HHS Public Access
Author manuscript
Am J Prev Med. Author manuscript; available in PMC 2020 January 01.

Published in final edited form as:
Am J Prev Med. 2019 January ; 56(1): 66–73. doi:10.1016/j.amepre.2018.07.030.

Lung Cancer Screening Inconsistent With U.S. Preventive Services Task Force Recommendations

Thomas B. Richards, MD[1], **V. Paul Doria-Rose, DVM, PhD**[2], **Ashwini Soman, MBBS, MPH**[3], **Carrie N. Klabunde, PhD**[4], **Ralph S. Caraballo, PhD**[5], **Simone C. Gray, PhD**[1], **Keisha A. Houston, DrPH, MPH**[1,6], and **Mary C. White, ScD**[1]

[1]Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia; [2]Division of Cancer Control and Population Sciences, National Cancer Institute, Rockville, Maryland; [3]Cyberdata Technologies, Atlanta, Georgia; [4]Office of Disease Prevention, NIH, Bethesda, Maryland; [5]Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia; [6]Division of Emergency and Environmental Health Services, National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, Georgia

Abstract

Introduction: Prior studies suggest overuse of nonrecommended lung cancer screening tests in U.S. community practice and underuse of recommended tests.

Methods: Data from the 2010 and 2015 National Health Interview Surveys was analyzed from 2016 to 2018. Prevalence, populations, and number of chest computed tomography (CT) and chest x-ray tests were estimated for people who did and did not meet U.S. Preventive Services Task Force (USPSTF) criteria for lung cancer screening, among people aged ≥ 40 years without lung cancer.

Results: In 2015, among those who met USPSTF criteria, 4.4% (95% CI=3.0%, 6.6%), or 360,000 (95% CI=240,000, 535,000) people reported lung cancer screening with a chest CT; and 8.5% (95% CI=6.5%, 11.1%), or 689,000 (95% CI=526,000, 898,000) people reported a chest x ray. Among those who did not meet USPSTF criteria, 2.3% (95% CI=2.0%, 2.6%), or 3,259,000 (95% CI=2,850,000, 3,724,000) people reported a chest x ray; and 1.3% (95% CI=1.1%, 1.5%), or 1,806,000 (95% CI=1,495,000, 2,173,000) people reported a chest CT. The estimated population meeting USPSTF criteria for lung cancer screening in 2015 was 8,098,000 (95% CI=7,533,000, 8,702,000), which was smaller than the 9,620,000 people (95% CI=8,960,000, 10,325,000) in 2010.

Address correspondence to: Thomas B. Richards, MD, Epidemiology and Applied Research Branch, Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Building 107, F-76, 4770 Buford Highway NE, Atlanta GA 30341. trichards@cdc.gov.

SUPPLEMENTAL MATERIAL
Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2018.07.030.

Conclusions: The number of adults inappropriately screened for lung cancer greatly exceeds the number screened according to USPSTF recommendations, the prevalence of appropriate lung cancer screening is low, and the population meeting USPSTF criteria is shrinking. To realize the potential benefits of screening, better processes to appropriately triage eligible individuals to screening, plus screening with a USPSTF-recommended test, would be beneficial.

INTRODUCTION

In 2011, the National Lung Screening Trial (NLST) reported that annual screening for lung cancer with low-dose computed tomography (CT) can reduce mortality from lung cancer compared with annual screening with chest radiography.[1] In the NLST, eligible participants were invited to undergo three screenings at 1-year intervals, were aged between 55 and 74 years at the time of randomization, had a history of cigarette smoking of at least 30 pack-years, and, if former smokers, had quit within the previous 15 years.[1]

Prior to the NLST, chest x-rays were often used to screen patients for lung cancer,[2] but this practice was not supported by scientific evidence.[3] In 2011, the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial reported that annual screening with chest radiography did not reduce lung cancer mortality when compared with usual care.[3]

In December 2013, the U.S. Preventive Services Task Force (USPSTF) recommended annual screening for lung cancer with low-dose chest CT.[4] This was a Grade B recommendation, which required insurers to cover lung cancer screening with no cost sharing under the Affordable Care Act.[4] In February 2015, the Centers for Medicare & Medicaid Services (CMS) issued a National Coverage Determination that established lung cancer screening with low-dose CT as an additional preventive service benefit under the Medicare program.[5] Both the USPSTF and CMS used the same smoking criteria as the NLST and 55 years as the starting age for lung cancer screening, but the USPSTF and CMS differed on the oldest age for screening.[6] The USPSTF recommended 80 years as the oldest age for lung cancer screening based on evidence from modeling studies.[4] By contrast, CMS determined 77 years as the oldest age for screening because this was the oldest age of participants at the end of the NLST screening period.[6]

