


Barriers, Facilitators, and Suggested Interventions for Lung Cancer Screening Among a Rural Screening-Eligible Population

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Abstract

Introduction: Rural areas are disproportionately affected by lung cancer late-stage incidence and mortality. Lung cancer screening (LCS) is recommended to find lung cancer early and reduce mortality, yet uptake is low. The purpose of this study was to elucidate the barriers to, facilitators of, and suggested interventions for increasing LCS among a rural screening-eligible population using a mixed methods concurrent embedded design study. **Methods:** Qualitative and quantitative data were collected from rural-residing adults who met the eligibility criteria for LCS but who were not up-to-date with LCS recommendations. Study participants ($n = 23$) took part in 1 of 5 focus groups and completed a survey. Focus group discussions were recorded, transcribed, and coded through a mixed deductive and inductive approach. Survey data were used to enhance and clarify focus group results; these data were integrated in the design and during analysis, in accordance with the mixed methods concurrent embedded design approach. **Results:** Several key barriers to LCS were identified, including an overall lack of knowledge about LCS, not receiving information or recommendation from a health care provider, and lack of transportation. Key facilitators were receiving a provider recommendation and high motivation to know the screening results. Participants suggested that LCS uptake could be increased by addressing provider understanding and recommendation of LCS and conducting community outreach to promote LCS awareness and access. **Conclusion:** The results suggest that the rural screening-eligible population is generally receptive to LCS. Patient-level factors important to getting this population screened include knowledge, transportation, motivation to know their screening results, and receiving information or recommendation from a provider. Addressing these factors may be important to increase rural LCS uptake.

Keywords

lung cancer, lung cancer screening, rural, rural health, tobacco, smoking

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Introduction

Lung cancer is the most common cancer that affects both men and women.¹ When lung cancer is diagnosed at a distant (late) stage, the 5-year survival rate is just 5.2%, in contrast to 57.4% when it is diagnosed at a localized (early) stage.¹ Unfortunately, most lung cancers are diagnosed at a distant stage,¹ especially in rural areas.^{2–4} Compared with urban areas, rural areas carry a disproportionate lung cancer burden exemplified by higher rates of overall incidence,^{3–6} late-stage incidence,^{2,4} and mortality,^{3,4,6,7} and the disparities are widening.^{3,5}

Screening for lung cancer with low-dose computed tomography (LDCT) reduces lung cancer mortality and is the only cancer screening test found to reduce overall

mortality.⁸ Since 2013, the US Preventive Services Task Force (USPSTF) has endorsed a grade B recommendation for annual LDCT for people 55 to 80 years old who have a 30 pack-year history of smoking and who are either current smokers or quit in the past 15 years.⁹ Embedded in the

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Table 1. Relevant Demographic and Health Characteristics of the Source Population.

	Source Population: New Hampshire and Vermont RUCC 7–9 Counties	Comparison: New Hampshire and Vermont RUCC 1–6 Counties
Demographic characteristics		
% Female ²³	71.3	54.1
% Non-Hispanic white ²³	94.4	90.6
% 65 years or older ²³	20.6	16.8
% High school degree or less ²⁴	42.8	33.9
% Below poverty level ²⁵	12.1	8.3
Health characteristics		
Adult smoking rate (%) ²¹	19.68	18.35
Lung cancer incidence rate (per 100 000) ²²	64.8	66.9
Lung cancer mortality rate (per 100 000) ²²	50.6	46.2

Abbreviation: RUCC, Rural Urban Continuum Code.

