The Controversy About Lung Cancer Screening

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A Comprehensive Cancer Center Designated by the National Cancer Institute
Disclosures

David S. Ettinger, MD, discloses that he has served as an advisor/consultant for AMAG Pharmaceuticals, Ariad Pharmaceuticals, Inc., Biodesix, Boehringer Ingelheim, Eisai Inc., Eli Lilly and Company, Helsinn Pharmaceutical, Genentech, Inc., Gilead, Golden Biotechnology, Corp. and Roche Laboratories
Objectives

- Review epidemiology: scope of the problem.
- Review previous data on lung cancer screening.
- Review National Lung Screening Trial.
- Review NCCN Lung Cancer Screening Guidelines.
- Medicare’s view of Lung Cancer Screening Guidelines.
- Importance of smoking cessation.
- Future directions.
- Take home message.
Select the Most Accurate Statement

A. I have been recommending LDCT for Lung Cancer screening to eligible patients.

B. I am still trying to decide whether to recommend Lung Cancer Screening to my patients.

C. I do not think we should be recommending Lung Cancer Screening.
Case of the Smoker…

A 50 y.o. man with a 40 pk yr smoking history and no other PMH, comes to your office because his best friend just died of lung cancer.

- He is asking for your advice about what he can do to prevent dying from lung cancer.
- What do you recommend?
Case of the Smoker…

What do you recommend?
A. Chest X-ray
B. Sputum Cytology
C. Low Dose Chest CT scan
D. Smoking Cessation
E. C and D
Introduction

More than 160,000 people die in the U.S. each year from lung cancer; these deaths are mostly from smokers and former smokers. 

Pulmonary practice guidelines have been published to ensure that smoking cessation counseling and detection of early-stage disease are addressed. 

Keywords: Pulmonary practice guidelines, Lung cancer screening, Lung cancer mortality, Smoking cessation counseling.
Primary Care Provider Beliefs About Lung Cancer Screening Recommendations of Expert Groups

Source: Am J Prev Med 2010;39(5)411-4
Perceived Effectiveness of Tests to Screen for Lung Cancer, by Patients’ Smoking Status

Source: Am J Prev Med 2010;39(5)411-4
### Primary Care Physicians’ Recommendations for Lung Cancer Screening, by Patients’ Smoking Status

<table>
<thead>
<tr>
<th>Vignette</th>
<th>% Recommending Screening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy never smoker aged 50 years</td>
<td>17.4</td>
</tr>
<tr>
<td>Healthy never smoker aged 50 years with smoking spouse</td>
<td>48.3</td>
</tr>
<tr>
<td>Otherwise healthy former smoker aged 50 years with 20 pack-year history who quit smoking 15 years ago</td>
<td>52.8</td>
</tr>
<tr>
<td>Otherwise healthy former smoker aged 50 years with 20 pack-year history who quit smoking 1 year ago</td>
<td>63.8</td>
</tr>
<tr>
<td>Otherwise healthy current smoker aged 50 years who has smoked 1 pack of cigarettes per day for 20 years</td>
<td>66.3</td>
</tr>
</tbody>
</table>

Source: Am J Prev Med 2010;39(5)411-4
Percentage of primary care physicians who ordered lung cancer screening tests by types of patients

LDCT = low-dose spiral computed tomography.
Note: Brackets indicate 95% CIs.
Lung Cancer Screening and the Primary Care Provider

• “Our results showing gaps in primary care physicians’ knowledge of lung cancer screening and use of unproven screening modalities suggest that in the United States – where most cancer screening occurs opportunistically rather than through organized programs.”

• This means that there is real potential for both underscreening and overscreening.
### 2012 Estimated US Cancer Deaths

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung &amp; bronchus</td>
<td>29%</td>
<td>26%</td>
</tr>
<tr>
<td>Prostate</td>
<td>9%</td>
<td>14%</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Pancreas</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Liver &amp; intrahepatic bile duct</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Leukemia</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Esophagus</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>All other sites</td>
<td>25%</td>
<td>24%</td>
</tr>
</tbody>
</table>

*American Cancer Society, Cancer Facts and Figures 2014*
## Trends in Five-year Relative Survival (%)*, 1975-2007

