Capacity Constraints and Geographic Variation in Access to Lung Cancer Screening

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Disclosures

• None
Evidence on screening implementation

Field et al. (2016 *Lung Cancer*)

- Red: further evidence is required on how to implement screening
- More research needed to avoid disparities
- Particularly as smoking burden concentrated among rural, low-education, low-income populations
9 components of high-quality lung cancer screening

1. Who Is Offered Lung Cancer Screening
2. How Often, and for How Long, to Screen
3. How the CT Scan Is Performed
4. Lung Nodule Identification
5. Structured Reporting
6. Lung Nodule Management Algorithms
7. Smoking Cessation
8. Patient and Provider Education
9. Data Collection
How much of the eligible population can access such centers?

- Concerns of the ability of community providers to meet these criteria (Bach et al. 2012 *JAMA*, MEDCAC 2015)
- May wish to restrict access to high-quality screening programs ONLY
- And yet, Access ↓ Takeup ↓
- **Tradeoff between high-quality, comprehensive programs and access**
- Depending on our priorities, may consider flexibility in whether every component of a gold standard screening program is met – especially for hard-to-reach populations
Surveys on capacity for lung cancer screening

- Eberth and Sercy (2015 *J Thor Imag*)
  - November 2014 survey of Society for Thoracic Radiology members
- Boiselle et al. (2016 *JAMA Onc*)
  - Latest in line of surveys of Academic Medical Centers and screening practices
    - Most recent survey wave in 2014-2015
- While informative, these surveys not inclusive of most potential community providers of lung cancer screening
4 studies of nationwide capacity constraints and geographic variation

1. Capacity in comprehensive lung cancer screening centers (Eberth et al. 2014 *Lung Cancer*)

2. Radiologist capacity and geographic disparities (Smieliauskas, MacMahon, Salgia, Shih 2014 *J Med Screen*)

3. CT scanner capacity and geographic disparities (Smieliauskas et al. *In progress*)


**Next steps:** Estimate impact of capacity on use of screening and stage at diagnosis
Capacity constraints and geographic variation

- Shared decision making
- CDC programs: NBCCEDP, NCCCP
- Other state/local public health department anti-smoking programs
- Existing capacity could serve as basis for broader lung screening
- Target areas and area risk factors of capacity constraints to avoid disparities
Comprehensive lung cancer screening centers (Eberth et al. 2014 *Lung Ca*)

- 203 LDCT centers in March 2014
  - LCA, NLST, I-ELCAP, STR
- 0.3 centers/100,000 people age 55-79
  ~65,000 USPSTF-eligible/center/year
- Variation across states
  - 11 states have no screening centers
  - Rural areas lack most; 11 large cities have none

Fig. 1. Lung cancer screening program locations overlaid with screening capacity at the state level.
Comprehensive lung cancer screening centers (Eberth et al. 2014 *Lung Ca*)

- Centers match somewhat better to smoking prevalence
- 2 years later: 427 LCA and 1388 ACR Centers
- Tradeoff between access and comprehensive multidisciplinary programs
  - Motivates studying spread of more basic components of screening programs

Fig. 3. Lung cancer screening program locations overlaid with smoking prevalence at the county level.
Radiologist capacity and geographic disparities (Smieliauskas et al 2014)

- Health Service Areas (HSAs) as geographies for cancer care
- Estimate total annual imaging procedures in each HSA
- Estimate incremental scan interpretations from scaling up lung cancer screening to 75% of USPSTF-eligible population (base case)

Table 1. Percentage Increases in Imaging Procedures per Year from Scaling-Up Lung Cancer Screening, including Sensitivity Analyses for Uptake and Eligibility Rates, by HSA

