Researching the links between the environment and health

DATE 2nd October 2019

VENUE Environment Ireland Conference, Croke Park

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The Irish Longitudinal Study on Ageing



Introduction

- Physical environment an important component of the 'social determinants of health' (WHO, 2008)
- Research linking the environment and health has a long history (e.g., 1854 London cholera outbreak)
- But there are methodological challenges



Our Approach

- Link spatially-coded individual-level micro-data with data on environmental exposures
- Survey micro-data from The Irish Longitudinal Study on Ageing (TILDA) and Healthy Ireland
- Environmental exposure data on radon risk, green and blue spaces, noise, air quality, *etc*.



Air Quality and Health

- Airborne pollutants associated with various non-communicable diseases and premature deaths (Cohen *et al.*, 2017; Forouzanfar *et al.*, 2016)
- Asthma the most prevalent respiratory condition worldwide (Soriano *et al.,* 2017)
 - Evidence that air pollution affects the onset and exacerbation of asthma (WHO, 2019)



Our Contribution

- Previous literature focuses mainly on children
 - Two-thirds of asthma deaths occur in over 65s (Gibson *et al.*, 2010)
- Ireland is a low pollution environment
- Ability to link rich micro-data on asthma and confounders from TILDA to NO₂ exposure



The Irish Longitudinal Study on Ageing (TILDA)

- Nationally-representative longitudinal study of the over 50s in Ireland
 - Harmonised with SHARE, ELSA, HRS,...
- At baseline (2010), 8,504 over 50s (and partners of any age) participated
- Further waves in 2012, 2014, 2016 and 2018
- Three modes of data collection:
 - CAPI, SCQ, health assessment
- Each participant's address is geo-coded





- A brown gas that may irritate the lungs and lead to lower respiratory conditions
- Forms as a result of burning of fuel, and traffic emissions are a major source
- Use data on NO₂ concentrations for Ireland produced by Naughton *et al.* (2018)
 - Land-use regression incorporating wind speed and direction



NO₂ Map





NO₂ in the TILDA Sample





Outcome Variables

- Asthma diagnosis 'has a doctor ever told you...'
- Medications used in the treatment of OAD

	No OAD medication	OAD medication	Total
No asthma diagnosis	7,241 <i>(88.7)</i>	183 <i>(2.2)</i>	7,424
Asthma diagnosis	360 (4.4)	378 (4.6)	738 (<u>9.0)</u>
Total	7,601	561 <i>(6.9)</i>	8,162



Results

	Asthma Diagnosis	OAD Medication
NO ₂ level (ppb)	0.0024 *** [0.0006, 0.0042]	0.00208 ** [0.0005, 0.0037]
High NO ₂ (NO ₂ > P ₉₅)	0.0241 [-0.0049, 0.0531]	0.0009 [-0.0264, 0.0282]
Other controls?	yes	yes
Ν	8,162	8,162

Marginal effects, with 95 per cent confidence intervals in parentheses

Results robust to defining outcome variable (0/1= diagnosis and OAD medication)



Study Limitations

- No repeated measures of NO₂ (yet) so cannot utilise longitudinal dimension of TILDA
 - Associations rather than causal effects
- No information on other pollutants (yet) so cannot disentangle relative impacts
 - Validate with new EPA estimates of NO₂ and PM



Summary

- 10 ppb increase in NO₂ associated with an approximate 2-2.5 pp increase in asthma/OAD medication use
- Suggests harmful health effects may be present at levels below standard regulatory thresholds
 - Current EU Directive limit is 21 ppb
- Future work will incorporate new EPA data on air quality in Dublin area, and explore links to other survey datasets (e.g., Healthy Ireland)



Research Team

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Extra Slides



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Previous Literature

- Clear evidence of adverse effects for children (Neidell, 2004; Currie and Neidell, 2005; Currie et al., 2009; Bowatte et al., 2014; Achakulwisut et al., 2019)
- Evidence of direct effect in adults is more inconsistent (Guarnieri and Balmes 2014; Le Moual *et al.*, 2013)



Methods

Estimate logistic models for each outcome (e.g., for diagnosed asthma):

 $Pr(asthma_i) = \Lambda(\alpha + \beta_0 NO2_i + \beta_1 high NO2_i + \sum \beta_k X_{ki})$

- *NO2_i* is estimated concentration of NO₂
- highNO2_i is a dummy variable for those >95th percentile
- X_k is a vector of other controls (age, sex, marital status, income, education, employment status, public health insurance cover, smoking status, mobility problems)



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