

Impact of Medicaid expansion on stage of diagnosis of lung cancer for rural and urban patients in New Hampshire

Benjamin Carter PhD¹  | Jasmine Denny MPH² | Andrew Lohrer MD, MPH^{2,3,4,5}

¹The Nelson A. Rockefeller Center for Public Policy and the Social Sciences, Dartmouth College, Hanover, New Hampshire, USA

²Geisel School of Medicine, Dartmouth College, Hanover, New Hampshire, USA

³Dartmouth Cancer Center, Lebanon, New Hampshire, USA

⁴Department of Surgery, Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire, USA

⁵The Dartmouth Institute for Health Policy and Clinical Practice, Lebanon, New Hampshire, USA

Correspondence

Benjamin Carter, The Nelson A. Rockefeller Center for Public Policy and the Social Sciences, Dartmouth College, 2 Webster Ave, Hanover, NH 03755, USA.
Email: benjamin.carter@dartmouth.edu

Abstract

Purpose: This study examines the impact of Medicaid expansion under the Affordable Care Act on the stage of lung cancer diagnosis among rural and urban patients in New Hampshire.

Methods: Data from the New Hampshire State Cancer Registry spanning 2010-2019 were analyzed to compare lung cancer diagnosis stages before and after the July 2014 Medicaid expansion. Rural-urban categorization utilized Rural-Urban Continuum Codes, and logistic regression with difference-in-difference analysis assessed the differential effects of Medicaid expansion on late-stage diagnoses between rural and urban patients.

Findings: Post-expansion, there was a significant decrease in the proportion of late-stage lung cancer diagnoses statewide. Rural patients initially had higher rates of late-stage diagnoses compared to urban patients, but post-expansion, this disparity diminished significantly. Logistic regression indicated reduced odds of late-stage diagnosis among rural patients after expansion (OR = 0.719, $P = .035$), demonstrating a greater benefit in rural areas.

Conclusions: Medicaid expansion in New Hampshire was associated with a substantial reduction in late-stage lung cancer diagnoses, particularly benefiting rural patients who historically faced higher barriers to health care access. These findings underscore the potential of Medicaid expansion to mitigate rural-urban disparities in cancer care outcomes.

KEYWORDS

Affordable Care Act, health care disparities, lung cancer, Medicaid expansion, rural health

INTRODUCTION

Lung cancer is the leading cause of cancer mortality in the United States but can be ameliorated by reducing late-stage diagnoses through increased access to care.^{1,2} Patients in rural settings are more frequently diagnosed with late-stage cancer and have higher rates of cancer mortality than patients in urban settings.³⁻⁵ This rural-urban divide may stem from systemic and structural factors, including higher rates of uninsured and decreased access to and receipt of care.^{6,7} For these reasons, lung cancer patients in rural and urban settings may

benefit differentially from initiatives aimed at improving access to care, including expanded health insurance coverage.

The Affordable Care Act (ACA) resulted in expanded access to through increasing pathways to insurance coverage, including increasing eligibility for Medicaid coverage for lower-income people in the states, like New Hampshire, that adopted this provision. Previous work has demonstrated that this Medicaid expansion was associated with earlier diagnosis with a number of malignancies, including lung cancer.^{8,9} For instance, patients who had continuous access to Medicaid insurance at 3 and 6 months prior were diagnosed with



earlier stages of lung cancer than patients who were enrolled at the time of diagnosis.¹⁰⁻¹² On July 1, 2014, New Hampshire joined other states in expanding access to Medicaid through the ACA by raising the maximum income eligibility from 75% of the Federal Poverty Level to 138%.¹³ Patients living in rural New Hampshire tend to have lower incomes and educational attainment and are more likely to be uninsured compared to patients in urban settings.^{14,15} Each of these social drivers create correlated but unique barriers to health and health care. Thus, the expected differential effects of the Medicaid expansion on rural and urban patients in New Hampshire are unclear.

