Knock, knock, who’s where: how location (and GIS and GPS) can help explain health
...... and a lot of other things

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What is Health/Medical geography?

- Health geography is the application of geographical approaches to the study of health, disease, and health care
  - Site, situation, place, location, region - geography
  - distribution and dispersion of disease/illness/wellness and the supply and demand for healthcare resources
Geospatial Science and Geohealth?

- Geospatial science: a discipline that focuses on using information technology to understand people, places, and processes of the earth
- Geographic Information Systems (GIS): a technology that is used to view and analyse data from a geographic perspective
- Geohealth: Health + GIS
  - Determinants of disease and ill health & wellness
  - Health care provision
Data

• Big datasets
  – usually existing data
  – Surveys OK - but need to be spatially representative

• Geographically located
  – Points (best!), mesh blocks, or CAUs/domicile codes

• Information about determinants of health with geography
  – e.g. proximity to health service, SES, ethnicity, built environment, transport routes
  – often ‘created’ using GIS
Methods

• Tools
  – Visualisation (mapping etc)
  – Spatial analysis
  – Disease clustering
  – Modelling
  – Mobility and Disease Tracking
Mapping

Fig. 5. (a) Child mortality in Auckland, New Zealand (1977-85), expressed as deaths per thousand children per year. (b) Empirical Bayes estimates of child mortality in Auckland.
Interpretation

- Asking (and answer) questions
- Informing policy
EXAMPLES
New Zealand Healthline call data used to measure the effect of travel time on the use of the emergency department

Edward Griffin a, *, John P. McCarthy b, Fiona Thomas b, Simon Kingham b

5. Conclusion

The evidence presented here highlights the importance that geographic proximity to EDs plays in determining people’s behaviour to attend – in essence geography matters for ED presentations.

Fig. 1. Compliant emergency presentations by drive time from nearest ED.
An ecological study investigating the association between access to urban green space and mental health

D. Nutsford a,*, A.L. Pearson b, S. Kingham a

Conclusion: This study found that decreased distance to useable green space and increased proportion of green space within the larger neighbourhood were associated with decreased anxiety/mood disorder treatment counts in an urban environment. This suggests the benefits of green space on mental health may relate both to active participation in useable green spaces near to the home and observable green space in the neighbourhood environment.
Residential exposure to visible blue space (but not green space) associated with lower psychological distress in a capital city

Daniel Nutsford a, Amber L. Pearson b,c,*, Simon Kingham a, Femke Reitsma a

5. Conclusion

This study, in the capital city of New Zealand, identified an association between increased views of blue space and decreased psychological distress while adjusting for covariates. In addition to
Associations between neighbourhood environmental characteristics and obesity and related behaviours among adult New Zealanders

Amber L Pearson, Graham Bentham, Peter Day and Simon Kingham

Table 4 Association between overweight, obesity, overweight+obesity and environmental factors adjusted for socio-demographic and other environmental factors

