
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

Unit for Biocultural Variation and Obesity
Institute of Social and Cultural Anthropology, University of Oxford

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

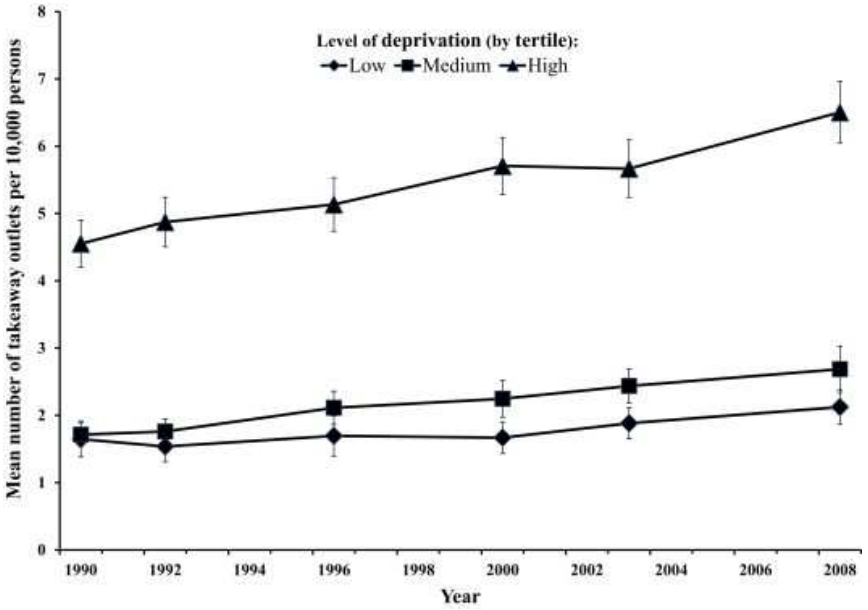
Maguire et al. (2015) in Health & Place:

"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"

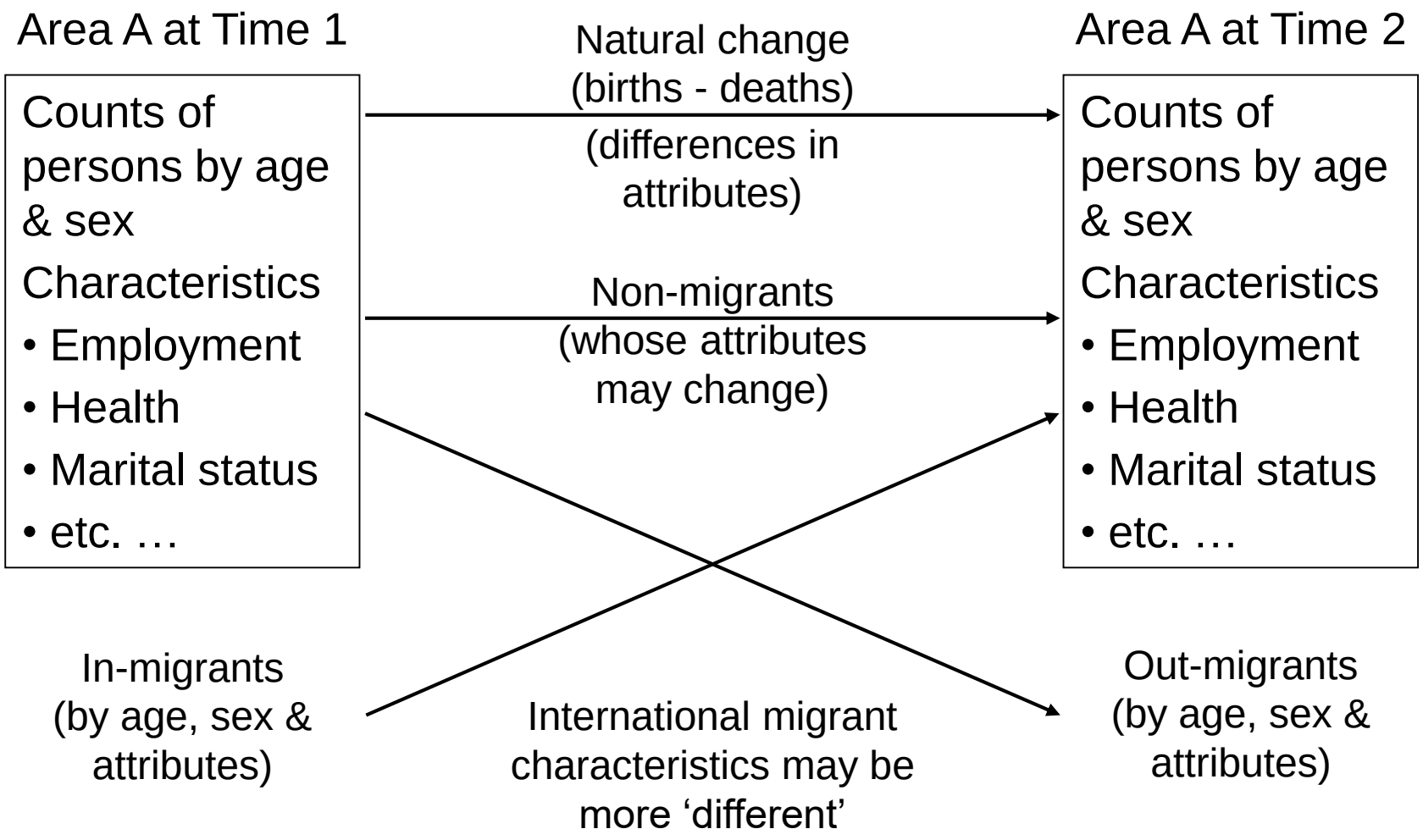


Limitations:

"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



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

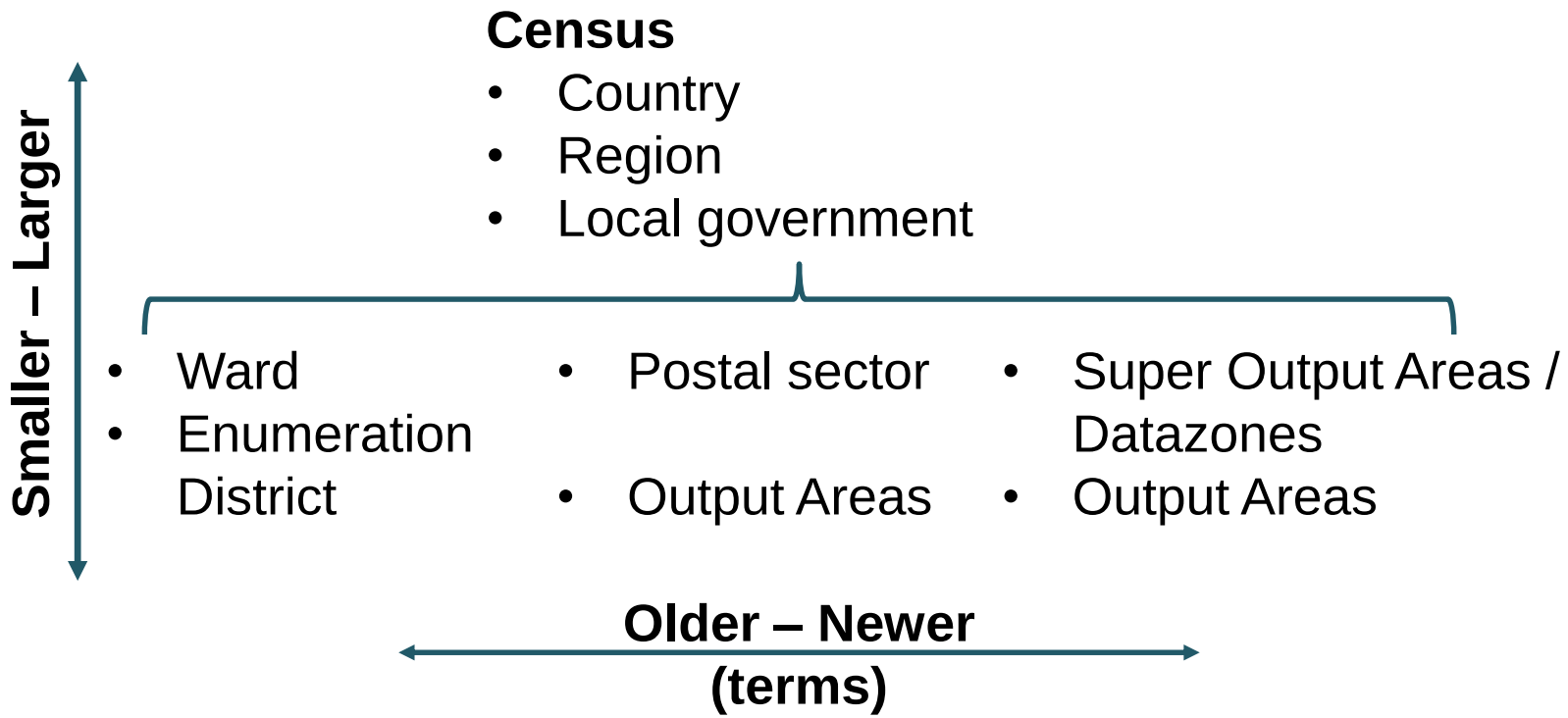
Areas with improving deprivation over time:

- 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



Electoral geographies
- Constituencies
- Wards

Vital Statistics / Admin
- Local government
- Wards > SOAs

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

- Census years: 1971, 1981, 1991, 2001 & 2011

Geography: GB

- 2011 Lower Super Output Areas (LSOAs) & Datazones

Variables: inputs to Townsend deprivation

- Unemployment, Non-home ownership
- No car access, Overcrowding

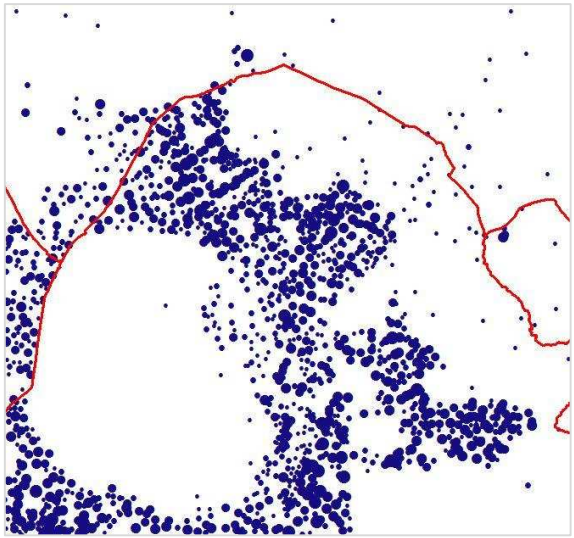
Deprivation calculation

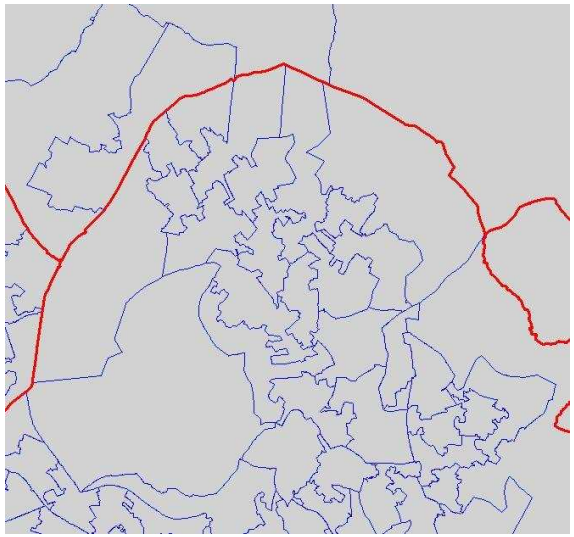
- Comparable over time

Geography: from source to target

Boundary change: data conversion

- Census years: 1971, 1981, 1991, 2001 & 2011
- Convert from ‘source’ geographies EDs & OAs
- To ‘target’ LSOAs / DZs





