

SUPPLEMENT

Appendix A: Description of ICD9 Codes used to define etiologies, complications and procedures

	ICD9 Codes	% of Decompensated Cirrhosis Group	% of Compensated Cirrhosis Group
Etiology			
Hepatitis C	070.41, 070.44, 070.51, 070.54, 070.70, 070.71, V0262	28.20%	33.28%
ALD	571.0, 571.1, 571.1, 571.3	51.24%	37.40%
Hepatitis B	070.20, 070.21, 070.22, 070.23, 070.30, 070.31, 070.32, 070.33, V0261	2.75%	3.10%
NOS	571.40, 571.41, 571.49, 571.5, 571.9	26.07%	31.57%
Other	571.42, 571.6, 576.1, 275.1, 573.0, 275.01, 273.4, 571.8	48.62%	60.27%
Procedures			
Liver Biopsy	50.11, 50.12, 50.13	2.19%	2.20%
Upper Gastrointestinal endoscopy	45.13, 45.14, 45.16, 42.23, 42.24, 44.13, 44.14	17.20%	6.72%
Variceal Ligation and/or sclerotherapy	42.91, 42.33	8.39%	0.36%
Insertion of Sengstaken tube /esophageal tamponade	96.06	0.06%	0%
Paracentesis	54.91	31.85%	2.29%
Thoracentesis	34.91, 34.04, 34.09	3.61%	2.27%
Transjugular Intrahepatic Portosystemic shunt	39.1	1.52%	0.01%
Mechanical ventilation beyond 96 hours	96.71, 96.70, 96.72	6.45%	4.12%
Hemodialysis	39.55	5.08%	4.03%
Orthotopic Liver Transplant	50.5	0%	0%
Red Blood Cell Transfusion	99.04	24.13%	11.52%
Platelets Transfusion	99.05	5.73%	2.88%
FFP Transfusion	99.07	9.76%	3.10%
Procedure Group (Included in Regression Analysis)			
Varices Treatment	Includes Upper Gastrointestinal endoscopy, Variceal Ligation and/or sclerotherapy and Insertion of Sengstaken tube /esophageal tamponade	24.03%	6.98%
Fluid Removal	Includes Paracentesis and Thoracentesis	34.20%	4.44%
Non-RBC Transfuse	Includes Platelets Transfusion and FFP Transfusion	12.66%	4.99%
Complications			
Portal Hypertension	572.3, 789.59, 289.53, 289.51, 287.4, 287.49, 287.5, 456.0, 456.20, 456.1, 456.21, 456.8, 455.0	89.15%	27.74%
Ascites	789.59	56.97%	0%
Splenomegaly	289.53, 289.51	0.40%	0.20%
Thrombocytopenia	287.4, 287.49, 287.5	28.65%	22.52%
Hyponatremia	276.1	19.54%	12.37%

Varices with Bleeding	456.0, 456.20	10.53%	0%
Varices without Bleeding	456.1, 456.21, 456.8, 455.0	22.37%	7.32%
Non-PHTN GI Bleeding	535.31, 569.3, 578.0, 455.2, 455.5, 455.4, 455.1, 455.6, 459.0, 287.8, 285.1, 280.0	25.08%	7.53%
Spontaneous bacterial peritonitis	567.23	4.04%	0.59%
Hepatorenal syndrome	572.4	5.82%	0%
Hepatic Encephalopathy	348.31, 348.30, 348.39, 572.2	32.38%	3.58%
Malnutrition	273.8, 262.0, 263.0, 783.21, 783.7	5.46%	3.86%
Hepatocellular Carcinoma	155.0	5.28%	4.38%
Hepatopulmonary Syndrome	573.5	0.13%	0.07%
Acute Renal Injury	584.9, 584.6, 584.7	20.19%	12.46%
Infection	590.10, 590.11, 595.0, 597.0, 599.0, 590.80, 590.81, 008.45, 112.2x, 590.2x, 590.3x, 480.x-485.x, 487.x, 488.x, 680.x-682.x, 684.x, 686.x	18.73%	20.23%

