Health Disparities of Black Americans Hospitalized for Decompensated Liver Cirrhosis

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Abstract

Background & Aims: Racial disparities have been reported in liver transplantation and chronic hepatitis C treatment outcomes. Determining causes of these disparities is important given the racially diverse American population and the economic burden associated with chronic liver disease.

Methods: A retrospective study was performed among 463 patients diagnosed with cirrhosis admitted from (January 1, 2013 to January 1, 2018) to a tertiary care academic medical center. Patients were identified based on the International Classification of Diseases (ICD-10) for cirrhosis or its complications. Demographic information, laboratory data, medical comorbidities, insurance and adherence to cirrhosis quality care indicators were recorded to determine their relationship to readmission rates and other healthcare outcomes. Results: A total of 463 individual patients with cirrhosis were identified including Whites (n=241), Hispanics (n=106), Blacks (n=50), Asian and Pacific Islander Americans (API, n=27) and Other (n=39). A significantly higher proportion of Blacks had Medicaid insurance compared to Whites (40% versus 20%, p=0.0002) and Blacks had lower median income than Whites ($45,710 versus $54,844, p=0.01). All groups received high quality cirrhosis care. Regarding healthcare outcomes, Black patients had the highest mean total hospital admissions (6.1±6.3, p=0.01) and the highest mean number of 30-day re-admissions (2.1±3.7, p=0.05) compared to all other racial groups. Multivariable proportional odds regression analysis showed that race was a statistically significant predictor of 90-day readmission (p=0.03). Conclusions: Black Americans hospitalized for complications of cirrhosis may experience significant disparities in healthcare outcomes compared to whites despite high quality cirrhosis care. Socioeconomic factors may contribute to these disparities.

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Trial Registration: Not applicable.

Keywords: African Americans; Liver Cirrhosis; Health Care Disparities

Background
The care of patients with chronic liver disease and cirrhosis is a costly endeavor for the United States healthcare system. The most recent estimates suggest that at least $2.5 billion yearly is spent on the care of these high-risk liver patients alone. Hospital readmissions among those with decompensated cirrhosis are a common and preventable occurrence with up to 53% of patients readmitted within 90 days. Due to the alarming cost of hospital readmissions, interventions to reduce cirrhosis readmission have been developed to address this problem. Racial and ethnic minorities have been shown to experience lower quality of health services
compared to white Americans across a spectrum of chronic disease. Racial disparities in liver transplantation\textsuperscript{9,10} and chronic hepatitis C treatment response\textsuperscript{11} have previously been reported. With regard to disparities in cirrhosis care, non-white race has been associated with more frequent readmission.\textsuperscript{12} Further, an analysis of the Nationwide Inpatient Sample showed that Blacks and Hispanics were less likely to receive portosystemic shunt and liver transplantation compared to whites and Blacks had higher in-hospital mortality than whites.\textsuperscript{13} The reasons for these disparities in cirrhosis care have not been determined from previous studies and remain an important gap in knowledge.

Decreasing health disparities becomes increasingly important over time since racial and ethnic minorities may comprise over half of the United States population by 2050.\textsuperscript{14} Since death from cirrhosis or end stage liver disease is relatively common in United States,\textsuperscript{15} reducing cirrhosis-related health disparities will also serve to benefit the wellness of our population as a whole. The purpose of our study is to analyze the effect of race, income, and health insurance on cirrhosis-related outcomes such as receipt of quality cirrhosis care, hospital readmission, and mortality among patients hospitalized for decompensated cirrhosis.

Methods

Study Design and Patient Population

We performed a retrospective study of all patients diagnosed with cirrhosis admitted to UC Davis Medical Center (UCDMC) between January 1, 2013 and January 1, 2018, a tertiary care academic medical center. Any available data prior to January 1, 2013 was not analyzed to emphasize the most current data available. Medical chart review was performed of the UCDMC electronic medical records, with patients identified initially based on the International Classification of Diseases (ICD-10) for cirrhosis or its complications. The specific (ICD-10) codes used to determine cirrhosis and complications of cirrhosis included, alcoholic cirrhosis of the liver without ascites (K70.30), alcoholic cirrhosis of the liver with ascites (K70.31), unspecified cirrhosis of the liver (K74.60), other cirrhosis of the liver (K74.69) esophageal varices with bleeding (I85.01), gastric varices (I86.4), hepatic failure,
unspecified with coma (K72.91), other ascites (R18.8) or spontaneous bacterial peritonitis (SBP) (K65.2). Demographic information, laboratory data, medical comorbidities, insurance, adherence to cirrhosis quality care indicators, 30 and 90-day readmission, and 30 and 90 day mortality were recorded for analysis. Median income was determined by zip code using a publically available online database (Income By Zip Code) of the American Community Survey 2017 5-year estimates. This study was approved by the Institutional Review Board at UCDMC.

