age 15-59 eligible for the hepatitis C testing, 88 percent consented to provide a sample that was subsequently tested at the Central Laboratory. Six percent refused to provide a sample, and 5 percent were not at home at the time of the survey. Specimens from a small proportion of the respondents (one percent) either could not be collected or tested for various reasons. Testing coverage was somewhat better among women compared to men (91 percent and 84 percent, respectively) and rural respondents compared to urban respondents (92 percent and 81 percent, respectively). Samples were obtained and tested for around 9 in 10 eligible women and men in both Upper and Lower Egypt governorates compared to somewhat less than 8 in 10 eligible women and men in the Urban Governorates and the Frontier Governorates.

Prevalence of disease

A total of 11,126 blood samples were collected and tested with valid results. Of these 1,632 (14.7%) were found to be positive by ELISA and CIA assays. A total of 1,650 blood specimens including 18 borderline negatives on the ELISA and CIA tests were further tested by PCR. A total of 1,096 samples (9.8% of the 11,126 samples tested) were found to be positive by PCR, indicating active HCV infection.

Table 1 presents the prevalence of active hepatitis C infection by socio-economic background variables. Men have higher prevalence of the disease compared to women. Infection rates increase directly with age. In addition, being married or formerly being married also increases the risk of HCV infection. Infection rates are markedly higher among rural residents, whether in Upper or Lower Egypt, than among urban residents. Rates decline with increases in education and wealth.

The much higher rates of infection among older cohorts (shown separately for women and men in Figure 1) and among rural than urban residents may be partially explained by the differential exposure of these groups to schistosomaisis campaigns during the 1960s-1980s, which, as noted above, are believed to have been a major transmission route for HCV infection in Egypt.

Table 2, which presents the prevalence of HCV infection by the respondent history of medical procedures and injections, shows that infection rates are more than twice as high among EDHS respondents who reported ever receiving an injection to treat schistosomaisis than among respondents who did not receive treatment. HCV infection rates are also higher among respondents who had other medical procedures shown in Table 2 than among respondents who did not report having the procedures.

Table 1: Percentage testing positive on HCV RNA test by socio-demographic characteristics, Egypt DHS 2008

Socio-demographic characteristics	Percentage positive on HCV RNA test	Number
Sex		
Man	12.1	5,298
Woman	7.8	5,828
Age group		
15-19	2.8	1,997
20-24	3.0	1,802
25-29	3.9	1,535
30-34	8.3	1,233
35-39	9.9	1,131
40-44	15.0	1,061
45-49	19.0	948
50-54	25.3	734
55-59	27.4	684
Marital status		
Never married	3.0	3,529
Married	12.8	7,088
Formerly married	16.8	509
Residence		
Urban Governorates	6.2	2,266
Lower Egypt Urban	8.8	1,171
Lower Egypt Rural	12.3	3,658
Upper Egypt Urban	7.8	1,250
Upper Egypt Rural	11.4	2,612
Frontier Governorates	3.3	169
Household wealth quintile		
Poorest	12.4	1,935
Poorer	11.4	2,308
Middle	10.9	2,314
Richer	8.0	2,305
Richest	6.9	2,264
Education		
No education	16.5	2,458
Primary	12.6	1,611
Secondary	7.3	5,413
Higher	5.7	1,643
Total	9.8	11,126

Figure 1: Prevalence of active hepatitis C infection in men and women age 15-59 years

