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HEPATITIS C IN A COMMUNITY IN UPPER EGYPT: RISK FACTORS FOR INFECTION

AHMED MEDHAT, MAGDA SHEHATA, LAURENCE S. MAGDER, NABIEL MIKHAIL, LAILA ABDEL-BAKI, MOHAMED NAFEH, MOHAMED ABDEL-HAMID, G. THOMAS STRICKLAND, AND ALAN D. FIX

Hepatitis C Prevention Project, Assiut University Faculty of Medicine, Egypt; University of Maryland School of Medicine, Baltimore, Maryland; Minia University Faculty of Medicine, Egypt

Abstract. This investigation's objective was to identify risk factors for hepatitis C virus (HCV) in a village in Upper Egypt with a moderately high prevalence (8.7%) of antibodies to HCV (anti-HCV). A representative sample of 6,012 (63%) of the 9,581 village inhabitants was included in the study. A questionnaire solicited information regarding risk factors for infection, and blood samples were tested for anti-HCV. Parenteral risks identified in age-adjusted analysis included blood transfusions, dental procedures, hospital admission, surgery, complicated deliveries, history of injection therapy for schistosomiasis, and history of frequent injections. Circumcision was pervasive and was not associated per se with ant-HCV; however, circumcision by an informal, rather than formal, health care provider was associated with anti-HCV among young men and boys. The results did not reveal any unique community-acquired exposures that caused HCV infections: inhabitants who had tattoos, who smoked goza, who were shaved by a community barber, or who had their ears pierced were not at greater risk for anti-HCV than those who did not. Risks identified in multivariate analysis for both those older and younger than 30 years included prior parenteral therapy for schistosomiasis and blood transfusion; for those 30 or younger, circumcision by an informal rather than formal health care provider, and frequent injections; and for those older than 30, never attending college, invasive medical procedures, and complicated deliveries. Selecting for those with blood transfusion, prior parenteral therapy for schistosomiasis, and invasive medical procedures would identify less than half of those infected. Inclusion of frequent injections would identify 80% of those infected with HCV, but as a result of the pervasive use of injections, it would not discriminate from those uninfected. Nonetheless, general reduction of these exposures and assuring sterile practices are logical goals for intervention.

INTRODUCTION

The prevalence of hepatitis C virus (HCV) antibodies (anti-HCV) is reported to be higher in Egypt than in any other country,[1,2] and there is evidence that large schistosomiasis control campaigns in the past that used repeated mass intravenous therapy with tartar emetic contributed to the establishment of a large reservoir of HCV infection in the population.[3–5] Those programs were discontinued 20 years ago, and, given the substantial reservoir of infection, it is of utmost importance to identify not only current risk factors for transmission but also those factors that indicate higher risk of past infection. Unlike in many Western countries,[6,7] intravenous drug use (IVDU) is rare in Egypt, especially in rural areas,[8] making this an unimportant mode of transmission, and exposure via tainted blood products has been minimized after the introduction of screening for anti-HCV.

Children and young adults have a relatively high anti-HCV prevalence, although it is less than in the older population, which suggests that HCV transmission continues in the country. We therefore designed and conducted investigations of risk factors for prevalent infection (which does not distinguish between past and present risks) and incident infection (to obtain data on recent infections for prevention efforts), focusing on rural areas, where the highest level of transmission was occurring.[5] These studies were performed in communities in the Nile Delta, where prevalence was the greatest and *Schistosoma mansoni* was a possible confounding variable,[3,9] and in Upper Egypt, where anti-HCV prevalence, although high, was less and *Schistosoma haematobium* was a possible confounder.[4] Herein, we report results of our analyses of risk factors for prevalent infection in the community in Upper Egypt.

MATERIALS AND METHODS

Community and subject characteristics. The demographic characteristics and prevalence of anti-HCV and its relationship to *Schistosoma haematobium* infection in the study population has been described elsewhere.[4] After obtaining informed consent from all adult participants and permission from parents of participating minors, questionnaire data and blood samples were obtained from 6,012 (62.8%) of the 9,581 village inhabitants 5 years of age or older and from 19 of the 1,646 children aged < 5 (an age group not targeted for this investigation). As noted in the earlier report, nonparticipants differed from the total population by more likely being male, and male nonparticipants were younger than male participants. Nonparticipants had a slightly lower level of education and were more likely to be unmarried than participants.

