RESEARCH LETTER

Trends in the Proportion of Patients With Lung Cancer Meeting Screening Criteria

Lung cancer screening using low-dose computed tomography is recommended for high-risk individuals by professional associations, including the US Preventive Services Task Force (USPSTF). The implications of the USPSTF screening criteria were investigated in a well-defined population retrospectively over 28 years to demonstrate trends in the proportion of patients with lung cancer meeting the criteria.

Methods | The cohort contained all Olmsted County, Minnesota, residents older than 20 years from 1984 through 2011, comprising approximately 140,000 people, of whom 83% were non-Hispanic white and socioeconomically similar to the Midwestern US population. All pathologically confirmed incident cases of primary lung cancer were identified using the Rochester Epidemiology Project database; the project has maintained a comprehensive medical records linkage system for more than 60 years based on hospital adaptation of the International Classification of Diseases, Ninth Revision, codes.

| Table. Characteristics of Olmsted County, Minnesota, Residents Diagnosed With Primary Lung Cancer, 1984-2011a |
|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| Age- and sex-adjusted incidence rate per 100,000 person-years (95% CI) | Overall | 52.3 (45.8-58.7) | 50.8 (45.0-56.6) | 55.8 (50.3-61.3) | 44.1 (39.7-48.5) | 49.8 (47.1-52.5) | <.001 |
| | Men | 75.4 (62.9-87.9) | 69.8 (59.2-80.3) | 70.6 (61.0-80.2) | 49.4 (42.4-56.3) | 63.8 (59.1-68.5) | .007 |
| | Women | 36.7 (29.7-43.7) | 37.0 (30.4-43.5) | 45.9 (39.3-52.6) | 40.1 (34.4-45.8) | 40.0 (36.8-43.2) | .14 |
| | 55-80 | 198 (77.0) [71.9-82.2] | 216 (71.8) [66.7-76.8] | 300 (75.0) [70.8-79.2] | 292 (74.3) [70.0-78.6] | 1006 (74.5) [72.1-76.8] | .75 |
| | >80 | 28 (10.9) [7.1-14.7] | 36 (11.9) [8.3-15.6] | 56 (14.0) [10.6-17.4] | 48 (12.2) [9.0-15.4] | 168 (12.4) [10.7-14.2] | .54 |
| Male sex | 150 (58.4) [52.3-64.4] | 177 (58.8) [53.2-64.4] | 216 (54.0) [49.1-58.9] | 199 (50.6) [45.7-55.6] | 742 (54.9) [52.3-57.6] | .02 |
| Cigarette smoking status at diagnosisb | Never | 25 (9.7) [6.1-13.3] | 26 (8.6) [5.5-11.8] | 40 (10.0) [7.1-12.9] | 34 (8.7) [5.9-11.4] | 125 (9.3) [7.7-10.8] | .83 |
| | Former | 98 (38.1) [32.2-44.1] | 126 (41.9) [36.3-47.4] | 205 (51.2) [46.3-56.1] | 190 (48.3) [43.4-53.3] | 619 (45.8) [43.2-48.5] | .002 |
| | Current | 134 (52.2) [46.0-58.2] | 149 (49.5) [43.8-55.1] | 155 (38.8) [34.0-43.5] | 169 (43.0) [38.1-47.9] | 607 (44.9) [42.3-47.6] | .003 |
| Smoking amount of ever smokers, pack-years | No. | 232 | 275 | 360 | 359 | 1226 |
| | <30 | 31 (13.4) [9.0-17.7] | 44 (16.0) [11.7-20.3] | 82 (22.8) [18.4-27.1] | 82 (22.8) [18.5-27.2] | 239 (19.5) [17.3-21.7] | <.001 |
| | ≥30 | 201 (86.6) [82.3-91.0] | 231 (84.0) [79.7-88.3] | 278 (77.2) [72.9-81.5] | 277 (77.2) [72.8-81.5] | 987 (80.5) [78.3-82.7] | <.001 |
| Smoking cessation of former smokers, quit-years | No. | 98 | 126 | 205 | 190 | 619 |
| | <15 | 68 (69.4) [60.3-78.5] | 92 (73.0) [65.3-80.8] | 119 (58.0) [51.3-64.8] | 103 (54.2) [47.1-61.3] | 382 (61.7) [57.9-65.5] | <.001 |
| | ≥15 | 30 (30.6) [21.5-39.7] | 34 (27.0) [19.2-34.7] | 86 (42.0) [35.2-48.7] | 87 (45.8) [38.7-52.9] | 237 (38.3) [34.5-42.1] | <.001 |
| NSCLC tumor staging | No. | 212 | 261 | 346 | 339 | 1158 |
| | I-II | 77 (36.3) [29.8-42.8] | 105 (40.2) [34.3-46.2] | 135 (39.0) [33.9-44.2] | 138 (40.7) [35.5-45.9] | 455 (39.3) [36.5-42.1] | .42 |
| | III-IV | 135 (63.7) [57.2-70.1] | 156 (59.8) [53.8-65.7] | 211 (61.0) [55.8-66.1] | 201 (59.3) [54.1-64.5] | 703 (60.7) [57.9-63.5] | .42 |
| SCLC tumor staging | No. | 44 | 40 | 53 | 52 | 189 |
| | Limited | 21 (47.7) [33.0-62.5] | 9 (22.5) [9.6-35.4] | 19 (35.8) [22.9-48.8] | 17 (32.7) [19.9-45.4] | 66 (34.9) [28.1-41.7] | .34 |
| | Extensive | 23 (52.3) [37.5-67.0] | 31 (77.5) [64.6-90.4] | 34 (64.2) [51.2-77.1] | 35 (67.3) [54.6-80.1] | 123 (65.1) [58.3-71.9] | .34 |

