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HCV Screening Behaviors and Infection Status among Vietnamese Americans

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Abstract

Objectives: The aim of this study was to identify socio-economic and acculturation factors associated with hepatitis C (HCV) screening and infection among US Vietnamese Americans.

Methods: Participants were recruited from 7 Vietnamese community-based organizations in Pennsylvania and New Jersey. The analysis ultimately included 309 participants who participated in a HCV education intervention program.

Results: Overall, 82.5% (255 of 309) intervention participants completed HCV screening over the 6 months prior to the post-intervention assessment. In multivariate-adjusted analysis, participants who lived in Vietnam for 40 years versus 20 years were more likely to receive HCV screening; unemployed individuals were less likely to receive HCV screening than employed people. Among screened participants, 7.5% had HCV infection.

Conclusions: These findings will guide future culturally and linguistically appropriate interventions to reduce HCV infection and HCV-related liver cancer.

Keywords

Asian Americans; Vietnamese; Vietnamese Americans; Hepatitis C; HCV screening; HCV infection

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Human Subjects Statement

This project was approved by the Temple University Institutional Review Board office (application #11187).

Conflict of Interest Statement

The authors have no conflict of interest to report.

The hepatitis C virus (HCV) is the most common chronic blood-borne infection in the United States (US) and is a leading cause of chronic liver disease and liver cancer.[1–3] From 2011 to 2012, documented incident HCV cases increased from 1229 to 1778; after controlling for asymptotic infection underreporting, the Centers for Disease Control and Prevention (CDC) estimated to be 21,870 new infections.[4] The CDC reports that approximately 2.7 million individuals (CI 2.2 to 3.2 million) are chronically infected with HCV in the US.[5,6] Of individuals newly infected with HCV, about 75%−85% progress to chronic HCV infection. Of those who develop chronic HCV, 60%–70% will develop chronic liver disease.[7] For those with untreated chronic HCV, 15%−30% will advance to cirrhosis over 20 years and 1%–5% will die from hepatocellular carcinoma (liver cancer) and cirrhosis.[1,7–11] Due to HCV liver-related morbidities, patients with chronic HCV are one of the most common groups needing intensive treatments like liver transplantation.[1,5] However, early identification and timely treatment can lead to the suppression of HCV and may delay progression to cirrhosis and liver cancer.[8–10]

Asian Americans and Pacific Islanders (AAPIs) have the highest incidence of liver cancer, among all ethnic groups, with rates of 21.4 per 100,000 for men and 8.1 per 100,000 for women, as compared to 8.0 and 2.8 for Whites, 12.5 and 3.8 for African Americans, and 15.9 and 6.2 for Hispanics, respectively.[11] In comparison with other racial and Asian ethnic groups in the US, Vietnamese men have the highest incidence of liver cancer (41.8 per 100,000 compared to 3.8 per 100,000 for non-Hispanic white men, 6.7 per 100,000 for Hispanic men, and 6.9 per 100,000 for African-American men).[12]

HCV Infection in the US

Most of the existing literature on HCV screening focuses on transmission routes and was conducted among high-risk groups including individuals who have HIV, have donated blood or received hemodialysis, and war veterans.[13–16] In the US, chronic HCV infection and risk factors are tracked through the National Health and Nutrition Examination Survey (NHANES). From data complied between 1988 through 1994, the strongest predictors of HCV infection were illegal drug use and high-risk sexual behavior.[17] Other factors included having Hepatitis B virus, being below the poverty level, having ≤12 years of formal education, and being divorced or separated.[17] Data from NHANES from 2003 through 2010 showed that those with chronic HCV were infected via injecting drug use and having a blood transfusion prior to 1992.[6] Other factors were being aged 40–59 years, male, non-Hispanic African American, having less education, and having less income. Compared to Whites, Asians had 0.88 lower odds of having a chronic HCV infection.[18] However, Asians have a greater risk than Whites of developing liver cancer once infected with HCV.[19–21]

