



# Gender and racial disparities in the incidence and mortality of pancreatic cancer in Mississippi State from 2003 to 2019

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*Contributions:* (I) Conception and design: B Nduma; (II) Administrative support: All authors; (III) Provision of study materials or patients: B Nduma; (IV) Collection and assembly of data: All authors; (V) Data analysis and interpretation: B Nduma; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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**Background:** In the United States, the incidence and prevalence of pancreatic cancer are well-established relative to the factors of gender and race. These rates can be seen to be dictated by biological, behavioral, socio-environmental, socioeconomic, and structural factors. This paper focused on the context of Mississippi, with a particular emphasis on racial and gender-linked mortality and incidence from 2003 to 2019.

**Methods:** Data were obtained from the Mississippi Cancer Registry. Specific parameters that were focused upon included the data source in the form of all cancer incidents and cancer mortality, geography in terms of cancer coalition regions, cancer sites in the form of the digestive system as a category to which pancreatic cancer belongs, and the year, ranging from 2003 to 2019.

**Results:** From the findings, the rates were more dominant in blacks than their white counterparts, suggesting racial disparity. Additionally, regardless of race, females exhibited lower rates compared to males. In the state, there were also marked geographical variations in disease incidence and mortality rates, with the Delta cancer coalition region faring the worst in terms of incidence rates for both races and genders.

**Conclusions:** It was concluded that in Mississippi, being a black male poses the highest risk. In the future, certain additional factors that will need to be investigated as per their probable moderating role to inform the coining of health care interventions at the state level. They include lifestyle and behavioral factors, comorbidities, stage of disease, and geographical variations or remoteness.

**Keywords:** Pancreatic cancer; cancer coalition region; incidence; mortality rate; racial disparity; gender disparity

Submitted Sep 20, 2022. Accepted for publication Apr 04, 2023. Published online May 22, 2023.

doi: 10.21037/jgo-22-913

**View this article at:** <https://dx.doi.org/10.21037/jgo-22-913>

## Introduction

In the United States (U.S.), one of the few cancers whose incidence is increasing is pancreatic cancer, yet little is known relative to racial disparities arising as per the condition's associated mortality and incidence (1). For

investigations that have focused on the years ranging from 2001 to 2015, for instance, with a specific emphasis on how race shapes the incidence and mortality aspects, findings have demonstrated that there have been 5-year time period declines in disparities in black versus white patients, but the incidence and mortality among blacks have remained

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higher (1). Despite the insightful nature of these outcomes, however, which point to the inference that pancreatic cancer mortality and incidence vary with cancer stage, patient age, and location but disparities between black and white patients are persistent, the specific factors responsible for the observed racial disparities are not highlighted vividly, a flaw that complicates efforts by healthcare authorities seeking to intervene.

In additional scholarly investigations, the focus has been on pancreatic cancer health disparities spanning more than 10 years, including variations in patient outcome, treatment, and epidemiology (2). The motivation of such investigations has been to give insight into the impact of these disparities on interventions that aim to promote equity, having unearthed health disparities in pancreatic cancer treatment based on determinants such as socioeconomic status,

ethnicity, and racial background (1,2). The results of such narrative reviews have indicated that most African Americans and Hispanics report higher rates and receive treatment at low-volume hospitals, as well as have lower surgical resection rates. Pancreatic cancer treatment delivery is also seen to be dictated by the factors of socioeconomic status and insurance concurrently (2). Hence, such studies can be seen to give insight into the existence of disparities based on socioeconomic status and race relative to pancreatic cancer treatment, but the underlying causes of those differences especially in socioeconomic statuses are not outlined vividly, yet they ought to be understood to inform interventions.

