Attitudes and Beliefs Toward Lung Cancer Screening Among US Veterans

Nichole T. Tanner, MD, MSCR; Leonard E. Egede, MD, MSCR; Clayton Shamblin, MD; Mulugeta Gebregziabher, PhD; and Gerard A. Silvestri, MD, FCCP

Background: Lung cancer (LC) is the leading cause of cancer-related death for veterans cared for by the US Veterans Health Administration. The LC burden among veterans is almost double that of the general population. Before implementation of an LC screening program, we set out to assess the role of beliefs and attitudes toward LC screening among veterans.

Methods: Veterans presenting to the Ralph H. Johnson VA Medical Center were invited to complete a self-administered survey. The survey comprised questions about demographics, smoking status, health status, and knowledge about LC and willingness to be screened. Responses from veteran ever and never smokers were compared.

Results: A total of 209 veterans completed the survey. Smokers were significantly ($P < .05$) more likely than never smokers to be less educated, have a lower income, and report poorer health. Smokers were more likely than never smokers to have two or more comorbidities, which trended toward significance ($P = .062$). Smokers were more likely to have been told by a physician that they were at high risk for LC and to believe that they were at risk. Nearly all veterans surveyed (92.8%) would have a CT scan for LC screening, and 92.4% would have surgery for a screen-detected LC.

Conclusions: Veterans are overwhelmingly willing to undergo screening for LC, and it seems that participation will not be a barrier to implementation of an LC screening program. The mortality benefit of LC screening, however, may not be generalizable to the veteran population because of a higher number of comorbid conditions.

CHEST 2013; 144(6):1783–1787

Abbreviations: LC = lung cancer; LDCT = low-dose CT; NLST = National Lung Cancer Screening Trial; VA = Veterans Affairs; VHA = Veterans Health Administration

In the United States and among US veterans cared for by the Veterans Health Administration (VHA), lung cancer (LC) is the leading cause of cancer-related death.^{1,2} As the second most common cancer in veterans (18%) and the deadliest, LC is a critical health-care problem in this population.² The LC burden among veterans is almost double that of the general population because of the high prevalence of smoking among those in military service.^{3–5} As a result, the age-specific incidence of LC has been estimated to be 76% higher among men who use the Veterans Affairs (VA) Health System compared with men in the general population included in the Surveillance, Epidemiology, and End Results cancer registry.³

The National Lung Cancer Screening Trial (NLST) is the first randomized, multicenter trial to demonstrate that in addition to detecting LC at an earlier stage, screening with low-dose CT (LDCT) scan decreases LC mortality by 20%.⁶ This evidence has resulted in

a category 2B recommendation for screening from the American College of Chest Physicians and the American Society of Clinical Oncology for current and former smokers meeting the NLST entry criteria (aged 55–74 years, ≥ 30 pack-years) in settings that can deliver comprehensive care.⁷ Furthermore,

For editorial comment see page 1749

because of the high burden of disease in the veteran population, the VHA has initiated an LC screening demonstration project to test the implementation of LC screening with LDCT scan in a small number of VA hospitals.

That LC screening by LDCT scan reduces mortality is fortunate, given the general public's enthusiasm about screening.⁸ However, smokers may be less enthusiastic about LC screening. In a previous survey,

smokers reported less screening for other types of cancer, less comprehension of what effective screening means, and less willingness to pay for LC screening than nonsmokers.⁹ The survey also demonstrated that smokers are less likely than their nonsmoking counterparts to want to participate in LC screening or undergo surgical therapy for a detected cancer.

Veterans represent a population with greater smoking-related comorbidities and a higher risk of cancer, which may make screening more attractive. Before the implementation of LC screening in veterans, we set out to assess the role of their beliefs and attitudes toward LC screening.

MATERIALS AND METHODS

Study Population

From April 2012 to May 2012, a self-administered survey was offered to veterans presenting for outpatient care at the Ralph H. Johnson VA Medical Center in Charleston, South Carolina. Patients were recruited from laboratory, pharmacy, primary care, urgent care, and specialty care (infectious disease; ear, nose, and throat; pulmonary; nephrology; CPAP) waiting rooms. Although the total number of veterans approached to participate was not recorded, we estimate that about 75% agreed to participate. Eligible patients were outpatients aged ≥ 18 years. Survey respondents were informed that their participation was voluntarily and anonymous. The Institutional Review Board at the Medical University of South Carolina and the Research and Development Committee at the Ralph H. Johnson VA Medical Center approved all procedures before study enrollment (IRB #Pro00016363).

