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What Factors Influence Minority Use of High Volume Hospitals for Colorectal Cancer Care

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Abstract

Background—Previous studies suggest that minorities cluster in low-quality hospitals despite living close to better performing hospitals. This may contribute to persistent disparities in cancer outcomes.

Objective—To examine how travel distance, insurance status, and neighborhood socioeconomic factors influenced minority under-utilization of high-volume hospitals for colorectal cancer.

Settings—All hospitals in California from 1996–2006

Patients—Colorectal patients from the California Cancer Registry undergoing resection between 1996–2006.

Main Outcome Measures—Multivariable logistic regression models predicting high-volume hospital use were adjusted for age, gender, race, stage, comorbidities, insurance status, and neighborhood socioeconomic factors.

Results—95,363 patients from 417 hospitals were included in the study. High-volume hospitals were independently associated with an 8% decrease in the hazard of death compared to other settings. A lower proportion of minorities used high-volume hospitals despite a higher proportion living nearby. Although insurance status and socioeconomic factors were independently associated with high-volume hospital use, only socioeconomic factors attenuated differences in high-volume hospital utilization of Black and Hispanic patients compared with whites.

Limitations—Use of cross-sectional data, racial and ethnic misclassification

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Conclusions—Minority patients do not use high-volume hospitals despite improved outcomes and geographic access. Low socioeconomic status predicts low utilization of high-volume settings in select minority groups. Our results provide a roadmap for developing interventions to increase the use of and access to higher quality care and outcomes. Increasing minority utilization of high-volume hospitals may require community outreach programs and changes in physician referral practices.

Keywords

disparities; minority health; colorectal cancer; high-volume hospitals; socioeconomic factors; insurance

INTRODUCTION

Colorectal cancer (CRC) is the fourth most commonly diagnosed malignancy in all US adults and the second most common cause of cancer death.¹ Although overall CRC incidence and mortality have declined in the past decades, racial and ethnic disparities in CRC outcomes have persisted.^{1–6} Observed racial differences in survival have been attributed to diagnosis at advance stages of disease and differences in the receipt of surgical therapy.^{7–10} In addition, emerging explanations for cancer disparities have pointed to a correlation between the characteristics of the hospitals where minority patients receive treatment and cancer mortality.^{11,12} In previous research, we found that certain minority groups under-utilize National Cancer Institute-designated cancer centers¹³ despite evidence showing improved outcomes associated with care in these settings.^{14,15}

High-volume hospitals (HVH) have also been shown to have a positive association with outcomes in colorectal cancer.^{16–21} For example, Harmon et al. reported that increasing hospital volume was associated with decreased length of stay, lower hospital charges, and lower rates of in-hospital mortality.¹⁶ Schrag et al. found that increasing hospital volume of colorectal operations was associated with decreased 30-day and 2-year mortality as well as reduced ostomy rates (even after taking into account individual surgeon volume).¹⁹ In 2007, Billingsley et al. showed a protective association between the use of high volume and very high volume hospitals and 30-day colon cancer mortality.²⁰ The investigators discovered that the association between volume and colon cancer outcomes was related to differences in clinical resources available in these settings. Most recently, Etzioni et al. found that patients treated in centers that have higher volume experience better overall survival, with differences persisting despite adjustment for individual surgeon volume.²¹

Nonetheless, recent studies have shown that minorities tend to receive treatment at low-volume and low quality hospitals,^{22–25} and this is also true for colorectal cancer.^{24,26} One potential barrier to high quality care may be geographic availability or travel distance. Patients often receive their care locally even when associated with worse outcomes.²⁷ In previous investigations, there appeared to be a negative effect of increasing travel time and distance on utilization of NCI-designated cancer centers.^{13,28} Still, others have shown that minorities with Medicare use low-quality settings, despite living closer to high-quality hospitals.²⁵ These findings suggest something more at work than travel distance and may

indicate differences in provider referral patterns. Minorities with cancer are less likely to be referred to high-volume centers²⁹ and specialists.³⁰ They also live in counties served by fewer specialists with diminished access to surgical facilities and resources^{31,32} and tend to receive their care from a small pool of lower quality physicians.³³

In this study, we sought to understand how geographic accessibility, insurance status, and socioeconomic status (SES) factors influence minority under-utilization of HVH in an all-payer, all age, racially and ethnically diverse dataset. We hypothesize that travel distance and neighborhood SES factors will predict minority use of high volume settings. A more ecological understanding of factors that determine where minorities receive care will guide future interventions to improve minority access to high quality settings potentially addressing disparities in cancer care and outcomes.