USPSTF's recommendation is the need for providers to engage patients in shared decision making (SDM) to discuss the benefits, risks, and patient preferences related to lung cancer screening (LCS).⁹ Because of the USPSTF's recommendation, Medicare and most insurance plans provide coverage for LCS at no cost to patients.^{10,11}

In 2016, the LCS rate in the United States was only 1.9%,¹² which likely saved about 233 lives—12 017 fewer than if everyone eligible were screened.¹³ Despite rural areas having a disproportionately higher percent of people eligible for screening, LCS rates are no higher in rural areas than in other parts of the country,¹⁴ and rural areas have unique challenges in getting patients screened.^{4,14} Little is known about why LCS uptake remains so low, though there are likely compounding patient, facility, system, and health care provider factors,^{4,15} including skepticism among the health care community¹⁶ and difficulty identifying patients who meet the criteria to be screened.¹⁷ Few studies have examined patient-level factors of LCS uptake in rural populations.

The goal of this study was to elucidate the barriers to, facilitators of, and suggested interventions for increasing LCS among a rural screening-eligible population. Given the complexity of patient-level factors, as well as the nascent nature of research in this arena, a mixed methods research design exploring these factors was warranted.^{18,19}

Methods

The Dartmouth College Committee for the Protection of Human Subjects approved study protocols and materials.

Setting, Source Population, Eligibility, and Recruitment

This study took place in New Hampshire and Vermont, an area local to the research team, in fall 2018. Because the

research team was interested in understanding the perspectives of the area's most rural residents, the study population was drawn from counties classified as 7–9 by the 2013 Rural Urban Continuum Codes (RUCC).²⁰ These counties have higher rates of smoking²¹ and lung cancer mortality,²² and the demographics comprise a population that is older,²³ less educated,²⁴ and more impoverished²⁵ than the rest of New Hampshire and Vermont (see Table 1).

Study participants were eligible if they lived in a New Hampshire or Vermont RUCC 7 to 9 county; met the USPSTF eligibility criteria for LCS based on age, smoking status, and smoking history; and were not up-to-date with USPSTF screening recommendations.⁹ All participants were screened for and met these criteria.

Participants were recruited through social media and newspaper advertisements, as well as through flyers circulated online and in-person. Recruitment continued until sufficient eligible participants were identified. Participants received \$40 and a meal for participating. All participants provided written informed consent.

Study Design and Data Collection

This mixed methods study followed a concurrent embedded study design¹⁹ in which “one data set provides a supportive, secondary role in a study based primarily on the other data type.”¹⁸ This primarily qualitative study used data collected in surveys to complement and clarify findings from focus group discussions.^{26,27} This design was selected on the premise that “a single data set is not sufficient, that different questions needs to be answered, and that each type of question requires different types of data.”¹⁸

Quantitative data were collected by paper surveys completed by participants on arrival at the focus groups. The survey contained 20 close-ended questions designed to assess participants' demographic characteristics, knowledge of LCS, and access to health services. Questions

were drawn from a literature review and validated national surveys.²⁸⁻³¹

Qualitative data were collected in 5 focus groups. The semi-structured focus group guide drew on previous cancer control focus group studies³²⁻³⁵ and was designed to facilitate discussion about participants' barriers to and facilitators of getting screened for lung cancer and their suggested interventions to increase LCS uptake in rural communities. In anticipation of participants having low knowledge about LCS, the moderator included a brief overview³⁶ of LCS during the focus groups. Focus group discussions ranged from 66 to 73 minutes and were audio recorded, transcribed, and led by the same moderator (JS).

Analytic Methods

The research team developed a codebook for analysis through a mixed deductive (content analysis) and inductive (grounded theory) approach.³⁷ Preliminary codes were determined by the broader team (JS, JAT, II, and TO) based on the study questions, and a trained evaluator (KC) developed additional codes through an iterative review of the data. The evaluator (KC) coded all transcripts using Dedoose qualitative analysis software³⁸ and grouped codes into themes. The codebook and resulting themes were discussed, refined, and approved by the research team. Survey and focus group data were integrated in the design phase and during analysis.^{18,19,26,27} Based on this analysis, the research team determined that 5 focus groups were sufficient for reaching saturation on relevant themes.

