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Increase in nonhepatic diagnoses among persons with hepatitis C hospitalized for any cause, United States, 2004–2011

X. Tong, **P. R. Spradling**

Division of Viral Hepatitis, Centers for Disease Control and Prevention, Atlanta, GA, USA

SUMMARY.

Although persons with hepatitis C virus (HCV) infection may experience nonhepatic illnesses, little is known about the frequency of and trends in such conditions in a population-based sample of HCV-infected persons. Using hospitalization data collected during 2004–2011 from the Nationwide Inpatient Sample of the Healthcare Cost and Utilization Project, we examined trends in comorbidities among all hospitalizations that included either a principal or secondary HCV diagnostic code (i.e., HCV was not necessarily the cause for hospitalization). We also compared comorbidities among all persons aged 45–64 years hospitalized with and without principal or secondary HCV diagnostic codes. The estimated number of hospitalizations among persons with HCV infection increased from 850 490 in 2004–2005 to 1 178 633 in 2010–2011; mean age at hospitalization was 50 years in 2004–2005 and 52.5 years in 2010–2011. There were significant increases in the prevalence of most medical and psychiatric comorbidities; the largest were for lipid disorders, chronic kidney disease and obesity. Among HCV-infected aged 45–64 persons hospitalized for any cause, the prevalence of alcohol /substance abuse, mental disorders, chronic kidney disease, pneumonia, hepatitis B virus infection and HIV infection were significantly higher than those aged 45–64 persons hospitalized without HCV infection ($P < 0.001$ for all). The prevalence of cryoglobulinaemia, vasculitis, nephrotic syndrome or membranoproliferative glomerulonephritis and porphyria cutanea tarda among hospitalizations with HCV infection was consistently low during the study period (i.e., <0.5%). The increase we observed in nonhepatic comorbidities associated with a high risk of HCV-related complications has important implications for the current HCV treatment recommendations in a greatly expanded treatment population.

Keywords

healthcare cost and utilization project; international classification of diseases; 9th revision; clinical modification; morbidity; nationwide inpatient sample; treatment guidelines

Correspondence: Philip R. Spradling, MD, Mailstop G37, 1600 Clifton Rd, NE, Atlanta, GA 30333, USA. pspradling@cdc.gov.

AUTHOR CONTRIBUTIONS

Study conception and design, XT and PS; data analysis and interpretation, XT and PS; drafting and critical revision of the manuscript, PS and XT.

DISCLOSURES/CONFLICT OF INTEREST

None.

WRITING ASSISTANCE

None.

DISCLAIMER

The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

INTRODUCTION

Approximately 2.7 million noninstitutionalized persons in the United States have chronic hepatitis C virus (HCV) infection [1] and, accordingly, are at risk for development of advanced liver disease and hepatocellular carcinoma [2]. In addition, HCV infection is associated with an array of nonhepatic conditions, directly or indirectly related to effects of the virus itself, which contribute to overall hepatitis C-related morbidity [3–9]. Some comorbid conditions, such as mixed cryoglobulinaemia and type 2 diabetes mellitus, may be ameliorated by eradication of infection with antiviral therapy [10–12]. Other conditions, unrelated to infection itself, such as lung disease from smoking or alcohol-induced liver injury, may remain a burden despite successful HCV treatment [13]. Still others, such as heart disease and nonhepatic cancers, seen typically among older aged persons without HCV infection, are likely to affect similar-aged persons cured of HCV infection.

New direct-acting oral agents capable of curing HCV infection in the majority of persons have been approved for use in the US and, in addition to arresting further liver injury, are likely to extend the duration of life among those who would otherwise have suffered substantial morbidity and early mortality from HCV-related conditions [14,15]. Although these new agents have demonstrated high tolerability and cure rates among relatively small numbers of carefully selected study participants, their performance in the real world among the wider, clinically heterogeneous HCV-infected population has yet to be fully examined. Studies that have assessed nonhepatic comorbidities among HCV-infected persons have largely included particular populations (e.g., veterans, persons with health insurance), particular comorbid conditions (e.g., psychiatric disorders, substance abuse, renal disease, diabetes), or were limited to a single specialty clinic or geographic setting [3–9,16,17]. Also, most have reported relatively static estimates of cumulative prevalence and have not included some of the serious, but less commonly encountered, extrahepatic manifestations of HCV infection (e.g., mixed cryoglobulinaemia, membranous glomerulonephritis, porphyria cutanea tarda).