In this short report, we analyze the effect of New Hampshire's Medicaid expansion on late-stage diagnoses of lung cancer by examining whether there was a differential impact on rural and urban patients. Patients living in rural (compared to urban) New Hampshire are more likely to be uninsured and were more likely to enroll in Medicaid after the expanded eligibility.^{15,16} We thus hypothesized that patients in rural settings may disproportionately see a reduction in late-stage diagnoses after the expansion compared to urban patients because of the comparatively larger gains in access to health insurance.

METHODS

Our data came from the New Hampshire State Cancer Registry (NHSCR) and included all incident lung cancer cases diagnosed in the State of New Hampshire from 2010 through 2019.¹⁷ Our analytic cohort consisted of adult lung cancer patients ages 18-64 years old who were diagnosed in New Hampshire. We excluded patients over age 65 and those who carry Medicare insurance, as these patient populations were not directly impacted by the insurance expansion provisions of the ACA. From 2016 through 2018, New Hampshire used a CMS waiver to institute a privatized Medicaid expansion called the Premium Assistance Program (PAP), meaning some patients who benefitted from the expansion were classified as having private insurance. We, therefore, included patients whose payor is classified as either Uninsured, Medicaid, Private, or not otherwise specified (NOS) in the primary analysis.

Our primary outcome measure is cancer stage at diagnosis as measured by the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute summary variables found in the NHSCR comprehensive dataset.¹⁸ The SEER summary variables provide a ranking of how far a cancer has spread from its point of origin at the time of diagnosis, ranging from localized to distant spread. For our analysis, "Late stage" was defined as patients presenting with metastatic disease as compared to presentation with local or regional disease at the time of diagnosis.

We measured patient rurality using Rural-Urban Continuum Codes (RUCC), which categorize metropolitan counties by their population size and nonmetropolitan counties by their population size, their degree of urbanization, and their proximity to metro areas.^{19,20} Higher values indicate greater rurality, with codes ranging from 1 (Counties in metropolitan areas with a population of 1 million or more) to 9 (Completely rural or less than 2,500 urban population, and not

adjacent to a metro area). For our analysis, we defined "Rural" to include small-town counties with urban populations between 2,500 and 19,999, and completely rural counties, with populations less than 2,500. "Urban" counties included metropolitan counties and Micropolitan counties with an urban population of at least 20,000. Outcomes for cancer patients in micropolitan areas are sometimes more similar to patients in metropolitan areas,^{21,22} and sometimes more similar to rural patients,²³ and there is currently no strong consensus among researchers on how best to define "rural."^{24,25} We included micropolitan counties as "Urban" rather than "Rural" because micropolitan patients had similar outcomes to metropolitan patients prior to 2014 (Figure S3).

The NHSCR asks providers to record patient race separate from their ethnicity, though a report from 2005 found many New Hampshire hospitals lacked policies for collecting race data which forced providers to depend on visual inspection and introduced bias.²⁶ Further, New Hampshire patients are 98% White, reducing the statistical power and validity analyses based on patient race. We omit patient race from our primary analysis for these reasons and because patient race is not a component of our theoretical framework. Sensitivity analyses including race/ethnicity did not significantly alter the results.

We generated a binary post-expansion variable to examine stage diagnosis before and after New Hampshire expanded Medicaid in 2014. We estimated the differential impact of rurality on the effect of the Medicaid expansion on late-stage diagnosis through a difference-in-difference analysis by interacting our binary rurality and post-expansion variables using logistic regression. The binary post-expansion variable was defined as 0 if years 2010 through 2013 and 1 if diagnosed in years 2015 through 2019. We omitted data from the year 2014 in our analysis to cleanly divide the sample into years before and after the policy's implementation. We estimate the odds of late-stage diagnosis for rural and urban patients in separate models before and after the expansion to test whether rurality was a significant predictor in both time periods. We included covariates for patient age, patient sex, a year variable to capture temporal trends, and within-state Area Deprivation Index (ADI) based on the location of diagnosis. The ADI ranks neighborhoods at the US Census block group level by socioeconomic disadvantage in the domains of income, education, employment, and housing quality.^{27,28}

Several secondary analyses were conducted to assess the robustness of the primary findings. A sensitivity model included payor type, with Medicaid enrollees as the reference group, to examine the effect of insurance status. A test of the parallel trends assumption was performed to ensure no significant pre-2014 differences in diagnosis trends between rural and urban populations. Additionally, 4 alternative models were tested, classifying RUCC 4-5 residents as urban.

