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Rural Disparities in Cancer Care: A Review of Its Implications and Possible Interventions

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Abstract

Cancer care has greatly improved in the last few decades, as evidenced by a 22% decline in the overall cancer-related death rate in the United States since 1991. However, the question presents itself whether rural residents, for whom the latest advancements are not as accessible, are also realizing these benefits as much as their urban counterparts. The aim of this study is to provide a review of the literature regarding the disparities in cancer care facing rural Appalachia and specifically West Virginia (WV) as well as possible solutions towards bridging this gap. We find that WV has a higher cancer incidence and mortality rate with fewer oncologists per resident, while rural areas in general have lower clinical trial participation and different treatment regimens. Though programs have been put in place such as mobile mammography clinics and local outreach, more work can be done in WV in the realms of teleoncology, virtual tumor boards, patient support groups, and physician training programs.

Introduction

In West Virginia (WV), the overall cancer-related death rate from 2008-2012 was 191.1 deaths per 100,000 residents, significantly higher than the national average of 166.4 (Table 1).[1] Though trends suggest that overall cancer-related death rates are falling both in WV and nationally, the 12% relative decline noted in WV from 1990 to 2011 lags behind the 22% national average decline, placing it second lowest behind Oklahoma at 9%.[2] This suggests a disparity in cancer care between WV and the nation at-large, which has prompted many studies examining this issue. Furthermore, such disparities have direct implications for WV given that it has the third highest national proportion of the elderly (those 65 years of age or older) at 17.3% of its population, and the elderly tend to have more cancer diagnoses.[3] As the segment of the aging population continues to increase so will the burden of cancer care in WV and the US. In fact, by 2030, total projected cancer incidence is estimated to increase by roughly 45% primarily driven by a 67% increase in cancer diagnoses of the elderly.[4]

Rural Cancer Incidence

Residents of WV from 2008-2012 had age-adjusted all-site cancer incidences of roughly 456.3 new diagnoses per 100,000 residents per year, which is significantly higher than the national rate of 432.3.[1] Cancer sites with significantly higher incidence rates in WV include lung, colorectal, bladder, kidney and renal pelvis, and cervical cancers (interestingly, prostate cancer had a significantly lower incidence rate). A variety of factors that differentiate residents of Appalachia (defined as regions in Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and all of WV) from other Americans likely contribute, including lower income and education levels as well as higher rates of poor health behaviors (ie. tobacco use).[5,6] Even among their Appalachian counterparts, WV residents have a higher incidence of particular cancers, such as cervical cancer.[7] Environmental exposures may play a role in increased cancer incidence in WV, as residents of rural counties with mountaintop coal mining have been found to have increased community cancer risk.[8] However, this merits more robust study given that results of research on this topic are mixed.[9]

Interestingly, when looking at cancer incidence rates at the county level in WV, urban counties constitute the top three spots and rural counties the bottom two (using the Health Resources Service Administration's definition of rural).[10] Hampshire, Cabell, and Wirt counties have the highest incidence rates at 594.8 (95% CI: 553.7 - 638.3), 590.1 (95% CI: 569.9 - 610.9), and 572.1 (95% CI: 493.7 - 660.1) cases per 100,000 residents, whereas Doddridge (336.7; 95% CI: 283.0 - 398.2) and Grant (343.5; 95% CI: 303.3 - 387.9) counties have the lowest.[11]

