Trends in Mortality and Health Care Burden of Cirrhotic Decompensation in Hospitalized Patients: A Nationwide Analysis

Faiz Afridi, MD, Anmol Mittal, MD, Nikolaos Pyrsopoulos, MD

Background

Mortality caused by cirrhosis is now the 14th common cause of death worldwide and 12^t common in the United States. We studied to inpatient mortality and hospitalization costs associated with cirrhotic decompensation fr esophageal variceal hemorrhage, ascites, he encephalopathy (HE), spontaneous bacteria peritonitis (SBP) and hepatorenal syndrome from 2007 to 2014.

Methods

Using the National Inpatient Sample databa first isolated patients 18 years or older with diagnosis of cirrhosis using ICD-9 codes. We identified patients with the admission diagr esophageal variceal hemorrhage, ascites, H and HRS. Time series regression was used to determine if a trend occurred over the stud period.

Results

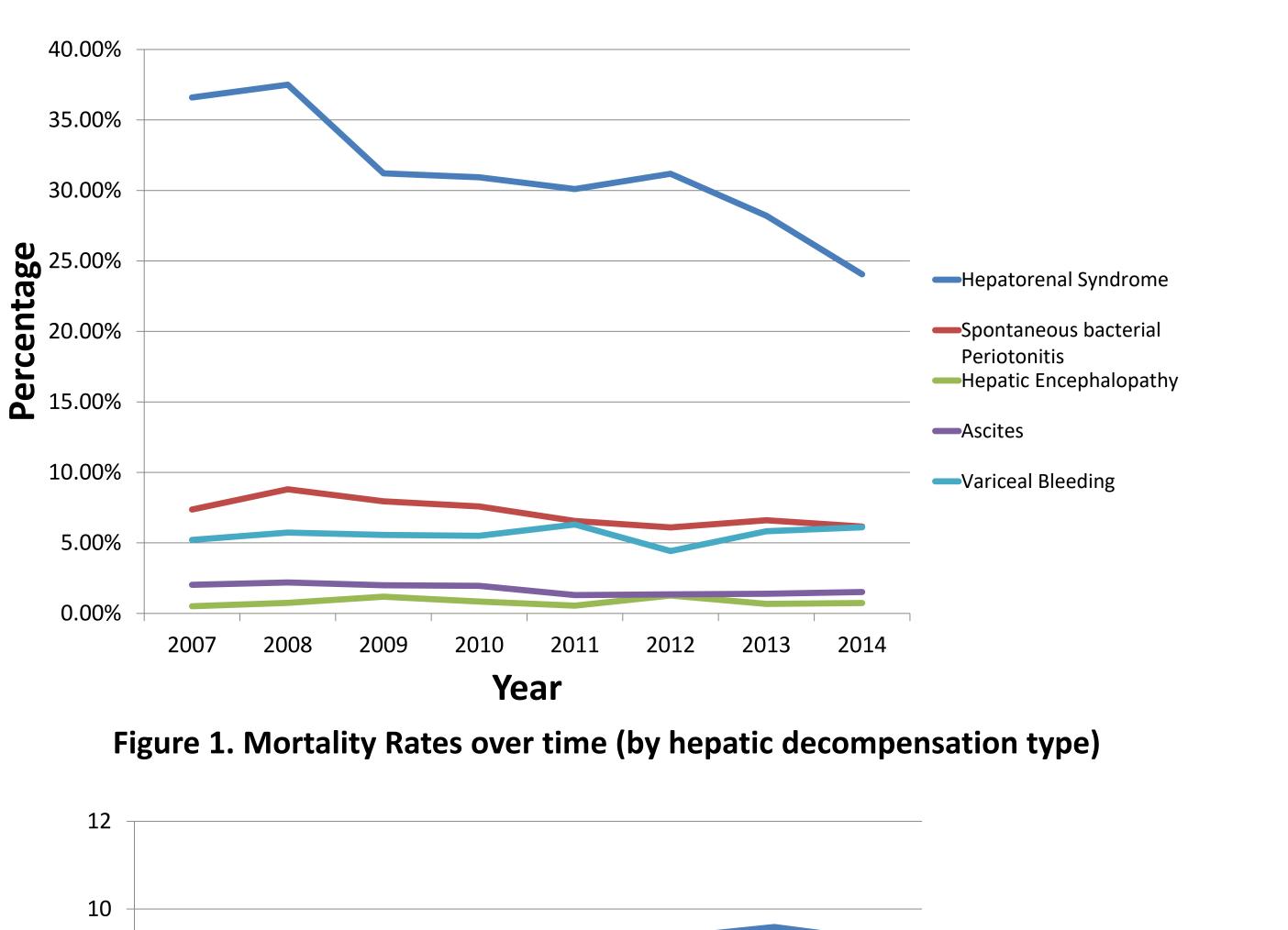
A total of 80,357 cirrhotic patients with the decompensations were captured. During th period, time series regression confirmed downtrends in mortality rates for decompensations from HRS and hepatic encephalopathy. No trend was noted in more rates for decompensations from SBP, ascites variceal bleeding. Length of stay decreased decompensations from SBP, HE, and varicea bleeding. No trend was noted for decompensations from HRS and ascites. Tin series confirmed increases in hospitalization for all decompensations except for hepatore