Vietnam War veterans both from the US and Vietnam have high rates of HCV, ranging from 10% to 20%.[16,22–24] Drug use, combat exposure (eg, blood contact during fighting), surgery, transfusions, and sexual encounters with a prostitute are major infection factors.[25] A cross-sectional study of patients in a San Francisco Veterans Administration Medical Center found that having had a blood transfusion before 1992 (OR= 2.29; 95% CI: 1.21, 4.26) and a tattoo (OR = 3.02; 95% CI: 1.60, 5.66) were statistically associated with HCV infection among individuals without a history of drug use.[26] HCV transmission through blood transfusions in

the US is rare since 1992 due to new screening procedures for donated blood.[27,28] Intravenous drug use accounts for approximately 60% of HCV transmission.[4,6,18,29] HCV transmission also occurs through needles used in acupuncture, tattoos and skin piercings, sexual contact, mother-to-child transmission, and blood transfusion in healthcare settings.[1,8,30] Because chronic hepatitis C is usually asymptomatic, infected individuals may be unaware that they are at risk for liver-related morbidity and mortality,[2,5,7,8,31,32] and can continue to transmit the virus to others. In one analysis of NHANES data, 49.7% of those newly diagnosed were aware of their positive HCV infection.[6] Thus, active screening and timely treatment is the key to HCV prevention, early detection, and survival.[8–10,31]

HCV in the Vietnamese Population

According to the World Health Organization, the prevalence of HCV in Vietnam was 2.0%–2.9% in 2010.[33] Other studies estimate chronic HCV to range from .38% to 4.3% in the Vietnamese general population and from 31% to 97.2% among Vietnamese injecting drug users.[23,24,34,35] Previous studies suggest this high prevalence may be attributable to unsafe blood bank practices, unsafe needle use in tattoos, acupuncture and transfusions for dialysis, and transmission from an infected mother to child.[35–37] Before safer programs were put into place,[27,38] the blood supply in Vietnam was dependent on commercial donors, many of whom were HCV infected drug users.[27]

HCV in the Vietnamese American Population

US studies of Vietnamese Americans find similar reasons for HCV transmission. In a retrospective survey of Asian Americans with HCV that included Vietnamese Americans (27.7% of the total sample), re-usage of needles and syringes when in Asia and having a blood transfusion before 1992 were major forms of HCV transmission.[39,40] Studies in California indicated Asian Americans were likely to have become HCV-infected due to unsafe blood transfusions and needle practices, perhaps in their home countries (89%–97% foreign born) or being born between 1945 and 1965.[21,22,41–43]

Community HCV sampling taken at health fairs report a wide range of HCV prevalence among Vietnamese Americans. In the Northern Virginia area, out of 222 screened, 2.2% of the sample (N = 7) were infected with HCV.[44] A marginally significant relationship was found in this study between HCV infection and patients' report of a family history of HCV.[44] A health fair of 617 Vietnamese Americans in the Baltimore-Washington, DC area reported 5% HCV infected overall and, of those over 70 years old, 13.9% infected.[45] In Houston, Texas, the prevalence of HCV in the small sample of 39 Vietnamese American participants, 6 (15.4%) were infected, an unusually high prevalence, perhaps due to some participants already knowing they were infected.[46]

Factors Associated with HCV Screening

Few previous studies among Asian Americans identify barriers to HCV screening. In one study of 1405 Vietnamese Americans in California, inadequate health insurance coverage, not having a regular physician and limited access to regular health-care were significant

barriers to HCV screening.[22] In studies of other US populations, lack of healthcare access, health insurance, less education, and being a drug user were barriers to screening and care for those chronically infected.[47,48] Further, many physicians feel uncomfortable asking patients about HCV risk factors and screening because they do not like asking about socially undesirable behavior and they are uncertain about patients' health insurance coverage.[49,50] Considering the high rates of HCV among the Vietnamese American population and the elevated risk of liver cancer once chronically HCV infected, research is needed to assess factors associated with HCV screening behavior and infection. Multivariate-adjusted models were developed to explore the associations among socio-demographic variables, acculturation, healthcare, HCV history, and prior exposures with HCV screening behavior and infection status.