Results

Table 2 includes a summary of study participant demographics (n = 23). Most participants (78.3%) were female and ranged from 55 to 75 years old (median age = 66 years). About 61% of participants were former smokers and 39% current smokers. All participants reported having health insurance, with approximately three-quarters (73.9%) covered by Medicare.

Table 3 provides a summary of the barriers to, facilitators of, and suggested interventions for increasing lung cancer screening uptake, as identified by study participants.

Barriers to Lung Cancer Screening

The three most fundamental barriers to LCS described by participants were (1) lack of knowledge about LCS, (2) not receiving information or recommendation from a health care provider, and (3) lack of transportation. Additional barriers that arose as themes in the focus groups included low motivation to know the screening results and feeling healthy (without symptoms). The primary barrier to returning for subsequent annual screenings, as described by participants, was receiving a negative or false-positive screening result.

Table 2. Characteristics of Study Participants (n=23).

	n (%)
State of residence (n = 23)	
New Hampshire	11 (47.8)
Vermont	12 (52.2)
Gender (n = 23)	
Female	18 (78.3)
Male	5 (21.7)
Age, years (n = 23)	
55-59	4 (17.4)
60-64	3 (13.0)
65-69	12 (52.2)
70-74	3 (13.0)
75-80	1 (4.3)
Highest level of education (n = 23)	
Less than high school	1 (4.3)
High school/GED	2 (8.7)
Post-high school training (not college)	4 (17.4)
Some college	9 (39.1)
College graduate	4 (17.4)
Postgraduate	3 (13.0)
Employment status (n = 23) ^a	
Employed	5 (21.7)
Retired	15 (65.2)
Disabled	3 (13.0)
Other	1 (4.3)
Health insurance/coverage (n = 22) ^{ab}	
Plan purchased through an employer or union	5 (22.7)
Plan purchased on own/by family	6 (27.3)
Medicare	17 (77.3)
Medicaid or other state program	1 (4.5)
TRICARE (formerly Champus), VA, or military	1 (4.5)
Some other source	2 (9.1)
No insurance/coverage	0 (0)
Gross household annual income, \$ (n = 22) ^b	
<20 000	4 (18.1)
20 000 to <35 000	6 (27.3)
35 000 to <50 000	3 (13.6)
50 000 to <75 000	8 (36.4)
>75 000	1 (4.5)
Current smoker (n = 23)	
Yes	9 (39.1)
No	14 (60.9)
What kind of place(s) do you most often go to when you are sick or need advice about your health? (n = 23) ^{12,a}	
Clinic or health center	8 (34.8)
Doctor's office or health maintenance organization	15 (65.2)
Hospital emergency room	2 (8.7)
Hospital outpatient department	1 (4.3)
Other	1 (4.3)
In the past 12 months, was there a time when you needed to see a doctor but could not because of cost? (n = 22) ^{13,b}	
Yes	4 (18.2)
No	18 (81.8)

^aParticipants were able to provide more than one response.

^bNot all study participants provided complete responses.

Table 3. Summary of Barriers, Facilitators, and Suggested Interventions Related to Lung Cancer Screening (LCS), as Identified by Study Participants.

Barriers to LCS	Facilitators of LCS	Suggested interventions
Lack of knowledge about LCS, including screening method, locations, eligibility criteria, and insurance coverage	Receiving a screening recommendation from a healthcare provider	Promoting provider understanding and recommendation of LCS
Not receiving information or recommendation from a healthcare provider	High motivation to know the screening results	Conducting community outreach to promote LCS awareness and access
Lack of transportation	Facilitator of annual screening:	Consideration in designing interventions: Address stigma and shame felt by smokers
Low motivation to know the screening results	Receiving a true-positive result ^a	
Feeling healthy (no symptoms)		
Barrier to annual screening: Receiving a negative or false-positive screening result		

^aParticipants described receiving a true-positive result as a facilitator of pursuing guideline-recommended annual screening. However, receiving a true-positive result would require lung cancer surveillance, rather than lung cancer screening.