Poor prognosis has been evidenced further in studies that have focused on the steadiness of pancreatic cancer incidence and prevalence across the U.S. Particularly, the condition has been affirmed to maintain lower survival rates, at nine percent (3). Factors documented to account for lower survival rates include delayed detection, as well as limitations in treatment options whereby only 20 percent of patients tend to be eligible for “curative” surgical resection (3). Since the 1970s, also, incompletely explained and long-standing differences in the rates of mortality and incidence of pancreatic cancer based on ethnic or racial background have been documented (4). Similar to earlier studies, the findings suggest specifically that African-Americans exhibit a higher mortality rate and also incidence compared to their counterparts in the non-Hispanic White community (5). Some of the factors that explain the disparities include lifestyle and behavioral factors such as alcohol consumption, obesity, diabetes, and smoking (6). Among African-Americans and Latinos, pancreatic cancer risk has been asserted to increase with an increase in the rate of sudden-onset diabetes (7). However, the recruitment of minorities in research studies centering on pancreatic cancer has been historically low (8). making the understanding of these disparities and the quest to guide intervention efforts unclear.

This study focuses on Mississippi State as the research context, and the target years span from 2003 to 2019. The year 2006 saw Mississippi report the highest pancreatic cancer-related death rate in the nation, standing at 12.7 out of every 100,000 persons (9). Further statistical outcomes for the respective counties on an age-adjusted basis yielded the rate of incidence standing as high as 26.91 in every 100,000 persons, with 51 percent of mortalities arising from treatment at the American College of Surgeons Commission on Cancer (ACS CoC) hospitals while the fate of the

### Highlight box

#### Key findings

- Our findings demonstrated the rates of pancreatic cancer were more dominant in blacks than their white counterparts, suggesting racial disparity. Additionally, regardless of race, females exhibited lower rates compared to males. In the state, there were also marked geographical variations in disease incidence and mortality rates, with the Delta cancer coalition region faring the worst in terms of incidence rates for both races and genders.

#### What is known and what is new?

- Poor prognosis of pancreatic cancer in the United States. Previous studies have also shown longitudinal differences in the rates of mortality and incidence of pancreatic cancer based on ethnic or racial background have been documented. Similar to earlier studies, the findings suggest specifically that African-Americans exhibit a higher mortality rate and also incidence compared to their counterparts in the non-Hispanic White community
- Paucity of data that demonstrates the racial disparity of pancreatic cancer rates in the state of Mississippi. This study focuses on Mississippi State as the research context, and the target years span from 2003 to 2019. The year 2006 saw Mississippi report the highest pancreatic cancer-related death rate in the nation of 12.7 out of every 100,000 persons.

#### What is the implication, and what should change now?

- The studies increase the awareness of racial disparity in the state of Mississippi and forecast similar implications in other states across the United States. This sets the stage for future studies on how to curtail these differences by recognition of the modifiable risk factors for pancreatic cancer. Also, the creation of comprehensive strategies specifically relevant and tailored to the needs of the affected populations would be recommended for implementation in Mississippi and other states.

remaining 49 percent remained unclear (10). Also, among the patients tracked at the state's CoC facilities, compared to the National Cancer Data Base (NCDB) nationwide CoC data, there were no significant changes relative to factors of first treatment modalities, stage at diagnosis, and age distribution. Also, compared to national figures, fewer patients have survived 2 years with locally advanced disease in the state (9,10). Concerning, particularly, has been the larger number of individuals with unknown pancreatic cancer treatment. Hence, in the wake of these complexities, the extent of disparities is worth uncovering. Through such efforts, it is projected that the results might sensitize health care providers in Mississippi regarding the need to establish a system of pancreatic cancer care that is deemed comprehensive, inclusive, and accessible. We present this article in accordance with the STROBE reporting checklist (available at <https://jgo.amegroups.com/article/view/10.21037/jgo-22-913/rc>).