METHODS

Study Population

We recruited participants from 7 Vietnamese community-based organizations (CBOs) located in Pennsylvania and New Jersey from 2010 to 2011. These Vietnamese CBOs are members of the Asian Community Health Coalition and partners of the Center for Asian Health, Temple University. A total of 321 Vietnamese American participants, aged 19 to 85, attended a hepatitis C educational program and completed questionnaires at baseline and post-intervention. The educational intervention was delivered in workshop format and covered general information about HCV and liver cancer including transmission, the course of the disease, and risk factors. Vietnamese specific information included HCV prevalence and risk factors for those living in Vietnam such as blood bank practices, transfusions, tattooing, and acupuncture. The risks for those who served in the Vietnamese army were noted such as the unsafe use of needles for vaccinations and transfusions and risks associated with warfare and sex.

Six-month follow-up data were collected for HCV screening behaviors and results. For HCV screening behavior, participants missing information for HCV screening (N = 12) were excluded, resulting in a final sample of 309. For infection status, an additional 53 participants who responded "don't know" for self-reported HCV infection and one participant who reported not having been screened for HCV but answered the infection question were excluded, leading to a final sample of 255.

Outcomes

The primary outcome variable was HCV screening behavior at 6 months' post-intervention because the largest intervention effect was expected to occur in the first few months after the intervention. Participants self-reported whether or not they had received a blood test for HCV during the past 6 months with either a "Yes" or "No." Among the 309 participants, 255 participants (82.5%) self-reported having a HCV screening test and these data were validated with medical records. The secondary outcome was HCV infection status among those receiving HCV screening during the prior 6 months. For infection status, participants were categorized as being "infected with hepatitis C" or "not infected with hepatitis C" and these results were validated with medical records.

Independent Variables

Detailed socio-demographic and healthcare-related information was self-reported in the baseline questionnaire, including age, sex, marital status, education, employment status, having health insurance, and having a regular physician. Age was treated as a continuous variable, and sex was grouped as male (reference) and female. The responses for marital status were collapsed into categories for analysis: “married” and “other,” which included “never married,” “divorced/separated,” and “widower.” Education was comprised of 4 categories: university or above, high school graduate, less than high school (reference), and missing. Employment status comprised 6 categories: employed (reference), unemployed, retired, homemaker, student, and missing. Moreover, responses to having health insurance and a regular physician were coded as binary variables (either yes or no).

Acculturation was assessed using number of years lived in Vietnam, participation in social-cultural gatherings, and English proficiency. Using the information gathered from the open-ended question, “How many years did you live in Vietnam?” we categorized length of stay in Vietnam as 0–20 (reference), 21–30, 31–40, or over 40 years. For participation in social-cultural gatherings, participants responded that they participated “all the time,” “sometimes,” or “not at all.” This variable was collapsed into 2 categories (yes and no). English proficiency was measured by how well participants thought that they spoke English. Answers were categorized as “Not at all,” “Not well,” and “Well or very well.”

HCV history was examined using information about family medical history and participants’ prior exposures. For family medical history, participants were asked whether or not a family member had ever had liver disease or had been infected with HCV. To assess prior exposures, participants reported whether or not they were ever exposed to any blood products and ever served in the Vietnamese army.

Data Analysis

Bivariate and multivariate-adjusted logistic regression analyses were performed to estimate the crude and adjusted odds ratio (OR) for variables that were possibly associated with HCV screening behavior and infection using Stata 11. For HCV screening behavior, English proficiency, family medical history (family member had liver disease or infected with HCV), participation in social-cultural gatherings, and exposure to blood products were not significant in the initial bivariate analysis, and consequently, were excluded from further analysis. Socio-demographic and healthcare-related variables, including age, sex, marital status, education, employment status, having health insurance, and having a regular physician were included because prior analyses with other Asian ethnic groups had shown statistical significance for some categories for these variables and allowed comparisons.[51] Similarly, for analysis of the HCV infection status outcome, the final model included age, sex, marital status, participation in social-cultural gatherings, and exposure to blood products. Variation inflation factor (VIF) values were used to assess model multicollinearity. All variables had VIF values that were in an acceptable range (1.20–2.65). Possible interaction effects were tested, and if found to be significant, stratified analysis was performed.

