This is an author produced version of *Not social mobility but deprivation mobility: places change their characteristics and people change their places.*

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**Conference or Workshop Item:**
Norman, PD orcid.org/0000-0002-6211-1625 *Not social mobility but deprivation mobility: places change their characteristics and people change their places.* In: Seminar at the Unit for Biocultural Variation and Obesity Institute of Social and Cultural Anthropology, 02 Nov 2017, University of Oxford.

10.13140/RG.2.2.10390.45121
Not social mobility but deprivation mobility: places change their characteristics and people change their places

Paul Norman (plus others named along the way)
School of Geography
University of Leeds
Many studies which link to areas use deprivation measures cross-sectionally

- Assume applies over time

Show how deprivation has been measured in a way which allows changing levels to be captured

Individual level studies whereby changes in people's circumstances over time can be related to their health
Applicability of fixed deprivation in time-series

Maguire et al. (2015) in Health & Place:
“Area deprivation and the food environment over time: A repeated cross-sectional study on takeaway outlet density and supermarket presence in Norfolk, UK, 1990–2008”

Method:
• Link food outlet locations to wards
• “Due to changing electoral ward boundaries, we were only able to use 2001 deprivation”

Limitations:
“2001 estimates … would best represent … deprivation. However, this approach may have introduced some error … so future studies should utilise data where this information has been captured at multiple time points.”
‘Outcomes’ linked to places, but places change

- Population age-sex: structure
- Socio-demographic characteristics: composition

Area A at Time 1

Counts of persons by age & sex
Characteristics
- Employment
- Health
- Marital status
- etc. …

Natural change (births - deaths)
(differences in attributes)

Non-migrants (whose attributes may change)

In-migrants (by age, sex & attributes)

International migrant characteristics may be more ‘different’

Area A at Time 2

Counts of persons by age & sex
Characteristics
- Employment
- Health
- Marital status
- etc. …

Out-migrants (by age, sex & attributes)

Non-migrants

In-migrants (by age, sex & attributes)
UK deprivation measures

Townsend (1987), deprivation …
“… a state of observable and demonstrable disadvantage relative to the local community or the wider society or nation to which an individual, family or group belongs”

Deprivation index for areas
A single figure index that summarises information from several variables that each indicate something relating to deprivation
• Deprivation of an area relative to national and other areas

Various deprivation schemes / indexes exist
• Jarman UPA; Townsend; Carstairs; Breadline Britain; Index of Multiple Deprivation (IMD)

Deprivation measures are invariably cross-sectional & not comparable over time. Time-series of health outcomes should have area characteristics change
• Deprivation composite constructed to measure deprivation over time for small areas in GB, 1971 to 2011:
  • Geographical consistency & Changing deprivation
Health / Deprivation relationship

In socio-demographic terms, places change

Changing area deprivation

Areas with improving deprivation over time:
  • Infant mortality improves more (Norman et al. 2008)
  • Cancer survival improves more (Basto et al. 2014)

Areas of persistent (dis-) advantage over time:
  • Have the (worst) best self-reported health & mortality (Boyle et al. 2009; Norman et al. 2010; Exeter et al. 2011)
Geographical relationships & hierarchies

Census
- Country
- Region
- Local government

Super Output Areas / Datazones
- Output Areas

Output Areas
- Postal sector
- Ward
- Enumeration District

Vital Statistics / Admin
- Local government
- Wards > SOAs

Electoral geographies
- Constituencies
- Wards
UK deprivation measures

Index scores

Townsend index:
- % Unemployed (log)
- % Non-home owners
- % No car access
- % Overcrowded households (log)

- Standardised using z-scores
- Summed to be index scores

‘Traditional’ deprivation measures, mainly for ward geography
- Uneven population distribution

‘Recent’ deprivation measures, mainly for Lower Super Output Area (LSOA) and similar ‘synthetic’ geographies
- More even population distribution

Quantiles
- For convenience, scores often categorised into quintiles / deciles
Measuring changing deprivation

Specification

Time frame

Geography: GB
• 2011 Lower Super Output Areas (LSOAs) & Datazones

Variables: inputs to Townsend deprivation
• Unemployment, Non-home ownership
• No car access, Overcrowding

Deprivation calculation
• Comparable over time
Geography: from source to target

Boundary change: data conversion
- Convert from ‘source’ geographies EDs & OAs
- To ‘target’ LSOAs / DZs

Norman et al. 2003
Input variables


Numerator & denominators of:
  • Unemployment
  • Non-home ownership
  • No car access
  • Household overcrowding

& Persons

At ED & OA level

Converted to LSOAs and Datazones for 2011
Calculating comparable deprivation

Standardise variables using z-scores
... & sum (equally) to Index

\[ z_{score} = \frac{(\text{Obs} - \text{Mean})}{\text{SD}} \]

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Norman 2010; Exeter et al 2011; Norman et al 2016
Deprivation change: GB 1971 to 2011