Appendix B: Primary Diagnosis Codes by organ system in each study group[†]

Diagnosis	DC Group		CC Group		NIS without cirrhosis	
	ICD-9 Code [‡]	Prevalence (%)	ICD-9 Code [‡]	Prevalence(%)	ICD-9 Code [‡]	Prevalence(%)
Liver						
Cirrhosis	571.2, 571.5	25.1	571.2, 571.5	4.5		
Viral Hepatitis	70.44, 70.71	4.6	70.71, 70.44	3.8		
Alcoholic CLD	571.1	1.0				
Other CLD	572.8	1.5				
Primary Liver Cancers	155.0	1.6	155.0	1.6		
Varices w or w/o bleeding	578.0	1.8				
Portal HTN						
Ascites	789.59	1.2				
Encephalopathy	572.2	12.9				
Hepatorenal Syndrome						
Hepatopulmonary syndrome						
Thrombocytopenia						
SBP	567.23	1.4				
Complication liver transplant						
Complication liver biopsy						
Pleural Effusion	511.9	1.0				
Cardiovascular						
Congestive Heart Failure	428.0	1.5	428.0	3.0	428.0	2.8
Arrhythmia			427.31	1.4	427.31	2.2
MI/CAD (atherosclerosis)			414.01	1.5	414.01, 410.71	4.3
Other Cardiac (Chest pain, HTN, aneurysm, syncope)			786.59	2.3	786.59	3.3
Pulmonary						
Asthma, COPD			493.22	1.2	493.22	1.4
Respiratory failure			518.81	1.1	518.81	1.1
Pulmonary Embolism					415.9	1.0

Gastrointestinal						
GI bleed (non-portal hypertensive)	578.9	6.2	531.40	2.8	578.9	1.0
Other GI (Abdominal pain, Pancreatitis, biliary system, hemorrhoids, small bowel obstruction, diverticulosis, appendicitis)	577.0	4.1	577.0	8.3	577.0	5.0
Infections						
Pneumonia	486.x	1.6	486.x, 491.21	4.4	486.x, 491.21	4.6
Urinary Tract Infection			599.0, 590.80, 590.10	1.5	599.0	1.6
Septicemia	03.89	3.7	03.89	3.7	03.89	2.2
Other Infections (cellulitis, colitis, HIV, abscess, endocarditis, Gangrene, venous insufficiency of legs)	682.6	1.6	682.6	4.9	682.6	2.8
Renal						
Acute Renal Failure	584.9	2.0	584.9	1.9	584.9	1.2
Electrolytes abnormalities (including hyponatremia)	276.1	1.1	276.1	2.0		
Psychiatry						
Alcohol-related disorders (withdrawal, alcohol-related delirium, alcoholic intoxication, alcohol dependence)			291.81	4.0		
Mood disorders			296.33	1.8	295.70	3.3
Nervous system						
Stroke/TIA			434.91	1.2	434.91	1.7
Other Nervous system (Dementia, Alzheimer's, Syncope)			780.2	1.4	780.2	1.9
Hematology/Oncology						
Anemia			285.9	1.3		
Obstetrics-Gynecology						
Pregnancy related Complications					654.21, 664.11	9.2
Other						
Endocrine – Diabetes Mellitus, Morbid Obesity			250.80	1.9	278.01	1.5
Musculoskeletal – Rehabilitation care, Arthritis, Fractures			V57.89	2.9	715.36, V57.89	6.6

†ICD 9 Codes listed in the DX1 position in years 2008-2011 were included for analysis if prevalence $\geq 0.1\%$. Codes were grouped based on organ system and clinical disease state through manual review. Groups of codes with $\geq 1\%$ prevalence in dataset are listed.

*Only ICD9 codes with $\geq 1\%$ prevalence are listed; if a group had no individual code $\geq 1\%$ in a category, the code with highest prevalence is listed.

