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The distribution of general dental practitioners with NHS contract numbers in relation to the distance of their practices from the seven dental undergraduate teaching hospitals in England outside London

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Objective To examine whether the presence of a dental school acts as an influence on the number of dentists practicing in the surrounding area. ***Research Design*** The project used Geographical Information Systems (GIS) mapping techniques, along with data on the location of NHS dentists, to plot dentist to population rates at selected distances from dental undergraduate teaching hospitals in England. A GIS map of dentist to population rates was then constructed for each of the dental schools and the rate patterns examined and compared. ***Results*** With the exception of Liverpool, the maps demonstrated higher than average rates up to two miles, and up to five miles for Manchester, from the location of the dental school before falling and then varying around the England and Wales average. No clear pattern emerged between dental schools, and no two schools produced a similar 'footprint'. ***Conclusions*** Within the constraints of the current study, it appears that for graduates from the seven dental undergraduate teaching hospitals in England outside London, who work as general dental practitioners with NHS contracts, factors other than the distance of a practice from their place of training appear to have a greater influence on their choice of geographical location where they work, than its distance from a dental hospital.

Key words: Decision making, dental, dentists, distribution, GIS, location, schools; workforce

Introduction

With inequality in workforce distribution around the United Kingdom, access to NHS dental care has become a problem for patients in many parts of the country. The recently announced expansion in dental student training may offer an opportunity to influence beneficially workforce distribution, in addition to overall dentist numbers.

It had been previously reported that dentists had a tendency to practice in the geographic area surrounding the dental school where they undertook undergraduate training (Coates and Rawstron, 1971), and a more recent paper by Fyffe and Pitts (1989) agreed with this but also considered the location of a dentist's original home and relatives, and market forces to be influential factors.

If the presence of a dental school was important to a dentist's choice of practice setting, then the location of any new dental school may help retain dentists in the local area, and may serve as a guide for the optimal location for any future dental training facilities.

This project was to conduct an investigation into dentist/population rates, relative to dental teaching hospitals, utilising data on the location of general dental practitioners (GDPs) holding an NHS contract in England. GDPs without NHS contracts, vocational dental practitioners, assistants and dentists working within the salaried and hospital dental services were not included. The working hypothesis was that the presence of a dental teaching hospital would influence the rate, producing a gradient radiating from the institution. If this relationship were established, it may be possible to develop a tool to predict the potential impact of dental undergraduate training facilities on access to NHS dental care within a chosen geographic area.

Method

The project used Geographical Information Systems (GIS) mapping techniques (Figure 1) along with available data on the location of NHS dentists, to plot dentist - population rates at selected distances from dental undergraduate teaching hospitals. The London teaching hospitals were not included due to the close proximity of several teaching hospitals. It was considered that if a distribution pattern did exist, it would be easier to demonstrate this around institutions with greater separation.

Data on dentist numbers and locations was obtained from the NHS Health and Social Care Information Centre, and population data from the Office for National Statistics (2001 census by output area). An initial map locating the dental schools to be studied was constructed

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Geographic Information Systems (GIS) is a computer technology that uses geographic information as an analytic framework for managing and integrating data. With geographic information systems, you can link information to location data, such as people to addresses, allowing you to see relationships or patterns intuitively that are not easy to see with traditional charts, graphs, or spreadsheets. In this paper, we are using what are known as choropleth maps, where data are classified into groups (based on ascending value) and a selection of colours are assigned to the groups. In this way we can communicate both the range of data values the mapped areas represent, as well as how those values differ geographically. The power of a map is that it should be able to show spatial patterns, if any such patterns exist.

