CME Topic

# Surveillance of the Colorectal Cancer Disparities Among Demographic Subgroups: A Spatial Analysis

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**Objective:** The literature suggests that colorectal cancer mortality in Texas is distributed inhomogeneously among specific demographic subgroups and in certain geographic regions over an extended period. To understand the extent of the demographic and geographic disparities, the present study examined colorectal cancer mortality in 15 demographic groups in Texas counties between 1990 and 2001.

**Methods:** The Spatial Scan Statistic was used to assess the standardized mortality ratio, duration and age-adjusted rates of excess mortality, and their respective *p*-values for testing the null hypothesis of homogeneity of geographic and temporal distribution.

**Results:** The study confirmed the excess mortality in some Texas counties found in the literature, identified 13 additional excess mortality regions, and found 4 health regions with persistent excess mortality involving several population subgroups.

**Conclusion:** Health disparities of colorectal cancer mortality continue to exist in Texas demographic subpopulations. Health education and intervention programs should be directed to the at-risk subpopulations in the identified regions.

**Key Words:** colorectal cancer, health disparities, public health informatics, Geographic Information Systems, spatial analysis.

In 2005, an estimated 56,290 deaths from colorectal cancer were expected in the United States, sustaining colorectal cancer as the third leading cause of cancer-related deaths among Americans.[1] Recent studies suggest that screening is effective in decreasing colorectal cancer in both incidence and mortality by early detection and removal of precancerous lesions or polyps, and enhancing survival rates among colorectal cancer patients.[2] Colorectal cancer is one of the most preventable types of cancer when detected at an early stage.[3] However, while the 5-year survival rate for colorectal cancer is around 90% for those cases detected at an early stage, only about 37% of colorectal cancers were diagnosed at an early stage in 2004.[4] At the state level, between 1989 and 1998, the age-adjusted mortality rate for colorectal cancer in Texas actually increased by more than 20%.[3] To target prevention and intervention efforts, it is important to understand the contributing risk factors for colorectal cancer affecting demographic groups living in different geographic regions.

## Key Points

- Colorectal cancer mortality in Texas was found to be distributed inhomogeneously among specific demographic subgroups and in certain geographic regions over an extended period.
- The study confirmed the excess mortality in some Texas counties reported in the literature, identified 13 additional excess mortality regions, and found 4 health regions with persistent excess mortality involving several population subgroups.
- Health disparities in colorectal cancer mortality continue to exist in Texas demographic subpopulations. Health education and intervention programs should be enhanced to address the at-risk subpopulations in the identified regions.

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State-level studies in Texas have found that colorectal cancer mortality disproportionately burdened population subgroups defined by certain demographic characteristics, such as age, gender, race/ethnicity, and by residential distribution. In terms of age, more than 90% of colorectal cancer cases are diagnosed in people aged 50 and older.[3] Regarding gender, epidemiologic data indicate that there is a pronounced variation in the risk of colorectal cancer by gender, with men at a greater risk of colorectal cancer mortality than women. Between 1984 and 1996, the averaged Texas age-adjusted mortality rate from colon cancer for males was 17.64, and for females 12.18 per 100,000 people.[5] The disparities on colorectal cancer mortality by gender have widened in recent years. In 2003, the American Cancer Society reported that the age-adjusted colorectal cancer mortality rate in Texans rose to 26.1 per 100,000 for men and 17.4 per 100,000 for women.[4] These rates paralleled national statistics of age-adjusted colorectal cancer mortality rates for men (25.8/100,000) and for women (18.0/100,000).[4] Risk of colorectal cancer also varies by race and ethnicity. National data suggested that African Americans (both female and male) have the highest age-adjusted mortality rate when compared with other subgroups. Current Surveillance, Epidemiology and End Results (SEER) data from the National Cancer Institute indicate that the age-adjusted colorectal cancer mortality rate for African Americans is 28.5 per 100,000, compared with 20.7 per 100,000 for whites in the same year.[6] The disparity trend appeared to hold true by gender and race. Between 1970 and 1994, age-adjusted colon cancer mortality in Texas was 16.57 for white males versus 12.20 for white females, and 21.46 for black males versus 17.22 for black females per 100,000.[7] A study reported in the *Southern Medical Journal* indicated that between 1980 and 1990, colorectal cancer mortality in Texas increased at a statistically significant level, notably in African-American and Hispanic males.[8] In terms of geographic distribution of mortality, the (Dallas-Fort Worth) Metroplex, Gulf Coast, Central and Southwest Texas areas, namely the Public Health Regions, or PHR 3, 5, 6, and 7, had the highest age-adjusted mortality rates for colorectal cancer[9] (refer to figures for Public Health Regions). In addition, several Texas-specific cancer studies confirmed that cancer mortality has unevenly burdened residents in specific geographic regions over an extended period of time.[10,11,12] Cooper and colleagues[8] reported that excess colorectal cancer mortality disproportionally affected certain racial and ethnic groups between 1980 and 1991. The affected regions included the Houston/Harris County area for non-Hispanic white men and women, and the Victoria Area for Hispanic men, all in PHR Region 6. Zhan and Lin[11] confirmed the excess of colon cancer mortality among the general population in the Southwest, Gulf Coast and Metroplex Regions of Texas from 1990 to 1997.