Norman et al. 2003

Input variables

Census years: 1971, 1981, 1991, 2001 & 2011

Numerators & 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

$$\text{zscore} = \frac{(\text{Obs} - \text{Mean})}{\text{SD}}$$

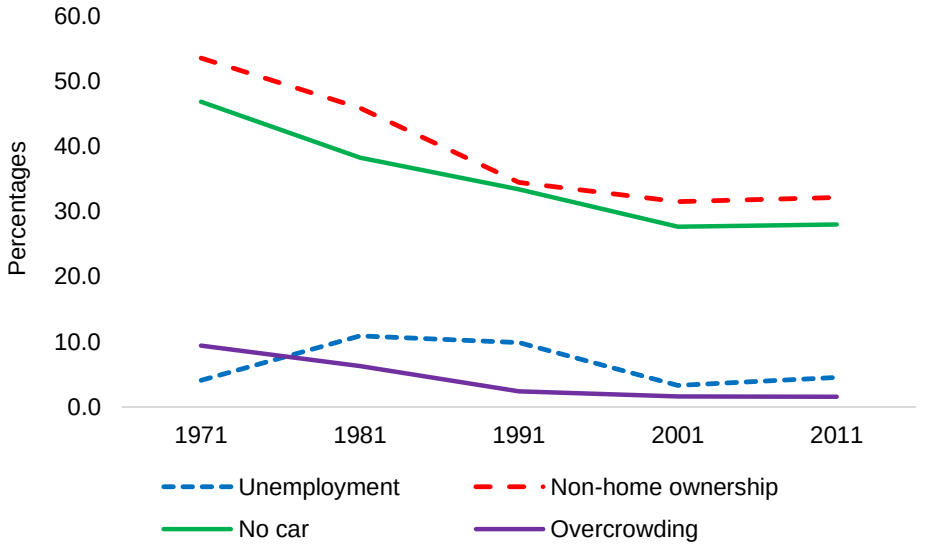
Cross-sectional	1971	1981	1991	2001	2011
Area	8	7	6	5	4
Mean	3.6	9.6	9.5	3.2	4.5
SD	2.3	6.2	6.6	2.1	2.5
Z-score	1.91	-0.42	-0.53	0.86	-0.20

Comparable	1971	1981	1991	2001	2011
Area	8	7	6	5	4
Mean	6.08				
SD	3.94				
Z-score	0.49	0.23	-0.02	-0.27	-0.53

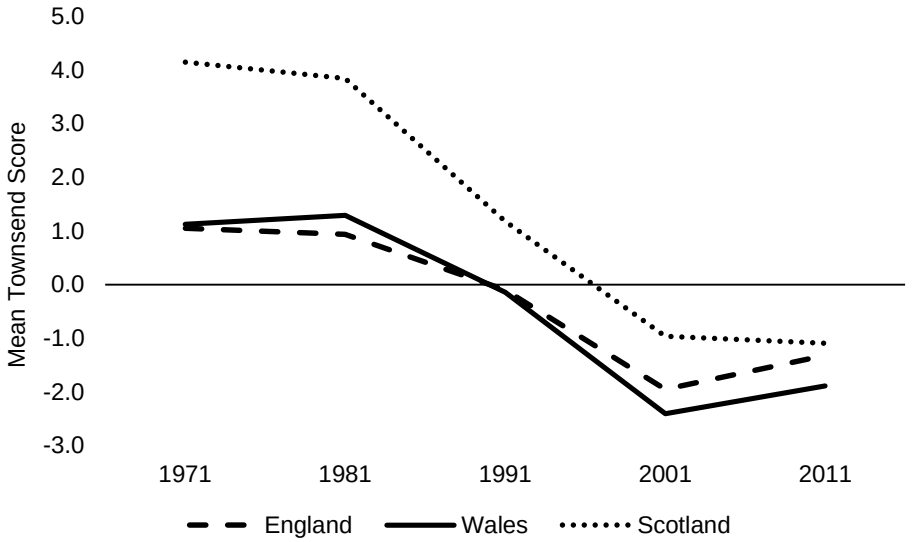
Norman 2010; Exeter et al 2011; Norman et al 2016

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

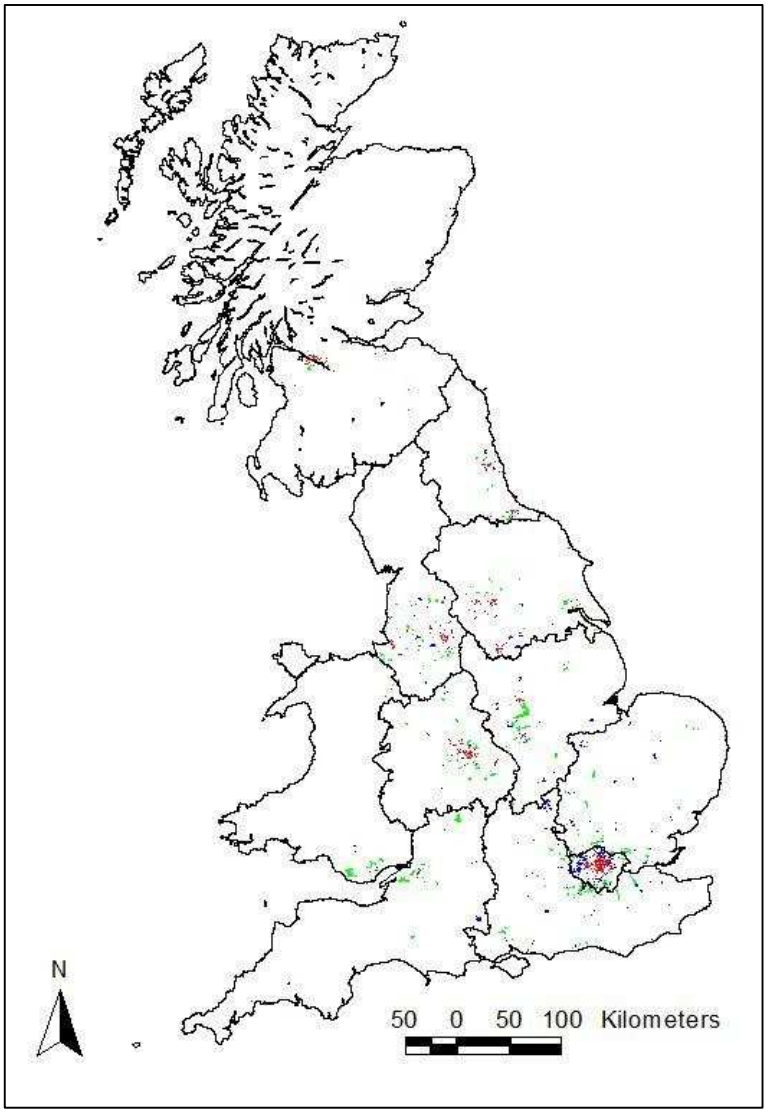
	1981	1991	2001	2011
1971	0.86	0.79	0.74	0.68
1981		0.91	0.85	0.80
1991			0.92	0.90
2001				0.94

b) Crosstabulations between 1971 and 2011 deprivation quintiles

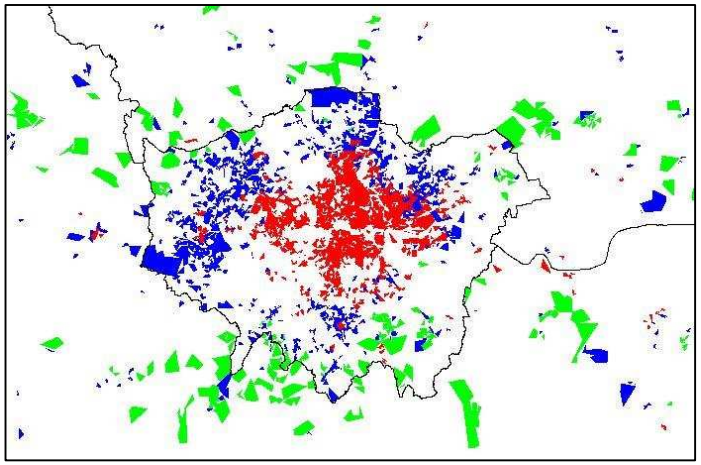
		2011					
		Q1	Q2	Q3	Q4	Q5	Total
1971	Q1	670	75	12	3	3	763
	Q2	4,050	951	229	74	13	5,317
	Q3	5,562	3,294	1,321	505	53	10,735
	Q4	2,659	3,501	3,298	2,104	498	12,060
	Q5	849	1,412	2,674	4,350	3,569	12,854
	Total	13,790	9,233	7,534	7,036	4,136	41,729