Figure 1. *Geographical Information Systems*

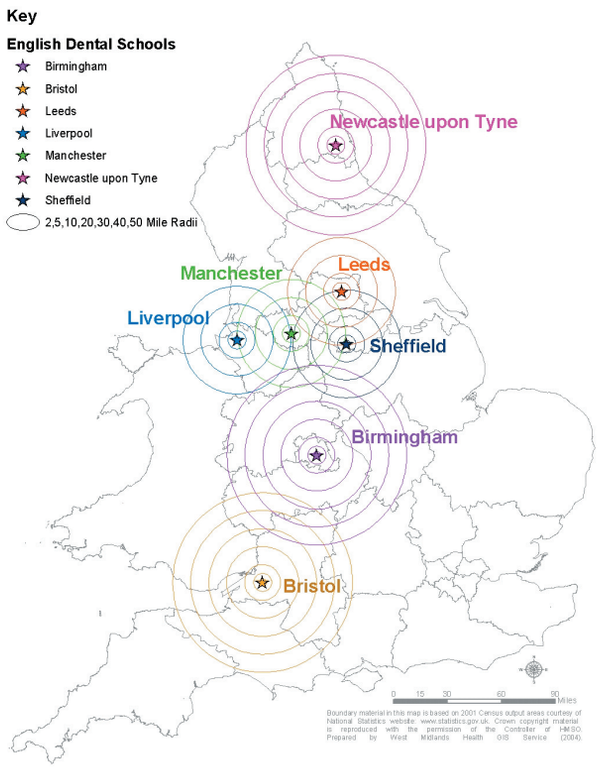

Figure 2. *Location of English dental schools examined in this study*

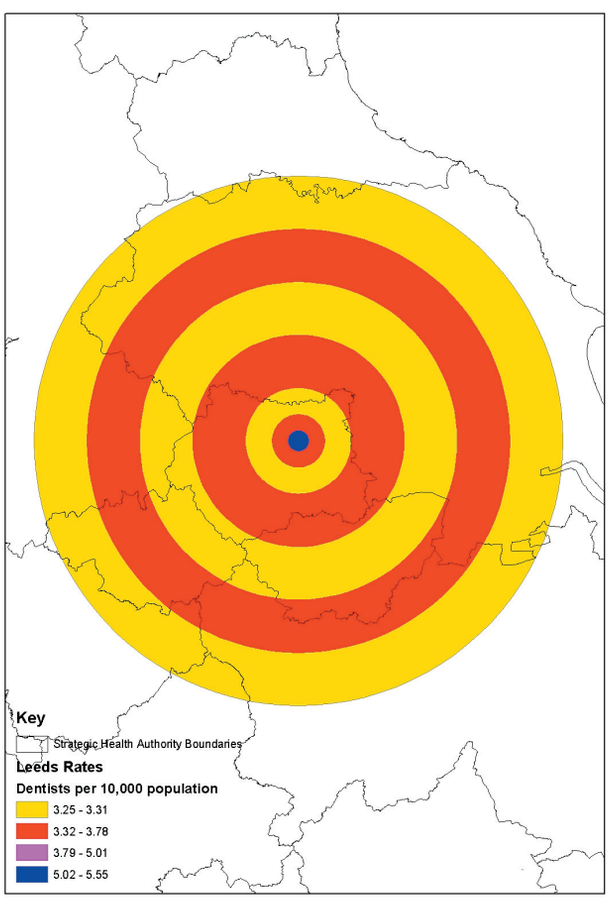

Figure 3. *Dentist to patient rates surrounding Leeds Dental School*

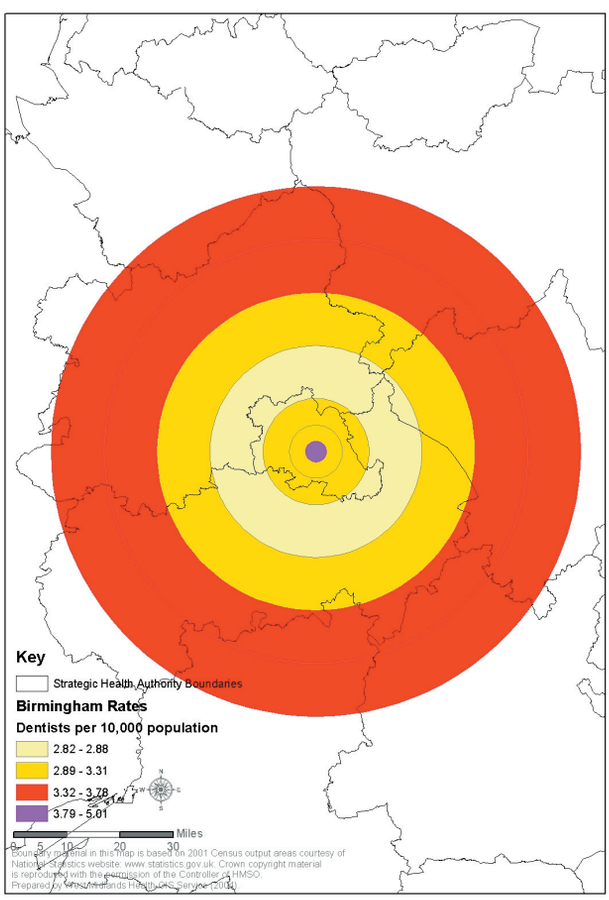

Figure 4. *Dentist to patient rates surrounding Birmingham Dental School*

with superimposed circles (Figure 2), arbitrarily set at a radius of 2, 5, 10, 20, 30, 40 and 50 miles. Considerable area overlap between schools was observed.

A GIS map of dentist:population rates was then constructed for each of the dental schools and the rate patterns examined and compared. The rate calculated for each band is based on the dentists and population within the enclosed area. Example maps are shown for Leeds and Birmingham, Figures 3 and 4. In addition, the rate profiles at the set distances were tabulated (Table 1) and overlaid in a graphical format to allow direct comparisons (Figure 5).

Results

With the exception of Liverpool, the maps demonstrated higher than average rates up to two miles, and up to five miles for Manchester, from the location of the dental school before falling and then varying around the England and Wales average of approximately 3.3 dentists per 10,000 population. Liverpool