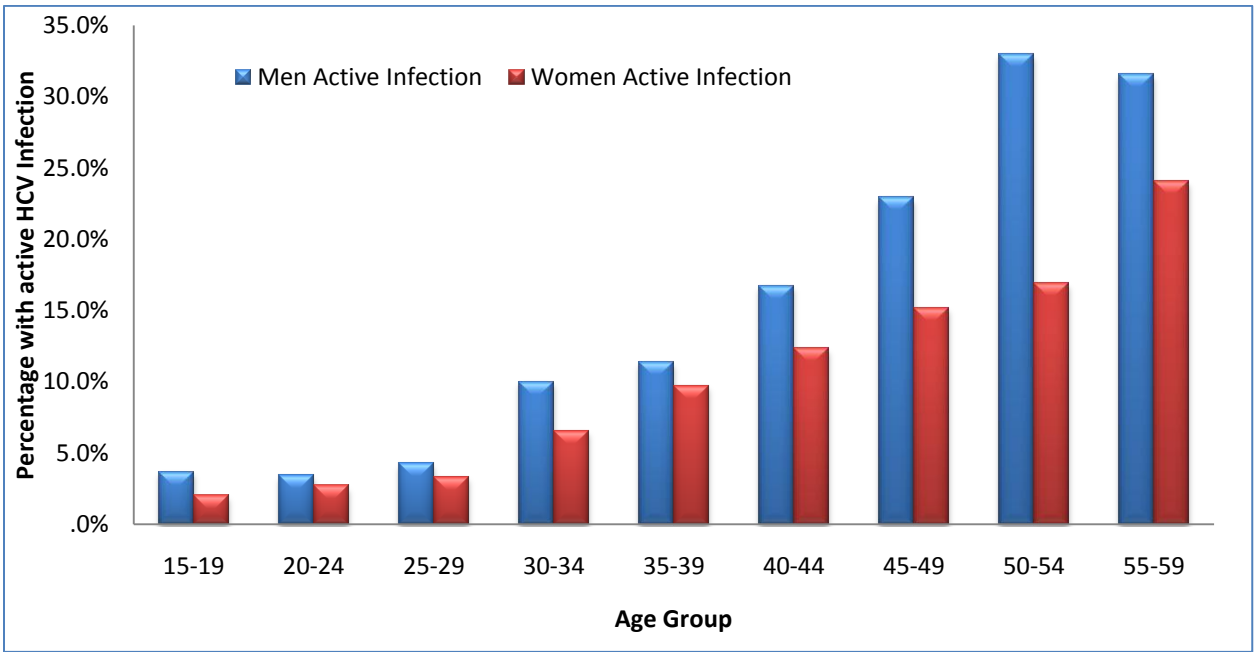

Table 2: Percentage testing positive on HCV RNA test by history of medical procedures and injections, Egypt DHS 2008

Medical procedures and injections	Percentage positive on HCV RNA test	Number
Surgery		
No/don't know	8.5	6,403
Yes	11.7	4,723
Blood transfusion		
No/don't know	9.6	10,668
Yes	16.0	458
Dental treatment		
No/don't know	7.7	4,403
Yes	11.3	6,723
Injection to treat schistosomiasis		
No/don't know	8.9	10,180
Yes	19.7	946
Injection for purpose other than schistosomaisis treatment		
No/don't know	7.2	753
Yes	10.0	10,373
Injection in which needle and syringe reused		
No/don't know	9.7	10,808
Yes	13.5	318
Total	9.8	11,126

Multivariate associations

The logistic regression results presented in Table 3 show unadjusted and adjusted associations between selected socio-demographic characteristics and medical procedures for all men and women tested for HCV Infection. Controlling for other characteristics, the adjusted model indicates that the risks of hepatitis C infection are significantly higher ($p \leq 0.05$) among respondents age 30 and older, currently and formerly married respondents, and respondents from Upper and Lower Egypt, particularly those from rural areas. A history of surgery, blood transfusion, or injection to treat schistosomaisis increase the risk of active infection with hepatitis C, independent of the other characteristics. The adjusted model also shows that HCV infection risks are significantly lower for educated respondents than those who never attended school and for those in the two highest wealth quintiles. Although significantly associated with higher infection rates in the unadjusted model, dental treatment, injections for purposes other than schistosomaisis and injection in which needle and syringe are reused were not significantly associated with HCV infection once controls for other risk factors were introduced.