To develop effective colorectal cancer prevention interventions for at-risk populations, it is important to understand how the excess mortality is distributed among population subgroups in different regions, and estimate the persistence of the excess mortality in terms of whether the trend of excess continues. The purpose of this study was to further determine and quantify the geographic variation of colorectal mortality in subgroups of Texas residents. The present study examined the areas of excess colorectal cancer mortality among 15 Texas population subgroups by gender, race/ethnicity and their combinations between 1990 and 2001, to compare and contrast the results with the published literature. This information could prove beneficial for the allocation of resources and development of preventive interventions directed toward at-risk population groups.

## Methods

Data for analysis included 16 age groups (group 1, aged 0–4; group 2, 5–9... to group 16, 75+), two gender groups, and the 4 major population subgroups in Texas (non-Hispanic white, blacks, Hispanics and "other"). First, a "Case File" was created to store colorectal cancer death cases, and the corresponding race, gender and age group by ethnicity. The data of counts were based on ICD-9 codes 153 to 154 for colorectal cancer in the study years 1990 to 1998, and ICD-10 codes C18-C21 for the years 1999 to 2001. The ICD-10 classification includes cancer deaths of colon, rectum and anus, cancer of the rectosigmoid junction and rectum, and cancer of the anus and anal canal. The data were collected from a publicly available cancer mortality source (Expert Health Data Programming Incorporated's Texas Vitalweb. Available at: http://www.ehdp.com). Second, a "Population File" was created to store the population by county, and the corresponding race, gender and age group by ethnicity for each of the study years. For intercensal years, population estimate data was obtained from the Texas Population Center of Texas A&M University. Finally, a third file, the "Geographic File," was created. This file contained data from the U.S. Census Bureau (http://www.cdc.gov/epiinfo/usa/tx.exe), including the longitudinal and latitudinal information on all 254 county centroids of Texas. The information was used as a proxy for the geographic location of each county. The excess colorectal cancer mortality, as measured by the geographic concentration of mortality in relation to other regions over an extended period, were detected using the SaTScan software[18] version 4.0 (Available at: http://www.satscan.org). The software performs spatial-temporal analysis adjusting for covariates such as age, gender and race/ethnicity. Our study was modeled after a study by Kulldorff and colleagues,[13] who had applied the spatial scan statistic in examining cancer burdens in the Los Alamos region of New Mexico. The same methodology has been widely applied in public health studies that investigated behavior-related diseases,[14–16] and for analysis of spatial distributions of health outcomes data in Texas, including colon cancer mortality,[11] breast cancer[10] and accidental poi-

