# Cancer in Oklahoma Data Brief Series:

# Cancer in Rural Oklahoma

**Ayesha B. Sambo, Janis E. Campbell, Lauri A. Hunsucker, Stephanie F. Pharr, Mark P. Doescher**

Community Outreach and Engagement, a program of OU Health Stephenson Cancer Center

OU Health | Stephenson Cancer Center

NCI Cancer Center
A Cancer Center Designated by the National Cancer Institute

## Introduction

Compared to Oklahoma, 33 states have higher all-cause cancer incidence rates, but only 3 states have higher all-cause cancer mortality rates.[1] Given this troubling gap between Oklahoma's cancer incidence and mortality rankings, in-depth examination of cancer incidence and mortality rates among the state's high-risk populations is warranted.

In 2020, Oklahoma's 1,304,265 rural residents represented 33% of the state's 3,959,353 population, which is roughly 2.5 times the national average of 13.9%.[2] Of the 77 counties in Oklahoma, 59 counties are designated as rural based on the U.S. Department of Agriculture (USDA) Economic Research Service's (ERS) 2013 Rural-Urban Continuum Codes (RUCC).[2] The USDA's ERS has developed several multi-level county classifications to measure rurality in more detail and to assess the economic and social diversity of nonmetro America.[3] Among these, the RUCC county-level classification scheme is widely used as it distinguishes metropolitan (urban) counties by their population size, and nonmetropolitan (rural) counties by their degree of urbanization and adjacency to a metropolitan area.[4]

Rural areas in the U.S. are generally associated with multiple socioeconomic and healthcare challenges. In 2020, the poverty rate in rural Oklahoma was 16.8% compared to 13.1% in urban Oklahoma and 11.4% in the US.[2] Additionally, in 2020, 21.6% of rural Oklahoma adults reported current smoking, compared to 19.1% of adults in the entire state, and 15.5% adults in the United States (US).[5] In 2020, 37.7% of rural Oklahoma adults were obese, compared to 36.4% of adults in the state and 31.9% adults in the US.[5] High rates of poverty,[6] tobacco use,[7] obesity,[8] and other factors are compounded by long distances required to access cancer care.[9] These factors can subsequently impact overall cancer incidence and mortality rates.

This data brief presents information on overall and cause-specific cancer incidence and mortality for the rural and urban populations of Oklahoma classified by RUCC status. It also examines cancer screening rates for the rural and urban populations, and concludes with a brief discussion of the significance of findings on clinical practice and public health policy.

## Methods

Cancer incidence data were obtained from the Oklahoma Central Cancer Registry (OCCR), and cancer mortality data were from Oklahoma Vital Statistics. Information about cancer screening was obtained from the Oklahoma Behavioral Risk Factor Surveillance System (BRFSS). All data sources used in this brief were publicly available and provided de-identified data.

To ensure the stability of estimates and confidentiality, Oklahoma Central Cancer Registry and Oklahoma Vital Statistics rates were suppressed if fewer than 5 counts were reported in a specific category and all rates were age adjusted to the 2000 US standard population. Incident cancers for all sites include *in situ* cancers, except breast cancer, which only includes invasive cancers.

BRFSS estimates were suppressed for stability if the unweighted sample size for the denominator was less than 50 or if the Relative Standard Error was above 0.3. All unknown values were excluded, and resulting percentages were weighted averages estimated from the sample and population sizes.

To analyze different levels of rural Oklahoma, in this brief "Rural Overall" refers to counties in the RUCC 4-9 group, "Large Rural" counties in the RUCC 4-6 group, and "Small Rural" counties in the RUCC 7-9 group. "Urban" refers to counties in the RUCC 1-3 group. Additionally, Hispanic persons were categorized as being Hispanic regardless of race. All individuals in the sample were categorized into one of the following ethnic and racial groups: Hispanic, Non-Hispanic (NH) White, Black/African American, American Indian/Alaska Native, and Asian and Pacific Islander.

**Results:** Overall, there were 8,463,410 cancer cases diagnosed between 2014 and 2018 in the US and 101,791 in Oklahoma. During this time frame there were 2,984,000 cancer deaths in the US and 40,956 deaths in Oklahoma. Between 2014 and 2018, there were 71,370 cancer cases and 24,432 cancer deaths in urban Oklahoma and 40,931 cancer cases and 16,484 cancer deaths in rural Oklahoma.

