Placing the Practice: GP Service Location Planning using GIS in Brighton & Hove

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ABSTRACT

Brighton & Hove City Primary Care Trust carried out an investigation in 2002 to establish the value of GIS in aiding decision-making to identify new surgery locations in the city. Using patient data and surgery catchments a number of additional re-location decisions were also modelled within the GIS. There were a number of data issues which affected the final modelling and which would be applicable in a wider primary care setting However the GIS was perceived by the PCT as being successful in providing outcomes which will directly assist in spatial decision making to model existing locations and identify potential new sites for GP surgeries in Brighton & Hove.

***Keywords and phrases*:** GIS, GP service planning, decision-making, geographic access to services.

Introduction

Brighton & Hove is a new city in the south of England with a mobile population of 247,820 that is in turn reflected in a complex and changing General Practitioner (GP) practice structure. To manage this change and reflect it's status as an 'under-doctored' area, the newly formed Brighton & Hove City Primary Care Trust needed to look closely at issues relating to existing practice distributions and service delivery to help plan for this changing future (Parker & Campbell 1998, Gatrell & Senior 1999, Thrall 1999). As part of the decision-making process, GIS have been used as an essential tool to map, visualise and model existing practice information and identify important issues linked to accessibility and utilisation (Haynes et. al. 1995, Smith & Jarvis 1998, Richards et. al. 1999, Smith, Higgs & Gould 2002). The visualisation of the spread of patients for each practice was of interest to both GPs and PCT planners (Lovett et. al. 1998, Higgs & Gould 2001) and breakdowns by age and gender were made possible by this process (Hirshron & Stewart 2001). The location of patients was mapped using geo-referencing techniques to show the individual and citywide distribution of patients and how they matched existing city and catchment boundaries (Rushton 1998).

Aims & Objectives

The initial aim of the project was to use the GIS to aid decision-making and a number of set objectives were tied in to that aim based on current primary health care planning issues within the PCT. The objectives of the work were three-fold: 1) to map the location of patients and practice catchments within Brighton & Hove; 2) to identify the potential location of new practices in an area which was known to be 'under-doctored' and; 3) to develop a set of case studies of GIS use in the planning of individual practices or areas within the city (Parker & Campbell 1998, Weber & Kwan 2002).

Methodology & Data Issues

The main sources of data were the latest GP patient list updates (February 2002) as well as main and branch surgery information. Patient data were anonymised but included information on age, gender, registered GP and unit postcode. Surgery information included data on location and individual practice catchment areas, which were digitized into the GIS from paper maps collated by the practices.

The technical process of conversion of these data threw up a number of data issues and problems (Dunn et. al. 2001). Individual patients were mapped against their unit postcode of residence. This process was carried out using the OS Code-Point product, which matched individuals to the unit postcode centroid. This led to some shifting of exact patient locations and multiple patients with different addresses were matched against a single point. However, all patients were correctly geo-referenced within the GIS and the relocation did have an implicit function of protecting patient anonymity. There were two significant problems with the postcoded data which related to incorrect entry at source and a recent change to the BN2 2 postcode sector, which had been split in December into two new sectors, BN2 0 and BN2 9. These changes were so recent that they had not yet been updated within the geo-referencing source data. Additional problems related to the numbers of registered patients, which given the nature of NHS records is exaggerated by an order of up to 14% in some places (Lovett et. al. 2002). With the exception of the over-counting issue, these data problems were broadly ironed out at the data cleaning stage.

Analysis & Results

In terms of the objectives listed above the following is a brief listing of results from the GIS modelling of the data. Individual practices were mapped alongside their theoretical catchments within the GIS. Results showed that for all fifty GP practices, the average number of registered patients per practice was 2,107 with a range from 575 to 4,156. From a catchment perspective, approximately 10% of all patients came from outside catchment boundaries while the data for individual practices ranged from around 75% to 100%, an average of 90%. A crude location-allocation process was carried out which sought to compare a theoretical distribution with both a modelled and actual distribution of patients and surgeries (O'Sullivan et. al. 2000). Theoretical modelling suggests an average of 4,872 for each surgery, compared to an existing approximate figure of 2,107 and many of the re-allocated patient numbers suggest an optimal list size of between four and six thousand. However, important variables such as number of GPs per practice, upper limits for list size and branch surgery location were missing from this process as they were difficult to model due to the limitations of the GIS.

