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Cigarette smoking in persons living with hepatitis C: The National Health and Nutrition Examination Survey (NHANES), 1999–2014

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Abstract

Background—Cigarette smoking is common in persons living with hepatitis C (hepatitis C+), but national statistics on this harmful practice are lacking. A better understanding of smoking behaviors in hepatitis C+ individuals may help in the development of targeted treatment strategies.

Methods—We extracted data from the National Health and Nutrition Examination Survey (NHANES) between 1999–2014. Hepatitis C+ were compared to hepatitis C– adults in the entire sample and in the subset of current smokers. Measures included demographics, current smoking, cigarettes/day, nicotine dependence, other tobacco use, substance use, and medical and psychiatric comorbidities.

Results—Complete smoking and HCV data were available for 39,472 (90.1%) of 43,793 adult participants in NHANES during the study years. Hepatitis C+ smoked at almost triple the rate of hepatitis C– adults (62.4% vs. 22.9%), with no significant difference between hepatitis C+ men and women (64.5% vs. 58.2%). Hepatitis C+ smokers were more likely to smoke daily than hepatitis C– smokers (87.5% vs. 80.0%), but had similar levels of nicotine dependence. Hepatitis C+ smokers were more likely to be older (mean age: 47.1 vs. 41.5), male (69.4% vs. 54.4%), Black (21.2% vs. 12.1%), less educated (any college: 31.8% vs. 42.9%), poor (mean family monthly poverty index: 1.80 vs. 2.47), uninsured (43.9% vs. 30.4%), use drugs (cocaine: 11.1% vs. 3.2%; heroin: 4.0% vs. 0.6%), and be depressed (33.2% vs. 13.5%). Multivariate analyses

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All authors had access to the dataset and assisted in the writing of the manuscript.

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revealed significant associations of both hepatitis C infection and cigarette smoking with current depression and hypertension.

Conclusions—There is a cigarette smoking epidemic embedded within the hepatitis C epidemic in the US. The sociodemographic profile of hepatitis C+ smokers suggests that the implementation of effective tobacco treatment will be challenging. Thoughtful treatment strategies that are mindful of the unique characteristics of this group are needed.

Keywords

Smoking; cigarette; tobacco; hepatitis C

Introduction

There are approximately 3,000,000 persons living with hepatitis C virus (hepatitis C+) in the United States (US).¹ Hepatitis C recently surpassed all other notifiable infectious diseases as a cause of death in the US.² Among hepatitis C+ individuals, mortality attributable to cardiovascular, respiratory, and non-hepatic cancers, all linked to tobacco use, exceeds that from liver-related causes.³

Hepatitis C in the US is concentrated in substance users, non-Hispanic Blacks, the poor, the undereducated, and those with mental health disorders,^{1, 4–6} all groups with high rates of cigarette smoking.⁷ National statistics on smoking rates among US hepatitis C+ persons are scarce, but one Veterans Administration study reported a smoking prevalence of 67% in >111,000 hepatitis C+ males in a 2001–2009 cohort.⁸

We have entered a new era in hepatitis C care with the advent of direct-acting antivirals (DAAs). These effective, but very costly, therapies cure the vast majority of recipients and reduce hepatitis C-related mortality.⁹ The US is poised to spend \$27 billion annually on DAAs to improve the quality and quantity of life for hepatitis C+ individuals,¹⁰ yet there is no organized strategy to combat the tobacco use that is destined to offset these benefits. We reviewed data from NHANES, 1999–2014, with the aim of generating information that will inform the development of cessation interventions for hepatitis C+ smokers. Two sets of analyses are presented. First, we compared smoking prevalence in hepatitis C+ vs. hepatitis C– persons. Second, we analyzed the subset of respondents who were current smokers, with the goal of identifying factors that distinguish hepatitis C+ from hepatitis C– smokers.

Methods

NHANES is a survey program conducted by the Centers for Disease Control that assesses the health and nutrition of US adults and children.¹¹ Since 1999, the survey has run continuously, and data are posted on a publicly available website. Participants include consenting, non-institutionalized civilians located in counties (15 per survey) throughout the US. Approximately 5,000 individuals are included in each survey.

Data extraction and definitions

We collected 147 NHANES data files from 8 survey cycles spanning 1999–2014. Tobacco use questions were systematically administered to adults ≥20 years old, so data were filtered for age ≥20.