Conclusions

This nationally representative population-based study shows that 10 percent of Egyptian adults have an active HCV infection. The results also highlight factors that are associated with higher risks of HCV infection. Among the medical procedures, a history of injection to treat schistosomaisis is, as expected a significant risk factor; after controlling for other potential risk factors, respondents who had an injection to treat schistosomiasis were 1.3 times more likely to have an HCV infection compared to respondents who had not had an injection to treat schistosomiasis ($p \leq 0.05$). Having ever had a blood transfusion and having had surgery were also associated with elevated risks of infection (36 percent and 17 percent, respectively). The latter is of particular concern since around 4 in 10 respondents reported having some type of surgery prior to the survey interview. The associations between HCV rates and blood transfusions and surgery do not necessarily establish causal relationships between these medical procedures and HCV infection. However, they point to the importance of emphasizing adherence to infection control procedures within health care facilities as a potentially very important factor in reducing HCV transmission in Egypt. The 2004 Egypt Service Provision Assessment Survey identified infection control as an area in which there were weaknesses within Egyptian health facilities (Ministry of Health and Population et al., 2005).

This study also found factors other than the medical procedures that are strongly associated with HCV infection risks. These include marital status, which points to spousal or interfamilial transmission factors that other studies have also noted but about which the actual transmission mechanisms are not well understood. Residence also appears to have a strong influence, with the odds of infection being highest for rural residents in Lower Egypt.

More research is clearly needed to inform efforts at prevention as are continued efforts to inform Egyptians about measures that they can take to avoid situations that may increase exposure to infected blood.

Table 3: Unadjusted and adjusted association between selected demographic and socioeconomic characteristics and medical procedures and injections with being positive on HCV RNA test among women and men age 15-59, Egypt 2008

	Unadjusted model		Adjusted model	
Characteristic	OR	P-values	OR	P-values
Socio-demographic				
Sex				
Man	1.00	—	1.00	—
Woman	0.62	0.000	0.58	0.000
Age group				
15-19	1.00	—	1.00	—
20-24	1.08	0.688	0.97	0.882
25-29	1.39	0.081	1.04	0.845
30-34	3.13	0.000	2.09	0.001
35-39	3.82	0.000	2.46	0.000
40-44	6.10	0.000	3.73	0.000
45-49	8.11	0.000	5.11	0.000
50-54	11.75	0.000	7.32	0.000
55-59	13.13	0.000	8.02	0.000
Marital status				
Never married	1.00	—	1.00	—
Married	4.81	0.000	1.58	0.004
Fomerly married	6.62	0.000	1.70	0.012
Residence				
Urban Governorates	1.00	—	1.00	—
Lower Egypt Urban	1.47	0.004	1.52	0.003
Lower Egypt Rural	2.14	0.000	2.05	0.000
Upper Egypt Urban	1.29	0.059	1.34	0.042
Upper Egypt Rural	1.96	0.000	1.79	0.000
Frontier Governorates	0.52	0.133	0.51	0.140
Household wealth quintile				
Poorest	1.00	—	1.00	—
Poorer	0.91	0.300	0.86	0.154
Middle	0.86	0.115	0.90	0.341
Richer	0.61	0.000	0.71	0.010
Richest	0.53	0.000	0.68	0.011
Education				
No education	1.00	—	1.00	—
Primary	0.73	0.001	0.79	0.018
Secondary	0.40	0.000	0.87	0.173
Higher	0.30	0.000	0.64	0.003
History of medical procedures and injections				
Surgery				
No/don't know	1.00	—	1.00	—
Yes	1.43	0.000	1.17	0.031
Blood transfusion				
No/don't know	1.00	—	1.00	—
Yes	1.80	0.000	1.36	0.030
Dental treatment				
No/don't know	1.00	—	1.00	—
Yes	1.52	0.000	1.09	0.245

Table 3, continued

	Unadjusted model		Adjusted model	
Characteristic	OR	P-values	OR	P-values
Injection to treat schistosomiasis				
No/don't know	1.00	—	1.00	—
Yes	2.50	0.000	1.28	0.011
Injection for purpose other than schistosomiasis treatment				
No/don't know	1.00	—	1.00	—
Yes	1.43	0.013	0.96	0.770
Injection in which needle and syringe reused				
No/don't know	1.00	—	1.00	—
Yes	1.44	0.028	1.19	0.342
Number	11,126		11,126	

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