

Small area data Looking towards a 2021 census

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Introduction



The Royal Geographical Society (with the Institute of British Geographers) has produced this collection of case studies on the use of small area population data to help non-experts understand why these data are so important to debates about the future of population statistics. Small area population data are deeply embedded in the work of many different organisations across public, private and non-profit sectors. A small collection such as this cannot hope to be comprehensive in any sense, but it is hoped that these diverse examples will be illustrative of the importance of small area data in informing practical policy and business decisions at local, regional and national levels.

The Society – as a world-leading scholarly geographical society – is committed to promoting and sharing the highest quality geographical research and analysis in support of evidence-based policy making. The Society effects knowledge exchange with policy makers through invited representation on advisory panels, discussions and conferences, policy briefings, Select Committee and consultation responses, and the nomination of experts to government reviews.



Foreword



The UK's censuses of population provide a unique, high quality source of information about the population which is detailed, both in terms of population characteristics and geographical scale. Censuses achieve very high levels of coverage and make it possible to understand the presence of small population groups in small areas. In England and Wales the smallest of these are presently known as output areas, containing on average 300 people, and lower layer super output areas, containing on average 1500 people. This collection of case studies demonstrates how these small area data are crucial to activities in environment, policy, cultural, health and commercial sectors. The strength of these small area data lies in their flexibility to answer society's important questions – to accurately assess which people will be affected by an emergency or to effectively target a policy that will meet the needs of a particularly disadvantaged group. In late

2013, the Office for National Statistics consulted on options for the future of population statistics; this included survey-based approaches that would be unable to support the case study uses presented here. Strong representations from user groups, including the Society, led to a recommendation to government, now accepted, that a full census should be held in 2021, using largely online data collection and including parallel work on the development of administrative data sources. However, the detailed form of the 2021 census is far from being finalised. Anyone taking part in the debate or making the decision needs to understand the importance of small area data and the many ways in which a well-ordered society relies on this crucial body of evidence for policy.



Professor David Martin FRGS, ACSS

University of Southampton and UK Data Service



Case Study 1

Flood emergency management and assessment: an example from HR Wallingford



Context

Flooding presents a very pressing threat to human life and property in the UK, with an increasing incidence of major flood events in recent years and concerns about human settlement in the most flood-prone areas. Such flooding could occur from rivers or the sea, heavy rainfall (causing surface water flooding), from excess groundwater or from dam failure. The sources of flooding at a site and the severity of the hazard are captured in flood risk assessments and informed by flood risk models such as those developed by HR Wallingford and others.

Importance of small area data

The Wallingford models combine representation of the physical behaviour of floodwater with the representation of the characteristics and behaviour of different population subgroups. Because areas prone to flooding are highly

localised, reflecting watercourses and local terrain, the exposure of populations to flood hazards must be modelled at very high geographical resolution and cannot rely on aggregate statistics for large administrative areas such as wards or local authorities (LAs). It is therefore essential to use demographic data and population characteristics for the smallest possible areas which can be integrated with the physical flood mapping.

Impacts

Flood risk assessments are used to inform local development plans and flood management strategies for local communities. HR Wallingford has developed a 'life safety model' which is a dynamic computer model that represents people's interactions with a flood and provides estimates of the number of people that are likely to be injured or killed as a result of a flood event, as well as the




time that is required for them to evacuate the area at risk.

The model uses data from census output areas to assess the different vulnerabilities of population groups such as the elderly and those suffering from long term, limiting illnesses. It can also represent the typical daily journeys of adults and children to the workplace and schools. The model simulates the behaviour of different population sub-groups, recognising that some are less mobile and able to evacuate areas at risk than others, hence car ownership is another population characteristic that is key to effective assessment.

The model allows hydraulic engineers and local planners to base emergency management decisions on credible estimates of loss of life using transparent and auditable data and methods. The ultimate impact of using such models is

to save lives and to manage emergency situations arising from flooding as effectively as possible – informing answers to key questions such as where to locate safe havens and evacuation routes, and whether it is better to initiate evacuation or advise the population to 'stay put'.

