



## Factors Associated with Hepatitis C Infection among Chronic HCV Egyptian Patients

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### Abstract

**Background:** Identification of risk factors of acute hepatitis C virus (HCV) infection in Egypt is crucial for developing appropriate prevention strategies. There are few community-based studies on the epidemiology and risk factors of hepatitis C infection in Egypt, which could not provide enough information. Clear identification of past and current risk factors for infection is of utmost importance so that intervention programs can be appropriately focused. This study aims to provide up-to-date information about changes in the incidence of individual risk factors for HCV infection transmission in Egypt.

**Methods:** A total of 396 chronic HCV patients on follow-up treatment at liver center in El-Qabbary General Hospital in Alexandria were evaluated retrospectively regarding the potential iatrogenic, community acquired and behavioral HCV risk factors. Risk factors for HCV transmission were found in all study populations.

**Results:** At least three identifiable risk factors were reported by each participant. Some behavioral and community-acquired exposures that entail several risky behaviors particularly, unsafe sexual practices were exclusively established among males. We report a significant decline in prevalence of HCV transmission through blood transfusion, parenteral treatment, hospitalization, surgery, non medicalized circumcision, Hijama done by informal practitioner, tattooing, folk body piercing and threading, sharing hygiene and sharp items, and the use of communal barber or manicure sets among younger age cluster.

**Conclusion:** The pattern of risk differed among older patients compared to younger age group suggesting improved medical care and infection control measures and raised public health awareness regarding the different modes of viral transmission.

**Keywords:** HCV, Risk factors, Chronic HCV patients, Egypt

### Introduction

Chronic hepatitis C virus (HCV) infection is a major public health crisis that affects approximately 300 million people worldwide and currently is the most frequent cause of liver related morbidity and mortality (1, 2). Up to 20% of chronic HCV patients develop liver cirrhosis after 20 years of infection. The ongoing HCV silent epidemic will

result in an increase in the incidence of chronic liver failure over the coming decades (2, 3).

HCV is spread primarily by direct contact with infected human blood. Blood and blood product transfusion, intravenous drug use, parenteral injections, and other iatrogenic practices are clue risk factors in HCV transmission (4-8).

Egypt has the highest and devastating prevalence of hepatitis C virus (HCV) in the world, amounting to 14-20% (1, 6). The start of the epidemic in Egypt dates to 1960s during the mass antischistosomiasis treatment campaigns that have ceased in 1980s. These employed the use of non-disposable glass syringes insufficiently sterilized for intravenous drug injections among Egyptian population, thus contributed to the establishment of a large reservoir of HCV infection in Egypt (5) and hence the continued spread of HCV infection among them long after interruption of such injection-based, mass treatment.

Despite advances in blood screening assays for HCV that has resulted in a remarkable reduction in transfusion-associated HCV infection in many developed countries (7), the prevalence infection is roughly stable or even increased in developing countries (1, 2, 6).

Absence of vaccine and cost effective medical therapy prioritize the primary prevention of HCV infection. Accurate epidemiological data and clear determination of past and current disease risk factor is therefore of utmost importance to understand the main ways of HCV transmission and consequently plan better prevention strategies.

We sought in the present study to provide up-to-date information about the change in the incidence of individual risk factors for HCV infection transmission in Egypt. The study involved a group of patients on follow-up treatment at liver center in El-Qabbary General Hospital in Alexandria.

## Methods

A descriptive cross sectional study was conducted at the Liver Center of El-Qabbary Hospital affiliated to the Ministry of Health and Population in Alexandria (Egypt). The study population comprised chronic HCV positive patients undergoing treatment with ribavirin/pegylated-interferon combination therapy. A total of 396 patients were enrolled in the study using simple random selection. A structured predesigned questionnaire form was used for data collection. Each patient was interviewed and had been particularly asked retrospec-

tively about the potential iatrogenic, community acquired and behavioral HCV risk factors.

