

ORIGINAL RESEARCH

Rural–urban otolaryngologic observational workforce analysis: The state of Nebraska

Frantzee LaCrete MD, MPH¹  | Kendra L. Ratnapradipa PhD² |
Kristy Carlson PhD³ | Elizabeth Lyden MS⁴ | Jayme R. Dowdall MD³

¹Department of Otolaryngology, University of Kansas, Lawrence, Kansas, USA

²Department of Epidemiology, College of Public Health, UNMC, 984375 Nebraska Medical Center, Omaha, Nebraska, USA

³Department of Otolaryngology—Head and Neck Surgery, College of Medicine, UNMC, 984395 Nebraska Medical Center, Omaha, Nebraska, USA

⁴Department of Biostatistics, College of Public Health, UNMC, 984375 Nebraska Medical Center, Omaha, Nebraska, USA

Correspondence

Jayme R. Dowdall, Department of Otolaryngology—Head and Neck Surgery, College of Medicine, UNMC, 984395 Nebraska Medical Center, Omaha, NE 68198-4395, USA.

Email: jayme.dowdall@unmc.edu

Abstract

Objective: To analyze the rural–urban access to otolaryngology (OHNS) care within the state of Nebraska.

Design: Cross-sectional study.

Methods: Counties in Nebraska were categorized into rural versus urban status based upon the 2013 National Center for Health Statistics urban–rural classification scheme with I indicating most urban and VI indicating most rural. The information on otolaryngologists was gathered utilizing the Health Professions Tracking System. Otolaryngologists were categorized based on the county of their primary and outreach clinic location(s). Travel burden was estimated using census tract centroid distance to the nearest clinic location, aggregated to county using weighted population means to determine the average county distance to the nearest otolaryngologist.

Results: Nebraska is a state with a population of 1.8 million people unequally distributed across 76,824 square miles, with rural counties covering 2/3 of the land area. Nebraska has 78 primary OHNS clinics and 70 outreach OHNS clinics distributed across 93 counties. More than half (54.8%) of the counties in Nebraska lacked any OHNS clinic. Overall, a statistically significant difference was found when comparing mean primary OHNS per 100,000 population and mean miles to a primary OHNS clinic with Level III counties being 5.17 linear miles from primary OHNS compared to Level V counties being 29.94 linear miles.

Conclusion: Overall, a clear discrepancy between rural and urban primary OHNS clinics in Nebraska can be seen visually and statistically with rural Nebraskans having to travel at least 5.5 times farther to primary OHNS clinics when compared to urban Nebraskans.

KEYWORDS

access to care, ENT, health disparities, Nebraska, OHNS, oto, otolaryngologist, otolaryngology, Rural Health, social determinants of health

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1 | INTRODUCTION

In the United States, 19% of the population live in a rural community including over 57 million people spread across 72% of the total land area.¹ The ongoing nationwide shortage of qualified healthcare providers disproportionately impacts residents in these areas, considering 68% of the shortfall is in rural communities.¹ Furthermore, rural areas have a higher rate of comorbidities and lower socioeconomic status compared to urban areas.^{2,3} Behavioral risk factors leading to cancer such as tobacco use and the human papillomavirus are more prevalent in rural communities,⁴⁻¹⁰ compounding existing health disparities. Although the lack of rural providers continues to persist across primary and specialty care, recent analyses report that 66%–72% of counties in the United States have no Otolaryngology–Head and Neck Surgery (OHNS) providers.^{11,12} One of the reasons for this may be consolidation. The number of OHNS practices with 1–2 providers fell from 80% in 2014 to 73% in 2021, contributing to access issues in rural communities.¹³

The OHNS workforce is insufficient to provide care for the entire US population¹⁴ and these specialty physicians tend to practice in cities with more than a million people.¹¹ Although the US physician shortage has been well documented,¹⁵ specific rural–urban analyses are limited in the literature. The purpose of this study was to examine the OHNS workforce distribution in Nebraska, a largely rural state comprised of 94% partially or entirely rural counties.¹⁶

