

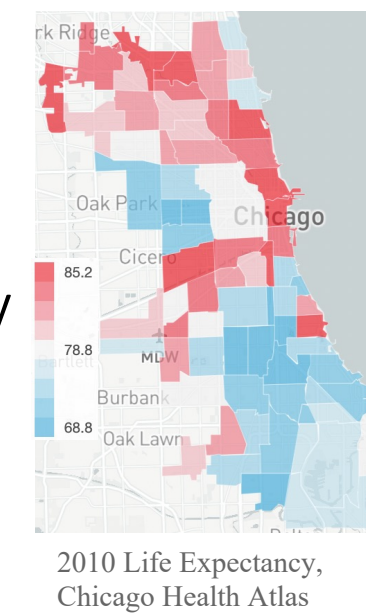
Social Vulnerability Is Associated with Increased Cirrhosis Mortality and Decreased Liver Transplantation

Praneet Polineni¹, Alexander Huang¹, Reiping Huang¹, Kexin Guo¹, Jonathan Jung¹, Alexandra Harris¹, Lihui Zhao¹, Alona Furmanchuk¹, Kiarri Kershaw², Marquita Lewis-Thames², Lisa McElroy³, Kofi Atiemo⁴, Nikhilesh Mazumder⁵, Dinee Simpson¹, Sanjay Mehrotra⁶, Daniela P. Ladner¹

¹NUTORC, Northwestern University Feinberg School of Medicine, ²IPHAM, Northwestern University Feinberg School of Medicine, ³Department of Surgery, Abdominal Transplant, Duke University School of Medicine, ⁴Department of Surgery, Abdominal Transplant, Weill Cornell Medical College, ⁵Division of Gastroenterology and Hepatology, University of Michigan, ⁶Department of Industrial Engineering and Management Sciences, Northwestern University

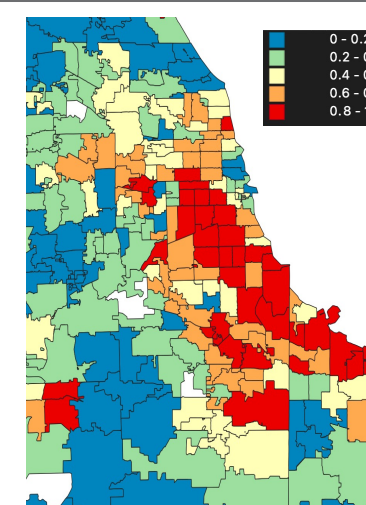
Background

- Prior research in a cirrhosis cohort (HealthLNK, 2006-2012) found poor health outcomes for Black and Hispanic patients with cirrhosis, though this does not account for other SDOH^{1,2}.
- Health outcomes vary significantly by geography across the country and within cities driven by societal factors and community level social determinants of health (SDOH)³
- The effect of these community-level SDOH are not well understood in liver cirrhosis.



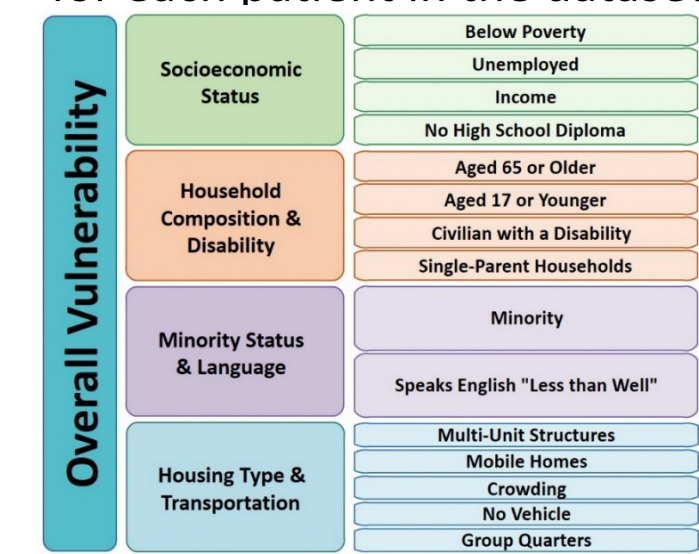
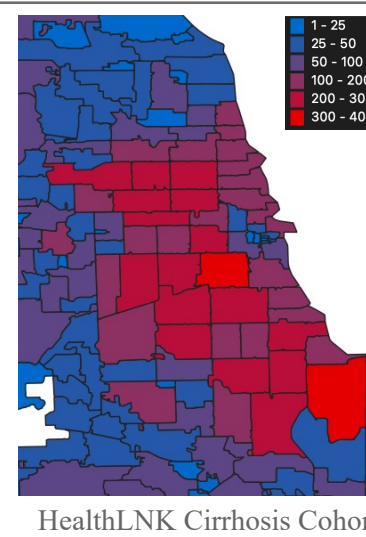
Research Objectives

- Evaluate differences in patient and disease characteristics based on community level SDOH
- Estimate the net effect of community level SDOH on cirrhosis mortality and liver transplantation



Methods

Patient Cohort:
19,906 patients with cirrhosis were identified in a deidentified dataset of patients from 6 centers in the Greater Chicago Metropolitan Area. This data was merged with Illinois Department of Public Health (IDPH) death data and United Network for Organ Sharing (UNOS) transplant data. 5-digit ZIP code data was available for each patient in the dataset.



