

# Racial Disparities in Inhospital Outcomes for Hepatocellular Carcinoma in the United States



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## Abstract

**Objective:** To study racial disparities in therapeutic interventions and hospitalization outcomes for hepatocellular cancer (HCC) in the United States.

**Patients and Methods:** Using the 2011 Nationwide Inpatient Sample (comprising hospitalizations between January 1 and December 31, 2011), we identified patients with HCC-related admissions using previously validated *International Classification of Diseases, Ninth Revision, Clinical Modification* codes. Among these, we also identified those that were procedure-related (associated with liver transplantation, hepatic resection, radiofrequency ablation, or transarterial chemoembolization). Multivariate regression was performed to identify the contribution of race to therapeutic interventions and outcomes.

**Results:** A total of 22,933 HCC-related hospitalizations were included, of which 10,285 were procedure related (45%). Blacks had a smaller proportion (35%) of procedure-related HCC hospitalizations than did whites (46%) (odds ratio [OR], 0.65; 95% CI, 0.49-0.86). Specifically, blacks had lower odds of liver transplantation (OR, 0.43; 95% CI, 0.26-0.71), hepatic resection (OR, 0.57; 95% CI, 0.33-0.98), and ablation (OR, 0.46; 95% CI, 0.29-0.74) ( $P=.002$ ) than did whites. Overall, 10.9% of HCC-related admissions resulted in death in blacks as compared with 6.4% in whites (OR, 1.58; 95% CI, 1.12-2.24).

**Conclusion:** Among patients admitted for HCC-related hospitalizations, blacks were less likely to receive liver transplantation, hepatic resection, and ablation than whites and had higher in-hospital mortality. Identifying racial disparities in health care is a necessary first step to appropriately address and eliminate them.

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Among racial and ethnic minorities, disparities in health care access and quality remain important causes of the disproportionate disease burden faced by these populations.<sup>1,2</sup> Racial disparities in cancer care access and outcomes are unfortunately no exception.<sup>3</sup> Extensive research<sup>4,5</sup> has documented these racial differences among many types of cancer. However, data on hepatocellular cancer (HCC) are limited. Two population-based studies<sup>6,7</sup> using the Surveillance, Epidemiology, and End Results Program (SEER) found racial differences in survival of patients with hepatocellular carcinoma, with blacks and Hispanics at a higher risk of death, even after adjusting for stage of HCC, time of diagnosis, and receipt of therapy. A review article<sup>8</sup> noted that racial and ethnic minorities appear to be disadvantaged in access to and outcomes of liver transplantation.

To our knowledge, no studies have been conducted to quantify the racial disparities in in-hospital treatment and outcomes for HCC. This is an important subgroup to study and offers novel insights into reasons for racial and ethnic disparities. First, hospitalized patients represent the subgroup at highest risk for poor outcomes, accounting for the largest fraction of morbidity and mortality associated with HCC. Second, one of the reasons proposed for disparities is reduced access to health care. By focusing on the patients who are receiving care at the hospital, one reduces the differences owing to access. Third, some of the previous studies examining racial disparities in HCC have focused exclusively on liver transplantation; however, given that a significant proportion of those with HCC will not be eligible for liver transplantation or may not receive a donor liver, this does not allow for broad comparisons of various treatments.



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Finally, hospitalization and related costs account for significant health care costs associated with HCC. Thus, identifying disparities in this population and barriers to effective quality care could considerably reduce population-wide disparities and reduce overall disease-related costs.

The aims of this study were to use a large national cohort of patients hospitalized with HCC to study racial disparities in inpatient treatment and outcomes by examining (1) racial differences in receipt of procedures for therapy for HCC and (2) racial differences in outcomes (in-hospital mortality and length of stay) in procedure-related HCC admissions.

## PATIENTS AND METHODS

### Data Source

We used data from the Nationwide Inpatient Sample (NIS) from 2011, comprising all hospitalizations between January 1 and December 31, 2011. This database is maintained by the Healthcare Cost and Utilization Project of the Agency for Healthcare Research and Quality.<sup>9</sup> It is the largest all-payer inpatient database in the United States, with data from approximately 8 million hospitalizations from 46 states, sampled to approximate a 20% stratified sample of nonfederal US short-stay hospitals. Each discharge is a unique entry and is coded with 1 primary discharge diagnosis and up to 14 secondary diagnoses as well as 15 associated procedures, coded using *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)*. Of note, rehospitalization and cause of death are not available in the database.

### Study Population

We identified hospitalized patients with HCC-related discharges using the *ICD-9-CM* discharge code for HCC (155.0). The *ICD-9-CM* code for HCC has been used in previous studies and presented a sensitivity and specificity of 0.95 and 0.93, respectively.<sup>10</sup> Among these discharges, we also identified ones that were procedure related, that is, having a procedure code for one of the following: liver transplantation (50.51 and 50.59), resection (50.22), ablation (50.23, 50.24, 50.25, and 50.26), or transarterial chemoembolization (TACE) (99.25) (see [Supplemental Table 1](http://www.mayoclinicproceedings.org), available online at <http://www.mayoclinicproceedings.org>).

### Study Variables and Outcomes

Age, sex, primary insurance status, and race were obtained from the NIS database. Comorbidity burden was measured using the Elixhauser index, a comprehensive set of 30 comorbidity measures that has been validated and is a widely used measure of comorbidity from administrative databases.<sup>11</sup> Hospital characteristics were obtained from the NIS hospital data file. We examined the frequency of various systemic complications (eg, acute renal failure, hypovolemia, and acute respiratory failure) associated with the hospitalization. We also examined liver-specific complications of interest (eg, cirrhosis, portal hypertension, hepatitis B, hepatitis C, and alcoholic liver disease). These liver-related complications have been extensively used in previous studies.<sup>12,13</sup> We also elucidated whether metastatic disease at presentation was the reason for worse outcomes in certain racial groups by using the *ICD-9-CM* codes for lung, bone, or abdominal lymph node metastases, the 3 most common HCC metastatic sites.

We stratified procedure- and non-procedure-related discharges by race. Our primary outcomes were frequency of procedure-related admissions, overall in-hospital mortality in HCC-related admission, procedure- and non-procedure-related mortality in HCC-related admissions, and length of stay. We also analyzed odds of distant HCC metastasis at hospital presentation as a secondary outcome.

### Statistical Analyses

Data were analyzed with the appropriate survey estimation (—svy—) commands using Stata/MP 13.1 (StataCorp LP). The estimates from the NIS were converted into national estimates after applying the corresponding strata weights provided. Continuous variables were expressed as means ± SDs, whereas categorical variables were expressed as proportions. The *t* test was used to compare continuous variables, whereas the chi-square test was used to perform between-group comparisons for categorical variables. Univariate and multivariate logistic regression was performed to identify independent factors associated with odds of procedure-related admission, overall in-hospital mortality, procedure- and non-procedure-related mortality, and odds of distant HCC metastasis. A *P* value of less

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