Deprivation change: GB 1971 & 2011

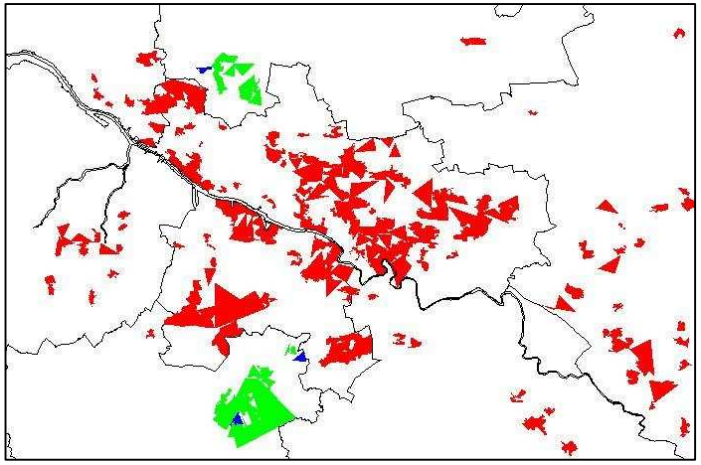
Deprivation change



London & surrounds



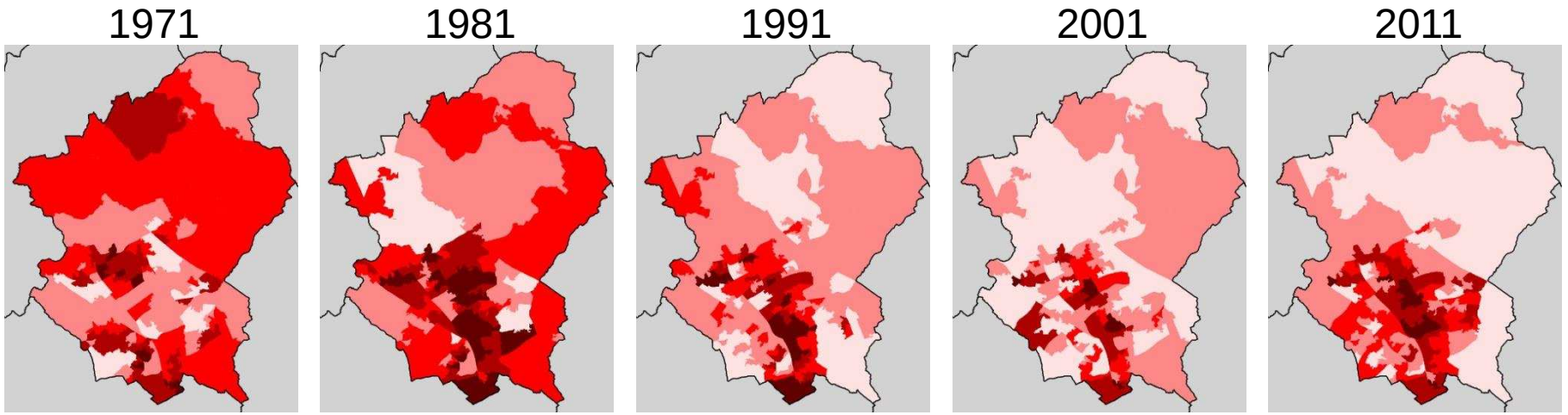
Glasgow & surrounds

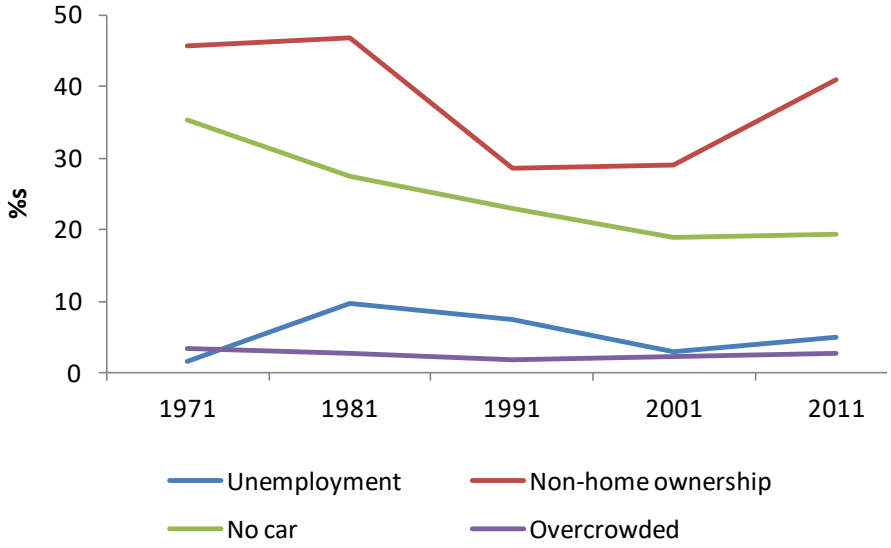


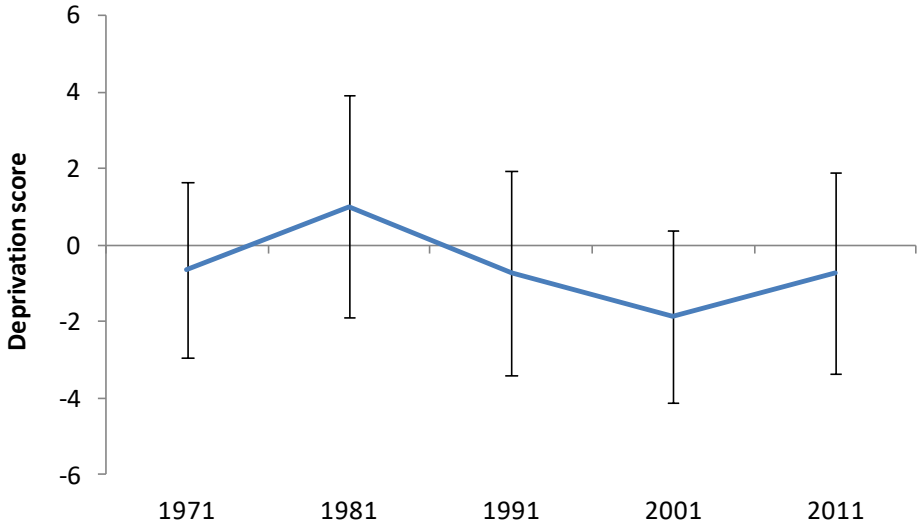
Green = Least; White = Less; Blue = More; Red = Most

Milton Keynes: villages & fields to concrete cows & roundabouts

Milton Keynes: changing deprivation







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

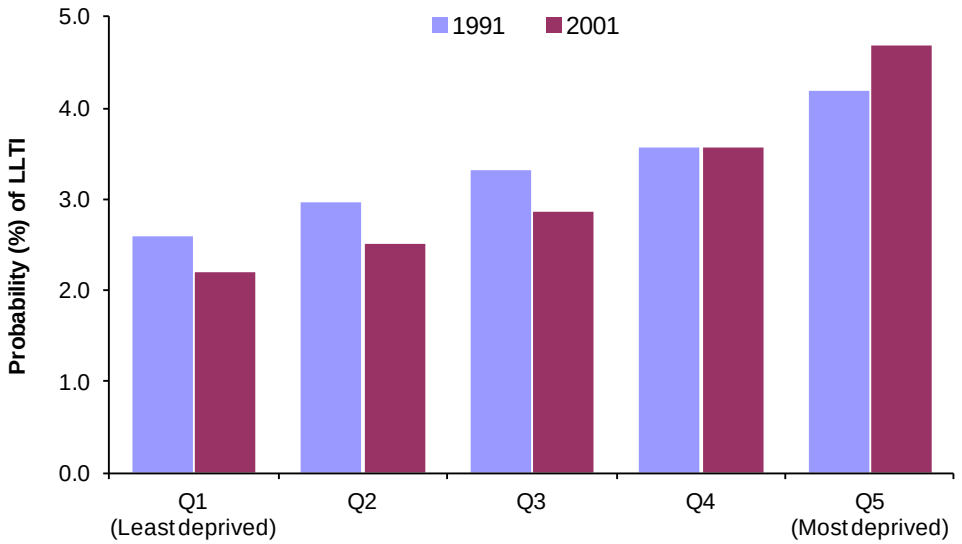
LLTI & Deprivation

(Area data)

Q5 : Q1 ratio

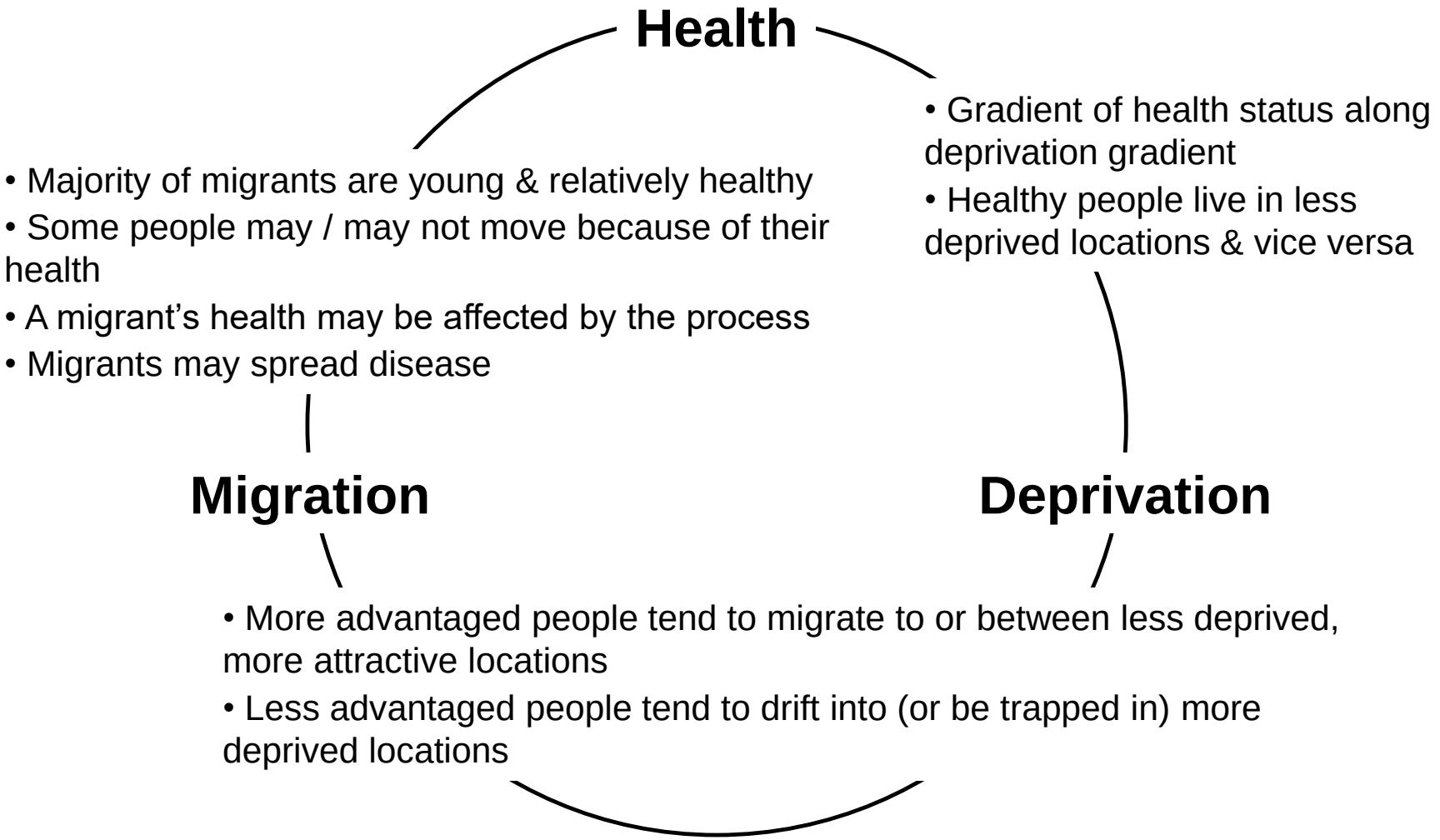
1991 = 1.61

2001 = 2.13



Might the change in gradient be due to migration?