**Figure 1: Map of Urban and Rural Counties in Oklahoma, RUCC 2013**

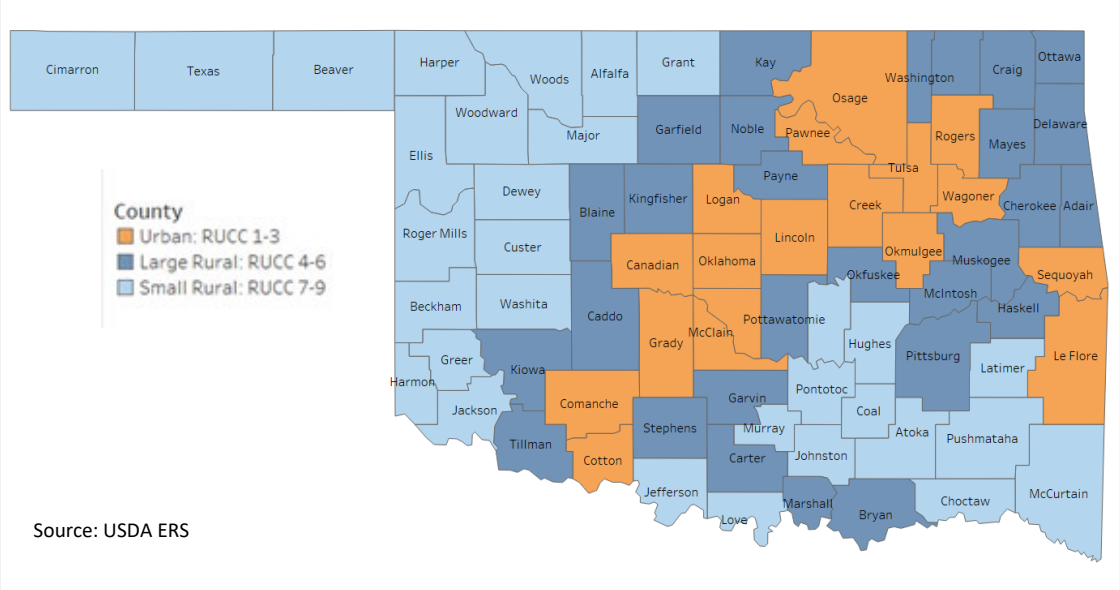
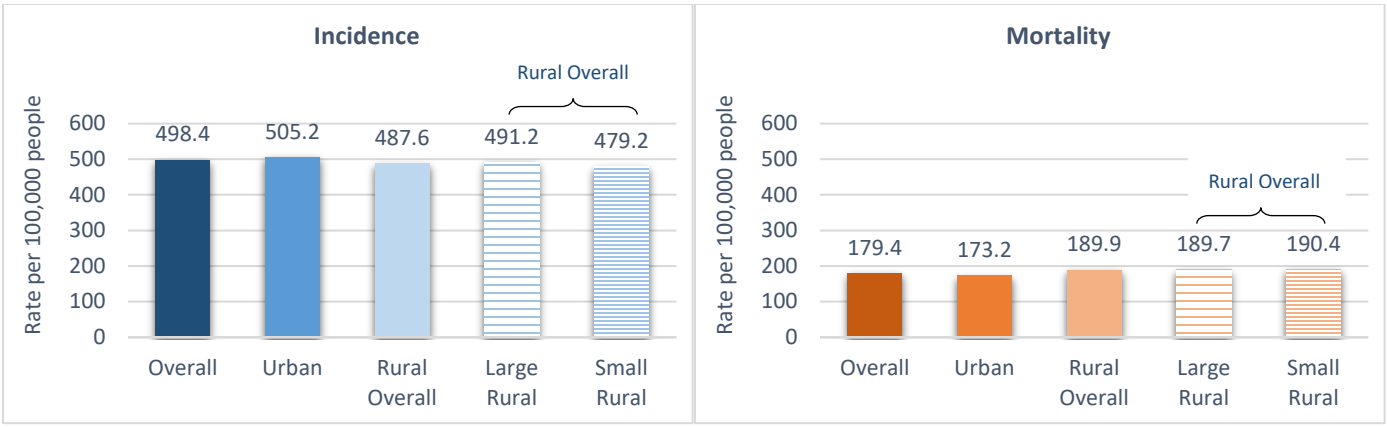



**Figure 1** maps counties in Oklahoma according to the 2013 RUCC classification system. Among the 77 counties in Oklahoma, 18 are urban counties (RUCC 1-3), 28 are large rural counties (RUCC 4-6) and 31 are small rural counties (RUCC 7-9). For more information, refer to Appendix 1 for definitions of every RUCC category and for a summary table of Oklahoma counties by RUCC.