### *Statistical analysis*

Data were collected, revised, coded and fed to statistical software SPSS (Statistical Package for the Social Sciences) for windows, version 16.0 (SPSS Inc., Chicago, IL, USA). All statistical analysis was done using two tailed tests and alpha error of 0.05 P value. The means with standard deviation and percent were used to describe the scale and categorical data, respectively. Pearson's Chi square test, Fishers exact test, Mont Carlo exact test, and Odds Ratio were used for categorical data analysis. A P values <0.05 is set as level of significance.

### *Ethical statement*

The study was approved by the institutional review board and the ethics committee of the High Institute of Public Health affiliated to Alexandria University, Egypt. The research complied with the international ethical research guidelines. All participants were invited to sign an informed written consent after explaining the aim and concerns of the study. Data sheets were coded to ensure anonymity and confidentiality of patient's data.

## Results

### *Patient's demographics*

About 55.6% of the studied HCV cases were males whereas females represented 44.4% with 1.25:1 M:F ratio. Their ages ranged between 19 and 59 (mean  $\pm$  SD= 41.5  $\pm$  10.2 years, median= 43, Q1=30, Q3=50). Most of the participants were from rural areas (n=322; 81.3%). Other sociodemographic characteristics are detailed in (Table 1).

### *Risky exposures among enrolled HCV seropositive cases*

The number of identifiable risk factors reported by each patient ranged from 3-24 (Fig. 1). Analysis of behavioral and community acquired risk factors for having HCV seropositive status (Table 2) revealed that, most of the patients (n=389; 98.2%)

gave a history of sharing hygiene and sharp items including razors, tooth brush, combs, towels, nail clippers, scissors, tweezers, and manicure cutter. Two thirds (n=288; 72.7%) were sharing barber or

manicure sets, and about 219 (55.3%) patients had a history of body piercing performed by a traditional practitioner. Other practices and community acquired risk factors are detailed in (Table 2).

**Table 1:** Sociodemographic data of the enrolled HCV patients

Characteristic	HCV cases (n=396)	
	n	%
<b>Age (yr)</b>		
19-29	58	14.6
30-39	102	25.8
40-49	131	33.1
50-59	105	26.5
Mean±SD=41.5±10.2 Median=43 (Range 19-59), Q1=33, Q3=50		
<b>Gender</b>		
Male	220	55.6
Female	176	44.4
<b>Residence</b>		
Rural	322	81.3
Urban	74	18.7
<b>Marital Status</b>		
Single	56	14.1
Married	320	80.8
Divorced	4	1.0
Widowed	16	4.0
<b>Education</b>		
Illiterate	74	18.7
Read & write	79	19.9
Primary education	42	10.6
Preparatory education	49	12.4
Secondary Education	137	34.6
University education	15	3.8
<b>Occupation</b>		
Health care worker	2	0.5
Employee	13	3.3
Manual worker	24	6.1
Farmer	68	17.2
Housewife	166	41.9
Trader	29	7.3
Butcher	2	0.5
Others (professionals and clerical workers)	29	7.3
Not working	63	15.9

Concerning the iatrogenic risk factors (Table 3); almost all patients (n=395; 99.75%, males 217/217, females 175/176) had history of circumcision (ritual clitorodectomy for females) that was done in only 25% of them by health care worker. History of parenteral treatment, hospitalization, dental manipulation, and operations was reported among (86.6%), (74.8%), (74.2%), 186 (47.0%) of

the patients. More than half of the cases (57.3%) had a history of traditional phlebotomy (ventosed blood-letting)/cupping (known in the Arab world as Hijama) that was performed in only one third (29%) by health care workers. Injectable anti-bilharzial drug, contact with HCV +ve index case, contact with jaundiced patients, and a history of endoscopy were reported by 128 (32.3%), 119

