

# **FACTORS ASSOCIATED WITH LUNG CANCER SCREENING IN URBAN VS. RURAL INDIVIDUALS AT RISK FOR LUNG CANCER**

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**RURAL &  
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# BACKGROUND: LUNG CANCER IMPACT

- Lung cancer is the leading cause of cancer deaths in the US
- The 5-year survival rate is ~20.5% overall, but 59.0% if found at an early stage
- The mortality rate is higher among rural populations
- Rural populations also have higher rates of smoking and higher overall and late-stage incidence rates
- National Lung Screening Trial (NLST) showed that Low-Dose Computed Tomography (LDCT) detected lung cancer earlier and reduced mortality up to 20% compared to chest x-ray, in high-risk individuals

# BACKGROUND: LDCT LUNG CANCER SCREENING

- US Preventive Services Task Force (USPSTF) began recommending annual LDCT lung cancer screening for high-risk individuals in 2013
  - High-risk individuals:
    - Current smokers and former smokers who quit within 15 years with a 30+ pack-year smoking history
    - Age between 55 and 80 years old
- Private insurance and Medicare began covering screening in 2015 (Medicaid varies by state)
- Population-based estimates of LDCT utilization range:
  - 3.8% in the 2015 National Health Interview Survey (NHIS) to 14.4% in the 2017 Behavioral Risk Factor Surveillance System (BRFSS) survey
  - Rural vs. urban estimates from 2015 NHIS were low in both groups (3.72% and 3.83%, respectively)

# STUDY AIMS

- To determine population-based, rural and urban estimates of utilization of LDCT screening for lung cancer using the 2018 (newest available) BRFSS survey
  - We examine predictors of LDCT screening for lung cancer using a mixed-effects model that incorporates state level clustering
- 2018 BRFSS-population-based phone survey of US residents on health-related risk behaviors, chronic health conditions, and use of preventive services
- Optional module: Lung Cancer Screening Module (LCSM)
  - Smoking History
  - Receipt of LDCT screening for lung cancer

# METHODS: DATA SOURCE & STUDY SAMPLE

- Sample: adults 55-80 years with 30+ pack-year smoking history, currently smoking or quit within the past 15 years, per USPSTF
  - Excluded those whose eligibility could not be determined due to incomplete data or who had a previous lung cancer diagnosis
  - Final sample included 2,620 eligible participants
- Outcome variable: receipt of LDCT screening to check for lung cancer
- Factors:
  - Rural-urban status
  - Demographic characteristics (e.g., age, gender, race)
  - Health factors (e.g., respiratory conditions, self-reported health status)
  - Socioeconomic factors (e.g., income, insurance status)

# METHODS: STATISTICAL ANALYSIS

- Exploratory analysis with chi-square tests
  - Overall
  - Stratified by rural/urban
- Mixed-effects multivariable logistic regression model (unadjusted/adjusted, survey weights)
  - Study factors as fixed effects
  - State as random effect (random intercept)
  - Random effect allows to capture unobserved variability not accounted for otherwise
  - Recalculated survey weights for use in our multilevel model

# RESULTS: EXPLORATORY ANALYSIS

- Exploratory analysis indicated no difference between rural vs. urban LDCT screening uptake
  - All eligible who were screened (19.54%)
  - Rural (N=383, 13.41%) vs. urban (N=2237, 20.15%) ( $p=0.45$ )
- Stratified exploratory analysis shows no association between LDCT screening and study factors in rural participants, except for pack-year history (sample size, power considerations)

# RESULTS: REGRESSION ANALYSIS

- Unadjusted model shows significant impact of rurality on screening uptake
- Rural BRFSS participants had odds of LDCT lung cancer screening 40% lower than urban BRFSS participants
- Adjusted model: non-significant association

	Unadjusted			Adjusted		
	Odds Ratio	95% CI	P-Value	Odds Ratio	95% CI	P-Value
<b>Demographic Factors</b>						
<b>Rurality</b>						
Rural	<b>0.60</b>	<b>0.37-0.97</b>	<b>0.04</b>	0.53	0.23-1.21	0.13
Urban	Reference	Reference	Reference	Reference	Reference	Reference



# RESULTS: REGRESSION ANALYSIS

- However, rurality was significant effect modifier in the relationship between smoking status and LDCT lung cancer screening uptake in adjusted mixed-effects model

	Adjusted		
	Odds Ratio	95% CI	P-Value
<b>Health Factors</b>			
<b>Smoking Status by Rurality</b>			
<u>Rural Participants</u>			
Former Smoker, ≥ 30 pack-year history, quit > 1 year ago, but < 15 years ago	<b>2.52</b>	<b>1.06-6.03</b>	<b>0.04</b>
Former Smoker, ≥ 30 pack-year history, quit within the past year	0.39	0.08-2.00	0.26
Current Smoker, ≥30 pack-year history	<b>0.14</b>	<b>0.03-0.67</b>	<b>0.01</b>
<u>Urban Participants</u>			
Former Smoker, ≥ 30 pack-year history, quit > 1 year ago, but < 15 years ago	Reference	Reference	Reference
Former Smoker, ≥ 30 pack-year history, quit within the past year	1.30	0.81-2.08	0.28
Current Smoker, ≥30 pack-year history	0.74	0.48-1.14	0.17

- Current rural smokers have odds of screening 86% lower than former urban smokers (p=0.01)

# LIMITATIONS

- Only a small number of states included this optional module in their survey
- Self-report of screening and smoking status
- Model could not account for evolving pack-year history due to data
- No available data on insurance type or other cancer detection and diagnoses
- Data does not allow to exclude participants with symptoms of lung cancer or other life-constraining illnesses, etc.
- Sample size of rural participants and low power to detect
- The NLST excluded participants who had previous malignancies within the last 5 years, but such exclusions are not part of the USPSTF recommendations
  - This may complicate survey reporting as well as increase measurement error in data collection

# DISCUSSION & CONCLUSION

- Estimates of screening utilization are higher than in past years
- There are no rural-urban differences in screening uptake except when clustering by state, but this was attenuated when accounting for other factors
  - Differences by state may be due to important factors such as access to screening and Medicaid coverage and power/sample size issues
- Rural current smokers had lower odds of screening utilization: important area of intervention
- This research focus is important as rural populations have higher tobacco use, lung cancer incidence, late-stage incidence, mortality and comprise a disproportionate percentage of the LDCT-eligible population

# THANK YOU!

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