Inter-relationships: health, deprivation & migration

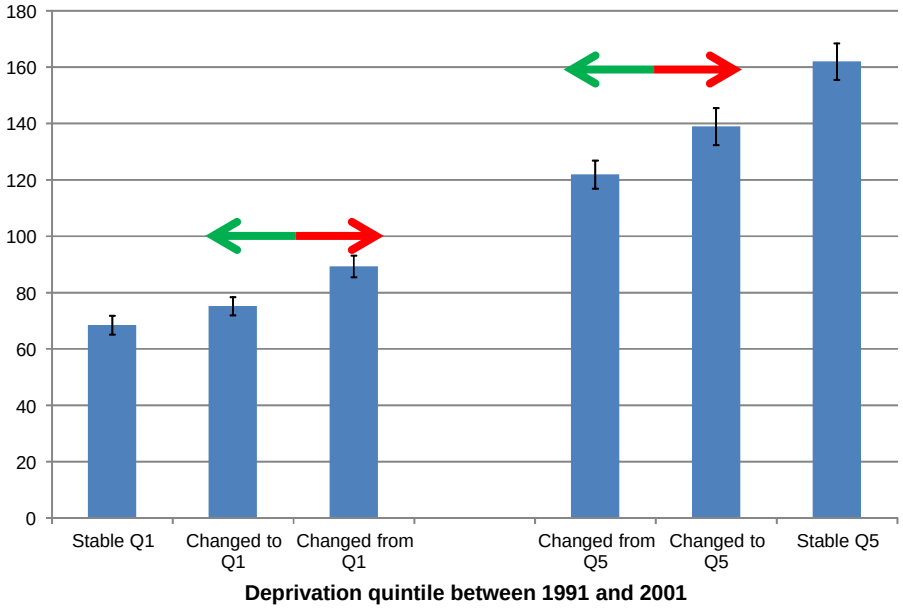


Changes affecting the deprivation extremes

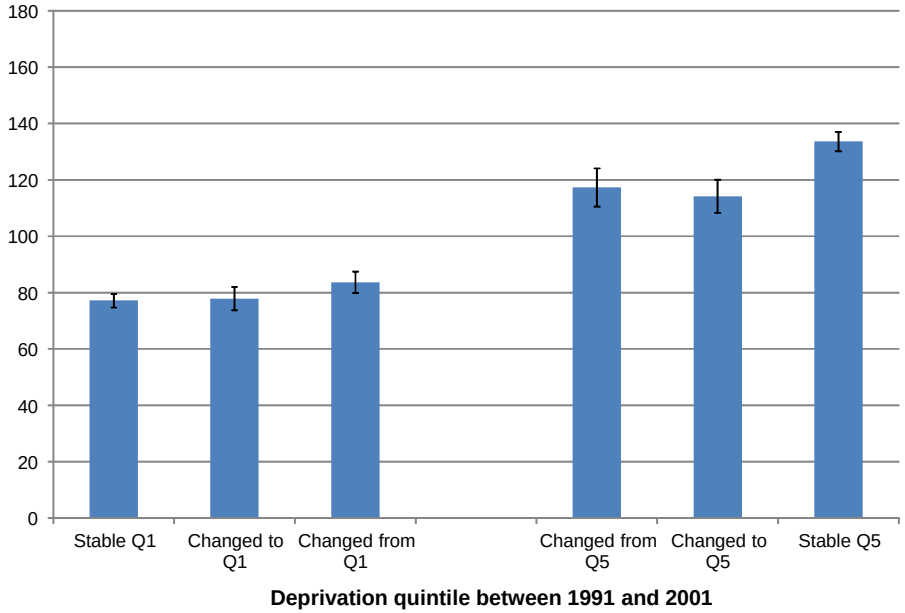
1991 to 2001 SIRs for LLTI

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

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

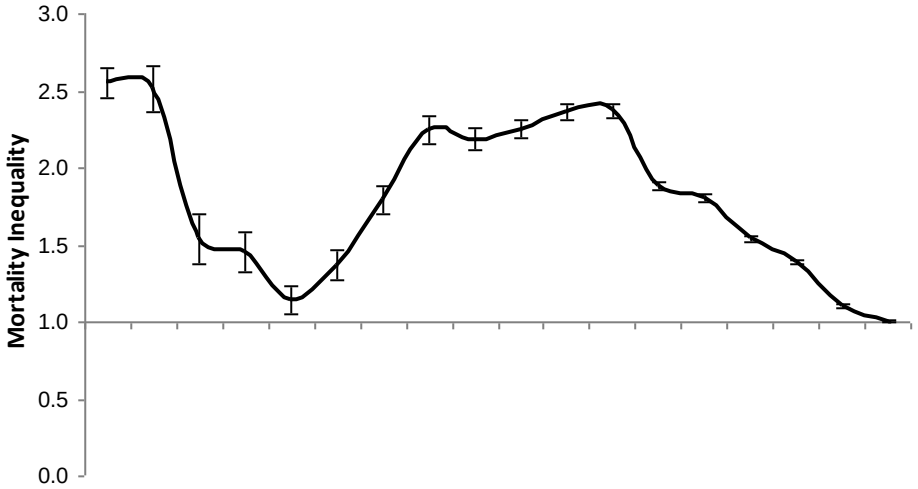
Are health inequalities the same at all ages?

(with Paul Boyle)

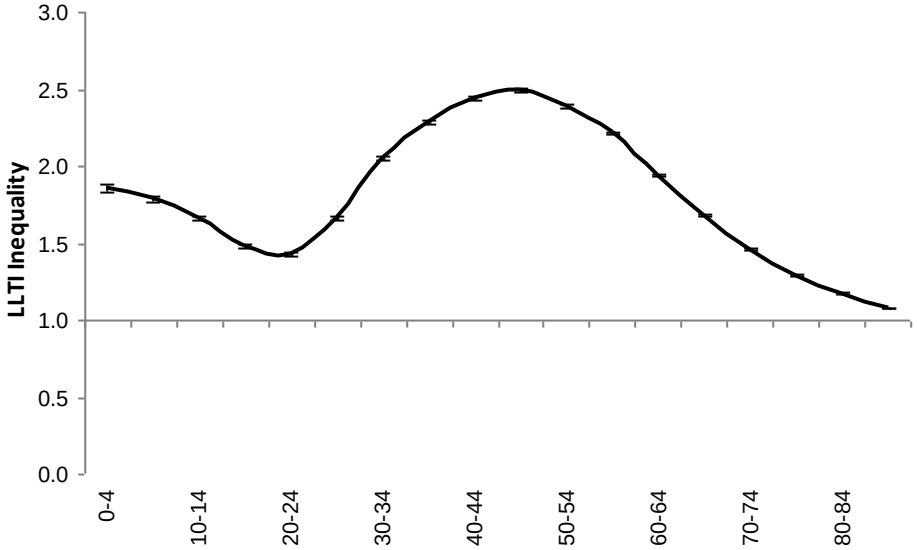
Cross-sectional inequalities by age

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:

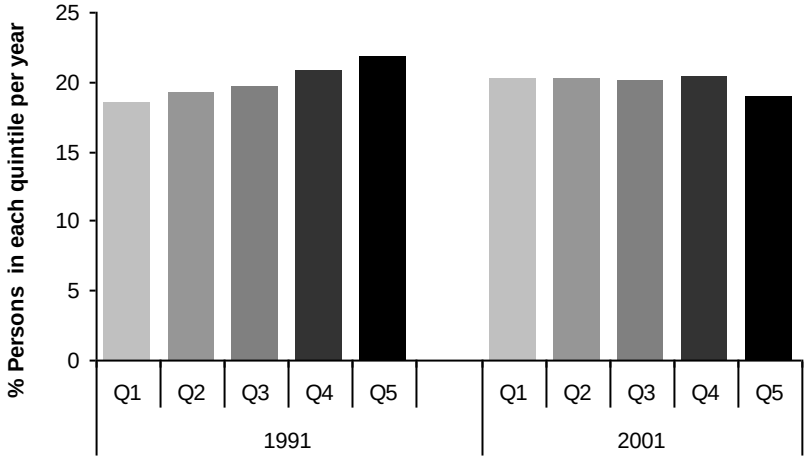
- Types of areas people typically move from & to at different ages
- Migration process itself is health selective

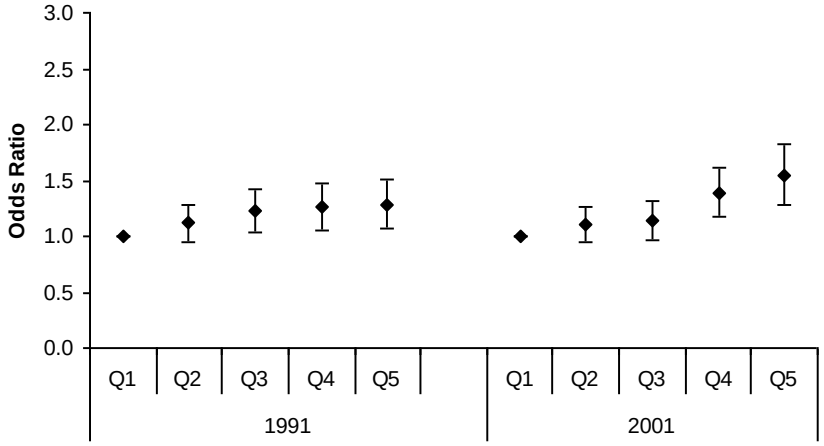
Using ONS Longitudinal Study for England & Wales, residents in households:

- Aggregations of individuals by deprivation quintile at two time points …

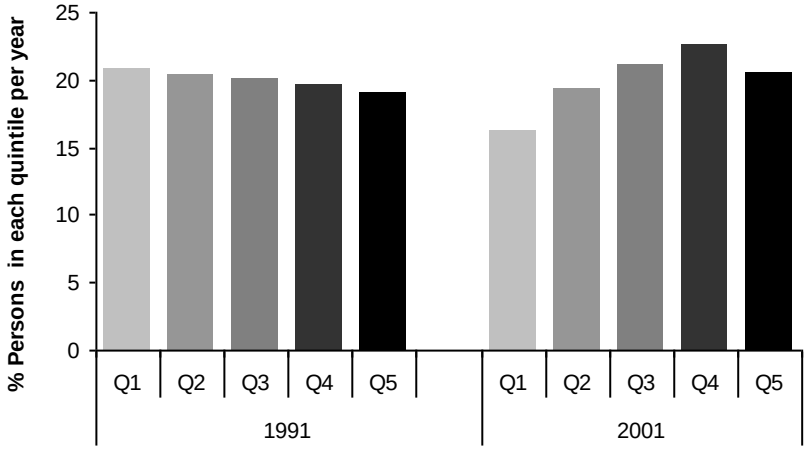
LLTI inequalities by age

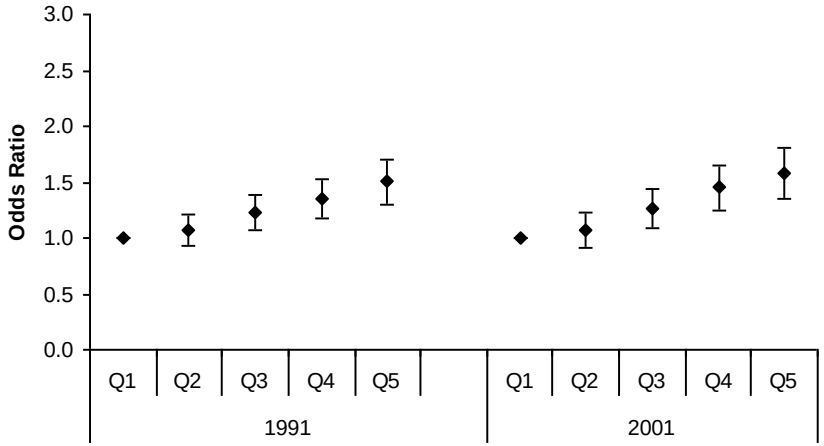
Age 0-9 in 1991 & 10-19 in 2001





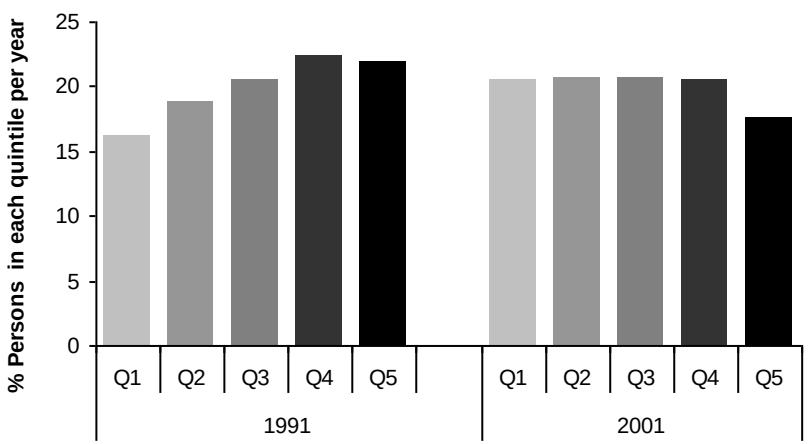
Age 10-19 in 1991 & 20-29 in 2001

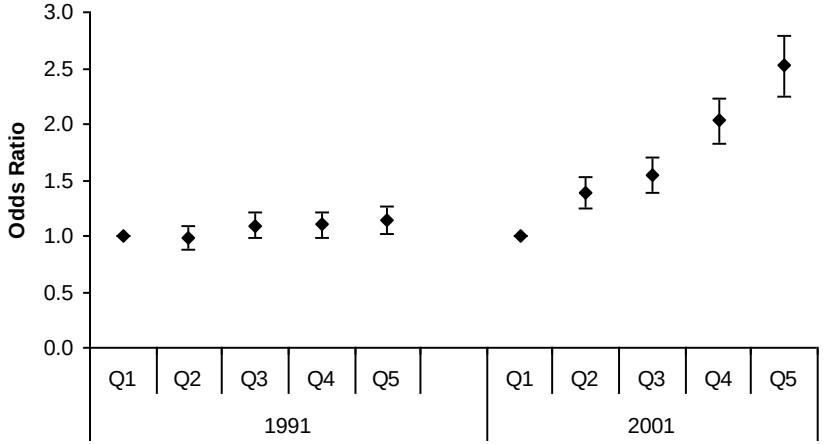




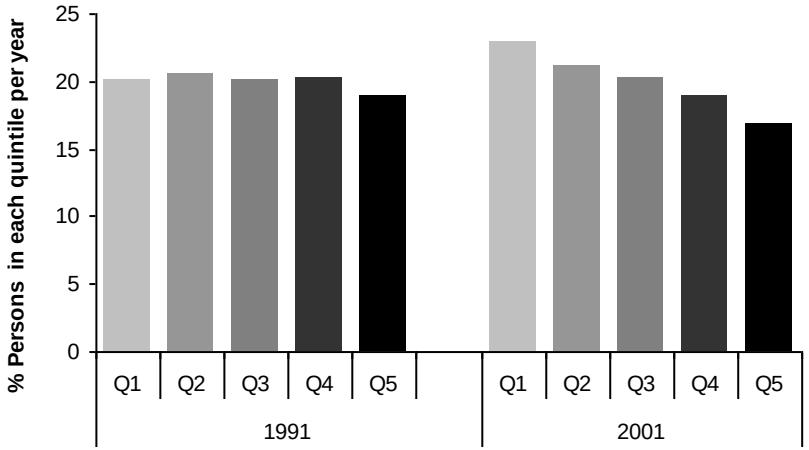
LLTI inequalities by age

Age 20-29 in 1991 & 30-39 in 2001



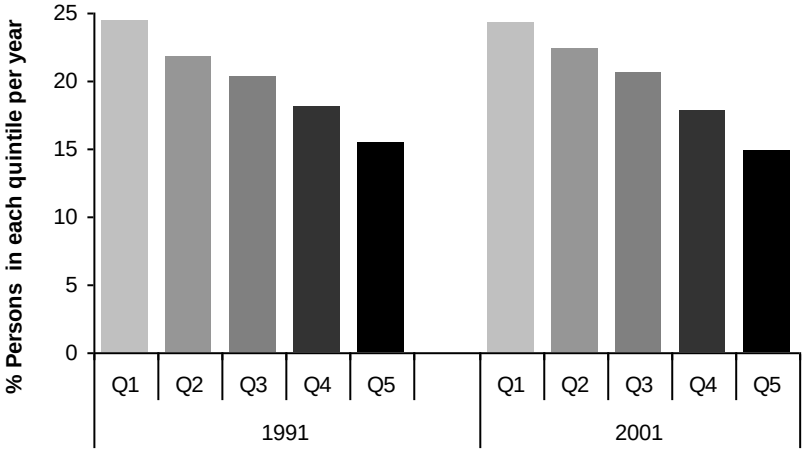


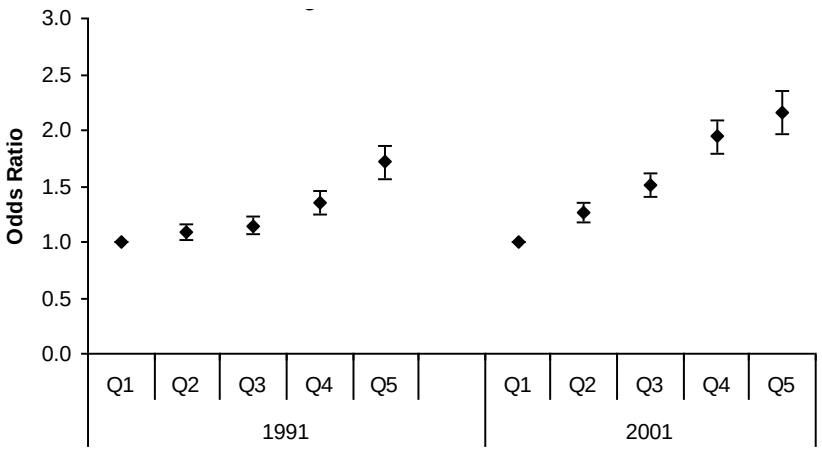
Age 30-39 in 1991 & 40-49 in 2001



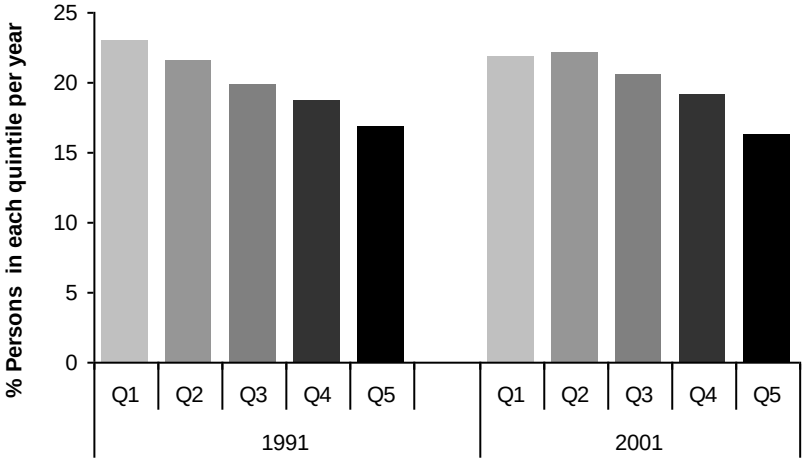
LLTI inequalities by age

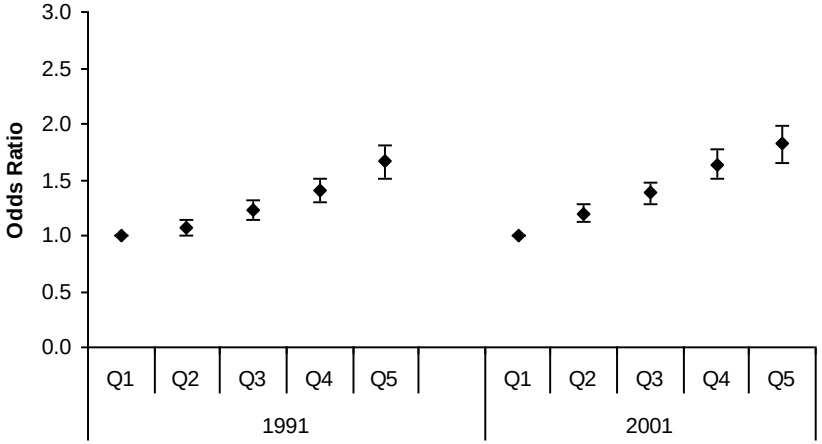
Age 40-49 in 1991 & 50-59 in 2001





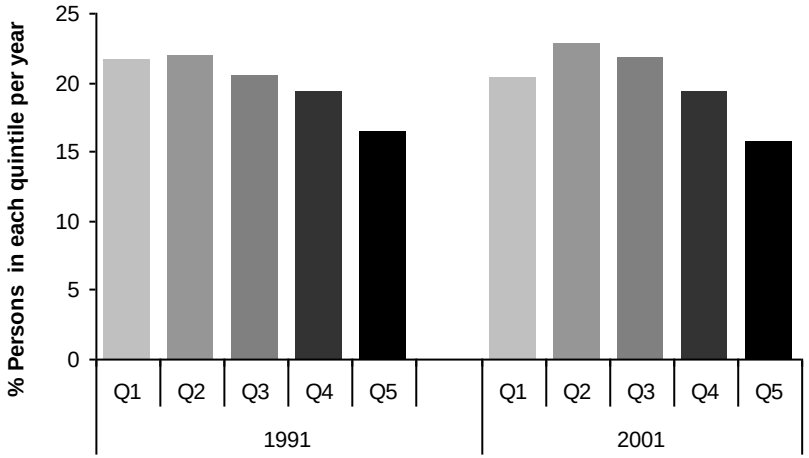