As the principal HCV-infected population in the US – persons infected in the 1970s and 1980s – continues to age, it could be expected that the comorbidity profile of the population might evolve as well. Thus, assessment of recent trends in nonhepatic comorbidities among HCV-infected persons may elucidate whether shifts in the relative predominance of conditions have occurred and identify conditions that represent burgeoning problems. A recent analysis using US national data demonstrated increasing rates of hospitalization of persons with HCV infection and advanced liver disease over 2004–2011 [18]. Using data from the same nationwide all-payer hospital inpatient care database, our purpose here was to determine whether changes occurred in the prevalence of nonhepatic comorbidities among hospitalized persons with HCV infection over time.

MATERIALS AND METHODS

Data source

Hospital discharge data were obtained from the Nationwide Inpatient Sample (NIS), the largest nationwide all-payer hospital inpatient care database in the US. The NIS is one of a family of databases and software tools developed as part of the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality (AHRQ) in partnership with state-level data-collection organizations to provide national estimates of inpatient care. The NIS contains all discharge data from more than 1000 hospitals each year, approximating a 20 percent stratified sample of US community hospitals, and includes charge information on all patients, regardless of payer, including persons covered by Medicare, Medicaid, private insurance, and the uninsured. The most recent version of the NIS (data year 2011) includes discharges from 1049 hospitals in 46 states, representing 97% of the US population [19]. As these data are publically available and do not contain direct personal identifiers, this study was exempt from review by an institutional review board.

In contrast with outpatient-centred databases such as the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS), which are relatively less representative and restrict the listing of secondary diagnoses, the NIS abstracts up to 15 diagnosis codes for each hospitalization, enabling a broader examination of comorbid conditions in the sample.

Primary analysis – distribution of and trends in nonhepatic comorbidities among hospitalizations with a principal or secondary HCV-related diagnostic code

The principal study group included patients aged 18 years or older in the database whose hospitalization for any cause listed HCV infection as the principal or among the secondary International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis codes (070.41, 070.44, 070.51, 070.54, 070.70, 070.71) (we classified such hospitalized persons ‘HCV infected’). Nonhepatic comorbidities were identified preferentially using AHRQ’s Clinical Classification Software (CCS) codes, if available, for a particular comorbidity (http://hcupus.ahrq.gov/toolssoftware/ccs/CCSUsersGuide.pdf). CCS codes represent a composite of individual ICD-9-CM codes collapsed into a smaller number of clinically meaningful categories, and account for changes in ICD-9-CM coding. If particular comorbidities did not have an applicable CCS code we used specific ICD-9-CM codes. The comorbidities assessed in this study were obesity, hypertension, diabetes, disorders of lipid metabolism, metabolic syndrome (a composite variable using the presence of at least two of the following: obesity, hypertension, diabetes or disorder of lipid metabolism), tobacco use/chronic obstructive pulmonary disease (COPD), mental disorders (which encompassed affective, thought and anxiety disorders), alcohol abuse, substance abuse except alcohol, renal failure/chronic kidney disease (including dialysis), ischaemic heart disease, nonhepatic cancers (which included head and neck, lung, prostate, oesophageal, breast and non-Hodgkin’s lymphoma), osteoarthritis, connective tissue disease, hepatitis B virus (HBV) infection and HIV infection.

We also examined the prevalence of extrahepatic conditions whose presence would be an indication for HCV treatment, including cryoglobulinaemia, vasculitis, proteinuria, nephrotic syndrome, membranoproliferative glomerulonephritis and porphyria cutanea tarda. A detailed listing of the ICD-9-CM and CCS codes utilized to identify principal and secondary conditions are presented in the Appendix.

