Racial and Geographical Disparities in Colorectal Cancer Incidence in Mississippi, 2003-2018

Sasha McKay (✉ sasha.mckay@stonybrook.edu)

Stony Brook University <https://orcid.org/0000-0002-3937-3352>

Jaymie Meliker

Stony Brook Medicine

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Abstract

Purpose: The aim of this study is to investigate racial and geographical disparities of colorectal cancer incidence in Mississippi.

Methods: Incidence data from 2003-2018 were obtained at the county-level from the Mississippi Cancer Registry. Incidence rate difference and 95% confidence intervals between age-adjusted colorectal cancer incidence for whites and blacks were calculated and mapped using ArcGIS.

Results: The black incidence rate for colorectal cancer was 59.8 per 100,000 while the white incidence rate was 48.9 per 100,000. Blacks experienced significantly higher incidence rates than whites in 39 counties throughout much of Mississippi. These areas of higher racial disparities did not cluster in a specific region of the state. In the southern part of the state an 8-county cold-spot region was detected without racial disparities; incidence rate for blacks was 41.3 per 100,000 in this region.

Conclusions: There are racial disparities throughout Mississippi except for an 8-county region towards the southern part of the state. Additional research should be conducted to identify what factors are responsible for the lower incidence rates among blacks in this region, and to implement effective interventions statewide to reduce racial disparities in colorectal cancer incidence.

Introduction

Colorectal cancer (CRC) is the third most commonly diagnosed cancer in both men and women. It is the second leading cause of cancer death in men aged 20 to 39 and the leading cause in men less than 50 years old [1]. Age-specific CRC incidence rates increase with age; it is 33.1 per 100,000 for ages 45-49 but doubles by the age of 60-64 [1]. CRC incidence rates are about 20% higher in blacks compared to non-Hispanic whites [2]. The landmark National Polyp study suggests that CRC is preventable through colonoscopy polypectomy and removal of adenomatous polyps [3]. CRC screening can reduce CRC incidence which in turn will reduce CRC mortality [4].

CRC mortality rates in the Lower Mississippi Delta were 40% higher than in the rest of the United States from 2009-2011 [4]. In addition all states experienced a decrease in CRC mortality rates other than Mississippi between 1990 and 2007 [5]. Mississippi has the highest rate of CRC incidence (48.2 per 100,000) and mortality (18 per 100,000) in the United States [6] [2].

In recent years, incidence data have become more widely available and used for mapping cancer rates in the US. The recent release of incidence data allows for a more nuanced picture of CRC since mortality data typically reflect a combination of incidence and quality of treatment. A recent study in North Carolina reported geographic patterns of CRC incidence for blacks and whites and found higher incidence rates among blacks, and a hot spot in eastern North Carolina of higher black-white incidence disparity [7]. We sought to conduct a similar study in Mississippi due to its high CRC incidence rates and sizeable

black population, with the intent of identifying regions where racial disparities could be addressed in the future by public health practitioners.

Methods

County-level CRC incidence data for both blacks and whites were obtained from the Mississippi Cancer Registry from cancer-rates.info from 2003 to 2018. This population-based cancer reporting system collects data for the population at risk, the number of cases, the crude rate, the age-adjusted rate, and the 95% confidence interval for the 82 counties in Mississippi. However, 6 of the 82 counties were omitted in our disparity analyses due to insufficient population size of whites or blacks resulting in missing data for either the black or white incidence rates in that county. The risk difference for the two groups was calculated using the following formula[8]:

$$IncidenceRateDifference = P_1 - P_2$$

where P_1 is the age-adjusted CRC incidence rate for blacks (a=number of cases, N_1 = age-adjusted denominator) of each county and P_2 for the age-adjusted CRC incidence rate for whites of each county (b=number of cases, N_2 =age-adjusted denominator). Confidence intervals (95%) were calculated as:

$$IncidenceRateDifference \pm 1.96 * SE$$

and the formula for the standard error (SE) [9]:

$$SE = \sqrt{((a*(N_1-a)/N_1^3)+(b*(N_2-a)/N_2^3))}$$

The incidence rate difference and confidence intervals were merged into a Mississippi county shape file and mapped using ArcGIS. If the confidence interval excluded 0 it was considered statistically significant.

Getis-Ord Gi* spatial cluster statistics were employed in ArcGIS to quantify whether a county is surrounded by similar counties for black-white incidence rate difference in CRC. Since each county is examined as a potential center of cluster, we employed the false discovery rate adjustment to account for multiple testing in calculating the p-value.

Results

CRC incident rate differences between blacks and whites were mapped in Mississippi counties (Figure 1). Significant racial differences in CRC incidence rates were observed in 39 counties. All counties with significant disparities showed blacks with higher incidence rates than whites. Some counties had higher incidence rates among whites compared with blacks but these were not statistically significant.

In the Getis-Ord spatial cluster analysis, no hot spot was detected which indicates there were not clusters of areas with pronounced racial disparities and that the disparities are sprinkled throughout many areas of the state. In the southern part of the State, a “cold-spot” cluster was detected, indicating no racial

disparities; this cold spot region spans 8 counties and is highlighted in blue in Figure 2. Incidence rates are markedly lower for blacks in this region compared with the state average (Table 1). This is a region of the state whose practices should be emulated for reducing racial disparities.

Table 1

Black and white incidence rates of CRC in the Cold Spot Region and the entire State Average, 2003-2018.