Data collection. An extensive questionnaire designed by a team of sociologists, epidemiologists, and clinicians familiar with modes of HCV transmission and local customs was administered by trained survey teams. Adults and children older than 10 were interviewed themselves; the female heads of the households normally provided information about younger children.

Laboratory testing. Anti-HCV was tested via a second-generation enzyme immunoassay (EIA) with recombinant HCV antigen bound to beads as the solid phase (Abbott HCV EIA 2.0; Abbott Laboratories, Chicago, IL), performed according to the manufacturer's instructions. Sera from 514 of the 523 participants with positive anti-HCV test results were tested for HCV RNA by a one-step reverse transcriptase–polymerase chain reaction method as described by Abdel-Hamid and others.[10]

Statistical methods. All exposures were tested for association with anti-HCV positivity in bivariate analysis with calculation of odds ratios and 95% confidence intervals while

adjusting for age. To perform this adjustment, we used separate logistic regression models controlling for age by including a dummy variable for those < 4 years old, dummy variables for each 2-year age group for those aged 4–40, and 5-year age groups for those older than 40. The use of the dummy variables in these models averted the need to assume a linear relationship between the log odds of seropositivity and age.

In addition, to estimate the association between statistically significant exposures as well as other factors of interest and anti-HCV while controlling for other exposures, we fit several multivariable logistic regression models. We chose to fit separate models for those below and above the age of 30 years because we previously found the inflexion in anti-HCV prevalence to occur at that age, and that age better separates those who were often and those who were rarely exposed to parenteral antischistosomal therapy in this area of Egypt. In all these models, to allow for correlation between members of the same household, we used the generalized estimating equations approach[11] assuming an exchangeable correlation structure within households. The models were fit by SAS software (Proc Genmod; SAS Inc., Cary, NC).

RESULTS

The anti-HCV prevalence in the community was 8.7% (95% confidence interval, 8.0–9.5) and was significantly higher among male than female subjects ($P < 0.0001$, Table 1). Prevalence increased with age, and there was a sharp increase after 30 years of age. Among those older than 20, anti-HCV prevalence was lower for those with at least some college education compared with those with less education ($P = 0.08$). Among the 514 anti-HCV positive sera tested for HCV RNA, 324 were positive (63%).

Frequency of exposures. Less than 1% of male and female subjects over the age of 30 reported that they had not been circumcised (Table 2). In general, female children were more likely than male children to be circumcised by an informal health care provider, and both men and women older than 30 were more likely than their younger counterparts to have been circumcised by an informal health care provider.

Frequent injections (≥ 10) were reported by the majority of both the older and younger participants, and sharing of syringes was not uncommon. Other relatively common exposures included hospital admission, sutures, surgery, intravenous catheterization, and dental treatment. Most adult women had given birth, usually assisted by a traditional birth attendant, and many reported having undergone abortions. A quarter of participants reported a history of schistosomiasis, and only 2% reported previous parenteral therapy for schistosomiasis, the majority of whom were older than 30 years (7% exposure in this group).

Age-adjusted associations between exposures and anti-HCV status. The odds of anti-HCV were increased among male subjects 30 or younger who had been circumcised by an informal health care provider compared with those who either had been circumcised by a formal health care provider or who had not been circumcised (Table 3). Because almost all older male and female subjects had been circumcised, analysis was performed for those 12 years old or younger to evaluate recent risk associated with circumcision. In this age group, there were no significant differences in anti-HCV prevalence between those circumcised and those not circumcised for the entire group (2.2 and 1.9%, respectively, $P = 0.86$), for male subjects (2.4 and 4.4%, respectively, $P = 0.18$), or for female subjects (1.8 and 1.0%, respectively, $P = 0.37$). However, the prevalence of anti-HCV was higher among boys who were circumcised by informal providers than among those circumcised by formal health care providers (4.9 and 0.5%, respectively, $P < 0.001$). This difference was not statistically significant for girls (2.1 and 0%, respectively, $P = 0.6$).

