



People's trajectories through deprivation space: associations with health

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Health / Deprivation relationship

In socio-demographic terms, places change ...

- Changing area deprivation: composition of the population

While ...

- Individuals live in different kinds of places at different ages

For different area types and individuals in different circumstances, health outcomes vary

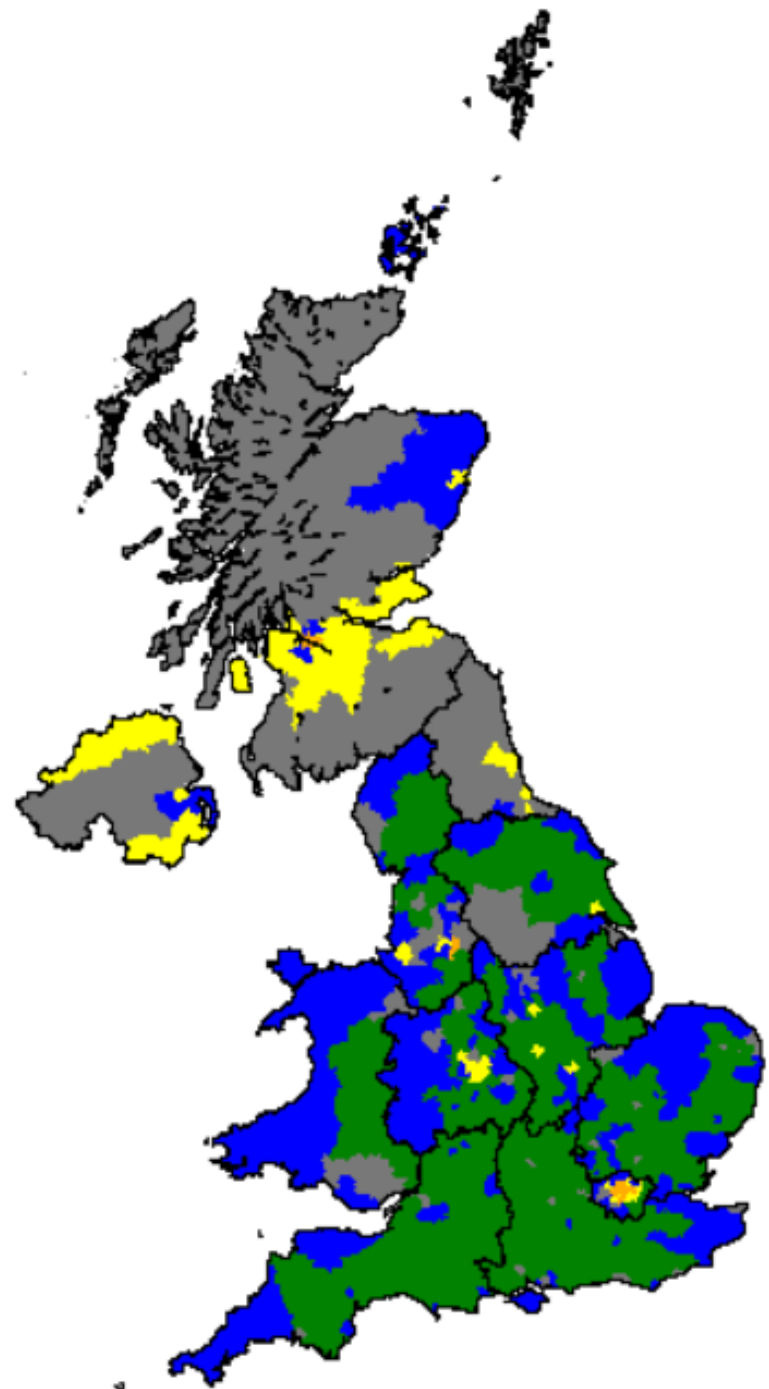
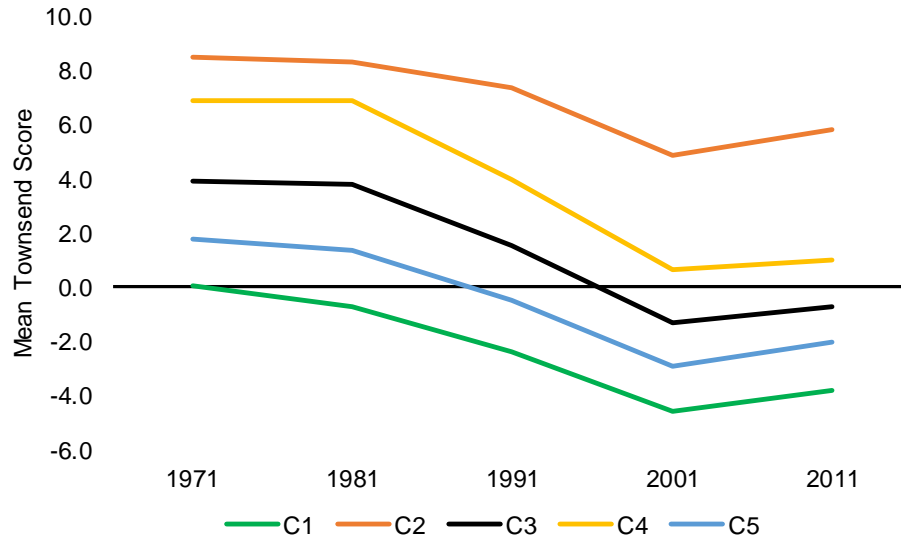
Vignettes ...

- UK (mainly)
- Official data sources (mainly)

Census: Area trajectories

UK

Local Authority Deprivation trends

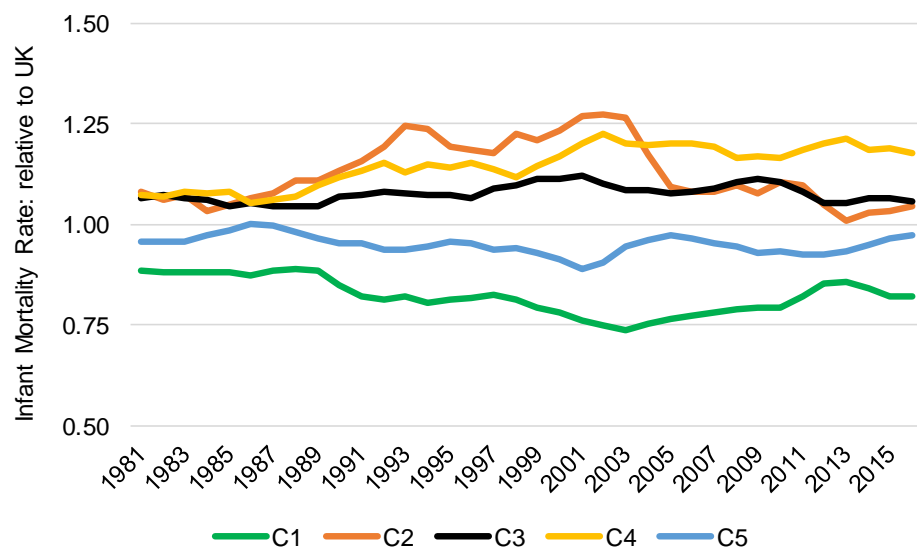
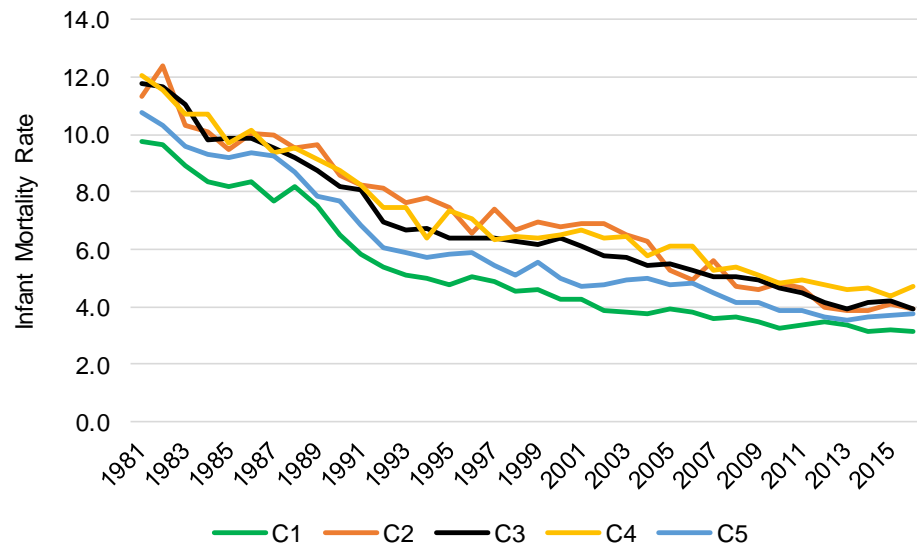


Norman (2010; 2016)
Norman & Darlington-Pollock (2017)
Lloyd et al. (2018)