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Category 1</th>
<th></th>
<th>Category 2</th>
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<th>Category 3</th>
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<th>Category 4</th>
<th></th>
<th>Category 5</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>OR 95% CI</td>
<td>p-value</td>
<td>OR 95% CI</td>
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<td>OR 95% CI</td>
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<td>OR 95% CI</td>
<td>p-value</td>
</tr>
<tr>
<td>Urban/rural category</td>
<td>0.82 0.64,1.05</td>
<td>0.113</td>
<td>0.99 0.70,1.42</td>
<td>0.970</td>
<td>1.16 0.77,1.73</td>
<td>0.478</td>
<td>1.34 1.05,1.72</td>
<td>0.018</td>
<td>0.034</td>
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<tr>
<td>NZdep</td>
<td>1.19 0.98,1.44</td>
<td>0.078</td>
<td>1.10 0.89,1.34</td>
<td>0.378</td>
<td>1.21 0.97,1.49</td>
<td>0.089</td>
<td>1.34 1.04,1.73</td>
<td>0.022</td>
<td>0.041</td>
<td></td>
</tr>
<tr>
<td>Greenspace</td>
<td>1.38 1.24,1.68</td>
<td>0.001</td>
<td>1.14 0.93,1.39</td>
<td>0.315</td>
<td>1.32 1.08,1.63</td>
<td>0.008</td>
<td>1.34 1.04,1.73</td>
<td>0.022</td>
<td>0.041</td>
<td></td>
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<tr>
<td>Foodshop</td>
<td>0.97 0.80,1.18</td>
<td>0.735</td>
<td>0.99 0.81,1.20</td>
<td>0.909</td>
<td>1.04 0.82,1.32</td>
<td>0.753</td>
<td>0.82 0.55,1.38</td>
<td>0.665</td>
<td>0.880</td>
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<tr>
<td>Gym/pool</td>
<td>0.98 0.81,1.16</td>
<td>0.805</td>
<td>1.01 0.83,1.24</td>
<td>0.890</td>
<td>1.13 0.96,1.47</td>
<td>0.338</td>
<td>1.07 0.79,1.44</td>
<td>0.678</td>
<td>0.533</td>
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<tr>
<td>Active travel</td>
<td>1.00 0.82,1.23</td>
<td>0.973</td>
<td>1.06 0.85,1.34</td>
<td>0.986</td>
<td>1.03 0.83,1.27</td>
<td>0.811</td>
<td>0.89 0.70,1.13</td>
<td>0.340</td>
<td>0.322</td>
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</table>

**Conclusion:** Similar to findings from other international studies, these results highlight greenspace as an amenable environmental factor associated with obesity/overweight and also indicate the potential benefit of targeted health promotion in both urban and deprived areas in New Zealand.
The effects of relocation and level of affectedness on mood and anxiety symptom treatments after the 2011 Christchurch earthquake

Daniel Hogg a,b, *, Simon Kingham a,b, Thomas M. Wilson c,d, e, Michael Ardagh f,g

In conclusion, intervention programs should target these highly vulnerable groups, as well as permanent relocatees from affected areas in the long term and temporary relocatees in the short-term aftermath of a natural disaster. As this study is the first of its kind, further research needs to be done.

Fig. 2. Mood or anxiety symptom treatment rates among Christchurch residents classified by mobility group in the pre-disaster year (2009/10) and the 1st (2011/12) and 2nd (2012/13) post-disaster year.
Conclusions: Infant mortality patterns are geographically similar for both Māori and Non-Māori. However, there are differences geographically between the two populations after accounting for deprivation.

Implications: Health services that can affect infant mortality should be aware of the geographical differences across NZ. Deprivation is an important factor in explaining infant mortality rates and policies that ameliorate its effects should be pursued, as it is the major determinant of the geographical pattern of infant mortality in NZ.
Variation in health and social equity in the spaces where we live: A review of previous literature from the GeoHealth Laboratory

Christopher Bowie, Paul Beere, Edward Griffin, Malcolm Campbell & Simon Kingham
Mobile technologies: Tracking

- Tracking people
- Life course
- Spatio-temporal – space and time
- The exposome
my ‘risk profile’ over a year or three

Dynamic: real-time place + exposures
n=525,600 per year @ 1min intervals

Static: Census (5-yearly) or Survey data (annually), n=1 location
Real time ‘risk’: spatio-temporal dynamics

• Accurately assigning exposure (to individuals and populations)
• How do environmental conditions alter as one moves around the city?
• ‘Person X’ knows when and where pollution is higher + almost real time

Dynamic (n=20-30 stations)

Static (e.g. LUR, 2 stations)

Pollution Quartiles
- High (most polluted)
- Medium-high
- Medium-low
- Low

Route (with air quality)
• How interpolation, averaging / method affect the result
• Winter (average), winter (daily), winter (hourly), winter (by minute)
Possible applications

• Geographical variations and/or spatio-temporal changes in:
  – accessibility and equity of health care service
  – disease distribution
  – environmental/social determinants of health
  – response to treatment and survival rates
Summary

• Geohealth
  – Big datasets
  – Geography
  – Spatial analysis (not just mapping)
• Place/geography is important
• Real potential to address health priorities
  ... and impact policy