Data and Procedure

Researchers and research assistants approached eligible patients in outpatient waiting rooms and provided a description of the survey study. Those interested and eligible provided verbal consent and were given the written survey to complete (e-Appendix 1). A research assistant was available to answer questions regarding the

survey. Two hundred and nine patients agreed to take the survey. We collected data on self-reported age, sex, race/ethnicity, marital status, education, household income, and employment. Additional measures were questions identifying comorbid conditions. Questions were also used from a previously developed and conducted nationwide survey of smokers and their nonsmoking counterparts about the respondent's knowledge about and willingness to be screened for LC.⁹ Smoking status was taken from the 2000 Behavior and Risk Factor Surveillance System and defined as having smoked at least 100 cigarettes during a lifetime.

Demographic Variables

Age was reported as age at last birthday. Race/ethnicity was categorized as black or African-American, white, or other. Marital status was categorized as married or not married. Education was categorized as less than or equal to a high school graduate or greater than high school graduate. Employment was categorized as employed or unemployed. Annual household income was categorized as $< \$40,000$ or $\geq \$40,000$.

Statistical Analysis

Respondent demographics were compared on the basis of smoking status by *t* tests and χ^2 tests, as appropriate. Multivariate logistic regression modeling adjusting for age, marital status, health rating, employment, education, home ownership, and whether the respondent was the primary source of household income was used to determine the odds of being willing to consider screening for LC across smoking groups.

RESULTS

The survey was completed by 209 veterans. Table 1 shows the demographics of the respondents by smoking status. The majority surveyed were men (87%). Current smokers were significantly younger (mean $\pm$ SD age, 53.4 ± 12.1 years) than former smokers (mean, 61.1 ± 12.5 years; $P = .002$). Significant differences between at least two of the three groups were noted in all of the demographic characteristics except race and being the family's primary source of income. Smokers were more likely than their never smoker counterparts to have two or more comorbid conditions; this trended toward significance ($P = .062$). Smokers were significantly ($P < .05$) more likely than never smokers to be less educated, have a lower income, and report poorer health, a finding consistent with the previous study.⁹ Although current and never smokers were similar in age, smokers were less likely to rate their health as good or excellent ($P = .002$).

Table 2 shows the surveyed beliefs about LC and respondents' willingness to be screened for LC. Current smokers were more likely to have been told by a physician that they are at high risk for LC (41.5%). Eighty percent of current smokers believe that they were at increased risk of LC. The responses of former smokers were very similar to that of never smokers, with only 7.6% of former smokers reporting that they had been told about an increased risk of LC by a physician and 15.2% believing that they were at an increased

Manuscript received January 8, 2013; revision accepted May 1, 2013.

Affiliations: From the Division of Pulmonary and Critical Care, Allergy and Sleep Medicine (Drs Tanner, Shamblin, and Silvestri) and Division of Internal Medicine and Geriatrics (Dr Egede), Department of Internal Medicine; Center for Health Disparities Research (Dr Egede); and Department of Biostatistics, Bioinformatics and Epidemiology (Dr Gebregziabher), Medical University of South Carolina, Charleston; and Center for Disease Prevention and Health Interventions for Diverse Populations (Drs Tanner and Egede), Charleston VA Research Enhancement Award Program, Ralph H. Johnson VA Medical Center, Charleston, SC.

Funding/Support: This study was supported by grants from the National Institutes of Health (NIH) [1K24CA12049-01A1] and South Carolina Clinical and Translational Research Institute Biomedical Informatics Services [NIH 1UL1RR029882].

Correspondence to: Nichole T. Tanner, MD, MSCR, Division of Pulmonary and Critical Care, Allergy and Sleep Medicine, Medical University of South Carolina, 96 Jonathan Lucas St, Ste 812-CSB, Charleston, SC 29425; e-mail: tripici@musc.edu

© 2013 American College of Chest Physicians. Reproduction of this article is prohibited without written permission from the American College of Chest Physicians. See online for more details.

DOI: 10.1378/chest.13-0056

Table 1—Demographics of Never, Former, and Current Smokers

Characteristic	No. Responding	Never Smokers (n = 102)	Former Smokers (n = 66)	Current Smokers (n = 41)	All Respondents (N = 209)
Age, y	208	54.2 ± 12.1	61.1 ± 12.5 ^a	53.4 ± 12.1 ^b	56.2 ± 12.6
Male sex	209	77.5	98.5 ^a	92.68 ^a	87.1
White race	197	44.3	58.7	54.1	50.8
Married	197	53.6	54.8	26.3 ^{a,b}	48.7
High school education or less	188	17.5	40.7 ^a	25	26.1
Employed	197	47.5	33.9	26.3 ^a	39.3
Family's primary income source	187	79.2	85.5	72.2	79.7
Home ownership	192	86.5	93.1	65.8 ^a	84.4
Income < \$40,000/y	194	38.4	48.3	75.4 ^{a,b}	48.5
Very good or excellent health	108	37.3	27.7 ^a	26.8 ^a	32.2
Two or more comorbid conditions	170	18.6	30.9	31.3 ^c	24.7

Data are presented as mean ± SD or %.