Many health care exposures were associated with anti-HCV in the age-adjusted analysis, including the following: frequent injections, hospital admission, sutures, surgery, intravenous catheterization, blood transfusion or donation, endoscopy, cesarean section, delivery by informal birth attendant, delivery by ventouse (vacuum) extraction, history of schistosomiasis, and receipt of parenteral therapy for schistosomiasis (Table 3). The strongest of these associations was for history of parenteral therapy for schistosomiasis (odds ratio, 5.5). In the first decade of life, anti-HCV was more common in those who had received a blood transfusion than in those who had not: 3 (25%) of 12 and 16 (1.4%) of 1,111, respectively ($P < 0.0001$). All 3 anti-HCV positive cases among those transfused were patients between 7 and 10 years of age, and 2 reported having undergone surgical procedures. Dental treatment and extraction were associated with anti-HCV status among those 30 and younger.

Among the community exposures, including shaving by the community barber and smoking goza, only cauterization was associated with anti-HCV prevalence, and this association was marginal (Table 3).

Multivariate regression results. The significant exposures common to both those over and those under age 30 included parenteral therapy for schistosomiasis and blood transfusion, which, excluding delivery by ventouse extraction (reported by only 11 women), were the exposures with the highest odds ratios for both age groups (Tables 4 and 5). For those 30 years old or younger, circumcision of male subjects by an informal health care provider, frequent injections, and dental treatment were also significantly associated with anti-HCV (Table 4). For the older age group, never having attended college, undergoing invasive medical procedures, and giving birth by

TABLE 1
Anti-hepatitis C virus (HCV) prevalence by age, sex, and education

Variable	n	Anti-HCV positive, n (%)
Total	6,033	523 (8.7)
Age (y)		
0–9	878	16 (1.8)
10–19	2,089	68 (3.3)
20–29	1,027	52 (5.1)
30–39	821	137 (16.7)
40–49	544	126 (23.2)
50+	674	124 (18.4)
Sex		
Female	3,316	215 (6.5)
Male	2,717	308 (11.3)
Education (for those > 20 years old)		
University attendance	89	7 (7.9)
School attendance	1,448	226 (15.6)
No school attendance	1,345	196 (14.6)

TABLE 2
Exposure to potential risk factors for hepatitis C virus

Risk factor	Total, n (%) (n = 6,033)	Age ≥30 years, n (%) (n = 4,165)	Age >30 years, n (%) (n = 1,868)
Circumcision			
Males			
None	166 (6.2)	164 (8.7)	2 (0.3)
By formal health care provider	768 (28.5)	696 (36.8)	72 (9.0)
By informal health care provider	1762 (65.4)	1033 (54.6)	729 (90.8)
Females			
None	425 (12.8)	421 (18.6)	4 (0.4)
By formal health care provider	155 (4.7)	139 (6.2)	16 (1.5)
By informal health care provider	2,731 (82.5)	1,700 (75.2)	1,031 (98.1)
Injection history			
Usually by informal health care providers	1,103 (18.3)	673 (16.2)	430 (23.0)
Report of sharing syringes	475 (7.9)	318 (7.6)	157 (8.4)
Frequently receives injections (> 10/lifetime)	3,901 (64.7)	2,448 (58.8)	1,453 (77.8)
Hospital or clinic experiences			
Admission	1,759 (29.2)	950 (22.8)	809 (43.3)
Sutures	927 (15.4)	553 (13.3)	374 (20.0)
Surgery	951 (15.8)	424 (10.2)	527 (28.2)
Intravenous catheter	947 (15.7)	463 (11.1)	484 (25.9)
Abscess drainage	325 (5.4)	201 (4.8)	124 (6.6)
Urinary catheter	84 (1.4)	28 (0.7)	56 (3.0)
Blood transfusion	165 (2.7)	67 (1.6)	98 (5.2)
Blood donation	184 (3.0)	60 (1.4)	124 (6.6)
Endoscopy	67 (1.1)	16 (0.4)	51 (2.7)
Dental treatments			
Any	1,998 (33.1)	708 (17.0)	1,290 (69.1)
Extractions	1,968 (32.6)	694 (16.7)	1,274 (68.2)
Gum treatment	141 (2.3)	50 (1.2)	91 (4.9)
Fillings	94 (1.6)	26 (0.6)	68 (3.6)
History of schistosomiasis	1,577 (26.1)	1,172 (28.1)	405 (21.7)
Parental treatment of schistosomiasis	134 (2.2)	11 (0.2)	123 (6.6)
Schistosoma haematobium in urine	196 (3.2)	179 (4.3)	17 (0.9)
Obstetric exposures (women ≥ 20 years old)			
Any delivery	1,470 (82.0)	511 (68.0)	959 (92.2)
Delivery with traditional birth attendants	1,398 (78.0)	471 (62.6)	927 (89.1)
Abortion	493 (33.1)	128 (24.9)	365 (37.5)
Delivery with ventouse extraction	11 (0.7)	2 (0.4)	9 (0.9)
Shaving at community barber (men only)	1,060 (39.0)	441 (23.2)	619 (76.0)
Smoking goza (men only)	340 (12.5)	144 (7.6)	196 (24.1)
Sharing razors within family (men)	214 (7.9)	96 (5.1)	118 (14.6)
Ear piercing (women only)	3,247 (98.0)	2,199 (97.3)	1,048 (99.4)
Cauterization	43 (0.7)	10 (0.2)	33 (1.8)

