



Final Report

produced by

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of

**The Common Services Agency
Information & Statistics Division**

and the

Scottish Renal Registry

for

Dr. C.G. Isles, of Dumfries and Galloway Royal Infirmary

in relation to

GIS Mapping of Travel-times for Renal Replacement Therapy Patients

for the period of February/March 2004

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1. Executive Summary

- **NHS Quality Improvement Scotland has set the target that NHS Boards should provide hospital dialysis within 30 minutes of all patients' homes, allowing for the constraints of population density and geography**
- **This target is based on patients' priorities, and on evidence that access to dialysis (and thus survival) diminish at travelling times greater than 37 minutes**
- **Dumfries & Galloway NHS Board fails to achieve this target for 45% of its renal replacement therapy population, compared to a Scottish average of 10%. It is the second worst performing mainland health board. If DGNHSB was performing at the average level for Scotland, after correcting for population density, only 19% of patients would be outwith the target**
- **Opening a satellite dialysis unit in Stranraer will reduce the number of patients outwith the target to 26%, with the median travelling time being reduced from 28 to 22 mins**
- **Opening a satellite dialysis unit in Newton Stewart will reduce the number of patients outwith the target to 34%, with the median travelling time being reduced from 28 to 26 mins**
- **When establishing a new dialysis unit, service planners should be aware that opening a satellite unit might lead to an increase in the local uptake of dialysis, and may also lead to different choices in type of dialysis**

2. Background

Haemodialysis is a life-saving treatment for patients, but very time-consuming, requiring 12-15 hours of treatment per week. Considerable additional time is spent travelling to and from dialysis units, waiting to be put on dialysis, and waiting for hospital transport. In a survey of patients by the Scottish Renal Association, transport was identified as the most important treatment quality issue. This has been recognised by NHS Quality Improvement Scotland, which set the standard that all NHS Boards should provide hospital haemodialysis within 30 minutes travel-time of patients' homes, allowing for the constraints of population density and geography (1).

Three previous studies have examined this issue in the UK and found that, the acceptance rate for dialysis declines with increasing distance/travel-time from a dialysis unit (2-4). The largest study identified a threshold at 37 minutes from a unit, beyond which patients were less likely to be offered dialysis (2). This provides the logical basis for the NHS QIS target.

Morbidity and perhaps mortality of renal replacement therapy patients may be adversely affected by increasing distance from a dialysis unit, as patients will not be able to switch to hospital haemodialysis freely. There is however no evidence available on this issue.

Dumfries & Galloway NHS Board faces greater challenges than most other NHS Boards, because of its low population density of 23 people per km² (5), and very poorly developed transport infrastructure.

3. The Brief

- Would a satellite dialysis unit have a bigger impact on patient travel-times, if it was opened at the Garrick Hospital, Stranraer, or at Newton Stewart Hospital?
- Would these satellites improve patient travel-times for patients in South Ayrshire?

4. Methods

The patient data were extracted from the Scottish Renal Registry. All patients who started renal replacement therapy (RRT) between 1st January 1982 and 31st December 2002 were included. This timescale was used (as opposed to current patients on dialysis), to smooth out the effect of varying prevalence rates over time in relatively small geographical subunits. This is particularly important when dealing with small populations such as Dumfries & Galloway. Patients were included regardless of current or previous type of RRT, because a high proportion of patients will require hospital haemodialysis at some point in their “dialysis career,” and because all patients should have the option of hospital haemodialysis available to them.

The most recent postcode available for each RRT patient who resided in Dumfries & Galloway or Ayrshire & Arran NHS Boards was identified. A postcode was identified for each existing dialysis unit (Dumfries & Galloway Royal Infirmary; Crosshouse Hospital, Kilmarnock) and each potential dialysis unit (Garrick Hospital, Stranraer; Newton Stewart Hospital).

A travel-time for all patients, from their home to every actual and proposed dialysis facility was calculated, using the fastest available road route. The software used for the analysis was: ArcGIS Version 8.3 with Proterritory module version 1.0.591 (26th May 2003), based on Bartholomew’s 100m Road Grid. Travel-times were calculated based on the following travel-time assumptions:

Road Type	Rural (mph)	Urban (mph)
Motorway	52	34
Dual Trunk	48	28
Single Trunk	48	28
Dual A Road	45	25
Single A Road	45	25
Dual B Road	32	20
Single B Road	32	20
Unclassified	24	16
Landfill	10	10
Unknown	6	4

All travel-time data are calculated using postcode units (e.g. DG3 4SD), which are small geographical areas containing no more than, but usually substantially less than 80 delivery addresses. Map data are restricted to postcode sectors (e.g. DG3 4?), to preserve patient anonymity. Barnardisation is also employed to protect patient anonymity: if the number of patients in a sector is x , then the graph will show x , $x+1$ or $x-1$, unless $x=1$ in which case 1 or 2 will be shown, or if $x=0$, then 0 will be shown.

