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Defining GP practice areas based on true service utilisation

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ABSTRACT

Where patients who are registered with a general practice actually live (the service utilisation area) often differ from what GPs consider their practice boundaries or catchment area to be, as well as from administrative boundaries. A key aim of primary care commissioners is to allocate resources efficiently and to locate services in such a way that access is convenient for patients. To achieve this robust understanding of practice service utilisation areas and the overlap between practices and administrative areas are essential. We used kernel analysis of the postcodes of over 400,000 registered patients to define GP service utilisation areas. We estimated service utilisation for each of 64 practices for a period of five years (2002–2006) exploring the areas in which 99%, 98%, and 95% of registered patients were expected to live. These service utilisation areas were not coterminous with other practices or with administrative boundaries. We present a simple analytical method to define GP catchment areas that captures the true service utilisation area and identifies the extent of overlap. This is a practical tool that can assist health care commissioning.

1. Introduction

Information is one of the main fundamental elements of a strong health system and is critical to reforms of primary care (World Health Organization, 2008; Don de and Taghreed, 2009). The World Health Organisation (WHO) has called for better information to be provided by health care systems, noting their current limitations in providing data on outcomes and impact (e.g. service utilisation, access to care and patient satisfaction) that are required to assess the effectiveness or efficiency of care (World Health Organization, 2008; Boerma et al., 2010).

In the UK, information about GP service utilisation has been important in informing the efficient allocation of resources and the location of services in settings that are convenient to patients (Department of Health, 2004; Department of Health, 2006; Department of Health, 2009). The development of Information Technology to support the flow and analysis of utilisation data has been encouraged by the UK Department of Health (Department of Health, 2004). Whilst new structures for commissioning in the UK are still evolving and may change further in future (Department of Health, 2010b), it is clear that Clinical Commissioning Groups (CCGs) are likely to collectively allocate approximately £85 billion each year, representing over 80% of the total NHS revenue budget (Department of Health, 2010b). They will also play a key role in implementing the Quality, Innovation, Productivity and Prevention (QIPP) agenda and will be expected to achieve unprecedented efficiencies. Information on spatial patterning of health services, including GP service utilisation areas will be valuable to commissioning organisations to highlight gaps and duplication in resources. Linked to information on prevalence, patterns of usage and public health inputs to Joint Strategic Needs assessment, it can inform more effective and efficient service configuration (Department of Health, 2007; NHS-Primary Care Commisioning, 2011).

The boundaries of PCTs and CCGs have in general been made coterminous to the boundaries of local authorities (LAs), covering populations between 100,000 and 1,300,000. GP practice populations vary in size from small single-handed practices with only a few hundred patients to those with over 25,000 patients. Primary care health data have until now been grouped by existing administrative bodies such as Local Authorities (LAs) and Primary Care Trusts (PCTs). Information at LA or PCT level can be appropriate for National budget allocations but for local health care decision-making, different spatial units may be necessary and beneficial. GP catchment areas have been traditionally used for local planning. These are geographical areas with boundaries, usually historical, that have been notified to the PCT and with which it has agreed. Patients residing within a practice's catchment area can ask to register with that practice, with substantial restrictions on the ability of the GP practice to refuse that request.

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Practice catchment areas are not geographically exclusive, particularly in urban areas. Furthermore, proposals to extend patient choice of practice to be no longer contingent on place of residence were laid out in the White Paper *Equity and Excellence: liberating the NHS in 2010* (Department of Health, 2010b). The public consultation on these proposals is completed (Department of Health, 2010a) but detailed plans for implementation have yet to appear in the face of significant professional concerns about feasibility. Practices remain at liberty, though not currently obliged, to accept patients outside their agreed boundaries. They may also retain patients who either move outside their practice boundary or find themselves outside following boundary changes. The agreed catchment area does not, therefore, represent the true catchment (service utilisation) area of a practice.

Other approaches have also been used to depict the area in which the majority of registered population reside. Such previous approaches to characterise GP practice catchment areas have varied in their complexity (Norris, 1952; Bailey, 1956; Wilson and Gibberd, 1990; Goody, 1993; Bullen et al., 1996; Lowe and Sen, 1996; Shortt et al., 2005; Jones et al., 2011) but most have relied on existing administrative boundaries. As such, they do not allow the degree of overlap between catchment areas to be considered and are only rough approximations of the true service utilisation areas. In one study (Bullen et al., 1996), one out of the three proposed solutions relaxed the use of administrative boundaries in order to reflect patient–GP flows. Because data reported by administrative areas are not accurate, any measure of health, well-being, and determinants of ill-health using these spatial units, is potentially inaccurate and biased. This inaccuracy is greatest in urban areas and may have increased following the liberalisation of restrictions on patient registration (Department of Health, 2010a).

