The Impact of the 2004 Irish Workplace Smoking Ban on Lung Cancer Incidence and Mortality

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Full text and citations:
theodorecaputi.com/files/thesis.pdf

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  - Health Services Executive
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  - Prof. Tony Fitzgerald
- Dedicated to all patients, survivors, and victims of cancer

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Background: The Smoking Ban

- Ireland: a global leader in tobacco control
- In 2004, Ireland institutes Comprehensive Workplace Smoking Ban
  - First national, comprehensive smoking ban anywhere globally
  - Covers all workplaces, including bars/pubs
 - Makes for a great quasi-experimental study

Background: The Smoking Ban

- Known health benefits include:
  - Improved worker respiratory function (4)
  - Reduced secondary-smoke exposure (5)
  - Reduced acute coronary syndrome (7)
  - Reduced acute pulmonary disease (8)
  - Reduced cardiovascular, cerebrovascular, and respiratory disease (9)
  - Reduced small for gestational age (10)
- Negative consequences? Not many…
  - No change in business revenues/costs (12)
  - No effect on wellbeing of smokers (14)

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Background: Lung Cancer

- Scope of the problem:
  - 5th most common cancer in Ireland
  - 2,566 new cases annually (18)
  - Costs €619 million, 4% of total health care spending (19)
- Second-hand smoke is a significant contributing factor to lung cancer (20-22)
- The smoking ban could be a solution!
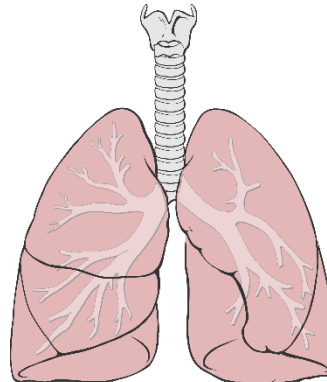
Background: Previous Literature

- Only two studies linking smoking bans to lung cancer:
  - Study of the 2007 Hong Kong smoking ban (27); authors cautioned against reading into immediate effect
  - Study of Kentucky municipal smoking bans (28); found 7.9% decrease in lung cancer incidence

嚴禁吸煙
No Smoking
違者定額罰款 : $1,500
Fixed Penalty for Violation

Complaint Hotline : 2961 8823
戒 煙 熱 線 : 1833 183
Quitline

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Research Question:

What was the effect of the 2004 Irish Workplace Smoking Ban on lung cancer incidence and mortality compared to a counter-factual scenario?

Methods: Data Sources
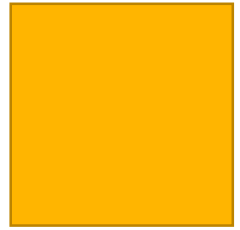
- National Cancer Registry Ireland:
  - Aggregated cancer incidence from 1994 to 2014
- Irish Central Statistics Office:
  - Quarterly cancer mortality data from 1994 to 2015
  - Irish population data by age and sex
- Health Service Executive:
 - Cigarette smoking prevalence data by age and sex from 2002 to 2018

Methods: Confounders

- Age and sex rates estimated separately
- Autocorrelation
- Smoking Rates (18)
  - Age-sex specific smoking prevalence
  - Previous studies suggest the ban did not affect smoking rates (9, 31, 32)
- Particulate Matter 2.5 (33)
  - EPA data messy → sensitivity analysis

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Methods: Statistical Analysis

- Study design: One-sample interrupted time-series analysis was conducted using Poisson regression

- Lagged effect: "Modelled interruption" from stepwise regression
  - 2010 for lung cancer incidence
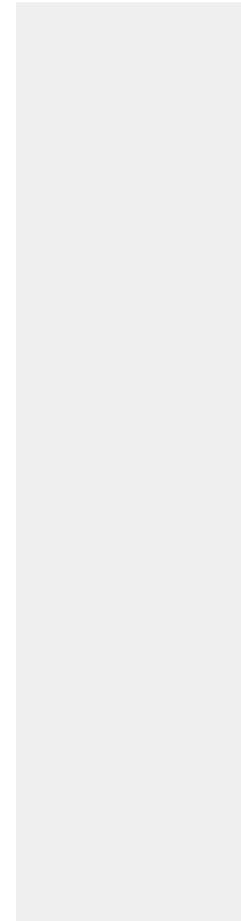 - 2006 for lung cancer mortality