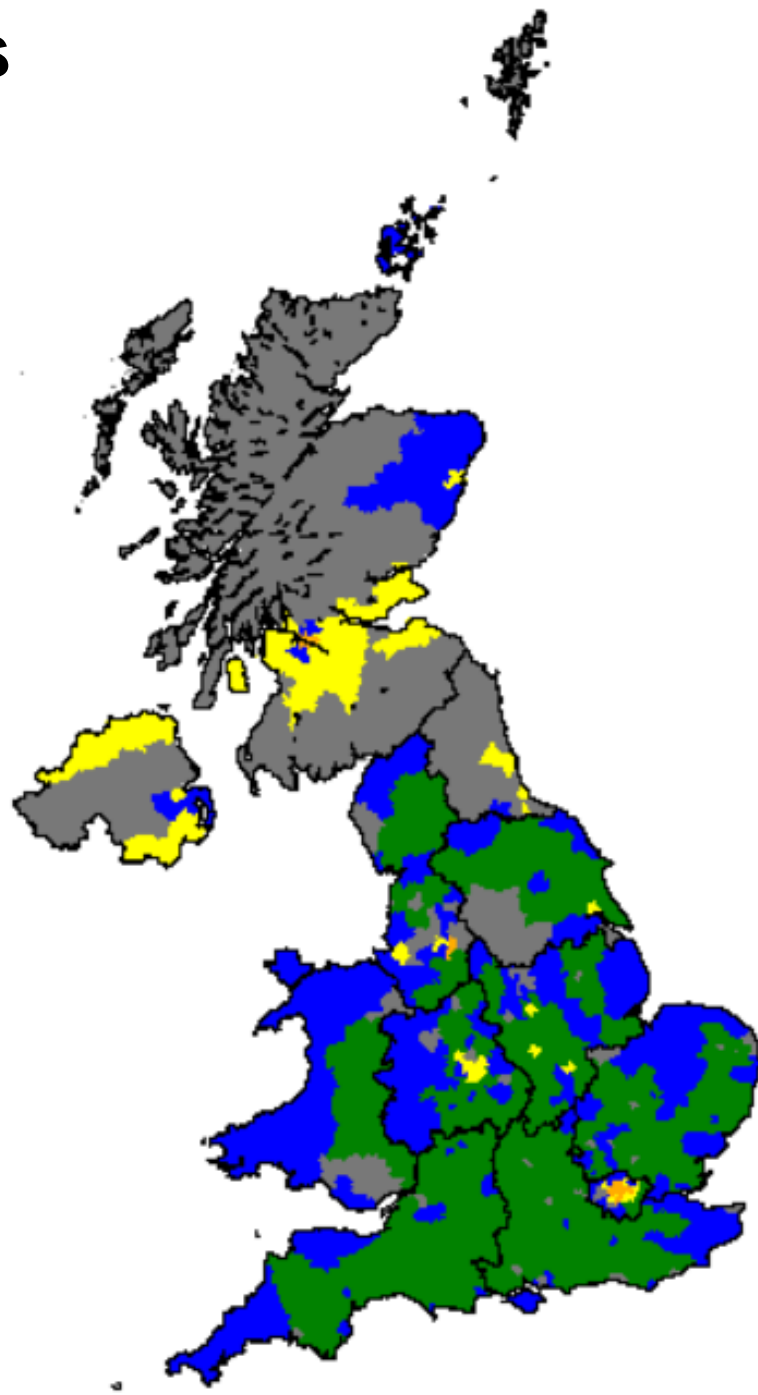
Vital Statistics: time series

UK

Infant mortality trends 1981-2016



Norman et al. (2008); Robinson et al. 2018)



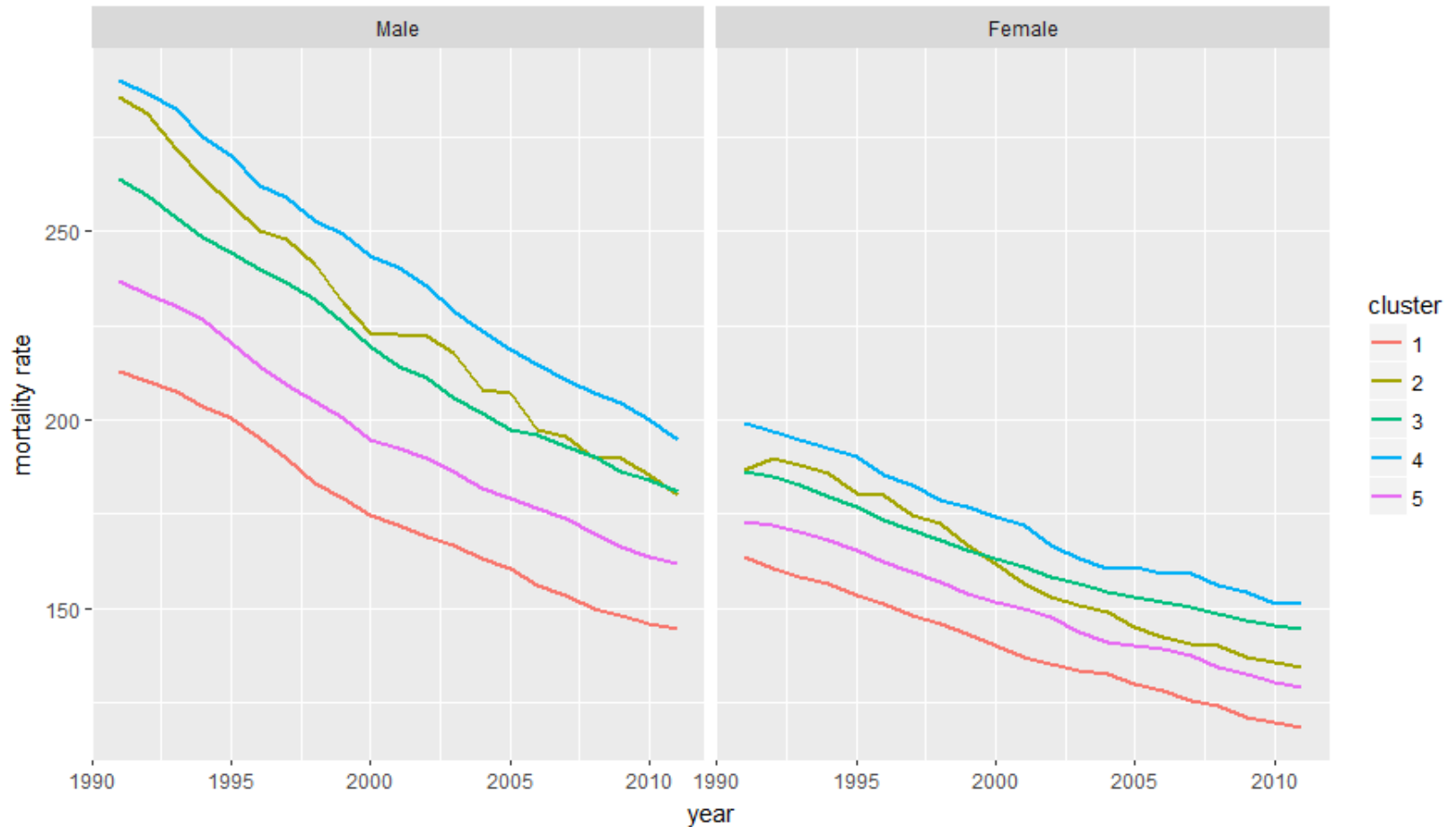
Vital Statistics: time series

England & Wales

Cancer mortality trends 1990-2012: All cancers

3 year rolling average of premature mortality rates by deprivation cluster 1990-2012

England and Wales



Data Source: UK Data Service

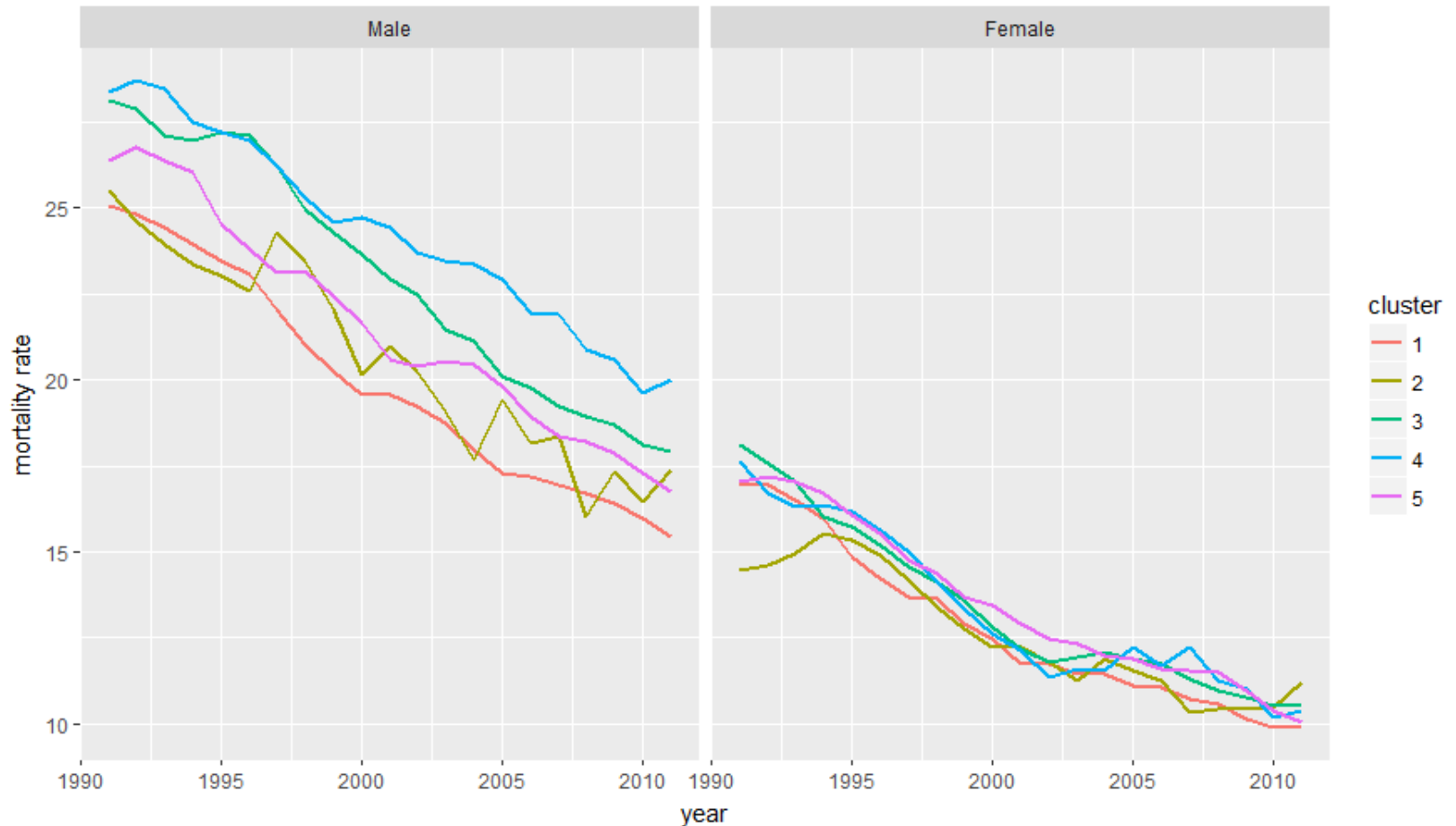
Vital Statistics: time series

England & Wales

Cancer mortality trends 1990-2012: Colorectal Cancer

3 year rolling average of premature mortality rates by deprivation cluster 1990-2012