RESULTS

Descriptive Statistics

Table 1 presents the descriptive analysis for examining HCV screening behavior. Of the total of 309 participants, 255 (82.5%) had received screening for HCV during the previous 6 months. Among those screened for HCV, the mean age was 50 years and approximately 58% were female and 67% were married. More than half of participants had lived in Vietnam for 21 years or more (65.5%) and another 20% were missing this information (N = 50). In regards to education, 18.8% of participants who received screening had a university education, 38.8% had a high school education, and 29% had less than a high school education; overall, 13.4% did not respond to this item (N = 34). Less than half of the participants (44.6%) had health insurance, and over half (55.4%) had a regular physician. Additionally, 18.3% had served in the Vietnamese army.

Compared to screened participants, those who had not been screened for HCV were similar with respect to age, sex, marital status, education, employment status, having health insurance, having a regular physician, and participation in social-cultural gatherings. Among the groups, marginal differences were found in number of years lived in Vietnam and significant differences for serviced in the Vietnamese army. More screened participants reported living in Vietnam for over 40 years (32.1% for screened vs 18.5% for non-screened) and had missing responses (19.6% missing for screened vs 13.0% missing for non-screened). Moreover, 18.3% of the screened participants had served in the Vietnamese army (N = 46), whereas only 3.9% of the non-screened participants did (N = 2).

Of the participants who were screened, 19 out of 255 (7.5%) reported that they were infected with HCV. Few variables distinguished participants who were HCV-infected compared to those not infected (Table 2). Those infected were younger (49.7% for infected vs 56.8% for not infected), less likely to attend social-cultural gatherings (52.6% for infected vs 77.1% for not infected), and more likely to have exposure to blood products (16.7% for infected vs 5.3% for not infected).

Factors Predicting HCV Screening

Only a small proportion of participants (17.5%) had not been screened for HCV over the previous 6 months (Table 3). In bivariate analysis, those who lived in Vietnam more than 40 years compared to ≤120 years (reference), those with less than a high school education compared to university or above (reference), unemployed compared to employed (reference), and those who served in the Vietnamese army were more likely to receive HCV screening. Based on type III tests to assess overall effects, only years lived in Vietnam ($p = .07$) and serving in the Vietnamese army ($p = .023$) were found to be statistically significant.

In the multivariate-adjusted model, compared to those who resided in Vietnam for less than 20 years, participants who lived in Vietnam for over 40 years were 3.7 times more likely to report having been screened for HCV (OR = 3.66; 95% CI: 1.06, 12.66). Participants who had below a high school education were 5 times more likely to report HCV screening compared to those with a university education or above, after adjusting for covariates (OR = 5.02; 95% CI: 1.44, 17.51). Unemployed individuals were less likely to have had HCV

screening compared to employed persons after adjusting for covariates (OR = 0.37; 95% CI = 0.14, 0.95). Furthermore, having served in the Vietnamese army was strongly and significantly associated with HCV screening (OR = 9.49; 95% CI = 1.73, 52.19).

HCV Infection

Table 4 presents the results for the factors associated with HCV infection status. Of the participants, 19 (7.5%) reported having an HCV infection. In the bivariate analysis, variables that were significantly associated with HCV infection included age, participating in social-cultural gatherings, and having been exposed to blood products. However in the multivariate-adjusted model, only age and participation in social-cultural gatherings were significantly associated with HCV infection. Participants who were older (OR = 1.06; 95% CI=1.01, 1.10) and did not take part in social-cultural gatherings were more likely to have an HCV infection compared to those who participated in social-cultural gatherings (OR = 4.72; 95% CI = 1.52, 14.68).