(30.1%), 109 (27.5%), and 47 (11.9%) patients. About 58 (14.7%) patients had previous blood/blood products transfusion; 7 of them were before 1992. History of blood donation was reported in 38 patients (9.6%), while 32 (8.1%) patients were previously rejected as blood donors. History of trauma, accidents, needle stick injuries, and accidental exposure to blood was claimed by 41 (10.4%), 6 (1.5%), and 5 (1.3%) cases respectively. Almost two thirds of the interviewed cases (63.4%) had a history of elevated liver enzymes and one-fourth (27.5%) had history of jaundice. Only 2 participants had completed a course of HBV vaccination, and another 3 had incomplete vaccination. Chronic diseases including, hypertension, chronic liver diseases and bronchial asthma were observed among 17.4%, 11.9% and 3.5% of the cases. None of the participant was on hemodialysis, or had a history of organ transplantation, sexual promiscuity, homosexuality or STDs. The

study sample was stratified at 35 years of age. Analysis of risk factors in each age cluster and among males and females are described in Table 2 and 3. Tattooing, folk body piercing, acupuncture, use of barber/manicure sets, folk Hijama, major /minor surgery, frequent blood transfusion and transfusion after 1992, being rejected as a blood donor, hospitalization, parenteral treatment, receiving injectable antibilharzial treatment, history of elevated liver enzymes, having hypertension or chronic liver disease were significant risk factors among older patients. On the other hand, tattooing, folk body piercing, acupuncture, major surgery and history of receiving injectable antibilharzial treatment were found significant among females, whereas use of barber sets, IVDUs, sharing drug paraphernalia, alcohol abuse, smoking, incarceration, traveling abroad, military service, Hijama done by HCW and endoscopy were established risky exposures among males.

**Table 2:** Risky exposures among enrolled HCV cases: Behavioral and community acquired risk factors

Risky Exposure	HCV cases (n=396)  n (%)	Age Cluster		OR (95% CI)	P	Gender		OR (95% CI)	P
		≤35 (n=126) n (%)	>35 (n=270) n (%)			Male (n=220) n (%)	Female (n=176) n (%)		
Tattooing	122 (30.8)	13 (10.6)	109 (89.3)	6 (3.2-11)	0.0001	31 (25.4)	91 (74.6)	6.5 (4-10.6)	0.0001
Body Piercing/Threading									
HCW	10 (2.5)	7 (70.0)	3 (30.0)	2.6 (0.7-10.5)	0.17	0 (0.0)	10 (100.0)	7455 (140-394652)	0.0001
Folk	209 (52.8)	36 (17.2)	173 (82.8)	4.2 (2.7-6.8)	0.0001	43 (20.6)	166 (79.4)	1358 (83-22250)	0.0001
Acupuncture	159 (40.2)	19 (11.9)	140 (88.1)	6 (3.5-10.4)	0.0001	56 (35.2)	103 (64.8)	4.1 (2.7-6.3)	0.0001
Sharing hygiene/sharp items	389 (98.2)	122 (31.4)	267 (68.6)	2.9 (0.6-13.2)	0.22	214 (55.0)	175 (45.0)	4.9 (0.6-41)	0.14
Use Barber/Manicure sets	288 (72.7)	144 (39.6)	174 (60.4)	9.5 (4.9-18.3)	0.0001	214 (74.3)	74 (25.7)	49.2 (20.7-116.7)	0.0001
IVDUs	29 (7.3)	8 (27.6)	21 (72.4)	1.2 (0.5-2.9)	0.61	29 (100.0)	0 (0.0)	54.4 (2.3-896.6)	0.005
Sharing drug paraphernalia	88 (22.2)	33 (37.5)	55 (62.5)	1.3 (0.8-2.3)	0.19	88 (100.0)	0 (0.0)	235.7 (14.5-3834)	0.0001
Alcohol abuse	10 (2.5)	3 (30.0)	7 (70.0)	1.1 (0.3-4.3)	0.9	10 (100.0)	0 (0.0)	17.6 (1.02-303)	0.04
Smoking	94 (23.7)	29 (30.8)	65 (69.1)	1.1 (0.6-1.7)	0.82	94 (100.0)	0 (0.0)	263.7 (16.2-4287)	0.0001
Incarceration	6 (1.5)	2 (33.3)	4 (66.6)	1.1 (0.2-6)	0.8	6 (100.0)	0 (0.0)	10.7 (0.6-191.2)	0.036
Traveling abroad									
Once	35 (8.8)	6 (17.1)	29 (82.8)	2.4 (0.9-6.1)	0.05	34 (97.1)	1 (2.9)	31.2 (4.6-252.6)	0.0005
More	12 (3.0)	2 (16.7)	10 (83.3)	2.5 (0.5-11.8)	0.2	12 (100.0)	0 (0.0)	25.1 (1.5-428)	0.025
Military service	193 (48.7)	61 (31.6)	132 (68.4)	1 (0.7-1.6)	0.93	193 (100.0)	0 (0.0)	2483 (150-41025)	0.0001