Social Determinants of Health:
The CDC Social Vulnerability Index (SVI) is a composite index measure designed initially for disaster management⁴ and applied to predict health outcomes⁵. It is reported as a percentile score (0 to 1 from least vulnerable to most) at the census-tract level and converted 5-digit ZIP code level by population weighted medians.

Propensity Score Weighting:
Identified similar patients based on patient demographic and disease characteristics.

Competing Risk Survival Analysis:
Fine-Gray sub-distribution hazard model to identify the hazard of all-cause mortality, liver related death, non-liver related death, or liver transplantation with appropriate competing risks or censoring at the end of study.

Table 1. Demographics and Disease Characteristics

Social Vulnerability Index	All	Very Low (0-0.2)	Low (0.21-0.4)	Moderate (0.41-0.6)	High (0.61-0.8)	Very High (0.81-1)
Number of Patients	19906	2710 (14%)	3822 (19%)	3608 (18%)	4360 (22%)	5406 (27%)
Mean Follow-up (years)	2.6	2.8	2.6	2.6	2.6	2.6
Mean Age (years)	57.1	57.9	57.9	56.9	56.8	56.5
Gender						
Female	8475 (43%)	1192 (44%)	1649 (43%)	1500 (42%)	1878 (43%)	2256 (42%)
↓ White	9038 (45%)	1954 (72%)	2583 (68%)	1917 (53%)	1771 (41%)	813 (15%)
↑ Black	4399 (22%)	81 (3%)	276 (7%)	579 (16%)	956 (22%)	2507 (46%)
Race/Ethnicity						
↑ Hispanic	3258 (16%)	132 (5%)	261 (7%)	410 (11%)	894 (21%)	1561 (29%)
Asian	520 (3%)	94 (3%)	85 (2%)	93 (3%)	180 (4%)	68 (1%)
Other	2691 (14%)	449 (17%)	617 (16%)	609 (17%)	559 (13%)	457 (8%)
Insurance						
Medicare/-aid	9950 (50%)	1287 (47%)	1882 (49%)	1797 (50%)	2227 (51%)	2757 (51%)
↑ Other	3158 (16%)	171 (6%)	309 (8%)	474 (13%)	801 (18%)	1403 (26%)
↓ Private	6798 (34%)	1252 (46%)	1631 (43%)	1337 (37%)	1332 (31%)	1246 (23%)
Etiology						
↑ Hepatitis C	8076 (41%)	875 (32%)	1314 (34%)	1443 (40%)	1876 (43%)	2568 (48%)
↑ Alcoholic	7369 (37%)	862 (32%)	1269 (33%)	1292 (36%)	1586 (36%)	2360 (44%)
↓ NASH	4671 (23%)	754 (28%)	1024 (27%)	873 (24%)	970 (22%)	1050 (19%)
Hepatitis B	1634 (8%)	173 (6%)	232 (6%)	296 (8%)	444 (10%)	489 (9%)
↓ Cholestatic	2153 (11%)	405 (15%)	536 (14%)	400 (11%)	432 (10%)	380 (7%)
Autoimmune	688 (3%)	80 (3%)	134 (4%)	141 (4%)	154 (4%)	179 (3%)
Decompensation						
Ascites	5227 (26%)	732 (27%)	1027 (27%)	957 (27%)	1147 (26%)	1364 (25%)
HE	3649 (18%)	485 (18%)	699 (18%)	686 (19%)	786 (18%)	993 (18%)
Varices	1207 (6%)	157 (6%)	204 (5%)	207 (6%)	272 (6%)	367 (7%)
SBP	864 (4%)	134 (5%)	184 (5%)	146 (4%)	189 (4%)	211 (4%)
HRS	1099 (6%)	159 (6%)	240 (6%)	231 (6%)	237 (5%)	232 (4%)
HPS	45 (0%)	8 (0%)	14 (0%)	7 (0%)	6 (0%)	10 (0%)
Other						
↑ Charlson	4.6	4.3	4.4	4.4	4.6	4.9
↓ HCC	2800 (14%)	436 (16%)	596 (16%)	528 (15%)	637 (15%)	603 (11%)

Table 1: Patient demographics and disease characteristics with trends significant by Chi-squared $p < 0.05$