The unit of analysis was the hospital discharge; that is, each '*n*' in the database represented a hospitalization rather than a single individual. Accordingly, one person conceivably could appear multiple times in the data depending on the number of times they were hospitalized. To develop national estimates from our findings, we used discharge weights, which were developed to extrapolate NIS sample discharges to the total discharges. Four 2-year time intervals were selected for this study: 2004–2005, 2006–2007, 2008–2009 and 2010–2011; the prevalence of nonhepatic comorbidities was assessed for each of these time intervals. Linear trends for comorbidities during 2004–2011 were computed to assess the changes over time using orthogonal polynomial contrasts and relative percent changes (RPC) were calculated (where RPC = rate2010/2011 – rate2004/2005)/rate2004/2005). A 2-tailed probability value of <0.05 was considered significant throughout the analyses. All statistical analyses were conducted using SAS 9.3-call-able SUDAAN (Research Triangle Institute, Research Triangle Park, NC) to account for the multi-stage, disproportionate stratified sampling design.

Secondary analysis – comparison of comorbidities between hospitalizations with and without HCV-related diagnostic codes

As the unit of analysis in NIS is the hospital discharge, it was impracticable to match comparison groups according to individual patient characteristics or to apply propensity scores. Therefore, to compare the prevalence of nonhepatic comorbidities during hospitalizations of persons with and those without infection (i.e., with *vs* without principal or secondary HCV-related codes), we examined the prevalence of the same collection of comorbidities among all hospitalizations of persons aged 45–64 years in 2010–2011. We limited our examination to this age group because it encompassed the mean age at hospitalization of the HCV-infected population and provided a manageable dataset for analysis (as opposed to comparison of all age groups for the entire study interval).

RESULTS

During the study period, the estimated number of hospitalizations among persons with HCV infection increased from 850 490 in 2004–2005 to 1 178 633 in 2010–2011 (Table 1). Among these hospitalized persons, the mean age increased from 50 years in 2004–2005 to 52.5 years in 2010–2011 (*P* for trend, <0.0001); approximately 62% were male. By looking at age at admission in groups, hospitalizations among HCV infected persons aged 35–54 decreased from 64.3% in 2004–2005 to 48.5% in 2010–2011, while those aged 55–64 increased from 17.0% in 2004–2005 to 32.4% in 2010–2011 (*P* for trend, <0.0001 for all). Among persons aged 18–34 or aged 65+ did not change over the time. The proportion of hospitalized persons with Medicare increased from 30.1% in 2004–2005 to 32.2% in 2010–2011 (*P* for trend = 0.003) and those with private insurance decreased from 21.7% to 16.9%.

There were no differences according to race, geographic region and type of hospital (teaching *vs* nonteaching). The proportion of hospitalizations with an in-hospital death decreased significantly from 3.7% in 2004–2005 to 2.7% in 2010–2011 (*P* for trend, <0.001).

From 2004 to 2011, significant increases were found in the prevalence of obesity, hypertension, diabetes, disorders of lipid metabolism, metabolic syndrome, tobacco use/COPD, mental disorders, renal failure/chronic kidney disease, nonhepatic cancers, connective tissue disease, osteoarthritis and ischaemic heart disease among hospitalized persons with HCV infection ($P < 0.0001$) (Table 2). The largest increases were observed for disorders of lipid metabolism, from 5.1% in 2004–2005 to 11.1% in 2010–2011 (RPC of 118%), followed by renal failure/chronic kidney disease (11.0% in 2004–2005 to 22.6% in 2010–2011, RPC of 105%), and obesity (3.5% in 2004–2005 to 6.0% in 2010–2011, RPC of 71%). Hypertension, diabetes, metabolic syndrome, tobacco use/COPD, mental disorders (which reached 65% in 2010–2011), nonhepatic cancers, connective tissue disease, osteoarthritis, influenza and ischaemic heart disease had RPC increases >20% during 2004–2011. The prevalence of metabolic syndrome increased from 16.1% in 2004–2005 to 25.1% in 2010–2011 (RPC of 56%, *P* for trend: <0.0001). Alcohol abuse (≈25%) and substance abuse (≈30%) were common but remained stable during the study period. The prevalence of hospitalized persons with HCV infection and an HIV diagnosis code decreased from 9.5% in 2004–2005 to 8.2% in 2010–2011, but this decrease was not statistically significant. In contrast, the prevalence of HBV-related diagnosis codes decreased significantly, from 5.5% in 2004–2005 to 3.9% in 2010–2011 (*P* for trend, <0.001).

