Using geographical information systems to plan dialysis facility provision

Sir,

We read Toubiana et al.'s article on geographical information systems (GIS) with interest [1]. They suggest that GIS may be used to plan healthcare delivery, and we can confirm that. In Scotland, the government provides funding for universal healthcare to 15 National Health Service (NHS) Boards, with the level of funding based on population, deprivation and rurality. These Boards are responsible both for the strategic planning and the delivery of all healthcare. The Scottish government has set a target that all patients should be able to access a haemodialysis unit within 30 minutes of their home, ‘within the constraints of population density and geography’ [2]. Previous research has confirmed that travelling times in excess of 37 minutes impact on take-on rates and thus presumably patient survival [3]. Furthermore, a Scottish Renal Association patient survey identified travelling time as the single greatest concern for patients (B.J.R. Junor, personal communication). Scotland has one of the most challenging geographical situations in Europe for the provision of dialysis, with a low population density of 65 people/km² (ranging from 8 to 1560 people/km² in the fifteen NHS Boards), and 99,638 people (2% of the population) living on 55 islands [4], with frequently difficult weather conditions.

NHS Dumfries and Galloway is one of the more rural NHS Boards with a population of 147,210 and a population density of 23 people/km² [4]. Currently, there is only one dialysis unit, in the main town of Dumfries. As a result the Board fails the government target badly, with 45% of renal replacement therapy (RRT) patients living >30 minutes from a dialysis facility (compared to a Scottish average of 15,000 miles per year) solely for the purpose of dialysis, compared to 2% elsewhere in Scotland (P < 0.001) [5]. The Board plan to open a satellite dialysis unit to solve this problem. We used ArcGIS 8.3 and ProTerritory 1.0.591 with Bartholomew’s 100 m road grid, to analyse the travelling time to the current and proposed dialysis facilities, for all RRT patients resident in the health board. We included all patients started on RRT between 1982 and 2002; all RRT patients potentially require hospital-based dialysis at some point in their life; a 21 year period was used to average out the likely requirements in low population areas. The software identifies the position of the dialysis facility and each individual patient using their postcodes ( Routinely collected by the Scottish Renal Registry), and calculates the estimated travelling time between the two points using an electronic map of the road network and estimated average speeds on each type of road. Postcode units in Scotland contain an average of 13 (range 1–100) delivery addresses. Using this software we generated maps of the current dialysis provision, and the relative impact of opening a satellite dialysis unit at two proposed sites (Table 1 and Figure 1). The impact on the neighbouring NHS board was also taken into account. Further details of our approach are available on the Scottish Renal Registry website (http://www.show.scot.nhs.uk/srr/Publications/DGNHSB_Time_Travel_Report.pdf). As a result of this work, the NHS Board agreed to situate the new satellite unit in the far west of the region, in Stranraer (labelled Garrick Hospital in Figure 1 and Table 1).

We believe this approach allows evidence-based planning of the provision of healthcare facilities, and is also useful in identifying gaps in provision. It is likely that such an approach would still be of value in countries with other funding and organizational structures, as long as complete data on the location of dialysis patients and facilities were freely available. We are currently applying the same approach on a whole-country basis, and our preliminary data are available on the same website (http://www.show.scot.nhs.uk/srr/Publications/Travelling_Time_Preliminary_Report.pdf). Areas of under-provision are clearly identified, according to government targets. Our experience suggests that this approach should be used routinely in healthcare planning.

| Table 1. Patient travelling time to the closest dialysis facility: impact of two proposed sites for a new satellite dialysis unit |
|---------------------------------|-----------------|-----------------|
|                                 | Current situation | Option 1 (Garrick) | Option 2 (Newton Stewart) |
| Median travel-time (range)      | 28 (1–113) min   | 22 (1–63) min    | 26 (1–57) min             |
| Patients exceeding 30 min target| 44.8%            | 25.6%            | 33.9%                      |
| D&G patients closer to A&A dialysis unit | 17.3% | 1.1% | 1.1% |
| A&A patients closer to D&G dialysis unit | 0% | 3.5% | 3.5% |

Fig. 1. Patient travelling time to the dialysis unit. Shaded areas represent 30 min isochrones around existing and proposed dialysis units. Bars represent the number of patients exceeding 30 minutes travelling time in each postcode sector (postcode unit data are amalgamated into sectors in the map to protect patient anonymity). (A) Impact of opening unit at Newton Stewart Hospital. (B) Impact of opening unit at Garrick Hospital.
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Reply

Sir,

MacGregor et al. give an interesting example of the utility of Geographical Information Systems (GIS) in the planning of dialysis facility provision. In effect, GIS permits decision-making for health programmes at local, state and governance assessment levels [United States National Public Health Performance Standards Program http://www.phppo.cdc.gov/nphpsp/EssentialPublicHealthServices.asp]. For local assessment, GIS demonstrates accessibility and quality of services delivered and the effectiveness of personal and population-based programmes provided. This level provides information necessary for allocating resources and reshaping programmes. For state assessment, GIS may contribute to the evaluation of patients’ health status and service utilization data, helping to assess programme effectiveness and to provide information necessary for allocating resources and reshaping dialysis and renal transplantation programmes to improve efficiency, effectiveness and quality. GIS permits the elaboration of scenarios supporting more effective planning for dialysis as well as for transplantation services. For governance assessment, GIS may contribute to the assurance of ongoing evaluation and critical review of dialysis or transplantation programmes based on analysis of health status and service utilization data.

Sir,

We read with great interest the article by Voytovich et al. [1], demonstrating the beneficial effect of a new insulin sensitizer, rosiglitazone, in renal transplant recipients. They concluded that short-term treatment with rosiglitazone improves glucose tolerance, insulin sensitivity and endothelial function in this group of patients.

The treatment modalities for diabetes mellitus and glucose intolerance include lifestyle modification, diet, exercise and pharmacologic intervention [2]. In this study, the authors did not give any information on dietary intervention, which is the mean predictor of the blood glucose level in diabetic and glucose-intolerant patients. Although this was not a crossover study, as the authors reported in the limitations section of the study, it might have been better to give a 4 week study period with a standard diet for all patients, in order to exclude the effect of nutritional factors. Also, seven patients were determined as post-transplant diabetes mellitus (PTDM) according to oral glucose tolerance test (two of them were previously known PTDM), but the authors did not give any information on the patients’ glycohaemoglobin or fructosamine levels, which could be more valuable parameters (not influenced by acute changes in blood glucose) before and after the rosiglitazone, even in a 4 week period. Fructosamine seems to be a more suitable measure in this study design, because it is a more sensitive marker for abnormal glucose tolerance and it reflects 3–4 weeks’ blood glucose control [3].

The main immunosuppressive agents responsible for PTDM are calcineurin inhibitors and steroids. Current evidence shows greater diabetogenicity of tacrolimus in multicentre studies [4]. Therefore, it would be interesting to see if there is any correlation in insulin resistance and the response to the rosiglitazone between the patients on cyclosporin or tacrolimus.