The Effect of Advances in Lung Cancer Treatment on Population Mortality by Subtype

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The Effect of Advances in Lung-Cancer Treatment on Population Mortality

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Background

- Rapidly declining lung cancer mortality rates
- ACS reported largest one-year drop in cancer mortality; decline in deaths from lung cancer drove the record drop
- This captures overall trend from all subtypes combined
- How much do specific lung cancer subtype contribute to this overall trend in mortality?

ACS = American Cancer Society
Study Aims
Study Aims

How do the two major subtypes contribute to the overall mortality decline?

- *Small cell (SCLC) and non-small cell lung cancer (NSCLC)*

Is the decline in the mortality more related to incidence or survival?

- *Mortality is influenced by both incidence and survival*
Study Aims

How do the two major subtypes contribute to the overall mortality decline?

- Small cell (SCLC) and non-small cell lung cancer (NSCLC)

Is the decline in the mortality more related to incidence or survival?

- Mortality is influenced by both incidence and survival

<table>
<thead>
<tr>
<th>Scenario 1: Mortality Decline</th>
<th>Scenario 2: Mortality Decline</th>
<th>Scenario 3: Mortality Decline</th>
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<tbody>
<tr>
<td>Incidence flat</td>
<td>Incidence decline</td>
<td>Incidence decline</td>
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<tr>
<td>Survival improve</td>
<td>Survival flat</td>
<td>Survival improve</td>
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Study Design
Study Design: Analysis Cohort

Lung and bronchus cancer cases in SEER-18 areas during 2001-2016

- SEER-18 areas cover 28 percent of US population
- SCLC and NSCLC defined based on Lewis et al.\textsuperscript{1}
- Coding challenges with classification of subtypes did not allow up to go back in time before 2001

\textsuperscript{1} Lewis et al. Cancer 2014
Study Design: Methods

Use incidence-based mortality (IBM) technique to partition subtype-specific mortality trends

- Because regular death certificate mortality do not have subtypes
- Details to follow in a few slides
- Joinpoint to assess IBM trend changes over time

Assess incidence and survival trends to understand IBM trends

- Estimate age-adjusted incidence rates by subtypes
  - Further adjusted for reporting delay
  - Joinpoint to assess incidence trend changes over time
- Estimate two-year lung cancer-specific survival by subtypes
  - Relative survival approach
Incidence-Based Mortality (IBM)
Why Do We Need Incidence-Based Mortality (IBM)?

- Information on lung cancer subtypes not available on death certificate mortality data, but available from SEER data on incident cases.
- IBM provides a resource to address this limitation in death certificate mortality data by linking SEER incident cases to mortality records.
- Therefore, we can use information on deaths in SEER cases to reconstruct mortality curves using IBM.
What Is Incidence-Based Mortality (IBM)?

IBM is a rate:

Death among incident cases by subtypes in year ‘x’

______________________________

General population in SEER areas in year ‘x’

- IBM rates are valid for a shorter period of time than death certificate mortality rates

- Require ‘n’ years of data on incident cases prior to each year of mortality data to account for ‘burn-in’ period
Death Certificate Mortality vs. Incidence-based Mortality (IBM): Lung and Bronchus
IBM likely represent lung cancer mortality more accurately than using death certificate mortality

**Implication**: deaths from lung cancer are actually somewhat lower than currently reported

Death certificate mortality, SEER-18

IBM: Diagnosis, any cancer
Cause of death, lung cancer

IBM: Diagnosis, lung cancer
Cause of death, lung cancer
Non-Small Cell Lung Cancer
NSCLC: IBM, Incidence, and Survival Trends, SEER-18

IBM and Incidence Trends

Males

IBM decreased -3.2% from 2006-2013 then at -6.2% 2013-2016
NSCLC: IBM, Incidence, and Survival Trends, SEER-18

Males

IBM and Incidence Trends

<table>
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<tr>
<th>Age-adjusted Rate per 100,000</th>
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NSCLC: IBM, Incidence, and Survival Trends, SEER-18

**Males**

IBM and Incidence Trends

- **2001-08:** -1.9*
- **2006-13:** -3.2*
- **2008-16:** -3.0*
- **2013-16:** -6.2*

**2-Year Lung Cancer Survival**

- **2001:** 26%
- **2011:** 35%

*Note: IBM stands for Incidence, Mortality, and Burden.
NSCLC: IBM, Incidence, and Survival Trends, SEER-18

IBM and Incidence Trends

**Males**
- 2001-08: -1.9*
- 2006-13: -3.2*
- 2008-16: -3.0*
- 2013-16: -6.2*

**Females**
- 2001-06: 0.5
- 2006-16: -1.4*
- 2006-14: -2.3*
- 2014-16: -5.8*

2-Year Lung Cancer Survival

- Males: 26
- Females: 35

2001-2016:
- IBM (Modelled and Observed)
NSCLC Survival Trends by Race-ethnicity and Gender, SEER-18 excluding Alaska, 2000-2014
Small Cell Lung Cancer
SCLC: IBM, Incidence, and Survival Trends, SEER-18

IBM and Incidence Trends

Males

Females

Age-adjusted Rate per 100,000

Survival (%)

2-Year Lung Cancer Survival

2001-16: -3.6*

2006-16: -4.3*

2001-16: -2.7*

2006-16: -3.7*

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Interpretation of the trends
Could other factors explain the sharper drop in NSCLC mortality?

Lung cancer screening?
- No because screening rates remained low and stable throughout the study period

Declining smoking rates?
- Undoubtedly, the declining smoking rates contribute to the declining incidence and mortality rates for lung cancer over time,
- But given the timing and magnitude of the drop, smoking alone did not explain

Targeted therapies?
- It correlated with several targeted therapies that were
- Approved by the U.S. Food and Drug Administration in 2013
Conclusions
Conclusions

SCLC: steady decline in mortality explained entirely by lower incidence (potentially attributable to reduced tobacco use)

NSCLC: steady decline initially followed by rapid decline in 2013-2016
  ▪ Mainly explained by dissemination of targeted therapies approved in 2013 for stage IV EGFR+NSCLC as first line therapy
  ▪ Estimates suggest possible population level impacts of targeted therapies

SEER currently do not have data on individual level drug use but has started a collaboration with Department of Energy to
  ▪ Enable collection of cancer surveillance data from multiple sources including detailed treatment, biomarkers along with decrease the interval for reporting
  ▪ Create detailed longitudinal patient trajectories
Thank you!