Appendix C: Description of classes of Co-morbidities

Comorbidity Class	Comorbidity Indicator Variables	% of Decompensated Cirrhosis	% of compensated cirrhosis	% of All NIS w/o cirrhosis
Heart	Congestive Heart Failure	8.99%	10.32%	7.79%
Heart	Valvular Disease	2.60%	3.17%	2.94%
Heart	Pulmonary Circulation Disease	2.66%	2.77%	1.74%
Heart	Peripheral Vascular Disease	2.70%	4.47%	5.01%
Hypertension	Hypertension	38.56%	49.98%	46.61%
NeuroPara	Paralysis	0.86%	1.58%	2.32%
NeuroPara	Other Neurological Disorders	5.88%	8.26%	6.80%
ChrnLung	Chronic Pulmonary Disease	14.86%	22.11%	16.93%
Diabetes	Diabetes without Complications	25.17%	26.65%	17.70%
Diabetes	Diabetes with Complications	4.71%	5.71%	4.06%
NI in Regression [†]	Hypothyroidism	8.84%	10.68%	10.18%
LytesRenl	Renal Failure	15.94%	13.40%	10.36%
NI in Regression [†]	Liver Disease	55.07%	89.74%	1.51%
NI in Regression [†]	Peptic Ulcer Disease x Bleeding	0.07%	0.06%	0.03%
NI in Regression [†]	Acquired Immunodeficiency Syndrome	0.67%	0.90%	0.23%
Cancer	Lymphoma	0.64%	0.74%	0.75%
Cancer	Metastatic Cancer	1.48%	1.89%	2.12%
Cancer	Solid Tumor without Metastasis	4.63%	3.73%	1.88%
NI in Regression [†]	Rheumatoid Arthritis/Collagen vascular disease	1.57%	2.63%	2.42%
NI in Regression [†]	Coagulopathy	37.51%	25.53%	3.56%
NI in Regression [†]	Obesity	6.94%	9.09%	9.95%
NI in Regression [†]	Weight Loss	11.18%	7.05%	4.00%
LytesRenl	Fluid & Electrolyte Disorders	42.64%	32.67%	20.74%
Anemia	Chronic Blood Loss Anemia	4.10%	1.42%	2.33%
Anemia	Deficiency Anemias	27.08%	22.19%	14.73%
AlcDrug	Alcohol Abuse	40.32%	31.25%	3.75%
AlcDrug	Drug Abuse	6.11%	8.89%	3.91%
Mental	Psychoses	4.58%	7.04%	4.23%
Mental	Depression	8.87%	12.22%	9.44%

[†]These comorbidities were not included in regression analysis.

Supplement D: Specific Outcome Measures by Group with Pregnancy Excluded

Outcome Variable	Decompensated Cirrhosis	Compensated Cirrhosis	All NIS w/o cirrhosis	NIS w/o cirrhosis and pregnancy complication*
No. of admissions (2014)	334,370.1	236,360.1	29,181,233.8	26,116,013.8
Percentage Increase in no. of admissions between 2008-2014	35.89%	24.22%	-7.72%	-7.73%
Total cost of hospitalization (2014)	\$4,570,431,130	\$2,801,813,569	\$333,194,350,525	\$319,834,050,612
Percentage Increase in total cost of admissions between 2008-2014	33.4%	25.33%	3.98%	3.93%
Median Cost per Admission (IQR) †	\$8,596 (\$9,633)	\$7,738 (\$8,998)	\$7,141 (\$9,137)	\$7,869.55
Medicare (IQR) †	\$8,618 (\$9,586)	\$7,922(\$9,028)	\$8,183(9,714)	\$8,193.11
Medicaid (IQR) †	\$8,801(\$10,568)	\$7,266(\$8,625)	\$5,073(\$6,023)	\$6,192.40
Private Pay (IQR) †	\$9,086(\$11,179)	\$7,962(\$9,881)	\$6,535(\$8,651)	\$7,724.98
Median Length of Stay (Q1-Q3)	4 (2-7)	4 (2-6)	3 (2-5)	3 (2-6)
In-hospital Mortality‡	6.66%	3.37%	2.13%	2.38%

*Admissions where primary diagnosis was pregnancy or its complications were excluded.