In 2013, The US Preventive Services Task Force (USPSTF) recommended annual screening for lung cancer with low-dose computed tomography (LDCT) for adults aged 55-80 years who have a 30-pack-year smoking history and currently smoke or have quit within the past 15 years.²⁹ However, uptake of LDCT has been limited: the screening rate in New England was estimated between 12.8% and 15.2% of the total number of patients eligible in 2018.³⁰ As additional secondary

TABLE 1 Descriptive statistics of the analytic cohort.

	Pre-expansion 2010-2013	Post-expansion 2015-2019	P-value
Age (M/SD)	56 (6.2)	58 (5.7)	$P < .001$
Female (N/%)	599 53.0%	783 54.9%	.348
Deprivation Index (M/SD)	5.6 (2.8)	5.7 (2.7)	.621
Race (N/%)			.696
Black; Asian/Pacific Islander; Other; Unknown	23 2.0%	26 1.8%	
White	1,107 98.0%	1,401 98.2%	
SEER Summary (N/%)			$P < .001$
Local	177 16.1%	358 25.9%	
Regional	281 25.5%	360 26.1%	
Distant	643 58.4%	664 48.1%	
Payor (N/%)			$P < .001$
Uninsured	151 14.2%	68 4.4%	
Private	559 52.6%	998 64.3%	
Medicaid	132 12.4%	296 19.1%	
NOS	222 20.9%	190 12.2%	
Rurality (N/%)			.247
Urban	681 60.3%	892 62.5%	
Rural	449 39.7%	535 37.5%	

analyses, we used a linear Poisson regression and a frequency plot (Supplementary Materials, Table S3 and Figure S1) to examine whether the annual number of lung cancer diagnoses in New Hampshire increased after the 2013 USPSTF recommendation.

All analyses were conducted in Stata Version 18. *P*-values less than or equal to .05 were considered statistically significant. The study was deemed exempt from review by the Dartmouth-Hitchcock Institutional Review Board.

RESULTS

Of the 2,557 patients in our analytic cohort, 1,382 (54.1%) were female and 2,508 (98.3%) were White (Table 1). Patients resided in communities with an average ADI of 5.7 (SD = 2.7), and 984 (38.4%) patients lived in rural New Hampshire. During the study period, 1,307 (52.6%) patients were diagnosed with late-stage lung cancer.

Patients diagnosed after New Hampshire's Medicaid expansion were older, while patient sex, ADI, race, and rurality were comparable before and after the expansion. The share of patients who were uninsured decreased by 9.8 percentage points after the Medicaid expansion, while the share of patients covered by Medicaid or Private insurance increased by 6.7 and 11.7 percentage points, respectively. The proportion of patients diagnosed with late-stage cancer dropped from 58.4% before the expansion to 48.1% after the expansion, while the proportion of patients diagnosed with local lung cancer increased from 16.1% to 25.9%.

In a multivariable-adjusted logistic regression, patients diagnosed with lung cancer after 2014 were associated with significantly lower odds (OR = 0.719; $P = .035$) of late-stage diagnosis (for full model details, see Table S1, Model 3 in the Supplementary Materials). The model also demonstrated reduced odds of late-stage diagnosis for females (OR = 0.725; $P < .001$), and for each additional year, a patient was aged (OR = 0.985; $P = .020$). While this model predicted no

TABLE 2 Change in late-stage diagnosis of lung cancer in rural and urban New Hampshire before and after 2014 Medicaid expansion.