To compare the prevalence of nonhepatic comorbidities among hospitalized persons with HCV infection and the general HCV-uninfected (i.e., no principal or secondary HCV-related codes) population of hospitalized persons, we examined the prevalence of the identical collection of comorbidities among all hospitalized persons aged 45–64 years in 2010–2011. Among hospitalized persons aged 45–64 with HCV infection, the prevalence of tobacco/COPD, alcohol abuse, mental disorders, substance abuse, renal failure/chronic kidney disease, pneumonia, HBV infection and HIV were significantly higher than among all HCV-uninfected hospitalized persons with the same age range ($P < 0.001$ for all, Table 3). Although the prevalence of cryoglobulinaemia, vasculitis, nephrotic syndrome or membranoproliferative glomerulonephritis, and porphyria cutanea tarda among hospitalized persons with HCV infection was consistently low during the study period (i.e., <0.5%), the prevalence of these among uninfected hospitalized persons was still significantly lower in comparison.

DISCUSSION

In this analysis, using data from the largest nationwide all-payer hospital inpatient care database in the US, we found that the prevalence of most major nonhepatic comorbid conditions among hospitalized persons with HCV infection increased significantly during 2004–2011. In general, for both groups, high prevalence conditions increased during the study period to a lesser degree (i.e., lower RPCs) than did low prevalence conditions. Among hospitalized persons with HCV infection the prevalence of mental disorders, tobacco

use/COPD, alcohol abuse, substance abuse and chronic kidney disease was particularly high (65%, 47%, 25%, 29% and 23%, during 2010–2011, respectively). Consistent with other studies that have demonstrated a growing healthcare burden related to hepatitis C [20,21], our analysis indicated an increase in the number of hospitalizations among HCV-infected persons during the study period. Notably, we found an increasing prevalence of hospitalized persons with HCV infection among persons aged 55–64 years old, which suggested that the post-Baby Boom population, for whom HCV testing is recommended only on the basis of risk assessment [22], constituted a demographic group with burgeoning HCV-associated morbidity.

Although the tolerability of newer HCV regimens appears to have much improved, recent trials using direct acting antivirals have typically excluded participants with impaired renal function, recent alcohol or substance abuse, malignancy, autoimmune disorders and significant heart disease, for example [23,24]. Expansion of therapy into a large population of patients may reveal issues related to toxicity, drug–drug interactions, adherence, and effectiveness that were not apparent in registration trials [15]. Furthermore, many successfully treated persons will survive to experience considerable morbidity related to ‘residual’ conditions such as ischaemic heart disease, hypertension, osteoarthritis and nonhepatic cancers, which in the past would have remained secondary concerns in the context of impending liver failure.