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites</td>
<td>49</td>
<td>56</td>
<td>67</td>
</tr>
<tr>
<td>Breast (female)</td>
<td>75</td>
<td>84</td>
<td>90</td>
</tr>
<tr>
<td>Colon</td>
<td>51</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>Leukemia</td>
<td>34</td>
<td>43</td>
<td>57</td>
</tr>
<tr>
<td><strong>Lung and bronchus</strong></td>
<td>12</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Melanoma</td>
<td>82</td>
<td>88</td>
<td>93</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>47</td>
<td>51</td>
<td>70</td>
</tr>
<tr>
<td>Ovary</td>
<td>36</td>
<td>38</td>
<td>44</td>
</tr>
<tr>
<td>Pancreas</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Prostate</td>
<td>68</td>
<td>83</td>
<td>100</td>
</tr>
<tr>
<td>Rectum</td>
<td>48</td>
<td>58</td>
<td>68</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>73</td>
<td>79</td>
<td>80</td>
</tr>
</tbody>
</table>

*5-year relative survival rates based on follow up of patients through 2008.
Source: Surveillance, Epidemiology, and End Results Program, 1975-2008, Division of Cancer Control and Population Sciences, National Cancer Institute, 2011.

American Cancer Society, Cancer Facts and Figures 2012
Prevention

“Single best way to prevent lung cancer deaths is to
  • Never start smoking, and
  • If already smoking, to quit permanently.”

NLST 2011
Tobacco Use in the US, 1900-2006

- **Per capita cigarette consumption**
- **Male lung cancer death rate**
- **Female lung cancer death rate**

*Age-adjusted to 2000 US standard population.


American Cancer Society, Cancer Facts and Figures 2012.
Why Lung Cancer Screening?

- High prevalence (1 in 13 to 1 in 15 in US)
- High mortality
  - #1 cancer killer in US
  - #2 cause of death in US
- Risk factors to target screening
  - Tobacco exposure
  - Occupational history
  - Family history
- Outcomes related to stage at diagnosis
Lung Cancer Screening
Magnitude of the Problem

Why wasn’t lung cancer screening approved by medical policy boards and insurers?
• Lack of data regarding efficacy
• Application of different standards
• Lack of patient advocacy
• Demographic and social discrimination
• Cost
Lung Cancer Screening
Background

Previous studies have established lower stage distribution, and improved resectability and survival
BUT not lower mortality.

No randomized trial has had an appropriate control. Randomized control trial very difficult to perform. Previous trials have had increased incidence in screened groups - ? Overdiagnosis, length, or lead time bias.
Ideal Screening Test

- Highly sensitive
- Few false-positives
- Cost-effective
- Widely available
Screening Biases

- Lead-Time
- Length-Time
- Overdiagnosis
Lead-time bias occurs when screening identifies disease at an earlier time but the time of death remains unchanged. In the above diagram, lead-time bias for population B creates the impression that patients diagnosed by screening have a longer survival, although actual mortality is unchanged. Population C does have improved survival, compared to the unscreened population A.

O: onset of disease; Dx: diagnosis.

Length-time bias occurs when screening detects less aggressive tumors. Cases that progress rapidly from onset (O) to symptoms and diagnosis (Dx) are less likely to be detected during a screening examination. Thus, patients whose tumors are identified by screening may appear to have better outcomes, but their tumors may differ biologically from the general cohort of patients with that cancer.

Adapted with permission from: Fletcher RH, Fletcher SW. Prevention. In: Clinical Epidemiology - The Essentials, 4th ed. Lippincott Williams & Wilkins, Baltimore 2005. Copyright © 2005 Lippincott Williams & Wilkins. [http://www.lww.com](http://www.lww.com)
Overdiagnosis in cancer screening

Overdiagnosis occurs when cancers that are non-progressive, as well as some very slow growing cancers, are detected by screening but will never cause clinical harm during a patient's lifetime. Overdiagnosis is an extreme form of length-time bias.