The National Health Interview Survey (NHIS) Cancer Control Supplements[7,8] in 2010 and 2015 collected data that can be used to monitor the extent to which health providers in community practice have implemented low-dose CT and abandoned chest x-rays for lung cancer screening. Given the developments in lung cancer screening before the start of the 2015 NHIS data collection, a potential hypothesis might be that the 2015 NHIS would reveal increased use of chest CT and reduced use of chest x-rays for lung cancer screening. Another hypothesis might be that substantial changes in lung cancer screening patterns would only become evident sometime after the end of the 2015 NHIS data collection, because the CMS determination[5] occurred in early 2015, and multiple challenges remained in 2015 that limited the uptake of lung cancer screening in community practice.[9–11]

Several prior studies have used data from the 2010 and 2015 NHIS to report on lung cancer screening consistent with NLST,[12,13] CMS,[14] or USPSTF risk criteria,[15,16] and also to estimate lung cancer screening prevalence for categories developed using individual risk-based models for lung cancer.[14,16] Combined, the prior studies indicate that, in 2015, the prevalence of lung cancer screening with chest CT among people meeting criteria was low[13–16]; chest x-rays were used more often than chest CT for lung cancer screening[14]; and screening was reported by individuals who did not meet the criteria for lung cancer screening, in addition to individuals who met criteria.[13,15]

The purpose of the current study is to more completely describe lung cancer screening inconsistent with USPSTF criteria. Three categories of lung cancer screening inconsistent with USPSTF criteria are defined, in addition to one category consistent with USPSTF criteria. For each category, the prevalence, population size, and number of chest CT and chest x-ray tests for lung cancer screening are estimated. Respondents aged 40 years or older are analyzed because that age group is the sample universe for NHIS questions on lung cancer screening; and respondents included both individuals who meet and do not meet the USPSTF criteria.

METHODS

Study Population

The study analyzed NHIS data collected in 2010 and 2015. The NHIS is an annual, cross-sectional, in-person interview survey of a nationally representative sample of the civilian, non-institutionalized U.S. population, selected with a multistage cluster sample design.[7,8] The survey includes components to collect information about the household, each family in the household, and a randomly selected sample adult and child in each family. The Cancer Control Supplements for the 2010 and 2015 NHIS also included questions about lung cancer screening among adults aged ≥ 40 years.[7,8] The National Center for Health Statistics Research Ethics Review Board and the Office of Management and Budget approved the NHIS data collection.

The 2010 NHIS interviewed 34,329 households and completed 27,157 sample adult interviews, with a final response rate of 60.8%; 16,957 of these respondents were aged ≥ 40 years.[7] The 2015 NHIS interviewed 41,493 households and completed 33,672 sample adult interviews, with a final response rate of 55.2%; 22,328 of these respondents were aged ≥ 40 years.[8] To facilitate statistical comparisons between 2010 and 2015, the adults aged ≥ 40 years from the 2010 and 2015 NHIS were combined. The following categories then were excluded: 119 individuals with a reported lung cancer diagnosis at an age younger than their age at interview, 70 respondents with unknown lung cancer status, and four individuals with missing age at interview or missing age at lung cancer diagnosis. The final study population aged ≥ 40 years included 39,092 respondents, with 16,878 from the 2010 NHIS and 22,214 from the 2015 NHIS.