^a*P* < .05 compared with nonsmokers by *t* test or χ^2 test, as appropriate.

^b*P* < .05 compared with former smokers by *t* test or χ^2 test, as appropriate.

^c*P* = .062.

risk. Of the 101 ever smokers surveyed, 27 would have met the entry criteria for the NLST on the basis of age and smoking history (Table 3).

Of the veterans surveyed, 50% believed that early detection of LC results in a good chance of survival. Nearly all surveyed (92.8%), regardless of smoking group, would have a CT scan for LC screening, and 92.4% would have surgery if found to have LC. Similar results were seen in the subset of survey respondents meeting entry criteria for the NLST. When assessing the attributes of the screening test for LC, there was no difference in the importance of screening convenience, risk of disease, screening accuracy, or cost reported among the three groups.

DISCUSSION

This study has several important findings. First, veteran smokers are more willing to participate in an

LC screening program than previously surveyed general population smokers.⁹ Second, unlike US smokers previously surveyed, the majority of veteran smokers are willing to undergo surgery for a screen-detected LC. Third, an overwhelming majority of veterans are willing to be screened and undergo surgery for a screened-detected LC. Finally, the percentage of veteran smokers with more than two comorbid conditions was higher compared with veteran never smokers. The combination of findings in this study suggest that veterans are open to LC screening and that there will be little barrier to implementation of a screening program. With about 30% of veteran ever smokers reporting more than two comorbid conditions, however, it remains to be seen which veterans should be offered LC screening.

Active smoking has previously been shown to be a barrier to LC screening. A nationwide telephone survey of 2001 people demonstrated that current smokers

Table 2—Veterans' Cancer Beliefs and Willingness to Be Screened for Lung Cancer

Characteristic	Never Smokers (n = 102)	Former Smokers (n = 66)	Current Smokers (n = 41)	All Subjects (N = 209)	Smokers vs Never Smokers, ^a OR (95% CI)
Told by a physician that he or she is at high risk for LC	3.9	7.6	41.5 ^{b,c}	12.4	8.7 (1.8-41.4)
Believes that he or she is at risk for LC	8.9	15.2	80.0 ^{b,c}	24.6	10.7 (3.5-33.5)
Believes that early detection of LC results in a good chance of survival	42.2	50	43.9	45	2.0 (1.0-4.0)
In making decision to be screened:					
Screening convenience is important	6.8	59.1	65.9	62.2	0.7 (0.3-1.4)
Risk of disease is important	82.4	90.9	80.5	84.7	2.2 (0.8-6.0)
Screening accuracy is important	89.2	89.4	87.8	89	1.5 (0.5-4.3)
Screening cost is important	67.3	62.1	75.6	67.3	1.0 (0.5-2.0)
Would have surgery if told he or she has LC	91.3	88.7	96.9	91.4	2.5 (0.6-9.8)
Would have a CT scan for screening	93	87.9	100	92.8	1.3 (0.3-6.5)

Data are presented as % unless otherwise indicated. LC = lung cancer.

^aLogistic regression analysis adjusted for marital status, health rating, employment, education, home ownership, income, and age.

^b*P* < .05 compared with nonsmokers by *t* test or χ^2 test, as appropriate.

^c*P* < .05 compared with former smokers by *t* test or χ^2 test, as appropriate.

Table 3—Respondents Who Met the NLST Criteria

Characteristic	Current Smokers (n = 16)	Former Smokers (n = 11)
Age, y	61.6 ± 4.5	61.5 ± 4.0
Pack-y	46.4 ± 17.7	62.3 ± 31.7
Years quit	...	6.27 ± 4.5
Believes to be at risk for LC	100	27
Would have CT scan	100	91.7
Would have surgery for LC	100	100

Data are mean ± SD or %. NLST = National Lung Cancer Screening Trial. See Table 2 legend for expansion of other abbreviation.