Lack of Knowledge About LCS. Survey responses and focus group discussions revealed lack of knowledge as a main barrier to LCS. Survey responses indicated that over half (52%) of participants had never heard of LCS, and fewer than 10% correctly identified the age at which LCS should begin (55 years). In focus groups, participants revealed little knowledge of who should get screened, where and how to get screened, whether insurance would cover screening, and the recommended screening method (LDCT).

Not Receiving Information or Recommendation From a Health Care Provider. In focus group discussions, participants identified lack of information or recommendation from a healthcare provider as a key barrier to receiving LCS. Some participants reported having an “occasional” relationship with a health care provider, but many described having trusting relationships with their providers and regularly going for visits. Regardless, participants reported receiving little to no information from their providers about LCS, despite receiving information about other cancer screenings. When prompted, participants said they were unsure why providers had not shared LCS information with them but posited as possible reasons the providers’ lack of knowledge about LCS guidelines and insurance coverage, as well as possible provider skepticism regarding patient interest in screening and the benefits of screening.

Lack of Transportation. During focus group discussions, participants broadly acknowledged transportation as a barrier to screening, particularly in the winter or when traveling long distances. Some participants discussed not having reliable transportation or being inhibited by transportation costs. While they were largely unaware of the travel distance to get to the nearest LCS facility, many participants assumed it would require going to a larger hospital outside of their communities. Survey responses indicated that participants would need to travel an average of about 23

minutes to travel for primary care, 21 minutes for cancer screening tests (eg, mammography), and 70 minutes for serious medical treatment.

Low Motivation to Know the Screening Results. In focus group discussions, low motivation to know the results of screening arose as a barrier. For those who were reluctant to know the results, the primary driver was fear, whether a fear of a true-positive or false-positive result. Others misperceived their risk, for example, by believing they were not at risk because they had no family history of lung cancer. Furthermore, some participants described screening as futile, either because they would not seek treatment or because they felt treatment would not be effective.

Feeling Healthy (No Symptoms). Participants described feeling healthy as a barrier to screening. While they seemed to understand the importance of screening for other types of cancer (eg, breast, colorectal) in the absence of symptoms, many participants felt they would need to exhibit symptoms (eg, cough) to warrant getting screened for lung cancer. One participant stated, “If I was not feeling well, if I couldn’t walk up a flight of stairs, if I couldn’t run or use the treadmill anymore, then [I would get screened].”

Receiving a Negative or False-Positive Screening Result as a Barrier to Annual Screening. Finally, participants were asked about barriers to getting screened on an annual basis. Discussions generally focused on how past LCS results—particularly negative (no cancer) and false-positive results—would influence their interest in getting screened again. Participants explained that a negative result would give them reassurance of their health and, therefore, mean future annual screenings would not be necessary. In contrast, some participants feared the possibility of a false-positive result and felt the additional appointments and tests stemming from the false-positive would discourage them from getting screened again.

Facilitators of Lung Cancer Screening

Beyond having some knowledge of the screening eligibility and guidelines, participants described 2 primary facilitators for LCS: (1) receiving a screening recommendation from a health care provider and (2) having high motivation to know the screening results. Participants also described receiving a true-positive result as a potential facilitator of getting screened the following year.

Receiving a screening recommendation from a health-care provider. Although participants typically did not recall their healthcare provider recommending screening, many believed having a recommendation from their provider would encourage them to get screened. Participants frequently mentioned looking to their providers for this type of recommendation. Some felt that if providers thought LCS was important, then providers would discuss it with patients. In particular, some participants did not feel it was their role to suggest health care services for themselves, instead relying on the provider to make these recommendations.

High Motivation to Know the Screening Results. While low motivation to know the results was identified as a barrier, high motivation to know the results was identified as a facilitator. This motivation seemed to be linked to participants' understanding of the purpose of screening and the consequences of not getting screened. One participant stated, "I'd want to know [the results] because [cancer] spreads so fast to other places." Those who mentioned being motivated to know the results talked about the benefit of knowing early to be able to treat the cancer or to have "options" in treatment. For some, their motivation was connected to the distance they would be willing to travel for screening, with one participant saying, "If I wanted it done I would go as far as I had to . . . I wouldn't mind going two, three hours."

