© Health Research and Educational Trust
DOI: 10.1111/1475-6773.12050
METHODS BRIEF

The Influence of Visiting Consultant Clinics on Measures of Access to Cancer Care: Evidence from the State of Iowa

Roger Tracy, Inwoo Nam, and Thomas S. Gruca

Objective. To determine the effect of visiting consultant clinics on measures of access to cancer care for rural patients.

Data Sources. 2010 Visiting Medical Consultant Database for the state of Iowa (Carver College of Medicine) and the Iowa Physicians Information System (Carver College of Medicine).

Study Design. We compared shortest driving times to the nearest medical oncologist for all Iowa census tracts under two scenarios: including only primary practice locations and adding monthly visiting consultant clinic locations.

Principal Findings. For rural Iowans, the median driving time to the closest site for medical oncology care falls from 51.6 to 19.2 minutes when monthly visiting consultant clinics are considered.

Conclusions. Including visiting consultant clinics has a significant impact on measures of geographic access to cancer care.

Key Words. Rural, access, cancer, medical oncologists

Cancer is the second leading cause of death in the United States (Xu et al. 2010). The specialized resources for treating cancer are usually located in urban medical centers and a small number of rural areas with sizable populations (Baldwin et al. 2008). This geographical concentration of cancer treatment resources could have important implications for the 62 million Americans living in rural areas (Office of Rural Health Policy 2011) who report higher levels of cancer than their urban counterparts (Jones et al. 2009). Reduced access to cancer treatment may affect the quality of care that rural patients receive. For example, rural cancer patients are less likely to participate in clinical trials (Baquet et al. 2006) or receive state-of-the-art treatments (Howe et al. 1992; Celaya et al. 2006) and they have higher mortality for some types of cancers (Howe et al. 1992; Monroe, Ricketts, and Savitz 1992).

To measure access to cancer treatment, prior studies measure the shortest travel times from the office locations of oncologists to either patient locations (Chan, Hart, and Goodman 2006) or population locations (Onega et al. 2008) as designated by zip code centroids. However, many rural hospitals host regular visiting consultant clinics (hereafter VCCs) conducted by oncologists from nearby urban areas (Tracy, Saltzman, and Wakefield 1996; Hicks, Hassinger, and Taparanskas 1997; Wakefield, Tracy, and Einhellig 1997; Kellerman et al. 2001; Drew et al. 2006). Through an oncology VCC, cancer patients may receive chemotherapy, biological treatments, and pain management services in their local community. Therefore, using physician office locations to determine rural patient proximity to available cancer care may introduce a significant bias in the resulting estimates of patient travel times. Using the state of Iowa as a case study, we examine how the presence of VCCs in rural communities affects the estimated average travel times for rural residents. For rural residents of Iowa, the median driving time to the closest site for medical oncology care falls from 51.6 to 19.2 minutes when monthly VCC sites are considered. At the state level, the proportion of the population within a 30-minute drive of a medical oncology care site increases from 57 to 89 percent when monthly oncology VCC sites are considered. Clearly, visiting consultant clinic sites are an important mechanism for providing medical oncology services in rural communities and need to be included in any studies of geographic access to cancer care in rural areas.

RESEARCH QUESTIONS

We performed analyses to address the following research questions:

1. How does the inclusion of VCC sites affect the average travel times for Iowa residents when measuring the closest site for medical oncology services?
2. How does the inclusion of medical oncology VCC sites vary in their effect on the minimum travel time based on the type of location, that is, urban area, large rural city, small rural town, isolated rural town?

Address correspondence to Thomas S. Gruca, Ph.D., Tippie College of Business, University of Iowa, Iowa City, IA 52242-1994; e-mail: thomas-gruca@uiowa.edu. Roger Tracy, M.A., is with the Office of Statewide Clinical Education Programs, Carver College of Medicine, University of Iowa, Iowa City, IA. Inwoo Nam, Ph.D., is with the College of Business, Chung-Ang University, Seoul, South Korea.

3. At the state level, how does the inclusion of medical oncology VCC sites affect the proportion of the population located within 10, 20, 30, or more minutes of driving time from the closest medical oncology care site?