Age 50-59 in 1991 & 60-69 in 2001

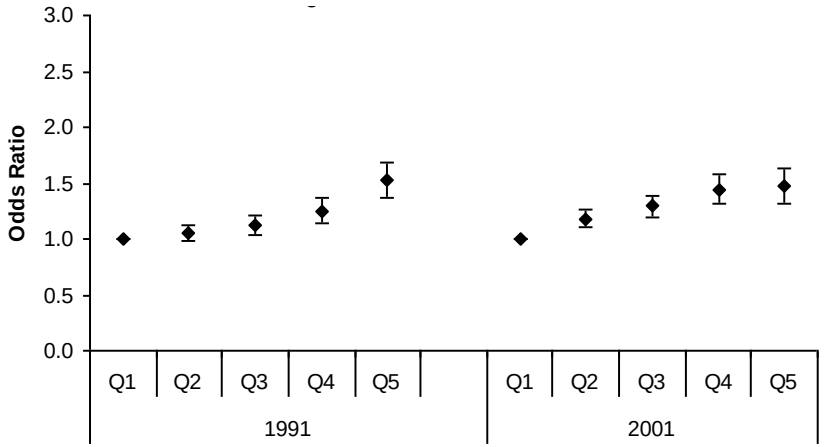




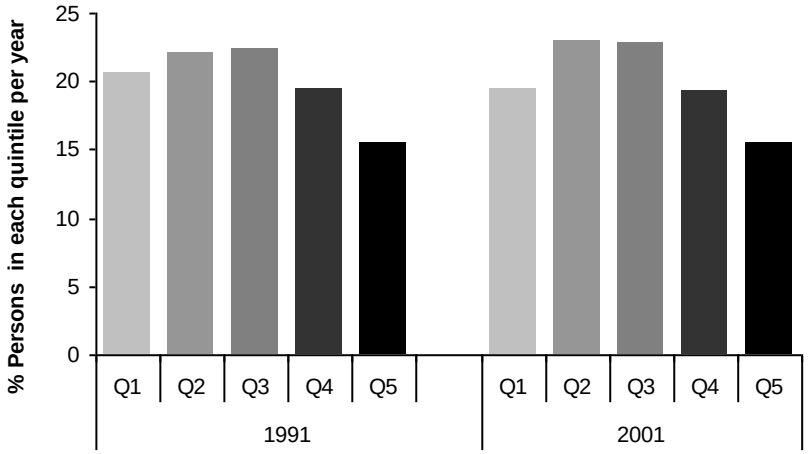
LLTI inequalities by age

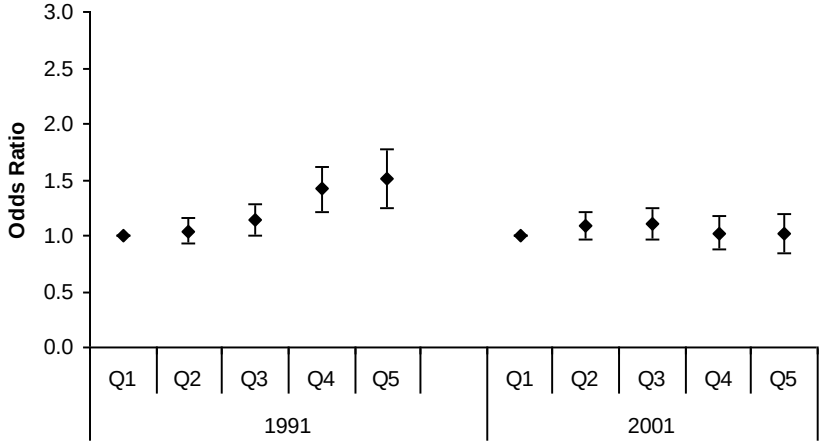
Age 60-69 in 1991 & 70-79 in 2001



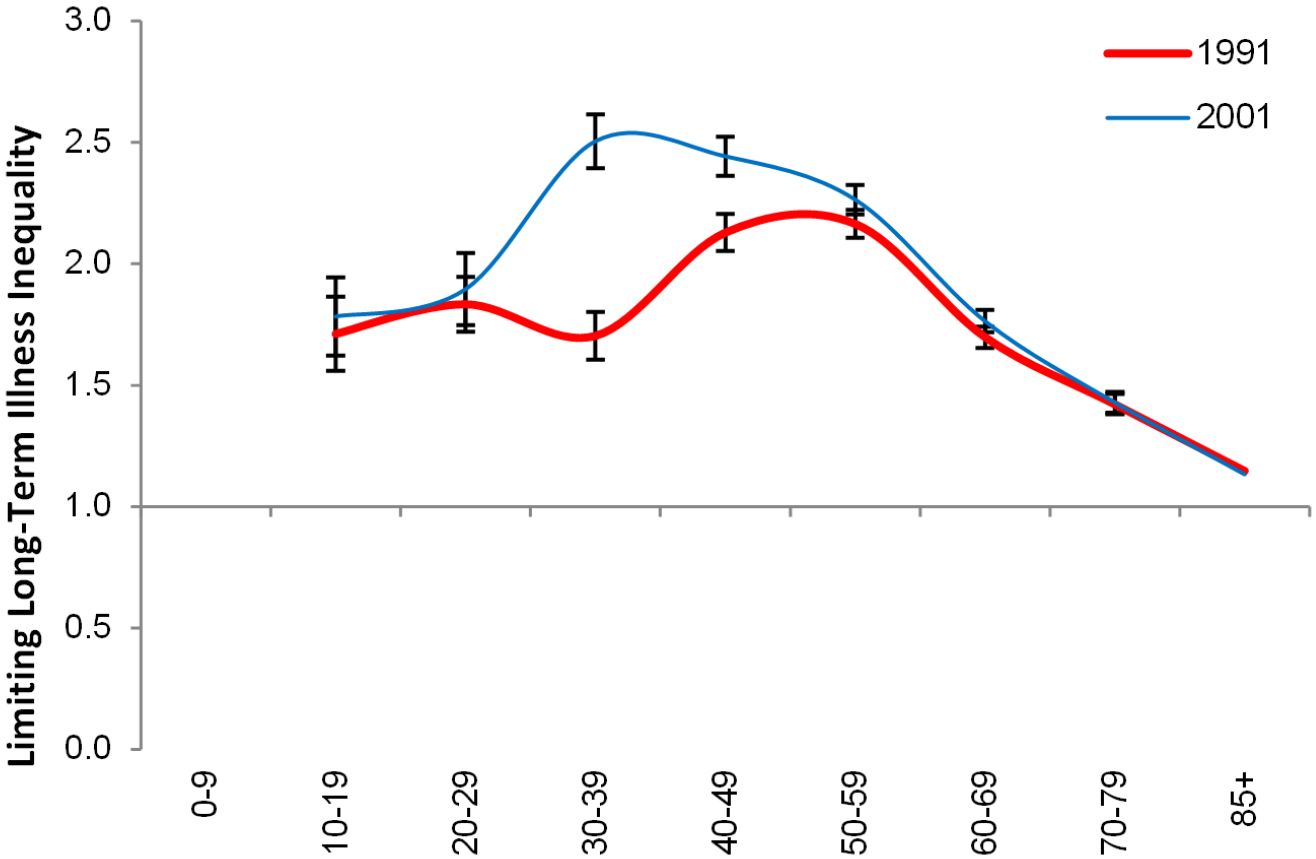


Age 70-79 in 1991 & 80+ in 2001





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

Department of Epidemiology and Public Health

UCL

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

The Leverhulme Trust

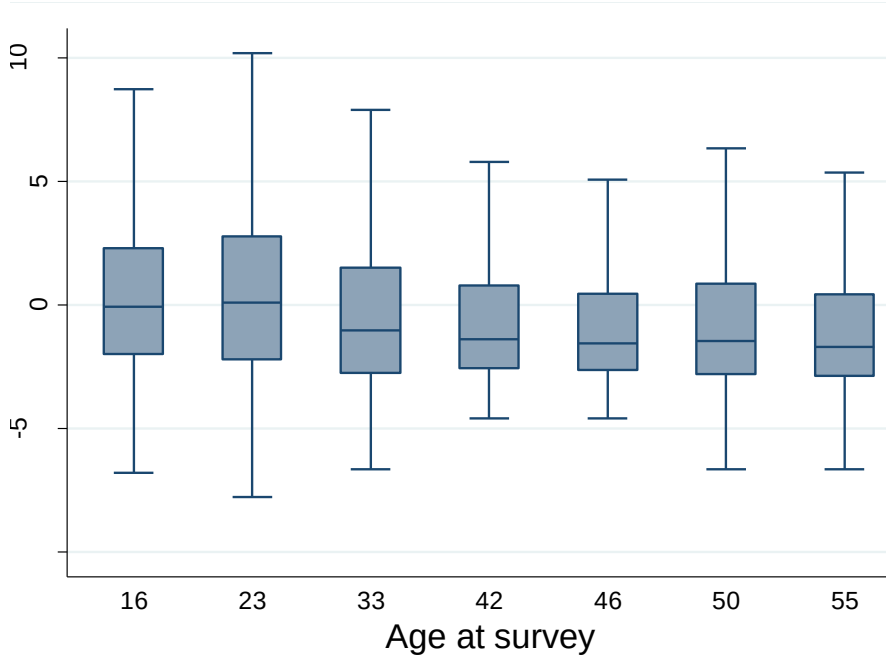
Data

- **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

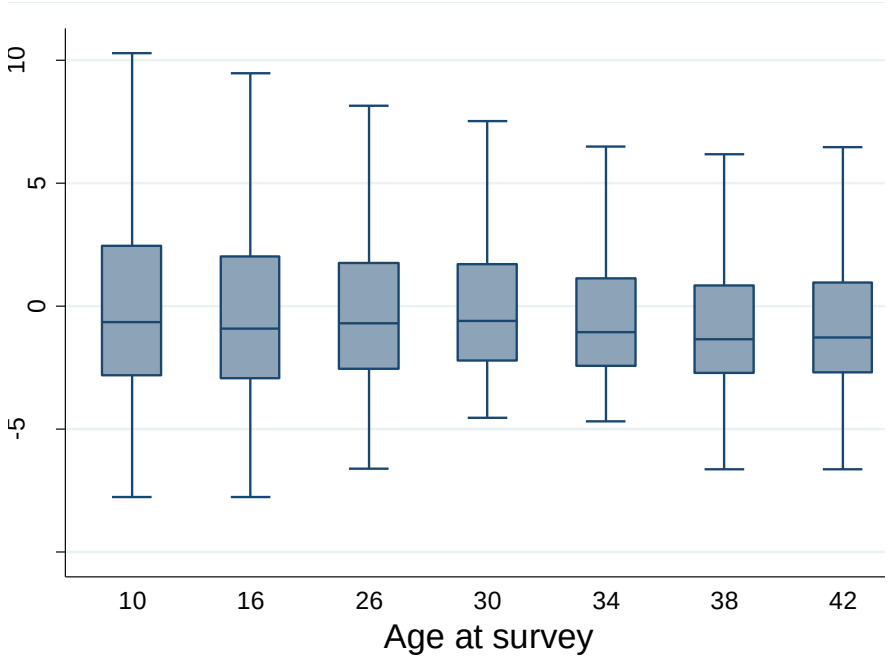
- Self-rated health: in general, would you say your health is...
  - excellent, very good, good, fair or poor