Recent applications of the model undertaken by HR Wallingford include major assessments of sea surge flooding in vulnerable areas such as the Humber Estuary, Lincolnshire and Canvey Island. These results are being used by the LAs to inform and develop their mass evacuation plans, including when to order the evacuation and which routes to designate for the evacuation. In a repeat of the 1953 storm surge, up to 400,000 people would have to evacuate from the east coast.



Case Study 2

Neighbourhood planning: making localism work. An example from Oxford City Council



Context

Local authorities (LAs) are charged with many different planning responsibilities in which local policy objectives can only be realised in the light of understanding very small area population characteristics. Populations vary over very local geographical scales: an apparently prosperous area can contain pockets of deprivation; an area apparently predominantly owner-occupied can contain pockets of social housing and/or private renting, and an area predominantly containing older people can contain pockets of young people for whom school places will be needed. Availability of population characteristics at the census output area scale is therefore essential, both to allow LAs to target their resources more efficiently at those areas in greatest need and to monitor the efficacy of policies previously adopted.

Importance of small area data

The government's localism agenda has introduced an opportunity for local neighbourhoods to produce neighbourhood development plans, thereby devolving responsibilities to local areas. Neighbourhood planning is about making sure a community gets the development it needs for the future, with a focus on achieving sustainable development. This is implemented through the building of homes, job opportunities and leisure and community facilities – including schools, health services and shops. Neighbourhood planning guidance makes it clear that neighbourhood groups producing plans will be expected to base their policies on evidence. Census housing, ethnicity, employment and travel to work data are central to the evidence needed to understand current and potential future needs. In addition, information about population, health, employment and jobs,



education and skills and groups of people with specific needs will help describe the 'baseline environment' as required by any sustainability appraisal.

Impacts

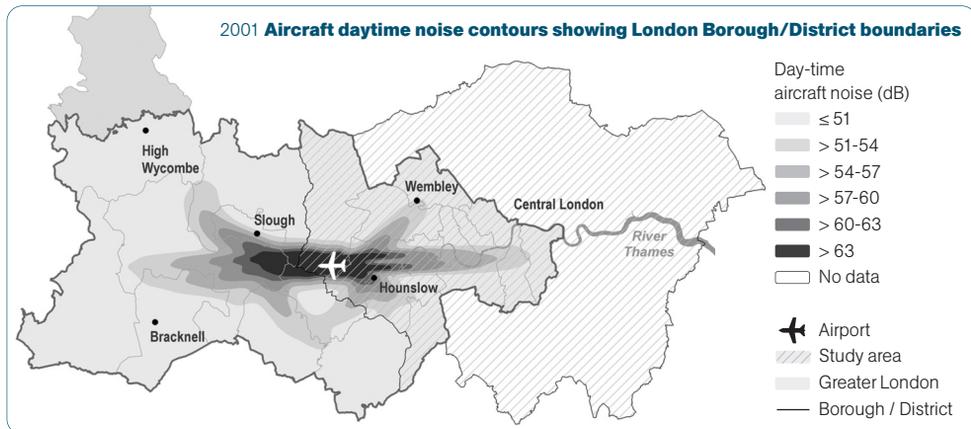
In consultation with multiple LAs, the Local Government Association identifies an even greater imperative for use of small area population data following a number of recent public sector reforms – the Localism Act 2011, the National Planning Policy Framework, welfare reforms, and the transfer of public health responsibilities. The importance of these data to delivering effective and sustainable planning is therefore growing rather than decreasing.

Oxford City Council is already receiving requests from groups wishing to start the neighbourhood planning process and consider that data at least at the lower layer super output area level will be essential for the preparation of these

neighbourhood plans. Oxford will use 2011 census data to update the baseline data contained in their sustainability appraisal scoping report, which will inform future planning policy documents. The data will also be used in the monitoring of adopted planning policy documents. Such monitoring is essential in order to understand whether policies are having the desired effects or need to be amended or new policies adopted. A new area action plan is being considered for the north of the city and small area census data have been identified as being needed to provide baseline information for sustainability appraisal and as a way of analysing the site in relation to its local context.

Case Study 3

Aircraft noise and heart disease: an example from around Heathrow airport



Context

Previous research has found links between living in a noisy environment and risk of high blood pressure, but few studies have looked at stroke, heart disease and circulatory disease. New findings raise the possibility that aircraft noise may be a contributing factor to these conditions.