Pack-years were defined as the average of number of packs (20 cigarettes) smoked per day multiplied by the number of years smoked. Within the final study population aged ≥ 40 years without a diagnosis of lung cancer, respondents meeting USPSTF recommendations for lung cancer screening were defined as current and former smokers aged 55−80 years with ≥ 30 pack-years of cigarette smoking history; additionally, former smokers must have quit within the last 15 years.[4]

Measures

Both the 2010 and 2015 NHIS surveys included two questions about chest x-rays: *In the last 12 months, did you have a chest x-ray? and Were any of the chest x-rays you had in the last 12 months done to check for lung cancer, rather than for some other reason?* The 2010 NHIS included three questions about chest CT or computed axial tomography (CAT) scans: (1) *In the last 12 months, did you have a CAT scan or CT scan?* (2) *Were any of the CAT scans you had in the last 12 months done of your chest area?* (3) *Were any of the CAT scans of your chest area done to check for lung cancer, rather than some other reason?* Appendix Table 1 (available online) provides details on the questions and answer choices in the 2015 NHIS. Although the 2015 NHIS included similar questions about chest CT scans to those in the 2010 NHIS, the 2015 NHIS added a new question with expanded answer choices to report the time of the most recent chest CT for lung cancer screening.

The chest CT analysis included respondents who reported either a *CT of the chest area or a CT of several areas of the upper body region*; the latter was one of the response options for the question asking whether the CT scan was of the chest area (Appendix Table 1, available online). Lung cancer screening with chest CT in the last 12 months was analyzed in the 2010 NHIS, and a year ago or less in the 2015 NHIS.

Four outcome measures were defined for respondents who reported a chest x-ray or chest CT to screen for lung cancer, after consideration of their age and smoking status. The first outcome measure was lung cancer screening consistent with USPSTF recommendations, defined as respondents who reported receipt of a chest CT to screen for lung cancer and who met USPSTF recommended age and smoking status criteria. The next three outcome measures were inconsistent with USPSTF recommendations, and included respondents who met USPSTF criteria and reported a chest x-ray to screen for lung cancer, respondents who did not meet USPSTF criteria and reported a chest x-ray to screen for lung cancer, and respondents who did not meet USPSTF criteria and reported a chest CT to screen for lung cancer.

Statistical Analysis

Data analysis was conducted during 2016 to 2018 with SAS-callable SUDAAN, version 11.0 software and the NHIS-provided final weights for household sampling probabilities and nonresponse. Weighted prevalence of screening by chest CT or chest x-ray were estimated with 95% CIs, for various combinations of age and smoking status. The p-values for differences in prevalence from 2010 to 2015 were evaluated using linear contrast procedures and t-tests ($p < 0.05$). Population estimates replicated the methods used in the prior analysis by Doria-Rose et al.[12] With this method, the U.S. total study population for all respondents aged ≥ 40 years without lung cancer was estimated, and then the population for each age and smoking status combination corresponding to USPSTF criteria, using the formula:

$$[(\text{U.S. total study population}) \times (\text{weighted percent prevalence of the age and smoking status combination} / 100)].$$

The total number of each type of screening test received (chest CT or chest x-ray) in each age and smoking status combined category was estimated, using the formula:

$$[(\text{Total population in the age and smoking status combination}) \times (\text{weighted percent prevalence of receipt of a lung cancer screening test in the age and smoking status combination} / 100)].$$

The percentage change from 2010 to 2015 in estimated populations and types of screening test were estimated, using the formula:

$$[100] \times [(2015\,\text{estimate} - 2010\,\text{estimate}) / 2010\,\text{estimate}].$$

RESULTS

In 2015, the estimated prevalence of lung cancer screening with chest CT was about 4% among individuals meeting USPSTF smoking status and age criteria (55−80 years; Table 1). Application of NLST age criteria (55−74 years) or CMS age criteria (55−77 years) gave similar results (Appendix Table 2, available online). The estimated prevalence in 2015 for lung cancer screening inconsistent with USPSTF criteria was 8.5% for respondents who met USPSTF age and smoking status criteria and reported a chest x-ray, 2.3% for respondents who did not meet USPSTF criteria and reported a chest x-ray, and 1.3% for respondents who did not meet USPSTF criteria and reported a chest CT (Table 1). For each lung cancer screening outcome measure, the difference between the estimated prevalence in 2015 compared to 2010 was not statistically significantly different ($p > 0.05$).

The number of U.S. adults aged 55−80 years without lung cancer that met USPSTF smoking status criteria in 2015 (8,098,000) was 15.8% (1,522,000) less than that in 2010 (9,620,000; Table 2). Less than half (42.8%) of the estimated population meeting USPSTF criteria in 2015 were aged 65−80 years (Table 2), and about half (49.4%) in both age groups (55–64 and 65–80) were former smokers (data not shown). The estimated number of never smokers aged ≥ 40 years without lung cancer in 2015 (90,543,000) was 15.0% (11,802,000) higher than that in 2010 (78,741,000; Table 2).