METHODS

This study uses the same sources of data, study population, and geographic information systems (GIS) analysis previously described in our study examining minority utilization of National Cancer Institute-designated Cancer Centers.¹³ Briefly, our data was drawn from a large-state, all payer administrative database comprised of a linkage between the California Cancer Registry (CCR) and the California Office of Statewide Health Planning and Development Patient Discharge Database (OSHPD-PDD). We identified all patients with colon and rectal cancer surgically treated between 1996 and 2006. We excluded patients enrolled in California's largest health maintenance organization (HMO) as these patients are limited in where they can receive treatment. Neighborhood socioeconomic characteristics were based on census block group data on the percent of residents living below 200% of the federal poverty level (% poverty), percent unemployed (% unemployment), and the percent of block group level residents with college education (% college). Geo-coding and calculation of the distance between patients, nearby hospitals, and the hospital where they received treatment was performed using GIS software (ArcGIS 10; Ersi Inc., Redlands, California). A hospital within a radius less than or equal to the calculated median travel distance for the state was considered "nearby."

For the analysis specific to this study, we defined high volume hospitals as those in the highest quintile of colon and rectal resections by annual volume of all hospitals in California. Statistical analysis was done using SAS 9.3 (SAS Institute Inc., Cary, North Carolina). Chi-square analysis was used to compare the proportions of each racial and ethnic group living near a high volume setting. A Cox regression model predicting the risk of death after surgery at HVH versus non-HVH was adjusted for age, gender, race, stage, insurance status, and neighborhood socioeconomic factors. Multivariable logistic regression models predicting HVH use were adjusted for age, gender, stage, comorbidities, insurance status, and neighborhood socioeconomic characteristics. The baseline model was limited to demographic and clinical factors. Subsequent models assessed the independent association of each additional set of factors. Model 2 was further adjusted for insurance type. Model 3 assessed the impact of socioeconomic factors. All comparisons were two-tailed and p-values <.05 were considered statistically significant.

RESULTS

A total of 79,231 diagnosed with colorectal cancer (CRC) and treated in 417 hospitals were identified. There were 44,691 (56%) patients treated in 83 HVH settings. The median distance for treatment was 4.7 and 5.5 miles for colon and rectal cancer, respectively. This calculated median travel distance was used to define “nearby” hospitals. Table 1 shows the socio-demographic and characteristics of patients included in the analysis. HVH settings were independently associated with an 8% decrease in the hazard of death (hazard ratio 0.92; 95% CI 0.90–0.94) compared to non-HVH settings after adjusting for patient characteristics, insurance status, and neighborhood socioeconomic factors.

Figure 1a shows the proportions of each racial/ethnic group living within the median travel distance of an HVH, while Figure 1b shows the proportion in each racial/ethnic group who took advantage of living nearby and sought care there. All racial and ethnic minority groups lived near HVH in significantly higher proportions than White patients (all $p < 0.001$). Figure 1B shows that significantly lower proportions of every minority group used HVH compared with White patients (all $p < 0.001$).

A logistic regression model predicting use of HVH by demographic and clinical characteristics is shown in Table 2. In this baseline model, estimates are adjusted for race, gender, age, and stage of disease. There was a negative association between each minority group and HVH use. There was a 36% lower odds [OR 0.64 (95% CI 0.60–0.68)] associated with Black race. Hispanic ethnicity was associated with 40% lower odds [OR 0.60 (95% CI 0.58–0.63)]; and API race/ethnicities were associated with 18% lower odds [OR 0.82 (95% CI 0.78–0.86)] of HVH use in comparison to White patients. Patients with Stage II, III, and IV disease were all less likely to use HVH compared with those with Stage I disease [Stage II OR 0.89 (95% CI 0.86–0.93); Stage III OR 0.94 (95% CI 0.91–0.98); Stage IV OR 0.89 (95% CI 0.85–0.93)].