RUTGERS

$ \begin{array}{c c c c c c c c c c c c c c c c c c c $						
4 th most Montality No /% (day) Average Total Change (0 2 th most 2006 37.19 8.49 50,841 2 th most 2007 317 26.18 8.47 60,225 trends in 2010 378 26.18 8.47 60,225 trends in 2011 407 28.01 6.35 p=0.031 from 2013 440 25.61 8.33 70,440 pass 3.43 67.72.55 8.43 67.73.4 nepatic Spontactus Bacterial Peritonits 2012 67.77 6.61 93.73.9 ial Mean overall 28.57 8.43 67.71.2 38.737 ial Mean overall 28.55 6.61 94.72.5 6.64 42.2846 ial 1100 5.24 p=0.083 6.61 42.2846 42.2846 ial 2011 1005 5.42 5.55 6.64 42.2846 pass is so is 2011 1005 5.42 <td></td> <td></td> <td></td> <td>Hepatore</td> <td>nal syndrome</td> <td></td>				Hepatore	nal syndrome	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $						
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1 th most	2007		•		Average Total Charge (Dollars)
2006 317 26.38 8.47 66.189 2011 407 26.39 8.35 p=0.001 8.35 p=0.931 77,346 p=0.101 1ts 2012 409 28.85 9.01 73,873 70,440 repatic Mean overall 21.38 7.94 73,873 70,440 nepatic Mean overall 28.87 6.01 73,873 70,440 nepatic Mean overall 28.85 9.01 73,873 73,873 nepatic Mean overall 28.87 6.61 73,873 73,970 2000 915 5.55 6.64 7,31 39,770 72,23 6.42 42,366 42,366 42,366 42,366 42,379 9,40 46,823 44,733 46,823 44,733 46,823 46,733 44,733 46,823 46,733 44,733 46,823 46,823 46,733 44,733 46,823 46,733 46,823 46,733 46,823 46,733 46,823 46,733 46,823 46,733 46,823 46,733 46,833 46,733						
trends in ts 2010 976 26.39 (28.01) 90.001 8.32 (3.35) 9-0.931 77,346 (73,37) 77,346 (74,73) 77,356 (74,73) 77,346 (74,73) 77,346 (74,73) </td <td>2^{en} most</td> <td></td> <td></td> <td></td> <td></td> <td></td>	2 ^{en} most					
ts 2011 407 28.01 P-0.00 8.35 P-0.91 73,36 P-0.00 74,36 P-0.00 74,37 P-0.00 74,36 P-0.00 74,37	trends in					-
US 2012 409 28.85 9.01 73,177 from 2014 463 21.38 7.94 73,177 hepatic 2014 463 21.38 7.94 73,873 ial Spontaneous Bacterial Portonitis 6.32 73,873 6.43 73,873 ial Mortality No / % (day) Average Total Charge (C 33,770 2007 672 6.4 7.11 39,770 2008 804 7.09 6.33 6.34 42,789 p = 0.023 2011 100 5.24 p=0.083 6.31 43,925 p = 0.01 asses, we 2012 1010 5.34 6.64 47,733 asses, we 2013 1020 4.44 6.34 45,733 ft 2014 1066 4.22 5.85 6.44 43758.00 asses 0.05 5.32 28,09 20.64 45,73 29,85 20.64 ft 2007 7481 0.5 5.39 9,90.13 35,52 9,90.13 33,52				28.01 p=0.001	8.35 p=0.931	77,346 p=0.106
ITOM 2014 463 21.38 7.94 73,873 heepatic Mean overall 28.57 8.43 67271.25 ial Spontaneous Bacterial Portonitis Mean Length of stay Average Total Charge (E 1al Mortality No /% (days) Average Total Charge (E 2007 672 6.44 7.13 39,770 2008 804 7.05 6.64 42,846 2010 955 5.56 6.64 42,846 2011 107 5.24 6.64 47,33 obases, we 2013 1002 4.45 6.64 47,33 obases, we 2013 1006 4.22 5.85 46,73 for them 2007 7481 0.66 5.33 22,8909 for beam overall 0.06 5.53 92,952 28,909 growsis of 2008 6689 0.66 5.33 92,001 growsis of 2001 7499 0.54 5.39 23,3	ts	2012	409			