ventouse extraction were significantly associated with anti-HCV (Table 5).

Identification of anti-HCV infected. Relatively few of HCV infections would be accounted for by the 3 exposures having the greatest risk (Table 6); combined, they would identify only 47% (24 and 55% among those aged ≤ 30 and > 30, respectively) in the study sample. Only 10% of those who were anti-HCV positive did not report any of the 5 potential risk factors in Table 6, but these factors were so ubiquitous among the anti-HCV–negative subjects they would be poor discriminators between those infected and not.

DISCUSSION

The high prevalence of anti-HCV in rural Egyptian villages[1,3,4] provides an unusual opportunity to investigate risks for infection with this virus in populations in which the current predominant risk factor for infection in the West, IVDU,[7,12,13] is not an issue.[8] Because of reservations regarding acceptability of questions about drug use, we do not have data about IVDU, but it is believed IVDU would be very rare or nonexistent in this setting. Although IVDU has been identified as a risk factor for infection in a small, metropolitan study of risk factors for HCV in Cairo,[14] IVDU was denied (and believed not present) in another rural Egyptian village in the Nile Delta.[8] The epidemiology of, and specific risk factors for, HCV infection in developing areas such as Egypt is quite different from that of the West,[15] and given the high prevalence of HCV, it is of utmost importance to identify past and current risk factors for infection so that intervention programs may be appropriately focused.[16]

The 2 communities in which we have been conducting studies of hepatitis allow us to examine and contrast risk factors for HCV. One of these is in the Nile Delta, where *Schistosoma mansoni* is endemic.[3,9] The other, and the subject of this report, is 375 km south of Cairo, up the Nile River, in Upper Egypt, where *S. haematobium* is the endemic *Schistosoma* species and the prevalence of anti-HCV, although still relatively high, is lower than in the Nile Delta village.[4] Farming is the principal occupation in both communities, but there are some socioeconomic differences between the two.

These data also provide the opportunity to investigate exposures from community-derived sources of infection (e.g., circumcision, injections from nontraditional health workers,

