

**THE USE OF A GEOGRAPHICAL INFORMATION SYSTEM  
IN IMPROVING THE EFFECTIVENESS OF THE  
COMMISSIONING OF DENTAL SERVICES - BACKGROUND**

Debbie White and R.J.Anderson

School of Dentistry

Dental Public Health

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Contents

[Background](#)

[Geographical Information Systems \(GIS\)](#)

[The Project](#)

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**Background**

There is a wealth of information for commissioning. This information includes, the dental epidemiology data collected locally on an annual basis and the information from the Dental Practice Board as to the cost and volume of service delivered, which is available quarterly. Local information about the location and time worked by general dental practitioners plus the demographical information about the region is available from local commissioning authorities or national sources. This information is rarely used and never to its fullest extent, as there are no reliable and agreed methods of condensing or interpreting it.

In October of 1994 the academic team of Dental Public Health at The University of Birmingham School of Dentistry was commissioned by the Regional Director of Research and Development to undertake a two year program of development directed towards improving the Oral Health of the Population of the West Midlands Health Region, by improving the effectiveness of the commissioning of dental services.

The objective of the development program was to use existing research information to develop reliable procedures that can be applied throughout the region to enhance the capacity of purchasing agents to identify targets for dental health care, plan future dental provision, assess the effectiveness of alternate providers and methods of provision, implement Oral Health Strategy targets and monitor performance in relation to these targets. For the two years the study would concentrate on the development of the available information to show the pattern of *need* linked to geographical, ethnic and social factors and the pattern of *provision* of primary care dental service, the numbers of persons providing primary care dental services and the skill mix, linked to geographical, ethnic and social factors.

It was agreed that the academic team would work in conjunction with a group of health service colleagues from the region comprising two FHSA General Managers, a FHSA General Dental Practice Adviser, the Regional Dental Officer and two other consultants in Dental Public Health.

The outcome of the project was that a manual would be produced. It would contain details of where the information was to be found, methods by which it could be collated and how the findings might be interpreted so that it would be of value in purchasing. It was hoped that draft versions of the manuals would be field tested by organisations involved in purchasing. When complete the manual would be available for all those purchasing dental services throughout the region. In addition a member of the development team would provide seminars, tutorials and workshops on the findings and give assistance to purchasers using them for the first time. It was envisaged that these manuals would contain principles which would be of value to the purchasers of other primary care services.

The project has taken place over a period of large scale re-organisation of the health service. The Regional Health Authority has become the Regional Office of the NHS Executive, Health Authorities and FHSAs have merged, as have

some individual health authorities. This has made it impossible to recruit and to hold meetings of the development team with colleagues from the health service. It was possible, however, to discuss the project and its progress with colleagues individually and to incorporate their comments. In addition, in the latter stages of the work the progress has been demonstrated to the Chief Dental Officer and other officers of the Department of Health, and to individuals representing most aspects of the dental profession.

### Geographical Information Systems (GIS)

There are several, commercially produced, geographical information systems available for desktop computers. These packages work with two types of information files. One type contains geographical information such as might be observed on any map. These geographical files are usually commercially produced and contain as much detail as required by the user. They often contain country, county or administrative boundaries and the location of towns, roads and railways. To enable this information to be used by mapping programmes it has to contain information as to the location of the features according to a defined mapping projection. Latitude and Longitude are a common example. However, within Britain the British National Grid System used by the Ordnance Survey is the most common projection. This system, which has its origin to the south west of the Isles of Scilly, has the potential to locate every site within Britain to the nearest metre using a pair of six figure references indicating the distance of the point, in metres, from the origin in a Northerly and in an Easterly direction. These co-ordinates or grid references are known as the Northings and Eastings respectively. It is the convention, when referring to Ordnance Survey maps, to find the Eastings quoted first and the 100,000 grid square identified by two letters. In practice location is accurate to the nearest 100 meters so for ease of use the first figure and the last two of each six figure Easting and Northing are often omitted when referring to a point on a particular Ordnance Survey map.

To use the British National Grid projection with a geographical information system the co-ordinates have to be expressed as six figure references based on the origin. To relate to the conventions of the program, the projection is known as Ordnance Survey Great Britain (OSGB) Eastings are referred to as Longitude and the Northings as Latitude. Longitude is usually quoted first.

The other type of information file used by geographical information systems are data files or tables. There are two types of data tables, attribute and points tables. The attribute tables contain in each row information associated with a geographical feature. The values describe each feature's individual characteristics or attributes. These tables are linked to geographic files using the name of the features to identify the attributes to the geographical features. Table 1 is an example of data suitable for an attribute file. Information in attribute files is used to produce thematic maps which demonstrate the differences between regions or locations.

Each row in a points table contains information about a single point on a map. This information must include the co-ordinates but may also include details of the attributes of the point. The co-ordinates are used to plot the location of the points and the attributes to change the size, or the shape of the points.

The geocodes or co-ordinates using the British National Grid projection for a points file may be found in two ways. The traditional method is to find the location on an Ordnance Survey map and then read the co-ordinates from the grid printed on the map. The second method may be used where the location is known by its address. The Royal Mail has allocated a Postcode to every address in the United Kingdom. Each Postcode is either unique to a single address or covers a group of residences numbering up to about twenty. It is possible to obtain from the Royal Mail a system known as Address Manager which contains details of all addresses in the UK, their allocated postcodes plus the British National Grid co-ordinates for the location or centre of the location where several residences have the same postcode. This information can be accessed using postcodes, or if necessary, details of addresses. The information available on the Address Manager system can also be incorporated into the Geographical Information System data files, known as lookup files, which enables grid references to be added to files which contain postcodes.

A Geographical Information System which has been established to include all the relevant information may be used in a variety of ways. The mapping of any file either geographic or table is plotted as a layer. Each layer can be presented in an infinite number of ways and either singly or more usually overlying each other. The major advantage of the system is that it can also be used to undertake detailed querying and analytical procedures on the data and to display it in an effective way as possible. Some analytical procedures may not require a graphical output but benefit from being able to incorporate the spatial relationships between features. In addition it is possible to select individual features on a map and display all the available information which relates to that point.

The whole system may be used to interrogate the data according to the needs of the user in a real time setting rather than by using a predetermined processing system. This property allows individual users to pose their own questions of the information rather than be given set answers to questions devised by others. Such a property is of particular advantage when a large amount of information from different sources is available and it is impossible to predict what might be used by an individual user in a particular circumstance.

## The Project

The value of a Geographical Information System in achieving the aims of this project became clear at the start of the work as it would enable all purchasers to use all the available information in a way which best suited their own particular circumstances. Thus the project was devoted to detailing the available information and showing how it can be used in a Geographical Information System, rather than producing a set of didactic guidelines for analysing the data which might, at best, be useful to a few.

Throughout the project the Geographical Information System used was Atlas GIS version 3. Progress with all aspects of Information Technology is such that, towards the end of the project, the program was no longer supported in the UK and was replaced by other systems. One of the newer systems (ArcView Version 2.1b) has been used with the information described in this document and the facilities are very similar to those described here. Some aspects are easier to use and others more difficult. In order to conclude this project it was decided to continue using Atlas GIS throughout. This does mean that some of the detail will be inappropriate to users of other GIS systems. However, the principles remain the same and will be of assistance to the reader.

Some of the information presented in the appendices relates to the use of the specific programmes used for the project. The details are included to help those who might be using the same or similar programmes. They are meant to be used as direct guidance when using the program and thus the detail should be ignored if it is being read without the programme running on a machine at the same time.

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[Return to Contents Page here](#)

[Return to File Transfer Contents page here](#)

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