The number of respondents reporting lung cancer screening consistent with USPSTF recommendations was similar in 2010 and 2015 (Figure 1 and Appendix Table 3, available online). In both 2010 and 2015, the number of respondents who reported lung cancer screening inconsistent with USPSTF recommendations greatly exceeded the number who reported screening consistent with USPSTF recommendations. Among the three categories of inconsistent lung cancer screening, the largest category was respondents who did not meet USPSTF criteria and reported a chest x-ray, followed by those who did not meet USPSTF criteria and reported a chest CT scan, and then those who met USPSTF criteria and reported a chest x-ray.

DISCUSSION

In 2015, the number of adults inappropriately screened for lung cancer greatly exceeded the number screened according to USPSTF recommendations, the prevalence of appropriate lung cancer screening was low, and the population meeting USPSTF criteria was shrinking.

Harms of lung cancer screening include the physical and psychological consequences of identifying and evaluating lung nodules, the impact of the cumulative radiation exposure on cancer risk, and the potential for overdiagnosis and overtreatment of lung cancer.[4,6,17] Harms may be higher in the general population than reported in clinical trials if lung cancer screening is inconsistent with the patient selection and methods used in clinical trials.[4,6,17] To achieve a moderate net benefit in U.S. community practice similar to that obtained in the NLST, the USPSTF cautioned that lung cancer screening needs to be limited to people at high risk, low-dose CT needs to be used, the interpretation of images needs to be standardized, and most false-positive tests need to be resolved without invasive procedures.[4,6]

Even among those who are eligible for screening according to USPSTF criteria, the ratio of benefits to harms may differ according to smoking history.[18] For example, Kovalchik and colleagues[18] calculated the predicted 5-year risk of death from lung cancer for NLST participants, and then stratified those individuals into five quintiles, with quintile 1 having the lowest risk, and quintile 5 having the highest risk. Those at lowest risk (in quintile 1) accounted for only 1% of the screening prevented lung cancer deaths, but were associated with the greatest number of false positives per prevented lung cancer death.

Clinical risk prediction calculators have been developed to identify individuals at high risk for lung cancer incidence and mortality, and also to quantify the probability that a lung nodule detected by lung cancer CT screening is malignant.[19–21] These calculators include an expanded list of risk factors in addition to smoking status and age. The risk prediction results have been used by radiologists as part of decisions about follow-up management of lung nodules,[22] and by patients and primary care providers[20,21] as part of the shared decision-making discussions[23] that are recommended by the USPSTF and required by CMS before the start of lung cancer screening. In its 2018 draft research plan on lung cancer screening,[4] one of the research questions proposed by the USPSTF was whether risk prediction models for identifying adults at higher risk of lung cancer mortality improve the balance of benefits and harms of screening compared with NLST criteria or USPSTF recommendations.

Among respondents meeting USPSTF criteria in 2015, the prevalence of recommended screening with chest CT was low. Healthy People 2020 does not include specific objectives for lung cancer screening to reduce the lung cancer death rate; however, interventions to stop smoking and increase lung cancer screening with low-dose chest CT consistent with USPSTF recommendations would align with Cancer Objective C-2.[24] A 70%−80% level of utilization might be a reasonable, longer-term objective for lung cancer screening, given the levels of screening reported for mammography (71.5%) and colorectal cancer screening test use (62.4%) in the 2015 NHIS.[25] In a simulation model of clinical, resource use, and fiscal impacts of implementing low-dose CT screening among high-risk individuals who were

Medicare beneficiaries, low-dose CT lung cancer screening utilization was assumed to be about 70% after 5 years of implementation.[26]

Lung cancer screening with chest x-rays was the largest contributor to lung cancer screening inconsistent with USPSTF criteria. Some health providers may be unaware that low-dose CT is the only recommended lung cancer screening test.[3,14] Additionally, some providers may have ordered a chest x-ray to screen for lung cancer rather than do nothing, if low-dose CT was not available in their geographic location.[14]