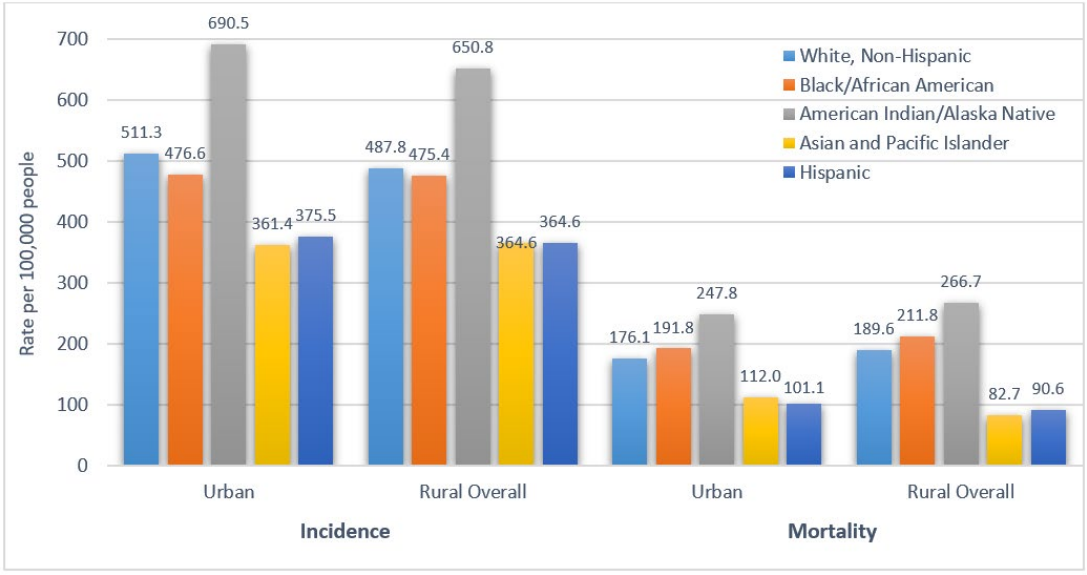
**Figure 2: Overall Age-adjusted Cancer Incidence and Mortality Rates for Urban and Rural Populations in Oklahoma, 2014-2018**




Source: OCCR and Oklahoma Vital Statistics

**Figure 2** shows overall age-adjusted cancer incidence and mortality rates for the entire state of Oklahoma and by urban and rural categories. The age-adjusted incidence rate is higher in urban Oklahoma than in rural Oklahoma, and within rural Oklahoma incidence is higher in larger rural counties than in smaller ones. Conversely for mortality, the age-adjusted mortality rate is lower in urban Oklahoma than in rural Oklahoma. Within rural Oklahoma virtually no difference in mortality was observed between large rural and small rural counties.

**Figure 3: Overall Age-adjusted Cancer Incidence and Mortality Rates for the Urban and Rural Populations by Race and Ethnicity in Oklahoma, 2014-2018**

