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Geographical disparities in access to cancer management and treatment services in England

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ABSTRACT

This study seeks to examine the extent to which cancer services are geographically located according to cancer incidence, and assess the association with cancer survival. We identified hospital sites serving English PCTs (Primary Care Trusts) with the management and treatment of breast, lung and colorectal cancer. Geographical access was estimated as travel time in minutes from LSOAs (Lower Super Output Areas) to the nearest hospital site and aggregated to PCT level. Correlations between PCT level mean travel times and cancer cases were estimated using Spearman's rank correlation. Associations between PCT level mean travel times and cancer relative survival rates were estimated using linear regression with adjustment for area deprivation and for a PCT level measure of the reported ease of obtaining a doctor's appointment. We found that cancer services tended to be located farther from areas with more cancer cases, and longer average travel times are associated with worse survival after adjustment for age, sex, year and area deprivation. This suggests that geographical access to cancer services remains a concern in England.

1. Introduction

Equity in access to healthcare is an important policy objective in England. The NHS was founded on the principle that services would be available to everyone and would be free at the point of delivery (NHS, 2015). Equity is also embedded in the operating model for the commissioning of specialised services, where NHS England seeks to provide consistent services to all regardless of location (NHS England, 2012). The provision of equitable cancer services is dependent on how they are organised. In England, service configuration since the 1990s has been based on the Calman and Hine report that recommended high quality and also accessible cancer care (Calman and Hine, 1995). The report stated that, '*All patients should have access to a uniformly high quality of care as close to the patient's home as possible*' and that '*services should be planned to minimise travelling times whilst maintaining the highest standards of specialist care*' (Calman and Hine, 1995, p.6). These recommendations have been endorsed by consecutive Governments with particular attention paid to improving quality by establishing specialised cancer centres (Department of Health, 2000; Haward, 2006). Indeed, some improvements in cancer survival in England have been attributed to this increase in specialisation (Haward, 2006; Oliphant et al., 2013).

The Calman-Hine recommendations also introduced a dilemma with regards to centralisation of services that ensures all patients have access to specialist care without having to travel too far for it (Munro, 2001). Healthcare providers and policymakers are thus faced with the substantial challenge of delivering geographically equitable cancer services within the constraints of finite healthcare resources and in the face of rising cancer incidence rates. Some geographical inequalities in access are inevitable (Gatrell and Wood, 2012) because certain populations, such as rural residents, will always need to travel farther to access specialist services. Inequalities in access are however unacceptable when they lead to avoidable disadvantages in health, and when they disproportionally affect those most in need (Gatrell and Wood, 2012).

Access issues are felt more acutely by those with the greatest need for healthcare, such as patients with chronic conditions who require regular hospital visits, those with lowest mobility such as elderly or disabled patients and also the most deprived (Mungall, 2005; Bentham and Haynes, 1985). Poor access is also known to amplify the effect of deprivation, whereby patients with the longest travel times and also in the most deprived areas are least likely to have a histological cancer diagnosis and optimal treatment (Crawford et al., 2009). In the UK, studies using individual level data have shown a negative association between travel to hospital and uptake for cancer treatment (Jones et al., 2008; Lau

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et al., 2013) and increased odds of diagnosis at death (Jones et al., 2010). Longer distance to specialist cancer centres has also been associated with higher cancer stage at diagnosis (Campbell et al., 2001) and with poorer survival (Campbell et al., 2000). These findings have been replicated outside the UK; in France, road distance to the nearest cancer centre was associated with worse survival (Dejardin et al., 2008). Studies that have employed alternative measures of healthcare accessibility have reached similar conclusions. For instance, one North American study used a derivative of the gravity model to capture the availability (supply) as well as the attractiveness (demand) of services (Wang, 2006), the study demonstrated an association between poor geographical access and advanced cancer stage (Wang et al., 2008).

Our study builds on the existing evidence by investigating geographical inequities in access at a population level. We define geographical access as travel times in minutes from area of residence to the nearest hospital for cancer management or treatment. We have applied the definition of equity that is most generally accepted by policy makers; equal access for equal need (Oliver and Mossialos, 2004; Allin et al., 2007), with 'need' being the capacity to benefit where there is an effective and acceptable intervention to improve or prevent ill health (Matthew, 1971; Wright et al., 1998). Healthcare need at a population level can be measured by the 'level of ill health' (Allin et al., 2007) and epidemiological measures such as prevalence or incidence can be used to describe 'how much of it there is' and 'where it is located' (Acheson, 1978; Williams and Wright, 1998).

Geographical inequities in access will be determined where areas with higher need also have poorer access to cancer services. Additionally, geographical access will be associated with relative survival rates to determine whether areas with poor access also have the worst outcomes. Lung, breast and colorectal cancers are among the commonest cancers totalling to about 40% of all cancer incidence in the England and amounting to approximately 120,000 cases annually (Cancer Research UK, 2016a). Treatment for these requires access to MDT, chemotherapy and radiotherapy, and so they are appropriate cancer sites for this work.