The study funded by Public Health England and the Medical Research Council, undertaken by Imperial College London and King's College London, compared data on day- and night-time aircraft noise with hospital admissions and mortality rates among a population of 3.6 million people living near Heathrow airport.




Importance of small area data

Small area data were fundamental to this study as clearly, environmental factors such as noise do not conform to administrative boundaries. Furthermore, it allowed utilisation of detailed census characteristics, such as deprivation and ethnicity, at the smallest geographical levels. The study would not have been possible without these data.

Impacts

Allowing for the effects of deprivation and ethnicity on health, the study found the risks of hospital admissions and deaths from stroke, heart and circulatory disease to be higher in areas with high levels of aircraft noise. The risks were between 10-20% higher in areas with highest levels of aircraft noise compared with the areas with least noise.

The findings have already helped inform public debate and input to policy regarding airport expansion and flight restrictions. Specifically they have been:

- published in the British Medical Journal in 2013 ¹
- the subject of much press coverage
- the basis of a Parliamentary Question and featured in several parliamentary discussions
- included in the Department for Transport consultation on night flight restrictions at Heathrow, Gatwick and Stansted (November 2013)

Case Study 4

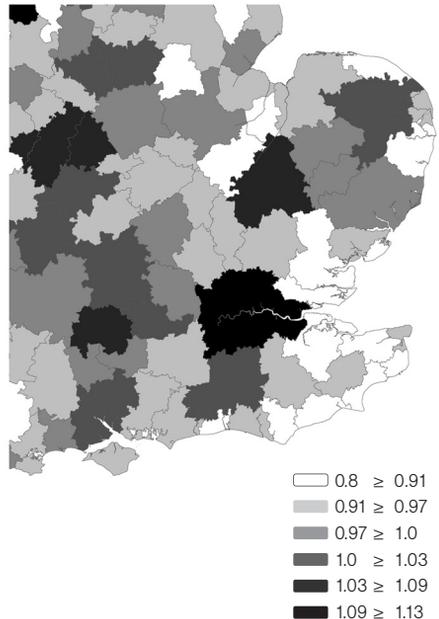
People on the move: understanding flows between places. A national example

Context

Many policy decisions rely on comparing statistics on areas, so using appropriately-defined areas makes for better policy decisions: large sums of public funding can be misallocated if the boundaries around these areas are not drawn appropriately.

Specifically in relation to commuting, the fine-grain commuting dataset from each new census has been analysed to permit demarcation of geographical regions known as travel to work areas (TTWAs) where the bulk of the resident population also work within the same area. TTWA boundaries are widely used by government and others because they accurately map economic geography, allowing valid comparisons to be made between areas.

Ratio of jobs to people in employment residing within 2001-based travel to work areas in the south-east of England





Importance of small area data

Much specialist analysis in support of policy on commuting and migration, termed ‘flow’ patterns, would be simply impossible without the robust data covering all small areas that is provided by the census. This is because the census asks individuals not only about their place of residence but also about their workplace and previous address. This allows the number and characteristics of people moving between each pair of small areas to be measured. There are no effective alternatives to the census data on local flows of commuting or migration.

The Office for National Statistics conducted experiments to see whether their Annual Population Survey could, instead, provide the data on commuting needed to update TTWA definitions. They found that reliable results were unobtainable using this method.

Alternative sources based on surveys are inherently limited by their sample size and therefore cannot adequately capture the magnitude and complexity of flows of people between areas.

Impacts

TTWAs have been used in many different applications, including:

- in developing current government policy
- helping to inform the choice of city locations for large companies
- creating Local Enterprise Partnerships through a TTWA template
- labour market policy and analysis
- housing policy implementation



Case Study 5

Planning ethnically sensitive bereavement services: an example from West Yorkshire



Context

Knowing where populations of different ethnic and religious groups live is important as cemeteries and crematoria aim to serve their surrounding neighbourhoods, and local needs vary. For example, Muslims require burial rather than cremation whereas for other population groups, including Christian, Sikh and Hindu, cremation is most common. Muslims also require individual rather than family graves, which has implications for space requirements.

