

The Direct and Indirect Costs of Employees with Hepatitis C Vary by Stage of Disease

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BACKGROUND

- Hepatitis C virus (HCV) infection is estimated to affect approximately 150 million people worldwide,¹ including 2.7 million patients in the United States (US),^{2,3} and is a growing global public health issue⁴
- The prevalence of HCV and the demographics of the HCV-infected population suggest that many HCV-infected patients will be employed in the workplace
- Direct and indirect costs associated with HCV are substantial⁴⁻¹⁰
- Employers, as payers of employee health benefits, are responsible for a significant portion of this healthcare cost burden; HCV-infected employees also bear a penalty through medical copays and lost productivity
- Employee absenteeism associated with HCV infection, particularly as a function of liver disease severity, is not well described
- To fully characterize the burden of disease progression for healthcare payers, the negative effects of HCV on employees must be understood

OBJECTIVE

- To examine health benefit costs and absenteeism among employees infected with HCV by varying stages of liver disease compared to employees without HCV

METHODS

- The current study is a retrospective analysis of administrative claims and employer payroll data
- Employees from the Human Capital Management Services (HCMS) integrated database^{4,11,12} were identified from July 2001–March 2013
- This database represents multiple geographically diverse, US-based employers with employee information on medical, prescription, and absenteeism (short-term disability [STD], long-term disability [LTD], workers' compensation [WC], and sick leave) claims

STUDY DESIGN

- Employees with chronic HCV were identified by International Classification of Diseases (ICD)-9 codes (Table 1) and then classified into one of the disease severity cohorts based on the algorithm in Table 2: non-cirrhotics, compensated cirrhosis (CC), decompensated cirrhosis (DCC), hepatocellular carcinoma (HCC), and liver transplant
- Index date was defined as the first date of most severe HCV disease claim for any given employee; non-HCV employees served as controls with a randomly selected index date
- Inclusion required 6-month pre-index baseline and 6-month post-index follow-up periods
- Employees were excluded if they had documented human immunodeficiency virus or hepatitis B virus based on ICD-9-CM codes from claims at any time in the data; subjects identified with HCV at any time were excluded from the non-HCV cohort

Table 1: HCV ICD-9-CM Codes

ICD-9-CM Code	Description
070.44	Chronic hepatitis C with hepatic coma
070.54	Chronic hepatitis C without mention of hepatic coma
070.70	Unspecified viral hepatitis C without hepatic coma
070.71	Unspecified viral hepatitis C with hepatic coma

HCV = hepatitis C virus; ICD-9-CM = International Classification of Diseases, 9th Revision, Clinical Modification

Table 2: ICD-9-CM Codes for Stages of HCV

Stages of HCV	Code(s) ^{13,14}
HCV without cirrhosis	ICD-9-CM codes for HCV (see Table 1) without an ICD-9-CM or CPT code classifying them into a more severe category (see below)
Cirrhosis	ICD-9-CM code(s) 571.2, 571.5, 571.6
CC	With a cirrhosis code, but with no code indicating DCC events
DCC (by presence of indicator Events)	ICD-9-CM Dx codes 456.0-456.2x, 348.3x, 572.2, 572.3, 572.4, 782.4, 789.59, 572.8, 530.7, 530.82, 578.x, or CPT codes 49080, 49081, 37140, 37160, 37180, 37181, 37182, 37183, 43204, 43205, 43243, 43244, 43400, 43401, or ICD-9 proc codes 54.9, 42.91, 44.91, or 96.06
These codes also specifically identify DCC	ICD-9-CM code(s) 070.44, 070.71
LT	V42.7x or CPT codes 47135 or 47136 or ICD-9 proc code 50.5x
HCC	ICD-9-CM code 155.xx

CPT = Current Procedural Terminology; CC = compensated cirrhosis; DCC = decompensated cirrhosis; Dx = diagnostic; proc = procedure; LT = liver transplant; HCC = hepatocellular carcinoma