Mean coverall Xoa Zabas Coverant Coverant Zabas Zabas <thzabas< th=""> Zabas <thzabs< th=""> <</thzabs<></thzabas<>	from	2013	410	25.61	8.3	70,440
$\begin{array}{ l $			463			-
	nepatic	Mean overall				67271.25
$\begin{array}{ c c c c c c c } & \hline & & & & & & & & & & & & & & & & & $	ial			Spontaneous B		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			NЛ	ortality No / %		Average Total Charge (Dollars)
20038047.096.2838,73720099155.256.6442,89920109565.366.6142,799201111075.24p=0.0836.6147,3312038es, we201311024.456.1846,823h the201410664.225.8546,733//e then201410664.225.8546,733gnosis ofMean everall5.496.4443758.00//e then200774810.65.4928,909to200966650.655.4332,781200074990.54p = <0.001	e (HRS)	2007		-		
$\begin{array}{ c c c c c c c } \hline 1200 & 915 & 5.25 & 6.46 & 42,799 & p = 0.083 & 6.67 & p = 0.083 & 6.67 & p = 0.083 & 6.67 & p = 0.001 & 45,025 & 47,331 & 45,025 & 47,331 & 45,025 & 47,331 & 45,025 & 47,331 & 45,025 & 46,733 & 47,331 & 45,025 & 45,73 & 47,331 & 45,025 & 45,73 & 47,331 & 45,025 & 45,73 & 47,331 & 45,025 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 47,331 & 45,73 & 4$						
pases, we by the first state in the study2012 201310115.34 1026.64 4.82 4.8247,331 6.1846,823 46,823We then studyMean overall5.496.4443758.00We then studyMortality No /%(days)Average Total Charge (DMean overall5.495.4929,36220077480.65.4929,362200866890.65.3228,909to201074990.54 $p = < 0.001$ 35,532201074990.54 $p = < 0.001$ 5.19 $p = < 0.001$ 3003201179950.48 $p = < 0.001$ 35,532 $p = < 0.001$ 201386180.444.9533,635 $p = < 0.001$ 35,532 $p = < 0.001$ 201485780.435.0938,044 $q = 33,751,38$ $q = 33,751,38$ e studied he study20074480.073.3316,95820107390.11 $p = .922$ 3.72 $p = .020$ 20117610.13 $p = .922$ 3.73 $20,214$ 20127150.11 3.49 $23,941$ 20132550.12 3.66 $25,853$ $p = .002$ 20147540.12 3.73 $30,214$ 0ortality 2014 7540.12 3.73 $30,214$ 0ortality 2014 7540.12 3.73 $30,214$ 0ortality 2014 7540.12 3.73						
pases, we by the first state in the study2012 201310115.34 1026.64 4.82 4.8247,331 6.1846,823 46,823We then studyMean overall5.496.4443758.00We then studyMortality No /%(days)Average Total Charge (DMean overall5.495.4929,36220077480.65.4929,362200866890.65.3228,909to201074990.54 $p = < 0.001$ 35,532201074990.54 $p = < 0.001$ 5.19 $p = < 0.001$ 3003201179950.48 $p = < 0.001$ 35,532 $p = < 0.001$ 201386180.444.9533,635 $p = < 0.001$ 35,532 $p = < 0.001$ 201485780.435.0938,044 $q = 33,751,38$ $q = 33,751,38$ e studied he study20074480.073.3316,95820107390.11 $p = .922$ 3.72 $p = .020$ 20117610.13 $p = .922$ 3.73 $20,214$ 20127150.11 3.49 $23,941$ 20132550.12 3.66 $25,853$ $p = .002$ 20147540.12 3.73 $30,214$ 0ortality 2014 7540.12 3.73 $30,214$ 0ortality 2014 7540.12 3.73 $30,214$ 0ortality 2014 7540.12 3.73		2010	956	5.96 p=0.083	6.61 n = <0.001	
