Comparison of melanoma incidence in metropolitan areas versus nonmetropolitan areas in the state of Texas stratified by poverty classification

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ABSTRACT

Numerous risk factors for the development of melanoma have been identified; however, there is conflicting research on whether residence in nonmetropolitan areas, with a population <49,999 people, is associated with an increased cancer risk. This retrospective study aimed to identify the correlation of nonmetropolitan residence in Texas and the incidence of melanoma, while also stratifying the results by poverty level. Data were obtained from the Texas Department of State Health Services' Texas Cancer Registry. The incidence of melanoma in Texas from 1996 to 2015 in nonmetropolitan and metropolitan counties was calculated and stratified by poverty classification. Overall, the incidence of melanoma was 51,431 out of 22,140,398 (0.23%) in metropolitan areas and 9685 out of 3,005,163 (0.32%) in nonmetropolitan areas. Thus, the proportion of residents with melanoma in nonmetropolitan areas was 1.39 times that in metropolitan areas, which translates to an ~39% increase in likelihood to develop melanoma. When these data were stratified by poverty, 57% of the cases of melanoma among those living in nonmetropolitan counties were in areas with a poverty rate of 10% to <20%; conversely, only 2% of the cases were among those living in nonmetropolitan counties with a poverty rate of 0% to 5%.

KEYWORDS Melanoma; poverty; risk factors; rural residence; skin cancer

Melanoma is an aggressive and often treatment-resistant human cancer with a high disease burden.¹ It may arise from any anatomical site in which melanocytes, cells that produce the pigment melanin, are present. In 2018, nearly 100,000 people were newly diagnosed with melanoma in the United States.² Multiple risk factors have been identified in association with melanoma development, including genetic mutations, ultraviolet exposure, and family history.³ However, there is conflicting research on whether rural residence is associated with increased cancer risk. According to the 2013 US Census, 15.3% of the population of Texas resides in rural areas.⁴ As such, Texas has the largest rural population of any state. Additionally, many studies demonstrate higher rates of melanoma prevalence in communities with higher socioeconomic status, likely due to increased access to dermatologists and increased early detection, whereas higher *mortality* due to melanoma persists in lower socioeconomic status

communities.⁵ This retrospective study aimed to explore the correlation of nonmetropolitan residence in Texas and incidence of melanoma, while also stratifying the results by poverty classification.

METHODS

Data from the Texas Cancer Registry of the Texas Department of State Health Services were obtained after submitting a limited-use data request. The data file covered the period 1995 to 2015 and was last edited November 13, 2017. After choosing the diagnosis of melanoma, 61,116 cases were available for analysis from the 2,083,816 cancer cases. Total populations of the counties included in the 2013 rural-urban continuum were obtained from the US Department of Agriculture Economic Research Service webpage. The incidence of melanoma was calculated for specific counties and for different poverty percentage levels within

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Table 1. Incidence of melanoma in Texas from 1995 to 2015 in metropolitan and nonmetropolitan areas^a

Area	Melanoma cases	Average total population (2013)	Population with melanoma
Metropolitan areas			
Combined	51,431	22,140,398	0.23%
Counties with population ≥ 1 million	38,383	16,205,427	0.24%
Counties with population of 250,000–1 million	8315	4,267,601	0.19%
Counties with population $< 250,000$	4733	1,667,370	0.28%
Nonmetropolitan areas			
Combined	9685	3,005,163	0.32%
Urban population of $\geq 20,000$ adjacent to a metropolitan area (up to 50,000)	1755	342,331	0.51%
Urban population of $\geq 20,000$ not adjacent to a metropolitan area (up to 50,000)	902	630,408	0.14%
Urban population of 2500–19,999 adjacent to a metropolitan area	4552	1,299,869	0.35%
Urban population of 2500–19,999 not adjacent to a metropolitan area	1665	523,107	0.32%
Completely rural < 2500 urban population adjacent to a metropolitan area	526	137,170	0.38%
Completely rural < 2500 urban population not adjacent to a metropolitan area	285	72,278	0.39%

^aCancer data provided by the Texas Cancer Registry, Cancer Epidemiology and Surveillance Branch, Texas Department of State Health Services (<https://www.dshs.texas.gov/tcr/>). Total population estimates and rural-urban continuum data obtained from the US Department of Agriculture, Economic Research Services (<https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/>).

