Data linkage and immunisation

Current status and potential
NZ has unique capacity in data-linkage

- Population ~ 4.7 million
- Birth cohort ~59,000
- Immunisation register from birth since 2006
Moving towards a new socioeconomic status measure
The IMD

RESEARCH ARTICLE
The New Zealand Indices of Multiple Deprivation (IMD): A new suite of indicators for social and health research in Aotearoa, New Zealand

Daniel John Exeter*, Jinfeng Zhao*, Sue Crengle*, Ariër Lee*, Michael Browne*

Section of Epidemiology & Biostatistics, School of Population Health, The University of Auckland, Auckland, New Zealand

*These authors contributed equally to this work.
*d.exeter@auckland.ac.nz
The New Zealand Index of Multiple Deprivation 2013

- **Employment**
  - Number of working age people receiving the Unemployment Benefit
  - Number of working age people receiving the Sicknote Benefit

- **Income**
  - Weekly Working For Families payments ($ per 1000 population)
  - Weekly payments ($ per 1000 population) in the form of income related benefits

- **Crime**
  - Victimization rates for:
    - Homicide and Related Offences
    - Assault
    - Sexual Assault
    - Abduction and Kidnapping
    - Robbery, Extortion and Related Offences
    - Unlawful Entry With Intent/Burglary, Break and Enter
    - Theft and Related Offences

- **Housing**
  - Number of persons in households which are rented
  - Number of persons in households which are overcrowded

- **Health**
  - Standardised Mortality Rate
  - Hospitalisations related to selected infectious diseases
  - Hospitalisations related to selected respiratory diseases
  - Emergency admissions to hospital
  - People registered as having selected cancers

- **Education**
  - School leavers <17 years old
  - School leavers Without NCEA L2
  - School leavers not enrolling into tertiary studies
  - Working age people without qualifications
  - Youth not in Education Employment or Training

- **Access**
  - Distance to nearest:
    - GPs or A&Es
    - Supermarkets
    - Service stations
    - Primary or Intermediate schools
    - Early Childhood Education Centres

Indicator counts are summed and divided by the population denominator to create the domain score for each neighbourhood. The domain score is ranked to create a domain rank. Each domain rank is standardised and transformed to an exponential distribution and these values are combined using the weights below.

- **Domain Ranks**
  - Neighbourhood working age population: 28%
  - Neighbourhood total population: 28%
  - Neighbourhood household population: 5%
  - Neighbourhood working age population: 9%
  - Neighbourhood total population: 14%
  - Neighbourhood household population: 14%
  - Neighbourhood working age population: 2%

This creates the overall IMD score for each neighbourhood, which is ranked to create the overall IMD rank.
Examples
To inform decision-makers about the acellular pertussis vaccine effectiveness with the NZ schedule (3 + 0)

The EPIC study
Effectiveness of pertussis vaccination in children

- Nested case-control
- Hospitalised/non-hospitalised pertussis
- Conditional logistic regression to calculate dose-specific VE
- Duration of protection examined
- High level of protection, no waning
Reporting on the Vaccine effectiveness of the trivalent influenza vaccine in NZ

The SHIVERS Studies
Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance

- CDC funded
- VE one component
- Case test-negative
  - ILI (GP presentations)
  - SARI (Hospitalisations)
- 2012 – 2016
Assessing the Vaccine effectiveness of the 3+0 schedule of MeNZB against confirmed gonorrhoea cases

- Novartis/GSK funded
- VE of MeNZB against gonorrhoea
- Retrospective case-control of patients at SHCs b 1984-1998 aged 15-30y
- linked to NHI & NIR Cases lab Gn, controls Ct
- VE 31% (95% CI 21-39)
  - Two subsequent studies now support
Assessing the vaccine effectiveness of maternal pertussis-containing booster dose in pregnancy for outcomes in infants


PIPIO
Pertussis vaccination in pregnancy and infant outcomes

- NZ HRC funded
- Retrospective cohort study infants born 28-38w gestation 1/1/13-31/12/13
- NHI, NMDS, EpiSurv, maternity collection, GMS, NIR
- Effective as expected but raises issues around 6-week dose.
- Need to repeat before publish
Evaluating the safety of pertussis-containing vaccine in pregnancy on maternal and infant outcomes


• GSK funded, investigator led
• Extremely challenging, but development of platform
  • Repeatable for other safety studies
• NHI, NMDS, EpiSurv, maternity collection, GMS, NIR
• Retrospective cohort of 68,550
• 000’s Maternal and infant outcomes guided by GAIA and Brighton Collab
• Prioritised outcomes, all screened
• Outcome: No safety concerns
• Manuscripts in prep.