Sociodemographic characteristics were defined by responses to single item questions in the DEMO dataset, except for insurance status in the HIQ dataset.

Cigarette smoking status was classified into three categories and one subcategory:¹²

1. Current smoker – reports [smoking ≥100 lifetime cigarettes] AND [currently smoking cigarettes every day or some days OR smoking a cigarette in the past 5 days].
 - a. Current non-daily smoker – a current smoker who reports smoking cigarettes on some days (i.e. not every day).
2. Ex-smoker – reports [smoking ≥100 lifetime cigarettes] AND [currently not smoking at all AND does not report smoking a cigarette in the past 5 days].
3. Never smoker – reports [smoking<100 lifetime cigarettes] AND [not smoking a cigarette in the past 5 days].

Average number of cigarettes smoked per day, number of years smoking, use of menthol cigarettes, and use of other tobacco products were derived from single item questions.

Nicotine dependence was derived from average daily cigarette consumption and minutes after waking until first cigarette, i.e. the Heaviness of Smoking Index,¹³ with scores of 0–2=very low, 3=low-moderate, 4=moderate, and 5–6=high.

Serum cotinine levels were derived from the laboratory dataset.

Hepatitis C testing is completed in NHANES for all consenting participants aged six years or older. The initial screen is a chemiluminescent microparticle immunoassay (CMIA) for anti-hepatitis C virus IgG and IgM. Before 2013, all CMIA+ samples were subjected to confirmatory recombinant immunoblot assay (RIBA). For RIBA+ and RIBA-indeterminate individuals, HCV-RNA nucleic acid amplification testing was performed. A positive HCV-RNA assay confirmed active hepatitis C infection. RIBA testing was not available for 2013–2014, so the HCV-RNA assay was conducted without the RIBA in this sample only. Reported prior hepatitis C treatment was relatively uncommon. A total of 34 participants reported prior treatment, and only 13 of them (38%) were HCV-RNA negative. Prior hepatitis C treatment was therefore not considered in our analyses. Active hepatitis C (hepatitis C+) was defined by a positive HCV-RNA test. Hepatitis C status was defined as uninfected (hepatitis C–) if either the antibody test/s were negative OR if the HCV-RNA test was negative.

Medical history (e.g. asthma, hypertension, lifetime substance use) was derived from single item questions.

Depression score was calculated from the Patient Health Questionnaire (PHQ-9), with a score of ≥ 10 signifying clinically relevant depression.¹⁴

Alcohol use was divided into four categories: (1) Never (<12 drinks ever) (2) Past only (≥ 12 drinks ever but no drinks in the past year) (3) Current non-excessive (≤ 2 drinks per day for men and ≤ 1 drink per day for women AND never ≥ 5 drinks in a day for the past year) (4) Current excessive (>2 drinks per day for men and >1 drink per day for women AND/OR ≥ 5 drinks in a day in the past year).¹⁵

Current marijuana, cocaine, and heroin use were defined as reported use within the past 30 days, past-only use was defined as any lifetime use but none in the past 30 days, and never use was defined as no lifetime use.

Statistical analysis

When performing analyses for individual NHANES cycles, we used the 2-year sample weights. When performing pooled analyses of eight NHANES cycles, we followed the NHANES guidance¹⁶ to calculate new survey weights, so that the estimates would be representative of the US population at year 2006, the midpoint of the combined survey period. Analyses used SPSS Version 24.0 and the R Version 3.3.2. survey package.¹⁷ In the first set of analyses, hepatitis C+ and hepatitis C- participants were compared for the entire NHANES sample. In order to better understand the contrasts between hepatitis C+ and hepatitis C- smokers, we conducted additional analyses that were restricted to current smokers.

For dichotomous variables, we estimated prevalence (for clinical outcomes) or proportions (for sociodemographic or behavioral variables) among the hepatitis C+ and hepatitis C- groups. For each variable, we calculated the odds ratio (OR) between the two groups and the corresponding 95% confidence intervals. We tested for statistical significance ($\alpha < 0.05$, two-tailed) using the Wald test. For categorical, non-dichotomous variables, we estimated the proportion of population in each category according to hepatitis C status and performed the survey chi-squared test to assess for differences between groups. For continuous variables, we used a survey t-test to compare means between the hepatitis C+ and hepatitis C- groups.