**Adherence to Cirrhosis Quality Indicators**

We determined adherence to cirrhosis quality indicators by assessing the following: receiving beta-blockers at discharge for secondary prophylaxis after being admitted for variceal bleed, receiving prophylactic antibiotics (IV ceftriaxone or equivalent) in the setting acute variceal hemorrhage, receiving diuretics at discharge for medium to large ascites in the absence of renal failure, receiving spontaneous bacterial peritonitis (SBP) prophylaxis at discharge with after diagnosis and treatment of SBP, receiving intravenous albumin as an inpatient in the setting acute SBP (1.5 g/kg IV on day 1, then 1g/kg on day 3), receiving IV antibiotics (cefotaxime or equivalent) for treatment of SBP, and receiving lactulose and/or rifaximin for hepatic encephalopathy (HE). Patients who did not receive this level of care in any of these categories were counted as non-adherent for our analyses for each respective category.

**Statistical Analysis**

Descriptive data was reported as percentages, means ± SD and medians (with range and confidence interval when appropriate). For comparative analytics, we used Kruskal-Wallis test for continuous/numerical variables and Fisher’s exact test for categorical variables. Multivariable regression analysis was done to identify independent associations connected to racial disparities in cirrhosis related health care and their effect on readmissions and mortality. Adjustment for potential confounders including age, race, gender, insurance status, median salary income and complications, as well as etiologies of cirrhosis was made. A p value <0.05 was considered significant.

**Results**

Baseline demographic characteristics of patients are summarized in Table 1. A total of 463 individual
patients with cirrhosis, out of 529 reviewed, were identified including whites (n=241), Hispanics (n=106), Blacks (n=50), and Asian and Pacific Islander Americans (API, n=27). The remaining 39 patients were categorized as Other. Mean age was 57.2 ± 10.8 years (range 24 to 96) and the majority of the patients were male (58.1%). Compared to other racial groups, a larger proportion of API did not speak English as their primary language (51.8%); p= <0.0001. A significantly higher proportion of Blacks, Hispanics, and API had Medicaid compared to Whites (p=0.0002). Blacks and Hispanics also had lower median income than Whites ($45,710 versus $54,844, p=0.01). Further, Blacks and Hispanics had higher mean MELD-Sodium (MELD-Na) scores compared to Whites (28.7±9.3 and 29.1±8.5 versus 26.4±9.5, p=0.02) (Table 2).

Regarding medical co-morbidities, API (70.4%) and Blacks (44.0%) had significantly higher prevalence of diabetes mellitus (DM) compared to Whites (33.3%, p=0.004). Blacks also had the highest prevalence of coronary artery disease (54.0%, p=0.0004) and chronic hepatitis C (38.0%, p <0.0001) compared to other racial groups. API had the highest proportion of cirrhosis from chronic hepatitis B compared to other races (25.9%, p <0.0001) (Table 3).

Adherence to most cirrhosis quality care indicators ranged from 87% to 100% (Figure 1) suggesting high quality inpatient cirrhosis care. The exception was that only 53.2% received the proper dosing of albumin (1.5g/kg IV albumin on day 1 and 1g/kg IV albumin on day 3 of SBP diagnosis). No racial disparities regarding receipt of quality cirrhosis care were identified.

Regarding healthcare outcomes, Black patients had the highest mean total hospital admissions (6.1±6.3, p=0.01), highest mean number of 30-day re-admissions (2.1±3.7, p=0.05). Blacks also had the highest mean number of 90-day readmissions (3.7±5.5, P=0.10) and highest mean total hospital days (46.3±54.5, p=0.07) though these did not reach statistical significance (Table 3).