Rural			Urban			Difference-in-difference estimate	
Pre-expansion	Post-expansion	Difference	Pre-expansion	Post-expansion	Difference	Unadjusted odds ratio	Adjusted ^a odds ratio
67.3%	47.7%	-19.6%	56.4%	47.6%	-8.8%	0.602 <i>P</i> = .047	0.597 <i>P</i> = .045

Note: Difference-in-difference estimates include 95% confidence intervals in parentheses.

^aControlling for patient age, sex, area deprivation index, and year of diagnosis.

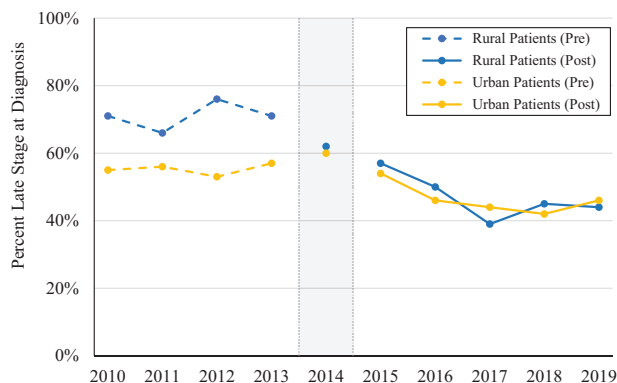


FIGURE 1 Unadjusted trends in percent of lung cancer patients presenting as late stage in New Hampshire (2010-2019), by rurality. Note: Shaded area indicates the time of Medicaid expansion. Medicaid, Uninsured, Private, and NOS payers are included.

significant effects for patient rurality ($P = .153$), subsequent models indicated significantly higher odds of the late stage for rural patients before the expansion, but not after (see Models 2 through 5 in the Supplementary Materials). Next, we examine whether the effects of the expansion differed by patient rurality.

Figure 1 presents unadjusted trends in the proportion of late-stage diagnoses of lung cancer throughout the study period for rural and urban patients. Table 2 presents difference-in-difference estimates of differential effect of New Hampshire's Medicaid expansion on patients' likelihood of late-stage presentation at diagnosis. Prior to the 2014 insurance expansion, 67.3% of rural patients were diagnosed with late-stage lung cancer which was significantly higher than 56.4% of urban patients ($P = .008$; Model 4 in Supplementary Materials). After the expansion, the proportion of late-stage diagnoses decreased by 19.6 percentage points among rural patients and 8.8 percentage points among urban patients, resulting in no difference between the percentage of rural (46.9%) and urban (46.4%) patients diagnosed with late-stage lung cancer ($P = .684$; Model 5 in Supplementary Materials). While both groups saw a reduction in late-stage diagnoses, both unadjusted ($P = .047$) and adjusted ($P = .045$) models demonstrated a greater reduction in odds ratios for late-stage diagnosis among rural patients after expanded coverage compared to urban patients. Full models and diagnostics are presented in Table S1.

A sensitivity model, which included payor as a variable with Medicaid enrollees as the comparison category, found that the primary

effects of rurality and the interactive Difference-in-Difference effect remained statistically significant (Table S6). A statistical test of the parallel trends assumption indicated no significant difference in the slopes of rural and urban diagnosis trends prior to 2014. Four additional models assessed whether including residents of RUCC 4-5 as urban influenced the estimates (Table S5). Rural patients had a higher stage at diagnosis than urban patients with no significant differences between micro- and metropolitan patients, indicating that combining micro- and metropolitan patients as urban for comparison with small town and rural patients was appropriate. Analysis for differential changes in diagnosis after the 2013 USPSTF recommendation found that the annual incidence rate of lung cancer diagnoses in New Hampshire decreased slightly each year from 2010 to 2019 (IRR = 0.992; $P < .001$) and did not differ by rurality ($P = .444$). These findings are consistent with the nationally decreasing rate in smoking and inconsistent with a spike in diagnoses, which might be expected if our results were driven by increased screening.¹

DISCUSSION

In this study of New Hampshire's lung cancer diagnoses from 2010 to 2019, we found that the ACA's Medicaid expansion was associated with significant decreases in late-stage diagnoses. Further, we found that late-stage diagnoses were higher among patients living in rural settings prior to the expansion. Proportions of late-stage diagnoses decreased across the state after the insurance expansion but more so for rural patients. Consequently, after expansion, there was no longer a statistically significant difference in the late-stage diagnosis between rural and urban patients. Our data demonstrated that the 2014 Medicaid expansion was associated with a dissolution of the disparity between rural and urban patients in late-stage diagnoses of lung cancer.