## Methods

This study used Mississippi Cancer Registry as a data source. The registry contains population-based linked datasets combining data gained from health administrative datasets and long-form census questionnaire respondents. This study conformed to the provisions of the Declaration of Helsinki (as revised in 2013). Whereas the long-form census questionnaire respondents are similar to the case of respondents in national household surveys, the health administrative datasets include information on annual mailing-address postal codes, ambulatory care, hospitalizations, cancer, and mortality. Indeed, the study concentrated on the successful linkage of cancer records to incidence and mortality records between 2003 and 2019, with the moderating factors on the focus being gender characteristics and racial origins. Hence, information was obtained via the linkage to the state cancer registry. Within the registry, specific parameters included the data source in the form of all cancer incidents and cancer mortality, geography in terms of cancer coalition regions, cancer sites in the form of the digestive system as a category to which pancreatic cancer belongs, and the year, ranging from 2003 to 2019. Regarding the study population, insights were gained from the registry in terms of sex and ethnicity, with the latter achieved by centering on the black race and the white race. Important to note is that race refers to distinct groups into which human species are divided based on inherited behavioral and physical differences (11). With

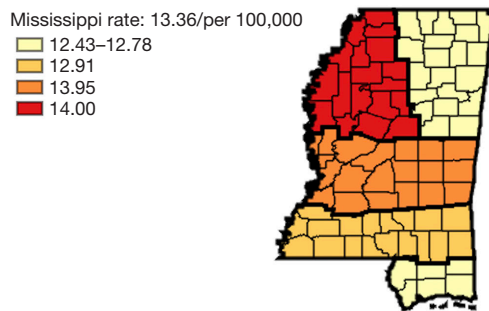
gender referring to the range of features pertaining to masculinity and femininity and differentiating between them, including gender identity and sex-based social structures (12).

Concerning the aspect of cancer definition, there was the estimation of cancer mortality rates and cancer incidence at the population level by gender and race in Mississippi, as demonstrated by the registry. Hence, the two indicators served as a baseline for the health status of various races relative to pancreatic cancer cases. New cancer cases, therefore, were defined as those that had occurred from 2003 to 2019. On the other hand, cancer deaths were deemed as those arising from a cancer form (pancreatic) that a physician had certified as the death's primary underlying cause. Hence, mortality data gained from the registry were those covering the period from 2003 to 2019.

Lastly, there was the statistical analysis aspect. As noted earlier, data were drawn from the Mississippi Cancer Registry. Thus, inferential and descriptive statistical approaches were used to present the results. From the descriptive statistical approach, data from the registry was collected, organized, analyzed, and presented meaningfully via graphical techniques, tabulation, and charts. On the other hand, the inferential statistical approach complemented the descriptive statistical technique through comprehensive discussions regarding the subject under investigation, eventually drawing conclusions considering the central subject under investigation.

## Statistical analysis

The cancer registry allows an end-user to select and download open-source data for didactics. In this study, the specific options select from the open-source cancer registry include all mortality cancer rates. With this study's focal area being pancreatic cancer epidemiology, the option chosen entailed all cancer incidence. In terms of geography, the Mississippi open-source cancer registry offers options such as data analysis by public health district, county, Delta or non-Delta regions, cancer coalition regions, rural or urban areas, and the Appalachian region. In addition, the geographical factor was then narrowed down to involve pancreatic cancer by cancer. The open-source cancer registry also allows an end user to select the cancer site to focus upon. In this case, pancreatic cancer was selected as the cancer. Additional navigation of the registry paves the way for the user to select the starting year and the ending year to ensure the timeframe being



**Figure 1** Age-adjusted pancreatic cancer incidence rates in Mississippi 2003–2019 by cancer coalition regions. Age-adjusted to the 2000 U.S. standard million population.

focused upon is specified. With age-adjusted rates on the focus, the starting year that was chosen was 2003 while the ending year was 2019. The registry provides additional room for the user to select the sex being focused upon and, in this case, all sexes were selected, implying both male and female populations had their pancreatic cancer used in the context of Mississippi. Relative to the factor of race or ethnicity, options include Black, White, or all, and the choice that was arrived upon was all races or ethnic groups, implying Mississippi's general population formed the focal demographic area.