Our findings have substantial implications relative to recently updated HCV treatment guidelines, which included recommendations to address ‘extrahepatic disease in which HCV treatment is most likely to provide the most immediate and impactful benefits’ [15]. Among the ‘highest priority’ conditions that warrant treatment regardless of the presence of liver disease are ‘type 2 or 3 essential mixed cryoglobulinaemia with end-organ manifestations (e.g., vasculitis)’ and ‘proteinuria, nephrotic syndrome, or membranoproliferative glomerulonephritis’ [15]. Although some of these conditions, such as membranous glomerulonephritis or vasculitis, may instead have been coded as renal failure/chronic kidney disease (23% prevalence) or connective tissue disease (10% prevalence), the prevalence of codes for these specific entities was exceedingly low among hospitalized HCV-infected persons. The degree to which the rarity of these codes correlates with the true prevalence of these conditions, or represents the low frequency of their diagnosis (for which biopsy may be necessary), or is reflective of coding practices, is unclear. Other conditions, considered ‘high priority’ for HCV treatment include HBV or HIV coinfection, nonalcoholic fatty liver disease (associated with metabolic syndrome), diabetes mellitus and porphyria cutanea tarda. The prevalence of these conditions among our study population in 2010–2011 was 3.9%, 8.2%, 25%, 26% and 0.1% respectively. Use of highly effective antiviral therapy may substantially ameliorate many of these conditions among HCV-infected persons, a phenomenon that has been demonstrated in earlier studies for some persons receiving pegylated interferon/ribavirin treatment [10,11,25]. In addition, treatment of persons at risk for transmitting HCV, such as those receiving or destined for haemodialysis (included among the renal failure/chronic kidney disease codes), has the potential to prevent nosocomial spread in high risk settings.

ICD-9 codes for the diagnosis of viral hepatitis have been tested and validated in the Veterans Administration healthcare system, and have demonstrated high specificity and positive predictive value in the identification of HCV-infected persons [13]. Nonetheless, a limitation of our study is that a small fraction of hospitalized persons classified as having HCV infection may have had resolved infection, successful treatment prior to hospitalization, or no HCV infection at all. Conversely, some of the hospitalized persons in the HCV-uninfected cohort could have had undiagnosed infection or were known to be infected but were missing HCV codes during hospitalization.

The results of this analysis should be interpreted in light of other limitations. First, the unit of analysis was the hospital discharge; therefore, we could not account for multiple hospitalizations from a single person, which could have spuriously increased the prevalence of some conditions. Second, our study population was limited to hospitalized persons, whose comorbidity profiles could differ from a strictly ambulatory population. Unavailability and inconsistent application of standardized diagnostic criteria for some conditions, differences in ICD-9-CM coding at the hospital level, and decreased likelihood of coding for non-threatening conditions among patients with severe illness might contribute to such a phenomenon (e.g., the apparent low prevalence of obesity among persons in this study, and the lack of codes for symptoms such as fatigue) [26]. Third, we were unable to identify whether conditions defined by ICD-9-CM codes were pre-existing or had developed during the hospitalization. Fourth, because of their absence in the database, we could not examine the degree to which clinical factors (e.g., laboratory information, treatment history) may have contributed to our findings.

In summary, we found increasing prevalence of a number of major comorbidities among hospitalized persons with HCV infection from 2004–2011, many of which are associated with a high risk of HCV-related complications and for which current HCV guidelines recommend antiviral therapy irrespective of the presence of liver disease. Although treatment may improve or resolve many of these conditions, their effect on HCV treatment efficacy, tolerability and adherence in a greatly expanded treatment population will require further assessment and consideration.

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Appendix

Appendix

ICD9-CM codes (Only the first 15 codes were used to identify health conditions even though 25 fields were used after 2009).

Outcome	ICD9-CM codes
Hepatitis C virus (HCV) infection	070.41, 070.44, 070.51, 070.54, 070.70, 070.71
Hepatitis B virus (HBV) infection	070.20, 070.21, 070.22, 070.23, 070.30, 070.31, 070.32, 070.33
HIV infection	CCS: 5

