

College Access for Cancer Prevention in Rural North Carolina

References and Data Sources

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1. Problem Statement Sources

Cancer Statistics

- **"NC ranks among states with the highest cancer incidence at 475.5 diagnoses per 100,000 residents."**
National Cancer Institute. (2026, January 28). Interactive Maps. State Cancer Profiles. <https://statecancerprofiles.cancer.gov/map/map.withimage.php?00&state&001&001&00&0&01&0&1&5&0#results>
- **"Cancer is the second-leading cause of death in North Carolina, at 151.1 deaths per 100,000 in 2023."**
CDC. (2025, August 11). Cancer Mortality. Stats of the States. <https://www.cdc.gov/nchs/state-stats/deaths/cancer.html>
- **"Forty percent of NC cancer deaths in 2023 were from lung, colorectal, or breast cancer."**
National Cancer Institute. (2024, July). *Cancer Information Service*. <https://schs.dph.ncdhhs.gov/schs/CCR/cp2024/NorthCarolina.pdf>
- **"majority of cancers are related to personal lifestyle or environmental factors..."**
National Cancer Institute. (2020, July). *Cancer Information Service*. <https://schs.dph.ncdhhs.gov/schs/CCR/cp2024/NorthCarolina.pdf>

Social Determinants of Health (SDOH) Definition

- **"These diagnoses are shaped by social determinants of health (SDOH), which the CDC defines as the non-medical and cumulative factors that influence individual health outcomes."**
CDC. (2024, May 14). *Social Determinants of Health*. Public Health Professionals Gateway. <https://www.cdc.gov/public-health-gateway/php/about/social-determinants-of-health.html>

Geographic & Demographic Data

- **"Thirty-five percent of North Carolinians live in rural counties."**
NCDHHS SCHS. (2024). *BRFSS REPORT: URBAN-RURAL RESIDENT, FINAL 2024*. NCDHHS. <https://schs.dph.ncdhhs.gov/data/brfss/urbanrural/docs/2024-UrbanSuburbanRuralData.pdf>
- **"[rural] college graduation rates are 43% lower (23.0% vs. 40.4%)"**
- NCDHHS SCHS. (2024). *BRFSS REPORT: URBAN-RURAL RESIDENT, FINAL 2024*. NCDHHS. <https://schs.dph.ncdhhs.gov/data/brfss/urbanrural/docs/2024-UrbanSuburbanRuralData.pdf>

Statistical Analysis & Research Findings

- **"College graduation emerged as the only consistently protective factor across all three cancer types, with effect sizes 4-16 times stronger than any other SDOH variable, including PCP access, smoking rates, and poverty."**
Thompson, M. E. (2025, December 20). Regularized Regression Approaches to Understanding North Carolina Cancer Inequities. Unpublished manuscript, NC State University. [Full report included as supplementary material]
- **"...lung cancer incidence and colorectal cancer incidence and mortality are significantly higher [in rural] (p=0.015, p=0.001, p=0.000) than urban areas."**
- Source: Thompson, M. E. (2026, February 3). *Urban vs. Rural Cancer Rate Comparison*. Statistical analysis using two-sample t-tests on NC county-level cancer data. Data sources: NCDHHS (cancer rates) and NCIOM (metro/nonmetro designation). [Analysis code included as supplementary material]

- **LASSO standardized coefficients: Breast incidence (-9.62), Lung incidence (-8.34), Colorectal incidence (-3.83)**

Thompson, M. E. (2025, December 20). Regularized Regression Approaches to Understanding North Carolina Cancer Inequities. Unpublished manuscript, NC State University. [Full report included as supplementary material]

2. Proposed Solution Sources

NC College Connect Program

- **"NC College Connect is a program that guarantees admission for public high school seniors with a 2.8+ weighted GPA to 40 NC colleges, and all 58 community colleges."**

CFNC. (n.d.). *NC College Connect*. Retrieved February 3, 2026, from <https://www.cfnc.org/nc-college-connect/>

College Cost Data

- **"The average cost of tuition and fees at the public universities in this program is \$5,832 per year."**
The University of North Carolina System. (2025, February 27). *The University of North Carolina Tuition and Fees Applicable to All Regular Full-Time Undergraduate Students 2025-26*. <https://www.northcarolina.edu/wp-content/uploads/reports-and-documents/finance-documents/undegraduate-tuition-and-fees-fy2025-26.pdf>
- **Average state Pell Grant: \$6,144**
National Center for Education Statistics. (2026, February 3). *Trend Generator*. IPEDS Integrated Postsecondary Education Data System. <https://nces.ed.gov/ipeds/trendgenerator/app/answer/8/36?f=6%3D37%3B4%3D1>
- **Low-income population in rural NC: 27.3%**
- NCDHHS SCHS. (2024). *BRFSS REPORT: URBAN-RURAL RESIDENT, FINAL 2024*. NCDHHS. <https://schs.dph.ncdhhs.gov/data/brfss/urbanrural/docs/2024-UrbanSuburbanRuralData.pdf>
- **K12 students in rural NC: 467,000**
NC Rural Center. (n.d.). *NC Rural Center | Building Vibrant Rural Communities*. NC Rural Center. Retrieved February 3, 2026, from <https://www.ncruralcenter.org/>