demonstrated a fairly consistent profile throughout, and Bristol produced a second peak at 20 miles. Each dental school map was unique with no obvious gradient pattern beyond two miles. No clear pattern emerged between dental schools, and no two schools produced a similar 'footprint'.

Discussion

This small project has demonstrated that the highest dentist/patient rate tends to be found within a 2-mile radius of a dental school. The subsequent mapping to PCT areas demonstrates the variability of NHS dentist to patient rates across England and Wales, with a tendency for lower dentist numbers in the North, the East, Wales and the South West.

The methods used in this project were simple and many variables are likely to be involved in where dentists chose to set up practice. It is also acknowledged that the holding of an NHS number does not necessarily reflect the level of commitment to the NHS, or the availability of access to care. The number of non-NHS dentists and their distribution was not considered.

Previously, Taylor *et al* (1976) found that dentists graduating in Manchester were more than twice as likely to practice in the type of area from which they originated

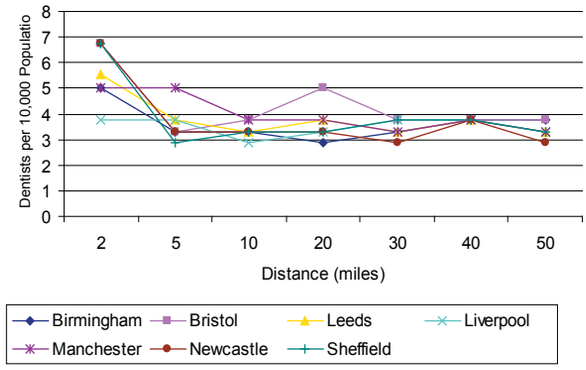

Figure 5. *Dentist to population rates for Primary Care Trusts in England and Wales*