In Table 3, we assessed the impact of insurance status (Model 2) and socioeconomic status factors (Model 3) on HVH use. Compared with private insurance, we found an independent and negative association between all insurance types and HVH utilization. Despite these strong associations, the negative correlation between minority race and HVH utilization persisted [Black OR 0.68 (95% CI 0.64–0.73); Hispanic OR 0.64 (95% CI 0.61–0.67); API OR 0.88 (95% CI 0.84–0.92)]. When neighborhood SES factors were added to the model, the difference in odds of utilization of HVH by Black and Hispanic patients decreased 15% and 17%, respectively [Black OR 0.83 (95% CI 0.78–0.89); Hispanic OR 0.81 (95% CI 0.77–0.85)]. Decreasing levels of unemployment and increasing levels of college education were each independently associated with increasing odds of HVH use. In the full model, decreasing levels of poverty were associated with decreased utilization of HVH.

DISCUSSION

The current study investigated the association between race, geographic proximity, insurance status, and neighborhood SES with minority use of HVH for the treatment of colorectal cancers in California. We found that HVH settings were independently associated

with an 8% decrease in the hazard of death compared to non-HVH settings. Our results show that most patients live in relatively close proximity to hospitals where CRC treatment is obtained (5.5 miles). While the proportion of minorities living within this travel distance from a HVH is the same or greater when compared with White patients, fewer minorities were served in these settings. In regression models, there was a negative association between minority race/ethnicity and HVH use. This negative association persisted despite adjustment for insurance status. Select SES characteristics – which indicate higher levels of social status (lower unemployment and higher levels of college education) – predicted increased HVH utilization. The addition of SES factors to our regression models were associated with a reduction in the disparity between Black and Hispanic patient use of HVH compared with their White counterparts. There was no significant effect of SES factors on utilization by API patients.

In contrast to other studies^{22,28}, this study did not find that geographic proximity or insurance explained low minority utilization of HVH. Despite the fact that a higher proportion of racial/ethnic minorities reside within 5 miles of an HVH setting, lower proportions of these patients used it. We also found that all insurance types were negatively associated with use of HVH compared with private coverage. Nonetheless, adjustment for insurance status in our models did not change the negative association between minority race/ethnicity and HVH use.

Our study demonstrated an association between improved colorectal outcomes and the use of HVH settings, consistent with other studies^{16–21}. Our findings are also consistent with recent work by Dimick et al., who also found that Black patients were less likely to use high quality hospitals despite the positive association between Black race and living nearby.²⁵ The investigators also found that neighborhood-level characteristics (residential segregation) predicted lower use of high quality hospitals. Similarly, our previous work has demonstrated that while minorities are more likely to live near NCI cancer centers, Blacks and Hispanics are less likely to be treated there.¹³ We found that neighborhood college education was the strongest driver of racially discrepant selection into a high quality hospital setting. We found a similarly strong influence of neighborhood education on hospital selection in the current study. In fact, accounting for this factor attenuated the difference between Black and Hispanic patients and their White counterparts.

Our study is novel because we have identified a potentially actionable characteristic to identify communities at risk for bypassing a nearby high quality setting in order to seek care in a low quality setting – settings where minorities have been shown to cluster for cancer care.^{12,34,35} The results of our study suggest that neighborhood level education influences hospital selection by minorities. While the ongoing implementation of the Patient Protection and Affordable Care Act emphasized insurance expansion, our findings suggest that insurance alone may not be enough to positively impact access to high quality cancer care; socially based neighborhood norms may more heavily influence choice of location of care. Increasing minority utilization of HVH may thus require community engagement efforts and attention by referring providers to the balance between patient preference and referral to settings associated with improved survival.