soning disparities.[17] The stepwise procedures were reported by the authors elsewhere.[10,17] SaTScan employs the Monte-Carlo simulation to conduct hypothesis testing, which can differentiate areas with unequal cancer mortality burden. In the present study, statistical significance was established at the 0.05 level without adjusting the significance level due to multiple comparisons. In addition, a space-time relationship was examined between the colorectal cancer mortality rate and the defined geographic area being studied (ie, a county). The null hypothesis of the homogenous Poisson process for this study provides that when no covariates are being considered, the expected deaths for each county are proportional to the population of that county area and that there is an absence of time trend. The alternative hypothesis is that the deaths are not homogenously distributed (or not exactly proportional to the population in the same geographic area), and/or there is a presence of temporal trend in the inhomogeneous distribution of health outcomes. The study used a parameter "50% of population at risk" in which a cluster, if detected, would comprise at most, 50% of the study population. The parameter was proposed by Kulldorff[13] as an optimal setting. The temporal setting of clusters was set at 90%, meaning that a detected cluster would include a maximum of 90% of the study period (ie, up to a maximum of 10 years), while time is treated nonparametrically, ie, as an indicator variable to make sure the clusters are not an artifact of temporal trend. This spatial-temporal analysis also includes a "spatial only" analysis that allowed the examination of cross-sectional prevalence of colorectal cancer deaths over the entire study period (12 years). A brief review of scan statistics and their applications to ecological studies and environmental sciences is available by Patil and Taillie.[18] The Poisson model is applicable in this study of colorectal cancer because the analysis involved small numbers of cases against larger population denominators, as is often the case with cancer. This is particularly true for the state of Texas, where in 2003 the age-adjusted mortality rate for colorectal cancer was estimated at 26.1 per 100,000 for males and 17.4 per 100,000 for females.[1] Both rates are relatively small in terms of the number of deaths in the numerator and the population at risk in the denominator. All rates are age-standardized and stratified for each of 16 groups using indirect standardization.

The SaTScan analysis produced the metrics useful for quantifying spatial clustering and estimating excess mortality in each group. These measurements included the P value, standardized mortality ratio (SMR), the age-adjusted rate, and the duration of excess. They were then imported into ArcGIS 8.0 software to produce Geographic Information Systems (GIS) maps, so as to present a visual illustration of the actual disparity for colorectal cancer mortality by Texas county excess mortality. For the purpose of analysis, we color-shaded the detected regions of excess mortality with dissolved county boundaries overlaid with the geographic boundary file of 11 Texas Public Health Regions (PHR).

## Results

This study included 390,144 records in both the case file and population file in the 254 Texas counties between 1990 and 2001. The overall mortality trends and specific geographic variations by subgroups are presented below. For the 12-year study period, there were 37,596 deaths attributable to colorectal cancer, resulting in an age-adjusted rate of 16.5 per 100,000. Males had higher age-and-race adjusted mortality

**Table 1. Characteristics of study population and deaths, Texas 1990–2001**

| Population | Average total population | (%) | Cumulative deaths | (%) | Annual age-adjusted rate (per 100,000) |
|---|---|---|---|---|---|
| All | 18,974,226 | 100 | 37,596 | 100 | 16.5 |
| Male | 9,388,316 | 49.48 | 19,133 | 50.89 | 17.0 |
| Female | 9,585,911 | 50.52 | 18,463 | 49.11 | 16.1 |
| Black | 2,205,661 | 11.62 | 5,283 | 14.05 | 20.0 |
| Male | 1,068,714 | 5.63 | 2,589 | 6.89 | 20.2 |
| Female | 1,136,947 | 5.99 | 2,694 | 7.17 | 19.7 |
| Hispanic | 5,342,242 | 28.16 | 4,313 | 11.47 | 6.7 |
| Male | 2,696,015 | 14.21 | 2,500 | 6.65 | 7.7 |
| Female | 2,646,227 | 13.95 | 1,813 | 4.82 | 5.7 |
| Non-Hispanic White | 10,946,960 | 57.69 | 27,745 | 73.80 | 21.1 |
| Male | 5,384,897 | 28.38 | 13,925 | 37.04 | 21.5 |
| Female | 5,562,063 | 29.31 | 13,820 | 36.76 | 20.7 |
| Other | 479,363 | 2.53 | 255 | 0.68 | 4.4 |
| Male | 240,673 | 1.27 | 136 | 0.36 | 4.7 |
| Female | 238,690 | 1.26 | 119 | 0.32 | 4.2 |