2 | METHODS

We performed an observational cross-sectional study of OHNS clinics in Nebraska. The University of Nebraska Health Professions Tracking System maintains an annually updated directory of all health professionals practicing in Nebraska, including clinic characteristics and locations (latitude, longitude). The unit of analysis was the county. County-level data including population and land area were obtained from the 2010 US Census,¹⁷ the 2010 rural–urban commuting area codes,¹⁶ and the 2013 National Center for Health Statistics (NCHS) urban–rural classification scheme.¹⁸ The NCHS scheme has six county classification levels to designate county rurality with the higher levels indicating more rural counties. Levels I–IV designate metropolitan areas, and levels V and VI are non-metropolitan (i.e., rural) areas. Nebraska does not have any Level I or II counties. OHNS were categorized into NCHS levels based on their outreach and/or primary clinic location. The estimated travel burden was based on census tract centroids to the nearest OHNS facility, aggregated to the county with mean population estimates. See Table 1 for variable definitions. To test statistical significance, *t*-tests, and analysis of variance (ANOVA) compared rates within and between urban–rural classification levels. Significance was determined with a *p*-value of <.05. The University of Nebraska Office of Regulatory Affairs determined this project did not constitute human subject research as defined at 45CFR46.102 and was not subject to federal regulations.

TABLE 1 Definition of the method variables.

| Variable | Definition |
|---|---|
| Mean distance to OHNS per county | Calculated by using a geocoded linear distance calculator with Bing maps to the centroid of each census tract. ²⁴ The county population weighted mean determined the mean miles to the OHNS. |
| Mean OHNS per county | OHNS were grouped by their respective NCHS classification level and the mean was calculated from the number of OHNS in each county in each NCHS level. |
| Mean OHNS per 100,000 population per county | Total number of OHNS in the county/ the county's total population |
| Mean OHNS per 100 square miles | Total OHNS per county/total county land area × 100 |

3 | RESULTS

Nebraska's total population of 1.8 million residents is unequally distributed across 76,824 square miles. At the time of this analysis, the state had 78 primary OHNS clinics and 70 outreach OHNS clinics (Figure 1). More than half (54.8%) of the counties in Nebraska lacked any OHNS clinic. Weighted mean travel distance to any OHNS location was greatest for Sheridan (43.49 miles), Deuel (39.49 miles), and Garden (39.44 miles) counties, all of which are Level VI counties. Many of the OHNS clinic locations are densely located in eastern Nebraska (Figure 2). Of the 70 outreach clinics, 30 (42.9%) are in Level VI counties, and 26 (37.1%) of the 27 (38.6%) Level III outreach clinics are in the Omaha metro area (Table 2).

3.1 | Primary OHNS clinics

Overall, a statistically significant difference was found when comparing mean primary OHNS per 100,000 population and mean miles to a primary OHNS clinic (Table 3). Significance was also established when comparing the total number of clinics per county between Levels III and IV–VI. The only significant difference when comparing the linear distance to a primary clinic among NCHS classification levels was in Level VI counties (29.94 miles). No differences were identified when analyzing the total number of OHNS per 100,000 populations in each classification.

3.2 | Outreach OHNS clinics

Significant differences were revealed between level III and other classifications for the number of clinics per county. The impact of outreach clinics on the total OHNS variables can be seen in a *t*-test comparing primary and total OHNSs per 100,000 populations and per