Regular vs. Low Dose Chest CT
## CT Scan Observational Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Population</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sone, et al. 1998, 2001</td>
<td>5,483</td>
<td>54% M (40-74) 46% smokers</td>
<td>88% Stage I</td>
</tr>
<tr>
<td>Sabue, et al. 2002</td>
<td>1,611</td>
<td>88% M (40-79) 86% smokers</td>
<td>77% Stage I 79% Stage I</td>
</tr>
<tr>
<td>Nawa, et al. 2002</td>
<td>7,956</td>
<td>79% M (40-69) 77% smokers</td>
<td>85% Stage I 100% Stage I</td>
</tr>
<tr>
<td>Diedrich, et al. 2002</td>
<td>817</td>
<td>72% M (40-79) All smokers</td>
<td>58% Stage I</td>
</tr>
<tr>
<td>Swensen, et al. 2002, 2003, 2005</td>
<td>1,520</td>
<td>52% M (50-85) All ≥ 20pyr</td>
<td>76% Stage I 61% Stage I</td>
</tr>
</tbody>
</table>
I-ELCAP Study in NEJM 2006

• Single arm observational study of 31,567 current or former smokers with LDCT 1993-2005.
• Screening resulted in diagnosis of lung cancer in 484 subject → 412 (85%) stage I
• Estimated 10 year survival rate was 88% (92% if resection w/in 1 mo.)

Evaluation of Screening Test

• Screening test should be evaluated in randomized controlled trials (RCT) to minimize methodological biases.
  – Lead-time bias
  – Length bias
  – Overdiagnosis

• Most important outcomes
  – Disease-specific mortality (not just survival)
  – Overall mortality
National Lung Screening Trial

Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening

The National Lung Screening Trial Research Team*

53,454 randomized to annual CXR vs. CT scans

Primary aim: to determine whether lung cancer screening using low-dose helical CT reduces lung cancer-specific mortality relative to screening with chest radiographs in a high-risk cohort.
National Lung Screening Trial (NCI)

- **Study design:** Randomized controlled trial
- **Interventions:** 3 screenings performed over 2 years:
  - **1º Outcome:** Lung cancer mortality assessed after 5 years of follow-up
- **Major eligibility criteria:**
  - Age 55 to 74 years
  - A cigarette smoking history of at least 30 pack-years
  - Current cigarette smokers and former smokers who quit within 15 years of randomization
- **Enrollment:** 53,454 participants at 33 sites
  - 90% statistical power to detect a 20% reduction in lung cancer mortality
  - Secondary endpoint of all cause mortality

National Lung Screening Trial NEJM 2011
## Screen Positivity* Rate by Annual Screening Round and Trial Arm

<table>
<thead>
<tr>
<th></th>
<th>LDCT</th>
<th>CXR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number Screened</td>
<td>Number Positive</td>
</tr>
<tr>
<td>Screening Round 1</td>
<td>26,309</td>
<td>7191</td>
</tr>
<tr>
<td>Screening Round 2</td>
<td>24,715</td>
<td>6901</td>
</tr>
<tr>
<td>Screening Round 3</td>
<td>24,102</td>
<td>4054</td>
</tr>
<tr>
<td>All Screening Rounds</td>
<td>75,126</td>
<td>18,146</td>
</tr>
</tbody>
</table>

* A positive screen is one that may be suspicious for lung cancer.

** A suspicious abnormality that has been stable for 3 rounds of annual screening may be called negative according to protocol.

National Lung Screening Trial NEJM 2011
### National Lung Screening Trial Results

#### Lung Cancer Specific Mortality

<table>
<thead>
<tr>
<th>Trial Arm</th>
<th>Person Years (py)</th>
<th>Lung Cancer Deaths</th>
<th>Lung Cancer Mortality per 100,000 py</th>
<th>Reduction in Lung Cancer Mortality (%)</th>
<th>95% CI</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDCT</td>
<td>144,103</td>
<td>356</td>
<td>247</td>
<td>20.0</td>
<td>6.8 to 26.7</td>
<td>0.004</td>
</tr>
<tr>
<td>CXR</td>
<td>143,368</td>
<td>443</td>
<td>309</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### All Cause Mortality

<table>
<thead>
<tr>
<th>Trial Arm</th>
<th>Person Years (py)</th>
<th>Deaths</th>
<th>All-cause Mortality per 100,000 py</th>
<th>Reduction in All-cause Mortality (%)</th>
<th>95% CI</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDCT</td>
<td>167,389</td>
<td>1877</td>
<td>1121</td>
<td>6.7</td>
<td>1.2 to 13.6</td>
<td>0.02</td>
</tr>
<tr>
<td>CXR</td>
<td>166,382</td>
<td>2000</td>
<td>1202</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conclusion

Screening with low dose chest CT conclusively reduces mortality from lung cancer in high risk patients.