Outcome	ICD9-CM codes
Obesity	278.0, 278.01, V85.3, V85.4
Hypertension	CCS: 98,99
Diabetes (with or without complications)	CCS: 49, 50
Disorder of lipid metabolism	CCS: 53
Tobacco use/Chronic obstructive pulmonary disease	3051, V1582, CSS: 127
Alcohol abuse	CCS: 660
Substance abuse except alcohol	CCS: 661
Mental disorders except alcohol abuse	CCS: 651, 653, 656, 657, 658, 659, 663
Renal failure/Chronic kidney disease	CCS: 157, 158
Influenza	CCS: 123
Pneumonia	CCS: 122
Cancer except liver cancer	CCS: 11–15, 17–43
Connective tissue disease	CCS: 202, 210, 211
Osteoarthritis	CCS: 203, 204, 205
Cryoglobulinaemia	2732
Vasculitis	4476
Proteinuria	7910
Nephrotic syndrome or membranoproliferative glomerulonephritis	5810, 5811, 5812, 5813, 58181, 58189, 5819, V1303
Porphyria cutanea tarda	2771
Ischaemic heart disease	CCS: 100, 101

Abbreviations:

AHRQ	agency for healthcare research and quality
CCS	clinical classification software
COPD	chronic obstructive pulmonary disease
HBV	hepatitis B virus
HCUP	healthcare cost and utilization project
HCV	hepatitis C virus
ICD-9-CM	international classification of diseases, 9th revision, clinical modification
NAMCS	national ambulatory medical care survey
NHAMCS	national hospital ambulatory medical care survey
NIS	nationwide inpatient sample
RPC	relative percent change

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Table 1

Characteristics of hospitalized persons aged 18+ years with a hepatitis C virus infection recorded as principal or secondary diagnosis code, Nationwide Inpatient Sample, 2004–2011

Demographic factors	Percent (SE)				*P* for trend
	2004–2005	2006–2007	2008–2009	2010–2011	
Estimated no. of hospitalizations	850 490	979 848	1 054 970	1 178 633	
Mean age (years) at admission (standard error)	50.0 (0.2)	50.8 (0.2)	51.8 (0.2)	52.5 (0.2)	<0.0001
Age at admission in groups					
18–34	8.3 (0.3)	8.0 (0.4)	8.0 (0.3)	8.4 (0.3)	0.75
35–44	20.7 (0.4)	17.0 (0.5)	13.2 (0.3)	11.1 (0.3)	<0.0001
45–54	43.6 (0.3)	43.6 (0.4)	41.0 (0.4)	3 7.4 (0.4)	<0.0001
55–64	17.0 (0.3)	21.6 (0.4)	27.4 (0.4)	32.4 (0.5)	<0.0001
≥65	10.3 (0.3)	9.8 (0.3)	10.4 (0.3)	10.7 (0.3)	0.14
Male	61.6 (0.3)	62.6 (0.4)	62.4 (0.3)	62.5 (0.3)	0.11
Race					
White	59.9 (1.4)	57.1 (1.5)	59.2 (1.3)	57.4 (1.7)	0.40
African American	22.1 (1.1)	24.1 (1.3)	22.0 (1.1)	24.6 (1.2)	0.24
Hispanic	13.0 (0.9)	14.1 (1.2)	12.7 (0.9)	12.9 (1.1)	0.67
Other	5.0 (0.8)	4.7 (0.6)	6.1 (0.6)	5.1 (0.6)	0.07
Health insurance					
Medicare	30.1 (0.5)	30.2 (0.7)	30.8 (0.5)	32.2 (0.6)	0.003
Medicaid	31.8 (0.9)	30.2 (0.9)	32.1 (0.7)	33.9 (1.2)	0.07
Private	21.7 (0.6)	19.3 (0.8)	19.3 (0.6)	16.9 (0.7)	<0.0001
Other	16.3 (0.7)	20.2 (1.5)	17.9 (0.8)	17.0 (0.8)	0.97
Region					
Northeast	20.8 (2.1)	20.5 (2.1)	23.5 (2.3)	24.6 (2.7)	0.20
Midwest	16.6 (1.5)	16.7 (1.7)	16.7 (1.7)	16.4 (1.9)	0.95
South	38.7 (2.2)	39.5 (2.8)	36.3 (2.4)	36.3 (2.5)	0.29
West	23.9 (1.9)	23.3 (2.1)	23.5 (1.9)	22.8 (1.9)	0.72
Teaching hospital	52.6 (2.2)	59.0 (2.4)	58.6 (2.2)	59.1 (2.3)	0.06
In-hospital death	3.7 (0.1)	3.2 (0.1)	2.9 (0.1)	2.7 (0.1)	<0.0001