England and Wales



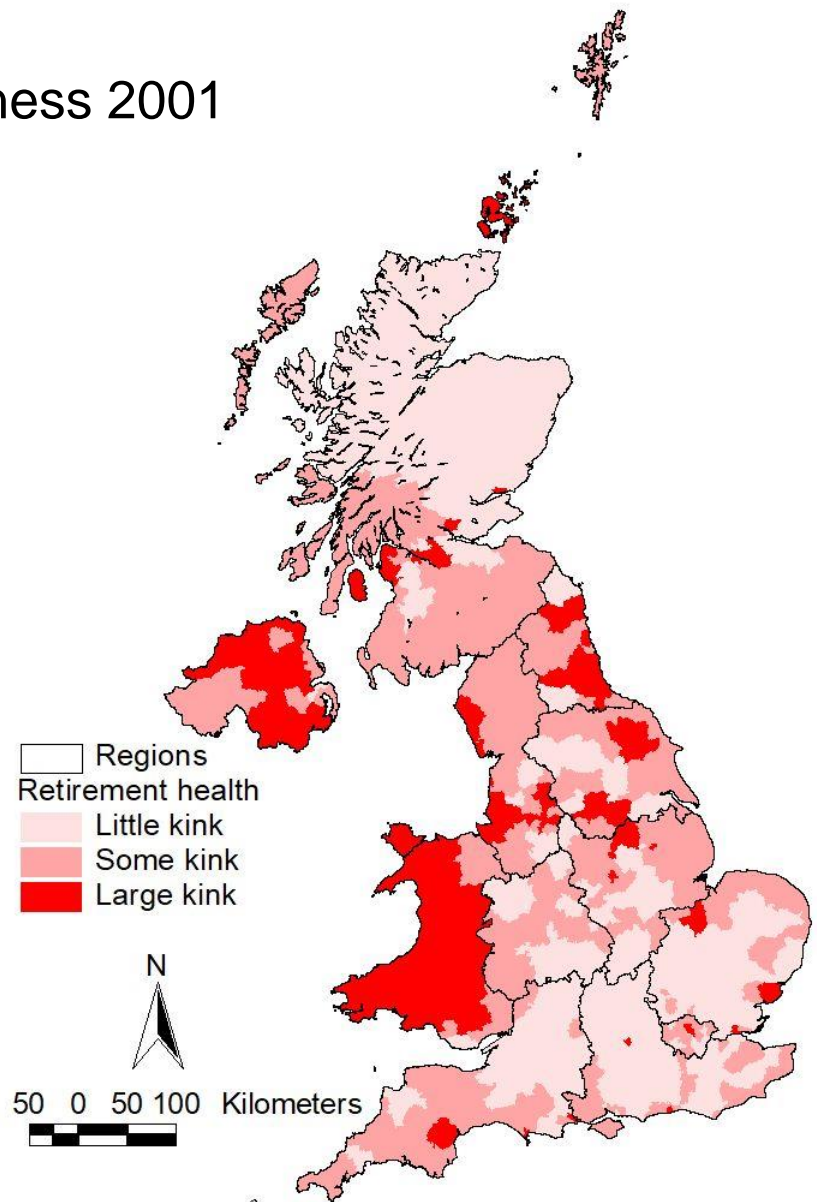
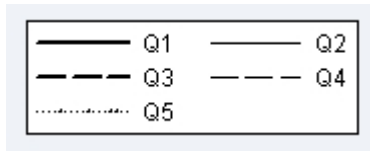
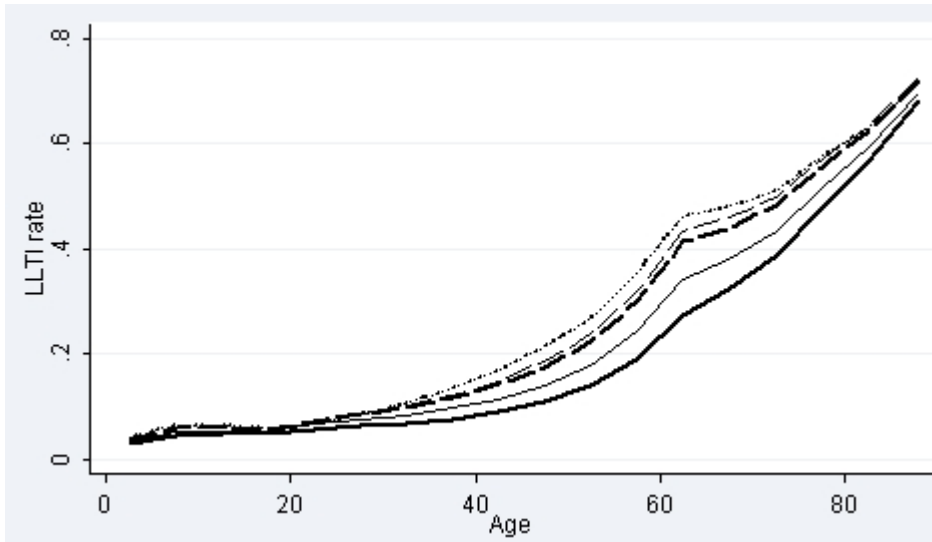
Data Source: UK Data Service

Sturley et al. (2018)

Census: Cross-section

UK

Age-schedules: Limiting long-term illness 2001



Vital Statistics: cross-section

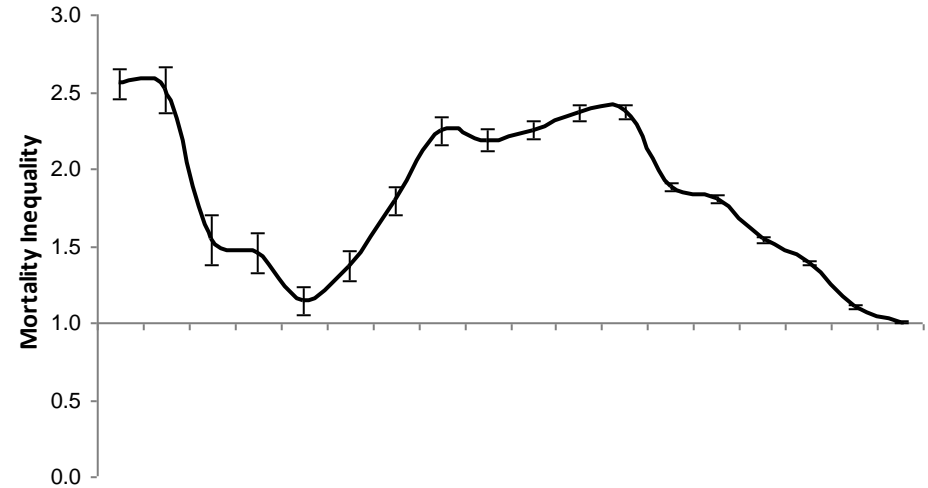
Inequalities by age

England & Wales

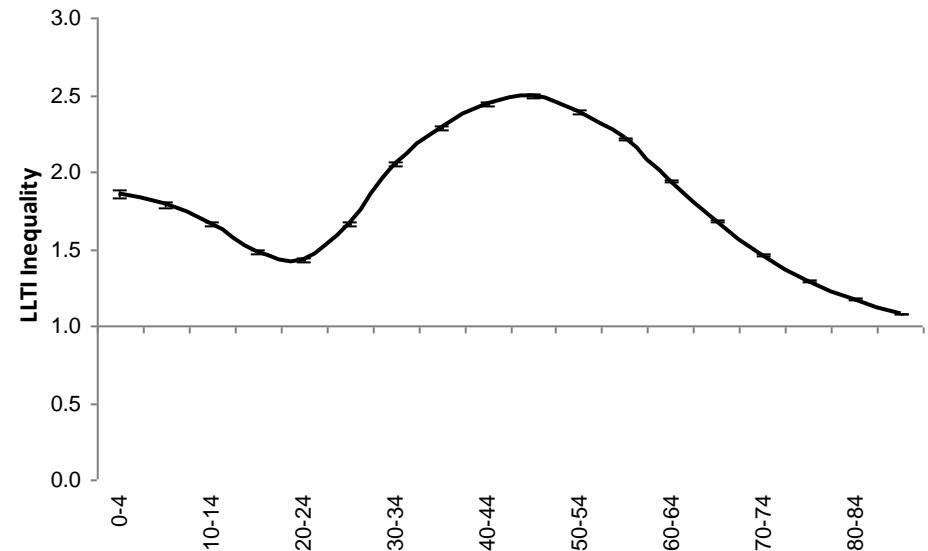
Ratio Most : Least deprived

Carstairs quintile

Mortality
(2000-02)



Limiting long-term illness
(2001)



Norman & Boyle (2014)

& see:

Dibben & Popham (2012)

Green (2013)

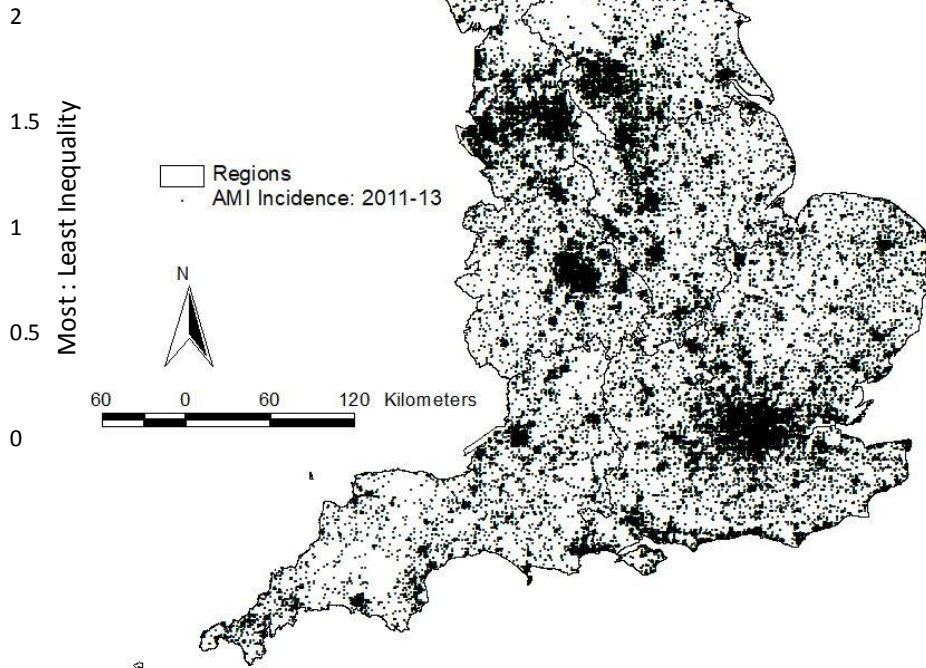
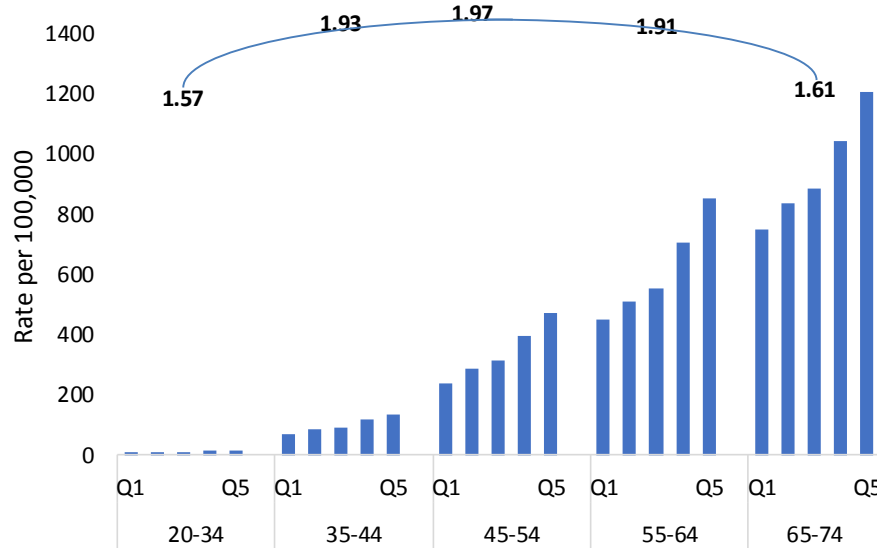
Hospitalisation: Cross-sectional