TABLE 3
Age-adjusted associations between exposures and anti–hepatitis C virus

Risk factor	Odds ratio (95% confidence interval)	
	Age ≥ 30 years	Age > 30 years
Circumcision by informal care provider*		
Males	2.0 (1.1–3.6)	0.7 (0.4–1.1)
Females	1.3 (0.5–3.4)	0.4 (0.2–1.2)
Injections		
Usually by informal health care provider (versus not)	0.9 (0.6–1.4)	1.0 (0.8–1.3)
Shared syringes	1.1 (0.7–2.0)	1.0 (0.6–1.5)
Reports "frequent" injections	1.6 (1.1–2.2)	1.3 (1.0–1.8)
Hospital and clinic exposures		
Admission	1.4 (0.9–2.0)	1.6 (1.3–2.0)
Sutures	1.4 (0.9–2.1)	1.8 (1.4–2.4)
Surgery	1.6 (1.0–2.5)	1.5 (1.2–1.9)
Intravenous catheterization	1.4 (0.9–2.2)	1.6 (1.2–2.0)
Abscess drainage	0.7 (0.3–1.6)	1.4 (0.9–2.1)
Urinary catheterization	3.0 (0.9–10.1)	1.3 (0.7–2.5)
Blood transfusion	5.7 (2.9–11.4)	2.3 (1.5–3.5)
Endoscopy	6.2 (1.8–21.6)	1.7 (0.9–3.2)
Blood donation	0.6 (0.2–2.1)	2.4 (1.6–3.7)
Obstetric exposures (women)		
Any delivery	1.1 (0.5–2.1)	1.6 (0.7–3.5)
Delivery by informal birth attendant	1.0 (0.6–1.9)	2.1 (1.0–4.3)
Cesarean section	–	2.2 (1.0–5.2)
Delivery with ventouse extraction	–	7.8 (2.1–28.8)
Dental treatment		
Any	1.5 (1.0–2.2)	1.0 (0.8–1.3)
Extractions	1.5 (1.0–2.3)	1.0 (0.8–1.3)
Gum treatments	–	1.1 (0.6–1.9)
Fillings	1.3 (0.3–5.7)	0.9 (0.5–1.8)
History of schistosomiasis	1.2 (0.9–1.8)	3.5 (2.7–4.5)
Received parental antischistosomal therapy	4.6 (1.1–18.2)	5.5 (3.7–8.1)
Schistosoma haematobium in urine	1.3 (0.6–2.7)	2.1 (0.7–6.4)
Shaving at community barber (men only)	0.9 (0.4–2.0)	1.1 (0.7–1.5)
Smoking goza in a group (men)	0.9 (0.4–2.0)	0.8 (0.5–1.1)
Sharing razors in a family (men only)	1.0 (0.4–2.6)	1.4 (0.9–2.2)
Ear piercing (women)	1.1 (0.1–8.9)	0.8 (0.1–6.8)
Tattoo	1.1 (0.5–2.8)	0.8 (0.5–1.0)
Cauterization	–	2.1 (1.0–4.4)

* Compared with those not circumcised and with those circumcised by a formal care provider.

TABLE 4
Age-adjusted effect of predictors on the odds of anti–hepatitis C virus for subjects ≤ 30 years of age based on a multivariable logistic-regression model

Variable	Odds ratio	95% confidence interval	*P* value
Male	1.4	0.6–3.3	0.44
Ever married	1.1	0.5–2.1	0.81
Males circumcised by an informal health care provider*	1.8	1.1–3.2	0.02
Females circumcised by an informal health care provider*	1.6	0.7–3.8	0.28
History of schistosomiasis	1.0	0.6–1.5	0.87
Injection treatment for schistosomiasis	4.4	1.1–18.3	0.04
Injections from informal health care provider	0.9	0.6–1.3	0.49
Frequent injections	1.6	1.1–2.2	0.01
Smoking goza	0.9	0.4–2.0	0.76
Surgery, endoscopy, intravenous or urinary catheterization, or renal dialysis	1.1	0.7–1.7	0.71
Sutures or abscess drainage	0.6	0.2–1.9	0.41
Giving birth attended by formal health care provider	1.1	0.3–4.3	0.94
Giving birth attended by informal health care provider	0.9	0.5–1.8	0.81
Blood donation	0.5	0.1–2.0	0.36
Blood transfusion	5.3	2.6–10.7	< 0.001
Dental treatment	1.5	1.0–2.2	0.08
Shaved by community barber	0.9	0.5–1.8	0.77

* Compared with those not circumcised and with those circumcised by a formal care provider.

hookah pipe [goza] smoking, shaving by community barber) in addition to the exposures associated with medical procedures (e.g., parenteral medical treatment, blood transfusion, gastrointestinal endoscopy, surgery, hospitalization, dental procedures) that occur in developed countries.