Receiving a True-Positive Result as a Facilitator of Annual Screening. Finally, participants felt that receiving a true-positive screening result would reinforce the importance of screening, encouraging them to get screened annually.

Suggested Interventions

Two themes arose from focus group discussions regarding how LCS awareness and access could be promoted among the screening-eligible population: (1) promoting provider understanding and recommendation of LCS and (2) conducting community outreach to promote LCS awareness and access. Woven throughout discussions was the need to consider the stigma associated with smoking when designing interventions.

Addressing Health Care Provider Understanding and Recommendation of LCS. Participants suggested that health care

providers may need to receive education themselves. For example, one participant stated, "I'd like to see doctors be more knowledgeable [about LCS] and be a more standard thing for the doctors to throw it out there, like they do with your mammogram and your colonoscopies." They felt it may be helpful for providers to have patient-facing media and materials available to share with patients (eg, screening checklists, pamphlets).

Conducting Community Outreach to Promote LCS Awareness and Access. Participants further suggested that information could be shared throughout the community through traditional media and communication channels, including word-of-mouth; social media, newspaper, radio, television, and billboard advertisements; and flyers on community bulletin boards and in community settings (eg, churches, establishments that sell tobacco). Additionally, they described several outreach strategies that could be employed, such as informational presentations at community venues (eg, senior centers, town halls) and education provided in people's homes via visiting nurses.

The research team also sought specific feedback from participants regarding a proposed community event to educate the public about different cancer screenings and, as appropriate, provide linkages to screening services (eg, referrals, scheduled appointments). Overall, participants were receptive to the idea and made suggestions to improve its likelihood for success. Participants discussed the importance of connecting the event with a larger community affair that people already attend, such as a county fair. They also provided input about the scope and experience of the event, such as ensuring privacy; having a nurse or doctor present; and making the event fun with prize drawings, food, and "attractive" health services like flu shots.

Discussion

While barriers to and facilitators of LCS have been studied previously, the findings of this study provide insights into factors specific to a rural, screening-eligible population. This study's results suggest that the LCS-eligible population in rural Vermont and New Hampshire is generally receptive to screening. Key factors influential to their future engagement in LCS include knowledge about LCS, transportation, provider recommendations for screening, and motivation to know the screening results. To address low LCS uptake, study participants were supportive of community outreach initiatives and efforts to increase healthcare providers' recommendations for screening.

Knowledge as a barrier to LCS has been previously documented in the literature.^{34,39,40} Consistent with the findings of this study, researchers conducting a survey in 2017 found several barriers related to knowledge; most of their screening-eligible survey respondents were completely unaware

of LCS (81%) or did not have enough knowledge about LDCT (62%).³⁹ More educational interventions targeting such knowledge deficits are needed, as several studies demonstrate their ability to increase knowledge about LCS and screening uptake.^{41,42} Given the findings from this study, such interventions may include written education in the form of advertisements and materials in health clinics. Because many existing websites and written materials about LCS may not be well understood by the target audience,⁴³⁻⁴⁶ content should be tested with the screening-eligible population to ensure comprehension.