Table 2

Prevalence (%) of selected health conditions among hospitalized persons aged 18+ years with a HCV infection recorded as principal or secondary diagnosis code, Nationwide Inpatient Sample, 2004–2011

	Percent (SE)					
Clinical conditions	**2004–2005**	**2006–2007**	**2008–2009**	**2010–2011**	**RPC**	***P* for trend**
Obesity	3.5 (0.1)	4.1 (0.1)	5.3 (0.1)	6.0 (0.1)	71%	<0.0001
Hypertension	34.9 (0.4)	39.3 (0.5)	43.6 (0.4)	46.7 (0.5)	34%	<0.0001
Diabetes	21.8 (0.3)	23.5 (0.3)	25.6 (0.3)	26.4 (0.3)	21%	<0.0001
Disorder of lipid metabolism	5.1 (0.1)	7.2 (0.2)	9.5 (0.2)	11.1 (0.2)	118%	<0.0001
Metabolic syndrome	16.1 (0.3)	19.2 (0.3)	22.8 (0.3)	25.1 (0.4)	56%	<0.0001
Tobacco use/COPD	33.1 (0.8)	38.9 (0.9)	43.2 (0.8)	47.0 (0.7)	42%	<0.0001
Alcohol abuse	23.5 (0.5)	24.5 (0.6)	24.0 (0.5)	24.9 (0.6)	6%	0.09
Mental disorder	53.2 (0.8)	56.9 (0.9)	62.2 (0.7)	65.1 (0.7)	22%	<0.0001
Substance abuse except alcohol	27.4 (0.9)	29.4 (1.2)	27.5 (0.8)	29.0 (1.1)	6%	0.42
Renal failure/Chronic kidney disease	11.0 (0.3)	18.1 (0.5)	20.0 (0.4)	22.6 (0.5)	105%	<0.0001
Cancer except liver	6.9 (0.2)	7.7 (0.2)	8.6 (0.2)	8.8 (0.2)	28%	<0.0001
Connective tissue disease	7.1 (0.1)	7.9 (0.2)	9.2 (0.1)	10.3 (0.1)	45%	<0.0001
Osteoarthritis	10.7 (0.2)	12.2 (0.3)	14.8 (0.3)	15.6 (0.3)	46%	<0.0001
Cryoglobulinaemia	0.2 7 (0.0)	0.24 (0.0)	0.25 (0.0)	0.30 (0.0)	11%	0.51
Vasculitis	0.30 (0.0)	0.29 (0.0)	0.25 (0.0)	0.29 (0.0)	−3%	0.36
Proteinuria	0.12 (0.0)	0.14 (0.0)	0.16 (0.0)	0.16 (0.0)	33%	0.002
Nephrotic syndrome or membranoproliferative glomerulonephritis	0.47 (0.0)	0.46 (0.0)	0.38 (0.0)	0.36 (0.0)	−23%	<0.0001
Porphyria cutanea tarda	0.10 (0.0)	0.12 (0.0)	0.11 (0.0)	0.10 (0.0)	0	0.61
Influenza	0.08 (0.0)	0.06 (0.0)	0.24 (0.0)	0.10 (0.0)	25%	<0.0001
Pneumonia	8.2 (0.1)	8.4 (0.1)	8.3 (0.1)	8.3 (0.2)	1%	0.47
Ischaemic heart disease	10.1 (0.2)	11.2 (0.2)	12.1 (0.2)	12.5 (0.2)	24%	<0.0001
HBV	5.5 (0.2)	4.8 (0.2)	4.3 (0.1)	3.9 (0.2)	−29%	<0.0001
HIV	9.5 (0.5)	9.1 (0.5)	8.4 (0.5)	8.2 (0.8)	−14%	0.09

HCV, hepatitis C virus; COPD, chronic obstructive pulmonary disease; HBV, hepatitis B virus; HIV, human immunodeficiency virus.