Importance of small area data

The census data allow changes in the ethnic and religious make-up of populations to be monitored. This can help inform bereavement services (BSs) with planning and delivery in places that have become much more ethnically diverse in the last two decades. For example, Kirklees Council, in collaboration with the

University of Manchester's Centre on Dynamics of Ethnicity, monitored ethnic diversity in Kirklees using 1991, 2001 and 2011 census data.^{2,3}

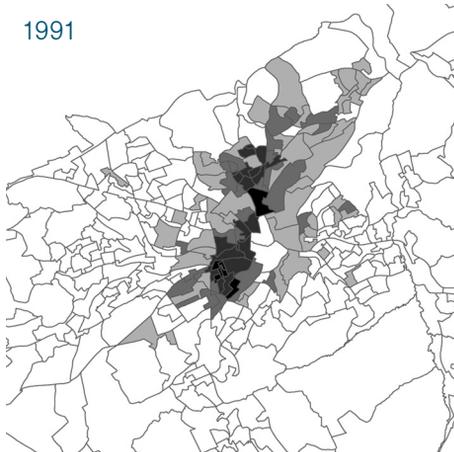
Impacts

Kirklees Council opened a new cemetery in October 2013 to accommodate the needs of the growing Asian and Muslim population in the surrounding area. Furthermore, as traded services, BSs generate income for their Council, allowing the authority to support other essential local services. Census data can also help future planning; taking the diversity of local populations into account will be vital as minority populations grow, age and, for second and subsequent generations, are more likely than their parents to be buried in the UK.

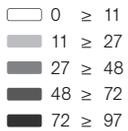
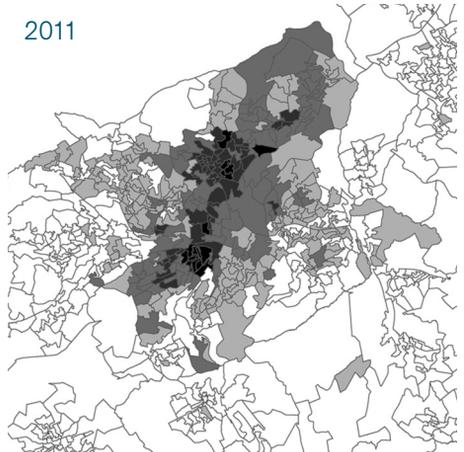
Sensitive planning and delivery of BSs is a culturally important impact that helps to foster social awareness and delivery.

**Changing percentage of non-white ethnicity in central
Kirklees 1991-2011 using small area census data**

1991



2011





Case Study 6

Establishing the prevalence of female genital mutilation: a public health priority for Bristol City Council



Context

Female genital mutilation (FGM) is classified as a human rights violation in the absence of any perceived medical necessity. It violates the rights to the integrity of the person and the attainable level of physical and mental health.⁴ FGM is recognised by the United Nations to be part of discrimination as well as a form of violence against girls. It was outlawed in the United Kingdom (UK) in 1985 and in 2003 the legislation was extended to include acts of FGM carried out abroad. The health risks associated with FGM are wide and some are severely disabling and likely to lead to serious and long term complications.⁵ The risk increases with the severity of the FGM.⁶

Importance of small area data

There is a critical data gap on girls at risk of FGM and actual prevalence, the latter being defined as the percentage of women

aged five to 49 who have undergone some form of FGM.⁷ In the absence of robust primary data on prevalence among women from FGM-practising countries who migrated internationally, European Union (EU) countries have utilised the 'extrapolation-of-African-prevalence-data-method', for which detailed census data are a key requirement. This uses prevalence data from established international surveys, the World Health Organisation or United Nations Children's Fund and extrapolates these onto data about the female population living in a given EU country and originating from FGM-practising countries. The EU recommends that when estimating prevalence of FGM, census data should be used as a starting point and should as a minimum, be disaggregated by country of origin, sex and age.




Impacts

The small area census data are vital to help better understand the extent of FGM and to inform decision making and resource allocation. FGM is an example of a complex public health challenge for which the flexibility of detailed census data currently provides the best basis for investigation and intervention. It requires not only demographic data but also, in this case, country of birth data for small areas in order to target the communities where interventions are mostly likely to reach those in need.