Another key analytical process included flexible community/area identification to identify exactly which patients went to which practice. Visualisations of such clusters were particularly well enabled by the GIS. Travel distances to surgeries were modelled to identify numbers of patients within a specified road distance/travel time zone for each practice (Lovett et. al. 2002). This allowed the PCT to model patient accessibility based on a travel distance basis. The modelling of the relocation of a specific surgery found that the number of patients within three kilometres of a selected surgery (Surgery A) would be increased by relocation from 81.22% to 84.73%. However this was counteracted by the more significant localised access within one kilometre, which would be significantly reduced from 37.26% to 11.25%. The results are listed in Table 1 below and relate to a very specific decision that the PCT is currently discussing in terms of practice relocation. As part of that decision a second surgery (Surgery B) was also modelled into the equation and showed a similar pattern where access would actually be lessened by relocation.

Table 1. Surgery Relocation and Impact on Patient Accessibility for two neighbouring GP practices in central Brighton.

Surgery A - Existing Location (Lewes Road)			**Surgery A - Proposed Re-Location (Preston Barracks)**		
Travel Distance Buffers	**Population**	**%**	**Travel Distance Buffers**	**Population**	**%**
All Practice	9926		All Practice	9926	
Within 1 km	3698	37.26%	Within 1 km	1117	11.25%
Within 2 km	6925	69.77%	Within 2 km	6230	62.76%

Within 3 km	8062	81.22%	Within 3 km	8410	84.73%
Surgery B - Existing Location (Hertford Road - Main Surgery only)			**Surgery B - Proposed Re-Location (Lewes Road – Previous location of Surgery A)**		
Travel Distance Buffers	**Population**	**%**	**Travel Distance Buffers**	**Population**	**%**
All Practice	4346		All Practice	4346	
Within 1 km	1458	33.55%	Within 1 km	507	11.67%
Within 2 km	2665	61.32%	Within 2 km	2539	58.42%
Within 3 km	3399	78.21%	Within 3 km	3296	75.84%

Another of the original objectives of the study was to identify potential locations for the placement of new GPs. The GIS used two methods to do this, by looking at the ideal location of surgeries. The first was based on a simple straight-line distance and a second more sophisticated method modelled travel time to surgeries alongside the relative size of the practice. Using both methods a number of significant clusters, especially to the north and west of the city, were identified as potentially filling gaps in existing primary care provision. However, the second approach uncovered a significantly larger number of clusters and total 'under-served' populations. The results are listed in Table 2 below.

Table 2 Potential Locations of new GP Surgeries in Brighton & Hove

Method 1			**Method 2**	
Straight Line Distance > 1kilometre to practice			**Travel Distance weighted by Practice Size**	
Cluster	**Patients Under-served**		**Cluster**	**Patients Under-served**
1. Westdene	2,442		1. Westdene	3,203
2. North Moulsecoomb	1,905		2. North Hollingbury	587
3. Bevendean	1,613		3. East Hollingbury	1,386
4. Marina	954		4. Falmer	6,988
5. West Woodingdean	374		5. North Moulsecoomb	980
6. Ovingdean	617		6. Bevendean	1,759
7. North Saltdean	1,516		7. Whitehawk	721
			8. Marina	1,606
Total	9,420		9. Ovingdean	2,008
			10. East Woodingdean	3,174
			11. Rottingdean	1,146
			12. North Saltdean	1,117
			Total	24,675

Conclusion

The development of GIS modelling within the PCT will be used initially as part of a process to decide where to allocate new GPs and where to locate potential new or modify current surgeries. The data on catchments was particularly useful to the PCT in terms of discussions with the practices about catchments and closed lists which is likely to be an issue in the developing area of primary care planning in the UK. In the process of developing

and demonstrating the system to the primary care management team at the PCT, information was enabled to support a number of additional policy issues. Indeed the ability to match patients location against catchments opened up a new set of data which had not previously been available. The PCT is keen to develop this research project to incorporate more detailed considerations of list constraints, accessibility, transport availability, specialist provision as well as more detailed scenario modelling of additional/replacement surgeries (Weber & Kwan 2002). Other key outputs related to data management, data gaps and ethical and confidentiality issues which will affect many PCTs and which need to be addressed to enable more efficient GIS use in primary health care planning (O'Dwyer & Burton 1998, Melnick & Fleming 1999).

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