UK Renal Registry 16th Annual Report: Appendix E Methodology for Estimating Catchment Populations of Renal Centres in England and Wales for Dialysis Patients

Introduction

Providing accurate centre-level incidence and prevalence rates for patients receiving renal replacement therapy (RRT) in the UK was limited until the 13th Annual Report by the difficulty in estimating the catchment population from which the RRT population was derived. One reason for this was that the geographical boundaries separating renal centres are relatively arbitrary and dependent upon a number of factors including referral practice, patient choice and patient movement. Previously, incidence and prevalence rates had been calculated at Local Authority/Primary Care Trust/Health Board level for which denominator data were available, but not at renal centre level.

UK Renal Registry (UKRR) Annual Reports prior to the 13th suggested an estimate of the size of the catchment populations. These were extrapolated figures originally derived from data in the 1992 National Renal Survey undertaken by Paul Roderick.

The purpose of this document is to present an estimate of the dialysis catchment population for all renal centres in England and Wales. The document also contains a methodological description and discussion of the limitations of these estimates. The previous three UKRR Annual Reports contained estimates for English renal centres using the same methodology as outlined here but using 2001 Census data and 2007 prevalent dialysis patients and has been explained in detail elsewhere [1]. The methodology has now been repeated using data from the 2011 Census in order to obtain more up to date estimates and also to include renal centres in Wales.

Methods

The UK Renal Registry database of the incident dialysis population between 1st January 2008 and 31st December 2012 was used to estimate the size of each renal centre's catchment population. This used the postcode and centre for each individual starting RRT on dialysis.

Polygons were constructed to define an area around the geographical location of each dialysis patient. The lines of the polygons, representing the boundaries between areas, were drawn such that they were equidistant between adjacent patients, creating a map of non-overlapping polygons covering the entire area of England and Wales. This method produces Thiessen polygons which have the property that all locations within each polygon share the same nearest dialysis patient [2].

The polygons of all patients attending the same renal centre were combined to create the catchment area for that centre. The catchment area for one centre might comprise of multiple unconnected polygons as a result of adjacent patients attending different renal centres. The Office for National Statistics (ONS) map of 2011 Census merged wards contains population estimates for England and Wales divided into 8,546 wards. This was overlaid on the map of renal centre catchment areas, enabling the proportion of each ward's area covered by each of the renal centre catchment areas to be calculated. Each ward's population was then allocated to the renal centres in proportions equal to the overlaid areas. Summing these proportions of populations across all of the Census wards for each renal centre produced the estimates of the total catchment population at each centre.

Results

The estimated dialysis catchment populations for renal centres in England and Wales are shown in Table E.1 and Table E.2 respectively. Table E.1 also displays the estimates contained in the previous three annual reports for comparison.

Discussion

These results show estimates for the size of the catchment areas for each of the renal centres in England and Wales.

There are some limitations to these results. The first is that the ward allocated to each renal centre was based upon dialysis patients only. Therefore it is possible that non-dialysis patients may come from a different catchment population. This is more likely where a renal centre provides specialist services and especially likely for patients undergoing renal transplantation. The catchment population for renal transplant patients will depend largely upon the distribution of workload between the referral centre and the transplanting centre for pre-transplant work-up, donor nephrectomy work-up and post-transplant care (including if and when care is returned to the referring centre).

After calculating the population estimates it was discovered that the number of incident dialysis patients at Plymouth in 2012 had been under-reported. If the missing patients had been included, an additional Thiessen polygon would have been constructed for each of them, potentially increasing the overall catchment area, and therefore population, for Plymouth. The magnitude of the reduction in the calculated catchment population caused by the under-reporting is difficult to accurately estimate as it depends on the location of the missing

Table E.1. Estimated dialysis catchment populations of English renal centres based upon firstly mid-2007 and secondly 2011 ONS Census ward population estimates (rounded to nearest 1,000)

Centre	Mid-2007 estimate	2011 estimate	Centre	Mid-2007 estimate	2011 estimate
B Heart	725,000	738,000	Leeds	1,647,000	1,670,000
B QEH	1,624,000	1,699,000	Leic	2,318,000	2,436,000
Basldn	408,000	415,000	Liv Ain	290,000	484,000
Bradfd	579,000	652,000	Liv RI	1,199,000	1,000,000
Brightn	1,195,000	1,297,000	M RI	1,469,000	1,531,000
Bristol	1,571,000	1,439,000	Middlbr	1,012,000	1,004,000
Camb	1,266,000	1,158,000	Newc	1,106,000	1,121,000
Carlis	314,000	321,000	Norwch	793,000	787,000
Carsh	1,916,000	1,913,000	Nottm	1,138,000	1,088,000
Chelms	466,000	510,000	Oxford	1,680,000	1,690,000
Colchr[a]		299,000	Plymth[b]	476,000	470,000
Covnt	870,000	892,000	Ports	2,003,000	2,024,000
Derby	647,000	703,000	Prestn	1,512,000	1,493,000
Donc	214,000	410,000	Redng	805,000	910,000
Dorset	725,000	862,000	Salford	1,420,000	1,490,000
Dudley	415,000	442,000	Sheff	1,489,000	1,372,000
Exeter	1,028,000	1,089,000	Shrew	391,000	501,000
Glouc	575,000	587,000	Stevng	1,088,000	1,204,000
Hull	987,000	1,020,000	Sthend	316,000	317,000
Ipswi	562,000	399,000	Stoke	897,000	890,000
Kent	1,163,000	1,224,000	Sund	589,000	618,000
L Barts	1,680,000	1,830,000	Truro	412,000	413,000
L Guys	1,154,000	1,082,000	Wirral	521,000	572,000
L Kings	970,000	1,171,000	Wolve	606,000	669,000
L Rfree	1,504,000	1,518,000	York	505,000	492,000
L St G	585,000	797,800	**England**	**51,050,000**	**53,399,000**
L West	2,227,000	2,399,000			

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[a]Mid-2007 estimates calculated before Colchester became a separate renal centre
[b]The 2011 catchment population for Plymouth may be too low (see main text of appendix for more details)

Table E.2. Estimated dialysis catchment populations of Welsh renal centres based upon 2011 ONS Census Ward population estimates (rounded to nearest 1,000)

Centre	2011 estimate	Centre	2011 estimate
Bangor	218,000	Swanse	885,000
Cardff	1,420,000	Wrexm	240,000
Clwyd	190,000	**Wales**	**2,953,000**

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patients relative to other patients at Plymouth and renal centres nearby.

Despite these limitations, this is the most valid methodology to date to estimate the size of the catchment populations for renal centres in England and Wales. The results of this analysis allow the UKRR to calculate estimates of the incidence and prevalence rates of renal replacement therapy at renal centre level, rather than only at PCT/HB level.

These results also provide other opportunities for study of the catchment populations. The ONS provides data on gender, age and ethnicity of the population at ward level. It should be possible to use this information to consider centre differences in the demographics of patients commencing or receiving RRT with adjustment for the catchment population characteristics.

Acknowledgements

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References

1 Judge A, Caskey FJ, Welton NJ, Ansell D, Tomson CR, Roderick PJ, Ben-Shlomo Y: Inequalities in rates of renal replacement therapy in England: does it matter who you are or where you live? Nephrol Dial Transplant. 2012 Apr;27(4):1598–1607 Nephron Dial Transplant. 2012 Apr;27(4): 1598–1607. doi: 10.1093/ndt/gfr466. Epub 2011 Aug 30
2 Boots BN: Voronoi (Thiessen) Polygons (Concepts and Techniques in Modern Geography); Norwich: Geo Books, 1986