**Table 2. Potential excess mortality [a] by subgroup and geographic region (PHR)**

| Population subgroups | Years (duration) | No. of deaths | Annual age adjusted rate/ 100,000 | *P* value | Standardized mortality rate | PHR | Figure 1 label |
|---|---|---|---|---|---|---|---|
| Spatiotemporal excess mortality | | | | | | | |
| All population, A | 1990–1997(8) | 7,544 | 17.5 | 0.002 | 1.06 | PHR 5–8,11 | 1.1 A |
| All population, B | 1993–2000(8) | 1,096 | 19.5 | 0.003 | 1.18 | PHR 3–4 | 1.1 B |
| All males, A | 1991–1994(4) | 1,579 | 19.4 | 0.007 | 1.14 | PHR 5–8, 11 | 1.2 A |
| All male, B | 2000–2001(2) | 197 | 24.7 | 0.035 | 1.45 | PHR 3–4, 7 | 1.2 B |
| All females | 1991–1999(9) | 927 | 19.4 | 0.001 | 1.21 | PHR 3–4 | 1.3 |
| Non-Hispanic white females | 1994–2001(8) | 1,878 | 23.5 | 0.002 | 1.14 | PHR 3–7 | 1.7 |
| Non-Hispanic white males, A | 1990–1994(5) | 1,489 | 24.8 | 0.001 | 1.15 | PHR 6–8, 11 | 1.10A |
| Non-Hispanic white males, B | 1997–1999(3) | 367 | 28.6 | 0.009 | 1.33 | PHR 2–3, 7, 9 | 1.10B |
| Black, male | 1996–1996(1) | 41 | 37.3 | 0.926 | 1.84 | PHR 3, 7 | 1.11 |
| Other male | 1993–1993(1) | 2 | 440.4 | 0.449 | 106 | PHR 3 | – |
| Other female | 2000–2001(2) | 5 | 61.3 | 0.267 | 13.00 | PHR 2 | – |
| Spatial only | | | | | | | |
| All non-Hispanic whites | 1990–2001(12) | 11,588 | 22.2 | 0.001 | 1.05 | PHR 3–4 | 1.4 |
| All black | 1990–2001(12) | 1,542 | 22.1 | 0.084 | 1.11 | PHR 2–4 | 1.5 |
| All Hispanics | 1990–2001(12) | 1,837 | 8.00 | 0.001 | 1.19 | PHR 6–9, 11 | 1.6 |
| Black, female | 1990–2001(12) | 848 | 22.8 | 0.027 | 1.16 | PHR 2–4 | 1.8 |
| Hispanic females | 1990–2001(12) | 729 | 6.8 | 0.001 | 1.19 | PHR 6–8, 11 | 1.9 |
| Hispanic males | 1990–2001(12) | 1,062 | 9.3 | 0.001 | 1.21 | PHR 6–9,11 | 1.12 |

[a] *Excess mortality is defined as up to 50% of study population, with temporal persistence for up to 90% of the study years, including purely spatial clusters adjusting for temporal effect nonparametrically.*

*PHR, Texas Public Health Region as defined by the Texas Department of Health and Human Services.*

*http://www.hhs.state.tx.us/aboutHHS/HHS_regions.shtml*

rates of 17.0 per 100,000 than females of 16.1 per 100,000. Table 1 summarizes the demographic characteristics of the study population in Texas.

