A propensity matched analysis of population movement implicating area contributions to increased cardiometabolic risk over time

Natasha J. Howard, Catherine Paquet, Neil T. Coffee, Graeme J. Hugo, Peter Lekkas, Anne W. Taylor, Robert J. Adams & Mark Daniel

Spatial Epidemiology & Evaluation Research Group:
School of Population Health, University of South Australia
(1) The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

“No relationships to disclose”
Presentation Outline

- Background on population movement and place-health studies
- Residential mobility theory and individual-level drivers of population movement
- Demonstration of propensity matching
- Implications for area-level (place) associations
- Future applications and considerations
LOCAL COMMUNITY CHARACTERISTICS

Socio-Economic Status

CARDIO-METABOLIC HEALTH
Local Community Characteristics

- Socio-Economic Status
- Walkability and Accessibility
- Crime and Safety
- Public Open Space
- Food Environment

Behaviours & Lifestyle

Psychosocial Factors

Stress

Cardio-Metabolic Health

Time (i.e., population movement)

Neither people nor places are static.
People move, too.

Health is a function of cumulative person-place interactions that occur across the life course.
Residential Mobility

- Vary temporal and spatial scales.
- Involves changes in a residential location, whether within a city or across continents.

Residential Mobility

- Individuals will change their residential location over the lifecourse (e.g., marriage, education, employment)
- Capital accumulation
- Unstable housing tenure
Residential choice.....

Shops and Facilities

Transport

Services (e.g., hospital)

Locations (e.g., beach)

Resources (e.g., Library)
Place-health considerations

- Limited **longitudinal** place-health cohort studies
  - Sample size large enough to study population movement
  - Limited information on space
Residential self-selection

- Need to account for residential self-selection in studies that focus on place-health relations.
- Potential biases for geospatial epidemiological analyses.
Case Study: Adelaide, South Australia
Adelaide, South Australia
Adelaide, South Australia
Research Funding

- Australia: National Health and Medical Research Council (NHMRC)
- Place and Metabolic Syndrome (PAMS) Project
PAMS Project Funding

**Partnership Grant 2010-2013**

**Linking place to metabolic syndrome:**
Levers for public health intervention

Evaluate local community characteristics in relation to the development of metabolic syndrome over time.

**Knowledge Translation Aims:**
- Differentiate the importance of area attributes;
- Differentiate the changeability of area attributes;
- Inform policy interventions on environments.

**Project Grant 2010-2014**

**Testing behavioural and psychosocial mechanisms underlying spatial variation in metabolic syndrome**

Evaluate the mechanisms by which local community characteristics explain the development of metabolic syndrome.

**Hypotheses:**
- Local community characteristics will predict:
  - development of metabolic syndrome;
  - trajectory of metabolic syndrome; and
  - worsening of components of metabolic syndrome.
Health data

North West Adelaide Health Study

- Longitudinal biomedical study with three waves collected over 10 years (nt1 = 4056, nt2 = 3206, nt3 = 2487)
- Adults (mean age (SD): 50.4 (16.3) yrs) randomly selected via Electronic White Pages directory from the north-western suburbs of Adelaide.
Health data

- **Measures:**
  - Clinical markers (anthropometrics, Blood Pressure, fasting blood sample)
  - Psychosocial measures (e.g., SF-36, GHQ-12)
  - Behaviours (e.g., food and physical activity, smoking)
  - Socio-demographics
Cardiometabolic Health

Cardiometabolic Risk Factors:
- Abdominal obesity
- Hypertension
- Reduced HDL
- Raised Triglycerides
- Fasting Plasma Glucose
- Increased LDL

Individual Risk Factors

Sum of Risk Factors

Metabolic Syndrome
South Australian Epidemiological Geographic Information System (SAEGIS)

Built Environment
- Land use / zoning, Road network, Satellite images
- Private sector businesses (e.g., Food stores)

Social Environment
- Census, Property Valuation, Crime

Health Data

North West Adelaide Health Study
Who moves?

Wave 2
n=3508
(98.5% of n=3563)

Movers
n=611
(17.4%)

Non-Movers
n=2897
(82.6%)

Mover information at Wave 1 and 2
n=604
Wave 2 non-participation

Demographics
- Males: 52.7%
- Mean Age: 48.1 (18 to 90)

Area-Level Socioeconomic Status
- Participants living within the Low & Lowest Quintile of the Index: 68.5%

Health Status
- Excellent/Very Good Health: 29.4%
- Fair/Poor Health: 24.7%

Individual Socioeconomic Status
- Bachelor Degree or higher: 20.9%
- Full time employed: 29.2%

Wave 2 non-participation
n=493
(12.2% of n=4056)
Socio-demographics

Movers
- Bachelor Degree or Higher 17.2%
- Low Income 20.9%

Wave 1-2
- Mean Age 44.3 years
- Renter 21.6%
- Excellent or Very Good Health 47.7%
Who moves area-level socio-economic status?