Inequalities by age:

England

Acute myocardial infarction 2011-13

Deprivation



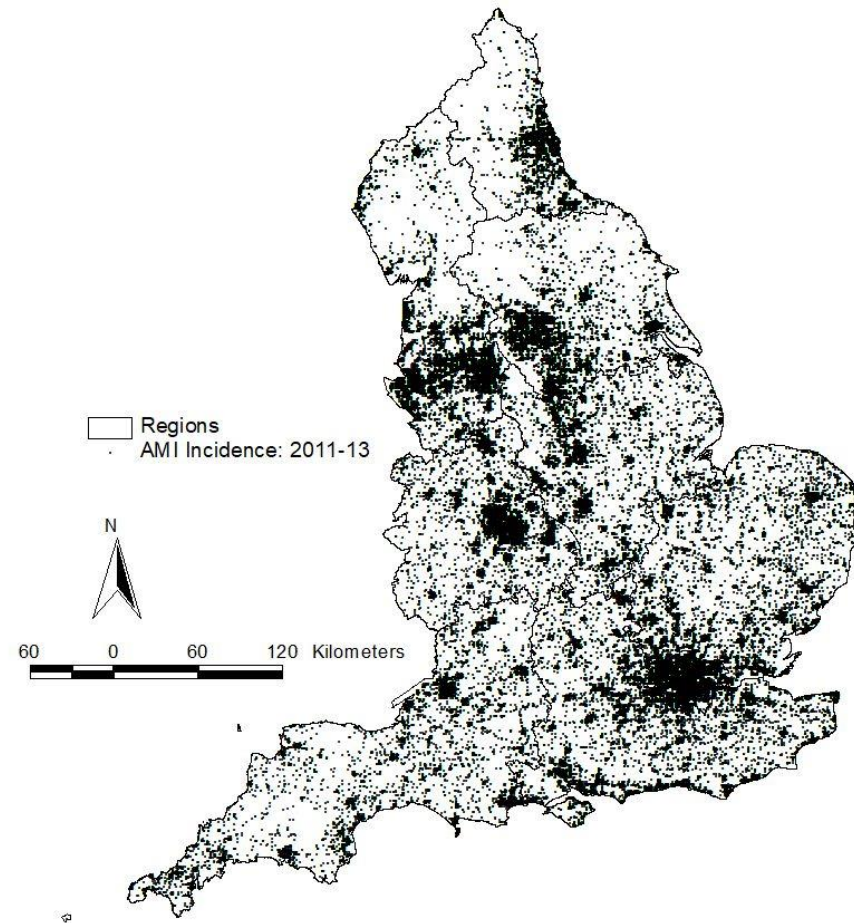
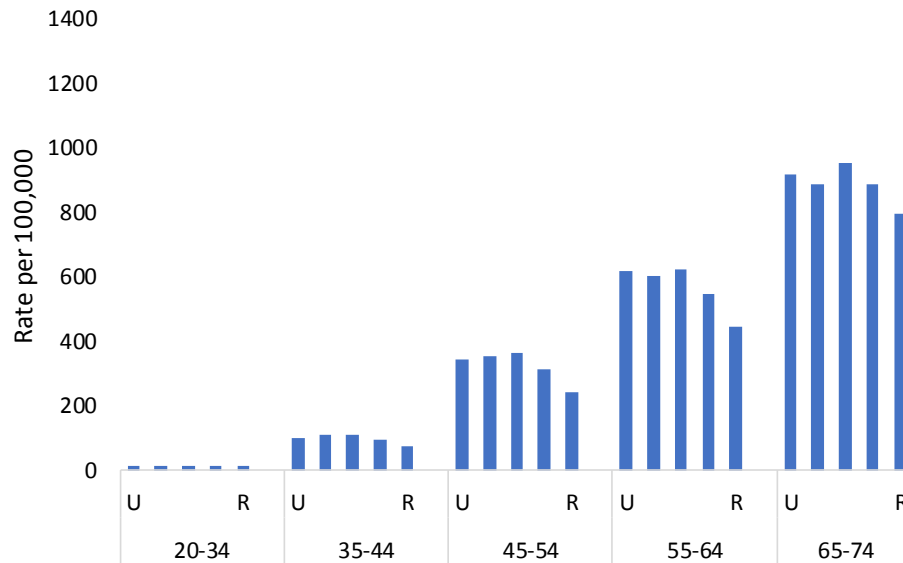
Hospitalisation: Cross-sectional

Inequalities by age:

England

Acute myocardial infarction 2011-13

Urban < > Rural

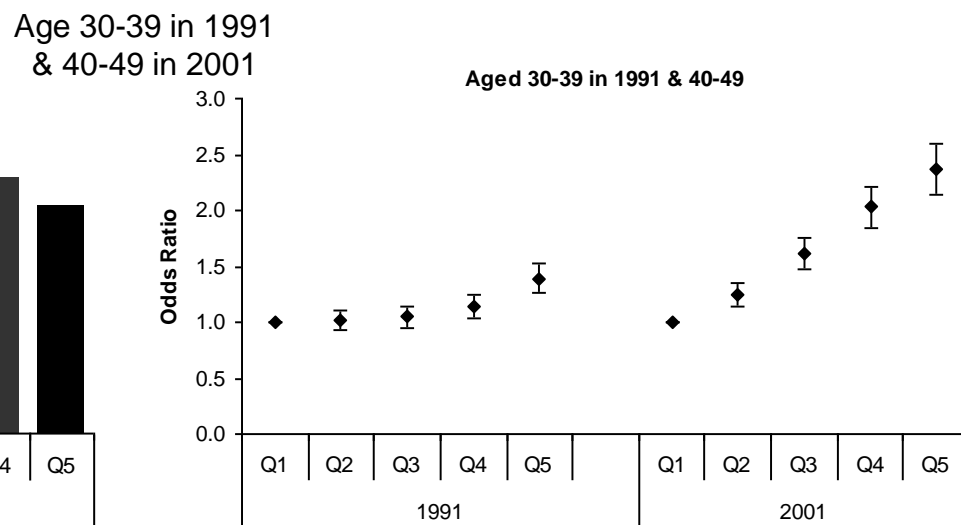
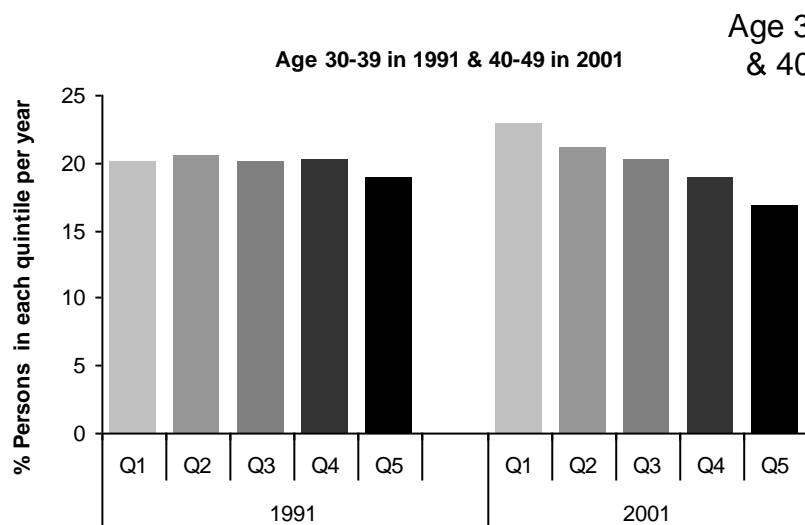
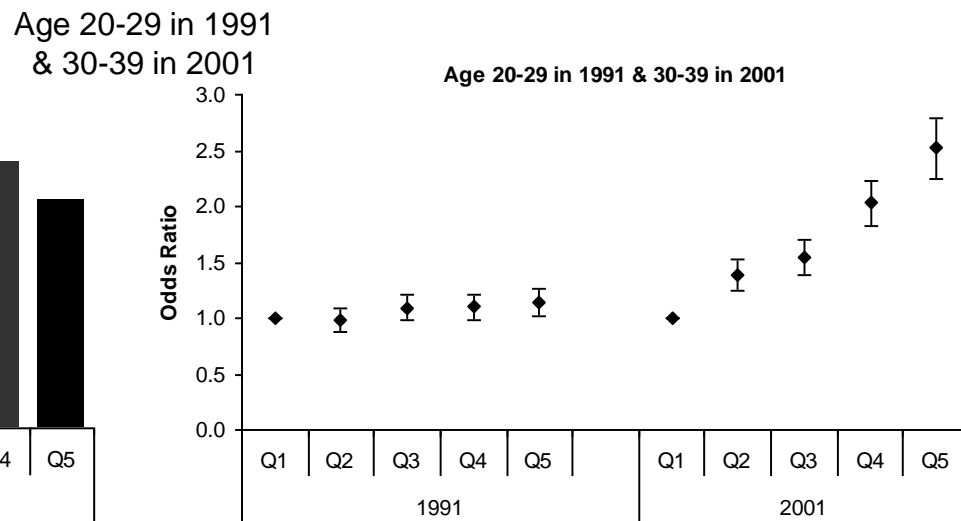
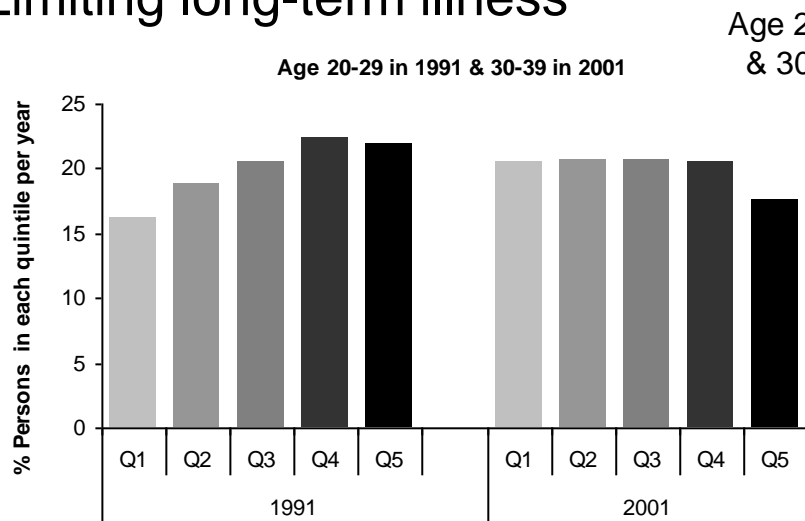


