Demographic and health time-series analysis of small areas in GB: the development of area measures and population estimates

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To date:

My involvement in this type of work started with my PhD (Norman 2002) and in subsequent publications which produced a set of subnational population related resources for GB and the UK through the development of methods: for geographical harmonisation when small area boundaries change (Norman et al. 2003; Norman 2006); of populations by age and sex in terms of the estimation of the past (Rees et al. 2004; 2005; Norman et al. 2008; Lomax & Norman 2016) and projection of the future (Norman et al. 2010; Rees et al. 2010, 2011 & 2012); of the calculation of changing area deprivation (Norman, 2010a); and of the analysis of demographic change (Tromans et al. 2008; Norman 2010b; Norman 2011). The resources relate to the period 1981 to 2001 with very full detail (relevant to the purposes) though with less detail from 1971 to 1981 and after 2001. Various datasets have been deposited at the UK Data Archive (study numbers 5850, 6045 & 6777). The same methods have been used to analyse changing deprivation for small areas in Australia (Norman et al. 2016).

In applied work, I have mainly used the resources for health related research of; infant mortality (Norman et al. 2008), all cause mortality (Rees et al. 2003; Norman et al. 2011), cause specific mortality (Exeter et al. 2011); limiting long-term illness and incapacity benefit (Bambra and Norman 2006; Norman & Bambra 2007; Ajebon & Norman 2016) and of children with life limiting conditions (Fraser et al. 2012; Norman & Fraser 2014). Further topics include small area analyses of local democracy (Norman et al. 2007), environmental equity (Mitchell & Norman 2012), traffic accidents (Lyons et al. 2009) and fire risk (Corcoran et al. 2007).

The examples above are area based; about whether aspects for small populations vary over space and time. Parallel to this, I have been involved in research which seeks to determine whether for individuals, there are different experiences for people who live in different kinds of places over time. As above, the focus is on health, particularly for persons: who move between levels of deprivation (Boyle et al. 2002; Norman et al. 2005) at different ages (Norman & Boyle 2014) or between urban and rural areas (Riva et al. 2011); in different countries from where they were born (Norman 2008; Popham et al. 2010); who do not move residence (Boyle et al. 2004); or who are socially mobile (Boyle et al. 2009); and where linkages to residential areas need estimation when specific locations are unclear or names of places have changed (Norman & Riva 2012). Analogous situations for cardiovascular disease have been researched in New Zealand (Darlington-Pollack et al. 2016).

As my academic profile developed and knowledge of the availability of the demographic resources have become more widely known, I have received requests to supply and manipulate data and collaborate in

ongoing research. These collaborations includes studies of general cancer (e.g. van Laar et al. 2010, 2012& 2013); specific cancers (Basta et al. 2014; Blakey et al. 2014; McNally et al. 2012, 2014 & 2015), coronary heart disease (Bajekal et al. 2013a&b; Scholes et al. 2013); coronary intervention treatment (Dondo et al. 2016; Hall et al. 2016), diabetes (Harron et al. 2010 & 2011), asthma (Hoskins et al. 2011 & 2012), hearing and visual impairment (Dawes et al. 2014a&b; Dawes et al. 2015), muscular dystrophy (Pierotti 2015) and neuromuscular disease (Woodcock et al. 2016).

To update:

More recent data are now available (both census and demographic births and deaths events) but with the inevitable boundary and data definitional changes which were resolved in the previous work. There was therefore a need to update, to redefine and to ensure the resources were fit for purpose for long run time-series analysis from 1971 to 2011 and by contemporary geographies (2011 definitions). The latter ensures that interpretations are relevant to current applications. Demand was building from various directions for the resources to be revised and made available.

Initially, a partial solution was needed for the Government's Foresight Future Cities initiative (work with Rees & Durham) and a proposal for future work was made to Joseph Rowntree (with Birkin, Malleson & Clarke). Previous collaborators at Leeds (Mitchell; Feltbower & Parslow), York (Fraser) and at Newcastle (McNally & colleagues) needed updated information and fuller resources for ongoing research. I also have new opportunities with researchers at Leeds (Connor), UCL (Jivraj & Murray), Manchester (Dawes and Becares), Nottingham (Edmondson-Jones) and Kings (Polling; Woodhead) all of whom want to link individual data to area characteristics for studies: of health and well-being through the life course; of visual and hearing impairment; of self harm and mental health using: longitudinal and cohort studies, hospital episode (in & out patients, A&E), the UK Biobank, etc. Public Health England (via Edwards in Birmingham) are keen to have annual population estimates for use as denominators in cancer rates.

Outputs

The aim was to produce for small area subnational areas in England, Wales and Scotland various datasets which comprise:

- 1971-2001 annual time-series of populations by five year age-groups and sex;
- Population density for the census years, 1971, 1981, 1991, 2001 and 2011;
- Deprivation scores and quantiles for the census years, 1971, 1981, 1991, 2001 and 2011;
- Sociodemographic variables (the inputs to deprivation measures).

To create the above requires data to be converted from their original geographies of dissemination (different at least once per decade) to the small area geographies for which the 2011 Census data were

released: i.e. Super Output Areas in England and Wales and Datazones in Scotland. A lack of data over this time-frame precludes widening out the (vector) geographical coverage to include Northern Ireland but equivalent data will be made available for 1991, 2001 and 2011. See Lloyd (2017) for a solution using population surfaces across the UK.

The development of the resources and initial analyses are reported in Norman (2016) and Norman & Darlington-Pollock (2017) and have been used in studies of accessibility to sports facilities (Higgs et al. 2015) and of inequities in improvements in air quality (Mitchell et al. 2015). The time-series of GB deprivation and density measures have been attached to the 1958 and 1970 British Birth Cohorts for a study at UCL (Jivraj et al.) and an equivalent dataset for England and Wales for attachment to the ONS Longitudinal Study (via Dennett at Celsius).

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