Data presented are based on the assumption that patients will be treated at their nearest available dialysis unit. It is also assumed that the transport provided for those patients will be efficient and direct.

5. Results

7882 patients started renal replacement therapy between 1982 and 2002 in Scotland. Of those patients, 285 resided in Dumfries & Galloway at the time of analysis, or immediately prior to death and 8 had no valid postcode, leaving 277 for analysis, and 532 resided in Ayrshire & Arran, of whom 10 lived on Arran (a travel-time cannot be generated for islands), and 13 had no valid postcode, leaving 509 for analysis.

Current Situation

Currently, there are dialysis facilities in Dumfries & Galloway Royal Infirmary and Crosshouse Hospital. In Dumfries & Galloway NHS Board, the median travelling time is 28 minutes, with a range of 1-113 minutes. 44.8% of patients exceed 30 minutes travel-time with a median travel-time of 88 (31-113) minutes. 17.3% of Dumfries & Galloway patients live closer to Crosshouse Hospital than Dumfries & Galloway Royal Infirmary, and would save 6(1-17) minutes if treated in Crosshouse Hospital. No Ayrshire patient lives closer to Dumfries than Crosshouse Hospital. The data are illustrated graphically in map 1.

Scenario 1: Satellite Dialysis Unit, Stranraer

If a satellite dialysis unit was opened at the Garrick Hospital, Stranraer, 28.2% of Dumfries & Galloway patients would be closer to the Stranraer unit. The median travelling time would improve to 22 minutes, with a range of 1-63 minutes. 25.6% of patients exceed 30 minutes travel-time with a median travel-time of 40 minutes, range 31-63 minutes. 1.1% of Dumfries & Galloway patients live closer to Crosshouse Hospital than Dumfries & Galloway Royal Infirmary or the Garrick Hospital, and would save 2 (1-2) minutes if treated in Crosshouse Hospital. 3.5% of Ayrshire patients live closer to the Garrick Hospital than Crosshouse Hospital, and would save 12 (5-43) minutes if treated there. The data are illustrated graphically in map 2.

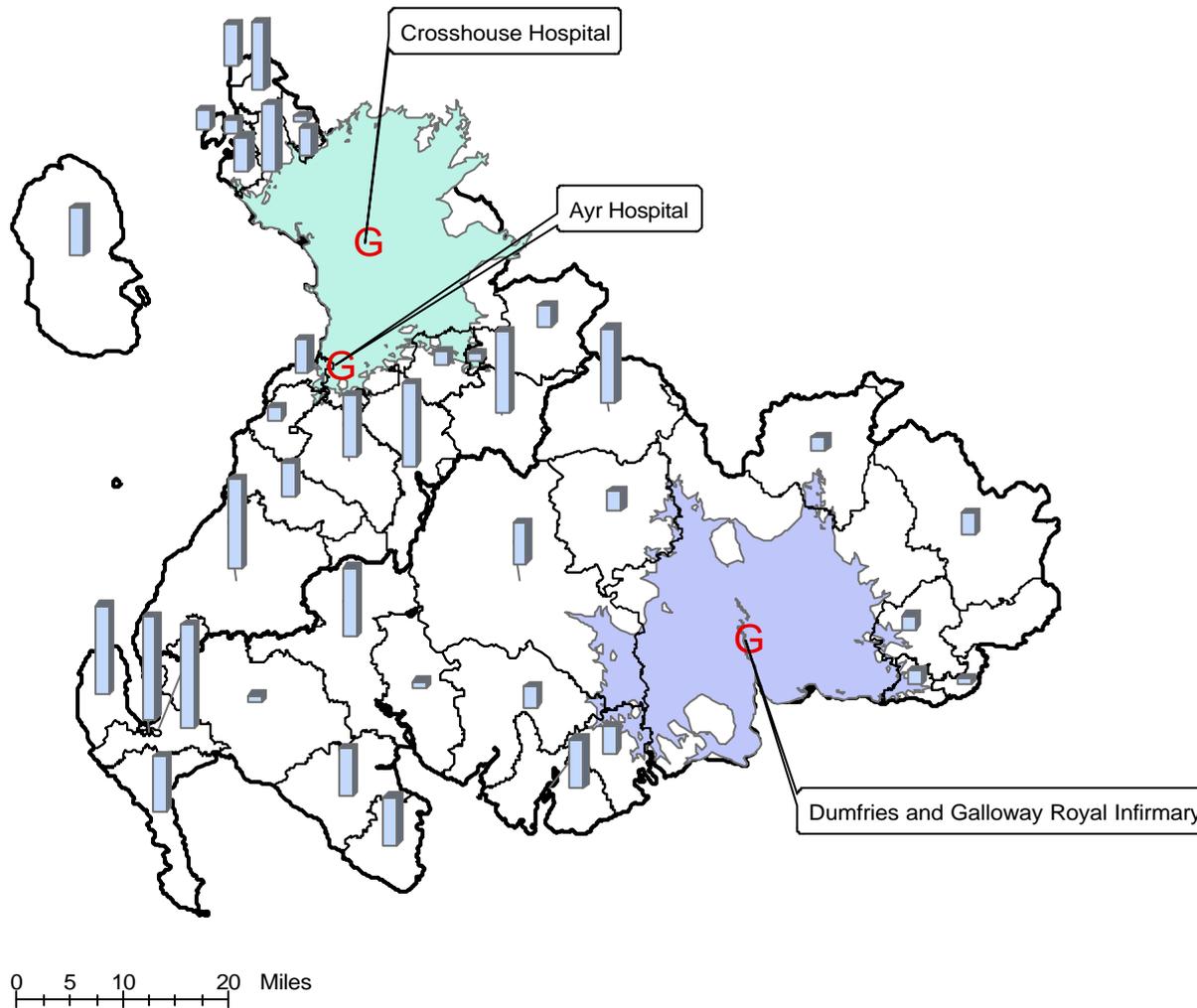
Scenario 2: Satellite Dialysis Unit, Newton Stewart