	State of Mississippi (per 100,000)	Cold Spot Region (per 100,000)
Average Black Incidence Rate	59.81	41.31
Average White Incidence Rate	48.88	46.06

Discussion

We report that blacks in Mississippi have higher incidence of CRC compared with whites. We did not find a hot-spot of this racial disparity, rather it persists throughout much of the State. The exception, however, was an 8 county “cold-spot” region in the southern part of the state. The average black incidence rate in the “cold-spot” region was 41.3/100,000 while the state average was 59.8/100,000 for blacks. This indicates that practices used in this cold-spot region to reduce black CRC incidence should be adopted more broadly to help reduce the racial disparities in the state.

The overall CRC incidence rate in Mississippi (48.2 per 100,000) is greater than the CRC incidence rate for the United States (38 per 100,000) from 2014-2018 [6]. Using data from our study 2003-2018, the black incidence rate for CRC is 59.8 per 100,000 while the white incidence rate CRC is 48.9 per 100,000 [6]. However, the incidence in the cold-spot region did not have the same disparity and instead had lower CRC incidence rates for blacks (41.3 per 100,000) while the CRC incidence rate for whites was similar to the state incidence rate (46.1 per 100,000).

One factor that may explain the racial differences in CRC incidence rates in Mississippi is access to recommended preventative colonoscopies or sigmoidoscopies. Clusters of low adherences to CRC and breast cancer screening guidelines in Mississippi have been identified but did not explicitly consider racial disparities [10]. Nineteen counties were identified as a cluster of both low breast cancer screening and low CRC screening. [10]. Out of these nineteen counties, we identified 8 counties (Attala, Bolivar, Jasper, Lafayette, Lauderdale, Leflore, Lowndes, and Newton) as having significant racial disparities in CRC, suggesting use of CRC screening may explain some of the disparities. Furthermore, black Mississippians reported they never received a colonoscopy or sigmoidoscopy at a higher rate (53.2%) compared with white Mississippians (41.9%) [11]. Areas with higher self-reported rates of colonoscopies or sigmoidoscopies had a higher ratio of gastroenterologists per facility offering colonoscopies [11]. This resulted in the rural areas of Mississippi having less coverage of CRC screening while the urban areas had essentially full coverage [11]. However, geographic proximity to a colonoscopy did not appear to be a major driving factor. Approximately 62% of Mississippi’s population live within a 30-minute drive to a gastroenterologist while 83% of Mississippi’s population live within a 30-min drive to a facility that offers

colonoscopies [11]. There was no association between duration of travel time to a colonoscopy facility and CRC health outcomes [11]; however, there was a strong association between CRC incidence and percentage of Mississippians that live below the poverty line ($r=0.461$, $P\leq 0.000$) [11]. Individuals living in the Lower Mississippi Delta were less likely to undergo screening for CRC [12] with lower CRC screening rates associated with lack of insurance, low household income, and black race [13]. This indicates that multiple factors are influencing racial disparities in CRC incidence in Mississippi.

Additional factors that influence CRC incidence are diabetes and obesity. Mississippi has one of the highest median rates of diagnosed diabetes (age-adjusted 12.4%) in adults in the United States (median age-adjusted 9.5%) for adults aged 18 or older[14] and one of the highest obesity rates in the United States with blacks being more likely to be obese compared to whites [15]. Type 2 diabetes mellitus is associated with an increased risk of CRC (OR, 1.42; 95% CI, 1.25-1.62). [16], as is obesity [17]. A study conducted in 2007-2009 illustrated that the obesity prevalence in the state of Mississippi was lowest in the southern and northeastern parts of state (between 30.5-33.3%) [18]. Some of the counties with the lowest obesity prevalence rates were also found in the cold spot (Pearl River, Stone, George, Hancock, Harrison, and Jackson) [18].

In this ecologic study we were able to quantify rates of CRC incidence and racial disparities; however, we did not have power to stratify by sex or by cancer stage. We also did not have individual-level data to understand the factors influencing each individual's cancer diagnosis. Future work in this region is needed to understand the factors that are driving the racial disparities in CRC incidence, and why the disparities virtually disappeared in the 8-county cold spot region.

In conclusion, racial disparities in CRC incidence persist through much of the state of Mississippi, with the exception of an 8-county region in the southern part of the state. Other regions of the state, and perhaps the country, should follow the lead of these eight counties to reduce racial disparities in CRC incidence. Additional research should be conducted to identify what these counties are doing and implement effective interventions to reduce racial disparities in CRC incidence.

Declarations

Statements and Declarations: The authors have no relevant financial conflicts or disclosures. This manuscript has been seen and approved by all authors.

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Conflicts of Interests

There are no competing interests.

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Figures

	Black-White Rate Difference, per 100,000	Mean White Incidence Rate	Mean Black Incidence Rate	No. of Counties with Significant Disparities
Lowest Quartile: -17 - 1	51.50	49.48	0
25-50%: 1 – 11	50.66	59.03	8
50-75%: 11 – 21	48.78	62.99	14
>75%: 21 - 36	44.56	67.74	17

• Areas with significant black-white rate difference ($p < 0.05$)

Figure 1

CRC incidence rate differences between blacks and whites in Mississippi counties, 2003-2018. Areas with significant rate differences (RDs) are indicated with the wider white circle.

Figure 2

Getis-Ord Gi* cluster analysis of CRC incidence rate racial disparities in Mississippi. No hot spots were identified. Only a cold spot indicating a region without racial disparities.