(37)
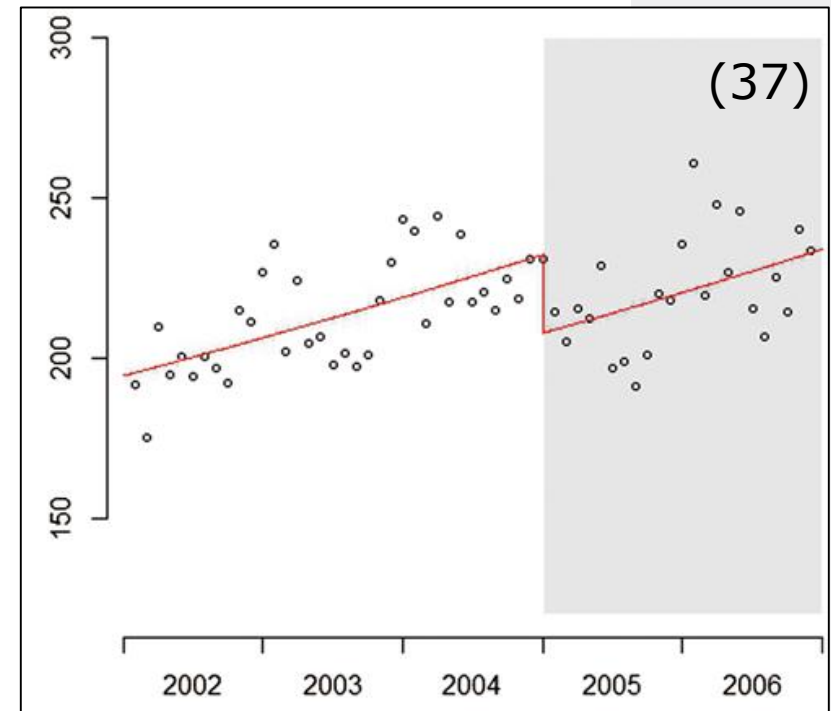
Methods: Statistical Analysis

$$\ln(E(Y_{t,s,a})) = \beta_0 + \beta_1 T_{t,s,a} + \beta_2 X_{t,s,a} + \beta_3 X_{t,s,a} T_{t,s,a} + \beta_4 C_{t,s,a} + \epsilon_{t,s,a}$$

$$\epsilon_{t,s,a} = \rho \epsilon_{t-Q,s,a} + u_{t,s,a}$$

- t, s, a – time, sex, age
- $Y_{t,s,a}$ - aggregated annual rate
- $T_{t,s,a}$ - years since study beginning
- $X_{t,s,a}$ - before/after "modelled interruption"
- $C_{t,s,a}$ - confounder matrix
- $\epsilon_{t,s,a}$ - error term
- β_2 - immediate effect
- β_3 - gradual effect

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Methods: Additional Analyses

- Effect Modification:
  - Male/Female
  - Age Groups
- Validation: Brain cancer (38)
- Total number of deaths averted
 - Predicted – Actual (with bootstrapped confidence intervals)