Table 2. Incidence of melanoma in Texas from 1995 to 2015 in metropolitan and nonmetropolitan areas stratified by the census tract poverty indicator^a

Poverty level	Melanoma incidence by county type			
	Metropolitan	Percentage	Nonmetropolitan	Percentage
0 to $< 5\%$	14,923	29.0%	199	2.1%
5% to $< 10\%$	14,556	28.3%	1356	14.0%
10% to $< 20\%$	14,292	27.8%	5530	57.1%
20% to 100%	7660	14.9%	2600	26.8%
Total	51,431	100%	9685	100%

^aCancer data provided by the Texas Cancer Registry, Cancer Epidemiology and Surveillance Branch, Texas Department of State Health Services (<https://www.dshs.texas.gov/tcr/>).

each rural-urban continuum category. A chi-square test was performed comparing the metropolitan and nonmetropolitan incidence among different poverty levels, defining significance at the $P < 0.01$ level.

RESULTS

The incidence of melanoma in metropolitan areas was 0.23%, significantly less than the 0.32% incidence in nonmetropolitan areas (*Table 1*) ($P < 0.01$). The relative risk of developing melanoma while residing in a nonmetropolitan area versus a metropolitan area was 1.39. Additionally, the highest category of melanoma incidence (0.51%) was in the nonmetropolitan area with an urban population of $\geq 20,000$ adjacent to a metropolitan area.

Those in nonmetropolitan areas residing in a county with a poverty level of 10% to $< 20\%$ (poverty indicator 3) had the highest melanoma incidence (57%) among all poverty-metropolitan area groupings (*Table 2*). Poverty indicator groups 1, 2, and 3 were similar in the metropolitan areas at 29%, 28%, and 28%, respectively. The single lowest category of incidence in the poverty-stratified table was in the 0% to 5% poverty group in nonmetropolitan areas, at 2%.

DISCUSSION

The prognosis of melanoma is directly proportional to the depth of neoplasm, which increases with time. Therefore,

early detection of malignant melanoma remains the key factor in reducing mortality.³ The ABCDE model is a useful tool for identifying early clinical presentations of melanoma. The acronym outlines the criteria of asymmetry, borders (irregular), color (changing), diameter (>5 mm), and evolution.³ This model may be incorporated into annual physical examinations and should be taught to patients for at-home early detection, especially in areas where access to primary care is limited.

It is a grim reality that there are extensive provider shortages in rural America. Approximately 20% of the US population resides in rural areas, whereas only 9% of physicians practice in rural communities.⁶ Texas is particularly susceptible to health care disparities and provider shortages given its large rural population. When dealing with these communities, practitioners should be vigilant while conducting annual screenings for melanoma.

According to *Table 1*, residents in nonmetropolitan areas are ~39% more likely to present with melanoma than residents in metropolitan areas of Texas. Within this data set, the patients residing in the nonmetropolitan group labeled urban area with $\geq 20,000$ adjacent to a metropolitan area had the highest incidence of melanoma. This is consistent with the findings of Bram et al,⁷ who showed that skin cancer incidence (type unspecified) significantly differed by metropolitan status, with more reports among people living in suburban areas (defined as areas with a population of 20,000–50,000) than in urban or rural areas. The Bram et al study classification of “suburban” is equivalent to the group “urban area with $\geq 20,000$ adjacent to a metropolitan area” in this study. Conversely, this study’s findings differ from those of Hashibe et al,⁸ who showed that the overall incidence rates of cancer (of all malignancy types) in rural counties were *lower* by 11.9 per 100,000 per year compared to metropolitan areas in Utah.

When these data were stratified using by the US Census tract poverty indicator, the melanoma incidence was highest, at 57%, among those living in nonmetropolitan counties with a 10% to <20% poverty level (*Table 2*). One possible explanation for this is disparities in access and affordability to health care for persons residing in nonmetropolitan areas. Additionally, it is important to note that in all poverty strata, the single lowest incidence of melanoma, at 2%, was in nonmetropolitan counties with the lowest poverty category (*Table 2*). This finding suggests that though the incidence of melanoma is higher in nonmetropolitan counties compared to metropolitan counties, that may not be the case when the poverty level is low.

More should be done to bridge the health care disparities between metropolitan and nonmetropolitan areas in Texas, especially in regards to accessibility to primary care physicians and dermatologists. Additionally, for patients residing in these areas, emphasis should be placed on early screening and home detection, because early detection is the best method to reduce mortality.³ Additionally, it is important to address the impact of poverty on cancer rates and produce targeted prevention strategies for this vulnerable population. More research should be conducted on what variables contribute to this observed phenomenon and what can be done to reduce the incidence gap between these populations.

Study limitations include lack of data stratification by age, gender, race, or other demographic factors. Additionally, the Texas Cancer Registry data cover the period 1995 to 2015, whereas the rural-urban continuum population classifications were done at one point in time in 2013. The percentage of incidence was computed by dividing 10-year incidence by the total population in 2000 (retrieved from the 2000 US Census). These percentages are contingent on the assumption that populations stayed relatively consistent throughout this time frame.

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