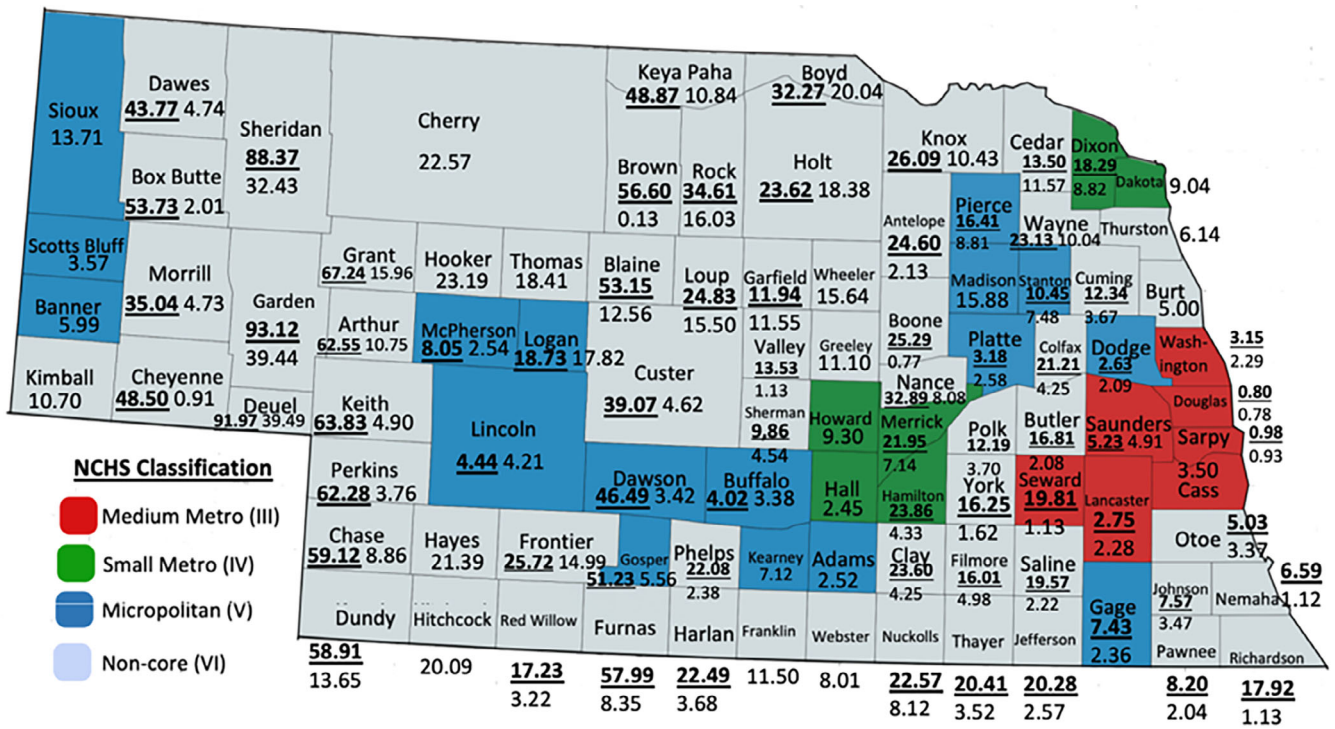


FIGURE 1 Location of Nebraska Otolaryngology clinics, classified as primary or outreach. Blue houses indicate the location of the primary Otolaryngology clinic locations. Red pins indicate the location of the Otolaryngology outreach clinics.