The first prevalence study in the UK to use this method was undertaken in 2007.⁸ This used data from the 2001 census on girls' and women's age (five-year age bands), country of birth, ethnicity and local authority of residence. The 'extrapolation-of-African-prevalence-data-method' was then applied and led to the estimate of

65,790 women in England and Wales who had been subject to FGM.

Public Health England and Bristol City Council will be applying this method to newly available 2011 small area census data to inform planning and commissioning of services within Bristol, to inform maternity, gynaecological and psychosexual care provision as well as other support services for girls and women with complications of FGM, for targeted advocacy with affected communities, and to monitor progress towards ending FGM in the UK.



Case Study 7

Housing strategy and policy: an example from Bristol City Council



Context

With continued population growth and the failure of housing supply to keep up with rising demand, housing remains a major policy concern. Local authorities (LAs) rely heavily on small area housing and population characteristics data from the census in order to deliver effective housing policies. Across both planning and management, housing is a field in which realisation of national objectives is critically dependent on having sufficient small area data.

Importance of small area data

The census provides the only detailed combination of information about population characteristics and housing stock, including dwelling types and tenure patterns for the smallest geographical areas. Without this data, the LA would be unable to have a clear understanding of the characteristics and needs of communities

at the very local level which enables the most effective targeting of scarce resources.

Impacts

Bristol City Council looks at the balance of tenures at the lower layer super output area (LSOA) level to identify areas of concentration of social housing which also exhibit deprivation characteristics such as long-term worklessness, poor educational achievement and low income. These data inform decisions on the allocation of LA affordable housing programme resources (AHPRs); prioritisation of schemes for the development of new affordable housing by housing associations; allocation of government AHPRs; introduction of local allocation schemes; balance of tenure in new affordable housing developments, and in the design of housing need and aspiration surveys for specific areas of the city.




The intended outcome is to encourage the development of balanced and sustainable communities in Bristol.

Small area data also support:

- development management officers in their implementation of housing policies within the local plan. Data on the composition of housing at a small area level is needed to assess the suitability of housing mix within development proposals and the contribution that different types of new residential development make to the housing mix of an area. It has also been relied upon at planning appeals
- the practical management of the housing stock. The data are regularly used to gain evidence for local targeted action and identify density of private sector housing and associated data such as deprivation, older people or vulnerable households. For example, resources can

be appropriately targeted at interventions, either through renewal activity and Home Action Zones for privately owned property or by the designation of discretionary licensing areas for private rented sector housing or enforcement

- selection of areas for energy efficiency initiatives. For example, grants for affordable warmth are based on LSOAs. Such targeted local action rarely covers a whole ward and more detailed local information is essential to identify smaller, manageable areas for action
- access to private sector homes for those no longer needing support. The census data are used alongside the council's own data to identify areas of the city with a supply of: one bed private rented homes; where more private access schemes are needed; and where private renting supply of the right size would make this possible.



Case Study 8

Planning for emergencies: the National Population Database example



Context

The Health and Safety Executive (HSE) has the day-to-day responsibility for enforcing health and safety legislation and its concerns range from nuclear installations and chemical plants, through to mines, factories, farms and other workplaces. This involves modelling the potential consequences of accidents on local populations to inform major planning applications, emergency preparedness and evacuation plans.

Importance of small area data

HSE requires population data to inform this risk assessment work and this can be particularly challenging because nationally consistent coverage is required, limiting the role of locally sourced data. HSE models accidents with highly variable impact and consequences; in some cases these can extend up to 20km and in others as little as 50m and it is necessary to be

able to differentiate between populations of varying sensitivity to harm, so the detailed geographical distribution of population is a central consideration.

Impacts

To address this need, HSE commissioned the Health and Safety Laboratory (an agency of the HSE) to develop the National Population Database (NPD).⁹ This is a computer-based tool for identifying and estimating population density and distribution for a range of population types and categories. The initial purpose of this database was to model populations and aid HSE in the provision of advice on land use around major hazard sites, however, its use has grown and it is now used across government for a variety of applications.