None was on hemodialysis, or had history of organ transplantation, STD, or homosexuality.  
P>0.05 is significant

Table 3: Risky exposures among enrolled HCV cases: Iatrogenic risk factors

Risky Exposure	HCV cases (n=396)  n (%)	Age Cluster		OR (95% CI)	P	Gender		OR (95% CI)	P
		<35 (n=126) n (%)	>35 (n=270) n (%)			Male (n=220) n (%)	Female (n=176) n (%)		
Circumcision									
HCW	101 (25.5)	69 (68.3)	32 (31.7)	1.4 (0.1-35.4)	0.8	86 (85.1)	15 (14.9)	16.7 (0.7-430)	0.08
Folk	294 (74.2)	56 (19.0)	238 (81.0)	12.7 (0.5-314)	0.13	134 (45.6)	160 (54.4)	2.5 (0.1-62)	0.6
Hijama/Cupping									
HCW	115 (29.0)	38 (33.1)	77 (66.9)	1.5 (0.9-2.6)	0.06	82 (71.3)	33 (28.7)	2.5 (1.5-4.2)	0.0003
Folk	113 (28.3)	14 (12.5)	98 (87.5)	5.4 (2.9-10.3)	0.0001	54 (48.2)	58 (51.8)	1.1 (0.6-1.7)	0.8
Surgery									
Minor	67 (16.9)	13 (19.4)	54 (80.6)	3.4 (1.8-6.8)	0.0002	41 (61.2)	26 (38.8)	1.05 (0.6-1.8)	0.86
Major	119 (30.1)	17 (14.3)	102 (85.7)	5 (2.8-9)	0.0001	48 (40.3)	71 (59.7)	2.4 (1.5-3.9)	0.0001
Transfusion of blood/blood products									
Before 1992	7 (1.8)	1 (14.3)	6 (85.7)	3.1 (0.4-26)	0.3	5 (71.4)	2 (28.5)	1.9 (0.4-10.1)	0.4
After 1992	51 (12.9)	10 (19.6)	41 (80.4)	2.1 (1-4.4)	0.04	24 (47.1)	27 (52.9)	1.4 (0.8-2.6)	0.2
Frequent	56 (14.1)	11 (19.6)	45 (80.4)	2.1 (1.1-4.2)	0.035	27 (48.2)	29 (51.8)	1.4 (0.8-2.4)	0.23
Infrequent	2 (0.5)	0 (0.0)	2 (100.0)	2.5 (0.1-54)	0.5	2 (100.0)	0 (0.0)	3.8 (0.2-8)	0.38
Blood donation									
Frequent	38 (9.6)	12 (31.6)	26 (68.4)	1.1 (0.5-2.3)	0.8	19 (50.0)	19 (50.0)	0.8 (0.4-1.5)	0.49
Rejected	32 (8.1)	10 (31.2)	22 (68.8)	9.1 (3.9-21.4)	0.0001	18 (56.2)	14 (43.8)	1.03 (0.5-2.1)	0.93
Dental manipulation									
Frequent	82 (20.7)	32 (39.0)	50 (61.0)	1.3 (0.7-2.3)	0.4	43 (52.4)	39 (47.6)	1.06 (0.6-1.9)	0.8
Infrequent	212 (53.5)	60 (28.3)	152 (71.7)	1.3 (0.8-2.1)	0.36	122 (57.5)	90 (42.5)	1.2 (0.7-1.9)	0.5
Invasive procedure (Endoscopy)	47 (11.9)	10 (21.3)	37 (78.7)	1.8 (0.9-3.8)	0.1	35 (74.5)	12 (25.5)	2.6 (1.3-5.1)	0.007