ONS LS: Longitudinal

Inequalities by age

England & Wales

Limiting long-term illness

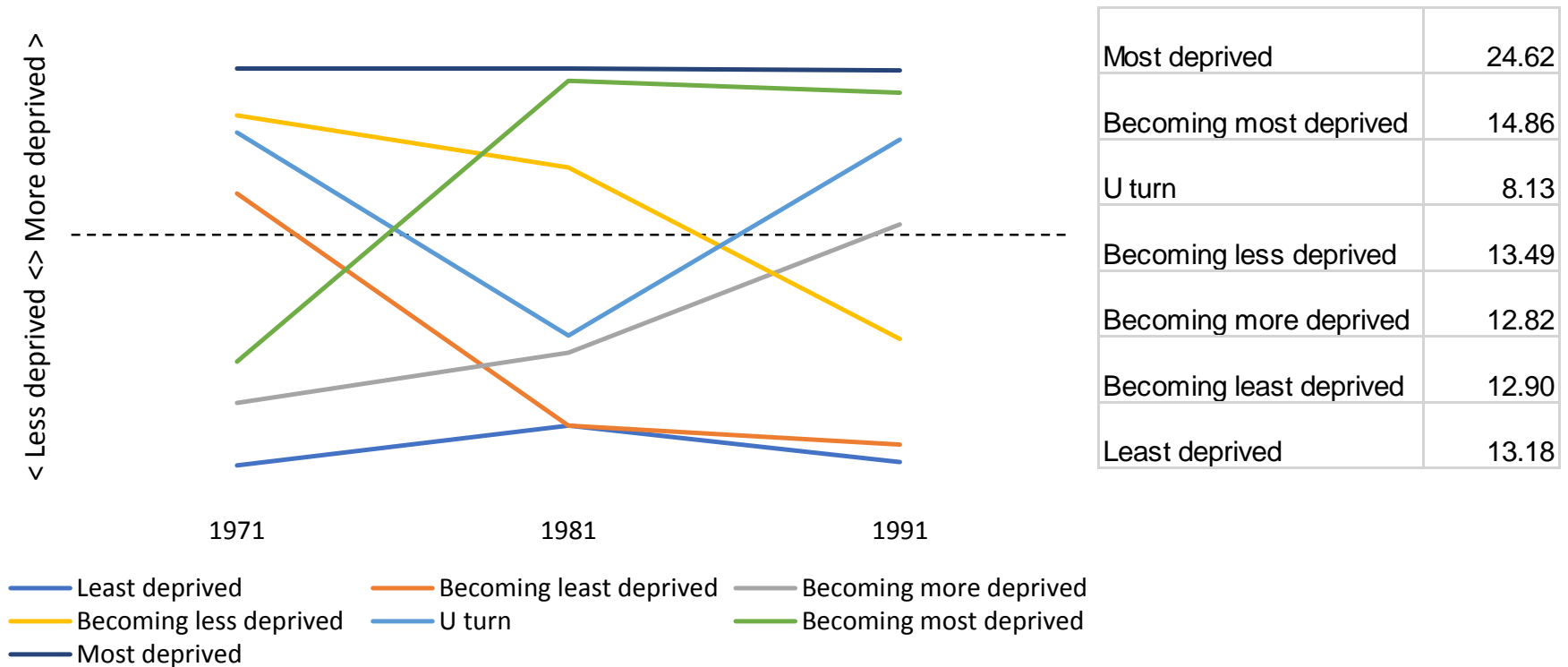


ONS LS: Deprivation trajectories

England & Wales

10 year time increments

- 315,683 individuals followed 1971 to 1991



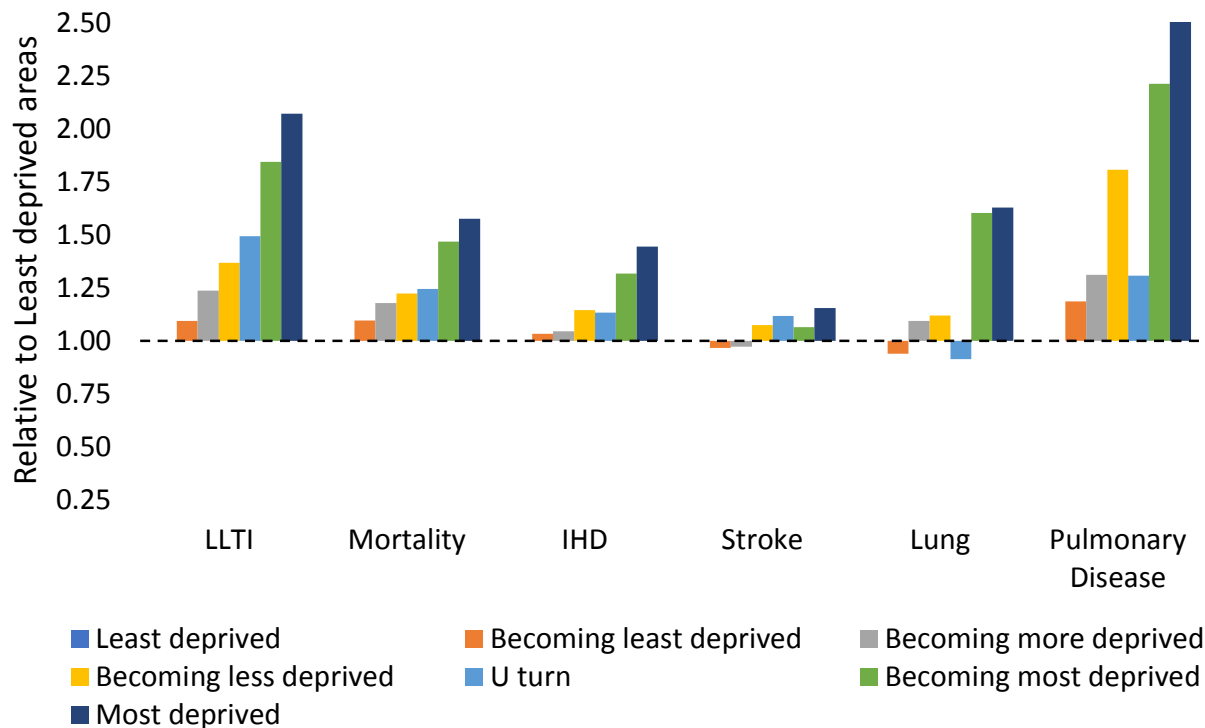
& see: Boyle et al. (2004); Norman et al. (2005); Boyle et al. (2009); Norman & Riva (2012)

ONS LS: Deprivation trajectories

England & Wales

LLTI & mortality

- 315,683 individuals followed 1971 to 1991
 - 50,903 with LLTI in 1991; 38,180 died post 1991

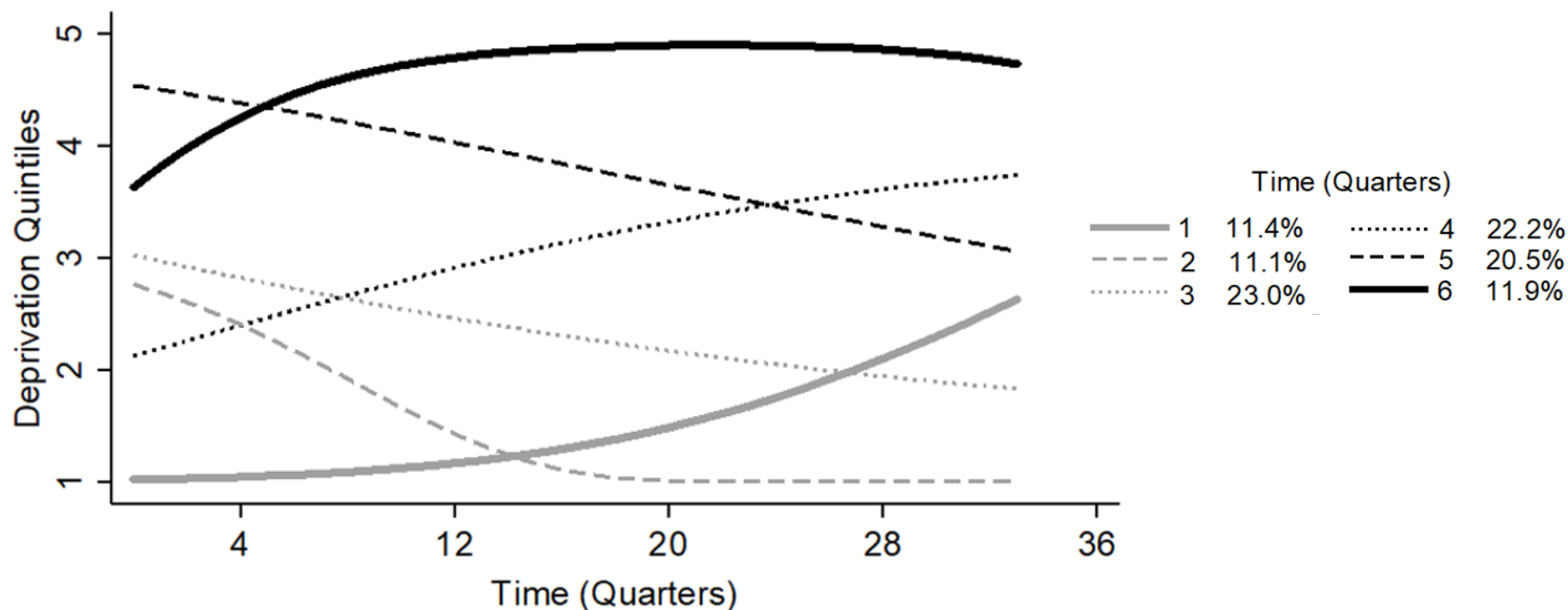


New Zealand: Deprivation trajectories

Cardiovascular disease outcomes

Classify people into deprivation-mobility groups:

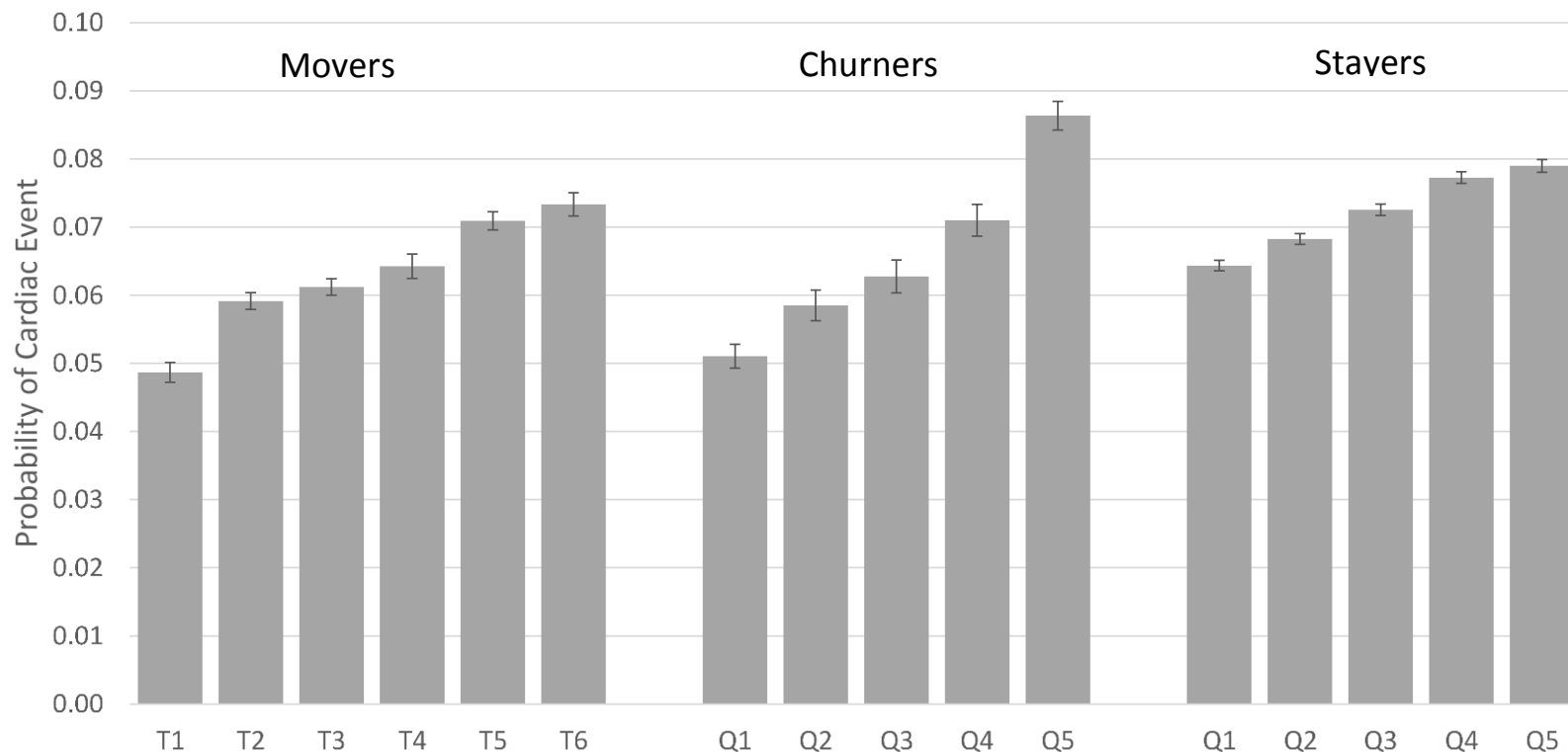
- 'Stayers' do **not** move on the observation period
- 'Churners' move but within the **same** level of deprivation
- 'Movers' move to an area with a **different** level of deprivation



See: Darlington-Pollock (2016; 2017); Shackleton et al. (2018)

New Zealand: Deprivation trajectories

Cardiovascular disease outcomes



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)

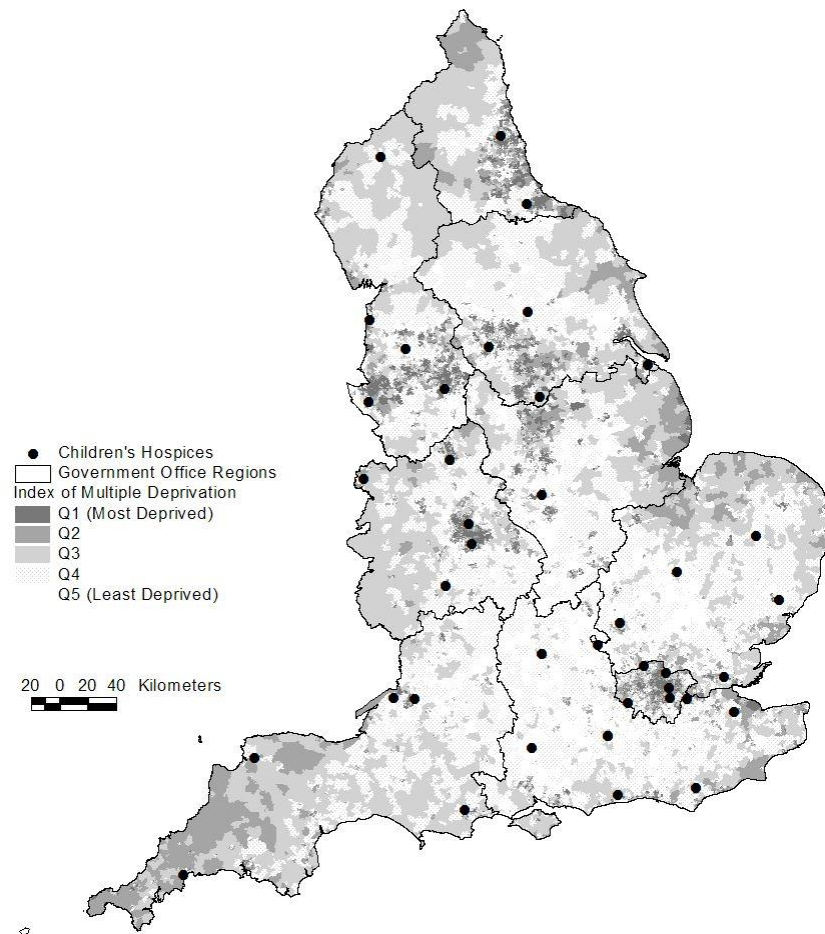
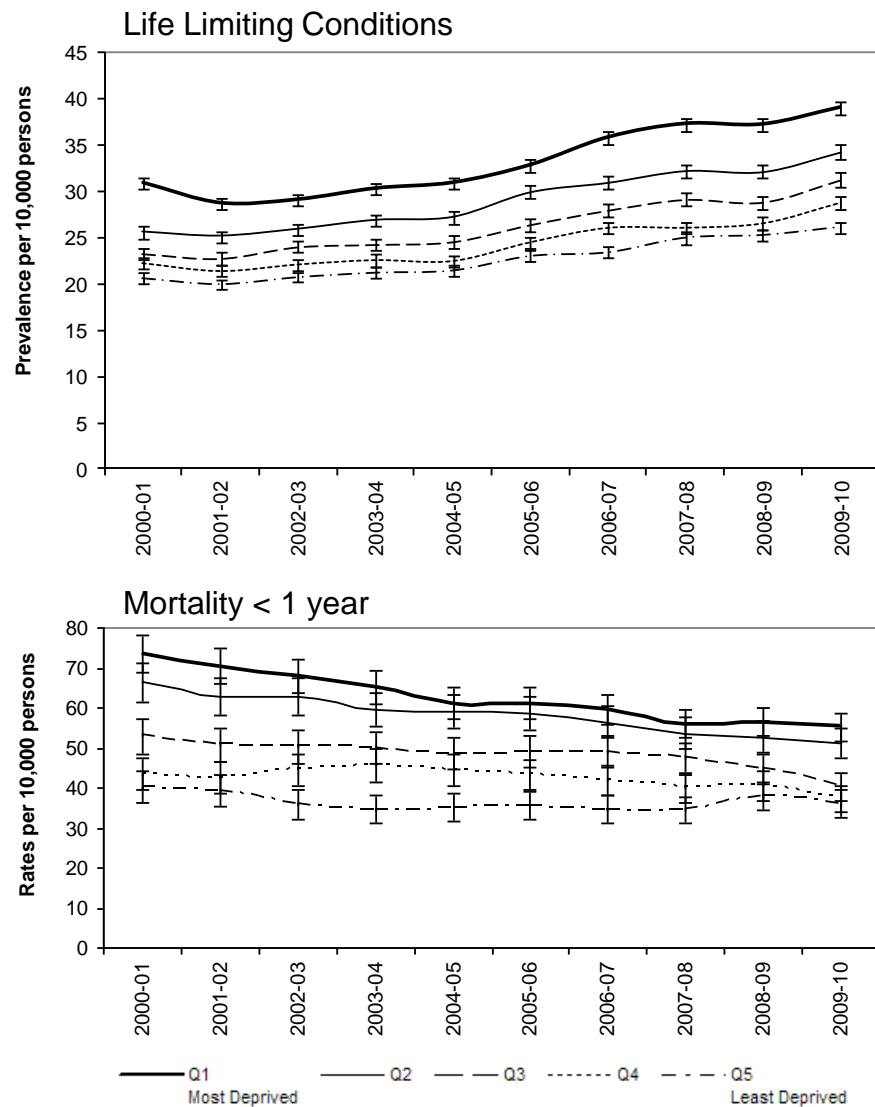
T1: move from least deprived quintile to higher deprivation, T2: move from mid deprivation to least deprived areas, T3: move from mid deprivation to less deprived area, T4: move from lower mid deprivation to higher deprivation, T5: move from most deprived to lower deprivation, T6: move from lower deprivation into most deprived areas.