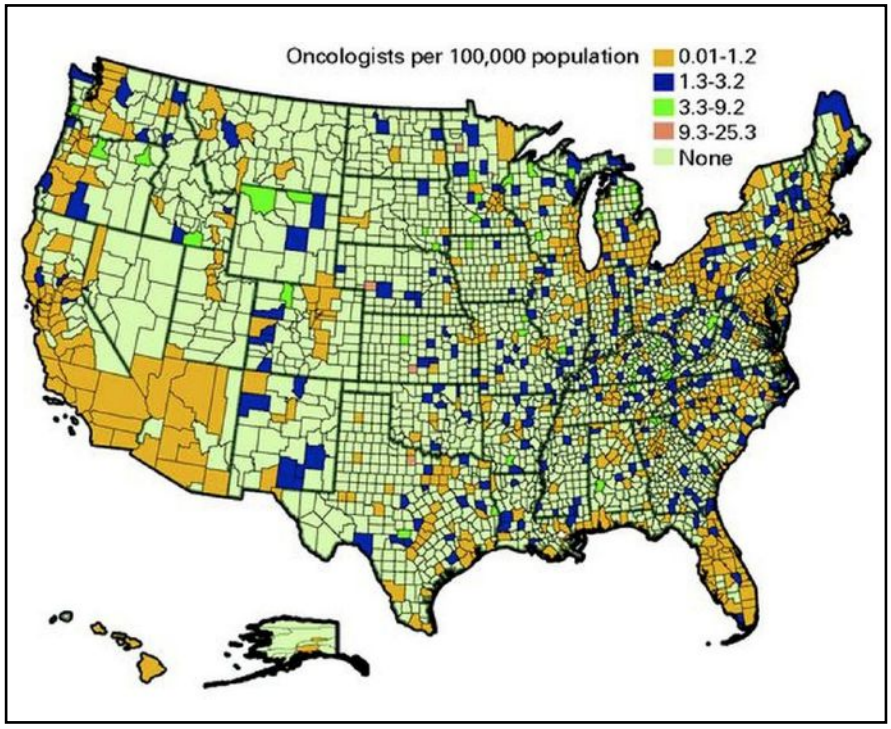
Objectives

1. *To describe the disparities in cancer care in West Virginia*
2. *To recognize possible solutions to cancer care disparities*

Table 1

Rates (per 100,000 residents)	United States of America	West Virginia	WV / National Ratios
All-Site Cancer Incidence Rate	432.3	456.3	1.056 (95% CI: 1.034 - 1.079)
All-Site Cancer Mortality Rate	166.4	191.1	1.149 (95% CI: 1.011 - 1.187)
Lung and Bronchus Cancer Incidence Rate	60.4	77.1	1.278 (95% CI: 1.212 - 1.345)
Lung and Bronchus Cancer Mortality Rate	45.0	59.6	1.324 (95% CI: 1.248 - 1.405)
Breast Cancer Incidence Rate	122.1	115.2	0.944 (95% CI: 0.904 - 0.985)
Breast Cancer Mortality Rate	21.3	22.3	1.047 (95% CI: 0.950 - 1.153)
Prostate Cancer Incidence Rate	105.1	90.4	0.860 (95% CI: 0.820 - 0.902)
Prostate Cancer Mortality Rate	19.6	16.0	0.807 (95% CI: 0.720 - 0.904)
Colorectal Cancer Incidence Rate	38.9	44.3	1.137 (95% CI: 1.062 - 1.219)
Colorectal Cancer Mortality Rate	14.7	17.2	1.171 (95% CI: 1.049 - 1.308)
Bladder Cancer Incidence Rate	20.2	24.5	1.213 (95% CI: 1.106 - 1.330)
Bladder Cancer Mortality Rate	4.4	4.5	1.018 (95% CI: 0.821- 1.263)
Kidney and Renal Pelvis Cancer Incidence Rate	15.8	18.7	1.182 (95% CI: 1.063 - 1.313)
Kidney and Renal Pelvis Cancer Mortality Rate	3.8	3.5	0.923 (95% CI: 0.724 - 1.178)
Cervical Cancer Incidence Rate	7.4	9.6	1.298 (95% CI: 1.120 - 1.505)
Cervical Cancer Mortality Rate	2.3	3.4	1.478 (95% CI: 1.154 - 1.895)

Figure 1



Further research is needed to investigate the factors such as greater amounts of air pollution that might account for higher cancer incidence in urban counties.

