Racial disparity in curative treatment and survival from solid-organ cancers

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Introduction

Disparities in cancer care provision often lead to wide heterogeneity in oncological outcomes, which can affect patient outcomes negatively in more vulnerable populations. However, recognizing and understanding factors that influence disparities in cancer care is a necessary first step before intervening to eliminate these disparities. The impact of disparity on receipt of curative cancer treatment and long-term oncological effects remains relatively unknown. Previous small studies have focused on the role of race on survival in single-solid organ malignancy, and failed to explore these associations with outcomes in a broader context. Furthermore, previous studies grouped all ethnic minorities together, and therefore lack granularity to identify disparities by individual ethnic minorities (black, Hispanic, Asian, other). As race is often closely associated with other risk factors for unequal access to specialized cancer treatment, such as socioeconomic status, education level, and insurance status, any investigation must be performed using data sets that allow accurate adjustment for these factors in the analysis. Therefore, it is imperative to understand the pattern of treatment allocation by race with appropriate confounding factor adjustments.

Using the National Cancer Database (NCDB) from the USA, this study aimed to characterize the impact of race on allocation of curative surgery and neoadjuvant therapy, and long-term survival in patients with non-metastatic cancer across eight common cancers including those of the oesophagus, stomach, liver, pancreas, colon, rectum, breast, and lung.

Methods

The NCDB, a joint project of the Commission on Cancer of the American College of Surgeons and the American Cancer Society, was used to identify patients diagnosed with a non-metastatic solid-organ cancer (oesophageal, gastric, liver, pancreatic, colonic, rectal, and lung) according to the ICD-O-3 codes from 2004 to 2016. Exclusion criteria were: metastatic cancer at diagnosis, other concurrent cancer diagnoses, and palliative treatment. Details of data collected and statistical analysis are available in Appendix S1.

Results

This study included 3 718 367 patients with non-metastatic oesophageal (102 033), gastric (95 533), liver (149 715), pancreatic (173 296), colonic (805 204), rectal (114 649), breast (1 314 521), and lung (963 416) tumours. Black race was associated with a greater prevalence of medical co-morbidities, lower survival in patients with non-metastatic cancer across eight common cancers including those of the oesophagus, stomach, liver, pancreas, colon, rectum, breast, and lung.
Table 1 Impact of race on receipt to curative cancer surgery and neoadjuvant therapy in non-metastatic cancers

| Race        | No. of patients | Odds ratio (95% CI) | No. of patients | Odds ratio (95% CI) | No. of patients | Odds ratio (95% CI) | Odds ratio (95% CI) |
|-------------|-----------------|---------------------|-----------------|---------------------|-----------------|---------------------|---------------------|
|             | Oesophageal     | Stomach             | Pancreas        | Stomach             | Colon           | Stomach             | Rectum              |
| White       | 37,936 (43.8)   | 1.00 (reference)    | 39,631 (60.4)   | 1.00 (reference)    | 16,030 (26.6)   | 1.00 (reference)    | 28,230 (23.8)       |
| Black       | 17,962 (18.6)   | 0.29 (0.28, 0.31)   | 18,196 (61.5)   | 1.05 (1.01, 1.09)   | 16,030 (23.8)   | 1.00 (reference)    | 13,870 (20.4)       |
| Hispanic    | 11,200 (33.0)   | 0.63 (0.59, 0.68)   | 15,535 (64.8)   | 1.21 (1.15, 1.27)   | 11,172 (14.2)   | 0.72 (0.66, 0.79)   | 11,972 (14.2)       |
| Asian       | 5,320 (30.7)    | 0.57 (0.51, 0.63)   | 45,282 (72.6)   | 1.73 (1.63, 1.83)   | 31,163 (37.0)   | 0.73 (0.64, 0.82)   | 67,508 (10.8)       |
| Other       | 7,550 (41.6)    | 0.92 (0.83, 1.01)   | 12,862 (60.5)   | 1.01 (0.92, 1.10)   | 33,180 (18.2)   | 0.73 (0.65, 0.82)   | 31,150 (7.5)        |

Values in parentheses are 95 per cent confidence intervals. Binary logistic regression models were adjusted for race, centre volume quintile, facility type, facility location, age at diagnosis, sex, Charlson–Deey co-morbidity score, insurance status, education level, median income, residence, AJCC clinical T category, and AJCC clinical N category.

The median income, advanced tumour stage (T3 or T4) (Fig. S1a), and node-positive disease (Fig. S1b) across seven of eight cancers studied (Tables S1–S8).