Cancer Treatment Costs

- **National expenditures by 2030: \$246B**
NIHCM. (n.d.). *Insights on Cancer: Rates, Costs, and Strategies*. NIHCM. Retrieved February 3, 2026, from <https://nihcm.org/publications/insights-on-cancer-rates-costs-and-strategies?token=gbCMAj1mGlgwqLfxwSaUvM2qc-dvNG3e>
- **Lifetime treatment costs: Lung (\$190,929), Breast (\$114,620), Colorectal (\$182,913).**
NCI. (n.d.). *Financial Burden of Cancer Care*. National Cancer Institute Cancer Trends Progress Report. Retrieved February 3, 2026, from https://progressreport.cancer.gov/after/economic_burden

Economic Data

- **Conservative wage premium for college graduates: \$20,000/year (BLS reports \$31,876 gap)**
Bureau of Labor Statistics. (n.d.). *Education pays, 2024*. Bureau of Labor Statistics. Retrieved February 3, 2026, from <https://www.bls.gov/careeroutlook/2025/data-on-display/education-pays.htm>
- **NC income tax rate: 3.99%**
NCDOR. (n.d.). *Tax Rate Schedules | NCDOR*. NCDOR. Retrieved February 3, 2026, from <https://www.ncdor.gov/taxes-forms/individual-income-tax/tax-rate-schedules#TaxYear2024-13671>

- **Value of Statistical Life (VSL): \$13,700,000 per life**
US EPA, O. (2014, April 20). *Mortality Risk Valuation* [Overviews and Factsheets]. EPA. <https://www.epa.gov/environmental-economics/mortality-risk-valuation>

3. Obstacles & Implementation Sources

- **“CFNC's NC Countdown to College program provides year-long support for students applying to college, including free applications during College Application Week, which is already integrated with NC College Connect.”**
NC DPI. (2025, October 16). *This College Application Week, Direct Admission is Waiting for About 70,000 Students* | NC DPI. <https://www.dpi.nc.gov/blog/2025/10/16/college-application-week-direct-admission-waiting-about-70000-students>
- **Median salary for College Access Program Academic Advisor in UNC System: \$44,000**
The University of North Carolina System. (n.d.). *UNC Salary Information Database*. Retrieved February 3, 2026, from <https://uncdm.northcarolina.edu/salaries/index.php>
- **"UNC system schools provide comprehensive student support: academic advising, tutoring, career counseling, mental health resources, peer mentoring."**
The University of North Carolina System. (n.d.). *Student Success—UNC System*. Retrieved February 3, 2026, from <https://www.northcarolina.edu/impact/student-success/>

4. Research Methodology Summary

Data Sources:

- **Cancer incidence and mortality data (2019-2023)**
NCDHHS SCHS. (n.d.-a). *NCDHHS: DPH: NC SCHS: Statistics and Reports: Cancer: Incidence Rates*. SCHS: Cancer Incidence Rates. Retrieved December 8, 2025, from https://schs.dph.ncdhhs.gov/data/cancer/incidence_rates.htm
NCDHHS SCHS. (n.d.-b). *NCDHHS: DPH: NC SCHS: Statistics and Reports: Cancer: Mortality Rates*. SCHS: Cancer Mortality Rates. Retrieved December 8, 2025, from https://schs.dph.ncdhhs.gov/data/cancer/mortality_rates.htm
- **Social determinants of health data (2021 snapshot)**
NCIOM. (n.d.). *NC County Health Data*. NC COUNTY HEALTH DATA. Retrieved December 8, 2025, from <https://nciom.org/nc-health-data-archive/map/>

Statistical Methods:

Ordinary Least Squares (OLS), Ridge regression, and Least Absolute Shrinkage and Selection Operator (LASSO) regression were used to identify SDOH predictors most strongly associated with cancer outcomes. LASSO was selected for variable selection due to multicollinearity among SDOH predictors. All predictors were z-scored (standardized) prior to modeling. Ten-fold cross-validation was used to select regularization parameters. Full methodology, diagnostic plots, and model outputs are provided in the supplementary *Regularized Regression Approaches to Understanding North Carolina Cancer Inequities* report. Supplemental code is also provided.

5. Key Statistics Reference Table

| Statistic | Value | Source |
|---|----------------|------------|
| NC cancer incidence rate | 475.5 per 100k | NCI |
| NC cancer mortality rate | 151.1 per 100k | CDC |
| Rural population (NC) | 35% (3.74M) | NCIOM |
| Rural college graduation rate | 23.0% | NCIOM |
| Urban college graduation rate | 40.4% | NCIOM |
| LASSO coefficient: Breast incidence | -9.62 | Thompson |
| LASSO coefficient: Lung incidence | -8.34 | Thompson |
| LASSO coefficient: Colorectal incidence | -3.83 | Thompson |
| Annual diagnoses prevented | 746.5 | Calculated |

| | | |
|----------------------------------|-----------------|------------|
| Annual program cost | \$308,002,565 | Calculated |
| Annual fiscal return | \$377,191,553 | Calculated |
| Net annual gain | \$69,188,988 | Calculated |
| Rural mortality reduction | 7.36% | Calculated |
| VSL per year | \$2,959,200,000 | Calculated |