2. Methods and materials

The study has a cross sectional ecological design, with measurements and inferences made at the level of NHS Primary Care Trust (PCT) area, as this was the scale at which data was available. It was not possible to obtain data on lower geographies for this study.

We used multiple sources to obtain information on the location of cancer hospital sites. In England, this information is collected by the National Peer Review Team (National Peer Review Programme, 2013) which holds details on the location of hospital sites that provide cancer treatment (chemotherapy and radiotherapy), and sites providing cancer management via multidisciplinary teams (MDTs). In order to account for the fact that patients in some parts of England may receive treatment in Wales and Scotland, we obtained similar Welsh data from the Welsh Health Directory (NHS Wales Informatics Services, 2015). At the time of the analysis, the Welsh Health Directory had complete information on the North Wales Cancer Network, but information was incomplete on the South Wales Cancer Network. Missing information was supplemented by Freedom of Information (FOI) requests from the Welsh Health Boards that are part of the South Wales Cancer Network. We also received data from the Information Services Division Scotland (Information Services Division, 2015) on hospital sites located in the southern Scotland Health Boards that may serve some English patients; Dumfries and Galloway, Borders, Ayrshire and Arran, Lanarkshire, Lothian and Greater Glasgow and Clyde. The Scottish data did not have information on MDT presence, and therefore hospitals offering chemotherapy were used as a proxy for presence of a MDT.

All the identified hospital sites were assigned a unique postcode, this is a geographical reference point in the U.K used to identify postal delivery areas (Office of National Statistics, 2015a). There are about 1.8 million postcodes and each have approximately 15–100 single addresses. Larger addresses that receive numerous mail items per day such as hospital sites, are assigned a single postcode and hence are accurately located (Office of National Statistics, 2015a).

Geographical access was determined as estimated travel time in minutes from all LSOA population weighted centroids in England, to the nearest hospital site offering treatment or management for the specified cancer. LSOAs are small geographic areas in England and Wales that are designed to improve the reporting of small area statistics. There are 32,844 LSOAs in England each with a population range of 1000 to 3000 residents (Office of National Statistics, 2015b). A population weighted centroid is a summary reference point at the centre of the population in a geographical unit (Office of National Statistics, 2013b). We used a Geographical Information System (GIS) (ArcGIS 10.3, Esri Inc.) Network Analyst module to estimate travel times from all 2011 LSOA population centroids in mainland England, to all postcodes of the identified hospital sites. The travel times generated at LSOA level were thereafter aggregated to the PCT level as this is the level at which cancer data was available. Aggregation was achieved by summing up all LSOA level travel times in a given PCT and obtaining an average. PCTs were English health administrations at the time of data collection that were responsible for planning and purchasing primary, community and secondary health services. They have a median resident population of 203,000 (Office of National Statistics, 2013c). There were 152 PCTs in England, at the time of this analysis.

The National Radiotherapy Advisory Group (NRAG) recommend travel of no longer than 45 min for radiotherapy treatment (National Radiotherapy Advisory Group, 2007) and therefore we used this as an important threshold for radiotherapy treatment. For travel to MDT and Chemotherapy, we used 20 min to mark an important threshold as this was the approximate average travel time to hospitals in England during the study period (Department for Transport, 2014). Further, we quantified the proportion of the population in England whose travel may exceed these thresholds using ONS 2009 mid-year population estimates (Office of National Statistics, 2013c; Office of National Statistics, 2013a).

The measure of population need adopted for this analysis was the number of cases of (breast (ICD-10 C50), colorectal (ICD-10 C17–21 and C26) and lung (ICD-10 C33–34) cancer in a PCT. This was obtained as a three year average for 2008 – 2010 from the publicly available National Cancer Intelligence Network (NCIN) dataset of newly diagnosed cancer cases per year (National Cancer Intelligence Network, 2010). Primary outcomes were identified as one and five year PCT relative survival rates for each cancer, also obtained from the NCIN public dataset (National Cancer Intelligence Network, 2014a). These relative survival rates were estimated nationally by NCIN using the actuarial method that divides observed with expected survival rates to give a population level relative survival rate (Parkin and Hakulinen, 1991; National Cancer Intelligence Network, 2014b). The 'observed one year survival rates' were estimated as the number of persons diagnosed with the specified cancer between 2010 and 2012 with mortality follow up to the end of 2013. The 'observed five year survival rates' were also estimated in the same way but for patients who had a diagnosis between 2002 and 2004 and followed up to 2009. The 'expected survival rates' were based on the population life tables matched by age, sex and period of observation (Parkin and