GB change in inputs

GB change in deprivation
Deprivation change: GB 1971 to 2011

Consistency between censuses

a) Correlations between deprivation scores at each census time point

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<td>0.86</td>
<td>0.79</td>
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<td>1981</td>
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<td>1991</td>
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<td>2001</td>
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b) Crosstabulations between 1971 and 2011 deprivation quintiles

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<tr>
<td>Q1</td>
<td>670</td>
<td>75</td>
<td>12</td>
<td>3</td>
<td>3</td>
<td>763</td>
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<td>Q2</td>
<td>4,050</td>
<td>951</td>
<td>229</td>
<td>74</td>
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<td>Q3</td>
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<td>505</td>
<td>53</td>
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<td>Q4</td>
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<td>3,501</td>
<td>3,298</td>
<td>2,104</td>
<td>498</td>
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<td>2,674</td>
<td>4,350</td>
<td>3,569</td>
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<td>Total</td>
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<td>9,233</td>
<td>7,534</td>
<td>7,036</td>
<td>4,136</td>
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Deprivation change: GB 1971 & 2011

Deprivation change

London & surrounds

Glasgow & surrounds

Green = Least; White = Less; Blue = More; Red = Most
Milton Keynes: villages & fields to concrete cows & roundabouts
Milton Keynes: changing deprivation


Unemployment
Non-home ownership
No car
Overcrowded

Deprivation score

-6 -4 -2 0 2 4 6


Interim reflection (i)

Health measures are regularly stratified across deprivation categories
A time-series of health stratified across cross-sectional deprivation is common
To understand health change (including population structure change)
also needs deprivation change
  • Needs geographical and measurement consistencies

GB ‘Long-term’ 10 yearly change using census data reveals:
• General reduction in deprivation
• Relative position of areas entrenched

Caveats: ‘measured in this way’
• LSOAs / Datazones not necessarily the ‘right’ geography
• Townsend not necessarily the ‘right’ deprivation
  • Input indicators assumed relevant over time
• Decennial censuses miss the intervening years
  … etc. …
Using consistent geography / changing deprivation

Area changes in deprivation:

- Individual records linked to areas to see how changes in deprivation experiences relates to health outcomes for individuals themselves
- Re-aggregate individual records at different time points

LLTI & Deprivation

(Area data)

Q5 : Q1 ratio
1991 = 1.61
2001 = 2.13

Might the change in gradient be due to migration?
Inter-relationships: health, deprivation & migration

Health

• Gradient of health status along deprivation gradient
• Healthy people live in less deprived locations & vice versa

Deprivation

• More advantaged people tend to migrate to or between less deprived, more attractive locations
• Less advantaged people tend to drift into (or be trapped in) more deprived locations

Migration

• Majority of migrants are young & relatively healthy
• Some people may / may not move because of their health
• A migrant’s health may be affected by the process
• Migrants may spread disease
Changes affecting the deprivation extremes

1991 to 2001 SIRs for LLTI

- Using ONS Longitudinal Study for England & Wales
- Linked individual records by area deprivation (combination)

Changes affecting the deprivation extremes

Migrants

Non-Migrants
Selective migration affecting local health rates?

Area health-deprivation relationship

- At least maintained or more exaggerated than if nobody moved & / or if areas didn’t change

But …

- Disaggregating the moves between deprivation categories by age shows some different directions
  
  e.g. Unhealthy elderly migrants moving from more to less deprived areas

Are health inequalities the same at all ages?

(with Paul Boyle)
Cross-sectional inequalities by age

England & Wales
Ratio Most : Least deprived by Carstairs quintile

Mortality (2000-02)

Limiting long-term illness (2001)

(c.f. Dibben & Popham, 2012 for England)
Variations by age

Population migration may redistribute the population such that the health–deprivation relationship varies by age

Proposition based on:
- Types of areas people typically move from & to at different ages
- Migration process itself is health selective

Using ONS Longitudinal Study for England & Wales, residents in households:
- Aggregations of individuals by deprivation quintile at two time points …
LLTI inequalities by age

Age 0-9 in 1991 & 10-19 in 2001

Age 10-19 in 1991 & 20-29 in 2001
LLTI inequalities by age


LLTI inequalities by age

Age 40-49 in 1991 & 50-59 in 2001

Age 50-59 in 1991 & 60-69 in 2001
LLTI inequalities by age

Age 60-69 in 1991 & 70-79 in 2001

Age 70-79 in 1991 & 80+ in 2001
Effect on inequality: putting people back
Interim reflection (ii)

Migration through the life course has strong, repeated patterns of moves between differently deprived areas (and urban-rural)
• Re-aggregating individual records across quintiles shows LLTI inequalities greatest in mid life
• No explicit allowance for longitudinal effects for the individual
  • (Could be achieved using ONS LS (or NILS or SLS))

But, time increments long
• What about the intervening years?

