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**The future of health research: small data?  
Challenges and opportunities associated  
with ubiquitous mobile data**

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**From 'blue skies' back down to earth**

**Overview**

- Context - a journey from high level theory, blue skies and imagination back to a real world example in NZ
- A short 'how to' with examples of potential future GeoHealth Research
- The challenges and the opportunities



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**Big versus Small**

- Big Data is usually Petabytes or larger (1PB = e.g. 223,000 DVDs OR the memories of 800 people)
- Small data is small enough for human comprehension (e.g. measuring location, temperature, noise, vibration....)
- Define - *Small data connects people with timely, meaningful insights (derived from big data and/or "local" sources), organized and packaged – often visually – to be accessible, understandable, and actionable for everyday tasks.*
- E.g. Smartphones + Sensors give us small data in real time



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**Collecting Small data: ubiquitous mobile data - a 'how to' guide**

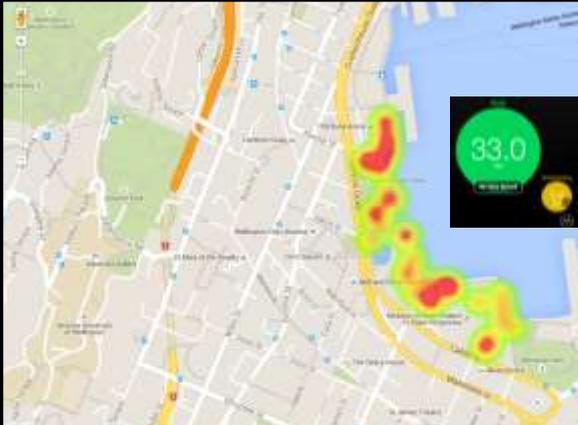
A 'simple' example

- Sensors + Smartphones
- Apps (e.g. Moves)
- Wearables (e.g. Fitbit / MiBand)






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Quantified Self: essentially, collecting data on yourself

So what?  
Get a smart device, get the data, crunch the data .... ?

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The Sensing City and Health: COPD pilot project

So what?  
Now what?

“We can be the first place in the world that correlates air pollution or poor air quality with incidences of COPD ... *in real time*”

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What is COPD (briefly)

- Chronic Obstructive Pulmonary Disease
- Disabling lung condition with frequent flare-ups
- Frequent use of health care
- Potential for an innovative approach to COPD management and hospital avoidance

Source: <http://www.nhlbi.nih.gov/health/health-topics/topics/copd/> for more

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Why does COPD matter (very briefly)

- 1 in 15 New Zealanders are affected by COPD
- 2 full hospital wards in Canterbury throughout winter
- COPD is NZ's 4th leading cause of death
- 4.2 days is the average hospital stay for COPD inpatients at a cost of \$750 per day

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5.1.2 COPD hospital admission rates, population aged 15 and over, 2009 (per 1000 per year)

Why COPD? NZ significantly over OECD avg.

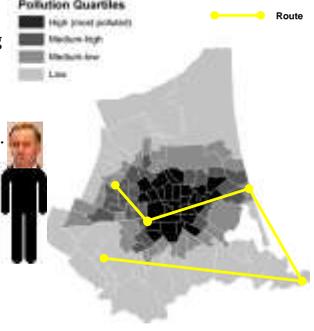
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Where is COPD found in Christchurch?

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### What might be an improvement?

- Following individuals to accurately assigning exposure
  - Lets follow a 'hypothetical' individual called John...
    - How does his COPD condition alter as he moves through the smart city?



**Pollution Quartiles**

- High (red/pink)
- Medium-high
- Medium-low
- Low

Route

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### Smart inhalers

- Inhalers (e.g. Ventolin, Duolin) are used to provide relief and symptom control in COPD
- Frequency of inhaler use provides an indication of symptoms
- Knowledge of inhaler use (**when, where, if**) will help management of COPD
- The Nexus-6 'Smart Inhaler' monitors:
  - Time and location of use (link to phone)
  - The dispensing of medication
  - The air temperature at point of use

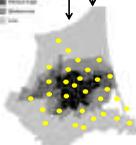


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Humidity: 37.7  
Pressure: 98.240  
Rain: 77  
Temperature: 16.53

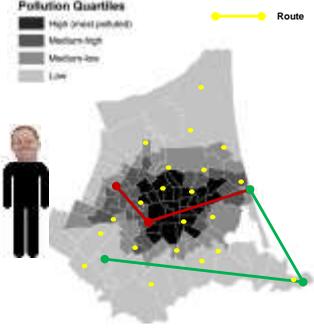
example environmental data from 1 of (hopefully 30+) sensors = better, real time pollution maps



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### Real time 'risk'

- Accurately assigning exposure
- following 'John'
- How does his COPD condition alter as he moves through the smart city?
- This time 'John' knows when and where** pollution is higher + smartinhaler data + real time



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Route

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### Challenges and opportunities? A few suggestions

- costs, volume(s) of data, privacy, ethics, ownership of data, accuracy
- understanding disease(s) better, 'better' data, real time interventions, costs

Your turn.... Really interested to hear your thoughts on this...



Never Offline.

Source: <http://time.com/331865/apple-watch/>

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Short journey through emerging research. Hopefully stimulating and useful. Thanks for listening. Questions or comments?

<http://www.geohealth.canterbury.ac.nz/>

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