## Results

From *Figure 1*, Delta Regional Coalition rates the worst, followed by the Central Regional Coalition, the Southern Regional Coalition, the Northeast Regional Coalition, and the Coastal Regional Coalition, respectively. The specific in-depth statistical data for the respective coalition regions are presented in tabular forms in *Figure 2*.

*Figure 2* illustrates the statistical outcomes concerning the incidence rate of cancer in the Delta, Central, Southern, Coastal and Northeast regional cancer coalition regions respectively. Specific findings demonstrate that in Mississippi, the highest incidence between 2003 and 2019 has been in Delta, rating the worst. On the other hand, the lowest incidence in the selected period is in the northeast.

*Figure 3* shows five (Delta, Central, Southern, Coastal and Northeast) regional cancer coalition regions, the graphical representation suggests that the rate in black males is consistently higher than the rate in white males.

It can also be observed from *Figure 4* that across the five cancer coalition regions in Mississippi, the incidence rate

in black females is consistently higher than the rate in their counterparts of the white race. At this point, it becomes imperative to gain additional insight into the subject of gender, offering a comparative analysis in males and females across these regions, pitting males versus females in the respective zones.

Between 2003 and 2019 in *Figure 5*, the incidence rate of pancreatic cancer can be seen to be consistently higher in black males than black females across all five regions. When the individual cancer coalition regions are compared, the coastal region favors the worst on the part of incidence in black males while the northeast zone favors the worst relative to pancreatic cancer incidence in black females. In both groups, however, the lowest incidence rate occurs in the southern cancer coalition region. Whether these statistical outcomes were similar to the case of white males versus white females in the same period and regions remains at stake.

Similar to the case of blacks, a comparison between males and females of the white race relative to the incidence of pancreatic cancer between 2003 and 2019 in *Figure 6* suggests that the rate is higher in males than females. Additionally, the northeast cancer coalition rate rates better in both genders while the incidence rate is worst in Delta for both male whites and female whites.

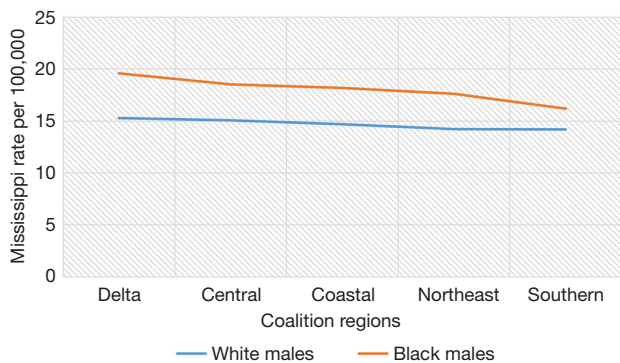
The statistical results concerning pancreatic cancer-related mortality rate in Mississippi in *Figures 7,8* suggest similar trend outcomes compared to the incidence rate. With cancer coalition regions on the focus, it is evident that Delta rates the worst implying it reported the highest mortality rate, with the northeast reporting the lowest mortality rate.

As indicated earlier, in both white and black males, the incidence rate between 2003 and 2019 was highest in Delta. *Figure 9* suggests that similar outcomes are found relative to the mortality rate, with Delta reporting the highest mortality rate arising from pancreatic cancer in Mississippi. Conversely, the lowest incidence rate in white and black males was in the southern cancer coalition region, and the mortality rate assumes a similar trend.