If a satellite dialysis unit was opened at Newton Stewart Hospital, 32.9% of Dumfries & Galloway patients would be closer to the Newton Stewart unit. The median travelling time would improve to 26 minutes, with a range of 1-57 minutes. 33.9% of patients exceed 30 minutes travel-time with a median travel-time of 37 minutes, range 31-57 minutes. 1.1% of Dumfries & Galloway patients live closer to Crosshouse Hospital than Dumfries & Galloway Royal Infirmary or Newton Stewart Hospital, and would save 2 (1-2) minutes if treated in Crosshouse Hospital. 3.5% of Ayrshire patients live closer to Newton Stewart Hospital than Crosshouse Hospital, and would save 9 (3-43) minutes if treated there. The data are illustrated graphically in map 3.

Summary Table

	Current	Scenario 1 (Garrick)	Scenario 2 (Newton Stewart)
Median travel-time (mins)	28	22	26
Range	1-113	1-63	1-57
Patients outwith 30m target	44.8%	25.6%	33.9%
D&G patients closer to A&A unit	17.3%	1.1%	1.1%
A&A patients closer to D&G unit	0%	3.5%	3.5%

Map 1: Current situation: 30min isochrones around Dumfries & Galloway Royal Infirmary and Crosshouse Hospital, with barnardised number of SRR patients outwith 30mins of both hospitals