When compared across major racial groups, non-Hispanic whites, blacks, Hispanics, and others had age-adjusted rates of 21.1, 20.0, 6.7, and 4.4 per 100,000 respectively. Mortality disparities by gender among the selected racial/ethnic groups were apparent: age-adjusted mortality rates for female non-Hispanic whites, blacks, Hispanics and others were 20.7, 19.7, 5.7 and 4.7 per 100,000; and for male non-Hispanic whites, blacks, Hispanics and others were 21.5, 20.2, 7.7 and 4.2 respectively.

Table 2 summarizes the measurements of excess mortality by SMR, P value, age-adjusted rate, and the duration of excess for each of 15 population groups. To determine potential excess mortality, we present color-shaded excess mortality regions in Figure 1. A "most likely" or "secondary" excess region is identified based on the values of 1) statistical significance, 2) a high SMR, 3) age-adjusted rate, and 4) excess mortality regions that persisted through most recent years (ie, year 2001). Among the 15 combined groups of gender, race and race-by-gender examined in the study, 13 public health regions* were identified with an excess colorectal cancer mortality of statistical significance. The majority of the areas of excess mortality were located throughout the Southeastern region of Texas and in the (Dallas-Fort Worth) Metroplex (involving 8 groups) and North East Texas (involving 4 groups). In terms of age-adjusted rates, black males in the counties near Metroplex and Central Texas presented the highest mortality rate (37.3/100,000) with the highest SMR (RR = 1.84); however, the excess mortality occurred only one year in 1996, and it was not statistically significant ($P = 0.926$). Non-Hispanic white males also presented a significant excess mortality, with rates of 28.6 and 24.8 per 100,000 in 1990 to 1994 and 1997 to 1999 respectively, followed by the "all male" group with a rate of 24.7 per 100,000 (RR = 1.45) between 2000 and 2001. Other female and male groups did not present statistically significant excess mortality. In terms of most recent excess mortal-

*In this study, the reference of Texas public health regions follows the conventional naming system used by the Texas Health and Human Services Regions (THHS, 2005). Available at: http://www.hhs.state.tx.us/aboutHHS/HHS_Regions.shtml. Accessed: July 10, 2005.

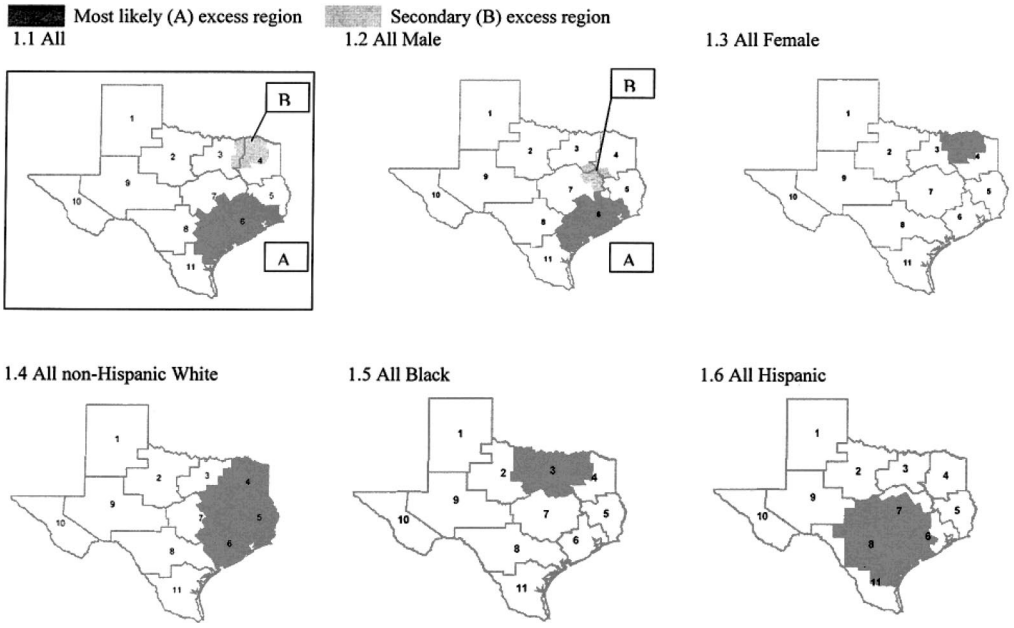


**Fig. 1** **Potential excess colorectal cancer mortality in Texas public health regions by population and subgroups, 1990 to 2001.**

