The Impact of Socioeconomic Status on Cirrhosis and Hepatocellular Carcinoma in the United States

Roselyn Nsenga[1], Sophia Tzavaras[1], Daniel Waldo[1], Amit G Singal[2], Elliot B Tapper,[1] Neehar D. Parikh[1]

1. Division of Gastroenterology and Hepatology, University of Michigan, Ann Arbor, MI
2. Division of Digestive and Liver Diseases, UT Southwestern Medical Center, Dallas, TX

Background and Aim

- Recent data has shown increases in mortality related to cirrhosis and hepatocellular carcinoma (HCC) across the US since 2008.
- There are however significant regional disparities, with states such as Kentucky, New Mexico, and Arizona, showing more pronounced rises in mortality than others (i.e. Maryland).
- We aimed to examine the association of socioeconomic factors on the rise in cirrhosis and HCC related mortality in the US.

Methods

- We used death certificate data from the Vital Statistics Cooperative, and population data from the US Census Bureau compiled by the Center for Disease Control and Prevention's Wide-ranging Online Data for Epidemiologic Research (1999-2017).
- We used coding for K74 (cirrhosis of liver); K70.3 (alcoholic cirrhosis); K70 (alcoholic liver disease); and C22 (HCC) in the multiple causes of death file to calculate age-adjusted mortality rates.
- We also compiled county level socioeconomic status (SES) data from 1999-2017 from the Federal Reserve Economic Data and Bureau of Labor Statistics and Census including median household income, unemployment rate, percentage of patients below poverty level and percentage of the population with at least a bachelor degree.
- We tested for associations between SES and 5-year county level mortality trends

Table 1. Socioeconomic factors by state 1999-2017

State	Educational Attainment (% Bachelor Degree, SD)	Poverty Rate (%, SD)	Median Household income (2018 USD)	Unemployment (%, SD)
Alabama	23.0 (1.3)	17.0 (1.5)	$48,394 ($2,506)	6.3 (2.1)
Alaska	27.8 (1.2)	10.0 (0.9)	$72,158 ($43,93)	7.0 (0.5)
Arizona	26.9 (1.4)	15.5 (2.1)	$55,208 ($2,768)	6.2 (2.0)
Arkansas	20.5 (1.6)	18.5 (1.5)	$44,739 ($2,151)	5.8 (1.4)
California	30.9 (1.5)	14.3 (1.5)	$64,757 ($2,655)	7.2 (2.5)
Colorado	37.3 (2.1)	11.2 (1.6)	$67,785 ($3,577)	5.2 (1.9)
Connecticut	36.6 (1.6)	9.1 (1.3)	$73,480 ($2,049)	5.6 (2.0)
Delaware	29.1 (1.7)	10.9 (1.6)	$62,543 ($4,787)	5.1 (1.7)
Florida	26.8 (1.4)	14.2 (2.1)	$51,936 ($2,144)	5.9 (2.4)
Georgia	28.4 (1.4)	15.5 (2.4)	$54,750 ($3,799)	6.2 (2.3)
Hawaii	30.4 (1.3)	10.3 (1.0)	$69,366 ($4,623)	4.4 (1.5)
Idaho	25.2 (1.3)	13.4 (1.7)	$54,596 ($2,640)	5.4 (1.8)
Illinois	31.5 (1.7)	12.5 (1.6)	$60,632 ($3,562)	6.7 (2.0)
Indiana	23.7 (1.5)	12.7 (2.5)	$54,374 ($3,349)	5.9 (2.2)
Iowa	26.1 (1.6)	10.9 (1.6)	$58,510 ($2,686)	4.2 (1.0)
Kansas	30.6 (1.6)	11.9 (1.6)	$55,155 ($2,875)	4.9 (1.1)
Kentucky	21.6 (1.5)	17.1 (1.8)	$47,615 ($2,825)	6.4 (1.9)
Louisiana	21.9 (1.3)	19.0 (1.0)	$45,910 ($2,505)	6.1 (1.1)
Maine	28.2 (2.0)	12.3 (1.4)	$53,660 ($2,288)	5.3 (1.6)
Maryland	37.0 (1.7)	9.1 (0.9)	$75,643 ($2,658)	5.0 (1.4)
Massachusetts	39.8 (2.0)	10.3 (1.1)	$68,771 ($2,447)	5.3 (1.6)
Michigan	26.2 (1.6)	13.9 (2.7)	$57,829 ($4,174)	7.3 (2.7)
Minnesota	32.9 (1.8)	9.5 (1.6)	$69,005 ($4,520)	4.7 (1.4)
Mississippi	20.2 (1.1)	20.8 (1.9)	$42,335 ($3,438)	7.1 (1.7)
Missouri	26.4 (1.6)	13.6 (1.8)	$55,925 ($3,958)	5.8 (1.8)
Montana	29.0 (1.7)	14.4 (0.8)	$48,757 ($4,447)	5.0 (1.1)
Nebraska	28.9 (1.6)	11.2 (1.3)	$59,028 ($1,692)	3.5 (0.6)
Nevada	22.5 (1.1)	12.5 (2.4)	$58,715 ($4,573)	6.9 (3.2)
New Hampshire	34.1 (1.7)	7.7 (1.2)	$74,286 ($2,803)	4.1 (1.1)
New Jersey	36.1 (2.0)	9.4 (1.2)	$72,659 ($3,840)	6.1 (2.0)
New Mexico	25.9 (0.9)	18.8 (1.4)	$48,271 ($2,332)	5.9 (1.2)
New York	33.4 (1.6)	9.8 (1.2)	$57,686 ($2,800)	6.1 (1.5)
North Carolina	27.7 (2.0)	15.0 (2.0)	$50,686 ($2,755)	6.4 (2.3)
North Dakota	27.5 (1.6)	11.3 (0.6)	$55,871 ($4,895)	3.2 (0.4)
Ohio	25.4 (1.6)	13.4 (2.2)	$55,204 ($3,686)	6.3 (1.8)
Oklahoma	23.6 (1.1)	15.7 (1.1)	$50,051 ($2,359)	4.7 (1.0)
Oregon	30.1 (2.0)	13.8 (2.1)	$57,950 ($3,220)	7.0 (2.0)
Pennsylvania	28.0 (2.0)	12.0 (1.4)	$58,181 ($2,612)	5.8 (1.4)
Rhode Island	31.3 (1.5)	12.5 (1.6)	$60,916 ($3,075)	6.7 (2.6)
South Carolina	25.2 (1.7)	15.8 (1.9)	$49,942 ($3,342)	6.8 (2.2)
South Dakota	26.5 (1.4)	13.1 (0.9)	$54,393 ($2,359)	3.5 (0.7)
Tennessee	24.1 (1.8)	15.7 (1.9)	$48,712 ($3,082)	6.1 (2.0)
Texas	26.8 (1.6)	16.4 (1.2)	$55,081 ($2,221)	5.6 (1.3)
Utah	30.5 (1.9)	10.8 (1.5)	$66,424 ($2,816)	4.6 (1.5)
Vermont	34.9 (1.9)	10.5 (1.3)	$60,649 ($3,365)	4.1 (1.0)
Virginia	35.5 (1.9	10.4 (1.0)	$68,604 ($2,153)	4.4 (1.4)
Washington	32.3 (1.8)	11.2 (1.5)	$65,648 ($4,154)	6.5 (1.4)
West Virginia	18.5 (1.3)	17.4 (1.0)	$44,625 ($2,523)	6.1 (1.2)
Wisconsin	27.2 (1.7)	11.0 (1.9)	$60,147 ($3,354)	5.4 (1.6)
Wyoming	25.1 (1.6)	10.7 (0.6)	$58,836 ($3,738)	4.4 (1.0)