The decrease from 2010 to 2015 in the size of the population who met USPSTF criteria for lung cancer screening is consistent with prior reports,[15,16] and with known decreases in daily cigarette smoking in the U.S. population between 2005 and 2014.[27] Assuming successful smoking control efforts will be sustained over time in the U.S., the number of individuals with 30 or more pack-years of cigarette smoking is likely to be reduced even further. A CHEST (American College of Chest Physicians) Lung Cancer Screening Guideline Panel concluded in 2018 that additional research is needed on the best way to promote smoking cessation in the context of lung cancer screening.[6] Smokers with a screen-detected nodule are more likely to quit smoking, whereas smokers with a negative screen may incorrectly believe that screening protects them from lung cancer and they continue to smoke.[6]

Lung cancer screening programs and multidisciplinary clinical teams for lung cancer evaluation and treatment currently tend to be clustered in larger, urban healthcare markets rather than geographically dispersed.[28] If the at-risk population is relatively small in size, mass media campaigns to promote lung cancer screening will need to be carefully worded to minimize requests for lung cancer screening from individuals who do not meet USPSTF criteria and would not benefit from screening.

Limitations

The NHIS questions did not address the quality of reported lung cancer screening, such as whether a shared decision-making discussion occurred prior to screening, whether smoking cessation was offered to current smokers, or whether the chest CT was obtained at an accredited imaging facility. Some of the NHIS lung cancer screening questions had a relatively small number of respondents, which limited reliable estimates for smaller age-group categories. The NHIS lung cancer screening estimates were based on self-reports without medical record validation of the indication or occurrence of the exam. The extent of misclassification among respondents reporting a chest CT or CAT scan is unknown. A comparison of self-reported chest x-rays with clinic data in the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial showed that self-reported chest x-ray screening had good sensitivity but poor specificity.[29] Cognitive testing of the 2015 NHIS lung cancer screening questions suggested that some respondents may not know the reason that their doctor ordered a test, and also that some respondents may not always distinguish between a “screening test” and “a test ordered to diagnose” a physical symptom.[30]

Strengths of the study include estimates of three different categories of lung cancer screening inconsistent with USPSTF recommendations, in addition to estimates of screening consistent with USPSTF recommendations. The study estimates are for a probability-based sample covering the entire U.S., and that potentially includes the use of lung cancer screening provided by non-accredited as well as accredited facilities.

CONCLUSIONS

To realize the potential benefits of lung cancer screening, better processes to appropriately triage eligible individuals to screening, plus screening with a USPSTF recommended test, would be beneficial.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGMENTS

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention, the National Cancer Institute, or NIH.

The U.S. government supported the National Health Interview Survey and preparation of this manuscript. All authors are federal government employees or contractors.

Tasks each author completed are as follows: TBR, VPD-R, CNK, KAH, and MCW helped with study design. TBR wrote the original draft. VPD-R, AS, CNK, RSC, SCG, KAH, and MCW all reviewed and edited the manuscript. AS performed the data analysis. MCW supervised the study.

No financial disclosures were reported by the authors of this paper.

REFERENCES

1. National Lung Screening Trial Research Team, Aberle DR, Adams AM, et al. Reduced lung-cancer mortality with low-dose computed tomographic screening. N Engl J Med. 2011;365(5):395–409. 10.1056/NEJMoa1102873. [PubMed: 21714641]
2. Klabunde CN, Marcus PM, Silvestri GA, et al. U.S. primary care physicians' lung cancer screening beliefs and recommendations. Am J Prev Med. 2010;39(5):411–420. 10.1016/j.amepre.2010.07.004. [PubMed: 20965378]
3. Oken MM, Hocking WG, Kvale PA, et al. Screening by chest radio-graph and lung cancer mortality: the Prostate, Lung, Colorectal, and Ovarian (PLCO) randomized trial. JAMA. 2011;306(17):1865–1873. 10.1001/jama.2011.1591. [PubMed: 22031728]
4. U.S. Preventive Services Task Force. Lung cancer: screening. Recommendation summary. www.uspreventiveservicestaskforce.org. Published 2013 Accessed July 9, 2018.
5. Centers for Medicare & Medicaid Services. Decision Memo for Screening for Lung Cancer with Low Dose Computed Tomography (LDCT) (CAG-00439N). www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=274. Published 2015 Accessed July 9, 2018.
6. Mazzone PJ, Silvestri GA, Patel S, et al. Screening for lung cancer: CHEST Guideline and Expert Panel Report. Chest. 2018;153(4):954–985. 10.1016/j.chest.2018.01.016. [PubMed: 29374513]
7. National Center for Health Statistics. Survey Description, National Health Interview Survey, 2010 www.cdc.gov/nchs/nhis/data-questionnaires-documentation.htm. Published 2011. Accessed July 9, 2018.
8. National Center for Health Statistics. Survey Description, National Health Interview Survey, 2015 www.cdc.gov/nchs/nhis/data-questionnaires-documentation.htm. Published 2016. Accessed July 9, 2018.