Because there was a distinctly higher prevalence of anti-HCV in the older members of the community than in the younger population, for most analyses, the study sample was stratified at 30 years of age. Analysis of risk factors among the older population may better define the risk factors for transmission in the past because many of these individuals would have been infected many years before. Likewise, analysis of risk factors in the younger group is more likely to provide insight into more recent modes of transmission.

Parenteral therapy of schistosomiasis and blood transfusion were associated with anti-HCV in both age groups. Parenteral therapy of schistosomiasis has repeatedly been identified as a risk factor for HCV infection in Egypt.[3–5,8,9,17,18] Among those older than 30, history of schistosomiasis was associated with an increased risk of anti-HCV, even after controlling for prior parenteral therapy. It is difficult to explain this finding. It is possible that some of the older subjects forgot they received parenteral therapy or misunderstood the question. This association was not observed in the Nile Delta village.[3,9] Nonetheless, parenteral therapy for schistosomiasis is no longer a risk for transmission of infection, but history of this exposure is an important marker for possible HCV infection, particularly among older Egyptians.

In the developed world, the risk of transmission through blood transfusion has greatly diminished with the introduction of effective screening.[7,15] However, blood transfusion remains an important past and a potential current risk for HCV transmission in developing countries, where anti-HCV screening is limited by technical and financial factors. Although blood transfusion was an independent predictor of anti-HCV in the younger population in this study, it was a rare exposure in the younger cohort in the Nile Delta community and is not associated with anti-HCV.[9] This difference in risk from blood transfusions between the 2 communities could be due to the older age cutoff defining the younger cohort in the Upper Egypt village than in the delta community, thus including in the current study a higher proportion of individuals who could have been exposed to transfusions before the availability of donor HCV screening in 1991. However, the proportion with anti-HCV was higher among those 10 years old or younger who had received a blood transfusion than among those who had not, suggesting that anti-HCV testing of the blood supply may not have been totally reliable.

TABLE 5

Age-adjusted effect of predictors on the odds of anti–hepatitis C virus for subjects > 30 years old based on a multivariable logistic-regression model

Variable	Odds ratio	95% confidence interval	*P* value
Male	2.3	0.6–9.4	0.25
Males circumcised by an informal health care provider*	0.7	0.4–1.3	0.26
Females circumcised by an informal health care provider*	0.4	0.1–1.2	0.10
Ever married	0.5	0.2–1.1	0.09
Attended college (versus no school)	0.2	0.1–0.9	0.03
Some school (versus no school)	0.8	0.6–1.1	0.25
History of schistosomiasis	1.6	1.1–2.3	0.01
Injection treatment for schistosomiasis	3.2	2.0–5.2	< 0.001
Injection from informal health care provider	0.7	0.5–0.9	0.01
Frequent injections	1.1	0.8–1.6	0.44
Smoking goza	0.8	0.5–1.2	0.21
Surgery, endoscopy, intravenous or urinary catheterization, or renal dialysis	1.3	1.0–1.7	0.02
Sutures or a§cess drainage	0.9	0.4–1.8	0.71
Giving birth attended by formal health personnel	0.3	0.04–2.7	0.30
Giving birth attended by informal health personnel	1.8	0.9–3.8	0.11
Giving birth with ventouse extraction	4.9	1.3–18.2	0.02
Blood donation	1.5	0.9–2.5	0.11
Blood transfusion	2.4	1.5–3.9	< 0.001
Dental treatment	1.0	0.8–1.4	0.75
Shaved by a community barber	1.0	0.7–1.5	0.94

* Compared with circumcision by formal health care provider.

Nonetheless, those anti-HCV–positive subjects in their first decade were exposed to additional invasive risks. It is not clear why blood donation was a significant risk in the age-adjusted analysis. It is possible that there was some confusion with blood transfusion among participants.