METHODS

Study Population

Our analyses used data from the Visiting Medical Consultant Database maintained by the Office of Statewide Clinical Education Programs (OSCEP) in the Carver College of Medicine at the University of Iowa. The office conducts an annual census of all worksites which employ one or more health professionals (including physicians, dentists, pharmacists, physician assistants, and nurse practitioners) on a full-time or part-time basis. The inventory of worksites, including all hospitals and medical clinics, is continually updated throughout the year using a wide range of sources. The data collected include the location, setting (name of hospital or clinic), affiliations of participating medical oncologists, location of the medical oncologist's primary practice, and visit frequency. This study uses the data collected for the year 2010.

The Iowa Physicians Information System, also from the OSCEP, provided information on the practice locations of all Iowa-based medical oncologists. Comparable information for bordering states came from the Visiting Medical Consultant Database (multiple years) and other sources.

Measures

U.S. Census Bureau city data provide latitudes and longitudes for the locations of medical oncologist primary practice sites and VCC locations. For patient populations, we used the latitude and longitude data from the 2010 US Census at the census tract level. These data also provided current (2010) population estimates. We used the Census tract as our unit of analysis as rural zip codes tend to be larger than in urban areas (Jones et al. 2010). Jones et al. (2010) found that the bias introduced using zip code centroids instead of actual patient addresses is relatively small, even in rural areas. Therefore, we expect that using Census tracts, which tend to be much smaller than zip codes in rural areas, is an appropriate unit of analysis for this type of study.

We coded every census tract in Iowa using the rural–urban commuting area codes (RUCA) from 2000 (Morrill, Cromartie, and Hart 1999). There are 30 different RUCA designations. We aggregated the census tracts into four categories: Urban areas (RUCA codes = 1.0, 1.1, 2.0, 2.1, 2.2, 3.0, 4.1, 5.1, 7.1, 8.1, 10.1), large rural city (RUCA = 4.0, 5.0, 6.0), small rural town (RUCA = 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2), and isolated rural town (RUCA = 10.0, 10.2, 10.3, 10.4, 10.5).

Forty-four new census tracts in the 2010 data do not appear in the 2000 Census. For these missing observations, we used the designation from the adjoining census tracts. Of these 44 missing observations, 42 were in urban areas where a relevant change in commuting patterns is unlikely. Therefore, we expect there to be little bias introduced by this imputation method for missing data.

Driving times and distances between medical oncology office locations or VCC locations and all census tracts in Iowa were computed using MPMile-Charter and Microsoft MapPoint.

RESULTS

Our sample consisted of 80 VCCs conducted by medical oncologists at rural hospitals or clinics in Iowa in 2010 (see Table 1). A total of 18 different medical oncology practices offered services in rural communities at least once a month. Fifty-five different medical oncologists participated in VCCs in Iowa. As a group, they made an estimated total of 2,130 visits during 2010. The average distance traveled was 56 miles (Median = 54 miles), which is comparable to a prior multi-specialty study (Drew et al. 2006). Further details may be found in Table 1.

We computed the minimum travel time between every Census tract in Iowa and the primary practice location of a medical oncologist, either in Iowa or an adjoining state. The median one-way travel times for urban areas, large rural cities, small rural towns, and isolated rural towns are presented in Table 2.

A recent study of Medicare data (Chan, Hart, and Goodman 2006) found median travel times for chemotherapy patients from large rural cities, small rural towns, and isolated rural towns were 45, 34.3, and 31.2 minutes, respectively, compared with 6.8 minutes in urban areas (12.4 minutes in urban areas of Iowa). The comparable median travel times for Iowans are 39.8, 51.6, and 58.3 minutes, respectively, when only the primary practice location of a medical oncologist is considered.

Table 1: Descriptive Statistics about Medical Oncology Visiting Consultant Clinics in Iowa (2010)

Number of medical oncology VCCs: 80 in 69 different rural communities
Community hospitals: 75
VA hospital: 1
Community clinic: 4
Number of participating medical oncology group practices: 18
Iowa: 11
South Dakota: 3
Nebraska: 2
Wisconsin: 2
Total number of medical oncologists visiting rural communities: 55
Iowa: 41
South Dakota: 5
Nebraska: 6
Wisconsin: 3
Distribution of visit frequency
1 visit per month: 38
2–3 visits per month: 22
4 or more visits per month: 20
Estimated total visits in 2010: 2130
Distribution of travel distances for medical oncologists
Distances (one way) to VCC sites
<20 miles: 2
20–30 miles: 7
30–40 miles: 13
40–50 miles: 10
50–100 miles: 42
>100 miles: 6

We then estimated the travel times from all census tracts for a combined set of treatment locations, that is, medical oncologist primary practice locations and VCC locations. We conducted separate analyses for VCCs that were conducted once a month and twice or more per month. These results are also presented in Table 2.