Legend

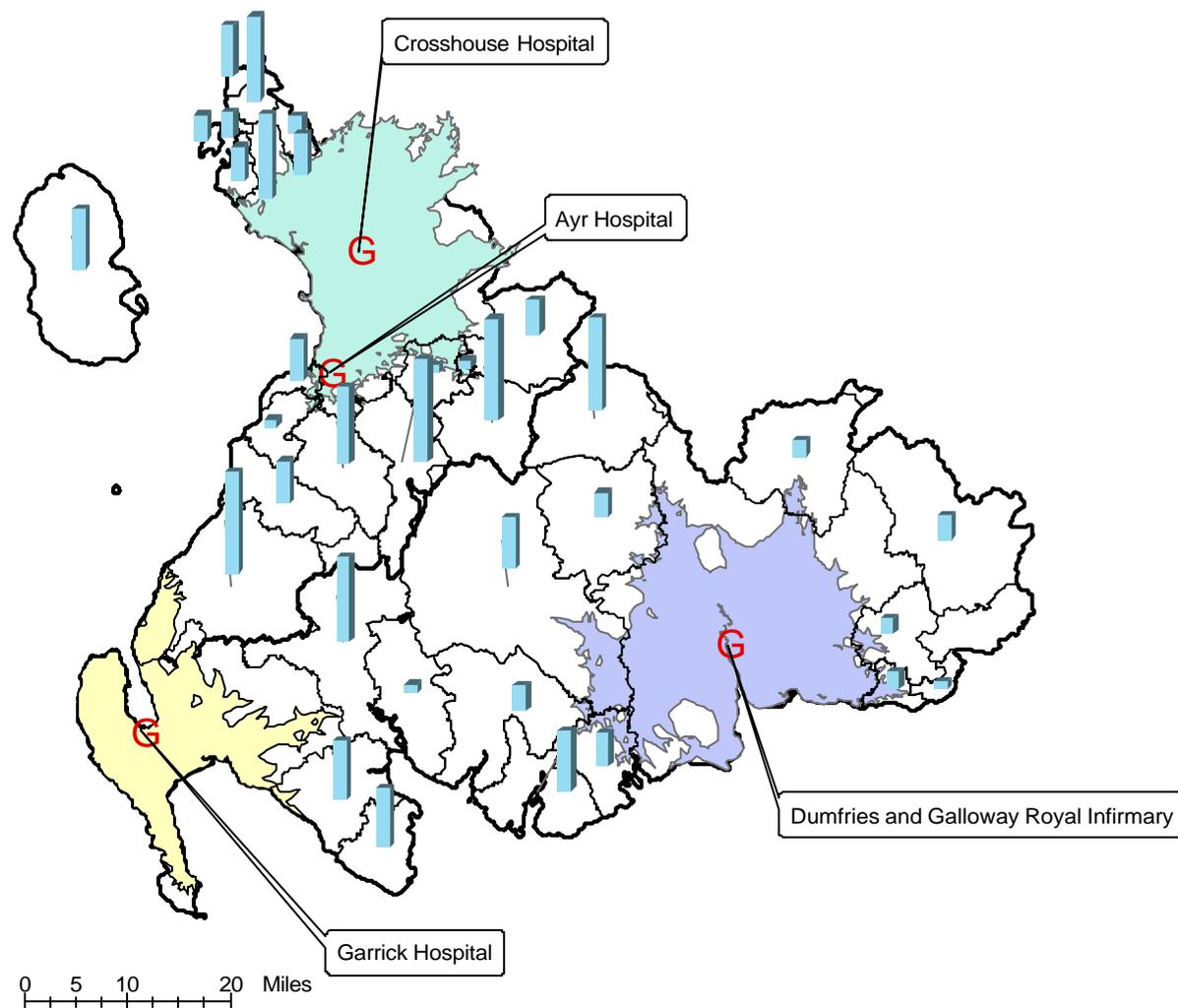
- G Hospitals
- Number of SRR patients by postcode sector**
- Vertical bar representing barnardised number of SRR patients
- Crosshouse Hosp 30min isochrone
- Dumfries & Galloway RI 30min isochrone
- D&G and A&A Health Boards

source: SRR data
 date of creation: 26/02/04
 author: Jillian Campbell

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Map 2: Stranraer Option: 30min isochrones around Dumfries & Galloway Royal Infirmary, Crosshouse Hospital and Garrick Hospital with barnardised number of SRR patients outwith 30mins of all hospitals