<table>
<thead>
<tr>
<th></th>
<th>Mean (%)</th>
<th>SD (%)</th>
<th>Min (%)</th>
<th>Max (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case</td>
<td>4.0</td>
<td>4.2</td>
<td>0.0</td>
<td>61.4</td>
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<tr>
<td>Uptake 50%</td>
<td>2.4</td>
<td>2.6</td>
<td>0.0</td>
<td>38.3</td>
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<tr>
<td>Uptake 100%</td>
<td>5.5</td>
<td>5.7</td>
<td>0.0</td>
<td>84.5</td>
</tr>
<tr>
<td>50% lower number of eligible smokers</td>
<td>2.0</td>
<td>2.1</td>
<td>0.0</td>
<td>30.7</td>
</tr>
<tr>
<td>50% higher number of eligible smokers</td>
<td>5.9</td>
<td>6.2</td>
<td>0.0</td>
<td>92.1</td>
</tr>
</tbody>
</table>

Notes: Abbreviations: HSA - Health Service Area. SD - Standard Deviation. Min - Minimum. Max - Maximum. Number of observations is 678 HSAs for all statistics, and does not include 127 HSAs without scans prior to scale-up, for which the percentage increase is undefined.
Radiologist capacity and geographic disparities (Smieliauskas et al 2014)
Radiologist capacity and geographic disparities

(Smieliuskas et al 2014)

• Highest constraints in Great Plains, lowest in West

• Predictors of capacity constraints:
  – Rural HSA
  – % smokers
  – % Hispanic
  – % low income

→ Geographic disparities may contribute to additional disparities
CT scanner capacity and geographic disparities

(Smieliauskas et al In progress)

• Simpler question:
  – How many smokers live in areas with no CT scanners?

• ACR Designated Lung Cancer Screening Center Technical Specifications
  – Multislice CT scanner (>=16 slice is best)

• HSA-level:
  – 33 HSAs have no CT scanners, 67 HSAs have no multislice CT scanners
  – Represent ~1% of the population
CT scanner capacity and geographic disparities (Smieliuskas et al In progress)

- Rural, low population, Great Plains, Mountain counties
  - No CT: 32% of counties, 750,000 USPSTF-eligible smokers (8% of total)
  - No multislice CT: 43% of counties, 1.1 million USPSTF-eligible smokers (11% of total)
Capacity constraints in thoracic surgery

(Edwards et al. 2014)

- Project thoracic surgery workforce requirements in Canada from CT screening
- Microsimulation model of smoking history and lung cancer incidence
- **Screening-eligible population peaks in 2017 and declines by > 50% by 2040**
- Cancer diagnoses ↑, shift to earlier stage cancers
- Thoracic surgery volume ↑ 24% by 2020 then gradually declines
- No study of geographic distribution

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**Figure 3.** Incidence of operable lung cancer per surgeon in the setting of computed tomographic (CT) screening, with variation according to the number of new thoracic surgery graduates per year. Operable lung cancer defined as (A) stages I and II and (B) stages I, II, and IIIA.
Policy considerations

• Summary: potential geographic access problems largely in rural areas
  – Important, but what about the costs?

• Different levels of evidence required for different policy decisions
  – USPSTF, Medicare coverage for patients who choose it
    • Currently, CT screening benefits > harms (and cost-effective)
  – Make large irreversible investments in capacity for universal, equitable screening
    • For the foreseeable future, CT screening expected benefits > harms (and cost-effective)

• The second statement and policy choice is questionable, given:
  – Blood-based ctDNA lung cancer screening tests may be imminent
  – Personalized, risk-stratified screening may further reduce capacity needs
  – …
...And projected drops in screening-eligible population

• 5% reduction in smoking rates in 7 years

• 50% decline in projected numbers of screening-eligible smokers from 2016 to 2032 (Tramontano et al. 2016 *BMJ Open*, Edwards et al. 2014 *Ann Thor Surg*)
Policy considerations

• All considered, demand for CT screening will probably be less than we think

• **To avoid overinvestment in capacity, small-scale, frugal approaches towards hard-to-reach**
  
  – Initial diagnosis by community CT scanners, PCPs and radiologists with referral to travel to screening centers for suspicious nodules

  – Pilot projects in using teleradiology, computer-aided detection, volumetric nodule analysis, PCP interpretation to ↑ access with minimal new workforce and programs
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