The median travel time for large rural cities drops from 39.8 to 10.1 minutes. For small rural towns, the median travel time fell from 51.6 minutes to 13 minutes. The median travel times for isolated small towns fell from 58.3 to 25.5 minutes. For all rural census tracts, the median travel time fell from 51.6 to 19.2 minutes. There was no change in the median travel times for residents of urban areas. For VCC sites with a visit frequency of two or more times per month, the respective travel times fall to 12.6, 18, and 32.6 minutes. For all nonurban census tracts, the median travel time is reduced to 23.5 minutes.

Table 2: Census Tract Travel Times in Minutes by Rural Location

	<i>Large Rural City</i>	<i>Small Rural Town</i>	<i>Isolated Rural Town</i>	<i>All Non-Urban Census Tracts</i>
(A) Median travel time to nearest medical oncologist primary practice location	39.8	51.6	58.3	51.6
(B) Median travel time to nearest medical oncologist primary practice location or medical oncology VCC location with a visit frequency of 1+ times per month	10.1	13.0	25.5	19.2
(C) Median travel time to nearest medical oncologist primary practice location or medical oncology VCC location with visit frequency of 2+ times per month	12.6	18.0	32.6	23.5
(D) Mean travel time to nearest medical oncologist primary practice location	41.8	54.9	62.0	54.4
(E) Mean travel time to nearest medical oncologist primary practice location or medical oncology VCC location with a visit frequency of 1+ times per month	13.9***	15.2***	26.9***	19.8***
(F) Mean travel time to nearest medical oncologist primary practice location or medical oncology VCC location with visit frequency of 2+ times per month	16.8***	19.2***	33.3***	24.5***
Number of census tracts	110	131	174	415

***Significantly different from average in Row D (travel time to nearest medical oncologist primary practice location), p -value < .0001 for a two-tailed paired comparisons t -test.

To assess the statistical significance in the reductions in travel times, we compared the means using a paired comparison t -test. The results are presented in Table 2.

The mean travel times were significantly lower when monthly VCC sites were included for large rural cities ($t = 10$, $p < .001$), small rural towns ($t = 17$, $p < .001$), isolated rural towns ($t = 17.9$, $p < .001$), and all nonurban census tracts ($t = 26$, $p < .001$). The results for the subset of medical oncology VCC sites with a visit frequency of two times per month or higher (Row E) are comparable.

Overall, these results show that estimates of travel times that use office locations of medical oncologists and ignore VCC locations are significantly biased upward for all rural locations in Iowa: large rural cities, small rural towns, and isolated rural towns.

To illustrate the impact of access to medical oncology services at the population level, we used the Census tract population counts data to compute the

cumulative proportion of the population in the state of Iowa that resides within 10, 20, or 30 minutes or more of driving time to the primary practice location of the closest medical oncologist (including those who practice outside the boundaries of the state). These results are presented in Figure 1.

We see that 57 percent of the population resides in Census tracts within a 30-minute drive of the primary practice location of a medical oncologist. This is consistent with the 2010 Census data stating that 55 percent of Iowa’s population lives in urban areas. These data show that 45 percent of Iowa’s population has to travel more than 30 minutes to reach the primary practice location of the closest medical oncologist.

We contrast these results with those considering the locations and frequencies of medical oncology VCCs. We present the results for the monthly VCCs and the subset with a visit frequency of two or more times per month in Figure 1. We see that the percentage of the population living within a 30-minute drive of any medical oncology care site is 89 percent. If we only consider those VCC sites where medical oncology services are offered at least two times per month, the proportion of the population is still very high at 81 percent.

To interpret these results, consider the definition of excessive travel distance used to define health professional shortage areas (HPSAs) for primary

Figure 1: Impact of Visiting Consultant Clinics on Travel Time to Nearest Medical Oncologist

medical care. The HPSA standards consider travel times longer than 30 minutes to be excessive.

Based on the 2010 population of Iowa, our analysis suggests that between 720,000 and 954,000 residents of Iowa would no longer be considered as living in an area having a “shortage” of medical oncology services, that is, living more than 30 minutes from the nearest site for medical oncology services.