9. National Academies of Sciences, Engineering, and Medicine. Implementation of Lung Cancer Screening: Proceedings of a Workshop. Washington, DC: The National Academies Press; 2017 10.17226/23680.

10. Kinsinger LS, Anderson C, Kim J, et al. Implementation of lung cancer screening in the Veterans Health Administration. JAMA Intern Med. 2017;177(3):399–406. 10.1001/jamainternmed.2016.9022. [PubMed: 28135352]

11. Gould MK, Sakoda LC, Ritzwoller DP, et al. Monitoring lung cancer screening utilization and outcomes in four Cancer Research Network sites. Ann Am Thorac Soc. 2017;14(12):1827–1835. 10.1513/AnnalsATS.201703-237OC. [PubMed: 28683215]

12. Doria-Rose VP, White MC, Klabunde CN, et al. Use of lung cancer screening tests in the United States: results from the 2010 National Health Interview Survey. Cancer Epidemiol Biomarkers Prev. 2012;21(7):1049–1059. 10.1158/1055-9965.EPI-12-0343. [PubMed: 22573798]

13. Huo J, Shen C, Volk RJ, Shih YT. Use of CT and chest radiography for lung cancer screening before and after publication of screening guidelines: intended and unintended uptake. JAMA Intern Med. 2017;177(3):439–441. 10.1001/jamainternmed.2016.9016. [PubMed: 28135349]

14. Soneji S, Yang J, Tanner NT, Dang R, Silvestri GA, Black W. Underuse of chest radiography versus computed tomography for lung cancer screening. Am J Public Health. 2017;107(8):1248–1250. 10.2105/AJPH.2017.303919. [PubMed: 28700293]

15. Jemal A, Fedewa SA. Lung cancer screening with low-dose computed tomography in the United States—2010 to 2015. JAMA Oncol. 2017;3(9):1278–1281. 10.1001/jamaoncol.2016.6416. [PubMed: 28152136]

16. Cheung LC, Katki HA, Chaturvedi AK, et al. Preventing lung cancer mortality by computed tomography screening: the effect of risk-based versus U.S. Preventive Services Task Force Eligibility Criteria, 2005−2015. Ann Intern Med. 2018;168(3):229–232. 10.7326/M17-2067. [PubMed: 29297008]

17. Humphrey LL, Deffebach M, Pappas M, et al. Screening for lung cancer with low-dose computed tomography: a systematic review to update the U.S. Preventive Services Task Force recommendation. Ann Intern Med. 2013;159(6):411–420. 10.7326/0003-4819-159-6-201309170-00690. [PubMed: 23897166]

18. Kovalchik SA, Tammemagi M, Berg CD, et al. Targeting of low-dose CT screening according to the risk of lung-cancer death. N Engl J Med. 2013;369(3):245–254. 10.1056/NEJMoa1301851. [PubMed: 23863051]

19. Brock University. Lung cancer risk calculators. https://brocku.ca/lung-cancer-screening-and-risk-prediction/risk-calculators/. Accessed July 9 2018.

20. Memorial Sloan Kettering Cancer Center. Lung cancer screening decision tool. www.mskcc.org/cancer-care/types/lung/screening/lung-screening-decision-tool. Accessed July 9, 2018.

21. University of Michigan. Lung cancer screening. Should I get screened? https://shouldiscreen.com/. Accessed July 9, 2018.

22. American College of Radiology. Lung CT Screening Reporting & Data System. www.acr.org/Clinical-Resources/Reporting-and-Data-Systems/Lung-Rads. Accessed July 9, 2018.

23. Agency for Healthcare Research and Quality. Lung cancer screening tools for patients and clinicians. https://effectivehealthcare.ahrq.gov/decision-aids/lung-cancer-screening/home.html. Accessed July 9, 2018.