ity, 8 groups presented persistent mortality rates through 2001; seven of them with a SMR of less than 1.2 and thus negligible, except for the one which occurred in the "all males" group (described above) in PHR 3, 4 and 7. In terms of disparity by gender, between 1990 and 2001, Hispanic females in PHR 6 to 9 and 11 were at 1.19 SMR compared with those in other regions, while the age-adjusted rate was only 6.8/100,000; non-Hispanic white males in PHR 2 to 3, 7 and 9 had the highest (RR = 1.33) age adjusted rate (28.6/100,000) between 1997 and 1999 that demonstrated statistical significance. Figure 1 presents the Texas regions of excess mortality by gender and demographic subgroups.

## Discussion

This study presents an overall colorectal cancer trend and outlines the specific geographic variations among demo-

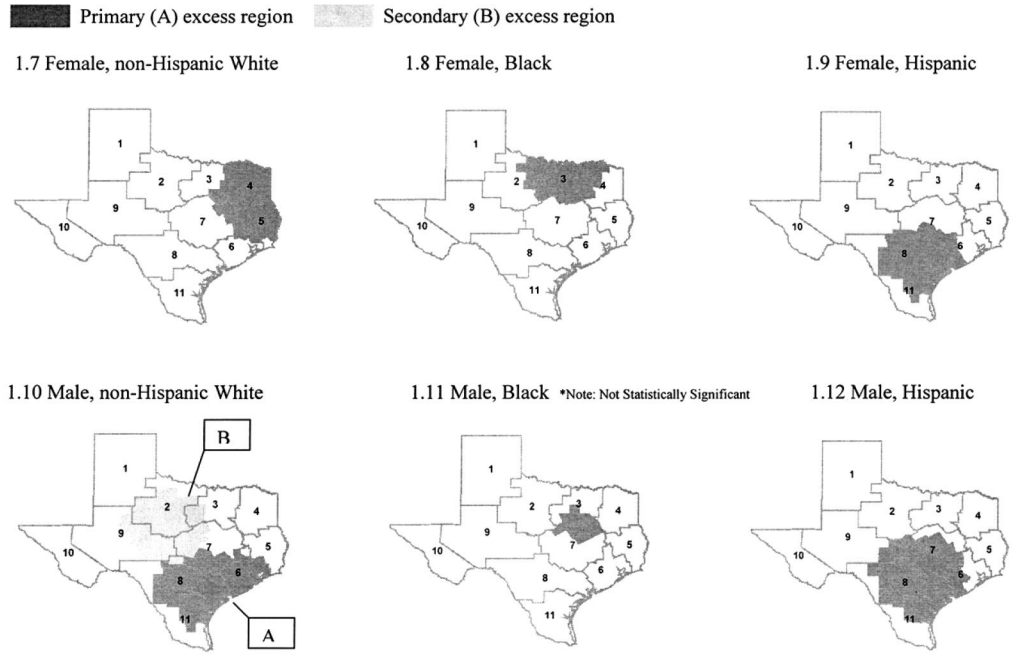


**Fig. 1** **(continued).**

graphic subgroups over an extended period. In terms of overall trend, between 1990 and 2001 there was a pronounced variation in mortality by gender. The age-adjusted mortality rate for females increased significantly (16.1/100,000—an increase of 33% when compared with the rates based on 1984-1996 data of 12.18 per 100,000), while that of males was somewhat reduced (17.00 versus 17.64). This suggests that the disparities in the mortality trend between females and males continued. While males still have high mortality, the gap appears to have narrowed over the recent years. This could possibly reflect a secular or cohort trend of increased incidence of colorectal cancer in females from environmental/dietary causes, reduced screening among females, or both. In contrast with other races, non-Hispanic white female mortality increased by 68% in comparison to the 1970 to 1994 period, and for blacks by 14.4% in the same period. In addition, among all race/ethnicity groups, only females in the "other" category exceeded males in the age-adjusted mortality rate; however, regions of excess mortality detected in the "other" group were not statistically significant. Consistent with the results of a previous study examining cancer data among Texas counties,[10] for the "other" group the age-adjusted rate (female = 61.3/100,000 and male = 440.4/100,000) and SMR (female = 13.00 and male = 106) were artificially inflated due to the small denominators of both population subgroups.