Neighbourhood deprivation score by sweep

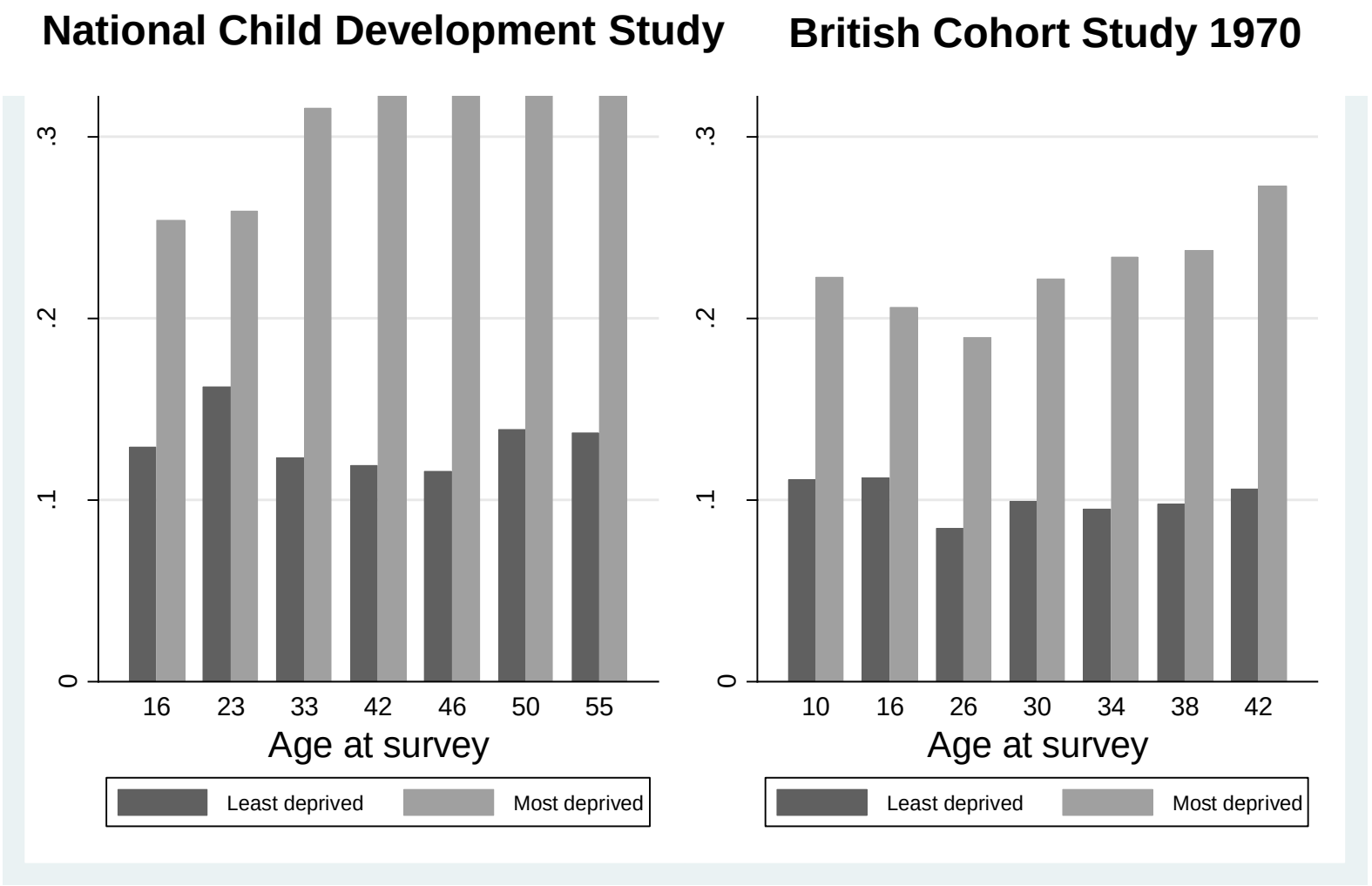
National Child Development Study



British Cohort Study 1970



Poor-rated health by neighbourhood deprivation decile



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

Vascular Informatics using Epidemiology & the Web (VIEW) longitudinal data

Variable	Category
Sex	Female; Male
Age	30-44; 45-54; 55-64; 65-74; 75-84
Ethnicity (prioritised)	Maori; Pacific; Indian; Other Asian; New Zealand European & Other (NZEO)
CVD hospitalisations (events)	CVD; No CVD
Deprivation (NZDep2006)	Q1- least deprived; Q2; Q3; Q4; Q5 – most deprived

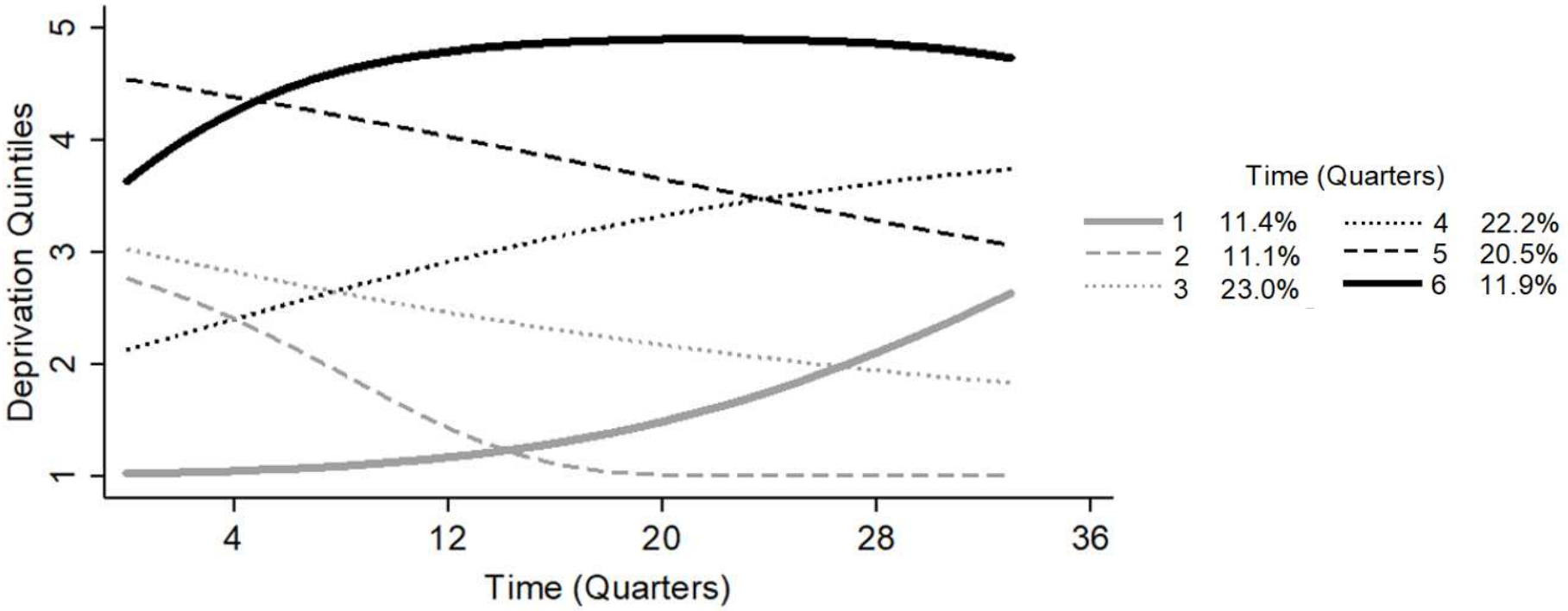
- Data from 2,418,397 individuals enrolled in NZ Primary Health Organisation
- Aged between 30 and 84 years
- During at least **1 of 34 calendar quarters** between 1st January 2006 to 30th June 2014

- Trajectory analysis
- Compare CVD risk for movers according to their deprivation trajectory

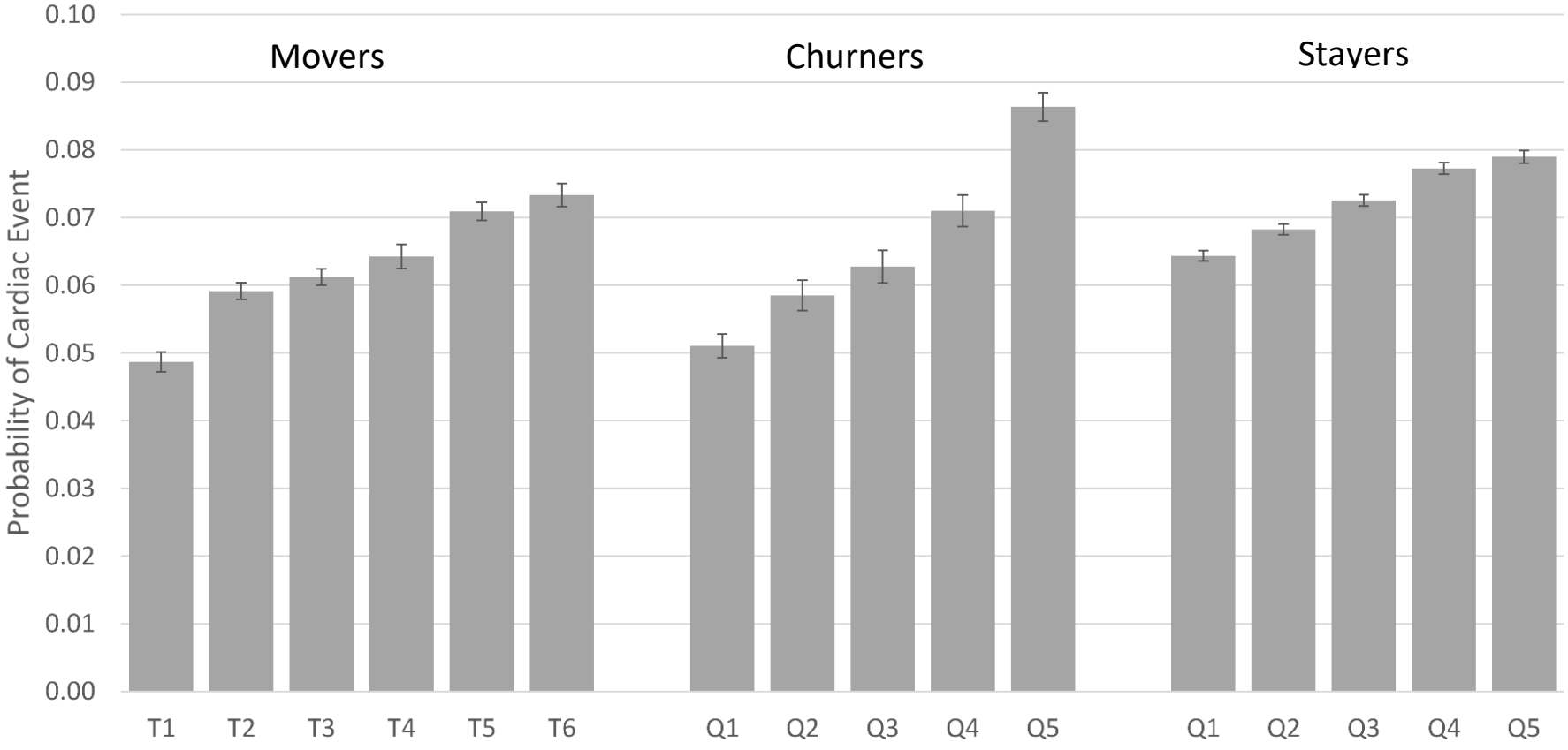
Trajectories

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

Boyle P & Norman P (2009) Migration and health. Chapter 19 in The Companion to Health and Medical Geography Brown T, McLafferty S & Moon G (eds.). Wiley-Blackwell: Chichester: 346-374

Boyle P, Norman P & Popham F (2009) Social mobility: evidence that it can widen health inequalities. Social Science & Medicine 68(10): 1835-1842

Boyle P, Norman P & Rees P (2004) Changing places: do changes in the relative deprivation of areas influence limiting long-term illness and mortality among non-migrant people living in non-deprived households? Social Science & Medicine 58: 2459-2471

Darlington F, Norman P & Gould M (2015) Migration and Health. Chapter 8 in Internal Migration: Geographic Perspectives and Processes (eds) Nissa Finney, Darren Smith, Keith Halfacree, Nigel Walford. Ashgate: Farnham: 113-128

Dibben, C. & Popham, F. (2012) Are health inequalities evident at all ages? An ecological study of English mortality records. European Journal of Public Health doi:10.1093/eurpub/cks019

Darlington F, Norman P & Gould M (2015) Migration and Health. Chapter 8 in Internal Migration: Geographic Perspectives and Processes (eds) Nissa Finney, Darren Smith, Keith Halfacree, Nigel Walford. Ashgate: Farnham: 113-128

Darlington F, Norman P, Ballas D & Exeter D (2015) Exploring ethnic inequalities in health: Evidence from the Health Survey for England, 1998-2011.Diversity & Equality in Health & Care 12(2): 54-65