National Lung Screening Trial NEJM 2011
Lung Cancer Screening


*J Natl Compr Canc Netw* 2012;10:240-265
NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®)

Lung Cancer Screening

NCCN.org

Continue
NCCN Guidelines Version 1.2015
Lung Cancer Screening

RISK ASSESSMENT\textsuperscript{a,b}

- Smoking history\textsuperscript{c}
  - Present or past
- Radon exposure\textsuperscript{d}
- Occupational exposure\textsuperscript{e}
- Cancer history\textsuperscript{f}
- Family history of lung cancer
- Disease history (COPD or pulmonary fibrosis)
- Smoking exposure\textsuperscript{g} (second-hand smoke)
- Absence of symptoms or signs of lung cancer (if symptoms, see appropriate NCCN Guidelines)

RISK STATUS

High risk:
- Age 55-74 y and
- ≥30 pack-year history of smoking and
- Smoking cessation <15 y (category 1)
  or
- Age ≥50 y and
- ≥20 pack-year history of smoking and
- One additional risk factor (other than second-hand smoke)

For patients eligible for screening, shared patient/physician decision making is required, including a discussion of benefits/risks

Moderate risk:
- Age ≥50 y and
- ≥20 pack-year history of smoking or second-hand smoke exposure\textsuperscript{g}
- No additional risk factors

Routine lung cancer screening not recommended

Low risk:
- Age <50 y and/or
- <20 pack-year history of smoking

Routine lung cancer screening not recommended

See Screening and Findings (LCS-2)
EVALUATION OF SCREENING FINDINGS

- <6 mm<sup>1</sup> → Annual LDCT for 2 years (category 1) and consider annual LDCT until patient no longer eligible for definitive treatment<sup>h,j,k</sup>
- 6-8 mm<sup>1</sup> → LDCT in 3 mo<sup>h,j</sup>
  - Solid or part solid nodule<sup>i</sup> → 
    - Low suspicion of lung cancer → LDCT in 3 mo<sup>h,j</sup>
    - Suspicion of lung cancer<sup>m</sup> → Biopsy<sup>p</sup> or Surgical excision
  - >8 mm<sup>1</sup> → Consider PET/CT
    - Solid endobronchial nodule → LDCT<sup>h,j</sup> in 1 mo (immediately after vigorous coughing)

FOLLOW-UP OF SCREENING FINDINGS

- Annual LDCT for 2 years (category 1) and consider annual LDCT until patient no longer eligible for definitive treatment<sup>h,j,k</sup>
- If no increase<sup>n,o</sup> in size, LDCT in 6 mo<sup>h,j</sup>
- If increase in size<sup>n,o</sup> → Surgical excision
- No cancer → Annual LDCT for 2 years (category 1) and consider annual LDCT until patient is no longer eligible for definitive treatment<sup>h,j,k</sup>
- Cancer confirmed → See appropriate NCCN Guidelines

<sup>1</sup>Categories per ACR Appropriateness Criteria for Lung Nodule Evaluation

<sup>h,j,k</sup>Categories per Fleischner Society Name of Document: Lung Cancer Screening (Thursday, November 7, 2013)
NCCN Guidelines Version 1.2014
Lung Cancer Screening

EVALUATION OF SCREENING FINDINGS

Suspected infection/inflammation

- Consider treatment with antimicrobials
- Repeat LDCT in 1-2 mo

New nodule at annual or follow-up LDCT

- No suspected infection/inflammation
  - Ground glass opacity (GGO)
  - Ground glass nodule (GGN)
  - Nonsolid nodule (NS)
- Multiple GGO/GGNs

Solid or part solid nodule

FOLLOW-UP OF SCREENING FINDINGS

Resolving → Radiologic follow-up to resolution or stability
Resolved → Annual LDCT screening (see LC)
Persistent or enlarging → PET/CT
Suspicion of lung cancer

See Evaluation of Screening Findings
(LCS-3)
See Evaluation of Screening Findings
(LCS-4)
See Evaluation of Screening Findings
(LCS-5)
RISKS/BENEFITS OF LUNG CANCER SCREENING

RISKS
- Futile detection of small aggressive tumors or indolent disease
- Quality of life
  - Anxiety of test findings
- Physical complications from diagnostic work-up
- False-positive results
- False-negative results
- Unnecessary testing
- Radiation exposure
- Cost
- Incidental lesions

BENEFITS
- Decreased lung cancer mortality
- Quality of life
  - Reduction in disease-related morbidity
  - Reduction in treatment-related morbidity
  - Improvement in healthy lifestyles
  - Reduction in anxiety/psychosocial burden
NCCN Guidelines for Patients™

Presented with the generous support of the Lung Cancer Alliance.