For certain medical diagnoses of interest, we also estimated adjusted ORs between the hepatitis C+ and hepatitis C- groups with survey multivariate logistic regression controlling for potential confounders including biologically important covariates: history of illicit drug use (ever/never), current smoking status, age, gender, and race.

Results

Participant sample

In the pooled cohort from 1999–2014, a total of 43,793 adults ≥ 20 years of age were included, and 39,472 (90.2%) provided adequate information to define both their hepatitis C and smoking status. Of these, 524 (1.3%) were hepatitis C+, and 8,820 (22.3%) were current smokers. Of the current smokers, 312 (3.5%) were hepatitis C+. Serum cotinine testing, a

biochemical measure of current smoking status ($>10\text{ng/ml}$ =current smoker¹⁸), was performed on 76.9% of the cohort, and it correlated moderately well with historical report: 92.2% of current, 8.0% of ex-, and 3.8% of never smokers had cotinine $>10\text{ng/ml}$.

Smoking prevalence

Hepatitis C+ individuals smoked at nearly triple the rate of hepatitis C- individuals (62.4% vs. 22.9%, $P<0.001$) in the 1999–2014 sample. Only 15.5% of hepatitis C+ individuals were never smokers compared with 52.6% of hepatitis C- individuals, $P<0.001$. Smoking prevalence did not differ significantly between hepatitis C+ males and females (64.5% vs. 58.2%, $P=0.27$), but the difference between hepatitis C- males and females was statistically significant (26.0% vs. 20.0%, $P<0.001$).

Demographics and clinical characteristics of hepatitis C+ vs. hepatitis C- smokers

Table 1 compares the sociodemographic characteristics of hepatitis C+ and hepatitis C- participants for both the overall sample and for the subset of current smokers. Hepatitis C+ respondents were more likely to be older, male, Black, poorly educated, poor, and less likely to be married/partnered and privately insured than hepatitis C- individuals. Hepatitis C+ smokers were more likely to be older, male, Black, poorly educated, poor, and less likely to be privately insured than hepatitis C- smokers.

Table 2 compares the clinical and behavioral characteristics of hepatitis C+ and hepatitis C- participants for both the overall sample and for the subset of current smokers. Histories of hypertension, illicit substance use, and injection drug use were more common in hepatitis C+ than hepatitis C- smokers. Current cocaine and heroin use were more common in hepatitis C+ than hepatitis C- smokers. Hepatitis C+ smokers were 2.5 times more likely to report clinically relevant depression than their hepatitis C- counterparts ($P<0.001$). Although there was no difference in current excessive alcohol use by HCV status, the prevalences were high in both groups of smokers (58.7% and 55.4%).

Cigarette smoking behaviors in hepatitis C+ vs. hepatitis C- smokers (Table 3)

There were no significant differences in daily cigarette consumption, nicotine dependence, or menthol cigarette usage by hepatitis C status. Hepatitis C+ smokers had been smoking for more years than their uninfected counterparts (30.4 vs. 23.9 years, $P<0.001$), and they were more likely to be daily smokers.

Multivariate analyses of clinical characteristics of hepatitis C+ vs. hepatitis C- individuals

Medical diagnoses that were associated with hepatitis C infection in the overall NHANES sample and that are known to be associated with cigarette smoking (i.e. emphysema, hypertension, stroke, current depression, and current excessive alcohol use) were subjected to logistic regression analyses in order to assess the relative associations of HCV status and current smoking with them. These analyses were adjusted for other biologically relevant covariates, i.e. age, gender, race, and history of illicit substance use (Table 4). The multivariate analyses demonstrated significant associations of both hepatitis C+ status and current cigarette smoking with hypertension and current depression.

Discussion

The CDC identifies hepatitis C as the leading reportable infectious killer in the US.² DAAs are destined to change the face of the hepatitis C epidemic, perhaps ending it altogether in the coming decades.¹⁹ This will be a costly enterprise, with projected US medication expenses of \$27 billion annually.¹⁰

The American Association for the Study of Liver Diseases (AASLD) with the Infectious Diseases Society of America (IDSA),²⁰ the US Department of Health and Human Services (DHHS),²¹ and the World Health Organization (WHO)²² have all published hepatitis C treatment guidelines since 2016. A large majority of US hepatitis C+ adults smoke cigarettes, and we describe herein the first national sample of PLHC women, who reported a smoking prevalence of 58.2%. The average smoker loses more than 10 years of life to this behavior,²³ yet the aforementioned guidelines are largely silent on tobacco use. The AASLD/IDSA mention cigarettes as a possible cofactor in the progression of liver fibrosis,²⁰ the DHHS action plan does not discuss tobacco use,²¹ and the WHO strategy statement makes a single mention, stating that smoking “may complicate chronic infection.”²² Smoking cessation is not a recommendation within any of these guidelines.