Socioeconomic factors and medical co-morbidities were found to be an independent predictor of 30-day hospital readmission (Table 4). Multivariable proportional odds regression showed that race was not a statistically significant predictor of 30-day readmission (p=0.21). However when Blacks were compared to whites, OR=2.21 with 95% CI (1.14-3.95) favoring 30-day readmission in Blacks. Coronary artery disease (CAD), chronic obstructive pulmonary disease (COPD), hepatic
encephalopathy (HE), and presence of ascites were all independently associated with 30-day readmission on multivariable proportional odds regression analysis. Insurance status was also found to be predictive of 30-day readmission. The odds ratio of 30-day readmission for lack of insurance versus private insurance was OR=0.45 with 95% CI (0.21-0.99). The odds ratio of 30-day readmission for Medi-cal insurance versus private insurance and Medi-cal insurance versus Medicare insurance were OR=1.15 with 95% CI (0.53, 2.47) and OR=1.35 with 95% CI (0.82-2.24), respectively.

Multivariable proportional odds regression analysis for predictors of 90-day readmission was also performed (Table 5). Race was a statistically significant predictor of 90-day readmission (p=0.03). The odds ratios of 90-day readmission for Black versus white and Black versus API were OR=4.69 with 95% CI (1.57, 13.95) and OR=8.45 with 95% CI (1.90, 37.60), respectively. Insurance status was also a statistically significant predictor of 90-day readmission (p = 0.0001). The odds ratios of 90-day readmission for lack of insurance versus Medi-cal insurance and Medi-cal insurance versus Medicare insurance were OR=0.15 with 95% CI (0.06-0.39) and OR=4.72 with 95% CI (2.11, 10.6), respectively. The odds ratio of 90-day readmission for Medi-cal insurance versus private was OR=2.57 with 95% CI (0.78 8.52).

MELD-Na and median income were not found to be predictive of readmission on univariable analysis so multivariable analysis was not performed on these variables regarding their relationship to hospital readmission. However, multivariable binary logistic regression analysis showed a statistically significant association between 30-day mortality and MELD-Na OR=1.06, 95% CI (1.03, 1.09), p< 0.0001.

Discussion
In this retrospective cohort study, Black patients admitted for decompensated liver cirrhosis had the highest mean total hospital admissions and mean number of 30-day readmissions compared to other racial groups. Black patients also trended towards the highest mean number of hospital days and 90-day readmissions, but these did not reach statistical significance. The disparities that were found may be the result of differences in socioeconomic factors such as insurance status. We found that Black patients were more likely to have Medicaid insurance compared to other racial groups at baseline. On
multivariable analysis, Black race conferred a 2-fold increased odds in 30-day readmission and a 4-fold increased odds in 90-day readmission compared to White race. Further, multivariable analysis also showed that Medicaid insurance was found to confer a 4-fold increased odds of 90-day readmission compared to Medicare insurance. Interestingly, lack of insurance was associated with lower odds of readmission when compared to private and Medicaid insurance. One explanation for this could be that patients with no insurance also had other socioeconomic disparities (such as lack of transportation to the hospital) that prevented them from being readmitted.

Racial disparities in liver disease may result from a combination of biological, socioeconomic, and cultural factors. After introduction of the MELD score, racial disparities have appeared to decrease regarding receipt of cadaveric liver transplantation. However recent studies have noted that Blacks were less likely than Whites to receive living donor liver transplantation and experience higher rates of liver transplant graft failure compared to Whites. With regard to cirrhosis care, non-white race was independently shown to be associated with a 2-fold increased odds of readmission. In a recent study of patients with hepatocellular carcinoma, Blacks were found to have had a significantly higher mortality compared to whites after adjusting for tumor stage, liver function, receipt of HCC treatment, and insurance status. Our findings add to the growing body of literature showing that Blacks may experience chronic liver disease disparity.