Main Results

- **The Smoking Ban significantly reduced lung cancer incidence and mortality.**
- Compared to counterfactual:
  - 3% (95%CI 2-5) decrease in lung cancer incidence
  - 209 (95%CI 155-274) fewer lung cancer cases/year
  - 1% (95%CI 0-2) decrease in lung cancer mortality
  - 122 (95%CI 104-143) fewer lung cancer deaths/year
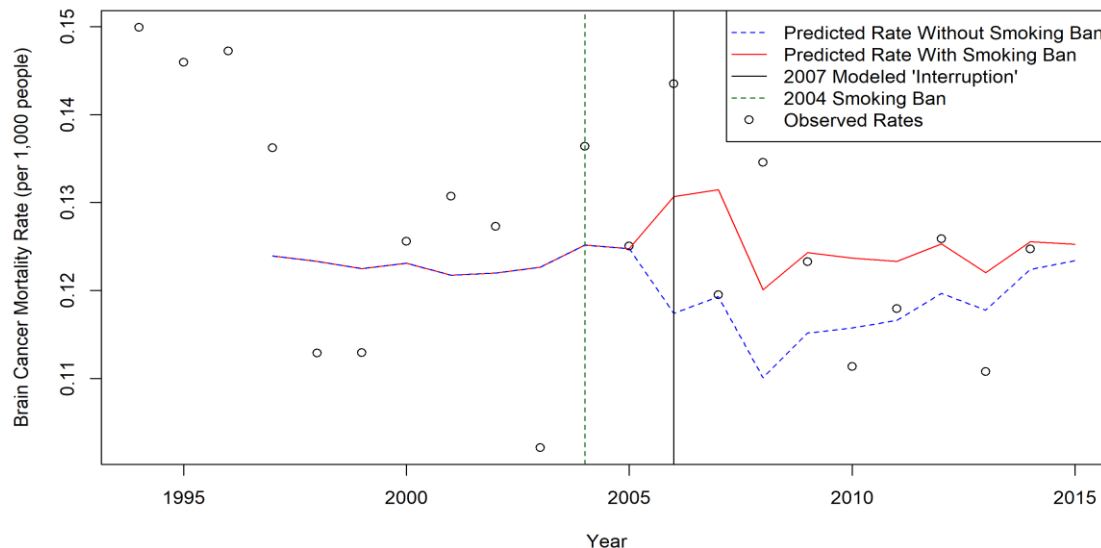
Effect on Lung Cancer Incidence
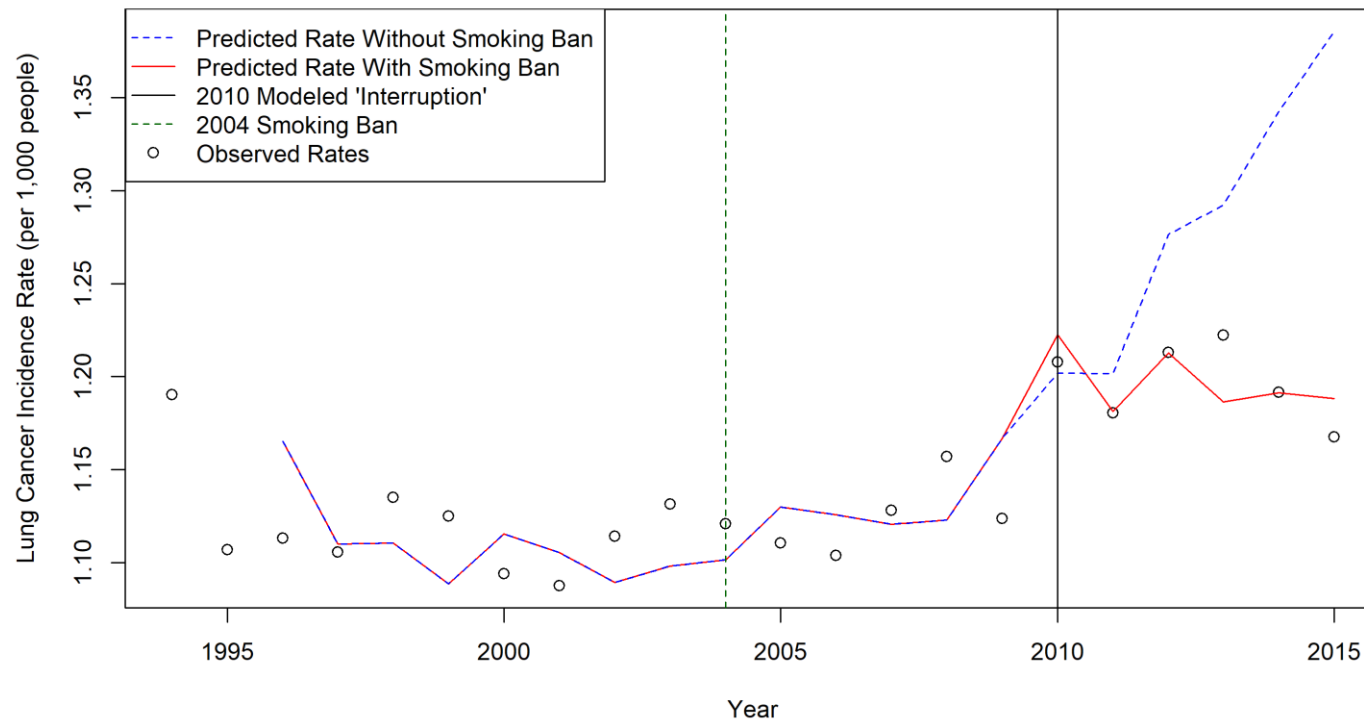
Effect on Lung Cancer Mortality
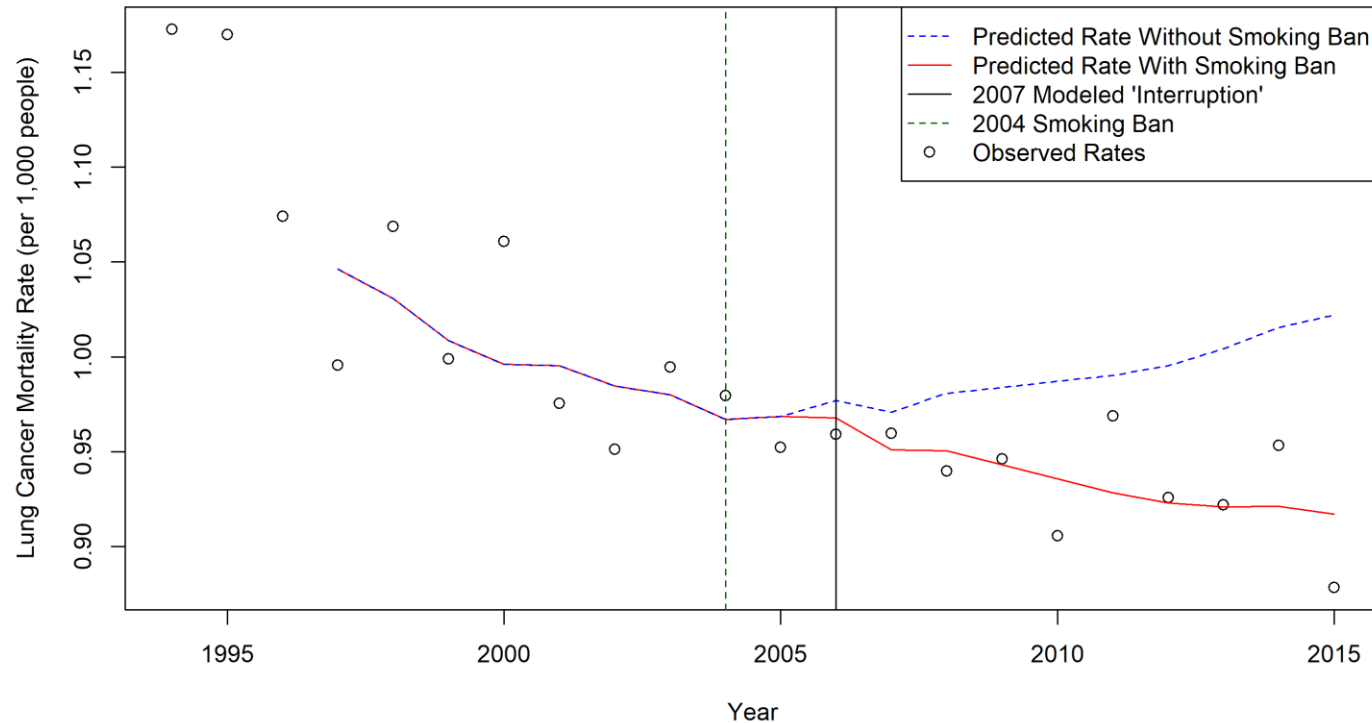
Additional Results

- Effect Modification
  - Not formally tested
  - Not much evidence for it, anyway
- No effects for brain cancer

Implications

- From lung cancer alone, ban averted 1,050 cases and 1,100 deaths
- Despite all the evidence in favor of smoking bans…
  - 11 EU countries don't have them (15)
  - 24 US states don't have them (16)
  - Some places may get rid of them! (43)

NEWS

Town repeals smoking bans after just 9 months

By Post Staff Report

June 22, 2013 | 7:01pm

Limitations

- One-sample interrupted time series leaves possibility of an external event occurring at same time as modelled interruption
  - Thorough review of tobacco control landscape
  - Brain cancer validity test
  - Similarity to Kentucky study (6.9% IRE vs. 7.9% KEN)
- Lack individual-level, longitudinal data

Conclusion

- Previous research shows plenty of benefits and few consequences of smoking bans

- This study adds to arsenal of evidence

- Future research with individual-level, longitudinal data to fully understand biology/policy implications

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Dissertation full text and citations:
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