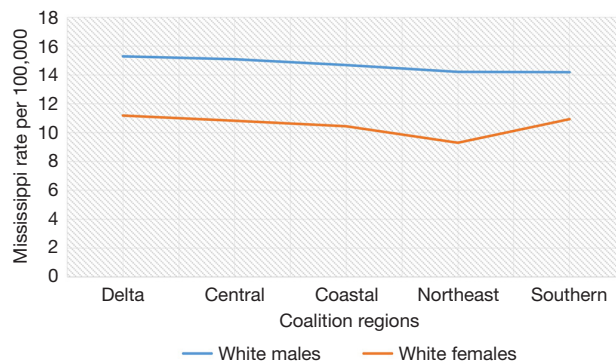
When it comes to a comparative analysis of white females versus black females in *Figure 10*, mixed outcomes accrue. In white females, the highest mortality rate was in Delta while the lowest was in the northeast regional coalition. In black females, however, it was in the northeast coalition region that the mortality rate was highest, with the lowest rate reported in the coastal regional coalition.

Similar disease incidence analysis between white males

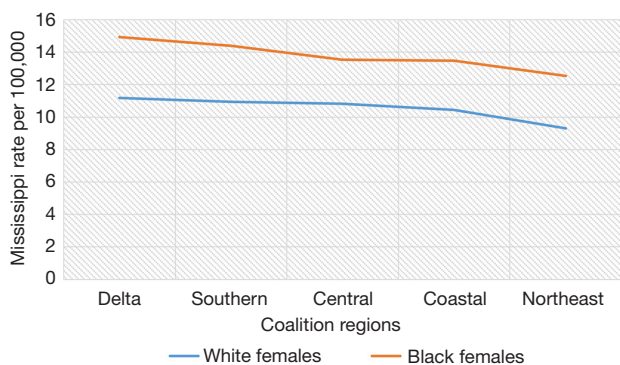




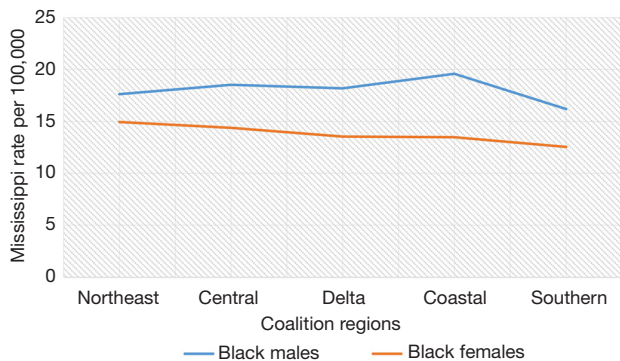
**Figure 3** Incidence rate of pancreatic cancer between white males and black males by cancer coalition regions in Mississippi between 2003 to 2019.



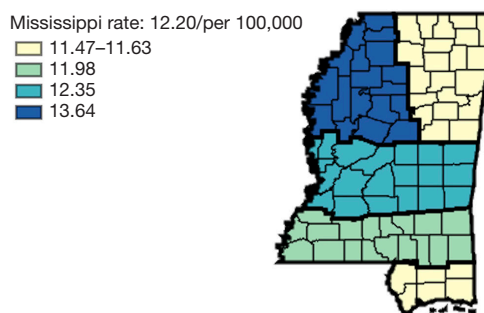
**Figure 6** Incidence rate of pancreatic cancer between white males and white females by cancer coalition regions in Mississippi between 2003 to 2019.



**Figure 4** Incidence rate of pancreatic cancer between white females and black females by cancer coalition regions in Mississippi between 2003 to 2019.



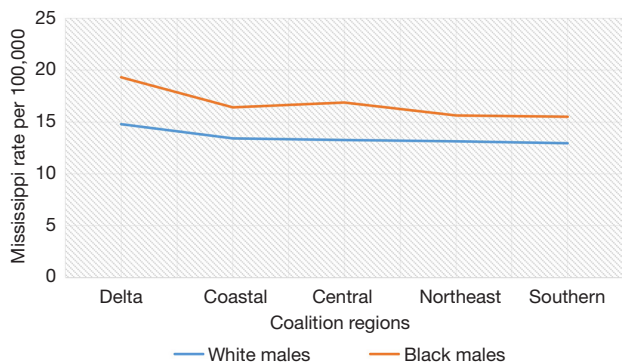
**Figure 5** Incidence rate of pancreatic cancer between black males and black females by cancer coalition regions in Mississippi between 2003 to 2019.