New Hampshire joined other states in expanding Medicaid in 2014 to increase access to care for citizens with low incomes and to decrease barriers to timely receipt of care. Our study focused on late-stage diagnoses of lung cancer, an outcome for which a significant disparity existed between urban and rural patients in New Hampshire. Although research shows that patients in rural settings often have more obstacles to care than patients in urban settings, our findings suggest that addressing just one of these barriers (insurance coverage) may significantly decrease rural disparities in lung cancer.¹⁴

These findings add to the broader literature on how expanding Medicaid access affects cancer-stage diagnoses. Prior research indicates that expanding Medicaid access had led to earlier-stage diagnoses of multiple cancers, including lung, in several states.^{10–12} The literature finds mixed effects for rurality on stage: While some data suggest that rurality is associated with higher rates of late-stage cancer diagnosis, or is nearly associated with later-stage diagnosis, other data suggest no effect on stage diagnosis.^{31–33} Our paper contributes to this literature, finding that rural patients had higher initial proportions of late-stage lung cancer and benefitted differentially from New Hampshire's Medicaid expansion.

Reducing geographic disparities in cancer diagnosis is critical, but advancements in lung cancer care often disproportionately benefit urban patients, potentially worsening mortality disparities.³⁴ One reason is that urban patients typically have better access to advanced prevention and treatment services.^{35,36} Further, living in a rural area independently increased the risk of death for lung cancer patients who received surgical treatment even after accounting for cancer stage, patient and hospital characteristics, and travel distance.³⁷ To address these disparities, efforts must focus on reducing late-stage diagnoses, improving access to high-quality treatments, and tackling the unique risks associated with rural living.

Our findings must also be considered in the context of a number of limitations. First, we included patients with private insurance in our analysis to avoid omitting patients who benefitted from New Hampshire's PAP waiver program from 2016 to 2018. While some privately insured patients may have benefitted from Medicaid Expansion, many others remained unaffected. Including patients unaffected by the expansion reduces the study's power to detect the policy's impact on stage at diagnosis and likely biases our findings in the null direction. Additional limitations include single-state analyses that may not be generalizable to other states or regions. However, our results provide key insights into a highly rural and understudied state in Northern New England. We were also unable to determine which specific patients gained coverage through the ACA-related provisions. However, results provide an important population-level evaluation of Medicaid expansion effects in rural communities.

CONCLUSIONS

In this study of New Hampshire's lung cancer patients, the ACA's Medicaid expansion was associated with a greater reduction in late-stage diagnoses among rural patients compared to urban patients. Our data reinforce how expanding access to health care can have differential benefits for rural communities. As policymakers weigh benefits of expanding access to care, these findings provide important data linking health outcomes to Medicaid's coverage expansion.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ORCID