24. Healthy People 2020. Cancer Objective C-2. Reduce the lung cancer death rate. Washington, DC: HHS, Office of Disease Prevention and Health Promotion www.healthypeople.gov/2020/topics-objectives/topic/cancer/objectives. Accessed July 9, 2018.

25. White A, Thompson TD, White MC, et al. Cancer screening test use—United States, 2015. MMWR Morb Mortal Wkly Rep. 2017;66(8):201–206. 10.15585/mmwr.mm6608a1. [PubMed: 28253225]

26. Roth JA, Sullivan SD, Goulart BH, Ravelo A, Sanderson JC, Ramsey SD. Projected clinical, resource use, and fiscal impacts of implementing low-dose computed tomography lung cancer screening in Medicare. J Oncol Pract. 2015;11(4):267–272. 10.1200/JOP.2014.002600. [PubMed: 25943596]

27. Jamal A, Homa DM, O'Connor E, et al. Current cigarette smoking among adults—United States, 2005−2014. MMWR Morb Mortal Wkly Rep. 2015;64(44):1233–1240. 10.15585/mmwr.mm6444a2. [PubMed: 26562061]
28. American College of Radiology. Accredited facility search. www.acraccreditation.org/accredited-facility-search. Accessed July 9, 2018.
29. Gren LH, Lamerato LE, Wright P, Marcus PM. Validation of self-report of chest x-ray exam at a Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial Center. Rev Recent Clin Trials. 2015;10(3):194–199. 10.2174/1574887110666150731145929. [PubMed: 26238206]
30. Willson S Cognitive interview evaluation of the 2015 NHIS Cancer Control Supplement. Questionnaire Design Research Laboratory, National Center for Health Statistics. www.cdc.gov/qbank/report/Willson_2014_NCHS_NHIS.pdf. Accessed July 9, 2018.

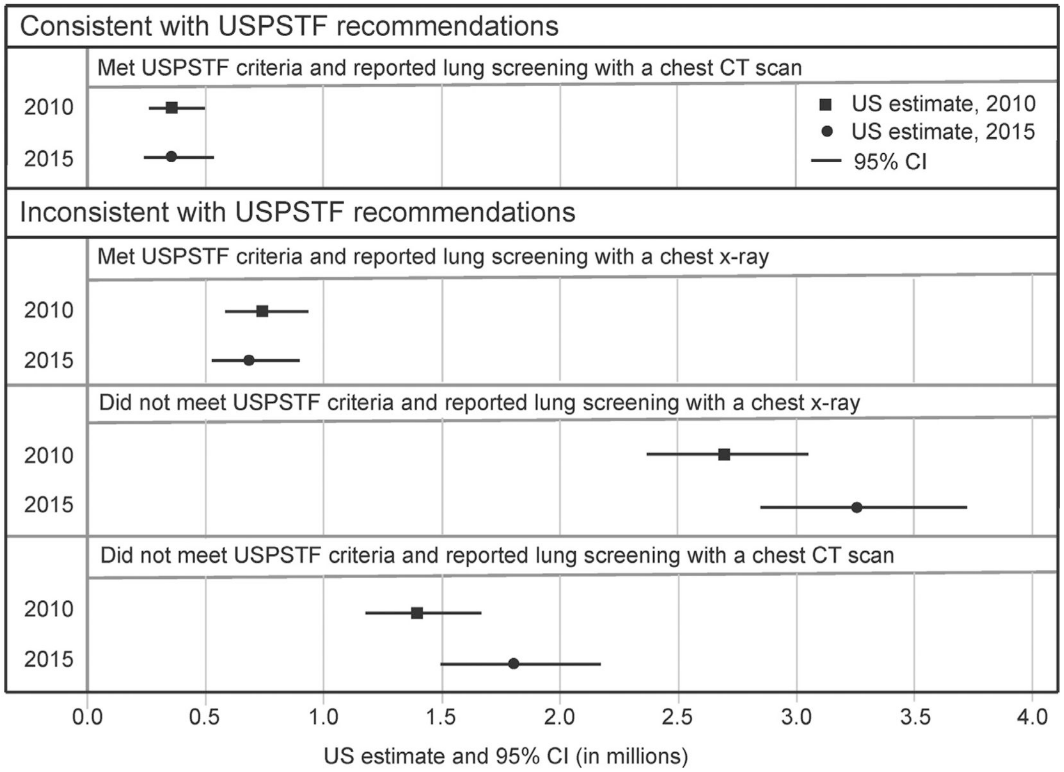

Figure 1.