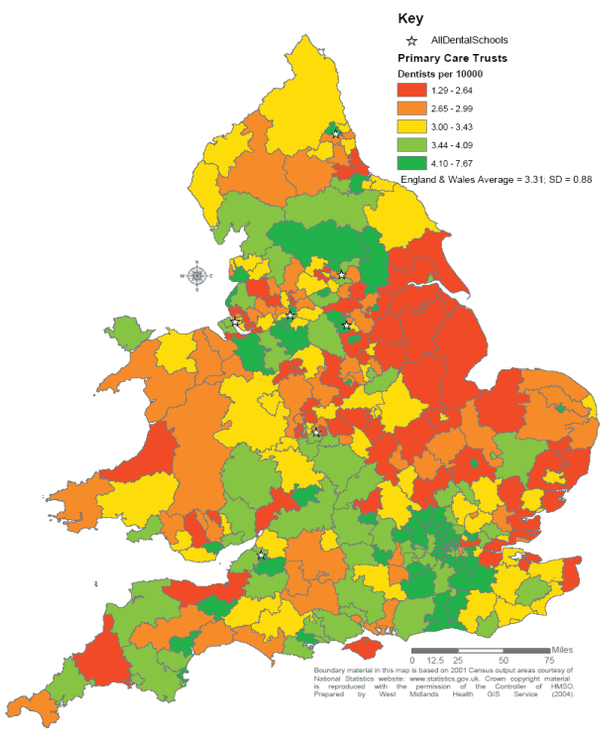

Figure 6. *Dentist to population rates for Primary Care Trusts in England and Wales*

Table 1. Dentists to population (per 10,000) around dental schools

	Distance (miles)						
Dental School	0 - 2	2 - 5	5 - 10	10 - 20	20 -30	30 - 40	40 - 50
Birmingham	5.01	3.31	3.31	2.88	3.31	3.78	3.78
Bristol	6.74	3.31	3.78	5.01	3.78	3.78	3.78
Leeds	5.55	3.78	3.31	3.78	3.31	3.78	3.31
Liverpool	3.78	3.78	2.88	3.31	3.78	3.78	3.31
Manchester	5.01	5.01	3.78	3.78	3.31	3.78	3.31
Newcastle	6.74	3.31	3.31	3.31	2.88	3.78	2.88
Sheffield	6.74	2.88	3.31	3.31	3.78	3.78	3.31

than to practice in an area of different dentist/population ratio. They also stated that any effect of proximity to undergraduate school tended to diminish over time. Lennon and Sharples (1979) found that within the West Midlands, the majority of students recruited locally remained to practice locally. This was also reported to be true for Newcastle students. This finding is supported by Thexton and McCarrick (1983), who considered that a local recruitment policy may help retain dentists close to school of origin, and conversely undergraduates recruited from other parts of the country have a tendency to be eventually lost to their region of origin.

A Scandinavian study (Sjostrom, 1996) also supports these findings but in addition found that if dentists did not go back to their place of origin, they tended to go to places that were comparable, for example those originating in remote areas tend to return to work in such areas.

Beyond a 2-mile radius from its location, the presence of a dental school has not been shown to be a principal determinant of the number of NHS dental practitioners. No convincing patterns can be seen in the GIS mapping in this project, and the concentration of dentists in any geographic area would appear to be more greatly affected by other factors.

Additional Mapping

During this work, a paper was published in *International Journal of Health Geographics* (Boulos and Phillipps, 2004), comparing the ratio of NHS dentists to population, for England and Wales, to other western countries using a 'traffic lights' method, to highlight those areas with the lowest ratios. This paper used data from the Dental Practice Board, which included vocational dental practitioners and assistants. Using our data set for principal dentists, maps were produced for Primary Care Trust geographic areas (Figure 6) using the same principles.

Our results suggest that the presence of a dental school may positively influence dentist to population ratios, but for only up to around two miles. Beyond this distance the ratio tends to be around the national average. Mapping of dentist to population ratios based on PCT areas illustrates the variability in this ratio over the country, at PCT boundary level.

Conclusions

In conclusion, factors other than the location of a dental undergraduate teaching hospital would appear to be of greater influence on where dentists set up in practice.

If we consider the available evidence, it may be postulated that if we wished to attract and retain dentists in specific geographic locations, we may be most successful if we recruit the undergraduates from the areas that we would wish them to eventually practice. It may be further conjectured that the establishment of a dental school in an under provisioned area, may attract local undergraduates who would then remain in the surrounding area.

Acknowledgements

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