While no data exists on interventions to reduce disparities in treatment options for CRC, a systematic review found that the most effective interventions to improve the likelihood of CRC screening involved patient education through direct contact (e.g., phone, in-person), patient navigator services, and provider-directed efforts (particularly training for providers working with patients of low health literacy).³⁶ Similar efforts may be needed to educate low SES patients about the potential for differences in cancer outcomes based on location of care. Similarly, interventions to educate minority-serving providers about the importance of high-quality cancer care may help them make better referral and treatment recommendations. A systematic review of the decision making process for minorities with cancer found that providers and provider-patient interactions strongly influence a patients' decision to pursue treatment.³⁷ Patients treated by providers who failed to advocate strongly for certain treatment modalities or who did not engage their patients in culturally sensitive decision-making are more likely to delay or even choose non-optimal treatment strategies. Provider-level interventions will also need to address previously identified unconscious racial biases which lead to differential treatment and referral recommendations.^{38,39}

LIMITATIONS

An important limitation to consider in our study is the use of cross-sectional registry data. We cannot conclude any causal link between patient characteristics such as race and the location of CRC care. Nonetheless, the strong associations we have uncovered between neighborhood SES factors and HVH use are of great importance. The results of our study clearly identify populations that may benefit from interventions to improve access to high quality care. Another limitation of registry data is that the racial and ethnic classification in the registry can be discordant with patient self-reports.^{40–43} A previous analysis of CCR data found that misclassification in the registry data likely results in an underestimate of Hispanic cancer cases.⁴⁴ Given this misclassification, we may erroneously estimate the use of HVH by Hispanic patients. Nonetheless, our findings still provide robust guidance about communities in need of improved access to high quality care regardless of race and ethnicity. We agree with Aspinall and Jacobsen when they argue that disparities “can routinely and successfully be challenged only if organisations are able to demonstrate this in the analysis of their ethnically coded datasets.”⁴⁵ The magnitude of disparities seen in this study suggests that disparities in HVH utilization by minorities are real and present, even with misclassification. Finally, the study is somewhat limited due to the solitary focus on CRC. We chose CRC because it is a high incident cancer⁴⁶, affects men and women nearly equally, there are persistent disparities, and the disease is treated in a wide variety of settings, both high and low volume. It is possible that minority patients may seek care for more complex malignancies in HVH settings in equal rates to White patients. In order to confirm the findings in the current investigation, the study should be repeated in other types of cancers.

CONCLUSIONS

Despite the limitations, we found that minority patients do not use HVH settings despite geographic access. Since these settings have been strongly associated with higher quality CRC care and improved survival, efforts to increase access in select populations may

positively impact long-standing disparities. Our study identified low SES as a negative predictor of HVH utilization. In doing so, we have provided a roadmap for developing targeted interventions to increase the use of and access to higher quality care and outcomes for racial/ethnic minorities. Future studies should evaluate use of HVH settings in other cancers.

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Figure 1.

a – Proportion of each racial/ethnic group living near a high-volume hospital, by race (Colorectal cancer, California 1996–2006)

b – Proportion of each racial/ethnic group using a high-volume hospital, by race (Colorectal cancer, California 1996–2006)

Table 1

Demographic characteristics (Colorectal cancer, California 1996–2006)

Characteristics	Cohort total	HVH N (%)	Non-HVH N (%)
Total	79231	44691	34540
Age (years)			
0–44	3310 (4.2)	1851 (4.1)	1459 (4.2)
45–54	7745 (9.8)	4463 (10)	3282 (9.5)
55–64	12929 (16.3)	7196 (16.1)	5733 (16.6)
65–74	21488 (27.1)	12091 (27.1)	9397 (27.2)
75–84	24024 (30.3)	13602 (30.4)	10422 (30.2)
85-high	9735 (12.3)	5488 (12.3)	4247 (12.3)
Gender			
Male	39100 (49.3)	22166 (49.6)	16934 (49)
Female	40131 (50.7)	22525 (50.4)	17606 (51)
Race			
White	57764 (72.9)	34031 (76.1)	23733 (68.7)
Black	4260 (5.4)	2042 (4.6)	2218 (6.4)
Hispanic	9381 (11.8)	4371 (9.8)	5010 (14.5)
API	7826 (9.9)	4247 (9.5)	3579 (10.4)
Cancer Type			
Colon	62510 (78.9)	34928 (78.2)	27582 (79.9)
Rectum	16721 (21.1)	9763 (21.8)	6958 (20.1)
Stage			
Stage I	16563 (20.9)	9681 (22.2)	6882 (20.3)
Stage II	25057 (31.6)	13939 (31.9)	11118 (32.9)
Stage III	21884 (27.6)	12401 (28.4)	9483 (28.0)
Stage IV	11235 (14.2)	6207 (14.2)	5028 (14.9)
Stage unknown	2786 (3.5)	1463 (3.3)	1323 (3.9)
Insurance Status			
Private	28586 (36.1)	18065 (44.2)	10521 (33.6)
Medicaid	4016 (5.1)	1526 (3.7)	2490 (8.0)
Medicare	38401 (48.5)	20880 (51.1)	17521 (56.0)
Uninsured	1190 (1.5)	425 (1.0)	765 (2.4)
Neighborhood Characteristics (median, IQR)			
% unemployment	96.8 (94.8, 98.2)	97.0 (95.2, 98.4)	96.4 (94.4–97.9)
% college education	33.0 (19.4, 50.1)	37.6 (22.5, 54.2)	28.1 (16.7, 43.0)
% poverty	76.9 (60.2, 87.7)	79.3 (63.4, 89.2)	73.2 (56.5, 85.1)