Interaction terms were tested for multiple variables including combinations of education, years living in Vietnam, serving in the Vietnamese army, employment, and marital status, but no variables were significant. Thus, the results are not presented here.

DISCUSSION

In the US, the CDC issues recommendations for HCV screening including: (1) had ever injected drugs; (2) were ever on chronic hemodialysis; (3) received blood transfusions or organ transplants before July 1992; or (4) received clotting factor concentrates produced before 1987.[52] Screening is recommended for recognized exposures such as: (1) healthcare workers after needle stick, sharp object, or mucosal exposures to HCV-positive blood; (2) children born to HCV-positive mothers;[52] (3) HIV-infected persons; and (4) adults born between 1945 and 1965.[13,28] Despite the 2014 presidential proclamation on World Hepatitis Day identifying HCV as a critical problem for Asian Americans, little has been done to improve awareness and increase detection for groups at high risk like Vietnamese Americans.[53]

Despite high liver cancer and HCV incidence rates among Vietnamese Americans, little research has been conduced factors associated with HCV screening behavior and infection.[22,36,42] The findings from this study can be used to develop culturally and linguistically appropriate interventions to increase HCV screening, reduce the number of those infected with HCV, and delay the progress to liver-related diseases and cancer among those unaware of their infection status by screening.

Hepatitis C Screening

A high rate of HCV screening was achieved in the 6 months following the intervention in this convenience sample of Vietnamese Americans attending an HCV educational workshop. Although screening was not offered as part of this workshop, information on Asian-American healthcare agencies and providers was available as well as information about programs that could reduce the costs of screening. No other studies reporting a similar intervention in this population were identified in our extensive literature review so a

comparison was not possible. In the workshop, most participants talked about being aware of hepatitis B virus but were surprised that they had not heard of HCV and were previously unaware of the risk factors. Because so many of the participants lived in Vietnam prior to improvements making blood products and needle practices safer, the participants may have been highly motivated to obtain screening.[35] In both the bivariate and multivariate-adjusted logistic regression analyses, living in Vietnam for over 40 years was significantly associated with receiving HCV screening.

In multivariate-adjusted analysis, unemployed individuals also were less likely to receive HCV screening compared to employed individuals. Healthcare factors, including having health insurance and a regular physician, were adjusted for in the multivariate-adjusted model, but there may be other effects related to unemployment that made it uniquely associated with HCV screening. Individuals who were unemployed had a lower level of education, with 33.9% of the unemployed having less than a high school education and 30.4% having a high school education. Only 10.7% of the unemployed in our sample received a university education or higher, and 25% of the education responses were missing.

Contrary to previous findings, in our study, individuals with less than a high school education were more likely to receive HCV screening.[17] This may be attributable in part to the fact that the less educated also lived in Vietnam longer. Among participants with a university education or higher, only 18.5% had lived in Vietnam for over 40 years, whereas 31.7% of high school graduates and 26.8% of those with less than a high school education reported having lived in Vietnam for over 40 years.

We found significantly higher HCV screening rates among those who served in the Vietnamese army. In the intervention, risk factors were discussed that may have put those who served in the Vietnamese army at increased risk for HCV. Being in the army may have made these participants think that they were exposed to HCV during their service period and perceived a stronger need for screening.[54,55]

Hepatitis C Infection

The percentage of HCV-infected among screened participants of 7.5% (19 out of 255) is comparable to other convenience samples of Vietnamese-American community members screened at health fairs which ranged from 2.2 to 15.4%.[37,45–46] The study of Vietnamese HCV screening at a health fair in the Baltimore-Washington DC area found a 5% infection rate overall with an elevated rate among those over age 70 (13.9%), similar to the relationship found here between age and infection and has been found in other studies such as among volunteer blood donors in New York and among adults from NHANES.[6,56] Because of historical events like unsafe blood transfusions and war that accounted for HCV infections among older populations, the prevalence of HCV may be expected to decrease over time.[17,56,57] Unfortunately, in the next 10 to 20 years, there may be increasing numbers of elderly persons with liver diseases due to chronic HCV infection.[58]

Not attending social-cultural gatherings also was associated with HCV infection in the current study. Perhaps the behaviors or events that led to being HCV positive are somewhat stigmatizing that would decrease participation in social-cultural gatherings. Or, perhaps

those who are infected had some health issues that decreased participation. Only a larger, cohort study will be able to answer these questions.