Heart disease, cancer, and stroke are the first, second, and fifth leading causes of death in the US.²⁴ The causal role of smoking in these health outcomes is firmly established. A meta-analysis of 22 studies (N=69,725) showed that hepatitis C likewise increases the risk for cardiac death, myocardial infarction and stroke even after adjustment for gender, body mass index, diabetes, hypertension, cholesterol, and smoking.²⁵ Hepatitis C causes both hepatocellular carcinoma (HCC)²⁶ and non-Hodgkin lymphoma.²⁷ It is also associated with cancers of the head and neck,²⁸ lung, pancreas, kidney, and anorectum.²⁹ With the possible exception of lymphoma, all of these cancers are separately linked to tobacco exposure. There is some evidence that these risks may be additive. For example, tobacco use amplifies the risk for HCC in hepatitis C+ individuals,³⁰ and it also compounds the risk for carotid plaque formation.²⁵

Widespread usage of DAAs promises increased longevity for those with HCV⁹ and may ultimately render hepatitis C infection a rare disease.¹⁹ Similar to HIV,³¹ it is possible, indeed likely, that effective antiviral therapy will allow tobacco use to emerge as the leading killer in the hepatitis C+ population. In order to avoid this undesirable outcome, public health authorities together with hepatitis C care providers, will need to make a concerted effort to combat tobacco use in this group.

The national sample described herein and one earlier paper reporting on a small cohort from the Bronx, New York³² indicate that hepatitis C+ smokers possess various characteristics that may interfere with successful quitting. Black race, low socioeconomic status, lower educational attainment, psychiatric illness, and comorbid substance use are all associated with lower cessation rates, and these factors also suggest the need for intensive tobacco treatment rather than brief interventions.^{33–37} We found that a larger proportion of hepatitis C+ smokers compared to hepatitis C– smokers use cigarettes daily, and they had significantly higher cotinine levels. The multivariate analyses demonstrated that hepatitis C

infection and smoking have independent, significant associations with both depression and hypertension. The emerging profile of hepatitis C+ smokers in the US suggests that this is a population bearing a heavy burden of psychiatric illness, other substance use (including alcohol), socioeconomic disadvantage, and important medical comorbidities.

The groups with the highest rates of hepatitis C in the US are also at risk for inconsistent care.³⁸ DAA therapy, including pre-treatment evaluation and post-treatment monitoring, typically lasts at least 12–24 weeks, during which time hepatitis C+ individuals interact frequently and predictably with the medical system, and this may represent a golden opportunity to promote cessation. Our findings suggest that interventions designed for this population should be mindful of the educational status, cultural background, poverty, reliance on public insurance, and hyperprevalence of depression and other substance use that characterize the group. The medical community has abundant experience treating tobacco use in depressed³⁹ and substance-using populations,⁴⁰ and this collective experience should inform the development of treatment strategies for hepatitis C+ smokers.

Our study has certain limitations. Like all surveys, the NHANES dataset is restricted to those interview and laboratory data that were collected from the participants. We cannot rule out residual confounding by unmeasured variables. Although completion rates were high, there were missing data for all of the analyzed variables, and we cannot ensure that the “missingness” was randomly distributed. We did not systematically verify smoking status with biochemical markers, although cotinine levels correlated well with reported smoking status in the 77% of the overall sample who provided specimens.

Sixteen years of experience from a nationally representative sample confirms the existence of a cigarette smoking epidemic embedded within the hepatitis C epidemic in the US. Hepatitis C+ individuals smoke at nearly triple the rate of the general population, and we describe herein a sociodemographic profile of this group that will be helpful in developing effective tobacco treatment strategies for them. It is public health folly to spend tens of billions of dollars annually on antiviral hepatitis C medications and ignore the lethal addiction affecting more than 60% of them. As we enter a new era of hepatitis C treatment it is a public health imperative to research, develop, and implement tobacco treatments for the hepatitis C+ community.

