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Social Vulnerability and the Hispanic Paradox in Cirrhosis Mortality

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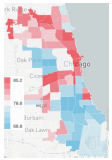
Background

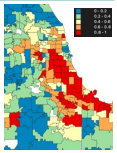
- Prior research in a cirrhosis cohort (HealthLNK, 2006-2012) found poor health outcomes for Black and Hispanic patients with cirrhosis, though this does not account for other SDOH[1,2].
- Health varies significantly by geography due to societal factors and community level social determinants of health (SDOH)[3]
- Hispanic patients have been reported to have improved outcomes compared to Non-Hispanic White patients, despite disease and SES



2010 Life Expectancy, Chicago Health Atlas

Research Objectives

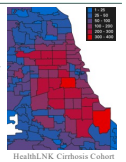
1. Evaluate differences in patient and disease characteristics based on community level SDOH
2. Estimate race and ethnicity interactions with SDOH and the effect on cirrhosis mortality and liver transplantation



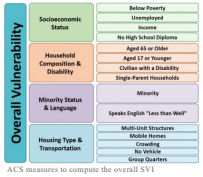
2010 SVI of 5-digit ZIP Code Greater Chicago Metropolitan Area

Methods

Patient Cohort:
20,010 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.



HealthLNK Cirrhosis Cohort Patient Count



ACS measures to compute the overall SVI

Social Determinants of Health:
The CDC Social Vulnerability Index (SVI) is a composite index measure designed initially for disaster management[4] and applied to predict health outcomes[5]. 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.

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. Interaction terms with race and ethnicity, sex, and insurance with SVI.

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)	p-value
Number of Patients		20010	2743 (14%)	3732 (19%)	3316 (17%)	4370 (22%)	5849 (29%)	-
Mean (SD) F/U - years		2.6 (2.0)	2.7 (2.1)	2.5 (2.0)	2.5 (2.0)	2.7 (2.1)	2.6 (2.0)	<0.01
Mean (SD) age -years		57.1 (11.7)	57.9 (11.9)	57.7 (11.8)	57.0 (11.8)	56.9 (11.8)	56.4 (11.4)	<0.01
Sex	Female	8516 (43%)	1178 (43%)	1614 (43%)	1401 (42%)	1862 (43%)	2461 (42%)	0.92
Race/ Ethnicity	White	9096 (45%)	2023 (74%)	2460 (66%)	1964 (59%)	1730 (40%)	919 (16%)	<0.001
	Black	4416 (22%)	83 (3%)	244 (7%)	385 (12%)	980 (22%)	2724 (47%)	
	Hispanic	3264 (16%)	120 (4%)	314 (8%)	355 (11%)	864 (20%)	1611 (28%)	
	Asian	524 (3%)	82 (3%)	102 (3%)	71 (2%)	173 (4%)	96 (2%)	
	Other	2710 (14%)	435 (16%)	612 (16%)	541 (16%)	623 (14%)	499 (9%)	
Insurance	CMS	10007 (50%)	1287 (47%)	1809 (48%)	1675 (51%)	2207 (51%)	3029 (52%)	<0.001
	Private	6837 (34%)	1303 (48%)	1600 (43%)	1262 (38%)	1337 (31%)	1335 (23%)	
	Other	3166 (16%)	153 (6%)	323 (9%)	379 (11%)	826 (19%)	1485 (25%)	
Etiology	Hep. C	8115 (41%)	850 (31%)	1299 (35%)	1291 (39%)	1868 (43%)	2807 (48%)	<0.001
	ALD	7409 (37%)	875 (32%)	1217 (33%)	1209 (36%)	1569 (36%)	2539 (43%)	
	NASH	4692 (23%)	784 (29%)	981 (26%)	828 (25%)	974 (22%)	1125 (19%)	
	Hep. B	1645 (8%)	155 (6%)	266 (7%)	238 (7%)	444 (10%)	542 (9%)	
	Biliary	2162 (11%)	416 (15%)	520 (14%)	378 (11%)	435 (10%)	413 (7%)	
	AIH	696 (3%)	81 (3%)	147 (4%)	109 (3%)	167 (4%)	192 (3%)	
Decompensations	Ascites	6874 (34%)	924 (34%)	1347 (36%)	1175 (35%)	1474 (34%)	1954 (33%)	<0.001
	HE	6947 (35%)	947 (35%)	1338 (36%)	1219 (37%)	1435 (33%)	2008 (34%)	
	Var. Bleed	591 (3%)	81 (3%)	118 (3%)	90 (3%)	133 (3%)	169 (3%)	
	SBP	1307 (7%)	193 (7%)	265 (7%)	213 (6%)	273 (6%)	363 (6%)	
	HRS	1256 (6%)	180 (7%)	288 (8%)	234 (7%)	268 (6%)	286 (5%)	
HCC		2812 (14%)	434 (16%)	593 (16%)	487 (15%)	626 (14%)	672 (11%)	<0.001
Mean (SD) Charlson CI		4.6 (3.5)	4.3 (3.3)	4.5 (3.4)	4.3 (3.4)	4.6 (3.5)	4.9 (3.6)	<0.01
Count (Rates/ Patient-year)	Waitlist	1772 (3.4%)	390 (5.2%)	490 (5.2%)	346 (4.1%)	335 (2.9%)	211 (1.4%)	<0.001
	Transplant	885 (1.7%)	193 (2.6%)	261 (2.8%)	172 (2.1%)	164 (1.4%)	95 (0.6%)	<0.001
	Death	5663 (11%)	751 (10%)	1051 (11%)	961 (11%)	1197 (10%)	1703 (11%)	0.40

Table 1: Patient demographics and disease characteristics. Significance by Chi-squared, ANOVA p<0.05