Limitations

A primary limitation of this study is the use of self-report data for independent and dependent variables, raising the possibility of recall bias. Respondents may have reported answers that are more socially desirable, which may have introduced bias, especially for the acculturation variables. Fortunately, the study did not ask specifically about possible transmission routes or stigmatized behaviors that may improve the reliability of the findings. Further, the primary outcome measures were validated against medical records, improving the validity of the results.

Although the current study cannot be generalized due to the nature of the sample and data collection, the results are consistent with other community studies using convenience samples and suggest a need for a larger, population-based study to provide a better test of the results reported herein. Because of the relatively small size of the Asian-American population, for subgroups like Vietnamese, large national databases rarely have sufficient numbers to allow for estimates of incidence or prevalence and analysis of risk factors. Hence, the current study is important to provide insight into HCV in this high-risk group.

Public Health Implications

Preventing HCV infection and promoting early detection of chronic HCV infection is challenging among culturally unique populations like the Vietnamese in the US. Even with national efforts like the White House initiative on hepatitis mentioned earlier, reaching out specifically to Vietnamese-Americans may not be cost effective through standard public health approaches. Community-based participatory approaches as we employed here that worked with community organizations and leaders may offer the best possibility of increasing community awareness and screening. HCV screening efforts are critical for early detection and avoiding the risks of cirrhosis, liver cancer, and ultimately, death.[28] Because many individuals with a positive test result for HCV infection are unaware of their infection status,[6,18] prevention programs are depending on screening.[29] Hence, providing screening programs to high-risk groups like Vietnamese-Americans should be an important national priority.[34,53] Such programs can aid in increasing the uptake of HCV screening and allow for timely monitoring and treatment.[48,57] Our findings can be used to guide the development of future intervention programs that are culturally and linguistically appropriate.

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Table 1

Demographics, Acculturation and HCV Risk Factors by Screening Status N = 309

	Screened (N = 255) N (%)	Not screened (N = 54) N (%)	p value
Age (Mean, SD)	50 (14.6)	49 (12.6)	.705
Sex			.890
Male	106 (41.6%)	23 (42.6%)	
Female	149 (58.4%)	31 (57.4%)	
Level of education			.193
University or above	48 (18.8%)	13 (24.1%)	
High school	99 (38.8%)	24 (44.4%)	
Less than high school	74 (29.0%)	8 (14.8%)	
Missing	34 (13.4%)	9 (16.7%)	
Employment status			.171
Employed	104 (40.8%)	22 (40.6%)	
Unemployed	42 (16.5%)	14 (25.9%)	
Retired	37 (14.5%)	7 (13.0%)	
Homemaker	42 (16.5%)	3 (5.6%)	
Student	18 (7.1%)	3 (5.6%)	
Missing	12 (4.6%)	5 (9.3%)	
Marital status			.435
Married	170 (66.7%)	33 (61.1%)	
Other	85 (33.3%)	21 (38.9%)	
Household income			.273
Less than $10,000	97 (38.0%)	18 (33.3%)	
$10,000 - $20,000	40 (15.7%)	5 (9.2%)	
$20,000 - $30,000	20 (7.8%)	7 (13.0%)	
Above $30,000	17 (6.7%)	7 (13.0%)	
Missing	81 (31.8%)	17 (31.5%)	
Health insurance			.552
Yes	111 (44.6%)	26 (49.1%)	
No	138 (55.4%)	27 (50.9%)	