In terms of geotemporal distribution, several PHRs presented persistent excess colorectal cancer mortality through the present decade affecting multiple groups, notably in Public Health Region 3, 4, 6, and 7, which includes the Dallas-Fort Worth and Houston metropolitan regions.

The results of this study confirmed most of the previously reported areas of excess colorectal mortality in the Southwest, Gulf Coast, part of Central Texas PHRs and Kauffman County between 1990 and 1997.[11] We found that in the Southwest, Gulf Coast and part of Central Texas regions, the excess mortality primarily affected both male and female non-black populations, and confirmed that the trend discontinued in 1997. On the other hand, in Kauffman and neighboring counties, excess mortality primarily affected non-Hispanic females and black males through 2001. This excess also involved the North Metroplex and Upper East Texas PHRs, affecting both non-Hispanic white and black females, with the trend persisting between 1990 and 2001. Compared with the findings based on 1980 to 1990 data,[8] the excess mortality affecting black males might have ceased in 1996 because the excess mortality in this group was no longer statistically significant. On the other hand, the excess mortality detected among Hispanic males in the South and Lower South Texas PHRs reported by Cooper and colleagues[8] was found to have persisted between 1990 and 2001 at a moderate and statistically significant level (RR = 1.21) in this study. Ongoing monitoring and preventive interventions are warranted to avoid the temporal trend of excess mortality from continuing. In addition, this study further confirms the finding by the Texas Cancer Data Center[5] regarding the identification of the 4 PHRs with the highest colorectal cancer mortality rate in Texas. The regions detected with excess mortality are prime targets for additional demographic studies to identify other disparities related to health care and access to quality colorectal cancer preventive and treatment services. The findings of this study may inform agencies such as the State Cancer Council, as well as cancer advocacy groups in developing strategic planning for colorectal cancer. These findings are significant, current, and consistent with other studies and, therefore, may provide insight for the development of interventions that intend to address the disparities of colorectal cancer mortality among demographic groups. The spatial and temporal analysis method has been employed to investigate other disease incidence or mortality[14–16] which may provide directions for advancing cancer prevention and control policies.

This study renders several research questions that warrant further discussion. First, a potential problem of data reliability is the change from ICD-9-CM to ICD-10-CM codes implemented in 1999. The literature has suggested that changes in coding practices due to the transition has inevitably introduced under- or over-representation of cases or counts to an extent that may bias research results.[19,20] In the present study the ICD-9 codes only included colorectal data, while ICD-10 codes included cancer of the colon, rectum and anus; cancer of the rectosigmoid junction and rectum; and cancer of the anus and anal canal. One may expect the more inclusive cancers to be reported with the ICD 10 codes, which may in turn result in the detection of relative excess mortality after 1999. However, the results of our study suggest that the changes in coding did not shift the temporal mortality trend toward 1999 and after, because in comparison with other periods, no substantial increase of mortality occurred beginning in 1999, or in between 1999 and 2001.

Second, the present study introduces spatiotemporal analysis as an attempt to quantify colorectal cancer disparities and focus intervention efforts on targeted regions and populations. By doing so it prompts additional research questions that warrant further clarification. For example, to determine potential excess mortality that may warrant preventive interventions, the present study focused on the regions with excess mortality of statistical significance, with a high SMR and age-adjusted rate that persisted through the most recent years. The addition of the temporal dimension has the strengthening effect of smoothing the rates in a cluster over time, and could give clues to colorectal cancer etiology or long-term risk factors. On the other hand, this approach to quantifying colorectal cancer mortality burden, though adequate for this study, does not provide a precise quantification of disparities. Future research could seek to model the disparity burden by, for example, developing a composite index that combines several

measurements such as SMR, adjusted rate, and duration of excess health to better quantify the magnitude of the disparities in a multivariate context.