Dedicated to the At-Risk Public.
Groups Recommending LDCT Screening for Lung Cancer

- American Society of Clinical Oncology
- American College of Chest Physicians
- American Thoracic Society
- American Lung Association
- American Association for Thoracic Surgery
- American Cancer Society
- National Comprehensive Cancer Network
- US Preventive Services Task Force
Medicare's Puzzling Refusal to Cover Lung-Cancer Screening

We know screening can save thousands of lives every year. But it's not provided to the group most likely to benefit.

By DOUGLAS E. WOOD And ELLA A. KAZEROONI

June 17, 2014 7:11 p.m. ET

If you could save thousands of lives, would you do it?

That's the question Medicare officials are now considering—whether to approve lung-cancer screening for Medicare beneficiaries, which we estimate could save 14,000 lives each year in that group alone. Most patients are discovered with lung cancer at a stage already too late for a cure, and cancer screening for early detection has been recommended for other common cancers for decades. The procedure has turned thousands of people into survivors rather than victims.
Congress Urges Medicare to Cover Lung Cancer Screening

Roxanne Nelson

June 05, 2014

Politicians have gotten involved and are campaigning to have lung cancer screening covered by Medicare, which insures people 65 years of age and older. Members of the US House and Senate are asking the Centers for Medicare & Medicaid Services (CMS) to approve coverage of lung cancer screening with low-dose CT.

The Senate letter has 45 signatories, and points out that the US Preventive Services Task Force has evaluated low-dose CT and given it a positive recommendation. "This means that patients with private insurance are gaining access but Medicare beneficiaries are still waiting," they write.

Low-dose CT is already covered by the Department of Veterans Affairs, the Department of Energy, and a number of large private insurers, such as WellPoint, Blue Cross Blue Shield affiliates, and Anthem affiliates.

In the letter from the House, the 134 signatories point out that "Americans pay into Medicare throughout their working lives and deserve to have access to potentially life-saving evidence-based screening."

Many major medical societies have come out in favor of lung cancer screening, including the American Association for Thoracic Surgery, the American Cancer Society, the American College of Radiology, the American Society of Clinical Oncology, the Lung Cancer Alliance, and the Society for Thoracic Surgeons.

Announcement by the Centers for Medicare & Medicaid Services (CMS) of their draft decision to approve coverage of low-dose computed tomography (CT) screening for high-risk lung cancer populations was made on November 10, 2014. This decision is applauded by all.
CMS Conditions into Medicare Coverage of Lung Screening

- Beneficiaries would have to go through counseling.
- Health professionals would be required to provide documentation that “shared decision-making took place.
- For providers, doing the screening, must meet eligibility criteria providing services that meet technical specifications set by the government and collecting data and submitting it to a national registry that would be approved by CMS.
The Cost of Lung Cancer Screening

- The US Preventive Service Task Force recommended LDCT screening in healthy persons between the ages of 55 and 80 with at least 30 pack-years of smoking history.
- Study used a model to forecast the 5-year results of implementation of a screening program in comparison to no screening.

JA Roth, et al, ASCO 2014
The Cost of Lung Cancer Screening

- Study used NLST data along with information from the SEER database, and peer-reviewed literature.
- Modeled various scenarios involving faster and slower diffusion of the program.
- In a scenario assuming gradual diffusion of LDCT screening (analyze how mammograph was introduced), the model forecasts 54,900 additional lung cancer diagnoses, most of which are stage I. Currently 15% of lung cancers are detected at the localized stage, but the LDCT program will raise that number to 32%.

JA Roth, et al, ASCO 2014
The Cost of Lung Cancer Screening

• Model showed that an additional 11.2 million LDCT scans would be performed with 2 million false positive results. Overall this results in $9.3 billion in excess expenditures; the bulk of that amount, $5.6 billion, is the cost of the CT scans themselves. Another $1.1 billion is for diagnostic workup, and an excess $2.6 billion would be spent on cancer care.

JA Roth, et al, ASCO 2014
The Cost of Lung Cancer Screening

- The rate of diffusion has a great influence on the downstream expenditures. If the LDCT screening program is spread more rapidly, then expenditures obviously will rise much more quickly, with more cancer diagnoses occurring within the first few years of the program.
- Medicare should plan for increased expenditures.