DISCUSSION

In assessing the availability of medical oncology care to rural residents, most researchers use the location of the physician’s primary practice to compute the expected travel time (or distance) for patients. Using 2010 data from medical oncology VCCs in Iowa, we show that the resulting travel time estimates are significantly biased upward. When all medical oncology VCC sites are considered, regardless of frequency, the median bias is 228 percent in large rural cities, 473 percent in small rural towns, and 233 percent in isolated rural areas. Even when we restrict the sample to those clinics offered two or more times per month, the comparable median biases are 209, 301, and 182 percent, respectively. Therefore, we conclude that the existing methodologies for assessing access to cancer care in rural areas and the assessments of access to cancer care may have to be reconsidered.

As demand for oncology services is expected to far outpace the increase in supply of oncologists (Erikson et al. 2007), the demands of the visiting consultant clinic model of providing access to rural populations should interest those concerned with physician workforce analysis and planning. A high percentage of the population of medical oncologists in Iowa participates regularly in visiting consultant clinics (49 percent in 2010). The experience of Massey Cancer Center-Medical College of Virginia Hospital suggests that the travel involved in visiting rural areas contributes to burnout among medical oncologists and other personnel (Smith et al. 1996; Desch et al. 1999; Lyckholm, Hackney, and Smith 2001). Prior research consistently shows that specialist physicians tend to locate their practices in urban areas (Fordyce et al. 2007), presumably to access larger patient populations as well as to take advantage of a wider array of entertainment and cultural activities, spousal employment options, and so on. The medical oncologists who staff visiting consultant clinics spend a lot of time traveling and providing care outside their usual office settings. How this different way of providing patient care affects physician satisfaction and retention would be a very interesting area for future research.

There are of course a number of limitations of this research. Our data are limited to medical oncologists in a single state and those in contiguous states who cross the Iowa border to provide itinerant services. These results may not generalize to other cancer specialists like radiation oncologists who rely on specialized staff and equipment which is concentrated in regional hospitals. However, these results remind us that measuring the travel estimates to “any” cancer specialist is problematic as a cancer patient may need access to different specialists at different points of the treatment process. In addition, we do not address the issue of the quality of care provided in these settings. However, prior research suggests that local access to medical oncology services, through a regular VCC, improves the quality of cancer care for rural patients (Smith et al. 1996; Desch et al. 1999; Lyckholm, Hackney, and Smith 2001).

CONCLUSION

Visiting consultant clinics are an important, but largely unrecognized, part of the health care system that provides cancer care in rural areas. Much of the growth in future demand for health care in the United States is being driven by the aging of the population (Kirschner, Berry, and Glasgow 2005) and rural areas are aging faster than urban areas (Rogers 2002). To better understand cancer care in rural areas, more research is needed on the prevalence, management, and impact of visiting consultant clinics in other states.

ACKNOWLEDGMENTS

Joint Acknowledgment/Disclosure statement: We would like to thank TH PYO for his assistance with this research.

Disclosure: None.

Disclaimer: None.

REFERENCES

- Baldwin, L. M., Y. Cai, E. H. Larson, S. A. Dobie, G. E. Wright, D. C. Goodman, B. Matthews, and L. G. Hart. 2008. “Access to Cancer Services for Rural Colorectal Cancer Patients.” *Journal of Rural Health* 24 (4): 390–9.