vs never smokers were statistically less likely to agree to LC screening with CT scan (71.7% vs 87.6%).⁹ The present study in veterans shows opposing results (100% vs 93%) for a variety of reasons. The veterans surveyed were presenting for outpatient appointments, meaning that they have an identifiable and established health-care provider, whereas those in the telephone survey were randomly selected, and many were unable to identify a usual source of care, a known barrier to participation in screening programs. Because the veterans have frequent exposure to the VA system, they may be more likely to accept health-care interventions. The benefit structure within the VHA depends on need and service connection, so many veterans are provided screening at no cost, and others are subject to the usual \$50 copay. This possible explanation may have caused a significant shift in favor of screening. The influence of cost on the willingness to undergo screening with LDCT scan was demonstrated in a recent survey of 108 smokers, wherein 82% reported an intention to undergo screening if recommended by their physician, which dropped to 32% if they had to pay for the CT scan.¹⁰

Veterans may also be more willing to accept screening than the general population because of concern about military exposures, such as Agent Orange, asbestos, and various chemicals that may be linked to an increased risk of cancer, which may partly explain why a very high proportion of veteran nonsmokers (93%) (who would not be eligible for LC screening on the basis of guidelines and NLST criteria) would accept LC screening. Additionally, there may be some element of respecting the chain of command and following orders that influences a veteran soldier's willingness to take advice from physicians to undergo LC screening.

A willingness to undergo surgery for a screen-detected LC in the surveyed veterans was extremely high. There are also racial and ethnic beliefs that influence the willingness to undergo surgery for LC. A larger proportion of ethnic minority veterans obtain their health care from the VA hospital system compared with all military veterans. The proportion of black patients with LC in the VA system is much higher than the non-VA population (23% vs 9% in

one study¹¹). When assessing the underuse of surgery for stage I and II LC, it was found that black patients receiving a diagnosis at VA facilities were more likely to refuse surgery than their white counterparts.¹² A potential explanation for this refusal has previously been described in a multicenter survey of black veterans.¹³ This survey found that 19% of blacks would refuse surgery for LC because of their belief that air exposure during LC surgery might cause tumor spread. The present study had an even distribution of blacks and whites and did not detect a difference in willingness to undergo LC surgery; however, this consideration is important when investigating barriers to screening.

We recognize limitations to this survey study. There is the possibility of respondent bias in that those who agreed to participate may have been more interested in LC screening, thereby contributing to the reported high percentage of those willing to be screened. In addition, a small percentage of current and former smokers (27%) participating in the survey would have met the inclusion criteria for the NLST and could potentially be offered screening with LDCT scan.

This study demonstrated a trend toward a higher number of comorbidities in veterans who are current or former smokers when compared with veteran never smokers. A number of factors, including comorbidities, have been identified as reasons why veterans do not always receive first-line guideline-recommended treatment of LC. A recent cohort study that evaluated the receipt of guideline-recommended therapy in veterans with LC aged ≥ 65 years found that only one-half of patients with local disease received guideline-recommended therapy.¹⁴ In this cohort, two-thirds of patients had one to three comorbid conditions and nearly one-fifth had four or more comorbid conditions. Worsening comorbidity was associated with a decrease in the rate of treatment.¹⁴ These data suggest that comorbidities prohibit the receipt of appropriate cancer treatment and, thus, have the potential to affect survival even if LC is detected earlier.

The stark difference in demographics between those enrolled in the NLST and the general population and veterans also raises the important question of whether the same mortality benefit would be realized in the estimated 7 million people in the United States³ who are eligible for LC screening according to NLST entry criteria.¹⁵ Although 70 years is the average age at LC diagnosis, only 9% of the NLST study population was aged > 70 years.¹⁵ The patients enrolled in NLST were younger and likely healthier than people who would participate in a broad-based LC screening. Those screened in the NLST were also less likely to be current smokers, less ethnically diverse, and more educated than the general US population and the population of veterans we surveyed.¹⁵ These differences

are in line with the healthy volunteer effect of screening trials in which there is a self-selection of participants who are better educated, are more health conscious, and have better access to medical care.¹⁶

There may be other reasons to believe that the mortality reduction documented in the NLST may not be generalizable to the American public or a VA population.¹⁷ NLST participants were followed in tertiary care facilities; had their LDCT scan read by trained thoracic radiologists who mainly recommended radiographic follow-up; and had a mortality rate from LC surgery of 1%, whereas the national average is between 3% and 5%. These circumstances are not standard in the community and, therefore, have implications for screening a veteran population.