value 2013 1102 4.45 6.18 46,823 h the 2014 1066 4.22 5.85 46,733 /e then Hean overall 5.49 6.44 43758.00 gnosis of Mortality No /% (days) Average Total Charge (D 2007 7481 0.6 5.49 20.32 to 2009 6689 0.6 5.32 28,909 to 2010 7481 0.6 5.43 32,761 dy 2011 7995 0.48 p = <0.001		2011	1107		6.37	45,025
h the 2014 1066 4.22 5.85 0.14 43758.00 43758.00 43758.00 42758.0	ases we					
Mean overall 5,49 6,44 43738,00 (e then gnosis of HE, SBP Z007 7481 0.6 5,49 Mean Length of stay 2007 7481 0.6 5,49 29,362 28,909 to 2000 6669 0.64 5,23 28,909 to 2010 7499 0.54 $p = <0.001$ 33,853 $p = <0.01$ 2011 7995 0.48 $p = <0.001$ 5.07 33,853 $p = <0.01$ 2012 8175 0.49 5.07 35,175 36,355 36,355 2014 8578 0.43 5.09 38,044 4.95 36,355 2014 8578 0.63 5.22 33751,38 16,949 e studied Mean overall 0.53 5.22 33751,38 16,958 2002 668 0.06 3.42 16,949 20,99 20,99 20,99 20,99 20,99 20,99 20,99 20,99 20,99 20,99 20,99	-					
Ve then gnosis of to dy Mean Length of stay Mortality No /% Mean Length of stay (days) Average total Charge (D 29,362 HE, SBP to dy 2009 6689 0.6 5.49 5.43 28,909 28,909 28,909	h the		1066			
gnosis of HE, SBP 2007 7481 0.6 5.49 29,362 2007 7481 0.6 5.49 29,362 2008 6689 0.6 5.32 28,909 2000 7499 0.54 5.32 28,909 dy 2010 7499 0.54 9 = <0.01	la than	Iviean overall				43758.00
gnosis of HE, SBP 2007 7481 0.6 5.49 29,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,362 28,363 28,781 38,781 28,781 38,781 28,781 38,532 $p = < 0.001$ 33,853 $p = < 0.01$						
HE, SBP 2007 7481 0.6 5.49 20.9 20,962 20,903	gnosis of		M	ortality No / %	- .	Average Total Charge (Dollars)
to 1000 000 000 000 000 000 000 000 000 0		2007				
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	че, звр	2008	6689	0.6	5.32	28,909
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	to	2009	6685	0.65	5.43	32,781
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		2010	7499	0.54 p = <0.001	5.29 p = <0.001	p = 20.001
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	dy					35,532
201485780.435.0938,044Mean overall0.535.2233751.38AscitesMean overall0.535.2233751.38Mortality No / %(days)Average Total Charge (Dhe study20074480.073.3316,55820086380.063.4216,94920096050.13.7520,85920107390.11 $p = .922$ 3.57 $p=0.290$ 20117610.13 $p = .922$ 3.7320,85920127150.113.4923,94120137550.123.6625,85320147540.123.7330,214Mean overall0.103.5822684.63Mean overall0.103.5822684.63Mean overall0.103.5822684.63Mean overall0.103.5822684.63Mortality No / %(days)Average Total Charge (DCall20073306.065.4437,02437,02437,02420104555.05 $p=0.616$ 46137,73546120114415.920104555.0520114415.920124504.6620134527.0820145064.4745,34653,308						
Mean overall 0.53 5.22 33751.38 e studied $$						