Accidental exposure to blood	5 (1.3)	0 (0.0)	5 (100.0)	5.2 (0.3-95.5)	0.3	3 (60.0)	2 (40.0)	1.2 (0.2-7.3)	0.84
Needle stick injury	6 (1.5)	2 (33.3)	4 (66.7)	1.7 (0.2-6)	0.94	3 (50.0)	3 (50.0)	0.8 (0.16-4)	0.78
Accident/injury	41 (10.4)	10 (24.3)	31 (75.6)	1.5 (0.7-3.2)	0.28	34 (82.9)	7 (17.1)	4.4 (1.9-10.2)	0.0005
Hospitalization									
Once	131 (33.1)	33 (25.2)	98 (74.8)	3.9 (2.3-6.9)	0.0001	81 (61.8)	50 (38.2)	1.3 (0.8-2.2)	0.3
More	165 (41.7)	36 (21.8)	129 (78.2)	4.7 (2.8-8.2)	0.0001	84 (51.0)	81 (49.0)	1.2 (0.7-2)	0.5
Parenteral treatment									
Once	57 (14.4)	20 (35.1)	37 (64.9)	3.6 (1.6-8)	0.0001	34 (59.6)	23 (40.4)	1.6 (0.14-17.6)	0.48
More	286 (72.2)	71 (24.8)	215 (75.2)	5.9 (3.1-11)	0.0001	151 (52.8)	135 (47.2)	1.7 (0.9-3.7)	0.07
Injectable anti-Bilharzial	128 (32.3)	0 (0.0)	128 (100.0)	228 (14-3705)	0.0001	58 (45.3)	70 (54.7)	1.8 (1.2-2.8)	0.005
Elevated liver Enzymes	251 (63.4)	62 (24.7)	189 (75.3)	2.4 (1.6-3.7)	0.0001	148 (59.0)	103 (41.0)	1.5 (0.96-2.2)	0.072
Jaundice	109 (27.5)	24 (22.0)	85 (78.0)	1.9 (1.2-3.2)	0.01	68 (62.4)	41 (37.6)	1.5 (0.94-2.3)	0.092
Contact with jaundiced patient	64 (16.2)	20 (31.2)	44 (68.7)	0.9 (0.5-1.7)	0.91	32 (50.0)	32 (50.0)	0.8 (0.4-1.3)	0.33
Contact with HBV/HCV +ve case	119 (30.1)	42 (35.3)	77 (64.7)	1.3 (0.8-2)	0.33	58 (48.7)	61 (51.2)	1.5 (0.96-2.3)	0.074
HBV vaccination									
Incomplete	3 (0.8)	2 (66.7)	1 (33.3)	4.3 (0.4-48)	0.2	2 (66.7)	1 (33.3)	1.6 (0.14-17.6)	0.7
Complete	2 (0.5)	0 (0.0)	2 (100.0)	2.3 (0.1-48.8)	0.6	0 (0.0)	2 (100.0)	6.3 (0.3-132)	0.2
Chronic disease									
Hypertension	69 (17.4)	1 (1.4)	68 (98.5)	53 (7.3-392)	0.0001	37 (53.6)	32 (46.4)	1.1 (0.6-1.8)	0.7
Asthma	14 (3.5)	5 (35.7)	9 (64.3)	1.4 (0.5-4.3)	0.5	7 (50.0)	7 (50.0)	0.8 (0.3-2.3)	0.68
chronic liver disease	47 (11.9)	5 (10.6)	42 (89.4)	6.6 (2.5-17.3)	0.0001	29 (61.7)	18 (38.3)	1.3 (0.7-2.4)	0.4
Others	5 (1.3)	0 (0.0)	5 (100.0)	8.6 (0.5-158.4)	0.14	2 (40.0)	3 (60.0)	1.8 (0.3-11.4)	0.49