Physician Supply and Mortality

Also of relevance to treatment of cancer is the supply and training of physicians. At the moment, 10% of physicians practice in rural areas, and only 4.8% of newly trained physicians are choosing to practice in such areas.[12] In WV, there are currently 76 oncologists, which for a population of roughly 1.85 million translates to an oncologist density of 4.1 specialists per 100,000 residents.[13] This falls on the lower end of the rest of the country, and of particular note is the scarcity of cancer specialists in many counties throughout the state (Figure 1, Kirkwood et al.).[14]

The importance of physician supply at the county-level to cancer survival is well supported in the literature. Aneja et al. has found that the presence of one radiation oncologist in a county results in a nearly 5% decline in prostate-cancer related deaths,[15] and even more robust mortality reductions have been noted for esophageal (22-79%) pancreatic (27-51%), and colorectal (12-47%) cancers.[16,17,18] The presence of one urologist in a county also may lead to a roughly 20% reduction in prostate and bladder cancer-related

deaths.[19] Similar trends exist for other cancers; for example, rural county residence is associated with a 5% increase in sarcoma-related mortality.[20] Likewise, residents who lived more than 50 miles away from a gynecologic oncologist had a nearly 60% higher risk of ovarian cancer mortality.[21]

Thus, the establishment of training programs in medical oncology and radiation oncology is key to ensuring that an adequate cancer workforce is available. Both West Virginia University and Marshall University Schools of Medicine currently have medical oncology fellowships, though neither at the moment has residency programs in radiation oncology.[22,23]

WV has significantly higher mortality rates for all-sites, as well as lung and bronchus, colorectal, and cervical cancers. When further examining the data by country, from 2008-2012, the top four counties with the highest cancer-related mortality rates per 100,000 residents were Webster (248.3; 95% CI: 209.8-292.4; urban), Wyoming (240.5; 95% CI: 215.5-268.4; rural), Lincoln (240.5; 95% CI: 214.0-269.6; urban), and Mingo (240.4; 95% CI: 216.0-266.9; rural) counties. Those with the lowest mortality-rates were Hardy (151.4; 95% CI: 126.7-179.9), Grant (129.7; 95% CI: 105.6-158.2), and Pendleton (127.9; 95% CI: 101.0-161.1) counties, all of which are rural.[2] Given that two of the top four are urban counties, this suggests that physician supply/proximity may be only one of a variety of factors that account for the higher mortality rates observed in WV. Even so, the effect of access to oncologists and radiation oncologists on cancer death rates has been supported by many studies in the literature.

Prevention and Treatment of Cancer in Rural America

The incidence of cancer is generally higher in Appalachia.[24] Additionally, mortality to incidence ratios are higher, specifically for breast, cervical, and prostate cancers, which some attribute to a lack of federally qualified health centers that provide cancer screening.[25] Lower rates of screening in rural areas are documented in the literature. For example, in Kentucky, residents of Appalachian counties were half as likely to have a colonoscopy or sigmoidoscopy performed within the past 10 years as their non-Appalachian counterparts.[26] As many screenings, such as colonoscopies, often are dependent upon physician recommendation, it is likely that factors such as lack of access to primary care contribute to these findings. This has implications for delayed presentation and initial staging of cancer. For example, white and African-American women residing in rural Mississippi were 4% and 19% more likely, respectively, to be diagnosed with advanced regional/distant breast cancer than their urban counterparts.[27] Similarly, late-stage diagnosis of melanomas is associated with areas of lower median education levels, as is the case in rural counties.[28]

Many studies have also focused on differences in breast cancer treatment in rural areas and implications for survival. Freeman et al. showed that following surgery, early-stage breast cancer patients in Appalachian counties of Kentucky are less likely to receive adjuvant radiation therapy,[29] which is associated with a 12.1% decline in 10 year survival.[30] This has been confirmed by other studies and is attributed to a paucity of radiation oncologists as well as radiation therapy facilities.[31] Additionally, patients in rural areas may be less likely to receive adjuvant chemotherapy. In a study of breast cancer patients in Wisconsin having similar likelihoods of recurrence, Andreason et al. revealed only 36% of rural patients underwent adjuvant chemotherapy compared to 52% of those in urban areas.[32] All of these factors likely contribute to changes in breast cancer mortality in rural areas. Though the number of breast cancer-related deaths in Appalachia have declined by 17.5% from 1969-2007, this reduction is not as robust as that observed in non-Appalachian counties (28.3%).[33]