†Median cost calculated for all years (2008-2014) combined and adjusted to 2014 dollars. IQR =Interquartile Range ‡Percent died prior to discharge

Supplement E: Demographics of patients admitted 2008-2014 with pregnancy excluded[†]

Discharge and hospital characteristics	% of Decompensated Cirrhosis	% of Compensated cirrhosis	% of All NIS w/o cirrhosis	NIS w/o cirrhosis and pregnancy complication*
<i>Mean Age, years (SD)</i>	58.3 (12.1)	59.3 (12.6)	57.2 (20.8)	60.5 (19.3)
18-44	10.5%	9.9%	29.8%	21.9%
45-64	61.4%	58.7%	28.7%	31.9%
65-84	26.0%	28.5%	31.8%	35.4%
85+	2.1%	2.9%	9.7%	10.8%
Male	62.5%	58.9%	40.1%	44.6%
<i>Race</i>				
White	60.6%	60.6%	61.7%	63.4%
Black	8.8%	11.4%	13.1%	13.1%
Hispanic	16.7%	14.4%	9.3%	8.1%
Asian or Pacific Islander	1.8%	1.8%	2.2%	1.9%
Native American	1.3%	1.1%	0.6%	0.6%
Other	2.9%	2.7%	2.8%	2.6%
Missing	7.9%	7.9%	10.4%	10.3%
<i>Median Income by Patient Zip Code[‡]</i>				
Quartile 1 (lowest income)	31.8%	33.3%	28.5%	28.7%
Quartile 2	25.7%	25.4%	25.7%	25.7%
Quartile 3	22.3%	21.5%	23.2%	23.1%
Quartile 4 (highest income)	16.9%	16.1%	20.2%	20.0%
<i>Admissions by Payer Type</i>				
Medicare	41.3%	46.3%	45.5%	50.1%
Medicaid	23.0%	22.1%	15.5%	12.4%
Private/HMO	22.3%	19.7%	29.7%	27.3%
Other	13.2%	11.6%	9.1%	5.9%
<i>Origin of Admission</i>				
Emergency Department	74.2%	69.5%	53.5%	58.7%
Transfer	6.8%	5.3%	4.9%	5.3%
<i>Disposition of Patient</i>				
Home	58.3%	61.9%	66.8%	63.3%
Transfer to another hospital	3.8%	2.8%	2.1%	2.3%
Transfer to SNF, intermediate care or another facility	15.5%	16.2%	15.6%	17.4%
Home Health Care	13.4%	13.0%	12.1%	13.3%
Teaching Hospital [§]	54.5%	53.2%	49.2%	51.0%
Rural Hospital	8.8%	9.7%	11.9%	12.0%
<i>Hospital Region[¶]</i>				
Northeast	18.5%	20.0%	19.6%	20.0%
Midwest	18.9%	18.6%	23.0%	23.2%
South	38.9%	39%	38.5%	38.6%
West	23.8%	22.5%	18.8%	18.1%

*Admissions where primary diagnosis was pregnancy or its complications were excluded.

[†]Mean and proportions presents in the table are weighted as per NIS discharges

[‡]Income by zip code included in each quartile varies by year. For dollar amounts included in each quartile each year, refer to http://www.hcup-us.ahrq.gov/db/vars/zipinc_qrtl/nisnote.jsp

[§]All rural hospitals are classified as non-teaching as per https://www.hcup-us.ahrq.gov/db/vars/nis_stratum/nisnote.jsp

[¶]For 2012-2014, NIS data includes divisions instead of regions. However, the 9 divisions in the data were grouped into regions as per https://www.hcup-us.ahrq.gov/db/vars/nis_stratum/nisnote.jsp