Figure 1. Competing Risk Survival Analysis

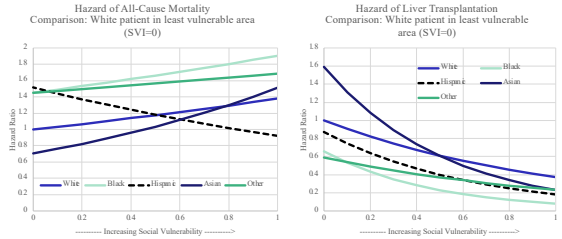


Figure 1: All-Cause Mortality and Liver Transplantation interactions by Race and Ethnicity and SVI

Table 2. Hazard Ratios of Cirrhosis Outcomes

All-Cause Mortality Covariates		Main Effects Odds Ratios	Model with Interactions Odds Ratios
Age		1.03 (1.03-1.04)	1.03 (1.03-1.04)
SVI		1.24 (1.05-1.47)	*1.28 (1.09-1.05)*
Sex	Male	*1.05 (0.97-1.14)*	*0.94 (0.78-1.13)*
Race/ Ethnicity	White	Reference	Reference
	Black	1.47 (1.31-1.64)	1.45 (1.04-2.02)
	Hispanic	0.87 (0.77-0.99)	1.52 (1.07-2.14)
	Asian	*0.93 (0.71-1.22)*	*0.71 (0.35-1.43)*
	Other CMS	1.34 (1.2-1.5) Reference	1.45 (1.15-1.83) Reference
Insurance	Private Insurance	*0.92 (0.84-1.01)*	*1.03 (0.86-1.29)*
	Other Insurance	1.35 (1.22-1.49)	1.45 (1.1-1.92)
Etiology	HCV	*0.95 (0.87-1.04)*	*0.95 (0.86-1.04)*
	ETOH	1.31 (1.18-1.46)	1.31 (1.18-1.45)
	NASH	1.36 (1.18-1.56)	1.36 (1.18-1.56)
	HBV	*1.06 (0.94-1.21)*	*1.07 (0.94-1.21)*
Decompensations	Ascites	1.57 (1.42-1.72)	1.56 (1.42-1.72)
	HE	1.37 (1.25-1.51)	1.38 (1.25-1.51)
	EV	0.55 (0.5-0.6)	0.55 (0.51-0.6)
	VB	*0.82 (0.62-1.07)*	*0.81 (0.62-1.06)*
	SBP	*0.98 (0.86-1.11)*	*0.98 (0.87-1.11)*
HCC		1.43 (1.31-1.57)	1.44 (1.31-1.57)
MELD		1.06 (1.05-1.06)	1.06 (1.05-1.06)
Charlson		0.98 (0.97-0.99)	0.98 (0.97-0.99)
Interactions	Asian*SVI	-	*1.55 (0.52-4.67)*
	Black*SVI	-	*1.08 (0.6-1.95)*
	Hispanic*SVI	-	0.44 (0.27-0.73)

Liver Transplantation Covariates		Main Effects Odds Ratios	Model with Interactions Odds Ratios
Age		0.98 (0.98-0.99)	0.98 (0.98-0.99)
SVI		0.32 (0.23-0.44)	0.37 (0.21-0.66)
Sex	Male	1.24 (1.06-1.46)	*1.24 (0.93-1.65)*
Race/ Ethnicity	White	Reference	Reference
	Black	0.33 (0.24-0.45)	*0.66 (0.32-1.36)*
	Hispanic	0.63 (0.49-0.81)	*0.87 (0.49-1.55)*
	Asian	*1.04 (0.65-1.67)*	*1.59 (0.67-3.76)*
	Other CMS	0.61 (0.49-0.77) Reference	0.59 (0.38-0.91) Reference
Insurance	Private Insurance	*1.04 (0.89-1.22)*	*0.91 (0.68-1.22)*
	Other Insurance	0.3 (0.2-0.44)	0.74 (0.4-1.38)
Etiology	HCV	1.26 (1.06-1.49)	1.24 (1.04-1.47)
	ETOH	0.71 (0.59-0.85)	0.71 (0.6-0.85)
	NASH	*0.87 (0.66-1.14)*	*0.87 (0.66-1.15)*
	HBV	*0.84 (0.63-1.11)*	*0.84 (0.63-1.11)*
Decompensations	Ascites	*1.12 (0.93-1.35)*	*1.13 (0.94-1.36)*
	HE	1.29 (1.07-1.57)	1.29 (1.07-1.57)
	EV	1.67 (1.42-1.98)	1.67 (1.41-1.97)
	VB	*1.03 (0.73-1.44)*	*1.03 (0.73-1.45)*
	SBP	*1.1 (0.92-1.32)*	*1.11 (0.93-1.33)*
HCC		2.6 (2.22-3.05)	2.6 (2.22-3.06)
MELD		1.06 (1.05-1.07)	1.06 (1.05-1.07)
Charlson		1.06 (1.04-1.09)	1.07 (1.04-1.09)
Interactions	Asian*SVI	-	*0.39 (0.06-2.54)*
	Black*SVI	-	0.33 (0.11-0.99)
	Hispanic*SVI	-	*0.56 (0.23-1.34)*

Table 2/3: Hazard ratios for All-Cause Mortality and Liver Transplantation with Interactions

Results

- High SVI has differing effects by race and ethnicity, with Hispanic patients in highly vulnerable areas having lower mortality

Limitations

- This study is retrospective in design and does not identify a direct causal relationship between social determinants and cirrhosis outcomes.
- 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

While increased vulnerability is associated with increased mortality and decreased liver transplantation, this effect is not the same for all patients. Interventions to reduce mortality or improve transplantation among cirrhosis patients needs further research to understand community level barriers to care.

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