	Screened (N = 255) N (%)	Not screened (N = 54) N (%)	p value
Regular physician to visit			.302
Yes	129 (52.9%)	31 (60.8%)	
No	115 (47.1%)	20 (39.2%)	
Years lived in Vietnam			.061
≤ 20 years	38 (14.9%)	13 (24.1%)	
21–30 years	56 (22.0%)	13 (24.1%)	
31–40 years	29 (11.4%)	11 (20.3%)	
> 40 years	82 (32.1%)	10 (18.5%)	
Missing	50 (19.6%)	7 (13.0%)	
Social cultural gatherings			.532
Yes	192 (75.3%)	37 (71.2%)	
No	63 (24.7%)	15 (28.8%)	
English proficiency			.294
Not at all	98 (39.20%)	16 (29.63%)	
Not well	119 (47.60%)	32 (59.26%)	
Well or very well	33 (13.20%)	6 (11.11%)	
Family had liver disease			.552
Yes	35 (13.73%)	5 (9.26%)	
No	124 (48.63%)	30 (55.56%)	
Do not know	96 (37.65%)	19 (35.19%)	
Family infected with HCV			.371
Yes	10 (4.0%)	1 (2.0%)	
No	124 (49.6%)	30 (50.0%)	
Do not know	116 (46.4%)	19 (38%)	
Served in Vietnamese army			.009
No	206 (81.8%)	50 (96.1%)	
Yes	46 (18.22%)	2 (3.9%)	
Exposed to blood products			.067
No	229 (93.9%)	52 (100%)	
Yes	15 (6.1%)	0 (0%)	

Table 2

Demographics, Acculturation and HCV Risk Factors for Screened Participants by Infection Status (N = 255)

	Infected (N = 19) N (%)	Not infected (N = 236) N (%)	p value
Age (Mean, SD)	49.66 (0.94)	56.84 (3.41)	.039
Sex			.161
Male	5 (26.32%)	101 (42.80%)	
Female	14 (73.68%)	135 (57.20%)	
Level of education			.075
University or above	0	48 (20.34%)	
High school	7 (36.84%)	92 (38.98%)	
Less than high school	7 (36.84%)	67 (28.39%)	
Missing	5 (26.32%)	29 (12.29%)	
Employment status			.599
Employed	8 (42.11%)	96 (40.68%)	
Unemployed	3 (15.79%)	39 (16.53%)	
Retired	3 (15.39%)	34 (14.41%)	
Homemaker	5 (26.32%)	37 (15.68%)	
Student	0	18 (7.63%)	
Missing	0	12 (5.08%)	
Marital status			.866
Married	13 (68.42%)	157 (66.53%)	
Other	6 (13.58%)	79 (33.47%)	
Household income			.785
Less than $10,000	7 (36.7%)	90 (38.1%)	
$10,000 - $20,000	3 (15.8%)	37 (15.7%)	
$20,000 - $30,000	2 (10.5%)	18 (7.6%)	
Above $30,000	0	17 (7.2%)	
Missing	7 (36.8%)	74 (31.4%)	
Health insurance			.462
Yes	10 (52.63%)	101 (43.91%)	
No	9 (47.37%)	129 (56.09%)	

	Infected (N = 19) N (%)	Not infected (N = 236) N (%)	p value
Regular physician to visit			.648
Yes	11 (57.89%)	118 (52.44%)	
No	8 (42.11%)	107 (47.56%)	
Years lived in Vietnam			.078
≤ 20 years	1 (5.26%)	37 (15.68%)	
21–30 years	1(5.26%)	55 (23.31%)	
31–40 years	4 (21.05%)	25 (10.59%)	
> 40 years	10 (52.63%)	72 (30.51%)	
Missing	3 (15.79%)	47 (19.92%)	
Social cultural gatherings			.017
Yes	10 (52.63%)	182 (77.12%)	
No	9 (47.37%)	54 (22.88%)	
English proficiency			.340
Not at all	10 (52.6%)	88 (38.1%)	
Not well	6 (31.6%)	113 (48.9%)	
Well or very well	3 (15.8%)	30 (13.0%)	
Family had liver disease			.569
Yes	3 (15.8%)	32 (13.6%)	
No	11 (57.9%)	113 (47.9%)	
Do not know	5 (26.3%)	91 (38.5%)	
Family infected with HCV			.268
Yes	2 (10.5%)	8 (3.5%)	
No	10 (52.6%)	114 (49.3%)	
Do not know	7 (36.9%)	109 (47.2%)	
Served in Vietnamese army			.743
No	15 (78.95%)	191 (81.97%)	
Yes	4 (21.05%)	42 (18.03%)	
Exposed to blood products			.054
No	15 (83.33%)	214 (94.69%)	
Yes	4 (16.67%)	12 (5.31%)	