The aim of this paper was to define the boundaries of GP service utilisation areas according to the distribution of their registered patients and such that overlap was minimised.

2. Methods

Newcastle and North Tyneside form part of an urban conurbation of around half million people in North East England with populations of 260,000 and 190,000 respectively. Due to the urban setting a high degree of overlap between practices could be expected, making it a good location for an exemplar study on developing a methodology for more accurately defining GP service utilisation areas. The Newcastle and North Tyneside conurbation is known for a high degree of social and health inequalities (Hacking et al., 2011; Taylor-Robinson and Gosling, 2011). Approximately 40% and 20% of population in Newcastle and North Tyneside, respectively, live in areas ranked as the 20% most deprived in England (Association of Public Health Observatories, 2011).

We obtained over 400,000+ postcodes of patients' residential addresses from the NHS Strategic Tracing Service (NSTS) for the period 2002–2006. This database is utilised for a wide range of NHS purposes and is regularly updated. Postcodes are abbreviated form of addresses and on average contain 15 delivery points. We received postcodes for patients registered to all General Practices in Newcastle and North Tyneside PCTs. However, after removing practices specializing in specific services such as sexual diseases, our final sample included the registered patients of 64 GP practices. We accessed the data from the Exeter database, after getting approval by the PCTs' Caldicott Guardians. Patients' postcodes were provided on the 1st April for each year and were assumed constant for the rest of the year. Data cleaning involved the identification of outliers, such as postcodes more than 50 miles outside our study area, and missing data. Using Geographical Information System (GIS) software, we identified 77 postcodes as outliers and removed them from the dataset. We found 192 patients without an assigned GP practice, these were not considered for analysis.

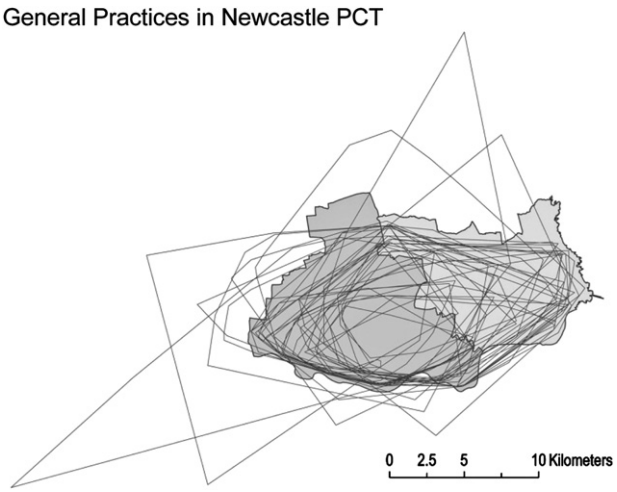

Fig. 1. Minimum Convex polygons depicting the area that all registered patients lived, by practice.

We drew a Minimum Convex Polygon around each practice population. The Minimum Convex polygons presented in Fig. 1 depicted the degree of overlap of service utilisation areas in Newcastle. Similarly, in North Tyneside the convex polygons were so extensive and overlapping that it was not possible to stipulate any catchment areas in that way. We then used kernel analysis to define three service utilisation areas per practice, out of the many options this approach allowed. We selected closely adjacent cut-off points (95%, 98%, 99%), in order to assess the sensitivity of the analysis to those measures. Previous approaches applied to hospital areas and based on administrative boundaries commonly cite the 75% nearest postcodes as cut off point (Phibbs and Robinson, 1993). Rather than using the 75% cut-off point to capture the core of service utilisation areas, we used values from the top of the range. This was because we were interested in examining the impact of kernel analysis on capturing the maximum extent of services areas, whilst reducing the overlap. The resulting spatial units represented the area in which 99%, 98%, and 95% of the practice population were expected to live.

The increase of choice on selecting GP practice may create more extensive catchment areas in the future. Where patients are more widely distributed, a lower cut-off point, such as 90%, could be more appropriate to capture the service area whilst removing what could be perceived as outliers. This could be evaluated by repeating the analysis and examining how extensive those areas become.

Kernel analysis has been described in the literature of geographical epidemiology (Bailey and Gatrell, 1995; Waller and Gotway, 2004) while previously it has been thoroughly described by Silverman (1986). This method has often been used in ecology to describe habitat selection and population dynamics of animals (Worton, 1989; Tufto et al., 1996). It has also been applied in public health (Petersen et al., 2009; Carlos et al., 2010) while it was recently used to examine school catchment areas (Singleton et al., 2011) and patterns of patient registration to GP practices (Lewis and Longley, 2012).

2.1. Statistical analysis

We used kernel analysis to estimate the patients' density per GP practice and define a spatial unit that could depict the area where the majority of patients were expected to reside. Kernel estimation is able to provide a smoothed estimate of a probability density from an observed sample of observations. The