Frequent injections, described as a risk factor for HCV in a previous report from Egypt,[19] were a significant risk factor for the younger but not the older group. This risk is so pervasive that it is a poor discriminator for infection, especially in the older group (Table 6). It is likely that injections given in rural communities by both traditional and nontraditional health care providers are an important cause of HCV transmission, and the importance of combating this ubiquitous risk in prevention programs cannot be overstated.[20–24]

A similarly common potential risk factor is dental treatment, which, like frequent injections, was associated with anti-HCV status only among those younger than 30. Although most studies have not found dental procedures to be a risk for HCV in Egypt or elsewhere,[9,12,25] there is evidence that they may pose a risk,[26–28] and in circumstances of prevalent infection and suboptimal sterile technique, they are a logical target for prevention programs.[16]

Invasive medical procedures, previously reported to be associated with HCV infection in Egypt,[29,30] had a small increased odds of HCV infection among those older than 30 but not among the younger participants. Improved precautions during these procedures may be responsible for the difference between the 2 age groups, but lower exposure rates among the younger cohort is also a likely explanation.

Giving birth by ventouse extraction, although rare (Table 2), was associated with HCV infection in women older than 30. This association may be due to other interventions associated with complicated deliveries rather than the actual process of vacuum extraction.

The results regarding circumcision are consistent with those from the study in the Nile Delta.[9] Circumcision was essentially universal among older female subjects, and those not yet circumcised were mostly younger girls. As was found in the delta community,[9] circumcision among male subjects by an informal health care provider was associated with HCV infection. The contrast of findings between male and female subjects may be because of sex-based differences in the practice of circumcision: boys are sometimes circumcised in groups at communal ceremonies, whereas girls are generally circumcised individually.

The results of this investigation, as well as previous reports, did not demonstrate other unique community-acquired exposures that caused HCV infections.[8,9] Inhabitants who had tattoos, smoked goza pipes, were shaved by a community barber, or had their ears pierced were not at greater risk for anti-HCV than those that did not.

An anticipated benefit of this study was the identification of risk factors helpful in identifying those most at risk for infection, for both screening and diagnostic purposes. Although history of blood transfusion or parenteral therapy for schistosomiasis were good discriminators between those infected and not (Table 6), they identified less than a quarter of those infected. Because of their pervasiveness in rural Egyptian communities, injections are difficult to prove or disprove as transmitters of HCV.

TABLE 6

Proportion of subjects with history of parenteral risk factors, by anti–hepatitis C virus (HCV) status

Anti-HCV status	Risk factors, n (%) of those of each serostatus with reported exposure					
	Blood transfusion	Invasive hospital procedure	Schistosomias is injection treatment	Frequent injections	Dental treatment	Any of these factors
All						
Negative	118 (2.1)	1,130 (20.5)	65 (1.2)	3,492 (63.4)	1,691 (30.7)	4,097 (74.4)
Positive	47 (9.0)	207 (39.6)	69 (13.2)	409 (78.2)	307 (58.7)	471 (90.1)
≤ 30 years old						
Negative	55 (1.4)	615 (15.3)	9 (0.2)	2,343 (58.3)	664 (16.5)	2,687 (66.9)
Positive	12 (8.1)	34 (22.8)	2 (1.3)	105 (70.5)	44 (29.5)	119 (79.9)
> 30 years old						
Negative	63 (4.2)	515 (34.5)	56 (3.8)	1,149 (76.9)	1,027 (68.7)	1,410 (94.4)
Positive	35 (9.4)	173 (46.3)	67 (17.9)	304 (81.3)	263 (70.3)	352 (94.1)

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Author's addresses: Ahmed Medhat, Magda Shehata, Nabiel N. H. Mikhail, Laila Abdel-Baki, and Mohammed A. Nafeh, Department of Tropical Medicine, Faculty of Medicine, Assiut University, Assiut, Egypt. Mohamed Abdel-Hamid, Viral Hepatitis Reference Laboratory, Hepatitis C Prevention Project, 10 Kasr El-Aini Street, Cairo, Egypt. Alan D. Fix, Laurence S. Magder, and G. Thomas Strickland, International Health Division, Department of Epidemiology and Preventive Medicine, University of Maryland School of Medicine, 660 West Redwood Street, Baltimore, MD, 21201.

Reprint requests: Alan D. Fix, Department of Epidemiology and Preventive Medicine, School of Medicine, University of Maryland–Baltimore, 660 West Redwood Street, Baltimore, MD 21201, Telephone: 410 706-3491, Fax: 410-706-8013, E-mail: afix@epi.umaryland.edu

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