No reported history of hemodialysis, organ transplantation, or STDs

P&gt;0.05 is significant

## Discussion

Risk factors for HCV transmission were found in all study populations. At least three identifiable risk factors were reported. This conflicts previously published results indicating that 40% of HCV infected patients have no apparent source of infection (4). The epidemiology of HCV infection has changed in Egypt because of life style change and newly introduced medical interventions. These have resulted in corresponding changes in ways of HCV transmission. Before, the main route of infection was the unsafe injection practices. The era of parenteral anti-schistosomal therapy (PAT) led in large-scale campaigns (between 1950s - 1980s) by the Egyptian Ministry of Health for controlling schistosomiasis was the main driver of the HCV epidemic in Egypt (5, 6). PAT represented a significant risk factor in the present study among older population. This contradicts results from a prior study where PAT was a risk for both older and younger age groups, which could be attributed to recall bias or participants' misunderstanding of PAT as any type of treatment for schistosomiasis (9). Parenteral therapy for schistosomiasis is no longer a risk for transmission of infection that followed a declining trend consequent to its replacement by oral treatment in last few decades. This could explain in part the cohort effect in increasing HCV prevalence in ages older than 30 years in Egypt.

Blood transfusion was incriminated in HCV transmission before the introduction of the universal blood screening practices. However, it remains a significant past and a potential current risk for HCV transmission in developing countries, where anti-HCV screening is limited by technical and financial factors. El-Ghitany et al., found in a recent meta-analysis comparing HCV risk factors worldwide and in Egypt that some HCV risk factors, including blood transfusion were decreasing over decades (8). In the present study, the risk of acquiring HCV infection through blood transfusion before and after 1992 was consistently higher among the older population. This disagrees with results of a community based study (9), where blood transfusion was an independent predictor

of anti-HCV in the younger age group despite using lower young age cutoff in defining his population (<30 years). Together, these suggest that anti-HCV testing of the blood supply has become more reliable in the past decade.

Most epidemiological studies conducted in Egypt attribute the bulk of HCV transmission among populations to behavioral and community-derived risky practices and exposures (9). The present study provided the opportunity to investigate exposures from community-derived sources of infection among males and female, and did demonstrate some behavioral and community-acquired exposures unique among males that entail several risky behaviors particularly unsafe sexual practices (10). These included IVDU, sharing drug paraphernalia, alcohol abuse, smoking, incarceration, military service, and traveling abroad. This reflects the reserved society that prohibits such practices among women (11). These risks were observed to decline among younger age cluster probably due to increased public education and awareness regarding these modes of viral transmission, however suggests the involvement of unreported/unidentified risk factor among them. On the other hand, tattooing, body piercing and acupuncture were more common among women. Tattooing and body piercing are growing social phenomena among young adults over recent years (12). Tattooing has been considered by some epidemiologists to be a minor factor implicated in HCV spread (13, 14). In Egypt, it is performed by non-licensed workers using non-sterile techniques. In other countries, tattooing was reported to predominate among HIV patients, IVDUs and in prisoners and thus confounded by other parenteral and sexual transmissions (13, 14). In Egypt, tattooing is linked more to rituals and traditions. Christians in Egypt tattoo their Christ symbol on their forearms. Nomads, Bedouins, gypsies and residents of Upper Egypt, particularly women use tattoo as a cultural tradition or as body art for esthetic concerns. Body piercing exclusively as ear piercing, was reported mostly by women, whereas that for folk medical raison, i.e. the introduction of thread through opening created in the skin to act as a counter irritant was experienced by both