- Baquet, C. R., P. Commiskey, C. D. Mullins, and S. I. Mishra. 2006. "Recruitment and Participation in Clinical Trials: Socio-demographic, Rural/Urban, and Health Care Access Predictors." *Cancer Detection and Prevention* 30: 24–33.
- Celaya, M., J. Rees, J. Gibson, B. Riddle, and E. Greenberg. 2006. "Travel Distance and Season of Diagnosis Affect Treatment Choices for Women with Early-stage Breast Cancer in a Predominantly Rural Population." *Cancer Causes and Control* 17: 851–6.
- Chan, L., L. G. Hart, and D. C. Goodman. 2006. "Geographic Access to Health Care for Rural Medicare Beneficiaries." *Journal of Rural Health* 22 (2): 140–6.
- Desch, C. E., M. A. Grasso, M. J. McCue, D. Buonaiuto, K. Grasso, M. K. Johantgen, J. E. Shaw, and T. J. Smith. 1999. "A Rural Cancer Outreach Program Lowers Patient Care Costs and Benefits Both the Rural Hospitals and Sponsoring Academic Medical Center." *Journal of Rural Health* 15 (2): 157–67.
- Drew, J., S. B. Cashman, J. A. Savageau, and J. Stegner. 2006. "The Visiting Specialist Model of Rural Health Care Delivery: A Survey in Massachusetts." *Journal of Rural Health* 22 (4): 294–9.
- Erikson, C., E. Salsberg, G. Forte, S. Bruinooge, and M. Goldstein. 2007. "Future Supply and Demand for Oncologists." *Journal of Oncology Practice* 3 (2): 62–5.
- Fordyce, M. A., F. M. Chen, M. P. Doescher, and L. G. Hart. 2007. *2005 Physician Supply and Distribution in Rural Areas of the United States*. Final Report #116. Seattle, WA: WWAMI Rural Health Research Center, University of Washington.
- Hicks, L. L., E. Hassinger, and W. Taparanskas. 1997. "Effects of Second Office and Hospital Consulting Practices of Physicians on Rural Communities." *Journal of Rural Health* 13 (3): 179–89.
- Howe, H. L., J. G. Katterhagen, J. Yates, and M. Lehnher. 1992. "Urban-rural Differences in the Management of Breast Cancer." *Cancer Causes and Control* 3: 533–9.
- Jones, C. A., T. S. Parker, M. Ahearn, A. K. Mishra, and J. N. Variyam. 2009. *Health Status and Health Care Access of Farm and Rural Populations*, EIB-57. Washington, DC: Economic Research Service, U.S. Department of Agriculture.
- Jones, S. G., A. J. Ashby, S. R. Momin, and A. Naidoo. 2010. "Spatial Implications Associated with Using Euclidean Distance Measurements and Geographic Centroid Imputation in Health Care Research." *Health Services Research* 45 (1): 316–27.
- Kellerman, R., T. Ast, J. Dorsch, and L. Frisch. 2001. "Itinerant Surgical and Medical Specialist Care in Kansas: Report of a Survey of Rural Hospital Administrators." *Journal of Rural Health* 17 (2): 127–30.
- Kirschner, A., E. H. Berry, and N. Glasgow. 2005. "The Changing Composition of Rural America: Age Race/Ethnicity and Sex." In *The Population of Rural America: Demographic Research for a New Century*, edited by W. Kandel, and D. L. Brown. New York: Springer.
- Lyckholm, L. L., M. H. Hackney, and T. J. Smith. 2001. "Ethics of Rural Health Care." *Critical Reviews in Oncology/Hematology* 40: 131–8.
- Monroe, A. C., T. C. Ricketts, and L. A. Savitz. 1992. "Cancer in Rural versus Urban Populations: A Review." *Journal of Rural Health* 8 (3): 212–20.

- Morrill, R., J. Cromartie, and G. Hart. 1999. "Metropolitan, Urban, and Rural Commuting Areas: Toward a Better Depiction of the United States Settlement System." *Urban Geography* 20 (8): 727–48.
- Office of Rural Health Policy 2011. *2009 Annual Report*. Rockville, MD: Health Resources and Services Administration, U.S. Department of Health and Human Services.
- Onega, T., E. J. Duell, X. Shi, D. Wang, E. Demidenko, and D. Goodman. 2008. "Geographic Access to Cancer Care in the U.S." *Cancer* 112 (4): 909–18.
- Rogers, C. C. 2002. "The Older Population in 21st Century Rural America." *Rural America* 17 (3): 2–10.
- Smith, T. J., C. E. Desch, M. A. Grasso, M. J. McCue, D. Buonaiuto, K. Grasso, K. Johantgen, M. H. Hackney, J. E. Shaw, and C. J. Simonson. 1996. "The Rural Cancer Outreach Program: Clinical and Financial Analysis of Palliative and Curative Care for an Underserved Population." *Cancer Treatment Reviews* 22 (Suppl A): 97–101.
- Tracy, R., K. L. Saltzman, and D. S. Wakefield. 1996. "Considerations in Establishing a Visiting Consultant Clinic in a Rural Hospital Community." *Hospital and Health Service Administration* 41 (2): 255–65.
- Wakefield, D. S., R. Tracy, and J. Einhellig. 1997. "Trends and Implications of Visiting Medical Consultant Outpatient Clinics in Rural Hospital Communities." *Hospital and Health Service Administration* 42 (1): 49–66.
- Xu, J., K. D. Kochanek, S. L. Murphy, and B. Tejada-Vera. 2010. "Deaths: Final Data for 2007." *National Vital Statistics Reports* 58. Hyattsville, MD: National Center for Health Statistics.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.