Receipt of curative surgery

Receipt of curative surgery varied from 11.6 to 94.5 per cent for white patients compared with 8.3–93.0 per cent for black race across these cancers (Table 1). Adjusted analyses, black race was independently associated with significantly lower rates of receipt of surgery compared with white patients for seven of eight cancers studied: oesophageal (odds ratio (OR) 0.29, 95 per cent c.i. 0.28 to 0.31), liver (OR 0.76, 0.74 to 0.79), pancreatic (OR 0.72, 0.70 to 0.75), colonic (OR 0.76, 0.74 to 0.78), rectal (OR 0.67, 0.63 to 0.70), breast (OR 0.55, 0.54 to 0.56), and lung (OR 0.71, 0.70 to 0.72). Similar results were seen for Asian and Hispanic race (Table 1). Physician recommendation was the most common reason for patients not having surgery across all cancers (Table S9).

Receipt of neoadjuvant therapy

Receipt of neoadjuvant therapy varied from 2.6 to 37.2 per cent for white patients compared with 2.5–34.8 per cent for black race across these cancers (Table 1). In adjusted analyses, black race was independently associated with significantly lower rates of receipt of neoadjuvant therapy than in white patients for six of eight cancers studied (Table 1).

Long-term survival

Median follow-up for the entire cohort was 25 (i.q.r. 19–36) months. Median survival for patients of black race was significantly shorter than that for white patients across oesophageal (22 versus 19 months), gastric (19 versus 20 months), liver (13 versus 14 months), pancreatic (10 versus 11 months), rectal (80 versus
93 months), and lung (20 versus 21 months) cancers (Fig. S2). Adjusted Cox regression analyses showed that black race was associated with significantly reduced survival for oesophageal (hazard ratio (HR) 1.14, 95 per cent c.i. 1.11 to 1.17), liver (HR 1.06, 1.04 to 1.08), pancreatic (HR 1.04, 1.02 to 1.06), colonic (HR 1.12, 1.11 to 1.13), rectal (1.17, 1.13 to 1.20), breast (HR 1.25, 1.23 to 1.26), and lung (HR 1.02, 1.01 to 1.03) cancers (Fig. S2). However, Asian or Hispanic race was often associated with significantly lower mortality rates than white race across all non-metastatic solid organ cancers (Fig. 1).

**Stratified analyses by time cohorts**

Stratified analyses were performed by time cohorts (2004–2007, 2008–2011, 2012–2016), which demonstrated consistent results.
for receipt of surgery (Table S10), receipt of neoadjuvant therapy (Table S11), and reflect long-term survival than chemotherapy (Table S12).

**Discussion**

This population-based cohort study of almost 4 million patients with non-metastatic cancer identified race as an important determinant of receipt of curative surgical resection and neoadjuvant therapy, and as a prognostic factor for long-term survival. Black race was associated with advanced T and N category at presentation, and was independently associated with lower rates of receipt of curative surgery, neoadjuvant therapy, and worse survival.

More advanced clinical presentation in ethnic minorities may be secondary to several factors. First, poor attendance at screening programmes for specific cancers, and distrust in the healthcare system may result in lower rates of early cancer diagnosis. However, discerning which factor is ultimately responsible and driving an interventional change is challenging. Second, a complex interaction between socioeconomic status and access to cancer care may influence delay in presentation of ethnic minorities. This may be exacerbated further by COVID. Large initiatives are being rolled out to address these issues.

Previous descriptive, single-region studies have demonstrated lower rates of surgery and poor long-term survival in black race across different cancers. There may be several explanations for the lower rates of curative surgery and survival in the present study. First, this could be due to refusal to undergo surgical intervention, misunderstanding of treatment guidelines on the part of the treating physician, or contraindications to surgery among black race. Second, previous studies have shown that rates of surgery vary according to socioeconomic status, and it is hypothesized that this is due to communication and financial barriers. Previous reports demonstrated that the likelihood of undergoing surgery increased when travelling more than 5 miles, which may be explained by travel associated with seeking tertiary-care centres. This could adversely affect patients of low socioeconomic status who may be unable to travel for care. Finally, studies of hospital-level variation in surgical practice have demonstrated that regional referral to high-volume centres may have a positive effect on outcomes.

Race is an important prognostic factor affecting receipt of surgical intervention and cancer survival in the USA. The findings of this study highlight the importance of implementing changes aimed at narrowing the disparities in outcomes between race in patients with cancer. Additional prospective analyses are warranted to further investigate the role of race in treatment decision-making and survival, and to identify specific hospital-level factors that affect disease management.

**Disclosure.** The authors declare no conflict of interest.

**Supplementary material**

Supplementary material is available at BJS online.

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**Snapshots Quiz**

**Question:** A middle-aged man presents with a long history of rectal bleeding and intermittent constipation. What is shown in this intraoperative image?

![Intraoperative Image]

**Answer:** A rectosigmoid junction intussusception caused by a malignant sigmoid tumour. Pathological examination reported a pT2 N0 sigmoid adenocarcinoma.

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