STATISTICAL ANALYSIS

- Medical, prescription and absenteeism claims were analyzed over the follow-up period in unadjusted and regression-adjusted analyses
- Absenteeism was analyzed by count (days) and costs of reimbursed wages
- The cohorts were examined using a 2-part regression model (logistic followed by generalized linear models), controlling for differences between cohorts and potentially confounding factors
- Medical, prescription, and absence costs were inflation adjusted to September 2013 dollars using the medical care Consumer Price Index values for medical services, prescription drugs, and all consumer goods and services, respectively
- P values < 0.05 were considered statistically significant

RESULTS

- There were 1,007 non-cirrhotics, 87 CC, 256 DCC, 17 HCC, 19 liver transplant, and 727,588 controls identified among employees in the database
- Overall, the HCV cohorts were older and more frequently male compared to the controls; race was similar among the cohorts (Table 1)
- In unadjusted analyses:
 - Mean medical and prescription drug costs were significantly higher in nearly all HCV cohorts compared to controls
 - Mean STD days and STD costs were greater in HCV cohorts compared to controls and progressively higher for more severe HCV cohorts, with the exception of the CC cohort
 - Sick leave costs were significantly greater for the non-cirrhotic and DCC cohorts compared to controls (Table 4)
- In regression analyses:
 - Mean direct medical costs were significantly higher for all HCV cohorts than for controls, with mean costs of \$1,813 for controls, \$4,611 for non-cirrhotic, \$4,646 for CC, \$12,384 for DCC, \$33,494 for HCC, and \$97,724 for liver transplant cohorts
 - Mean STD days and costs were significantly greater for the non-cirrhotic (2.03 days; \$299), DCC (6.20 days; \$763), and liver transplant cohorts (21.98 days; \$2,537) compared to controls (1.19 days; \$155)
 - Mean sick leave costs were significantly greater for the non-cirrhotic (\$373) and DCC cohorts (\$460) compared to controls (\$327)

Table 3: Demographic Characteristics

Metric	LT			HCC			DCC			CC			Other chronic HCV ²			No chronic HCV (control cohort)	
	Mean	SE	P-value vs. controls	Mean	SE	P-value vs. controls	Mean	SE	P-value vs. controls	Mean	SE	P-value vs. controls	Mean	SE	P-value vs. controls	Mean	SE
N	19			17			256			87			1007			727588	
Age ¹	51.03	1.72	<0.0001	56.32	0.92	<0.0001	49.36	0.56	<0.0001	51.9	0.69	<0.0001	47.10	0.30	<0.0001	40.45	0.01
Tenure	13.66	2.12	0.0011	18.12	2.44	<0.0001	10.96	0.62	<0.0001	9.53	0.87	0.0365	9.05	0.27	<0.0001	7.77	0.01
Annual salary ²	\$74,075	\$9,442	0.0328	\$58,793	\$7,445	0.6303	\$53,204	\$2,126	0.5928	\$53,173	\$3,912	0.7773	\$51,213	\$984	0.0015	\$54,343	\$46
Female (%)	10.5%	7.2%	0.0016	29.4%	11.4%	0.1531	37.1%	3.0%	0.0021	37.9%	5.2%	0.1012	42.6%	1.6%	0.0092	46.70%	0.10%
White (%)	47.4%	11.8%	0.1389	17.6%	9.5%	0.2164	35.9%	3.0%	0.1342	28.7%	4.9%	0.5675	36.7%	1.5%	0.0004	31.6%	0.1%
Black (%)	0.0%	0.0%	0.1878	5.9%	5.9%	0.7116	10.9%	2.0%	0.1372	8.0%	2.9%	0.9144	9.8%	0.9%	0.0932	8.4%	0.0%
Hispanic (%)	10.5%	7.2%	0.3492	23.5%	10.6%	0.0013	10.2%	1.9%	0.0015	5.7%	2.5%	0.9496	6.8%	0.8%	0.109	5.6%	0.0%
Other race (%)	0.0%	0.0%	0.4454	0.0%	0.0%	0.4704	3.5%	1.2%	0.6101	1.1%	1.1%	0.3164	2.2%	0.5%	0.1405	3.0%	0.0%
Race missing (%)	42.1%	11.6%	0.4134	52.9%	12.5%	0.9043	39.5%	3.1%	0.0001	56.3%	5.3%	0.3667	44.5%	1.6%	<0.0001	51.5%	0.1%
Exempt (%)	47.4%	11.8%	0.1383	29.4%	11.40%	0.8487	25.4%	2.7%	0.0336	25.3%	4.7%	0.2079	23.8%	1.3%	<0.0001	31.6%	0.1%
Percent full-time (%)	94.7%	5.3%	0.951	100.0%	0.00%	0.3159	97.3%	1.0%	0.0469	98.9%	1.1%	0.0715	96.3%	0.6%	0.0083	94.4%	0.0%