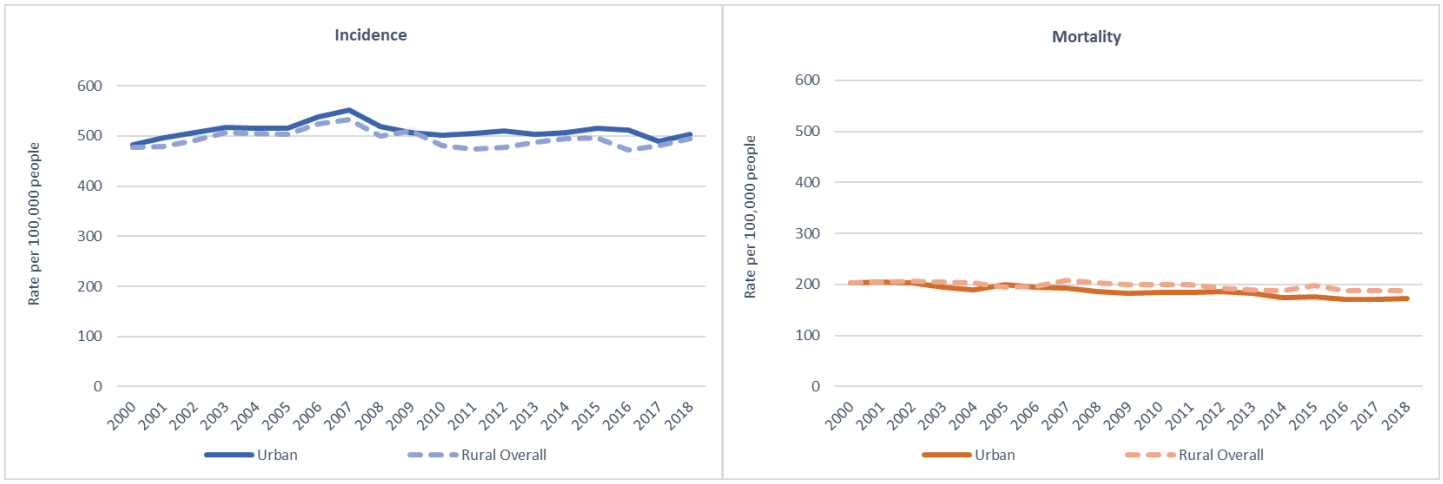



Source: OCCR and Oklahoma Vital Statistics

**Figure 3** shows age-adjusted incidence and mortality rates by race and ethnicity for the urban and rural populations in Oklahoma. For each racial and ethnic group, except the Asian and Pacific Islander group, the age-adjusted incidence rate was higher among the urban population than the rural one. The American Indian/Alaska Native group had the highest

incidence rates of all groups in both urban and rural Oklahoma locations. In contrast, mortality rates were higher among the rural populations than the urban ones for the Non-Hispanic White, Black/African American and American Indians/Alaska Native groups, but lower for the Asian/Pacific Islander and Hispanic groups. Among all groups, the American Indian/Alaska Native group had the highest mortality rate and the Black/African American group had the second highest mortality rate in both urban and rural counties.

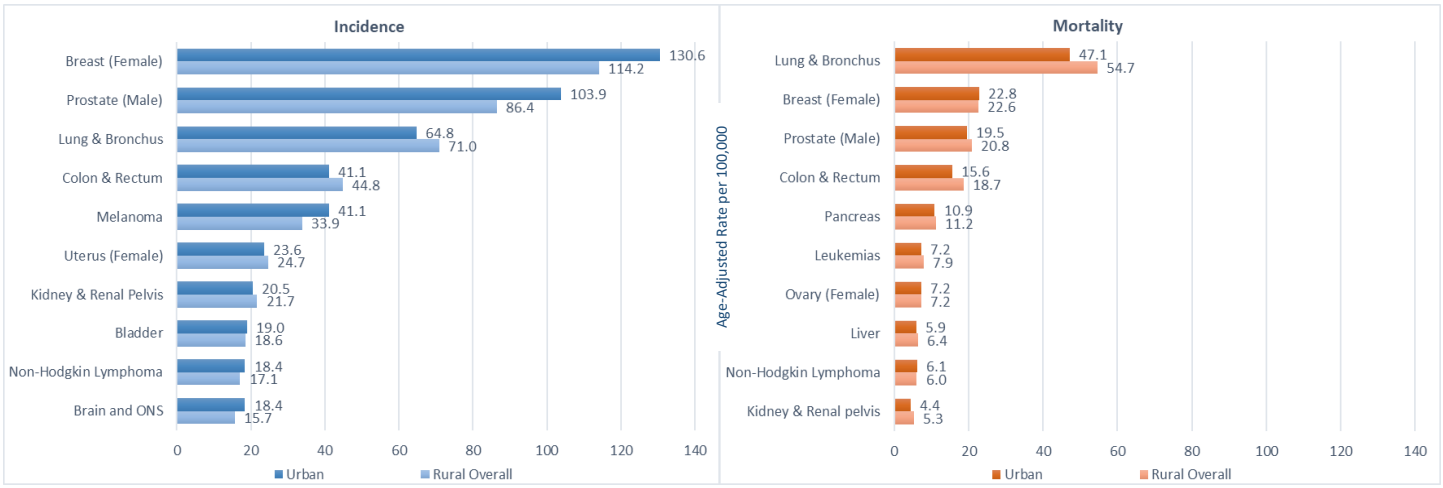
**Figure 4: Trend of Overall Age-Adjusted Cancer Incidence and Mortality Rates for the Urban and Rural Populations in Oklahoma, 2000-2018**