Table 3

Factors Associated with HCV Screening (N = 309)

Variable	Bivariate		Multivariate-adjusted	
	OR	95% CI [b]	OR [a]	95% CI [b]
Age	1.00	(0.98, 1.03)	0.97	(0.94, 1.01)
Sex				
Male	REF		REF	
Female	0.98	(0.53, 1.80)	1.06	(0.50, 2.24)
Years lived in Vietnam				
≤ 20 years	REF		REF	
21–30 years	1.47	(0.62, 2.53)	1.33	(0.49, 3.60)
31– 40 years	0.90	(0.35, 2.30)	0.96	(0.30, 3.05)
> 40 years	2.81	(1.13, 6.97) **	3.66	(1.06, 12.66) **
Missing	2.44	(0.72, 11.76)	2.92	(0.72, 11.76)
Marital status				
Married	REF		REF	
Others	0.79	(0.43, 1.44)	1.08	(0.50, 2.31)
Level of education				
University or above	REF		REF	
High school	1.12	(0.19, 1.05)	1.43	(0.58, 3.54)
Less than high school	2.51	(0.15, 1.04) *	5.02	(1.44, 17.51) **
Missing	1.02	(0.15, 1.15)	1.76	(0.52, 5.94)
Employment status				
Employed	REF		REF	
Unemployed	0.64	(0.30, 1.36)	0.37	(0.14, 0.95) **
Retired	1.12	(0.44, 2.83)	0.70	(0.17, 2.89)
Homemaker	2.96	(0.84, 10.42) *	1.67	(0.43, 6.49)
Student	1.27	(0.34, 4.68)	1.12	(0.25, 5.06)
Missing	0.51	(0.16, 1.59)	0.38	(0.08, 1.76)
Health insurance				
Yes	REF		REF	

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Variable	Bivariate		Multivariate-adjusted	
	OR	95% CI [b]	OR [a]	95% CI [b]
No	1.20	(0.66, 2.17)	1.23	(0.47, 3.18)
Regular physician				
Yes	REF		REF	
No	1.38	(0.75, 2.56)	1.59	(0.63, 4.05)
Served in the Vietnamese army				
No	REF		REF	
Yes	5.58	(1.31, 23.78)**	9.49	(1.73, 52.19)**

* p ≤ .10;

** p ≤ .05

Note.

a = Adjusted for age, sex, years lived in Vietnam, marital status, level of education, employment status, having health insurance, having a regular physician, and served in the Vietnamese army.

b = 95% confidence interval

Table 4

Factors Associated with HCV Infection (N = 255)

Variable	Bivariate	Multivariate-adjusted		
	OR	95% CI[b]	OR[a]	95% CI[b]
Age	1.04	(1.00, 1.07) **	1.06	(1.01, 1.10) ***
Sex				
Male	REF		REF	
Female	2.1	(0.73, 6.01)	2.34	(0.76, 7.21)
Marital status				
Married	REF		REF	
Others	0.92	(0.34, 2.50)	0.95	(0.32, 2.80)
Social-cultural gatherings				
Yes	REF		REF	
No	3.03	(1.17, 7.85) **	4.72	(1.52, 14.68) ***
Exposure to blood products				
No	REF		REF	
Yes	3.57	(0.91, 14.02) *	2.67	(0.63, 11.30)

* p ≤ .10;

** p ≤ .05;

*** p ≤ .01

Note.

a = Adjusted for age, sex, marital status, participation in social gatherings, and exposure to blood products.

b = 95% confidence interval