It integrates data from a wide range of sources, including mapping data from Ordnance Survey (OS) and detailed population data from the census at the output area (OA) level. It is essential that population characteristics are used for the smallest possible areas in order that data can be extracted which correspond to the geographical footprint of areas affected by different potential events. A sophisticated methodology using Geographic Information Systems is used to attach OA level census data, and other statistics from government datasets, to map locations provided by the OS. It is critical for the census data to include average household size, age structure and economic activity to ensure that spatial variation in the occupancy of houses at different times of day can be captured, so not to under- or over-estimate the potential populations at risk from some form of hazard.

As well as its continued use for the HSE, the NPD has also been used for many other purposes, including:

- the demographic analysis element of the Strategic Siting Assessment for new nuclear power stations on behalf of Office for Nuclear Regulation
- modelling the consequences (including economic impact) of accidents at major hazard sites; modelling impacts for the National Risk Assessment
- other organisations and government agencies including Ministry of Defence, Public Health England, Environment Agency and Sellafield use the NPD to inform risk assessments and/or plan for emergencies



Case Study 9

Geodemographic profiling of customers and clients: an example from Beacon Dodsworth



Context

Small area census data are key to businesses and other organisations in the market research industry, particularly through the creation of geodemographic classifications, which involve the analysis of a very large number of social characteristics, in order to group small geographical areas into a structured hierarchy of area types. The Office for National Statistics undertook its own geodemographic classification from 2001 census data and updated versions of several such classifications are being prepared as 2011 census data become available.

Importance of small area data

Beacon Dodsworth's geodemographic classification product is called P² People and Places. Important factors leading to the construction of P² were the free availability, robustness and completeness

of the census data. Having this nationally consistent detailed data available at output area (OA) level is key to the entire classification. OAs are well suited to this use because they have been specially designed for data publication, standardised by population size and social characteristics and, unlike many other administrative areas, are stable over time.

Impacts

P² is based on a very wide range of socioeconomic data (for example on ethnic groups) which means it can provide in-depth characterisation of disadvantaged groups, which is particularly useful to the public sector. P² has been built into the National Health Service (NHS) Strategic Health Asset Planning and Evaluation system¹⁰ available to NHS staff, and was used extensively for the North West Public Observatory's study *Where Wealth Means Health: Illustrating Inequality in the North West*.¹¹



These tools allow not only the public sector but also businesses and services to profile their current customers or clients using their own data and to relate their behaviour and preferences to the types of area in which they live, allowing development of information-based strategies for better marketing and service delivery and, ultimately, for economic returns. For example, new areas can be sought which contain people similar to current customers, or sites can be optimally located to serve a specified customer type. Examples of clients who use the P² classification include:

- regional newspaper group Trinity Mirror for whom the impact generated from targeted localised press advertising is highly effective, offering creative and cross-platform solutions that cannot be replicated in the national press or other channels

- opticians Vision Express use Beacon Dodsworth's tools to identify the similarities in their customers' characteristics and lifestyles. These are then compared with population profiles of other areas to work out suitable store locations

These examples are indicative of many businesses who do not undertake their own analysis of small area census data in-house, but whose decisions and investments are nevertheless informed through the use of rich social characteristics for OAs that are only available from the census.

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Numbered footnotes in text

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Images: data acknowledgement

Page 6

Map adapted from Kmietowicz, Z. (2013) Aircraft noise is linked to raised risk of cardiovascular disease *British Medical Journal*, 347: f6082. Aircraft noise data supplied by the Civil Aviation Authority

Pages 8 & 11

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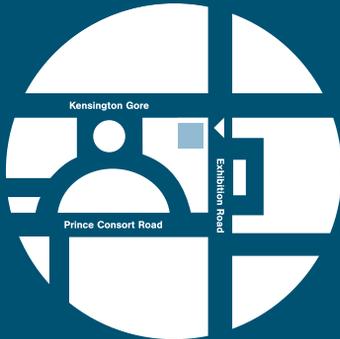
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E policy@rgs.org

W www.rgs.org/policy

How to find us



Entrance is on Exhibition Road
Nearest Tube station South Kensington

Royal Geographical Society (with IBG)
1 Kensington Gore London SW7 2AR

T +44 (0)20 7591 3000

E enquiries@rgs.org

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