Abbreviations: API=Asian/Pacific Islander; HVH=high volume hospital; % unemployment=proportion of those in census block who are unemployed; % college education=proportion of the census block with a college education. % poverty=proportion of those in census block living below 200% Federal Poverty Level (FPL).

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Table 2

Logistic regression model predicting the odds of using high volume hospitals (Colorectal cancer, California 1996–2006)

	Model 1: Baseline		
Patient Characteristics	OR	95% CI	P value
Race			
White	1 (ref)		
Black	0.64	0.60–0.68	<0.001 *
Hispanic	0.60	0.58–0.63	<0.001 *
API	0.82	0.78–0.86	<0.001 *
Age			
0–44	1 (ref)		
45–54	1.02	0.94–1.11	0.59
55–64	0.93	0.86–1.00	0.059
65–74	0.94	0.87–1.01	0.089
75–84	0.92	0.86–0.99	0.034 *
85-high	0.90	0.83–0.980	0.012 *
Sex			
Male	1 (ref)		
Female	0.98	0.95–1.00	0.148
Stage			
I	1 (ref)		
II	0.89	0.86–0.93	<0.001 *
III	0.94	0.91–0.98	0.003 *
IV	0.89	0.85–0.93	<0.001 *
Missing data	0.80	0.74–0.86	<0.001 *

Abbreviations: *=p<0.05, API=Asian Pacific Islander; OR=odds ratio; CI=confidence interval; ref=reference

Table 3

Logistic regression models estimating the odds of HVH use for racial/ethnic minority groups, adjusted for insurance status and socioeconomic status factors (Colorectal Cancer, California 1996–2006)

Patient Characteristics	Model 2: Baseline + Insurance Status			Model 3: Baseline + Insurance + SES factors		
	OR	95% CI	P value	OR	95% CI	P value
Race						
White	1 (ref)			1 (ref)		
Black	0.68	0.64–0.73	<0.001*	0.83	0.78–0.89	<0.001*
Hispanic	0.64	0.61–0.67	<0.001*	0.81	0.77–0.85	<0.001*
API	0.88	0.84–0.92	<0.001*	0.86	0.82–0.90	<0.001*
Insurance						
Private	1.0 (ref)			1.0 (ref)		
Medicaid	0.39	0.37–0.42	<0.001*	0.43	0.40–0.46	<0.001*
Medicare	0.70	0.67–0.72	<0.001*	0.68	0.66–0.71	<0.001*
No insurance	0.36	0.31–0.40	<0.001*	0.37	0.33–0.42	<0.001*
Missing data	0.67	0.64–0.71	<0.001*	0.68	0.65–0.72	<0.001*
Neighborhood SES (continuous)						
% unemployment (decreasing)				1.02	1.02–1.02	<0.001*
% college education (increasing)				1.01	1.00–1.02	<0.001*
% poverty (decreasing)				0.99	0.99–0.99	<0.001*

Model 2 is adjusted for age, gender, stage of disease, and insurance status; Model 3 includes all previously listed factors + neighborhood socioeconomic characteristics.

Abbreviations: *p<0.05, API=Asian Pacific Islander; OR=odds ratio; CI= confidence interval; ref=reference; SES=socioeconomic status; % unemployment=proportion of those in census block who are unemployed; % college education=proportion of the census block with a college education. % poverty=proportion of those in census block living below 200% Federal Poverty Level (FPL).