Source: OCCR and Oklahoma Vital Statistics

**Figure 4** shows trends of overall cancer incidence and mortality for the urban and rural populations in Oklahoma. For incidence, the urban population in Oklahoma has slightly higher rates for most time periods. Incidence rates have not trended lower in either the urban or rural populations. In contrast, cancer mortality rates have been slightly but persistently higher in the rural population than in the urban one. However, mortality rates have gradually trended downward in both the urban and rural populations.

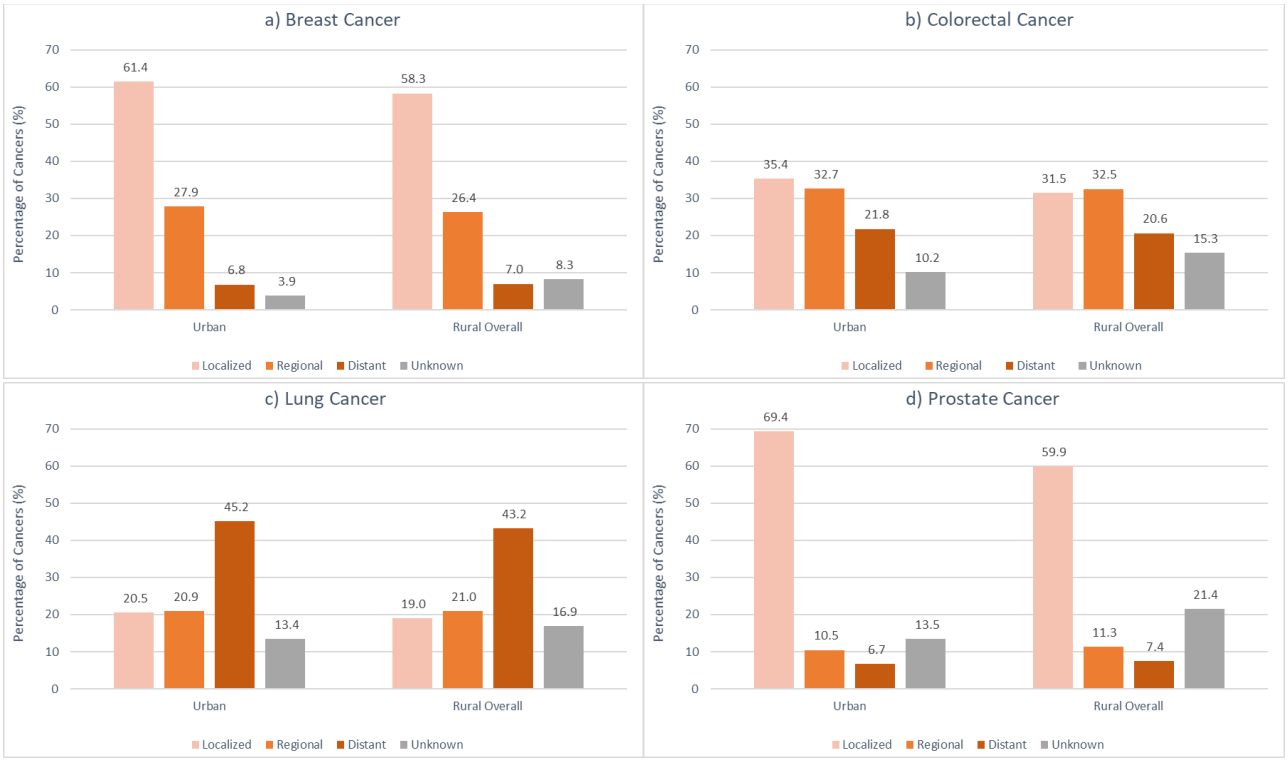
**Figure 5: Top 10 Cancers for Incidence and Mortality for the Urban and Rural Populations in Oklahoma, 2014-2018**