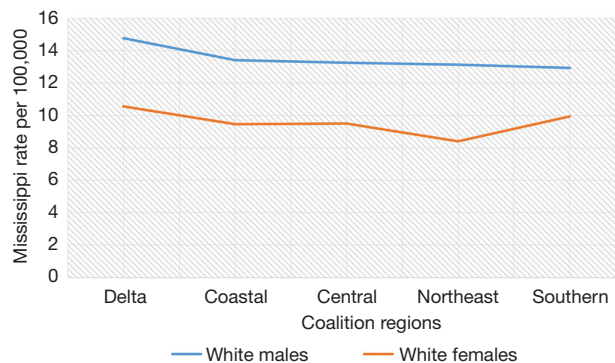
**Figure 7** Age-adjusted pancreatic cancer mortality rates in Mississippi 2003–2019 by cancer coalition regions. Age-adjusted to the 2000 U.S. standard million population.

period spanned from 2003 to 2019. As per the data from the Mississippi Cancer Registry, specifically concerning pancreatic cancer, the state is divided into five regional cancer coalitions. The coalitions include Delta, Central, Northeast, Southern, and Coastal coalitions. To present the results, two main sets were focused upon. The first set touched on incidence rates while the second set revolved around mortality rates. From the findings, some degree of consistency was evident. For instance, between 2003 and 2019, the rate was consistently higher in black males than in white males. Still, with this population category on the focus, a look at the mortality rates depicted black males rating consistently worsen than their white male counterparts, findings that were found to hold in all the five regional cancer coalitions. It is also worth highlighting

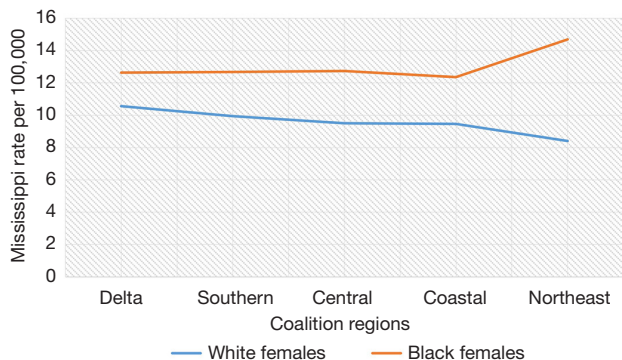




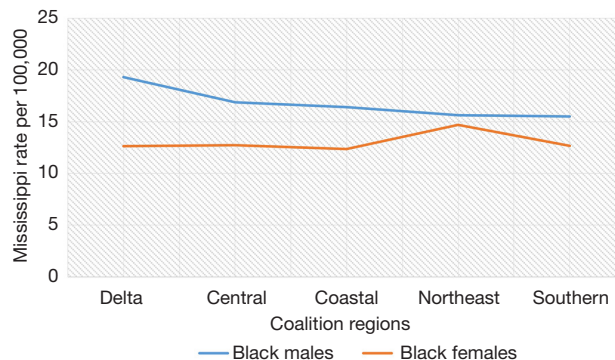
**Figure 9** Mortality rate—white versus black males (racial disparity in mortality rate).



**Figure 11** Mortality rate—white males versus white females (gender disparity in mortality rate).



**Figure 10** Mortality rate—white versus black females (racial disparity in mortality rate).



**Figure 12** Mortality rate—black males versus black females (gender disparity in mortality rate).

However, the dilemma that emerges entails the remainder of the groups whose incidence and mortality data might not have been captured in the cancer coalition regions due to factors such as access challenges (especially in rural zones) and sociocultural factors, historical injustices, and systemic issues. Whether similar rates would have been achieved or the equation would have tilted after incorporating such data remains unclear, pointing to the criticality of improving population representativeness by widening the level of collaboration among hospital networks to gain such data more comprehensively.