Legend

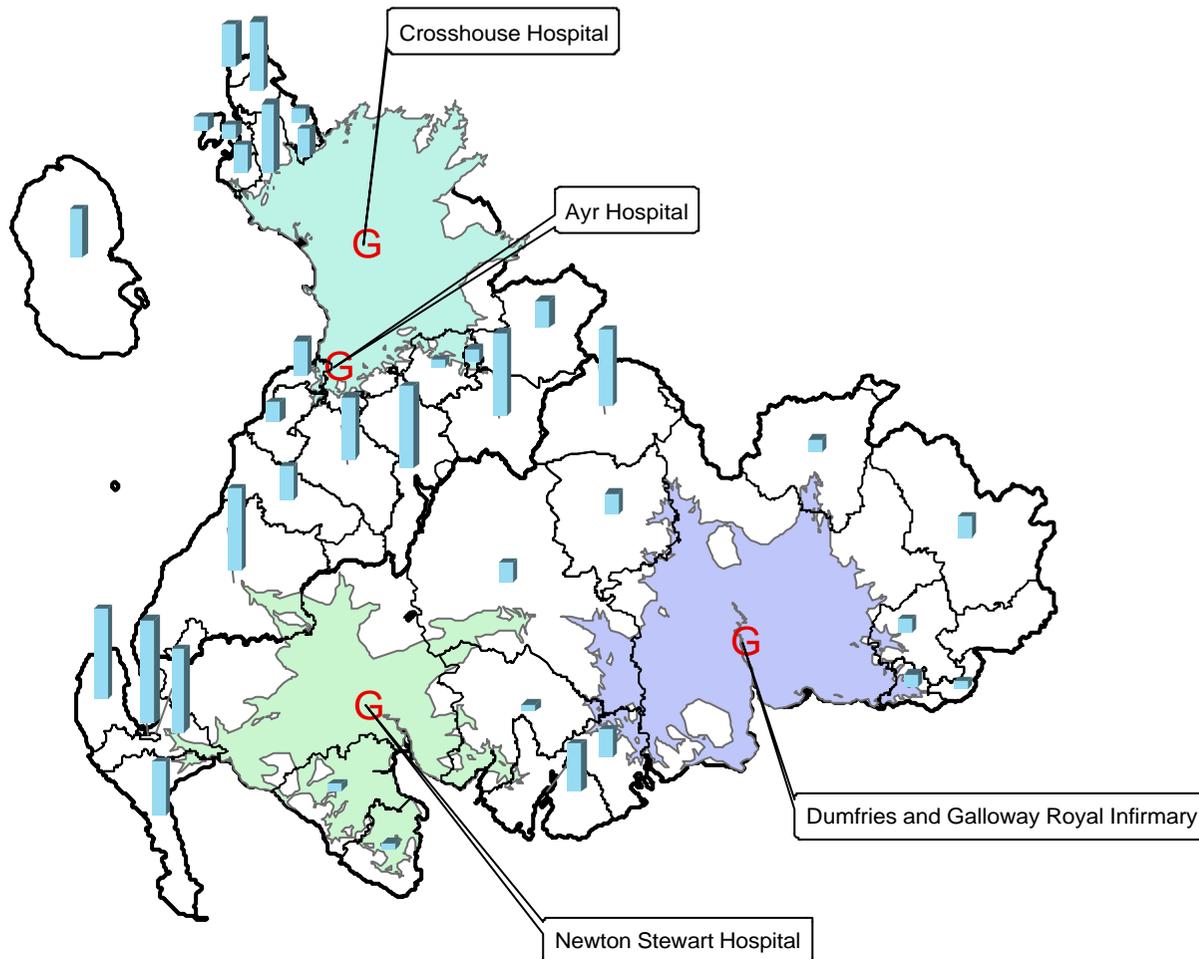
- G Hospitals
- Crosshouse Hosp 30min isochrone
- Garrick Hospital 30 minute isochrone
- Dumfries & Galloway RI 30min isochrone
- D&G and A&A Health Boards
- Number of SRR patients by postcode sector**
-
-

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Map 3: Newton Stewart Option: 30min isochrones around Dumfries & Galloway Royal Infirmary, Crosshouse Hospital and Newton Stewart Hospital with barnardised number of SRR patients outwith 30mins of all hospitals



Legend

Number of SRR patients by postcode sector

- Bar chart icon representing the number of SRR patients by postcode sector.
- Crosshouse Hosp 30min isochrone
- Newton Stewart Hospital 30 minute isochrone
- Dumfries & Galloway RI 30min isochrone
- D&G and A&A Health Boards
- Hospitals

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6. Implications

Dumfries & Galloway NHS Board fails to achieve the NHS Quality Improvement Scotland travel-time target by a substantial margin, which is not simply explained by the local geographical challenges.

Establishing a satellite unit in Galloway will address a significant proportion of that problem. A unit established in Stranraer would have the biggest impact, both in terms of number of patients achieving the travelling time standard, and in terms of the actual time travelled. There is however, a relatively small advantage over the site in Newton Stewart. Other issues may determine which is the most suitable site. Of note, between 28 and 33% of patients would be closest to the proposed satellite, which has implications for the size of the satellite unit.

Either proposed satellite may have a minor impact on travel-time for a small number of patients in Ayrshire & Arran NHS Board. However, if these patients were to be catered for, it would require a 19-23% increase in the capacity of the satellite unit, because of the relative size of catchment populations.

The following caveats about this analysis should be borne in mind:

- It assumes that patients will receive dialysis in the nearest available unit, i.e. that there is sufficient capacity in each unit for its surrounding population, and that all those patients are suitable for a satellite facility
- It assumes efficient transport is available for patients to take them directly from their home to the unit
- It assumes certain travelling speeds on different classes of road – the analysis can easily be adjusted to different travelling speeds
- It makes no assumptions about impact on the local acceptance rate for dialysis rate. Conceivably, the existence of a unit may increase uptake of dialysis in the surrounding area.
- It makes no assumptions about developments by other healthcare providers, for example NHS Ayrshire & Arran

7. References

1. NHS Quality Improvement Scotland. Adult Renal Services: National Overview. 2003
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3. Roderick *et al.* *J Health Serv Res Policy* 1999; 4: 139-146
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5. General Register Office for Scotland. Land area and population density, by administrative area; 30 June 2002.
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