Ascites Ascites Mestudied Mortality No / % Mean Length of stay (days) Average Total Charge (D Average Total Charge (D 16,958 2007 448 0.07 3.33 16,958 2008 638 0.06 3.42 16,958 2009 605 0.1 3.75 20,859 2010 739 0.11 3.49 21,144 2012 715 0.12 3.66 25,853 2014 755 0.12 3.66 25,853 2014 754 0.12 3.73 30,214 es, and Mean overall 0.10 3.58 22684.63 4 for 2007 330 6.06 5.44 37,024 eal 2007 330 6.06 5.44 37,024 2009 358 5.03 4.61 37,735 9 = <0.017			0570			
he studyImage: constraint of the studyImage: constraint of the studyAverage Total Charge (Damping)20074480.073.333.3316,95820086380.063.323.3216,95820096050.113.753.7520,85920,85920107790.117610.133.750.223.7520127150.1123.6625,85322,85322,85320137550.123.6625,85330,21425,85320147540.103.5822684.6322,8542015Mean overall0.103.5822684.6322,8534 for10.1010.103.5822,85340,926201610.1010.103.583,702440,92620173306.065.4437,02440,92620093585.034.6137,7354.6520093585.034.6137,7354.6520093585.034.6137,7354.6520104555.054.634.634.6320114415.99-0.6164.639-0.0174.85,1710.05520134557.084.614.634.6320134527.084.644.634.6320145064.944.634.635.3,308						
he studyImage: constraint of the studyImage: constraint of the studyAverage Total Charge (Damping)20074480.073.333.3316,95820086380.063.323.3216,95820096050.113.753.7520,85920,85920107790.117610.133.750.223.7520127150.1123.6625,85322,85322,85320137550.123.6625,85330,21425,85320147540.103.5822684.6322,8542015Mean overall0.103.5822684.6322,8534 for10.1010.103.5822,85340,926201610.1010.103.583,702440,92620173306.065.4437,02440,92620093585.034.6137,7354.6520093585.034.6137,7354.6520093585.034.6137,7354.6520104555.054.634.634.6320114415.99-0.6164.639-0.0174.85,1710.05520134557.084.614.634.6320134527.084.644.634.6320145064.944.634.635.3,308	e studied				Mean Length of stay	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			M	ortality No / %	(days)	Average Total Charge (Dollars)
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	ne study	2007	448	0.07	3.33	16,958
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$						
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$						
20127150.11 3.49 23,94120137550.12 3.66 25,85320147540.12 3.73 $30,214$ Mean overall0.10 3.58 22684.63Mean overall0.10 3.58 22684.63Mean overallMortality No $\sqrt{(days)}$ Average Total Charge (Days)ad for eal 2007 330 6.06 4.61 2007330 6.06 5.44 $37,024$ 2008 370 4.86 5.04 $40,926$ 2009 358 5.03 4.61 $37,735$ 2010 455 5.05 4.63 4.663 2011 441 5.9 $9-0.017$ $48,517$ 2012 450 4 4.76 $48,174$ 2013 452 7.08 4.87 4.87 renal2014 506 4.94 4.87 $53,308$				n = 0.07	3.57 2.72 p=0.290	p = 20.001
20137550.12 3.66 25,85320147540.12 3.73 $30,214$ 20147540.10 3.58 22684.63 Mean overall0.10 3.58 22684.63 Variceal bleedingMean overall 0.10 3.58 22684.63 Variceal bleedingOn costs2010 330 6.06 5.44 $37,024$ 2007 330 6.06 4.63 4.61 $37,735$ 2009 358 5.05 4.61 $37,735$ $40,697$ 2010 455 5.05 4.61 $37,735$ 2010 455 5.05 4.63 4.61 $40,697$ 2011 441 5.9 4.61 4.63 $40,697$ 2012 450 4 4.76 $48,174$ 2013 452 7.08 4.47 $45,346$ renal 2014 506 4.94 4.87						