Figure 1. Competing Risk Survival Analysis

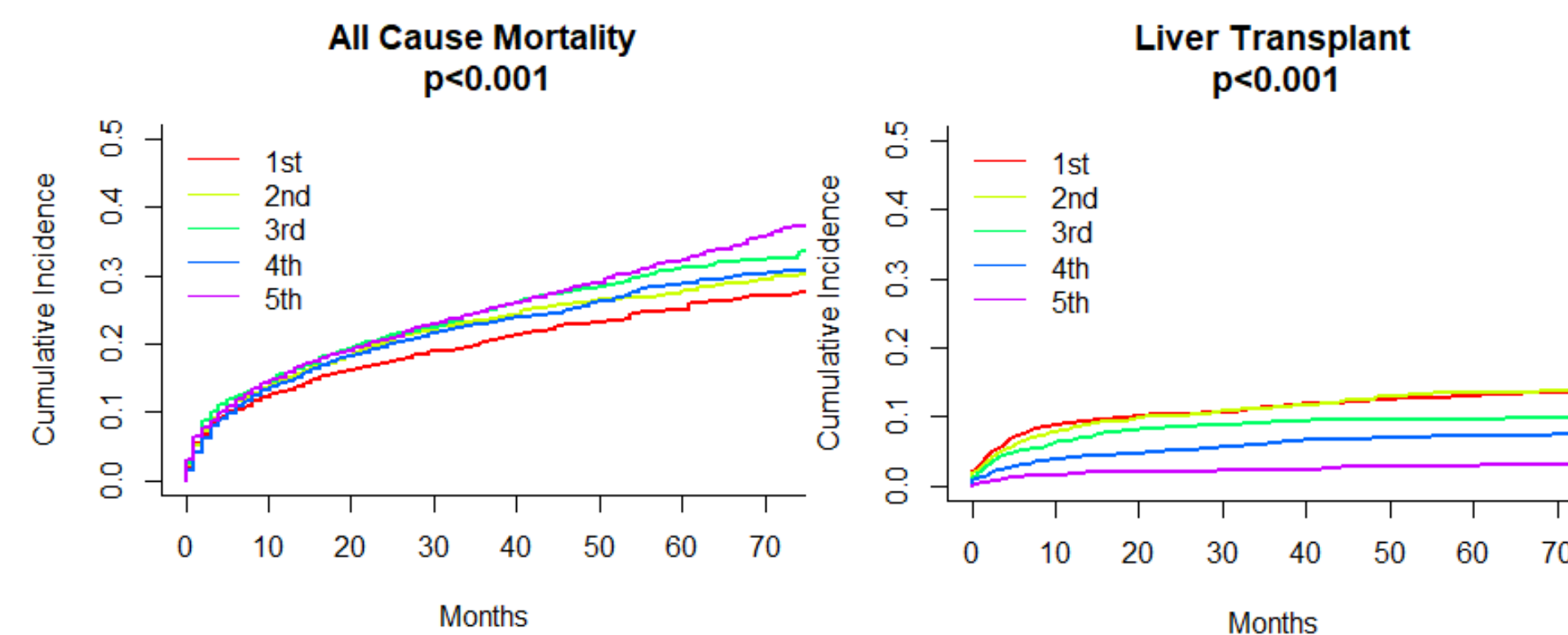


Figure 1: Cumulative Incidence of All Cause Mortality and Liver Transplantation stratified by quintiles of SVI (1st is lowest 0-0.2, 5th is highest 0.81-1)

Table 2. Hazard Ratios of Cirrhosis Outcomes

Outcome	Hazard Ratio (95% CI)	p-value
All-Cause Mortality	1.30 (1.20-1.55)	$p < 0.001$
Liver Related Mortality	0.96 (0.85-1.11)	$p = 0.52$
Non-Liver Related Mortality	1.39 (1.14-1.70)	$p < 0.001$
Liver Transplantation	0.17 (0.13-0.21)	$p < 0.001$

Table 2: Hazard ratios for outcomes comparing propensity-weighted patient with the highest vulnerability (SVI=1) to the lowest vulnerability (SVI=0)

Results

- Increased Vulnerability (SVI) is associated with increased all cause mortality, decreased liver transplantation, and increased non-liver related mortality.
- SVI was not associated with increased liver related mortality, though preliminary subgroup analysis suggests this effect is not uniform (i.e. Hispanic paradox)

Limitations

- This study is retrospective in design and does not identify a direct causal relationship between social determinants and cirrhosis outcomes.
- It is relatively dated, covering the period from 2006-2012, the era before DAA treatment for HCV.
- The SVI measure is limited to the geographic level of data was limited to the 5-digit zip code, within which significant variance of community level SDOH can exist. It is also an index measure not constructed from relevant factors (i.e. food deserts, public spaces).

Conclusions

Community level SDOH (SVI) predicts cirrhosis outcomes after accounting for patient and disease characteristics. Increased vulnerability is associated with increased mortality and decreased liver transplantation. This confirms previous research in relation to other chronic disease processes that find that increased social vulnerability is associated with worsened health outcomes.

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