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Clinical significance

- Hepatitis C+ adults in the US smoke cigarettes at almost three times the rate of hepatitis C– adults (62.4% vs. 22.9%).
- Hepatitis C+ smokers are more likely than hepatitis C– smokers to be older, male, Black, poorly educated, poor, uninsured, drug-using, and depressed.
- Hepatitis C+ smokers are more likely to be daily smokers than hepatitis C– smokers.
- Hepatitis C is associated with depression and hypertension in US adult smokers.

Table 1

Sociodemographic characteristics of hepatitis C+ versus hepatitis C- participants.

Characteristic	NHANES, 1999–2014			NHANES, 1999–2014: Smokers only		
	HCV- (N=38,983)	HCV+ (N=524)	P	HCV- (N=8,508)	HCV+ (N=312)	P
Age (95% CI)	46.7(46.3–47.1)	49.3 (48.3–50.3)	<0.001	41.5 (41.1–41.9)	47.1(45.9–48.3)	<0.001
% Male	47.9%	67.3%	<0.001	54.4%	69.4%	<0.001
Race/ethnicity (%)			<0.001			0.002
White	69.8%	62.2%		70.6%	64.8%	
Black	10.6%	23.6%		12.1%	21.2%	
Mexican-American	8.1%	6.0%		6.9%	6.5%	
Other Hispanic	5.3%	4.2%		4.9%	2.9%	
Other*	6.2%	2.7%		5.2%	4.6%	
Education (%)			<0.001			<0.001
<9 th grade	6.3%	8.1%		5.9%	8.5%	
Some HS	12.1%	21.2%		20.4%	23.6%	
HS Grad/GED	23.9%	31.8%		30.9%	36.0%	
Some college	30.6%	31.0%		30.9%	29.6%	
College grad	27.1%	7.9%		12.0%	2.2%	
Married/partnered	64.1%	52.8%	<0.001	44.5%	49.1%	0.25
Medical insurance (%)			<0.001			<0.001
Private	64.7%	40.4%		50.4%	30.8%	
Medicare	7.0%	5.5%		4.8%	4.9%	
Medicaid	4.2%	8.7%		7.4%	11.3%	
Medicare+Medicaid	1.2%	4.3%		1.4%	4.1%	
Other public insurance	4.1%	6.9%		5.2%	5.0%	
Other or unknown insurance	0.3%	0.2%		0.4%	0.0%	
Uninsured	18.5%	34.0%		30.4%	43.9%	
Family monthly poverty level index (95% CI)	3.00 (2.94–3.06)	2.01 (1.83–2.20)	<0.001	2.47 (2.40–2.55)	1.80 (1.57–2.04)	<0.001

Note: HCV- =without active hepatitis C infection, HCV+=with active hepatitis C infection, CI=confidence interval, HS=high school, GED=general educational development.

* Includes Asians, a category that was not included in all survey years.

Ratio of monthly family income to the HHS poverty guidelines specific to family size.

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Table 2

Clinical and behavioral characteristics hepatitis C+ versus hepatitis C- participants.

Characteristic	NHANES, 1999-2014*			NHANES, 1999-2014: Smokers only*		
	HCV- (N=38,983)	HCV+ (N=524)	P	HCV- (N=8,508)	HCV+ (N=312)	P
Medical history (%)						
Asthma	13.6%	15.1%	0.47	13.1%	24.4%	0.19
Cancer	8.9%	7.8%	0.50	6.9%	6.5%	0.82
Diabetes	8.3%	9.7%	0.41	6.2%	9.1%	0.17
Emphysema	1.8%	4.5%	<0.001	3.4%	4.3%	0.50
Hypertension	29.8%	41.1%	<0.001	24.7%	34.3%	0.006
Cocaine, heroin, or methamphetamine use	18.7%	71.6%	<0.001	35.1%	80.1%	<0.001
Injection drug use	2.1%	52.1%	<0.001	4.8%	53.6%	<0.001
Myocardial infarction	3.3%	4.5%	0.28	3.5%	5.0%	0.22
Stroke	2.7%	4.7%	0.02	2.8%	3.3%	0.65
Depression score (95% CI)	3.0 (2.9-3.1)	5.6 (4.8-6.4)	<0.001	4.1 (3.9-4.3)	6.5 (5.6-7.4)	<0.001
Current depression (PHQ score 10)	7.4%	25.3%	<0.001	13.5%	33.2%	<0.001
Other (non-cigarette) tobacco product use	4.0%	6.4%	0.03	3.7%	4.6%	0.58
Current excessive alcohol use	34.3%	52.7%	<0.001	55.4%	58.7%	0.44
Non-tobacco substance use						
Alcohol (%)						
Current excessive	34.3%	52.7%	<0.001	55.4%	58.7%	0.23
Current non-excessive	45.1%	33.6%		35.6%	35.2%	
Past only	7.5%	8.7%		5.4%	5.3%	
Never	13.1%	4.9%		3.5%	0.7%	
Marijuana (%)						
Current	9.5%	21.2%	<0.001	26.7%	28.7%	0.32
Past only	50.2%	66.5%		56.3%	60.6%	
Never	40.3%	12.3%		17.1%	10.7%	
Cocaine						
Current	1.1%	7.7%	<0.001	3.2%	11.1%	<0.001