Variations in treatment regimens for rural patients also exist for other cancers. Notably, retrospective studies have found that only 46.5% of elderly lung cancer patients in rural and medically-underserved areas of WV received guideline-concordant care, which was associated with a nearly one year decline in survival outcomes.[34] Baldwin et al. observed that rural cases of early-stage prostate cancers are 3.4% less likely to receive standard treatment regimens.[35] Similarly, rural patients with stage III colon cancer who had to travel 50 miles or greater were less likely to receive adjuvant treatment than those closer to treatment sites.[36]

Clinical Trials in Appalachia

Also of importance is whether rural patients are given the opportunity to participate in clinical trials, which may provide novel treatment strategies for cancer sites with poorer prognoses such as brain neoplasms and other cancers that have progressed on standard therapy. Prior studies have demonstrated that areas with higher socioeconomic levels, approved cancer programs, and greater oncologist density (all of which are significantly lower in rural Appalachia) are associated with increased clinical trial participation.[37] Furthermore, research shows that rural residents are much less likely to be recruited for such trials.[38]

There are barriers to involving rural participants in clinical trials. A survey of principal investigators'(PIs) attitudes at 5 academic centers in South Carolina found that PIs perceive rural residents as being the most difficult to recruit.

Reaching out through local doctors for participants was not common, and it was very uncommon to look for other means (ie. faith-based organizations, television, radio, etc.) of participant recruitment.[39] Furthermore, PIs perceive rural residents as having less knowledge and understanding of clinical trials.[40] From the perspective of patients, residents of rural areas often believe that clinical trials are deceptive in nature, lack general knowledge regarding the purpose of clinical trials, and are often dissuaded by complicated informed consent forms. These barriers make rural residents less likely to participate in clinical trials relative to urban residents.[41,42]

Review of Attempted Solutions

Telemedicine, or the use of telecommunication to provide medical care from a distance, may have a role in improving cancer care in rural areas. Perhaps the most prominent example of teleoncology in the US is the University of Kansas Medical Center's (UKMC), which reported successful implementation of remote supervision of chemotherapy.[43] Patients come to a local health site where a nurse follows directions for the physical exam from the oncologist communicating via video. Relevant information, such as labwork, radiographs, etc., is then faxed to the corresponding oncologist for continuous review and monitoring. To provide incentives for chemotherapy administration, this system had local sites collect revenues. Costs in this model decreased with time and steadily approached those of traditional encounters. Patient satisfaction from other models of telemedicine was positive overall following treatment.[44,45] Roughly half of patients in the UKMC study had some concerns regarding nurses rather than physicians performing certain aspects of the physical exam, though all patients surveyed expressed satisfaction with the model overall. Telemedicine may also be particularly helpful for post-treatment follow-ups. For example, a study done in British Columbia, Canada, found that a telemedicine program for colorectal cancer patients with geographic barriers led to a rise in the number of follow-ups with 80% of patients satisfied with the program.[46]

Of concern with telemedicine is the safety of remotely monitoring chemotherapy. Pathmanathan et al. compared the incidence of adverse effects (ie. febrile neutropenia, diarrhea, vomiting) between rural and urban patients in Australia with either metastatic colorectal or node-positive breast cancers undergoing chemotherapy treatment over a 24 month period, and no significant difference in the occurrence of any side effects was noted.[47] Similarly, ambulatory cancer patients in Singapore were monitored via a pharmacist-run teleoncology service, which utilized a short-message-service algorithm to guide patients thru a decision-making process to provide information should a

pharmacist not be available to talk. This trial had 73% adherence, and of those who completed the service, nearly 2/3 of patients were satisfied.[48] These results support the feasibility and safety of chemotherapy administration and monitoring via telemedicine.