See: Darlington-Pollock (2016; 2017); Shackleton et al. (2018)

Hospital Episode Statistics: time-series

England

Life Limiting Conditions 2001-10



Fraser & Norman (2017)
Norman & Fraser (2014)
Fraser et al. (2014; 2012)

Hospital Episode Statistics: time-series

What about the future?

Life Limiting Conditions



The screenshot shows the Rainbow Trust website. The logo 'RAINBOW TRUST' is in large, colorful letters, with 'SUPPORTING FAMILIES WITH A SERIOUSLY ILL CHILD' below it. The navigation menu includes 'HOME', 'CONTACT US', 'JOBS & VOLUNTEERING', and 'COMPANIES'. There are two buttons: 'Events' (blue) and 'Donate' (pink). A green navigation bar contains 'About', 'Support for families', 'Our impact', 'Get involved', 'Shop', and 'News'. A news article headline reads 'MPs urge government to act on patchy access to children's palliative care' with a '< BACK TO NEWS' link below it.



The screenshot shows the Together for Short Lives website. The logo 'together for short lives' is in the top left. The navigation menu includes 'Changing Lives', 'Get Support', 'Get Involved', 'About Us', and 'Donate'. A section titled 'Policy and influencing' contains the text 'All-Party Parliamentary Group for Children Who Need Palliative Care'.

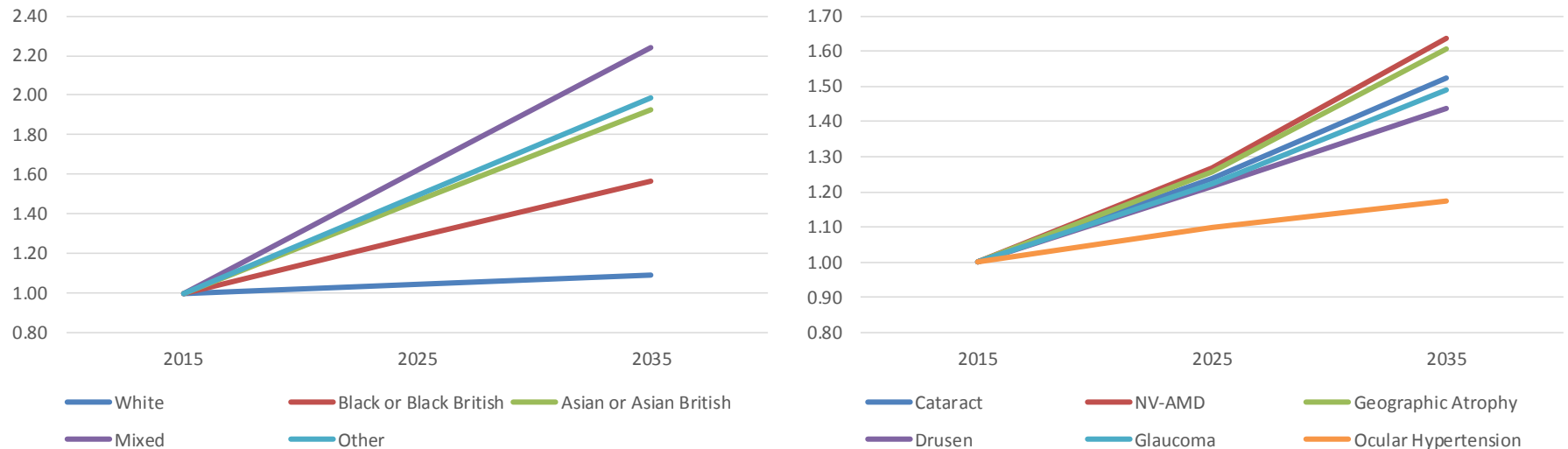
True Colours Trust. Estimating Current and Future Prevalence of Life-Limiting Conditions in Children and Young People in the UK utilising multiple data sources GBP 80k Lorna Fraser (PI), Paul Norman, Roger Parslow, Stuart Jarvis (Co-Is) April 2018 for 18 months

The future?

Importance of ethnicity & population projections

How many cases of various eye conditions might there be?

Lots of ifs, buts & maybes ...



Population increases c. 17% > > > Eye conditions increase c. 42%

From Buchan et al. forthcoming, hopefully!
See Whynes et al. (2018); Rees et al. (2013b) for applied work
& Rees et al. (2011, 2012, 2013a) about projections

Summary

- People live in different kinds of places at different life stages
- As people change locations, the locations themselves change
- Inequalities may be greatest in mid-life

Conditions by age?

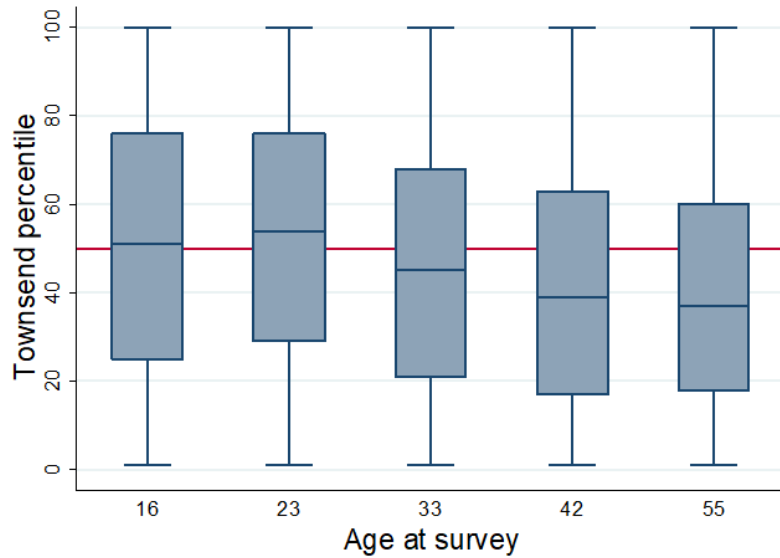
- Different causes of death more prevalent at different ages
- May be the case with morbidity but evidence base partial

Need to look into

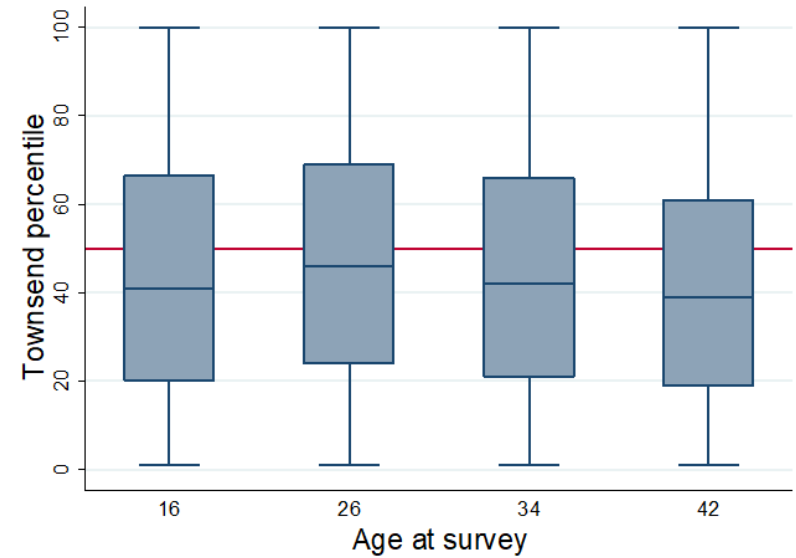
- Age area type trajectories (not just deprivation)
- Morbidity by age predicting later morbidity & mortality
- Needs much larger cohort / longitudinal sample of individuals than currently available linked historically to areas (Jivraj et al. 2019)
- Can inform Age-Area-Person type interventions for later avoidable conditions
- Carry out projections to inform the direction of travel

Cohort studies?

