Geographic Access to Lung Cancer Screening Services in Vermont

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Background

In 2022, the United States Preventive Services Task Force (USPSTF) released updated lung cancer screening guidelines recommending annual low dose computed tomography (LDCT) screening for current and former heavy smokers aged 50 to 80 years. In Vermont, only 23% of eligible adults report being up to date with lung cancer screening, compared with breast cancer (75%) and colorectal cancer (70%) screening rates (BRFSS, 2022).

Methods

Estimating Access: To determine spatial accessibility to lung cancer screening (LCS) services, an enhanced Two-Step Floating Catchment Area (E2SFCA) (Luo & Qi, 2009) method was used. This method generates an accessibility score based on the interaction between supply and demand within catchment areas.

Spatial accessibility scores were calculated per 100,000 population and adjusted by applying distance-based weights using a Gaussian decay function to drive-times within a 60-minute catchment area (Hashtarkhani et al, 2024). For interpretation, a Spatial Access Ratio (SPAR) was calculated by dividing each region's accessibility score by the state average accessibility score. A SPAR greater than 1 indicates a geographic region with greater access than the state average, while a SPAR less than 1 indicates less access than the state average. The SPAR was mapped using Natural Jenks Breaks.

Population estimates and demand were determined using subcounty geographies (SCIDs) for Vermont residents aged 50-79. SCIDs were developed for statewide geographic analyses and combine town and census tract boundaries to minimize data suppression (<6 cases) and reduce variation in population size across analysis areas. Census tracts are used in higher-population cities and towns, while towns are displayed as undivided or combined units in less populated areas. To minimize data suppression, the 89-area SCID version was used. Using E911 address point data, residential addresses were used to determine the population-weighted center of each SCID.

Supply was determined by using a list of healthcare facilities maintained by Vermont's Cancer Coalition, Vermonter's Taking Action Against Cancer (VTAAC), that have been identified as offering LCS services. The addresses of these facilities were then geocoded.

Smoking Prevalence: Smoking prevalence was calculated from adults (18+) who self-reported as cigarette smokers in Vermont's 2011-2020 Behavioral Risk Factor Surveillance System (BRFSS) surveys. An area's estimated smoking prevalence was considered statistically different from the state prevalence if the p-value was ≤0.10 and the two-stage False Discovery Rate method determined the difference was unlikely due to chance.

Cancer Standardized Incidence Ratios (SIRs): Lung cancer data are reported as SIRs based upon VCR data from 2013-2022. An area's SIR was considered statistically different from the state SIR of 1.00 if the p-value was ≤0.10 and the two-stage False Discovery Rate method determined the difference was unlikely due to chance.

Geographic analyses were performed using ArcGIS Pro and statistical analyses were performed using RStudio.

Results

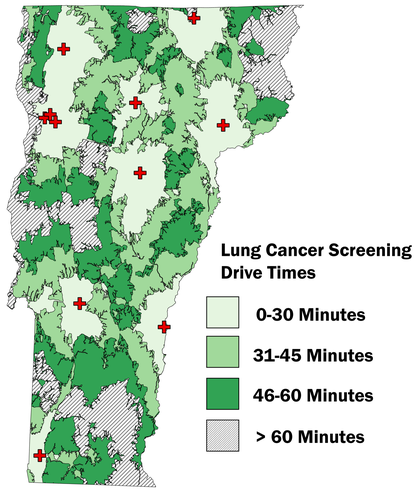
This analysis represent a first step towards understanding and identifying areas for intervention to increase LCS uptake throughout Vermont. When used in conjunction with additional disease and risk data, different regions can be identified that may benefit from different, more targeted forms of intervention begin to appear:

- Areas with higher numbers of estimated smokers and/or high advanced-stage lung cancer incidence and **greater** spatial access may benefit from complementary services, including patient navigation, increased referral rates, and improved access for uninsured adults.
- Areas with higher numbers of estimated smokers and/or high advanced-stage lung cancer incidence and **limited** spatial access compared with the state may benefit from additional screening locations, including mobile LCS services.

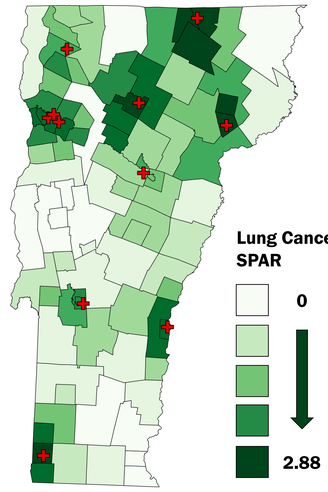
Estimated Percent of Population Within Each Lung Cancer Screening Facility Service Area, Vermonters, Aged 50-79

Service Area	Percent of Population (%)
0-30 Minute Drive Time	63%
30-45 Minute Drive Time	22%
45-60 Minute Drive Time	11%
60+ Minute Drive Time	5%

Lung Cancer Screening Facility 60-Minute Service Areas



Lung Cancer Screening Spatial Accessibility Ratios (SPAR)



Cigarette Smoking Prevalence and Advanced Stage Lung Cancer

Conclusions

Although most of Vermont's population has access to lung cancer screening services within a 60-minute drive time, accessibility varies by region and may contribute to disparities in screening uptake.

Further analysis should incorporate additional information, including provider availability, lung cancer mortality data, and other barriers to access such as financial, educational, insurance coverage, facility capacity (e.g., appointment availability and hours of operation), and transportation considerations, to better tailor interventions to community needs.

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Citations & Data Sources
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