ortality es, and20147540.12 3.73 $30,214$ Mean overall0.10 3.58 22684.63 Variceal bleedingVariceal bleedingOutling No / %Mean Length of stay (days)2007 330 6.06 5.44 $37,024$ 2008 370 4.86 5.04 $40,926$ 2009 358 5.03 4.61 $37,735$ 2010 455 5.05 4.63 $9=0.017$ $48,517$ 2011 441 5.96 4.66 $9=0.017$ $48,517$ 2012 450 4 4.76 $48,174$ 2013 452 7.08 4.47 $45,346$ renal2014 506 4.94 4.87 $53,308$	• -					
Mean overall0.103.5822684.63d forVariceal bleedingd forMean length of stayeal20073306.0620083704.8620093585.0320104555.0520104555.0520114415.920124504.6120134527.0810004555.0520134527.0810004555.0620134527.0810004555.0620134527.0810004555.0510004555.0510004555.0510004555.0510004555.0510004555.0510004555.0510004555.0510004555.0510004555.0510004555.0510004555.0510004555.0510004555.0510004554.6110004554.6110004.6110004.6110004.6110004.6110004.6110004.6110004.6110004.6110004.6110004.6110004.6110004.61 <td>ortality</td> <td></td> <td></td> <td></td> <td></td> <td></td>	ortality					
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	-	Mean overall		0.10	3.58	
CalContractionMortality No / %ContractionAverage Total Charge (D Average Total Charge	-			Varicea	l bleeding	
CalContractionMortality No / %ContractionAverage Total Charge (D Average Total Charge	d for				•	
2008 370 4.86 5.04 40,926 40,926 2009 358 5.03 4.61 37,735 37,735 2010 455 5.05 4.63 9-0.017 40,697 9-0.017 2012 450 450 4 4.63 9-0.017 48,517 9-0.017 2013 452 7.08 4.76 4.76 4.87 4.8,517 9-0.017 1014 506 4.94 4.87 4.87 4.8,517 9-0.017 1015 452 7.08 4.48 5.95 5.95 5.95 9-0.017 4.8,517 9-0.01	_			•		Average Total Charge (Dollars)
2009 358 5.03 2010 455 5.05 2011 441 5.9 2012 450 4 2013 452 7.08 1000 4.61 4.63 1000 441 5.9 1000 441 5.9 1000 455 4.61 1000 441 5.9 1000 455 4.61 1000 455 4.61 1000 455 4.61 1000 455 4.61 1000 455 4.61 1000 455 4.61 1000 4.61 4.63 1000 4.61 4.63 1000 4.61 4.61 1000 4.61 4.61 1000 4.61 4.61 1000 4.61 4.61 1000 4.61 4.61 1000 4.61 4.61 1000 4.61 4.61 1000 4.61 4.61	dl					
20104555.05 4.63 $p=0.017$ 40,697 $40,697$ $p=0.017$ 20114415.9 4.66 4.66 $p=0.017$ $48,517$ $p=-0.017$ $48,517$ $48,517$ $p=-0.017$ $48,517$ $48,517$ $p=-0.017$ $48,517$ $48,517$ $48,517$ $48,517$ 506 4.66 4.76 4.67 $48,517$ $48,517$ $48,517$ $48,517$ 506 4.94 4.47 4.87 4.87 $45,346$ $45,346$ $45,346$ 4.87 4.87 $55,308$ 4.94 4.87 4.87 $55,308$ 5						
2012 450 4 2013 452 7.08 renal 2014 506 4.94						·
2012 450 4 2013 452 7.08 renal 2014 506 4.94	me			5.9 p=0.616	4.66 p =0.017	48,517 p = <0.001
20134527.084.4745,346renal20145064.944.8753,308	n coste					
				7.08		
	renal	2014	506	4.94	4.87	53,308
Mean overall 5.37 4.81 43965.88		Mean overall		5.37	4.81	43965.88