Movers
n=604

- Move Up SES
  n=234
  (38.7%)

- Same SES
  n=211
  (34.9%)

- Move Down SES
  n=159
  (26.3%)
Who moves area-level socio-economic status?

Movers
n=604

Move Up SES
n=234
(38.7%)

Same SES
n=211
(34.9%)
Who moves area-level socio-economic status?

Movers: n=604

- Move Up SES: n=234 (38.7%)
- Same SES: n=211 (34.9%)
- Move Down SES: n=159 (26.3%)
Application: Research objectives

- To implicate area-level influences by accounting for individual factors using propensity matched pairs of ‘movers’ and ‘non-movers’.

- To assess the difference between the two groups according to a number of biomedical cardiometabolic risk markers.
Propensity score estimation

- Matching of members of a treatment group to members of a no treatment group.
- Applied within observational studies to reduce and bias and approximate a randomized trial (Parsons, 2004).
- Rosenbaum and Rubin (1983) have demonstrated as a ‘balancing score’ that ensure that the resulting matched samples have similar distributions.
Propensity score estimation

Following steps in specifying the propensity score model (Austin, 2007):

1) Derive a list of measured baseline variables that are likely related to exposure/outcome.

2) Derive an initial propensity model by including all variables in the list as main effects.

Four steps: Specifying propensity score model, matching, statistical assessment of balance, estimation of effect.
Step 1: Propensity Score Model

Change: marital status
- Married,
- Separated or Divorced,
- Widowed,
- Never Married

Change: work status
- Full time,
- Part time or Casual,
- Unemployed,
- Home duties,
- Retired,
- Student

Income change match
- 1 "Decrease"
- 0 "Same"
- 2 "Increase"

Age Cohort
- 1 ">30 yrs"
- 2 "30 - 44 yrs"
- 3 "45 - 54 yrs"
- 4 "54 - 64 yrs"
- 5 "65 yrs +"

Education
- 1 "Bachelor Degree or higher"
- 0 "Less than Degree"

Housing Tenure
- 1 "Paying off Mortgage"
- 2 "Owner"
- 3 "Renting"

Child status
- 1 "Child living at home"
- 0 "Child not at home"
Propensity Score Estimation

- Propensity Score was estimated by a logistic regression model.
- Wave 1 to 2 ‘Mover’ regressed on the individual-level predictors of mobility.

Greedy Match Macro
(SAS 9.2. System for Windows)
Step 2: Propensity Score Matching

Mover
n=413

- Change in marital status match (0,1)
- Change in work status match (0,1)
- Income change match (0,1,2)
- Age
- Bachelor Degree or higher (0,1)
- Housing Tenure

Non-mover
n=413

- Change in marital status match (0,1)
- Change in work status match (0,1)
- Income change match (0,1,2)
- Age
- Bachelor Degree or higher (0,1)
- Housing Tenure
Step 3: Assessment

- Difference between matched pairs ‘Movers vs Non-movers’ were assessed by T-test.
- Non-movers had an increase in the count of elevated risk factors (mean 0.04) than ‘Mover’ counterparts (mean -0.11).
‘Non-movers’ had a greater increase in risk of cardiometabolic disease.

Understanding mobility patterns will inform:

✓ knowledge on residential self-selection;
✓ interpretations on relationships between environmental contexts and health behaviours;
✓ how individual-level drivers implicate area-level relationships.
1. Matching ‘movers’ to ‘non-movers’ with respect to their propensity to re-locate into areas of varying fast-food outlet exposures through drivers of individual mobility.

2. Comparing mover/non-mover matches on their change in cardiometabolic risk.
Practical implications

- Include residential movement within population based cohorts
  - Spatial sampling
  - Consider movement in loss of sample
  - Collect information on other mobility drivers
Future directions

- Further understandings on the characteristics of residential mobility.
- Investigate other built environmental influences and assess how residential mobility implicates area-level factors.
We occupy locations and, in the course of our lives, move from place to place. We all have our own 'geographies' as well as our own biographies.

Gatrell (2002, p.3)

People move between places.

Movement changes places.
We occupy locations and, in the course of our lives, move from place to place. We all have our own 'geographies' as well as our own biographies. Gatrell (2002, p.3)

People move places

- Explore the dynamics of how neighbourhoods/local areas are formed and how they change.

- Consider how population movement influences residential segregation, influence the socio-spatial reproduction of local areas.
Contact Information

Spatial Epidemiology and Evaluation Research Group
School of Population Health & Sansom Institute for Health Research
University of South Australia
Level 8, South Australian Health & Medical Research Institute, Adelaide, South Australia

t: +61 8 8302 2776
e: natasha.howard@unisa.edu.au
@: @natasha_howard
w: unisa.edu.au/sansom institute/pams/