Results

Figure 1. Trend in age adjusted mortality for fibrosis and cirrhosis of the liver (K74)

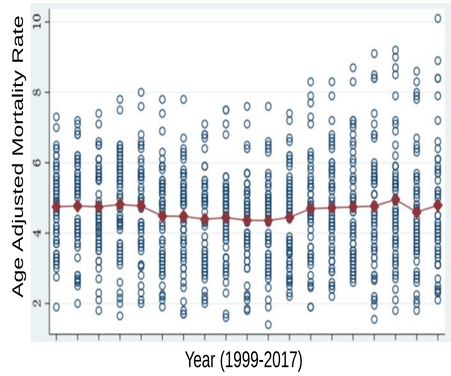


Figure 2. Trend in age adjusted mortality for alcoholic liver disease (K70)

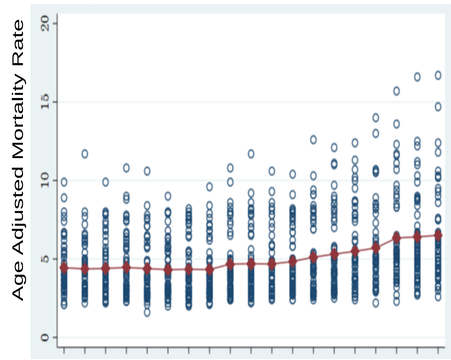
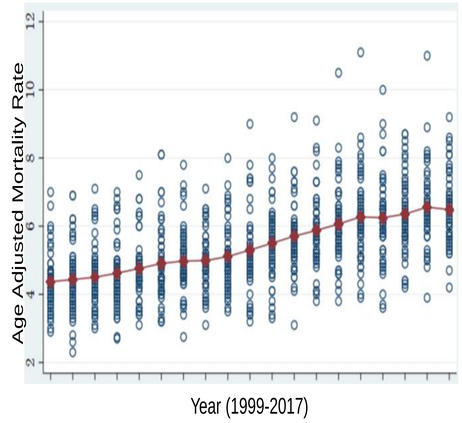


Figure 3. Trend in age adjusted mortality for hepatocellular carcinoma (C22)



Results

- Age-adjusted mortality related to cirrhosis, alcoholic liver disease, and HCC increased from 2008-2017
- Socioeconomic indicators remained stable up until the US financial crisis in 2008-09, when all SES indicators, except for percentage of population with a college degree, deteriorated until the economic recovery 2011-2014, with heterogeneity in the rate of recovery across counties ($p<0.001$).
- Cirrhosis-related mortality and higher unemployment ($r=0.14$; $p<0.001$) and lower education levels ($r=-0.13$; $p<0.001$) were positively correlated.
- Alcoholic cirrhosis mortality was positively correlated with unemployment ($r=0.043$; $p=0.038$) and income levels ($r=0.044$; $p=0.036$), and negatively correlated with poverty ($r=-0.15$; $p=0.037$), although all associations were weak.
- There was no correlation between socioeconomic factors and HCC-related mortality.

Conclusions

- Cirrhosis an HCC related mortality have increased since 2008, which coincides with the financial crisis in the US. Counties that had lower SES indicators, including unemployment and education had faster growth in cirrhosis mortality.
- Higher income and lower poverty were associated with lower alcohol-cirrhosis related mortality, possibly reflecting decreased alcohol access.
- Focused interventions to curb cirrhosis related mortality based on SES community status are warranted