Characteristic	NHANES, 1999–2014*				NHANES, 1999–2014: Smokers only*				
	HCV- (N=38,983)		HCV+ (N=524)		HCV- (N=8,508)		HCV+ (N=312)		P
Past only	16.9%	60.1%	30.3%	63.6%					
Never	82.0%	32.2%	66.6%	25.2%					
Heroin									
Current	0.2%	2.4%	0.6%	4.0%				<0.001	
Past only	1.8%	30.7%	4.2%	30.7%					
Never	98.1%	66.8%	95.2%	65.3%					

Note: HCV- = without active hepatitis C infection, HCV+ = with active hepatitis C infection, CI = confidence interval, PHQ = Patient Health Questionnaire – 9, 16

* Data were not available for the entirety of 1999–2014 for all listed variables. For variables with missing years, the data were aggregated for all years available.

Table 3

Tobacco use characteristics of hepatitis C+ versus hepatitis C– participants.

Characteristic	NHANES, 1999–2014: Smokers only		
	HCV– (N=8,508)	HCV+ (N=312)	P
Smoking frequency			
Daily	80.0%	87.5%	0.04
Non-daily	15.8%	10.1%	
Not classifiable	4.3%	2.4%	
Nicotine dependence *			
Very low	45.7%	39.1%	0.46
Low-Moderate	24.3%	25.7%	
Moderate	19.0%	21.6%	
High	11.0%	13.6%	
Cigarettes per day (95% CI)	14.4 (14.0–14.9)	16.0 (14.2–17.7)	0.09
Cotinine level, ng/mL (95% CI)	207 (202–213)	264 (244–283)	<0.001
Number of years smoking (95% CI)	23.9 (23.4–24.3)	30.4 (29.2–31.7)	<0.001
Smokes menthol cigarettes (%)	27.1%	29.2%	0.54

Note: HCV– =without active hepatitis C infection, HCV+=with active hepatitis C infection, CI=confidence interval.

* Derived from the Heaviness Smoking Index.¹⁵

Table 4

Multivariate logistic regression for medical diagnoses associated with active hepatitis C.

Diagnosis	Univariate OR for HCV+ vs. HCV-	Multivariate logistic regression			
		HCV+ vs. HCV-		Current smoker vs. Current non-smoker	
		ORadj	95% CI	ORadj	95% CI
Emphysema*	2.60	2.14	0.92–5.01	7.81	5.40–11.3
Hypertension [†]	1.64	1.65	1.20–2.27	1.13	1.01–1.27
Stroke [‡]	1.79	1.80	0.82–3.94	2.33	1.90–2.85
Current depression [§]	4.21	2.47	1.69–3.60	2.63	2.28–3.05
Current excessive alcohol ^{//}	2.14	1.12	0.69–1.81	2.14	1.81–2.54

Note: HCV- =without active hepatitis C infection, HCV+=with active hepatitis C infection, OR=odds ratio, ORadj=adjusted odds ratio, CI=confidence intervals

* Older age and ethnicity/race were also associated with emphysema.

[†] Older age and ethnicity/race were also associated with hypertension.

[‡] Older age and ethnicity/race were also associated with stroke.

[§] Older age, ethnicity/race, history of use of cocaine, heroin, or methamphetamine, and female gender were also associated with current depression.

^{//} Younger age, ethnicity/race, history of use of cocaine, heroin, or methamphetamine and male gender were also associated with excessive alcohol use.

Ethnicity/race associated with the highest rates of the specific medical diagnoses were: White for emphysema and excessive alcohol use, Black for hypertension and stroke, and Hispanic (not including Mexican-American) for current depression.