Source: OCCR and Oklahoma Vital Statistics

**Figure 5** ranks the top 10 cancers for incidence and mortality for the rural population in Oklahoma, and compares rates for these cancers to the corresponding rates for the urban population. Notably, the top 4 cancers for incidence match the top 4 cancers for mortality, and these cancers have much higher rates than the others. For incidence, the rural population in Oklahoma has higher incidence rates than the urban population for four of the top 10 cancers, with the most notable incidence disparities occurring for cancers of the lung and bronchus (1.1 times), colon and rectum (1.1 times), uterus, and kidney and renal pelvis (1.1 times). However, for mortality, the rural population has higher mortality rates for seven of the top 10 cancers, with the most notable mortality disparities occurring for cancers of lung and bronchus (1.2 times), colon and rectum (1.2 times), and kidney and renal pelvis (1.2 times).

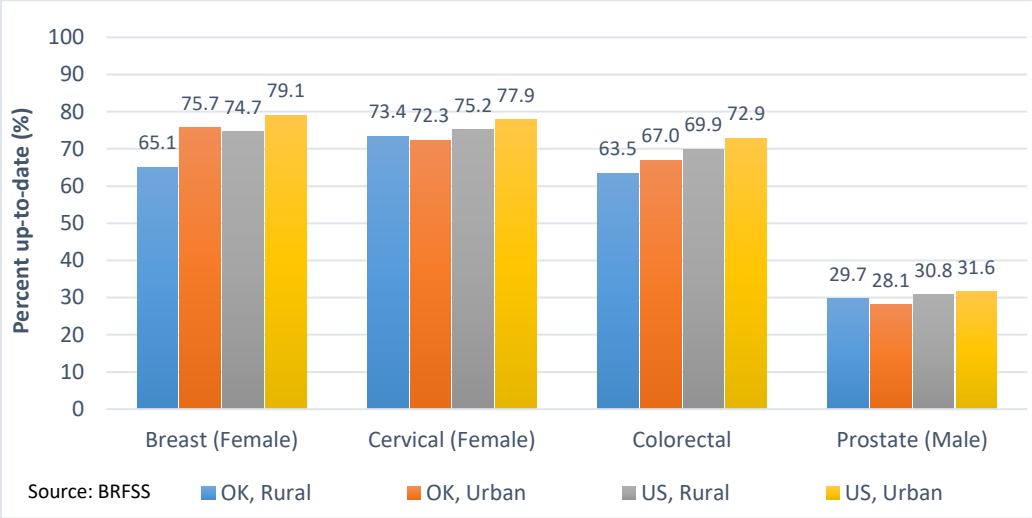
**Figure 6: Stage at Diagnosis for the Top 4 Cancers, Urban and Rural Populations in Oklahoma, 2014-2018**




Source: OCCR

**Figure 6** presents the stage at diagnosis for the top 4 cancers in urban and rural Oklahoma. Staging varies considerably by cancer site, but there are differences between rural and urban Oklahoma. Most breast cancers are diagnosed at the localized stage, but the percentage of unknown stage for breast cancer is higher in the rural Oklahoma population than in urban one. For colorectal cancer, the percentage of cancers diagnosed at the localized stage is lower and the percentage of ones diagnosed with an unknown stage is higher in the rural Oklahoma population than in the urban population. For lung cancer, most cancers are diagnosed at distant stage, but the percentage of unknown stage at the time of diagnosis is higher in the rural Oklahoma population than in urban one. Lastly for prostate cancer, the percentage of cancers diagnosed at the localized stage is much lower and the percentage diagnosed at an unknown stage is much higher in the rural Oklahoma population than in the urban one. Studies have shown that survival for cancers with an unknown stage is significantly poorer than for those with earlier stages such as localized stage.[10]

**Figure 7: Cancer Screening for the Urban and Rural Populations in Oklahoma and the United States, 2020**




**BRFSS Cancer Screening Definitions:**

**Breast:** Women aged 50-74 years having received a mammogram in the past 2 years

**Cervical**: Women aged 21-65 years having received a Pap test in the past 3 years

**Colorectal:** Adults aged 50-75 years who have fully met the USPSTF recommendation (blood stool test in the past year, and/or sigmoidoscopy in the past 5 years, and/or colonoscopy in the past 10 years, and/or stool DNA test within the past 3 years, and/or virtual colonoscopy within the past 5 years)