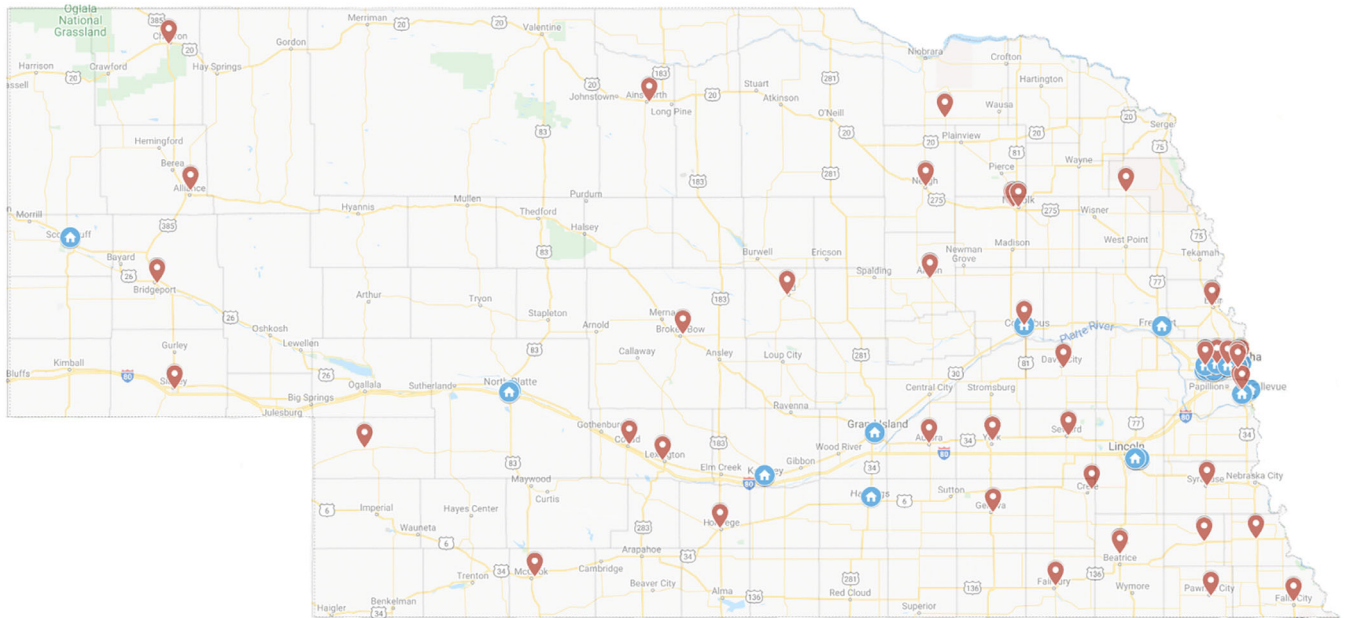


FIGURE 2 National Center for Health Statistics (NCHS) urban-rural classification scheme for Nebraska counties with associated distance (primary, outreach).

100 square miles within each classification level, as each classification level was significantly different when comparing the primary and total OHNSs per 100,000 populations, per 100 square miles, and mean miles

to OHNS. There was no difference seen between Levels III, IV, V, and VI counties when looking at mean miles to any OHNS, but there is a difference seen when looking at mean miles to primary OHNS.

TABLE 2 Nebraska county classification summary.

| | NCHS classification level | | | | Total |
|------------------------------------|---------------------------|----------|-----------|-----------|-----------|
| | III | IV | V | VI | |
| Number of counties | 7 | 6 | 17 | 63 | 93 |
| Total population | 1,044,362 | 108,856 | 326,396 | 346,727 | 1,826,341 |
| Rural population | 97,891 | 34,553 | 110,154 | 248,057 | 490,655 |
| Mean percent rural | 39.54 | 57.61 | 58.74 | 84.47 | 74.65 |
| Total land area (mi ²) | 3,674.07 | 2,883.88 | 14,693.04 | 55,573.23 | 76,824.22 |
| Primary OHNS clinics | 63 | 2 | 13 | 0 | 78 |
| Outreach OHNS clinics | 27 | 1 | 12 | 30 | 70 |
| Total OHNS clinics | 90 | 3 | 25 | 30 | 148 |

Abbreviation: OHNS, Otolaryngology—Head and Neck Surgery.

TABLE 3 County-level OHNS aggregated to NCHS classification.

| | NCHS Classification-Level Mean (SD) | | | |
|---|-------------------------------------|--------------|---------------|---------------|
| | III | IV | V | VI |
| Mean primary OHNS/100,000 population by county* | 2.08 (3.66) | 0.57 (1.39) | 2.06 (2.90) | 0 |
| Mean total OHNS/100,000 population by county | 4.52 (4.79) | 2.40 (4.41) | 4.53 (5.46) | 7.12 (10.24) |
| Mean primary OHNS/100 square miles by county* | 2.51 (5.76) | 0.06 (0.15) | 0.09 (0.12) | 0 |
| Mean total OHNS/100 square miles by county* | 3.71 (8.20) | 0.09 (0.15) | 0.17 (0.21) | 0.07 (0.10) |
| Mean miles to primary OHNS by county* | 5.17 (6.63) | 14.15 (8.47) | 13.05 (14.45) | 29.94 (22.07) |
| Mean miles to any OHNS by county | 2.28 (1.50) | 6.85 (2.85) | 6.41 (4.95) | 9.50 (8.83) |

*Significance ($p < .05$) on analysis of variance (ANOVA) and post hoc Tukey.