Unlike chemotherapy, radiation therapy is more difficult to provide remotely given high financial barriers to obtaining the necessary equipment. As such, rural patients travel to large referral centers to receive radiation, though telemedicine may be of use in reducing trips for treatment planning and simpler protocols (ie. external beam radiation as opposed to brachytherapy, which requires more active surveillance). In Japan, one study was able to accurately transmit radiotherapy plans from a workstation at a cancer center to an affiliated hospital 50 km away to allow for editing of beam data remotely.[49] Prior studies conducted in Japan also demonstrated accurate reproducibility of planned isocenters (the point at which beams of radiation converge) for 3D-conventional radiotherapy.[50] Similar successful attempts at a teleradiotherapy network were reported in Germany for treatment of Hodgkin's lymphoma by means of high-quality transfer of imaging data and real-time teleconferences.[51]

Unique to cancer care, particularly for more difficult and rare cases, are tumor boards. Thus, telemedicine's application led to the advent of virtual tumor boards (VTBs) to allow local providers the opportunity to consult with specialists. As an example, the University of North Carolina (UNC) offered this option to community physicians. Ninety-one percent of participating UNC oncologists felt that the presenting physician's questions were addressed and that the information provided was adequate for discussion, and 19% felt that VTBs were less likely to lead to a consensus on treatment. Furthermore, only 9% experienced some sort of technology glitch during meetings. VTBs seem to be a viable and satisfactory option, though noted barriers include a lack of time for such meetings.[52] Other VTB initiatives by Baylor and in the UK have been implemented with high physician satisfaction.[53,54] VTBs have been noted to increase the likelihood that cases from community centers are discussed at tumor boards, expedite the process of interdisciplinary discussion, and reduce travel burden for rural providers.[55]

Telemedicine also has the potential to improve management of cancer-associated mental health issues. In rural areas, patients do not have access to support groups or counselors. A virtual connection of patients facing similar circumstances to address associated symptoms such as depression and pain could be helpful. As an example, a Stanford study found that breast cancer patients in rural areas showed significant decreases in both depression as well as post-traumatic stress disorder (PTSD) symptoms after participating in a videoconference support group.[56] The Indiana Cancer Pain and Depression Trial (INCPAD) noted similar results as patients who received telecare management via telephone and automated symptom monitoring had declines in depression and pain scores.[57]

Other initiatives aim at educating providers and patients about cancer care through developing networks between community stakeholders and cancer providers. Of most relevance to WV is the Appalachian Community Cancer Network (ACCN), a National Cancer Institute-designated Community Network Program with partners in Kentucky, Ohio, Pennsylvania, Virginia, and WV. In WV, the ACCN has worked closely with the Webster County Cancer Education Project to provide breast and cervical cancer screening as well as the Wetzel County Cancer Coalition to assist patients with transportation for treatment.[58] The network also provides guidance, support, and mini-grants to organizations facing difficulty in implementing educational interventions.[59] WVU also has a mobile mammography clinic, which in 2009 was able to provide 360 mammograms in 20 counties across the state, with roughly 50% of women from underserved backgrounds, and by 2015 had provided services to nearly 8,700 women.[60,61] A statewide network has also been established to involve more WV residents in clinical trials.[62]

Outside of WV, there are other successful rural outreach and educational programs. Physician awareness programs in Arkansas have led to significant increases in screening recommendations for prostate, breast, and colorectal cancers.[63,64] Similarly, in Mississippi, an educational outreach program had 883 community volunteers complete 16 hours of training in cancer awareness and the importance of clinical trials. The volunteers also attended monthly continuing education meetings to disseminate information in their respective communities regarding screenings provided by the state's Department of Health. Following the program, pap smears increased 23% and mammograms increased 117%.[65]

Conclusion

Disparities in rural Appalachia with regards to cancer incidence, mortality, and treatment are well documented. To address the lack of specialists practicing in rural WV, a variety of education and screening outreach programs have been implemented and met with success. However, other possible solutions, notably telemedicine, virtual tumor boards, patient support programs, and physician training programs in radiation oncology have yet to be implemented or documented in WV. Success with

these initiatives in areas facing similar challenges suggests more work can be done to bridge the gap in cancer care for West Virginians.

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CME Post-Test

18. The all-site cancer mortality rate per 100,000 residents in WV is significantly higher than the national average. a. True b. False

19. Monitoring of chemotherapy via telemedicine has proven to be as safe as traditional encounters in studies done thus far. a. True b. False

20. The oncologist density in WV is roughly 10 per 100,000 residents. a. True b. False