**Prostate:** Men aged 40 years and above having received a PSA test in the past 2 years

**Figure 7** shows the percentage of up-to-date cancer screening for the urban and rural populations in Oklahoma and the US. When comparing rural women to urban women in Oklahoma and the US, rural women in Oklahoma are the least likely to be up-to-date with breast cancer screening. For cervical cancer screening, rural women in Oklahoma are less likely be up-to-date than rural and urban women in the US, but more likely than urban women in Oklahoma. The figure also shows that rural residents in Oklahoma are the least likely of the four groups to be up-to-date with colorectal cancer screening. For prostate cancer, rural men in Oklahoma are less likely be up-to-date than rural and urban men in the US, but more likely to be up-to-date on prostate cancer screening than urban men in Oklahoma.

## Conclusions and Implications for Practice and Policy

Findings from this brief demonstrate the need to address the higher overall cancer mortality rate documented for the rural population of Oklahoma. The state's rural population has higher mortality rates for seven of the top 10 cancers for mortality. In particular, the rural population experienced high incidence rates and even higher mortality rates for cancers of the lung and bronchus, colon and rectum, and kidney and renal pelvis.

To improve cancer outcomes and mitigate disparities, one approach is to increase receipt of evidence-based cancer screenings. Compared to their national counterparts, both the rural and the urban populations of Oklahoma reported lower screening rates for each type of cancer screening test. Screening rates for breast and colorectal cancer were especially low in the rural population of Oklahoma. For rural populations, barriers to accessing cancer screening include lack of education, financial and health insurance barriers[11,12] and also transportation barriers, such as the need to travel long distances to receive screening tests.[13,14] Financial barriers to screening for many rural (and urban) residents have been reduced because Oklahoma voters passed Initiative 802 to expanded Medicaid coverage through the Affordable Care Act, which went to effect in 2021. However, many rural residents in Oklahoma still face distance barriers to screening. It is likely that this has been exacerbated by the spate of rural hospital and clinic closures that have affected the state in recent years.[15] To address distance barriers, mobile outreach to rural communities, such as is currently being done statewide for mammography, could be expanded to include additional evidence-based cancer prevention and screening services.

Furthermore, the rural-urban gap in cancer mortality can be explained at least in part by delays in diagnosis leading to late-stage presentation and an unknown stage at the time of diagnosis for many cancers. In fact, reduced access to care and specialist services increases the risk of advanced or unknown stage at diagnosis.[16] Financial concerns cause many individuals with symptoms to delay health care, which can be devastating in terms of cancer outcomes.[17] Importantly, the aforementioned expansion of Medicaid coverage in Oklahoma for individuals between the ages of 19-64 through the Affordable Care Act will help reduce financial barriers to cancer-related care for many low-income individuals in the state, and particularly in rural areas where poverty rates are highest. Additionally, campaigns to increase public awareness of when to seek health care when specific-cancer related symptoms arise could be directed towards rural populations in an effort to reduce late or unknown stage at the time of initial diagnosis.

Also, efforts to improve the quality of cancer treatment in rural populations are warranted. For example, clinical trials advance cancer treatment and persons participating in clinical trials have been shown to receive high-quality care.[18] This is why it is imperative that clinical trials enroll participants from diverse backgrounds, including those who live in rural areas. Funding for research should be directed in ways that ensure diversity among patients enrolled into cancer clinical trials. One way to do accomplish greater clinical trials participation among cancer patients from rural locations is to develop and support partnerships between academic centers with expertise in clinical trials research and community oncology practices.

These and additional actions are needed in order to achieve the ambitious, but worthy, goal of eliminating cancer disparities among the rural population of Oklahoma.

**Suggested Citation:** Sambo AB, Campbell JE, Hunsucker LA, Pharr SF, and Doescher MP. Cancer in Oklahoma Data Brief Series: Cancer in Rural Oklahoma. Community Outreach and Engagement, Stephenson Cancer Center, OU Health. 2022 Sep.; 2(6).

For more information, please contact: Community Outreach and Engagement, Stephenson Cancer Center, OU Health. Email: SCC-surveillance@ouhsc.edu

**References:**


1. US Cancer Statistics Working Group. U.S. Cancer Statistics Data Visualizations Tool, based on 2020 submission data (1999-2018): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; www.cdc.gov/cancer/dataviz. Accessed Apr. 18, 2022.