Population estimates for adults who reported lung cancer screening, 2010 and 2015.[a]

[a]Respondents are adults aged ≥ 40 years without lung cancer. Estimates are rounded to nearest million. Lung cancer screening categories are not mutually exclusive.

CT, computed tomography; USPSTF, U.S. Preventive Services Task Force.

Table 1.

Estimated Prevalence of Lung Cancer Screening, 2010 and 2015[a]

	2010			2015			
Variable	**N**	***n***	**Weighted % (95% CI)**	**N**	***n***	**Weighted % (95% CI)**	***p*-value[b]**
Consistent with USPSTF recommendations							
Met USPSTF criteria and reported a chest CT scan	1,085	40	3.8(2.7, 5.2)	1,228	62	4.4 (3.0, 6.6)	0.52
Inconsistent with USPSTF recommendations							
Met USPSTF criteria and reported a chest x-ray	1,085	80	7.7 (6.1, 9.7)	1,246	111	8.5 (6.5, 11.1)	0.60
Did not meet USPSTF criteria and reported a chest x-ray	13,937	310	2.1 (1.8, 2.4)	18,606	440	2.3 (2.0, 2.6)	0.24
Did not meet USPSTF criteria and reported a chest CT scan	13,936	164	1.1 (0.9, 1.3)	18,439	242	1.3 (1.1, 1.5)	0.23

[a]Respondents are adults aged ≥ 40 years without lung cancer. Lung cancer screening categories are not mutually exclusive.

[b]The *p*-values are for the differences in prevalences from 2010 to 2015 using linear contrast procedures and *t*-tests ($p < 0.05$). CT, computed tomography; USPSTF, U.S. Preventive Services Task Force.

Table 2.

Population Estimates by USPSTF Criteria, Cigarette Smoking Status, and Age Group[a]

Variable	2010, Population (95% CI)	2015, Population (95% CI)	Difference 2015–2010, *n* (%)
Smokers, age 55–80 years, met LJSPSTF criteria			
55–64 years	5,408,000 (4,927,000, 5,935,000)	4,631,000 (4,187,000, 5,119,000)	−777,000 (−14.4)
65–80 years	4,212,000 (3,790,000, 4,678,000)	3,467,000 (3,098,000, 4,341,000)	−745,000 (−17.7)
Total	9,620,000 (8,960,000, 10,325,000)	8,098,000 (7,533,000, 8,702,000)	−1,522,000 (−15.8)
Smokers, age ≥ 40 years, did not meet LJSPSTF criteria			
40–54 years	27,137,000 (26,066,000, 28,241,000)	22,511,000 (21,476,000, 23,586,000)	−4,626,000 (−17.0)
55–64 years	11,382,000 (10,719,000, 20,034,000)	12,345,000 (11,589,000, 13,146,000)	962,000 (8.5)
65–80 years	10,545,000 (9,886,000, 15,677,000)	13,974,000 (13,229,000, 14,757,000)	3,429,000 (32.5)
≥ 81 years	1,523,000 (1,283,000, 6,314,000)	1,703,000 (1,445,000, 2,006,000)	180,000 (11.8)
Total	50,587,000 (49,237,000, 52,016,000)	50,533,000 (49,207,000, 51,876,000)	−55,000 (−0.1)
Never smokers, age ≥ 40 years, did not meet LJSPSTF criteria			
40–54 years	39,017,000 (37,718,000, 40,343,000)	41,854,000 (40,479,000, 43,258,000)	2,837,000 (7.3)
55–64 years	19,090,000 (18,183,000, 20,034,000)	23,636,000 (22,576,000, 24,737,000)	4,546,000 (23.8)
65–80 years	14,866,000 (14,092,000, 15,677,000)	19,239,000 (18,353,000, 20,162,000)	4,373,000 (29.4)
≥ 81 years	5,768,000 (5,268,000, 6,314,000)	5,813,000 (5,331,000, 6,336,000)	45,000 (0.8)
Total	78,741,000 (77,323,000, 80,102,000)	90,543,000 (89,244,000, 91,832,000)	11,802,000 (15.0)

[a]Respondents are adults aged ≥ 40 years without lung cancer. Estimates are rounded to nearest thousand. USPSTF, U.S. Preventive Services Task Force.