

Inpatient Costs and Outcomes Associated With Hepatitis C, Human Immunodeficiency Virus, and Co-Infection With Both in the United States

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BACKGROUND

Hepatitis C virus (HCV) is an emerging public health problem with over 180 million people infected worldwide.¹ In the United States (US), approximately 3.2 million people are affected.² Human immunodeficiency virus (HIV) is also one of the biggest health concerns globally, with 33 million people infected worldwide³ and 1.2 million people infected in the US.⁴ Over time, chronically infected patients develop complications such as cirrhosis of the liver and hepatocellular carcinoma. The CDC estimates nearly 8,000–10,000 deaths due to chronic liver disease each year. Co-infection with HCV and HIV can result in more rapid disease progression and a higher prevalence of cirrhosis⁵ leading to increased disease burden.

OBJECTIVES

To generate national estimates of per-discharge inpatient costs, length of stay (LOS), and probability of death among patients infected with chronic HCV, HIV, and those co-infected with both. Results were compared with patients without chronic HCV or HIV.

METHODS

Study Design

Retrospective database analysis

Data Source

Discharge data were collected from the 2005 Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS).⁶

- The NIS is the largest all-payer inpatient care database in the US.
- The 2005 NIS dataset contains data for approximately 8 million inpatient stays.
- The NIS is the only national hospital database with charge information on all patients, regardless of payer, including those covered by Medicare, Medicaid, private insurance, and the uninsured).
- The NIS includes numerous demographic, clinical, and resource use variables for each inpatient stay, including patient age, gender, and race, diagnosis codes, LOS, total charges, admission and discharge status, payer, and hospital-specific characteristics.
- Sampling weights allow for generating nationally representative estimates.
- Steiner and colleagues (2002) provide a comprehensive review of this source and other HCUP data sources.⁷

Inclusion Criteria

Criteria for inclusion in the study were as follows:

- Discharges with at least one International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis code for the conditions of interest:
 - Chronic HCV: 070.44, 070.54, 070.70, or 070.71
 - HIV: 042.xx (including all fourth- and fifth-digit modifiers)
- Discharges were classified into four mutually exclusive groups:
 - Chronic HCV alone without HIV
 - HIV alone without chronic HCV
 - Chronic HCV and HIV co-infection
 - No chronic HCV or HIV (comparator group)

Outcome Measures

- Per-discharge total costs
 - NIS's charge data converted to costs using facility-specific cost-to-charge ratios
 - Costs presented in 2007 US dollars
- Per-discharge LOS
- Cost per day
- Probability of death

Statistical Techniques

- All analyses were conducted using SUDAAN[®] software, version 9.0, to account for the NIS's complex survey design.
- T-tests were used to test for significant differences in outcomes between groups.

RESULTS

Patient Characteristics (Table 1)

- There were 39,163,834 discharges in the US in 2005.
- Among these:
 - 390,966 were for chronic-HCV only
 - 136,596 were for HIV only
 - 26,000 were for chronic HCV and HIV co-infection
 - 38,610,272 were unrelated to chronic HCV or HIV.
- Patients with chronic HCV only were slightly older on average (51 years) compared to those with HIV only (43 years) and HCV and HIV co-infection (46 years).
- A greater proportion of patients in the three study groups were male (61% to 70%) compared to the group without HCV or HIV (42%).
- Patients hospitalized for HCV or HCV and HIV co-infection were predominantly black.
- Medicare and Medicaid were the primary payers for over half of the discharges in the study sample. The proportion of patients receiving Medicaid in the three study groups of interest was greater than that of the comparator group.

Table 1. Patient Characteristics^{a,b}

Study Cohort	HCV Only (n = 390,967)		HIV Only (n = 136,596)		HCV + HIV (n = 26,000)		No HCV or HIV (n = 38,610,272)	
	n	%	n	%	n	%	n	%
Mean age (SD)	50.66 (11.75)		42.55 (10.58)		45.80 (8.18)		47.19 (28.57)	
Gender								
Male	238,565	0.61	94,936	0.70	18,266	0.70	16,052,724	0.42
Female	152,262	0.39	41,575	0.30	7,734	0.30	22,980,025	0.60
Missing/invalid	139	0.00	85	0.00	--	--	129,966	0.00
Race								
White	195,384	0.50	32,255	0.24	7,647	0.29	19,636,793	0.51
Black	56,847	0.15	51,667	0.38	9,267	0.36	3,395,297	0.09
Other	57,288	0.15	20,070	0.15	4,505	0.17	5,522,526	0.14
Missing/invalid	81,448	0.21	32,605	0.24	4,580	0.18	10,609,219	0.27
Payer type								
Medicare	121,480	0.31	39,514	0.29	8,337	0.32	14,556,694	0.38
Medicaid	119,800	0.31	54,811	0.40	12,525	0.48	7,642,013	0.20
Private insurance	86,321	0.22	23,261	0.17	2,326	0.09	13,684,300	0.35
Other	62,825	0.16	18,694	0.14	2,773	0.11	3,231,966	0.08
Missing/invalid	539	0.00	317	0.00	39	0.00	48,861	0.00

SD = standard deviation.
^a Percentages and counts do not sum within categories due to rounding.
^b Counts were weighted to obtain nationally representative estimates.