Uneven time increments
NCDS58

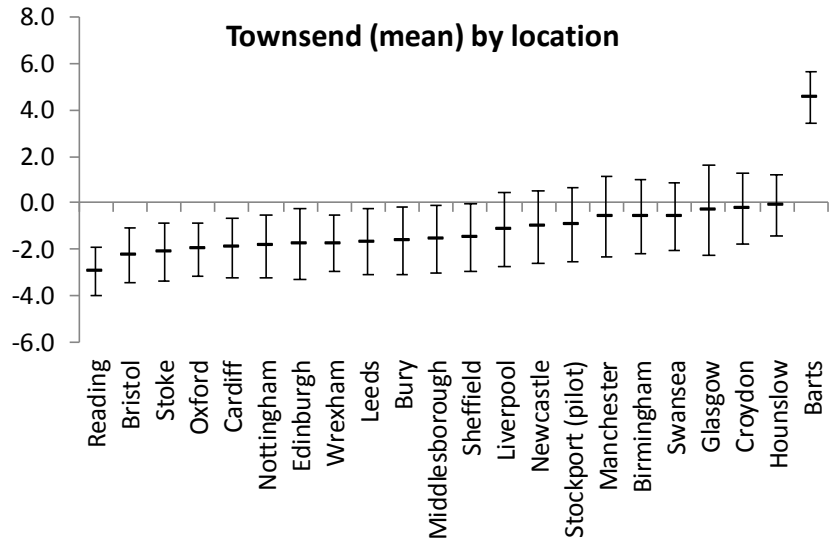


BCS70

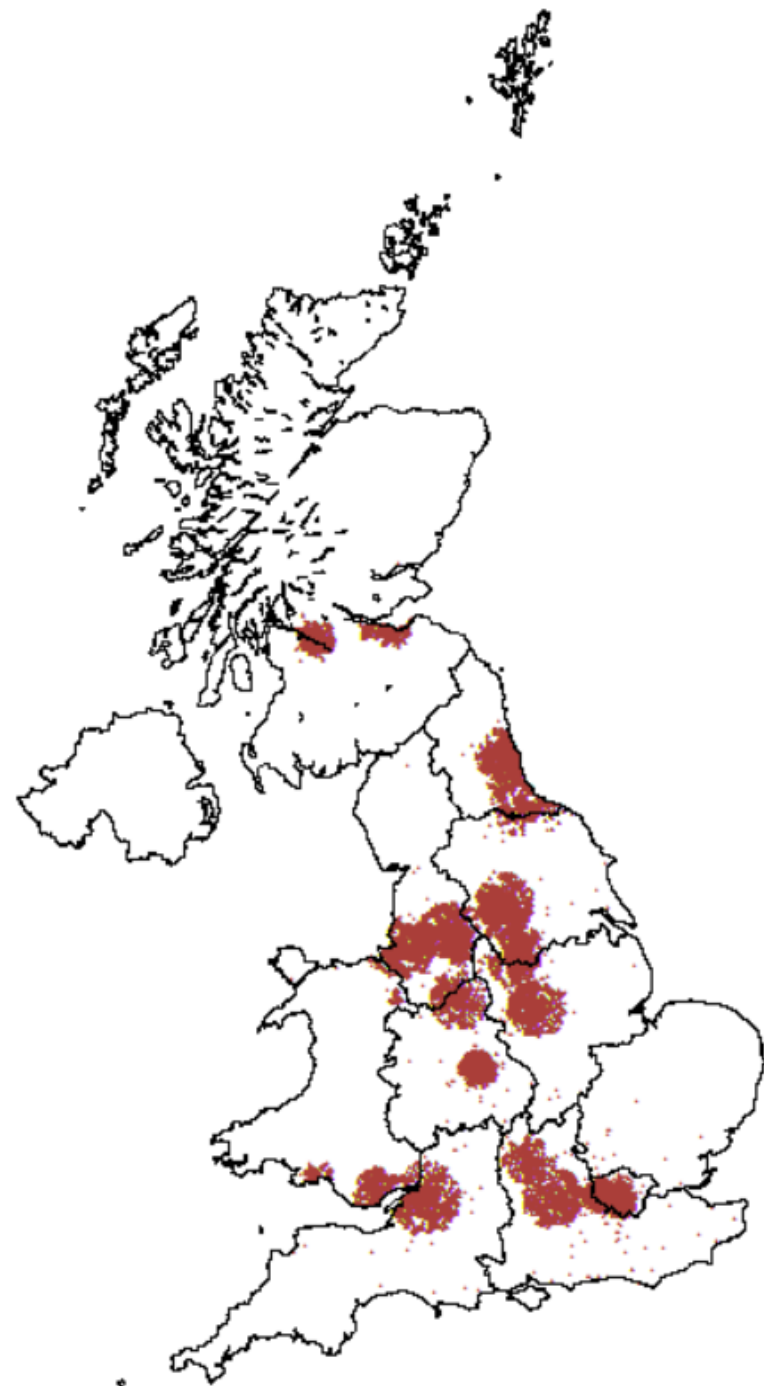


Big Data?

UK Biobank



Supergroup	%
Blue Collar Communities	9.58
City Living	8.22
Constrained by Circumstances	7.39
Countryside	4.76
Multicultural	8.70
Prospering Suburbs	39.41
Typical Traits	20.97



References

- 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
- Buchan J, Norman P, Shickle D, Cassels-Brown A, MacEwen C (2018) UK national eye health epidemiological modelling: How much more demand on services can be expected in the next 20 years? (In preparation)
- 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](https://doi.org/10.1016/j.socscimed.2016.07.041)
- 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>
- Dawes P, Dickinson C, Emsley R, Bishop P, Cruickshanks K, Edmondson-Jones M, McCormack A, Fortnum H, Moore DR, Norman P & Munro K (2014) Vision impairment and dual sensory problems in middle age. *Ophthalmic and Physiological Optics* 34(4): 479-488 DOI:10.1111/opo.12138
- Dawes P, Dickinson C, Emsley R, Bishop P, Cruickshanks K, Edmondson-Jones M, McCormack A, Fortnum H, Moore DR, Norman P & Munro K (2015) Understanding visual impairment in UK Biobank – Authors' Reply. *Ophthalmic and Physiological Optics* 35(1): 107-108 DOI:10.1111/opo.12178
- Dawes P, Fortnum H, Moore DR, Emsley R, Norman P, Cruickshanks K, Davis A, Edmondson-Jones M, McCormack A, Lutman M, Munro K (2014) Hearing in middle age: a population snapshot of 40- to 69-year olds in the United Kingdom. *Ear and Hearing* doi: 10.1097/AUD.000000000000010
- 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
- Dondo T.B., Hall M., Timmis A.D., Batin P.D., Oliver G., Alabas O.A., Norman P., Deanfield J.E., Bloor K., Hemingway H. & Gale C.P. (2016) Geographic variation in the treatment of non ST-segment myocardial infarction in the English National Health Service: a cohort study. *BMJ Open* doi:10.1136/bmjopen-2016-011600
- Fraser L & Norman P (2017) The use of Routine Data in Health Research; an example from Palliative Care. *SAGE Research Methods* DOI: <http://dx.doi.org/10.4135/9781526423658>
- Fraser L K, Lidstone V, Miller M, Aldridge J, Norman P, McKinney P A, Parslow R C. (2014) Patterns of diagnoses amongst children and young adults with Life-Limiting Conditions; implications for service provision. *Palliative Medicine* DOI: 10.1177/0269216314528743
- Fraser L K, Miller M, Hain R, Norman P, Aldridge J, McKinney P A & Parslow R C (2012) Rising national prevalence of Life Limiting Conditions in Children in England. *Paediatrics* DOI: 10.1542/peds.2011-2846
- Green M (2013) The equalisation hypothesis and changes in geographical inequalities of age based mortality in England, 2002-2004 to 2008-2010. *Social Science and Medicine* 87: 93-98
- Hall M, Laut K, Dondo T, Alabas O, Brogan R, Gutacker N, Cookson R, Norman P, Timmis A, de Belder M, Ludman P, Gale C (2016) Patient and hospital determinants of primary percutaneous coronary intervention in England, 2003-13. *Heart* doi:10.1136/heartjnl-2015-308616
- Jivraj S, Murray E, Norman P & Nicholas O (2019) Not another neighbourhood effects review: life course exposures to socio-economic neighbourhood context on health and wellbeing. *Social Science & Medicine* (submitted)
- Lloyd CD, Catney G, Williamson P, Bearman N & Norman P (2018) Deprivation Change in Britain. *PopChange Briefing 2*. Liverpool: Centre for Spatial Demographics Research, University of Liverpool.
- Marshall A & Norman P (2013) Geographies of the impact of retirement on health in the United Kingdom. *Health & Place* 30: 1-12 <http://dx.doi.org/10.1016/j.healthplace.2012.11.004>
- Munyombwe T, Lovelace R, Green M, Walpole S, Brownlee A, Brownlee J, Norman P, Oliver G, Batin P, Timmis A, Hall M, Gale CP (in preparation) Association between active transport to work and acute myocardial infarction in men and women

References (cont.)

- 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 & Fraser L (2013) Self-reported general health and Body Mass Index: a U-shaped relationship? *Public Health* 127: 938-945 DOI 10.1016/j.puhe.2013.07.003
- Norman P & Fraser L (2014) Prevalence of life-limiting and life-threatening illness in children and young people in England: time trends by area type. *Health & Place* 26: 171-179 <http://dx.doi.org/10.1016/j.healthplace.2014.01.002>
- 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) Identifying change over time in small area socio-economic deprivation. *Applied Spatial Analysis and Policy* 3(2-3) 107-138
- 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/10.17632/389scndjy.1>
- Norman P (2017) Demographic and health time-series analysis of small areas in GB: the development of population estimates and measures of area characteristics. *MOJ Public Health* 6(4): 00179. DOI: 10.15406/mojph.2017.06.00179
- Norman P (2018) Clarity in research frameworks for studying 'health selective migration'. Invited Commentary in *Journal of Epidemiology & Community Health* DOI:10.1136/jech-2018-210678
- Norman P, Boyle P & Rees P (2005) Selective migration, health and deprivation: a longitudinal analysis. *Social Science & Medicine* 60(12): 2755-2771
- 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>
- Norman P, Marshall A & Lomax N (2017) Data analytics: on the cusp of using new sources? *Radical Statistics* 116: 19-30
- Rees P, Wohland P & Norman P (2013a) The demographic drivers of future ethnic group populations for UK local areas 2001-2051. *Geographical Journal* 179(1): 44-60 doi: 10.1111/j.1475-4959.2012.00471.x
- Rees P, Wohland P, Norman P & Boden P (2011) A local analysis of ethnic group population trends and projections for the UK. *Journal of Population Research* 28(2): 129-148 doi: 10.1007/s12546-011-9047-4
- Rees P, Wohland P, Norman P & Boden P (2012) Ethnic population projections for the UK, 2001-2051. *Journal of Population Research* 29: 45-89 DOI 10.1007/s12546-011-9076-z
- Rees P, Zuo C, Wohland P, Jagger C, Norman P, Boden P & Jasinska M (2013b) The implications of ageing and migration for the future population, health, labour force and households of Northern England. *Applied Spatial Analysis & Policy* 6: 93-122 DOI: 10.1007/s12061-013-9086-7
- Robinson, T, Brown H, Barr B, Fraser, L, Norman P & Bamba C (2018) Blair's Babes? Investigating the impact of New Labour's English health inequalities strategy on geographical inequalities in infant mortality: a time trend analysis. *JECH* (submitted)
- Shackleton N, Darlington-Pollock F, Norman P, Jackson R, & Exeter D (2018) Longitudinal deprivation trajectories and risk of cardiovascular disease in New Zealand. *Health & Place* 53: 34-42 <https://doi.org/10.1016/j.healthplace.2018.07.010>
- Sturley C, Downing A, Norman P & Morris M (2018) Spatial variations in bowel cancer mortality by deprivation: England and Wales. *British Society for Population Studies. Annual Conference: Winchester*

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 & Vital Statistics
- EDINA / UKBORDERs, National Statistics Agencies, etc. for supply of GIS data
- UKDS for the National Child Development Study and British Cohort Study & Vital Statistics
- Access to the VIEW data in New Zealand
- UK Biobank