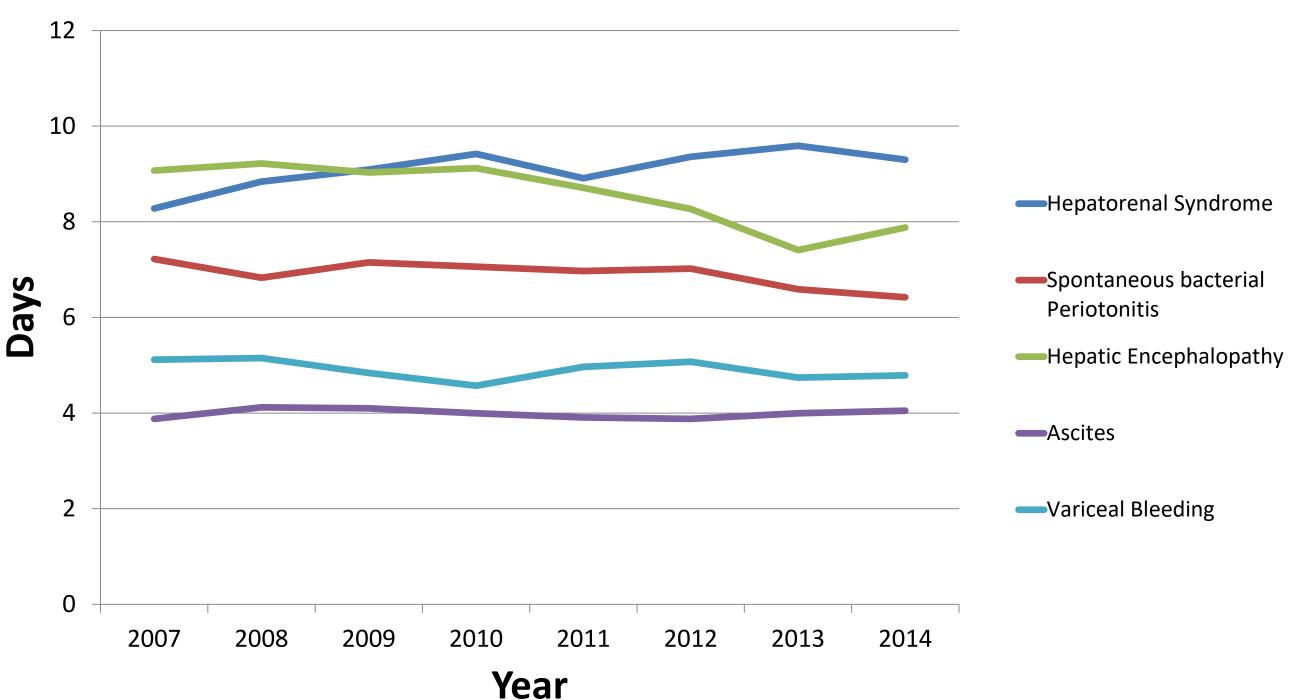


Figure 2. Mean Length of Stay over time (by hepatic decompensation type)

From 2007-2014, inpatient mortality rates decreased for cirrhotic decompensations secondary to HRS and hepatic encephalopathy. However, no difference was seen for decompensations from SBP, ascites, and variceal bleeding. Length of stay decreased for decompensations from SBP, HE and Variceal Bleeding while it remained unchanged for ascites and HRS. Hospitalization costs increased across the board except for hepatorenal syndrome.

Conclusion