4 | DISCUSSION

This study documents the complete census of all OHNS primary and outreach clinics in Nebraska. The state's total population of 1.8 million people is unequally distributed across 76,824 square miles, with rural counties covering 2/3 of the land area. The results of this study confirm that travel distance to primary clinics is considerable in the sparsely populated rural counties. We expected the density of OHNS clinic locations to decrease by population density; however, we did not anticipate finding zero primary OHNS clinics in Level VI counties. The distance for Levels IV–VI county residents to a primary OHNS clinic may be at least five times as far as those living in level III counties. The quantification of the distance to each OHNS clinic by county is a unique aspect of this research. To our knowledge, no other studies have used this calculation. An Iowa study measured drive time to the closest primary Otolaryngology clinic including those from adjoining states.¹⁹ In an urban–rural comparison, researchers from Illinois reported fewer academy-registered Otolaryngologists located in rural counties and no registered providers in level VI counties.²⁰ Although the results were similar to our study, Illinois has a larger population, smaller land area, and only 11% of residents live in rural counties.

The lack of statistical significance reported in previous studies regarding travel distance and total clinics per 100,000 populations may be attributed to the impact of outreach clinics. Over half (54.8%) of the counties in Nebraska lack any OHNS clinic compared to overall

rates in the United States of 66%–72%.^{11,12} There is an opportunity to close this gap considering the rapid expansion of telemedicine during the COVID-19 pandemic²¹; however, DeGuzman et al. reported only 58% of cancer survivors in rural areas have adequate broadband to connect with a healthcare provider.²² Another factor that contributes to health disparities in rural areas is poverty. Nebraska ranks in the 10th percentile for uninsured in the United States with county rates from 6% to 21%.¹⁷ Adequate insurance coverage does not translate to access to care if funds are not available for a reliable vehicle or gas to travel. The average distance to a primary OHNS clinic among the 6 Nebraska counties in “persistent poverty” was 44.19 miles.²³

This study did not include advanced practice providers, or allied health professionals such as respiratory therapists, speech-language pathologists, and audiologists which may also impact rural access to care. Furthermore, census track centroids are an approximation that does not take roadway networks or road type into account. Therefore, driving distance may be longer or shorter than estimated and does not actually represent patient travel distance (or time). Finally, this study did not include data regarding the availability of telemedicine.

5 | CONCLUSION

Overall, a clear discrepancy between the availability of rural and urban primary OHNS clinics in Nebraska exists. Although statistical significance

was not reached in the comparison of clinics per 100,000 population, the paucity of total OHNS clinics can be appreciated visually. The majority are located on the eastern border where only ½ of the population resides. The analysis of driving distance to an OHNS primary clinic was mixed, likely reflecting the impact of outreach clinics. This measure can be utilized in the future to determine if driving distance or OHNSs per 100,000 population has any significant impact on outcomes of head and neck cancers or other OHNS-related conditions. The results of this study serve as a foundation for healthcare access research designed to measure the disparities between urban and rural counties on patient outcomes.