Darlington-Pollock F, Shackleton N, Norman P, Lee, A & Exeter D (2017) Differences in the risk of cardiovascular disease for movers and stayers in New Zealand: A survival analysis. International Journal of Public Health DOI 10.1007/s00038-017-1011-4 http://rdcu.be/ua5A

Darlington-Pollock, F, Norman, P, Lee, A, Grey, C, Mehta, S & Exeter D (2016) To move or not to move? Exploring the relationship between residential mobility, risk of CVD and ethnicity in New Zealand. Social Science & Medicine 165: 128-140 doi:10.1016/j.socscimed.2016.07.041

Exeter D J, Boyle P J & Norman P (2011) Deprivation (im)mobility and cause-specific premature mortality in Scotland. Social Science & Medicine 72: 389-397

McNally RJQ, James PW, Blakey K, Basta NO, Norman PD, Pearce MS (2017) Can changes in population mixing and socio-economic deprivation in Cumbria, England explain changes in cancer incidence around Sellafield? Spatial and Spatio-temporal Epidemiology 21: 25-36 https://doi.org/10.1016/j.sste.2017.02.002

Norman P & Boyle P (2014) Are health inequalities between differently deprived areas evident at different ages? A longitudinal study of census records in England & Wales, 1991-2001. Health & Place 26:88-93 http://dx.doi.org/10.1016/j.healthplace.2013.12.010

Norman P & Darlington-Pollock F (2017) The Changing Geography of Deprivation in Great Britain: Exploiting Small Area Census Data, 1971 to 2011. Chapter 30 in Stillwell, J (ed.) The Routledge Handbook of Census Resources, Methods and Applications: 404-420

Norman P & Riva M (2012) Population health across space and time: the geographical harmonisation of the ONS Longitudinal Study for England and Wales. Population, Space & Place 18: 483-502 DOI: 10.1002/psp.1705

Norman P (2010) Demographic and deprivation change in the UK, 1991-2001. In Understanding Population Trends and Processes Volume 2: Spatial and Social Disparities (eds.) John Stillwell, Paul Norman, Claudia Thomas & Paula Surridge. Springer: Dordrecht: 17-35

Norman P (2016) The Changing Geography of Deprivation in Britain: 1971 to 2011 and Beyond. Chapter 11 in Champion T and Falkingham J (eds.) Population change in the United Kingdom: Rowman & Littlefield: London: 193-214

Norman P (2017) Area characteristics: Great Britain 1971 to 2011. Mendeley Data: http://dx.doi.org/10.17632/389scnndjy.1

Norman P, Boyle P & Rees P (2005) Selective migration, health and deprivation: a longitudinal analysis. Social Science & Medicine 60(12): 2755-2771

Norman P, Boyle P, Exeter D, Feng Z & Popham F (2011) Rising premature mortality in the UK s persistently deprived areas: Only a Scottish phenomenon? Social Science & Medicine 73 1575-1584 doi:10.1016/j.socscimed.2011.09.034

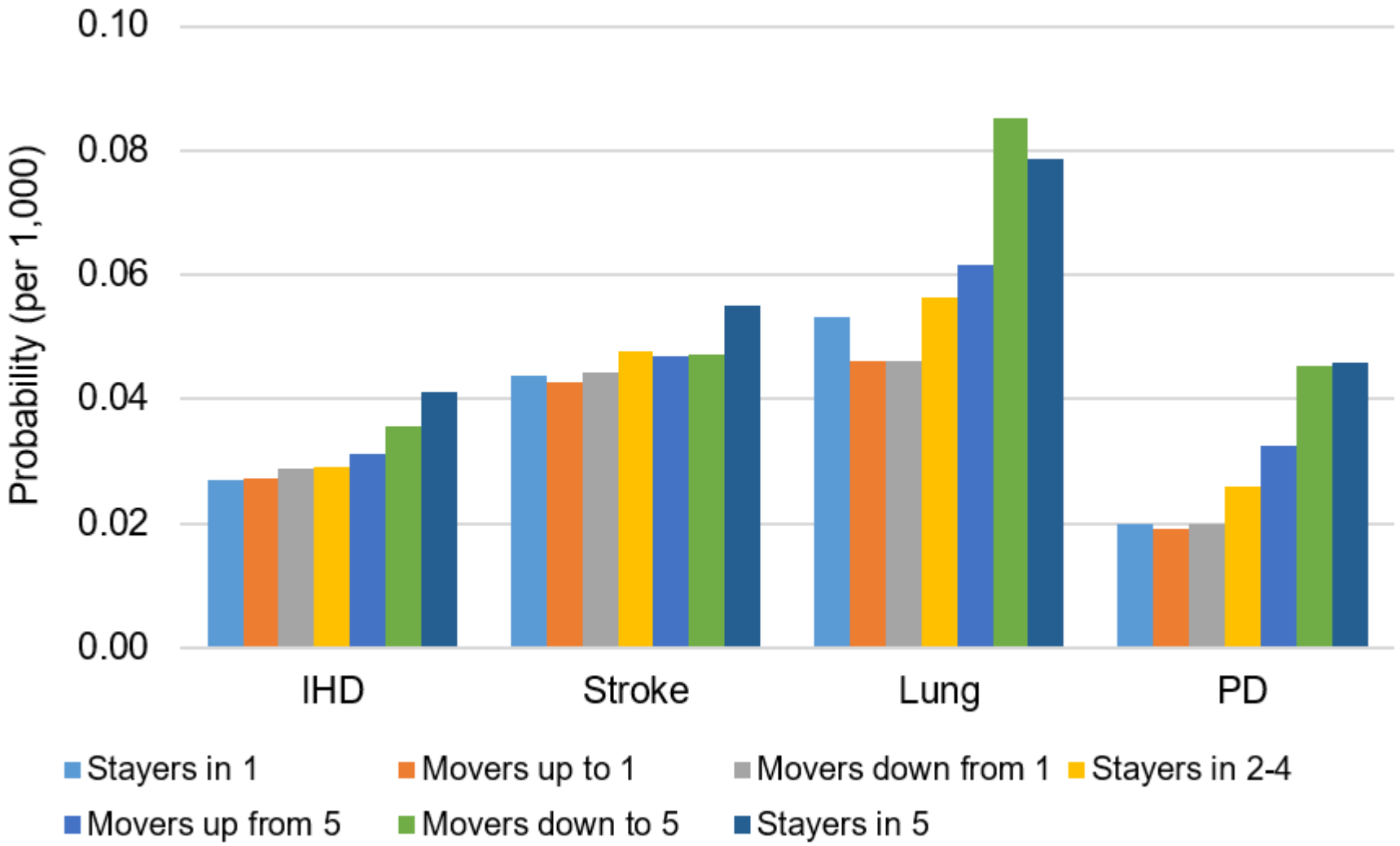
Norman P, Charles-Edwards E & Wilson T (2016) Relationships between population change, deprivation change and health change at small area level: Australia 2001-2011. In Demography for Planning and Policy: Australian Case Studies (eds) Tom Wilson, Elin Charles-Edwards and Martin Bell: Springer: 197-214

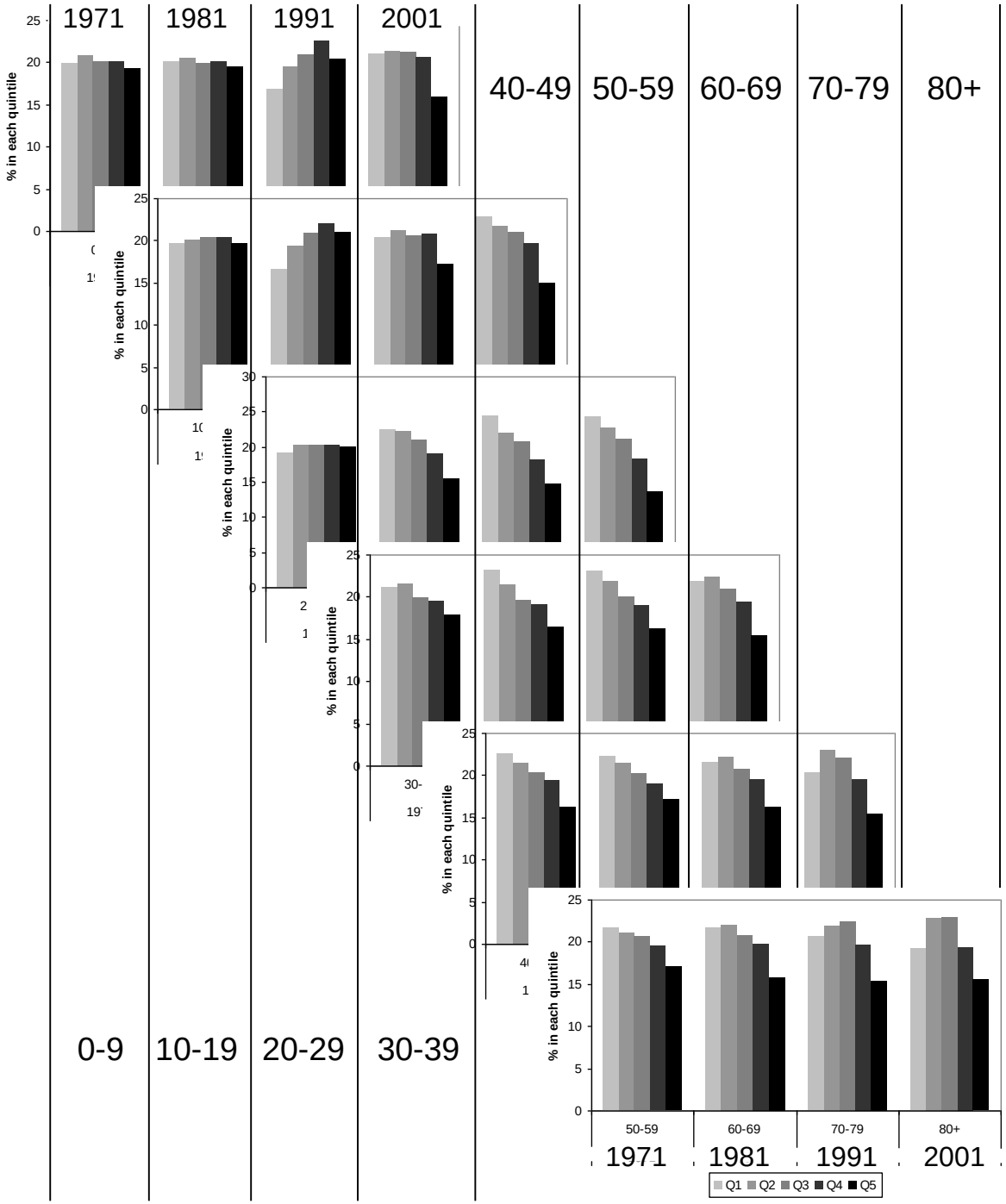
Norman P, Gregory I, Dorling D & Baker A (2008) Geographical trends in infant mortality: England and Wales, 1970–2006. Health Statistics Quarterly 40: 18-29 http://www.ons.gov.uk/ons/rel/hsq/health-statistics-quarterly/no--40--winter-2008/index.html

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

Mortality by cause




1971
1981
1991
2001
40-49
50-59
60-69
70-79
80+
0-9
10-19
20-29
30-39
% in each quintile
50-59
60-69
70-79
80+
1971
1981
1991
2001
Q1 Q2 Q3 Q4 Q5