In conclusion, to reduce mortality from any cancer screening program, the target population must be willing to undergo testing and treatment of screen-detected cancers. This study demonstrates that the majority of veteran smokers are willing to undergo screening for LC with LDCT scan and that it would seem that participation would not be a barrier to implementation of an LC screening program within the VHA system. What remains to be determined is whether high-risk veterans with other comorbidities will realize the same reduction in LC mortality as participants who have been screened in the NLST. Before broad-based implementation of LC screening occurs in the VA system, more investigation needs to be done to identify which veterans should be screened to reduce mortality and minimize risk.

ACKNOWLEDGMENTS

Author contributions: Drs Tanner, Egede, and Silvestri had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Dr Tanner: contributed to the survey development, data collection and entry, and manuscript writing.

Dr Egede: contributed to the survey development and manuscript writing.

Dr Shamblin: contributed to the data collection and entry and manuscript writing.

Dr Gebregziabher: contributed to the statistical analysis and manuscript writing.

Dr Silvestri: contributed to the survey development and manuscript writing.

Financial/nonfinancial disclosures: The authors have reported to CHEST that no potential conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article.

Role of sponsors: The NIH K24 award supplied salary support to Dr Silvestri to allow for mentoring on this project. The SCTR award provides support for the RedCap database that was used for this study.

Additional information: The e-Appendix can be found in the "Supplemental Materials" area of the online article.

REFERENCES

1. *Cancer Facts and Figures*. Atlanta, GA: American Cancer Society; 2011.
2. Zullig LL, Jackson GL, Dorn RA, et al. Cancer incidence among patients of the US Veterans Affairs Health Care System. *Mil Med*. 2012;177(6):693-701.
3. Harris RE, Hebert JR, Wynder EL. Cancer risk in male veterans utilizing the Veterans Administration medical system. *Cancer*. 1989;64(5):1160-1168.
4. McKinney WP, McIntire DD, Carmody TJ, Joseph A. Comparing the smoking behavior of veterans and nonveterans. *Public Health Rep*. 1997;112(3):212-217.
5. Kleven RM, Giovino GA, Peddicord JP, Nelson DE, Mowery P, Grummer-Strawn L. The association between veteran status and cigarette-smoking behaviors. *Am J Prev Med*. 1995;11(4):245-250.
6. Aberle DR, Adams AM, Berg CD, et al. Reduced lung-cancer mortality with low-dose computed tomographic screening. *N Engl J Med*. 2011;365(5):395-409.
7. Bach PB, Mirkin JN, Oliver TK, et al. Benefits and harms of CT screening for lung cancer: a systematic review. *JAMA*. 2012;307(22):2418-2429.
8. Schwartz LM, Woloshin S, Fowler FJ Jr, Welch HG. Enthusiasm for cancer screening in the United States. *JAMA*. 2004;291(1):71-78.
9. Silvestri GA, Nietert PJ, Zoller J, Carter C, Bradford D. Attitudes towards screening for lung cancer among smokers and their non-smoking counterparts. *Thorax*. 2007;62(2):126-130.
10. Jonnalagadda S, Bergamo C, Lin JJ, et al. Beliefs and attitudes about lung cancer screening among smokers. *Lung Cancer*. 2012;77(3):526-531.
11. Campling BG, Hwang WT, Zhang J, et al. A population-based study of lung carcinoma in Pennsylvania: comparison of Veterans Administration and civilian populations. *Cancer*. 2005;104(4):833-840.
12. Landrum MB, Keating NL, Lamont EB, Bozeman SR, McNeil BJ. Reasons for underuse of recommended therapies for colorectal and lung cancer in the Veterans Health Administration. *Cancer*. 2012;118(13):3345-3355.
13. Margolis ML, Christie JD, Silvestri GA, Kaiser L, Santiago S, Hansen-Flaschen J. Racial differences pertaining to a belief about lung cancer surgery: results of a multicenter survey. *Ann Intern Med*. 2003;139(7):558-563.
14. Wang S, Wong ML, Hamilton N, Davoren JB, Jahan TM, Walter LC. Impact of age and comorbidity on non-small-cell lung cancer treatment in older veterans. *J Clin Oncol*. 2012;30(13):1447-1455.
15. Aberle DR, Adams AM, Berg CD, et al. Baseline characteristics of participants in the randomized National Lung Screening Trial. *J Natl Cancer Inst*. 2010;102(23):1771-1779.
16. Ederer F, Church TR, Mandel JS. Sample sizes for prevention trials have been too small. *Am J Epidemiol*. 1993;137(7):787-796.
17. Silvestri GA. Screening for lung cancer: it works, but does it really work? *Ann Intern Med*. 2011;155(8):537-539.