All employees had at least 6 months of health plan enrollment before and after their index date. P-values are calculated using t-tests for continuous variables and chi-squared tests for dichotomous variables.
¹ Due to missing data, N's for the LT, HCC, DCC, CC, other HCV, and no HCV cohorts are 19, 17, 256, 87, 1007, and 727,570 for age; ² Due to missing data, N's for the LT, HCC, DCC, CC, other HCV, and no HCV cohorts are 17, 17, 256, 85, 985, and 698,686 for salary; ³ Other chronic HCV represents the HCV cohort without cirrhosis (or any of the other stages). SE = standard error

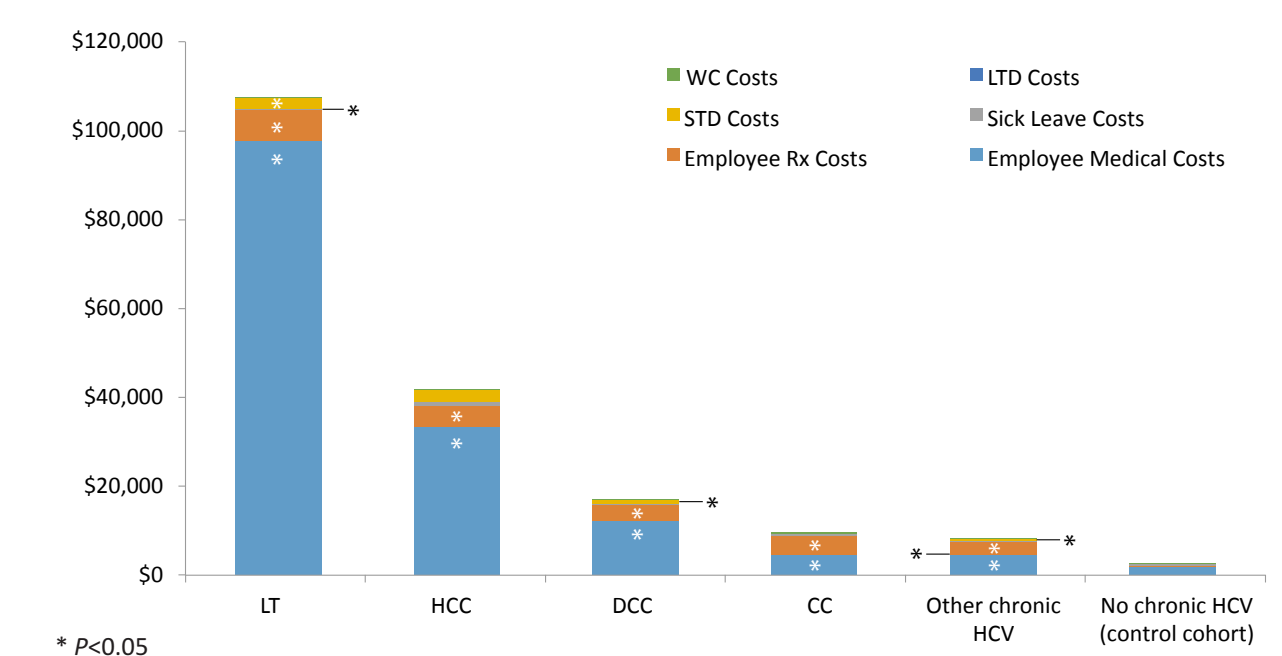
Table 4: Descriptive View of 6-Month Post-Index HCV-Related Medication Use and Cost and Absence Day Outcomes