Third, further analysis should be conducted among at-risk population subgroups identified in this study and in the literature. For example, the Texas Cancer Council has reported that more than 90% of colorectal cancer patients were diagnosed at age 50 and older. Incidence rates are six times higher among persons aged 65 years and older than for those aged 50 to 64 years, and more than 70% of all newly diagnosed colorectal cancers occurred in persons aged 65 years and older.[3] Therefore, additional analysis may be directed to these high-risk age groups to determine the magnitude and spatial distribution of both incidence and mortality for colorectal cancer. In addition, although this study did not find any hot-spot excess mortality region (ie, those with SMR $>$ 2.0), further studies should be conducted to explore how policy changes or new screening or treatment methods for colorectal cancer may affect the disease distribution among populations, and in turn affect the geographic distribution of excess mortality. For example, Medicare has covered some screening tests for colorectal cancer since 1998, but as of 2001, it has covered all recommended colorectal cancer screening tests through Part B of the program, which covers the 65 and older population. Further studies may examine recent data to explore the effect of screening coverage on colorectal health by demographic groups.

Fourth, efforts should be directed to study "other" demographic subgroups. The present study, consistent with the literature, found that males generally have higher mortality rates than females across most race/ethnicity subgroups, with the exception of the females in the "other" racial category which exceeded males in terms of age-adjusted rates. This may suggest that females in the "other" category experience additional barriers to health care access. The "federal standards for maintaining, collecting, and presenting federal data on race and ethnicity" (OMB Statistical Directive 15) provides for the collection and reporting of health data by 6 races[21] (including American Indian or Alaska Native, Asian, black or African-American, Native Hawaiian, Pacific Islander, and white) and two ethnicities (Hispanic or Latino versus non-Hispanic or Latino). Misclassification of race/ethnicity may account for some persons being categorized as "other," in which case the mortality rates for correctly categorized race/ethnicities may be over- or underestimated, although how this affects the detection of clusters (ie, relative rates between racial/ethnic groups) remains unclear. Misclassification can come from two sources: census and cancer registry. State health reporting authorities should seek to disaggregate the "other" category and include those population subgroups not otherwise included. The disaggregation of the "other" group health data may be particularly urgent for the Asian population, which is among the fastest growing subgroup in the U.S. according to the Census 2000, and is confronting many clear and present epidemic challenges.

## Conclusion

The findings for the total population group were relatively consistent with previous studies in that most of the excess mortality was identified in the Southeast (around Harris County encompassing the city of Houston) region and Metroplex (around Dallas County) of Texas. In addition, the present study identified several regions of potential excess mortality among racial groups that have not been previously reported. In particular, several demographic groups warrant particular notice, including the male population in PHR 3 to 4 and 7 (RR = 1.45, rate = 24.7/100,000, between 2000 and 2001), and the other 7 population subgroups with excess mortality trends persisting to the present decade. In addition, the multiple population groups in Public Health Regions 3, 4, 6, 9 and 11 have experienced persistent excess mortality over time, which warrants further investigation. Overall, this study provides evidence that the spatiotemporal analysis for differentiation of excess mortality among age, gender and race/ethnic groups constitutes a potentially relevant method for public health planning and health disparities studies. The findings of demographic disparities of the disease may assist state health authorities in updating their action plans, as they are both significant and current. The spatiotemporal analysis should be considered for developing prevention and intervention programs for addressing the demographic disparities of colorectal cancer mortality, given the limited resources, increased racial/ethnic diversity and aging of the population of the state of Texas, with which to confront the disproportional burden of this disease.

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*Please see James Wooten's editorial on page 915 of this issue.*

*We find a delight in the beauty and happiness of children that makes the heart too big for the body.*

—Ralph Waldo Emerson