A disproportionate amount of the screening-eligible population resides in rural areas,¹⁴ yet these areas often do not provide sufficient access to LCS facilities.^{47,48} While some participants in this study indicated they would travel long distances to get screened for lung cancer, those participants tended to be highly motivated. Based on these results, it seems that addressing poor access to local LCS facilities is an especially important step toward engaging the less motivated—but equally at-risk—subset of the LCS-eligible population. Lack of access is a barrier not only to getting screened the first time but also in following the recommendation to be screened annually. Given that the goal is to consistently retain eligible patients in a screening program, alternative models for providing LCS services in rural communities should be considered. Possible solutions include having accredited LCS centers partner with smaller rural facilities to assist in the development of local screening programs or deploying mobile computed tomography units to travel to rural communities lacking LCS facilities, which has been done for breast, cervical, and colorectal cancer screenings.⁴⁹

Nevertheless, while improving access and knowledge among the screening-eligible population are 2 important steps to improving LCS rates, those steps are not likely to work if healthcare providers are disinclined to talk with patients about LCS. Provider influence regarding cancer screening can be a powerful force,^{50,51} and this study's findings confirm that such a powerful force would facilitate LCS. Underlying some study participants' motivation to receive their screening results were susceptibility, family history, and interest in pursuing treatment for a positive result—all of which should be discussed between patients and providers during SDM. Primary care providers (PCP) have a role to play in proactively and consistently identifying LCS-eligible patients to talk with them about LCS and engage them in SDM. Unfortunately, though, PCPs face multiple complex barriers in being champions for LCS. First, not all professional organizations endorse LCS; for example, the American Academy of Family Physicians does not support LCS for all patients, contending there is insufficient evidence, but does recommend providers engage patients in SDM.⁵² Furthermore, PCPs^{15,53,54} are influenced by perceived high false-positive rates, which

lead to concerns of overdiagnosis and unnecessary procedures.⁵⁵⁻⁵⁷ These concerns may deter some PCPs from discussing LCS with patients, though SDM provides an opportunity for PCPs to discuss these concerns with patients. Unfortunately, though, studies indicate that not all SDM conversations are adequate in quality.^{15,53,54} Finally, LCS is a complex multistep screening process and, as such, PCPs often have knowledge gaps regarding clinical guidelines for LCS,^{55,57-59} identifying patients for screening,⁵⁷ insurance coverage,⁵⁹ and how to locate accredited LCS facilities.⁵⁹ Given the importance study participants attributed to receiving information from their PCPs, future interventions should address PCPs' barriers to discussing LCS with patients and facilitating SDM.

Limitations

This study has several limitations. First, the study focused on understanding the perspectives of people living in rural Vermont and New Hampshire, and the findings may not be generalizable to other rural populations, particularly those with lower uptake of other cancer screenings or more racially and ethnically diverse populations. Study participants may also not be representative of the breadth of the screening-eligible population, as our participants all had health insurance and were mostly female and toward the middle of the screening-eligible age range. Additionally, the sample size was relatively small ($n = 23$); while consistent themes were heard across the 5 focus groups, additional focus groups or a larger sample size may have provided additional or different themes. Participants were also not up-to-date with LCS recommendations and, thus, described their *perceived* facilitators to screening; people who are up-to-date with LCS may report different *actual* facilitators to screening. The study also did not look at perspectives of health care providers regarding LCS and their receptivity to the interventions proposed by the study participants. Finally, as of April 2020, the USPSTF's grade B recommendation for LCS was being updated; barriers to and facilitators of LCS may shift accordingly.

Study Implications

Primary care and community health practitioners should consider conducting targeted patient and public education efforts to encourage those at highest risk for lung cancer to speak with their PCPs about LCS. Education initiatives in rural communities, in particular, should be coupled with information about where and how to access LCS. Where practicable, access to LCS should be expanded by reducing lack of transportation as a barrier.

Future research opportunities include replication of this study in other rural communities, particularly those with low rates of other cancer screenings and more ethnic and

racial heterogeneity. Further research is also needed to describe rural healthcare providers' beliefs, knowledge, and attitudes about LCS; facilitators of and barriers to their consistent identification of patients for a discussion about LCS; and intervention opportunities targeting these audiences.

Conclusion

This study identified several key factors pertinent to getting a rural population screened for lung cancer, including knowledge about LCS, health care provider recommendation for LCS, motivation to know the screening results, and transportation. To increase rural LCS rates, these factors may need to be considered.

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