JA Roth, et al, ASCO 2014
The Cost of Lung Cancer Screening

• The expenditure increases represents about $3 per month for each medicine member.
• Important to remember the caveats of such a study. It is a model, not actual data, it makes assumptions.
• Which is more important – saving money or saving lives?

JA Roth, et al, ASCO 2014
Smoking Kills

- Leading preventable cause of death in developed world
- 70% of deaths from tobacco will be in developing world
- 5-6 million deaths world-wide
- If do not quit, smoker has 50% risk of dying due to smoking
- 50% of deaths will be in middle age
• 20% decline in overall cancer deaths from 215/100,000 to 172/100,000 since 1991
• Lung cancer deaths between 1991-2010
• Men: decreased 34%
• Women: decreased 9%

CA Journal for Cancer Clinicians, 2014
Tobacco Industry

- China National Tobacco
- Philip Morris, International - NYC & Lausanne
- Philip Morris, Richmond, VA USA
- British American Tobacco, London, UK
- Japan Tobacco International
- Imperial Tobacco - Bristol, UK
- RJ Reynolds - USA
Tobacco Industry

• Six leading tobacco industry = $35 Billion
• More than the combined profits (2010) of
  – Coca Cola
  – McDonalds
  – Microsoft
• Marlboro - approx. 50% global market share
It Is NEVER Too Late To Quit

2014 Surgeon General Report
2014 USA Surgeon General’s Report

Conclusions:

- In cancer patients and survivors, the evidence is sufficient to infer a causal relationship between cigarette smoking and adverse health outcomes. Quitting smoking improves the prognosis of cancer patients.

- In cancer patients and survivors, the evidence is sufficient to infer a causal relationship between cigarette smoking and increased all-cause mortality and cancer-specific mortality.

Conclusions:

- In cancer patients and survivors, the evidence is sufficient to infer a causal relationship between cigarette smoking and increased risk for second primary cancers known to be caused by cigarette smoking, such as lung cancer.

- In cancer patients and survivors, the evidence is suggestive but not sufficient to infer a causal relationship between cigarette smoking and the risk of recurrence, poorer response to treatment, and increased treatment-related toxicity.

Tobacco (or Nicotine?) During or After Treatment

- Decreases response to chemotherapy
- Increase metabolism of the drug?
- Inhibition of action in cell?
- Increases probability of recurrence
- Increase probability of second primary
- Increases or decreases toxicity
- Decreases quality of life
- Decreases overall survival
- Increased cancer specific mortality
Current smoking cessation therapies

Non-pharmacological
Behavioral support
- One-off interventions
- Intensive counseling
- Self-help materials
- Tailored self-help programs
- Quitlines

Alternative therapies
- Hypnosis
- Acupuncture

Pharmacological
Nicotine replacement therapy
- Gum
- Patch
- Nasal spray
- Inhalator
- Sublingual tablet
- Lozenge
- Mouth spray

Other pharmacological treatments
- Antidepressants
- Anxiolytics
- Appetite suppressants
- Nicotine receptor blockers
- Vaccines
Smoking Cessation

- To improve cancer outcomes, smoking cessation is very important.
- The 5A’s describe the core components of tobacco cessation

Tobacco Cessation Strategies

<table>
<thead>
<tr>
<th>The 5A’s</th>
<th>The 5R’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>(for patients ready to quit)</td>
<td>(for patients not ready to quit)</td>
</tr>
<tr>
<td>Ask</td>
<td>Relevance</td>
</tr>
<tr>
<td>Advise</td>
<td>Risks</td>
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<tr>
<td>Assess</td>
<td>Rewards</td>
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<tr>
<td>Assist</td>
<td>Roadblocks</td>
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<tr>
<td>Arrange</td>
<td>Repetition</td>
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</tbody>
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Future Directions: Biomarker Screening for Lung Cancer

• Investigations ongoing into novel noninvasive biomarkers for early detection.
  • MicroRNAs regulate the gene expression of lung cancer used in conjunction with LDCT screening.
  • FAM3C (exsomal protein) – exhaled volatile organic compound.
  • Serum thymidine kinase 1 levels.
Conclusions

• **SMOKING CESSATION** for current smokers.
• **LUNG CANCER SCREENING**
  - Follow strict criteria for high risk individuals
  - Do it at a center with radiologic, diagnostic and treatment capabilities.
  - Be committed to close follow-up.