Benjamin Carter PhD  <https://orcid.org/0000-0001-5837-1507>

REFERENCES

1. Siegel RL, Giaquinto AN, Jemal A. Cancer statistics, 2024. *CA Cancer J Clin.* 2024;74(1):12–49. doi:10.3322/caac.21820
2. Flores R, Patel P, Alpert N, Pyenson B, Taioli E. Association of stage shift and population mortality among patients with non-small cell lung cancer. *JAMA Netw Open.* 2021;4(12):e2137508. doi:10.1001/jamanetworkopen.2021.37508
3. Singh GK, Williams SD, Siahpush M, Mulhollen A. Socioeconomic, rural-urban, and racial inequalities in US cancer mortality: Part I—all cancers and lung cancer and Part II—colorectal, prostate, breast, and cervical cancers. *J Cancer Epidemiol.* 2012;2011:e107497. doi:10.1155/2011/107497
4. Obeng-Gyasi S, Timsina L, Bhattacharyya O, Fisher CS, Haggstrom DA. Breast cancer presentation, surgical management, and mortality across the rural-urban continuum in the National Cancer Database. *Ann Surg Oncol.* 2020;27(6):1805–1815. doi:10.1245/s10434-020-08376-y
5. Atkins GT, Kim T, Munson J. Residence in rural areas of the United States and lung cancer mortality: disease incidence, treatment disparities, and stage-specific survival. *Ann Am Thorac Soc.* 2017;14(3):403–411. doi:10.1513/AnnalsATS.201606-469OC
6. Ziller EC, Coburn AF, Loux SL, Hoffman C, McBride T. Health Insurance Coverage in Rural America. 2003. Accessed March 1, 2024. <https://www.kff.org/wp-content/uploads/2013/01/health-insurance-coverage-in-rural-america-pdf.pdf>
7. Zhang W, Mueller KJ, Chen LW. Uninsured hospitalizations: rural and urban differences. *J Rural Health.* 2008;24(2):194–202. doi:10.1111/j.1748-0361.2008.00158.x
8. Ji X, Castellino SM, Mertens AC, et al. Association of Medicaid expansion with cancer stage and disparities in newly diagnosed young adults. *J Natl Cancer Inst.* 2021;113(12):1723–1732. doi:10.1093/jnci/djab105
9. Takvorian SU, Oganisian A, Mamtani R, et al. Association of Medicaid expansion under the Affordable Care Act with insurance status, cancer stage, and timely treatment among patients with breast, colon, and lung cancer. *JAMA Netw Open.* 2020;3(2):e1921653. doi:10.1001/jamanetworkopen.2019.21653
10. Bradley CJ, Given CW, Roberts C. Late stage cancers in a Medicaid-insured population. *Med Care.* 2003;41(6):722–728. doi:10.1097/01.MLR.0000065126.73750.D1
11. Dawes AJ, Louie R, Nguyen DK, et al. The impact of continuous Medicaid enrollment on diagnosis, treatment, and survival in six surgical cancers. *Health Serv Res.* 2014;49(6):1787–1811. doi:10.1111/1475-6773.12237
12. Ramsey SD, Zeliadt SB, Richardson LC, et al. Disenrollment from Medicaid after recent cancer diagnosis. *Med Care.* 2008;46(1):49–57. doi:10.1097/MLR.0b013e318158ec7f
13. Medicaid Income Eligibility Limits for Parents, 2002–2023. Kaiser Family Foundation. Accessed April 12, 2024. <https://www.kff.org/medicaid/state-indicator/medicaid-income-eligibility-limits-for-parents/>
14. USDA Economic Research Service. New Hampshire State Data. 2024. Accessed April 25, 2024. <https://data.ers.usda.gov/reports.aspx?StateFIPS=33&StateName=New%20Hampshire&ID=17854>