The rates in black females were also higher than in white females in all the five coalition regions, with Delta rating the worst and the Northeastern coalition region yielding the lowest incidence rates of pancreatic cancer. When it comes to mortality rates, however, black females' rates are higher than those for white females, but the trend is similar to the incidence rate only for the case of white females

whereby Delate had the highest mortality rate while the Northeastern coalition had the lowest mortality rate. For black females, the lowest mortality rate was in Coastal while the highest rate was in the Northeast coalition region. From additional scholarly studies, factors contributing to this consistency in disparities between black females and white females have been documented. Some of them include attribution to interethnic differences in the effects and distribution of predominant environmental risk factors (16). Specific factors include red meat intake (17), adiposity (18) and (19,20).

To determine gender disparity, the incidence rates of pancreatic cancer were determined by comparing white males with white females, as well as black males with black females. The same approach applied to the mortality rate, aimed to determine gender disparities. From the results, females rated more favorably than males concerning the attribute of incidence, regardless of whether they were



white or black. This trend held further when it came to the comparative analysis of the mortality rates, with the rates in white males being higher than in white females and also in black males than in black females. At this point, an additional theme that emerged was that being a black male proved the riskiest while being a white female proved the least risky.

Gender disparities have been linked to some factors. They include smoking and associated behaviors (21). and sex-steroid hormones (22). The factor of remoteness has also been found to explain higher mortality rates (23,24). but whether, in this case, the population of blacks residing in remote areas was significantly higher than whites between 2003 and 2019 is worth understanding further. Studies that concur with this position hold that geographical variations affect the survival rate and hence the mortality rate whereby they shape disparities in supportive care needs and the quality of care (25,26).

Indeed, this study established that between 2003 and 2019, there were gender disparities, but certain factors could not be clarified vividly. For instance, the statistical information fails to discern the probable role of the pancreatic cancer stage on the incidence and mortality rates. Another factor involved the age of diagnosis. Indeed, the statistics drawn from the state cancer registry were age-adjusted, implying the probable impact of age of diagnosis on the mortality rates, if any, remained unknown. Lastly, there is the factor of comorbidities. Whereas some scholarly insights hold that the presence of pre-existing conditions could increase the mortality rate by compromising health-related quality of life (26), whether this was the case in Mississippi remained unclarified. In the future, such factors are worth considering even further to increase understanding of their probable moderating role and, in turn, inform the recommendation of strategies tailored to the target population's needs with more accuracy and precision.

## Conclusions

In summary, this paper established that between 2003 and 2019, there were persistent racial and gender disparities in disease mortality rates and incidence. Also, Delta fared the worst based on most parameters that were analyzed. In the future, it will be critical to increase the understanding of these values by incorporating the probable role of moderating factors such as lifestyle and behavioral factors, morbidity, stage of disease, and geographical variations or

remoteness of the area of residence and their impact on disease incidence and mortality rates. In so doing, better, comprehensive strategies specifically relevant and tailored to the needs of the affected populations would be recommended for implementation in Mississippi and other states.

## Acknowledgments

*Funding:* None.

## Footnote

*Reporting Checklist:* The authors have completed the STROBE reporting checklist. Available at <https://jgo.amegroups.com/article/view/10.21037/jgo-22-913/rc>

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <https://jgo.amegroups.com/article/view/10.21037/jgo-22-913/coif>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study conformed to the provisions of the Declaration of Helsinki (as revised in 2013). Ethical approval was not required for this current study.

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**Cite this article as:** Nduma B, Ambe S, Ekhaton C, Fonkem E. Gender and racial disparities in the incidence and mortality of pancreatic cancer in Mississippi State from 2003 to 2019. *J Gastrointest Oncol* 2023;14(3):1478-1487. doi: 10.21037/jgo-22-913