PIPS
The Pertussis in Pregnancy Study
Does prior receipt of HPV vaccine reduce adverse maternal and perinatal outcomes?


- National, retrospective cohort study with datalinking
- Approx. 35,000 first pregnancies
  - Just over a third had prior vaccination (partial or total)
  - Significant reduction in preterm birth
    - ?possible link with preeclampsia, IUGR

- New study being developed
  - shared data: NZ, Australia and Sweden

Novel use of General Practice databases and consultation notes

SPOTS Senior

Quantifying the incidence and burden of herpes zoster in New Zealand general practice: a retrospective cohort study utilising a natural language processing software inference algorithm

Turner N, MacRae J, Nowlan M, McBain L, Stubbe M, Dowell A, manuscript in development

• Cross-sectional retrospective cohort study
• Interrogating 22 million GP electronic medical records
  • 2005 – 2015
• Data-linking for analysis
• Natural language algorithm:
  • PPV 0.82 (0.72-0.92),
  • Specificity 0.998 (0.9997-0.9999), sensitivity 0.84 (0.74-0.92)
  • GP expert PPV 0.53, spec 0.9991, sens 0.93
• Over 6 million GP records
• Incidence 48.6/10,000 patient years (47.6-49.6)
• Incidence increasing over time

Figure 2: Herpes zoster index consultation rate by age group (95% CIs)
Masters studies in progress using data linkage

• **Is there breakthrough pertussis in NZ infants and young children** (Chisholm H, Howe A, Petousis-Harris H, Best E, Turner N)
  - Cohort study to test the hypothesis
  - Data mining of breakthrough pertussis cases to generate hypothesis
  - Using a new index of deprivation

• **What is the optimal pertussis schedule for NZ** (Lambert C, Howe A, Petousis Harris H, Turner N)
  - Vaccine schedule administered to pertussis cases
  - Adjusted model suggesting 2+0 and 2+1 lower OR for pertussis than 3+0

• **Effectiveness of the pneumococcal conjugate vaccines against clinically suspected invasive pneumococcal disease in NZ** (Petousis-Harris D, Howe A, Best E, Palmu A, Turner N)
  - From previous work on pneumo epidemiology and vaccine impact in NZ
  - CSIPD based on ICD-10 codes used in a prior RCT in Finland (FinIP)
  - High VE
  - Also compared schedules
Extending data-linkage – the IDI (Integrated data infrastructure)
First IDI study completed:
Effectiveness of the MeNZB vaccine against gonorrhoea-associated hospitalisation

GoNZB cohort

- National health index population demographics table
- Customs NZ journey data table
- National minimum dataset (hospital discharges)
- National immunisation register
- Education and tax datasets (basic table of whether or not a person has filed a tax return) as extra checks for presence in New Zealand

- Result - VE against gonorrhoea hospitalisations significant

Second IDI study completed

Exploring immunisation inequities among migrant and refugee children in NZ

The Redknot (Huahou) study


• Retrospective cohort study
• IDI database 29 million
  • 2006 - 2015
• Cf vaccination and VPD
  • Foreign-born children <5 yrs (75,000); NZ-born children of recent migrant mothers (50,000); and NZ non-migrant (570,000)
• Multiple findings
  • Low immunisation recording for foreign-born
  • Lowest on refugee visa and Pacific ethnicities
Some planned studies

• Additional pneumococcal vaccine effectiveness studies
  • i.e. Head to head comparisons with PCV7:10:13
• Pertussis breakthrough
• Additional vaccine safety studies
• Impact of HPV vaccine (cancer registry)
Lessons

Administrative datasets...
- Exposure misclassification (e.g., maternal immunisation)
- Coding always takes longer than you think
  - Estimate hours, multiply by ten, raise to the power of 8
- Acquired taste – few individuals to take this on, like *pecorino cheese*
- We are improving
Our core team

Nikki Turner
Dir IMAC

Helen Petousis-Harris
Vaccinologist

Janine Paynter
Epidemiologist

Donna Watson
Project Manager

Anna Howe
Epidemiologist

Emma Best
Paed ID

5 Doctoral students
3 Masters students