15. Rural Data for Action, A Comparative Analysis of Health Data for the New England Region. 2014. Accessed April 25, 2024. https://nerha.memberclicks.net/assets/docs/RHRT_DataBook_2014_FINAL.pdf
16. The Effects of Medicaid Expansion in New Hampshire. New Hampshire Fiscal Policy Institute; 2023. Accessed July 11, 2024. <https://nhfpi.org/resource/the-effects-of-medicaid-expansion-in-new-hampshire/>
17. New Hampshire Department of Health and Human Services. Cancer Registry. Accessed April 12, 2024. <https://www.dhhs.nh.gov/programs-services/disease-prevention/cancer/cancer-registry>
18. Surveillance, Epidemiology, and End Results Program. National Cancer Institute. Accessed April 25, 2024. <https://seer.cancer.gov/index.html>
19. USDA Economic Research Service. Rural-Urban Continuum Codes. Accessed April 25, 2024. <https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/>
20. USDA Economic Research Service. Rural-Urban Continuum Codes, Documentation. Accessed April 12, 2024. <https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation/>
21. Fowler ME, Kenzik KM, Al-Obaidi M, et al. Rural-urban disparities in mortality and geriatric assessment among older adults with cancer: the cancer & aging resilience evaluation (CARE) registry. *J Geriatr Oncol.* 2023;14(4):101505.
22. Weeks KS, Lynch CF, West M, et al. Impact of rurality on stage IV ovarian cancer at diagnosis: a Midwest cancer registry cohort study. *J Rural Health.* 2020;36(4):468-475.
23. Loehrer AP, Chen L, Wang Q, et al. Rural disparities in lung cancer-directed surgery: a Medicare cohort study. *Ann Surg.* 2023;277(3):e657-e663.
24. Meilleur A, Subramanian SV, Plascak JJ, et al. Rural residence and cancer outcomes in the United States: issues and challenges. *Cancer Epidemiol Biomarkers Prev.* 2013;22(10):1657-1667.
25. Hirko KA, Xu H, Rogers LQ, et al. Cancer disparities in the context of rurality: risk factors and screening across various US rural classification codes. *Cancer Causes Control.* 2022;33(8):1095-1105.
26. Riddle BL. On the coding and reporting of race and ethnicity in New Hampshire for purposes of cancer reporting. *Ethn Dis.* 2005;15(2):324-331.
27. Neighborhood Atlas. Accessed July 19, 2024. <https://www.neighborhoodatlas.medicine.wisc.edu>
28. Kind AJH, Buckingham WR. Making neighborhood-disadvantage metrics accessible—the Neighborhood Atlas. *N Engl J Med.* 2018;378(26):2456-2458. doi:10.1056/NEJMp1802313
29. US Preventive Services Taskforce. Lung Cancer: Screening. 2013. Accessed July 19, 2024. <https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening-december-2013>
30. Fedewa SA, Kazerooni EA, Studts JL, et al. State variation in low-dose computed tomography scanning for lung cancer screening in the United States. *J Natl Cancer Inst.* 2021;113(8):1044-1052.
31. Andrilla CHA, Moore TE, Man Wong K, Evans DV. Investigating the impact of geographic location on colorectal cancer stage at diagnosis: a national study of the SEER cancer registry. *J Rural Health.* 2020;36(3):316-325. doi:10.1111/jrh.12392
32. Leech MM, Weiss JE, Markey C, Loehrer AP. Influence of race, insurance, rurality, and socioeconomic status on equity of lung and colorectal cancer care. *Ann Surg Oncol.* 2022;29(6):3630-3639. doi:10.1245/s10434-021-11160-1
33. Fairfield KM, Black AW, Lucas FL, et al. Association between rurality and lung cancer treatment characteristics and timeliness. *J Rural Health.* 2019;35(4):560-565. doi:10.1111/jrh.12355
34. Ray MA, Faris NR, Derrick A, et al. Rurality, stage-stratified use of treatment modalities, and survival of non-small cell lung cancer. *Chest.* 2020;158(2):787-796.
35. Henley SJ, Thomas CC, Lewis DR, et al. Annual report to the nation on the status of cancer, part II: progress toward Healthy People 2020 objectives for 4 common cancers. *Cancer.* 2020;126(10):2250-2266.
36. Johnson AM, Hines RB, Johnson JA III, Bayakly AR. Treatment and survival disparities in lung cancer: the effect of social environment and place of residence. *Lung Cancer.* 2014;83(3):401-407.
37. Logan C, Feinglass J, Halverson AL, et al. Danger in America's small towns: rural-urban survival disparities for patients with surgically treated lung cancer. *J Am Coll Surg.* 2021;233(5):S258-S259.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Carter B, Denny J, Lohrer A. Impact of Medicaid expansion on stage of diagnosis of lung cancer for rural and urban patients in New Hampshire. *J Rural Health.* 2025;41:1–6. <https://doi.org/10.1111/jrh.70001>