ORCID

Frantzee LaCrete  <https://orcid.org/0000-0001-9916-9778>

REFERENCES

- National Organization of State Offices of Rural Health. National rural health day: key messages & data points. 2022 Accessed October 22, 2022. <https://en.calameo.com/read/00457233912cd83fb719c>
- O'Connor A, Wellenius G. Rural-urban disparities in the prevalence of diabetes and coronary heart disease. *Public Health*. 2012;126(10):813-820.
- Wallace AE, Young-Xu Y, Hartley D, Weeks WB. Racial, socioeconomic, and rural-urban disparities in obesity-related bariatric surgery. *Obes Surg*. 2010;20(10):1354-1360.
- Doogan NJ, Roberts ME, Wewers ME, et al. A growing geographic disparity: rural and urban cigarette smoking trends in the United States. *Prevent Med*. 2017;104:79-85.
- Zahnd WE, Fogleman AJ, Jenkins WD. Rural-urban disparities in stage of diagnosis among cancers with preventive opportunities. *Am J Prevent Med*. 2018;54(5):688-698.
- Allareddy V, Konety BR. Characteristics of patients and predictors of in-hospital mortality after hospitalization for head and neck cancers. *Cancer*. 2006;106(11):2382-2388.
- Mackley HB, Teslova T, Camacho F, Short PF, Anderson RT. Does rurality influence treatment decisions in early stage laryngeal cancer? *J Rural Health*. 2014;30(4):406-411.
- Ringstrom MJ, Christian J, Bush ML, Levy JE, Huang B, Gal TJ. Travel distance: impact on stage of presentation and treatment choices in head and neck cancer. *Am J Otolaryngol*. 2018;39(5):575-581.
- Zhang H, Dziegielewski PT, Nguyen TJ, et al. The effects of geography on survival in patients with oral cavity squamous cell carcinoma. *Oral Oncol*. 2015;51(6):578-585.
- Javadi P, Sharma A, Zahnd WE, Jenkins WD. Evolving disparities in the epidemiology of oral cavity and oropharyngeal cancers. *Cancer Causes Control*. 2017;28(6):635-645.
- Vickery TW, Weterings R, Cabrera-Muffly C. Geographic distribution of otolaryngologists in the United States. *Ear Nose Throat J*. 2016;95(6):218-223.
- Liu DH, Ge M, Smith SS, Park C, Ference EH. Geographic distribution of otolaryngology advance practice providers and physicians. *Otolaryngol Head Neck Surg*. 2021;167(1):48-55. doi:10.1177/01945998211040408
- Quereshy HA, Quinton BA, Ruthberg JS, Maronian NC, Otteson TD. Practice consolidation in otolaryngology: the decline of the single-provider practice. *OTO Open*. 2022;6(1):2473974X221075232.
- Hughes CA, McMenamin P, Mehta V, Pillsbury H, Kennedy D. Otolaryngology workforce analysis. *Laryngoscope*. 2016;126:S5-S11.
- Zhang X, Lin D, Pforsich H, Lin VW. Physician workforce in the United States of America: forecasting nationwide shortages. *Human ResourHealth*. 2020;18:1-9.
- Comartie J. 2010 Rural urban commuting area codes (revised 7/3/2019). U.S. Department of Agriculture. Data set 1. 2019.
- U.S. Census Bureau. Census. Summary file 1, Table P2. 2010.
- Ingram DD, Franco SJ. NCHS urban-rural classification scheme for counties. *Vital Health Stat* 2. 2013;166:1-81.
- Gruca TS, Nam I, Tracy R. Reaching rural patients through otolaryngology visiting consultant clinics. *Otolaryngol Head Neck Surg*. 2014;151(6):895-898.
- Urban MJ, Wojcik C, Eggerstedt M, Jagasia AJ. Rural-urban disparities in otolaryngology: the state of Illinois. *Laryngoscope*. 2021;131(1):E70-E75.
- Gonzalez JN, Axiotakis LG, Yu VX, Gudis DA, Overdeest JB. Practice of telehealth in otolaryngology: a scoping review in the era of COVID-19. *Otolaryngol Head Neck Surg*. 2022;166(3):417-424. doi:10.1177/01945998211013751
- DeGuzman PB, Bernacchi V, Cupp CA, et al. Beyond broadband: digital inclusion as a driver of inequities in access to rural cancer care. *J Cancer Survivor*. 2020;14(5):643-652. doi:10.1007/s11764-020-00874-y
- Daily G, Cantarero R, Rosario de Guzman M, Hong S, Taylor S. Mapping quality of life in Nebraska: graphic distribution of poverty. DigitalCommons@University of Nebraska-Lincoln. 2017 Accessed at <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1000&context=mapquallifene>
- CDX Technologies. CDXGeoData. 2020 Accessed July 22, 2020. www.cdxtech.com/cdxgeodata

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