genders. Body piercing involving other body parts such as lips, tongue, nose, eyebrows ...etc. is a rare practice in such highly reserved rural society where the majority of the study population resides. Hepatitis C virus infection is hyper-endemic among IVDUs populations that are subjected to several risky behaviors such as sharing needles with sexual and non-sexual partners, sharing non-sterile drug paraphernalia, or exchanging sex for drugs or money (11, 15-19). The percentage of patients reporting injection drug use (7.3%) is considerably low in comparison to other studies conducted in Egypt (23%) (20) or in developed countries. IVDU is believed to rarely exist in rural communities (20), or that history denial contributed to its under estimation in the present setting. Younger age group (19 -  $\leq 35$ ) had a relatively lower HCV prevalence, suggesting a cohort effect. Analysis of risk factors among the older age cluster that would have been infected many years before, tracks the risk factors for transmission in the past, whereas data from younger group provide insight into more recent modes of transmission. Consistent with results of Medhat et al., (9) male circumcision and female ritual clitorodectomy were essentially universal practices. The latter was done by informal practitioners since strategies and policies have been implemented to abandon this practice so that it could not be done in health care facilities. However, despite commendable work, it is still prevalent as a cultural and traditional ritual that is erroneously linked to Islamic religion (21). The present study evidence a change in the trend of exposures from some community-derived sources. There is a significant decrease in prevalence of tattooing, non medicalized circumcision, Hijama and cupping done by informal practitioners, folk body piercing and threading, sharing hygiene and sharp items, and the use of communal barber or manicure sets among younger age cluster. This could reflect public health awareness of risks acquired from these sources. Occupational health care exposure was not common in the study population. Farming is the principal occupation in rural communities where prevalence is the greatest for *Schistosoma mansoni* infection (22).

The rapid introduction of new technologies and invasive procedures in health care settings has raised possibility of acquiring acute HCV infections through hospitalization particularly in developing countries (23-25). Shortage of supplies, break in standard precautions during minor procedures and improper sterilization adopted in health care settings found in rural and remote areas are beyond the exposures associated with medical procedures particularly parenteral medical treatment, endoscopy, surgery, and dental manipulations. This risk was significantly higher among older participants suggesting laxity in effective infection control measures in the last decades (25) that have been improved afterwards or evidence to the significant higher prevalence of chronic diseases and the frequent parenteral treatment and invasive medical procedures among them.

Evidence from prior studies pointed to the importance of the sexual transmission of HCV (8, 26-29). Inquiry into the patient's sexual history helps to identify an appreciable number of possible high-risk activities for HCV transmission. However, in the present study, reservation about this taboo issue has limited history taking. All participants denied practices of sexual promiscuity. The study was limited by lack of controls and thus could not provide an appropriate judgment. The analysis of risk factors was not evidence based rather than being based on the subjects' memory thus prone to recall bias. We were also confronted with responder bias due to some sensitized and private questions concerning taboo and social stigmatic issues like sexual promiscuity, homosexuality and substance abuse and these together could influence the results.

## Conclusion

Several possible risks for HCV transmissions could be identified in a single chronic HCV patient. Some behavioral and community-acquired exposures that entail several risky behaviors, particularly unsafe sexual practices, alcohol and substance abuse were exclusively established among males. Unhygienic practices, including tattooing,

non medicalized circumcision, Hijama done by informal practitioner, folk body piercing and threading, sharing hygiene and sharp items, and the use of communal barber or manicure sets significantly declined among younger age cluster.

Egypt, has limited financial resources to challenge HCV infection and support wide-scale prevention programs. Targeting and prioritizing prevention activities are therefore essential. Investment in communication strategies directed at the public is crucial for promoting behavior changes and reducing risky behaviors and emphasize safe practices. Expansion to involve all healthcare settings and institutions should be considered.

## Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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