Metric	LT			HCC			DCC			CC			Other chronic HCV ²			No chronic HCV (control cohort)	
	Mean	SE	P-value vs. controls	Mean	SE	P-value vs. controls	Mean	SE	P-value vs. controls	Mean	SE	P-value vs. controls	Mean	SE	P-value vs. controls	Mean	SE
% using Ribavirin	0.00%	0.00%	0.9853	0.00%	0.00%	0.9861	5.47%	1.42%	<0.0001	9.20%	3.12%	<0.0001	3.38%	0.57%	<0.0001	0.0018%	0.0005%
% using Peginterferon	0.00%	0.00%	0.9603	5.88%	5.88%	<0.0001	14.45%	2.20%	<0.0001	26.44%	4.76%	<0.0001	14.20%	1.10%	<0.0001	0.0131%	0.0013%
% using Telaprevir	0.00%	0.00%	0.9942	0.00%	0.00%	0.9946	1.56%	0.78%	<0.0001	1.15%	1.15%	<0.0001	0.99%	0.31%	<0.0001	0.0003%	0.0002%
% using Boceprevir	0.00%	0.00%	0.9909	0.00%	0.00%	0.9914	0.78%	0.55%	<0.0001	0.00%	0.00%	0.9805	0.20%	0.14%	<0.0001	0.0007%	0.0003%
STD costs ³	\$6,094	\$2,701	0.0507	\$2,504	\$1,629	0.1904	\$1,642	\$614	0.0228	\$47	\$47	0.0002	\$374	\$94	0.1318	\$232	\$3
LTD costs ⁴	\$1,812	\$1,432	0.2383	\$0	\$0	<0.0001	\$119	\$87	0.3342	\$0	\$0	<0.0001	\$126	\$94	0.3335	\$35	\$3
WC costs ⁵	\$0	\$0	<0.0001	\$0	\$0	<0.0001	\$618	\$397	0.3627	\$486	\$466	0.6231	\$756	\$337	0.1373	\$256	\$9
Sick costs ⁶	\$386	\$333	0.9551	\$3,316	\$2,162	0.2081	\$774	\$139	0.0094	\$644	\$263	0.3754	\$537	\$64	0.0417	\$406	\$2
STD days	22.69	11.75	0.0958	22.58	14.51	0.1736	9.13	2.27	0.0009	0.67	0.67	0.2456	2.67	0.55	0.0297	1.47	0.02
LTD days	63.54	43.78	0.1748	0	0	<0.0001	1.38	1.19	0.4068	0	0	<0.0001	1.35	0.9	0.2861	0.39	0.03
WC days	0	0	<0.0001	0	0	<0.0001	0.96	0.71	0.4598	0.25	0.23	0.4261	1.17	0.56	0.1948	0.44	0.02
Sick days	0.85	0.61	0.141	9.99	6.32	0.2269	3.16	0.52	0.0132	2.47	0.82	0.4199	2.18	0.22	0.1355	1.86	0.01
Employee medical costs	\$142,045	\$47,440	0.0085	\$48,031	\$13,053	0.0028	\$17,418	\$2,394	<0.0001	\$6,021	\$976	<0.0001	\$5,562	\$430	<0.0001	\$1,926	\$11
Employee treatment costs	\$10,846	\$2,631	0.0009	\$7,344	\$3,847	0.0915	\$4,075	\$527	<0.0001	\$5,019	\$1,064	<0.0001	\$2,951	\$240	<0.0001	\$437	\$2