Differences seen in the receipt and quality of healthcare pertaining to those with liver disease may also be related to health insurance status and lower socioeconomic status. Significant disparities in access to treatment of chronic HCV infection since the approval of direct acting antiviral (DAA) agents, have been reported. Medicaid has been associated with a higher proportion of patients receiving absolute denials and significantly lower odds of treatment than those covered by Medicare and those who are commercially insured. In one study, nearly half of Medicaid beneficiaries in four states were denied access. Younossi ZM, et al., reported insurance-specific disparities after analyzing the non-start rates of patients who were prescribed sofosbuvir-based regimens. Non-start
rates were the highest in Medicaid-covered patients at (35%), as compared to Medicare (2%) and commercial insurances (6%). This study also showed that those with commercial coverage were 6.5 times as likely to start sofosbuvir based therapy compared to patients with Medicaid.\textsuperscript{22} Medicaid has also been reported to be associated with higher Model for End-Stage Liver Disease (MELD) scores at transplant registration and also associated with worse post-transplant outcomes.\textsuperscript{23}

Adherence to evidence based cirrhosis care has been previously been described as suboptimal.\textsuperscript{24, 25} In a study of Veterans Affairs patients with cirrhosis complicated by ascites, only 33.2% of patients receiving all recommended care.\textsuperscript{26} Similar findings of suboptimal cirrhosis care have been reported in the setting of variceal bleeding, screening for varices, and HCC surveillance with ultrasound.\textsuperscript{27, 28, 29} Compared to these previous studies, adherence to evidence based cirrhosis care at our institution was improved with 87-100% adherence to most quality indicators which may reflect increased awareness of cirrhosis care in the current era. No racial disparities in receipt of quality cirrhosis care were identified in our study, which suggests that racial disparities in cirrhosis outcomes occurred despite high quality cirrhosis care.

Chronic comorbid conditions\textsuperscript{30, 31} and complications of liver cirrhosis\textsuperscript{32} are both predictors of hospital readmission and poor healthcare outcomes. In patients with cirrhosis, hepatic encephalopathy (HE) and ascites are most strongly associated with readmission within 30 or 90 days.\textsuperscript{32, 33, 34} Our study’s findings align with what is reported in the literature with respect to these well-established risk factors of readmission following a hospitalization for decompensated liver cirrhosis. On multivariable analysis, the presence of HE conferred a 2-fold increased odds in 30-day readmission and a 4-fold increased odds in 90-day readmission. The presence of ascites also nearly conferred a 2-fold increased odds in 30-day readmission and a 4-fold increased odds in 90-day readmission. MELD-Na was associated with an increased odds of 30-day mortality on multivariate binary logistic regression analysis. Further, CAD and DM conferred nearly a 2-fold increased odds in 30-day and 90-day readmission, respectively.

Limitations of our study are typical for retrospective design. The categorization of patients as being diagnosed with cirrhosis and its complications by ICD-10 codes and their assignment into racial
groups was dependent on accuracy of this information as recorded in the electronic health record. Further, hospital readmission, mortality, and liver transplantation, which occurred outside of our health system would not have been captured when data was abstracted. In summary, we found health disparities in Black Americans hospitalized for decompensated liver cirrhosis. Black race was independently associated with increased odds of hospital readmission. At baseline, Medicaid insurance was more prevalent in Black patients and was independently associated with higher odds of readmission. This study highlights the need for further etiologic studies on racial disparities in cirrhosis care specifically to identify actionable intervention targets in order to reduce these disparities seen in the Black community.

Abbreviations
API, Asian and Pacific Islander; CAD, coronary artery disease; CI, confidence interval; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; DAA, direct acting antiviral; GI, gastrointestinal; HE, hepatic encephalopathy; ICD, International Classification of Diseases; MELD, model for end-stage liver disease; SBP, spontaneous bacterial peritonitis; UCDMC, UC Davis Medical Center.

Declarations
Ethnics approval and consent to participate: This study was approved by the Institutional Review Board of UC Davis Medical Center.
Consent for publication: Not applicable.
Availability of data and materials: All data generated or analyzed during this study are included in this published article as a supplemental file.
Competing interests: The other authors have no potential competing interests to be disclosed, including (financial, professional, or personal) that were relevant to this manuscript.
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important intellectual content; statistical analysis), Eric Chak MD, MPH (study concept and design; analysis and interpretation of data; drafting of the manuscript; critical revision of the manuscript for important intellectual content; study supervision).

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Figures

Figure 1: Baseline adherence to cirrhosis quality indicators at UC Davis Health System, January 2013 to January 2018.

HE: hepatic encephalopathy; GI: gastrointestinal; SBP: spontaneous bacterial peritonitis

Figure 1
Baseline Adherence to Cirrhosis Quality Indicators at UC Davis Medical Center, January 2013-January 2018.

Supplementary Files
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Completed Spreadsheet_2nd Data Gathering_Cirrhosis Chak.xlsx