Case studies:
• Using British birth cohorts
  • Cohort study data not collected contemporary with census years
• Using New Zealand CVD data
  • More detailed time increments
How important are neighbourhood effects across the life course on health and wellbeing?

Stephen Jivraj, Owen Nicholas, Emily Murray
Department of Epidemiology and Public Health, University College London

& Paul Norman
School of Geography, University of Leeds
Data

- **1958** National Child Development Study and British Cohort Study **1970** birth cohort studies
- Linked to **Townsend** deprivation scores measured at censuses, **1971-2011** at 2011 Lower Super Output areas

- Self-rated health: in general, would you say your health is...
  - excellent, very good, good, fair or poor
Neighbourhood deprivation score by sweep

National Child Development Study

British Cohort Study 1970

excludes outside values

Age at survey

excludes outside values

Age at survey
Poor-rated health by neighbourhood deprivation decile

National Child Development Study

British Cohort Study 1970
Birth cohorts: Summary

- The cohorts have a general shift towards less deprived areas by mid-life

- Poor self-reported health inequalities least for young adults but increasing in mid-life

- N.B. More work ongoing
Risky moves and cardiovascular disease in New Zealand

Nichola Shackleton, University of Auckland
Fran Darlington-Pollock, University of Liverpool
Dan Exeter, University of Auckland
Paul Norman, University of Leeds
Explore how residential mobility and the nature of a move interacts with risk of CVD for different ethnic groups in New Zealand

- Cardiovascular disease (CVD) one of the leading causes of death globally, marked variations between ethnic groups;
- Residential mobility an important *determinant* of CVD in Auckland (Exeter et al., 2015);
- Importance of *deprivation mobility / change* for migration-health relationship
  - Differences in migration patterns between ethnic groups in New Zealand
### Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
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<tbody>
<tr>
<td>Sex</td>
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<tr>
<td>Age</td>
<td>30-44; 45-54; 55-64; 65-74; 75-84</td>
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<tr>
<td>Ethnicity (prioritised)</td>
<td>Maori; Pacific; Indian; Other Asian; New Zealand European &amp; Other (NZEO)</td>
</tr>
<tr>
<td>CVD hospitalisations (events)</td>
<td>CVD; No CVD</td>
</tr>
<tr>
<td>Deprivation (NZDep2006)</td>
<td>Q1- least deprived; Q2; Q3; Q4; Q5 – most deprived</td>
</tr>
</tbody>
</table>

- Data from 2,418,397 individuals enrolled in NZ Primary Health Organisation
- Aged between 30 and 84 years
- During at least 1 of 34 calendar quarters between 1\textsuperscript{st} January 2006 to 30\textsuperscript{th} June 2014
- Trajectory analysis
- Compare CVD risk for movers according to their deprivation trajectory
Classify people into deprivation-mobility groups:

- **Stayers** → do not move on the observation period
- **Churners** → move at least once but within the **same** level of deprivation
- **Movers** → move to an area with a **different** level of deprivation
Results

Error bars represent 95% confidence intervals.
Models adjusted for Age, Age squared, Gender, Ethnicity, number of quarters observed prior to event, and number of moves.
Trajectory analysis conducted on Movers (those who move to a different deprivation quintile)
T1: move from least deprived quintile to higher deprivation, T2: move from mid deprivation to least deprived areas, T3: move from mid deprivation to less deprived area, T4: move from lower mid deprivation to higher deprivation, T5: move from most deprived to lower deprivation, T6: move from lower deprivation into most deprived areas.
Conclusions

- CVD differences for stayers and churners
  - Similar to other health investigations
- Trajectory analysis a novel approach
  - Health relationships analogous to Start : End combinations
- Developing research
  - Ethnic stratification to identify further commonalities in deprivation sequences for movers
- Reasons behind the move
  - Favourable or unfavourable?
Postscript

Over time: Geography of (non-) deprivation entrenched
• Inequalities by age, new-ish agenda
  • Different health conditions?

Resource of area deprivation (and population density) by contemporary geographies from 1971 to 2011
• Used to link individual records in cohort and LS
  • Caveats
    • ‘Measured in this way’
    • Decennial time points

Migration through the life course has strong, repeated patterns of moves between differently deprived areas (and urban-rural)

Different risks for people moving between / staying in different levels of deprivation
• Largely concomitant with what we would expect
References

Data suppliers
• ONS Longitudinal Study access via CeLSIUS is supported by the ESRC Census of Population Programme (award ref. H 507 25 5179), the authors alone are responsible for the interpretation of the data (LS project clearance 30033 & 30163)
• National Statistics Agencies, CASWEB & Nomisweb for supply of census data
• EDINA / UKBORDERs, National Statistics Agencies, etc. for supply of GIS data
• UKDS for the National Child Development Study and British Cohort Study
• Access to the VIEW data in New Zealand