Table 3

Characteristics and prevalence of selected health conditions among hospitalized persons aged 45–64 years, by HCV infection status, Nationwide Inpatient Sample, 2010–2011

	Percent (SE)		
Characteristics	**Hospitalizations with HCV**	**Hospitalizations without HCV**	**Overall *P*-value**
Estimated no. of hospitalizations	932 141	18 626 828	
Male	64.7 (0.3)	49.3 (0.1)	<0.0001
Race			
White	55.6 (1.6)	67.2 (1.0)	<0.0001
African American	27.0 (1.3)	18.7 (0.7)	
Hispanic	12.4 (0.9)	9.0 (0.6)	
Other	5.0 (0.6)	5.1 (0.3)	
Health insurance			
Medicare	36.3 (0.6)	23.2 (0.2)	<0.0001
Medicaid	31.2 (1.1)	16.1 (0.4)	
Private	18.0 (0.7)	46.6 (0.7)	
Other	14.4 (0.7)	14.0 (0.4)	
Region			
Northeast	24.1 (2.1)	20.3 (0.8)	<0.0001
Midwest	16.6 (1.6)	23.0 (0.9)	
South	35.9 (1.9)	38.9 (0.9)	
West	23.4 (1.3)	17.9 (0.6)	
Teaching hospital	59.2 (1.8)	49.7 (1.0)	<0.0001
In-hospital death	3.1 (0.1)	1.7 (0.0)	<0.0001
Clinical conditions			
Obesity	6.2 (0.1)	14.3 (0.2)	<0.0001
Hypertension	52.7 (0.4)	54.8 (0.2)	<0.0001
Diabetes	29.6 (0.3)	30.1 (0.2)	0.08
Disorder of lipid metabolism	12.7 (0.2)	29.2 (0.3)	<0.0001
Metabolic syndrome	28.7 (0.3)	40.3 (0.3)	<0.0001
Tobacco use/COPD	46.9 (0.7)	35.0 (0.4)	<0.0001

	Percent (SE)		
Characteristics	**Hospitalizations with HCV**	**Hospitalizations without HCV**	**Overall *P*-value**
Alcohol abuse	24.9 (0.5)	8.5 (0.2)	<0.0001
Mental disorder	63.6 (0.6)	47.9 (0.4)	<0.0001
Substance abuse except alcohol	23.5 (0.9)	5.8 (0.2)	<0.0001
Renal failure/Chronic kidney disease	25.3 (0.5)	15.6 (0.2)	<0.0001
Cancer except liver	10.1 (0.2)	14.9 (0.3)	<0.0001
Connective tissue disease	10.8 (0.1)	12.6 (0.1)	<0.0001
Osteoarthritis	16.6 (0.3)	20.6 (0.3)	<0.0001
Cryoglobulinaemia	0.33 (0.03)	0.008 (0.001)	<0.0001
Vasculitis	0.30 (0.02)	0.20 (0.004)	<0.0001
Proteinuria	0.16 (0.01)	0.15 (0.01)	0.29
Nephrotic syndrome or membranoproliferative glomerulonephritis	0.38 (0.02)	0.16 (0.004)	<0.0001
Porphyria cutanea tarda	0.12 (0.01)	0.02 (0.001)	<0.0001
Influenza	0.11 (0.01)	0.13 (0.0)	0.02
Pneumonia	8.9 (0.2)	7.2 (0.1)	<0.0001
Ischaemic heart disease	14.7 (0.2)	19.3 (0.2)	<0.0001
HBV	3.8 (0.2)	0.3 (0.004)	<0.0001
HIV	7.8 (0.7)	1.1 (0.1)	<0.0001

HCV, hepatitis C virus; COPD, chronic obstructive pulmonary disease; HBV, hepatitis B virus; HIV, human immunodeficiency virus.