Abbreviations: NSCLC, non–small-cell lung cancer; SCLC, small-cell lung cancer.

a Values are expressed as number (percentage) [95% confidence interval] unless otherwise indicated.

b The trend for incidence rates was tested by fitting a Poisson regression model with age, sex, and year of diagnosis as the independent predictors. The trend for proportions was tested by the Cochran-Armitage test.

Never smokers were defined as those who smoked less than 100 cigarettes during lifetime and former smokers were defined as those who quit smoking 1 year ago or longer before diagnosis.
Trends in lung cancer incidence rates were determined based on decennial census data adjusted for the age and sex distribution of the US population in 2000. Cases were grouped into 4 calendar-year intervals (each 7 years) when assessing secular trends to minimize the annual rate fluctuations. Assuming a Poisson distribution, 95% confidence intervals for incidence rates were calculated with generalized linear models using the Poisson error structure and a log-link function.4,5 The proportion of cases meeting USPSTF screening criteria were identified. The criteria included asymptomatic adults aged 55 to 80 years, having a 30-pack/year smoking history, and currently smoking or having quit within the past 15 years.1 The Cochran-Armitage trend test was used for comparing proportions. Two-sided \( P < .05 \) was considered statistically significant. Analyses were performed using SAS version 9.3 (SAS Institute Inc).

**Results** | There were 1351 patients with incident primary lung cancer between 1984 and 2011. The mean (SD) age was 68.1 (11.3) years and 54.9% were male. The age- and sex-adjusted incidence rate decreased from 52.3 (95% CI, 45.8-58.7) per 100 000 person-years in 1984-1990 to 44.1 (95% CI, 39.7-48.5) per 100 000 person-years in 2005-2011 \( (P < .001; \text{Table}) \). Trend analyses showed a decline in men but not women. The proportion of patients with lung cancer who smoked more than 30 pack-years declined, and the proportion of former smokers, especially those who quit smoking more than 15 years ago, increased.