2. U.S. Department of Agriculture. Economic Research Service. State Fact Sheets, March 29, 2022. https://www.ers.usda.gov/data-products/state-fact-sheets. Accessed Apr. 25, 2022.

3. U.S. Department of Agriculture. Economic Research Service. Rural Classifications, June 17, 2021. https://www.ers.usda.gov/topics/rural-economy-population/rural-classifications/. Accessed June 13, 2022.

4. U.S. Department of Agriculture. Economic Research Service. Rural Urban Continuum Codes, Dec. 10, 2020. https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/. Accessed June 13, 2022.

5. Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. 2020.

6. Dobis EA, Krumel TP, Cromartie J, Conley KL, Sanders A, Ortiz R. Rural America at a Glance: 2021 Edition. 3. U.S. Department of Agriculture. Economic Research Service.

7. Doogan NJ, Roberts ME, Wewers ME, et al. A growing geographic disparity: Rural and urban cigarette smoking trends in the United States. *Prev Med*. 2017;104:79-85.

8. Lundeen EA, Park S, Pan L, O'Toole T, Matthews K, Blanck HM. Obesity prevalence among adults living in metropolitan and nonmetropolitan counties - United States, 2016. *MMWR Morb Mortal Wkly Rep.* 2018;67(23):653-658.

9. Lam O, Broderick B, Toor S. How far Americans live from the closest hospital differs by community type [online]. Pew Research Center, December 2018.

10. Luo Q, Yu XQ, Cooke-Yarborough C, Smith DP, O'Connell DL. Characteristics of cases with unknown stage prostate cancer in a population-based cancer registry. *Cancer Epidemiol*. 2013;37(6):813-819. doi:10.1016/j.canep.2013.09.008

11. Wang H, Roy S, Kim J, Farazi PA, Siahpush M, Su D. Barriers of colorectal cancer screening in rural USA: a systematic review. *Rural and Remote Health*. 2019;19(3). doi:https://doi.org/10.22605/RRH5181

12. Charlton M, Schlichting J, Chioreso C, Ward M, Vikas P. Challenges of Rural Cancer Care in the United States. *Oncology* (Williston Park). 2015;29(9):633-640.

13. Shete S, Deng Y, Shannon J, et al. Differences in Breast and Colorectal Cancer Screening Adherence Among Women Residing in Urban and Rural Communities in the United States. *JAMA Netw Open.* 2021;4(10):e2128000. Published 2021 Oct 1. doi:10.1001/jamanetworkopen.2021.28000

14. Chandak A, Nayar P, Lin G. Rural-Urban Disparities in Access to Breast Cancer Screening: A Spatial Clustering Analysis. *J Rural Health*. 2019;35(2):229-235. doi:10.1111/jrh.12308

15. McCarthy S, Moore D, Smedley WA, et al. Impact of Rural Hospital Closures on Health-Care Access. *J Surg Res.* 2021;258:170-178. doi:10.1016/j.jss.2020.08.055

16. Tracey E, McCaughan B, Badgery-Parker T, Young J, Armstrong B. Distance from accessible specialist care and other determinants of advanced or unknown stage at diagnosis of people with non-small cell lung cancer: A data linkage study. *Lung Cancer*. 2015;90(1):15-21.

17. Timothy HP, King WD, Thibodeau S, et al. Mortality due to cancer treatment delay: systematic review and meta-analysis. *BMJ*. 2020;371:m4087. doi:10.1136/bmj.m4087

18. Weber JS, Levit LA, Adamson PC, et al. American Society of Clinical Oncology policy statement update: the critical role of phase I trials in cancer research and treatment [published correction appears in J Clin Oncol. 2019 Feb 1;37(4):353]. *J Clin Oncol*. 2015;33(3):278-284. doi:10.1200/JCO.2014.58.2635

## Data Sources:

Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2020.

Oklahoma State Department of Health (OSDH), Center for Health Statistics, Health Care Information, Vital Statistics, on Oklahoma Statistics on Health Available for Everyone (OK2SHARE). https://www.health.state.ok.us/stats/Registries/cancer/Final/mortality.shtml

Oklahoma State Department of Health (OSDH), Disease, Prevention, & Preparedness Service, Chronic Disease Service, Oklahoma Central Cancer Registry (OCCR), on Oklahoma Statistics on Health Available for Everyone (OK2SHARE). https://www.health.state.ok.us/stats/Registries/cancer/Final/Statistics.shtml