Hospital Characteristics (Table 2)

- Patients with HCV and HIV co-infection were more likely to be seen in an urban hospital.
- Most hospitals were located in the South (37% to 48%).
- The distribution of hospital bed size was similar across the three study groups and the comparator group.
- Over 60% of all HIV-related discharges were at teaching hospitals.

Table 2. Hospital Characteristics^{a,b}

Study Cohort	HCV Only (n = 390,967)		HIV Only (n = 136,596)		HCV + HIV (n = 26,000)		No HCV or HIV (n = 38,610,272)	
	n	%	n	%	n	%	n	%
Hospital location								
Rural	34,431	0.09	5,833	0.04	774	0.03	5,176,710	0.13
Urban	356,535	0.91	130,764	0.96	25,226	0.97	33,987,124	0.88
Hospital region								
Northeast	79,492	0.20	33,599	0.25	8,398	0.32	7,753,745	0.20
Midwest	63,229	0.16	18,392	0.13	2,543	0.10	9,020,549	0.23
South	146,160	0.37	65,104	0.48	10,965	0.42	14,942,227	0.39
West	102,084	0.26	19,502	0.14	4,094	0.16	7,447,313	0.19
Hospital bed size								
Small	39,787	0.10	10,311	0.08	2,060	0.08	4,777,831	0.12
Medium	98,357	0.25	32,219	0.24	6,234	0.24	9,563,664	0.25
Large	252,822	0.65	94,067	0.69	17,706	0.68	24,268,777	0.63
Hospital type								
Teaching	189,207	0.48	84,800	0.62	17,616	0.68	16,069,288	0.42
Nonteaching	201,758	0.52	51,796	0.38	8,384	0.32	22,540,984	0.58

^a Percentages and counts do not sum within categories due to rounding.
^b Counts were weighted to obtain nationally representative estimates.

Costs Associated With Chronic HCV-Related Complications (Figures 1a and 1b)

- Total cost per hospitalization was lowest for HCV at \$11,795 and was significantly higher for HIV (\$14,594) and for HCV and HIV co-infection (\$14,686). The total hospitalization cost for the comparator group was nearly half (\$8,859), $P < 0.01$ for all three groups.
- Cost per day, however, was lower for all three groups compared to those without HCV or HIV, although the difference was not statistically significant for those with chronic HCV only.

Figure 1a. Total Cost

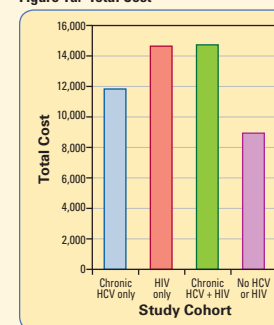
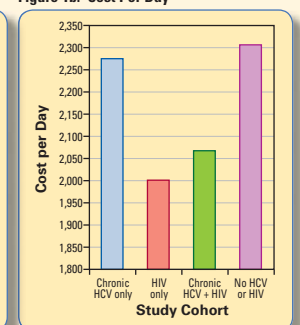


Figure 1b. Cost Per Day



Length of Stay and Probability of Death (Figures 2a and 2b)

- The average LOS for chronic HCV-related hospitalizations was 6.03 days, while that for HIV-related hospitalizations and for HCV and HIV co-infection was higher at 7.87 days. In comparison, hospitalizations not related to HCV or HIV had an average LOS of only 4.62 days, $P < 0.01$ for all three groups.
- The probability of death associated with HCV only, HIV only, and HCV and HIV co-infection was 3.5%, 5.1%, and 5.6%, respectively. The probability of death associated with non-HCV or HIV-related hospitalizations combined was only 2.1%, $P < 0.01$ for all three groups.

Figure 2a. Length of Stay

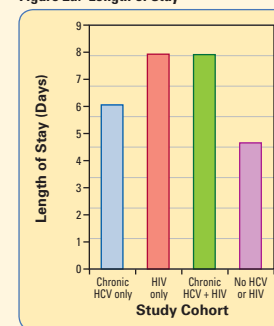
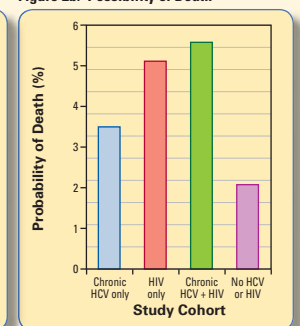


Figure 2b. Possibility of Death



LIMITATION

- Conditions were identified based on diagnosis codes, which if recorded inaccurately, may cause some discharges to be misidentified as chronic HCV- or HIV-related.

CONCLUSIONS

- This is one of few studies to quantify differences in inpatient costs and outcomes associated with HCV, HIV, and HCV and HIV co-infection in a multipayer US population.
- Hospitalizations related to HCV and HIV co-infection were longer and more expensive compared to those related to HCV only.
- Policy makers and other decision makers should be aware of this burden as strategies to allocate resources are developed.

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