We observed a decline in the relative proportion of patients with lung cancer meeting the USPSTF criteria overall from 56.8% (95% CI, 50.8%-62.9%) in 1984-1990 to 43.3% (95% CI, 38.4%-48.2%) in 2005-2011 \( (P < .001; \text{Figure}) \). The proportion of patients who would have been eligible under the criteria decreased in women from 52.3% (95% CI, 42.9%-61.8%) to 36.6% (95% CI, 29.8%-43.4%) \( (P = .005) \) and in men from 60.0% (95% CI, 52.2%-67.8%) to 49.7% (95% CI, 42.8%-56.7%) \( (P = .03) \).

**Discussion** | The proportion of patients with lung cancer in Olmsted County meeting the USPSTF screening criteria decreased significantly between 1984 and 2011, with only 37% of female and 50% of male patients eligible for screening during the most recent interval. Our findings may reflect a temporal change in smoking patterns in which the proportion of adults with a 30-pack-year smoking history and having quit within 15 years declined. The secular trends in lung cancer incidence rates in Olmsted County are comparable with US Surveillance, Epidemiology and End Results registry data,6 but may not be generalizable to the entire US population. The decline in the proportion of patients meeting USPSTF high-risk criteria indicates that an increasing number of patients with lung cancer would not have been candidates for screening. More sensitive screening criteria may need to be identified while balancing the potential harm from computed tomography.

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COMMENT & RESPONSE

Assessing the Benefit of Vascular Closure Devices After Femoral Artery Puncture

To the Editor: Arterial closure devices have demonstrated benefits with regard to a decrease in complications and recovery time in the setting of therapeutic arterial procedures. 1 A meta-analysis left a question regarding increased complication risk vs the rapid, reliable, inexpensive, and safe alternative of manual compression. 2 The Instrumental Sealing of Arterial Puncture Site—CLOSURE Device vs Manual Compression (ISAR-CLOSURE) randomized clinical trial 1 was an adequately powered study that provides assurance that the studied arterial closure devices were noninferior to manual compression with regard to efficacy and complications.

Nonetheless, the decision to use a closure device should offer a significant benefit of either decreased cost or improved outcome rather than simply being noninferior. The only clear benefit demonstrated in this study was the 9-minute reduction in time required to achieve hemostasis, which may be misleading. Time to hemostasis, defined as sheath removal to no bleeding, 3 is not an accurate measure of comparison. For both devices, the added time involved for angiographic evaluation of the artery, preparing the device, and deploying it occurred prior to removing the sheath.

The primary benefit of an arterial closure device over manual compression, in most practices, is a reduction in time to ambulation that can result in decreased recovery room time. In the ISAR-CLOSURE trial, time to ambulation was not an end point, but the benefit was built into the methods (eg, the pressure bandage and presumably bedrest duration was set at 2 hours after device closure and 6 hours after manual compression). However in recent years, this benefit has been questioned because the traditional 4- to 6-hour bedrest requirement after femoral artery puncture has been shown to be excessive, with no increased complication risk after only 1 hour of immobilization. 4, 5

Noninferior safety and efficacy does not justify the use of a $250 device to save 9 minutes of manual compression.

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In Reply Dr Hoffer questions whether the advantage of a 9-minute reduction in time to hemostasis observed with vascular closure devices (VCDs) compared with manual compression in our trial was real. In his opinion, the reduction in time to hemostasis may not have been observed had the time needed for angiographic evaluation of the punctured artery been taken into account in the VCD group.

However, angiographic evaluation of the punctured artery is a common practice in many centers, irrespective of vascular closure strategy used. It takes less than 1 minute to perform and helps identification of access site problems that require special treatment before the patient leaves the catheterization laboratory.

Hoffer also questions whether the reduction in time is worth the cost. We agree that a cost-effectiveness analysis is important, but it has not yet been performed for our trial.

Hoffer also comments on the protocol-mandated longer time for use of the pressure bandage in the manual compression group in our study, which would produce earlier mobili-