Costs are adjusted for inflation to September 2013 dollars. P-values are calculated using t-tests for continuous variables and chi-squared tests for dichotomous variables.
¹ All employees had at least 6 months of health plan enrollment before and after their index date; ² Other chronic HCV represents the HCV cohort without cirrhosis (or any of the other stages)
³ Eligible employee N's for the LT, HCC, DCC, CC, other HCV, and no HCV cohorts are 13, 12, 168, 49, 623, and 456,097 for STD; ⁴ Eligible employee N's for the LT, HCC, DCC, CC, other HCV, and no HCV cohorts are 13, 14, 189, 61, 726, and 455,351 for LTD; ⁵ Eligible employee N's for the LT, HCC, DCC, CC, other HCV, and no HCV cohorts are 17, 17, 238, 79, 914, and 644,692 for WC; ⁶ Eligible employee N's for the LT, HCC, DCC, CC, other HCV, and no HCV cohorts are 9, 11, 123, 28, 460, and 343,143 for sick leave
 STD = short-term disability; LTD = long-term disability; WC = workers' compensation

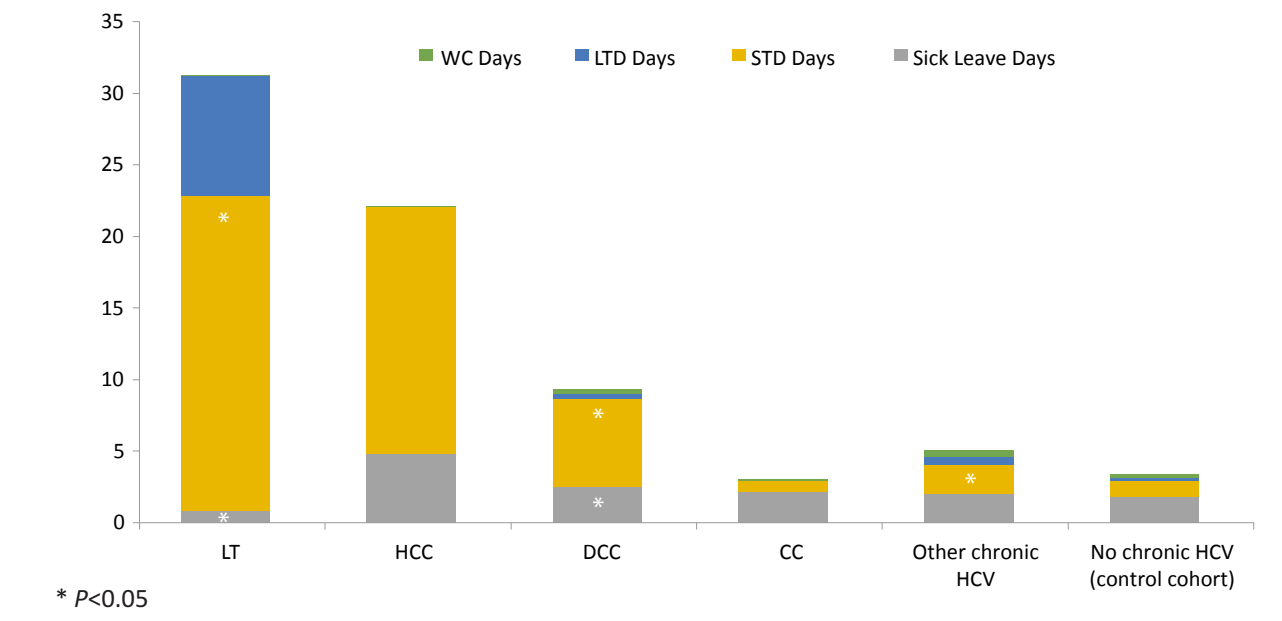
- WC and LTD did not appear to be significantly higher in HCV cohorts compared to controls; this may be due to small patient counts in these cohorts or the rarity of these events
- Total 6-month costs across all health benefit types for the liver transplant, HCC, DCC, CC, other HCV, and control cohorts were \$107,541, \$41,744, \$17,155, \$9,689, \$8,488, and \$2,864, respectively (Figure 1)

Figure 1: Regression-Adjusted 6-month Health Benefit Costs per Employee



- Total 6-month absence days for eligible employees across cohorts for the liver transplant, HCC, DCC, CC, other HCV, and control cohorts were 31.26, 22.11, 9.34, 3.05, 5.12, and 3.41, respectively (Figure 2)

Figure 2: Regression-Adjusted 6-month Health Benefit Absence Days per Eligible Employee



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