

UK Renal Registry 20th Annual Report: Appendix D Methodology for Analyses of CCG/HB Incidence and Prevalence Rates and of Standardised Ratios

This appendix describes the methods used for calculating the standardised incidence ratios for the incident UK RRT cohort, the standardised prevalence ratios for the total UK RRT cohort and the standardised ratios (SR) for prevalent transplant patients.

Patients

For the incidence rate analyses, all new cases recorded by the UK Renal Registry (UKRR) as starting RRT in each year were included. For the prevalence rate analyses, prevalent patients at the end of the year were included.

Years used

Analyses have been completed for each of the last six years. Combined analyses over the six years have also been done for the incidence rates and rate ratio analyses as there can be small numbers of incident patients particularly in the smaller areas.

Geography

The areas used were the 207 English Clinical Commissioning Groups (CCGs) valid from April 2017, the seven Welsh Local Health Boards, the 14 Scottish Health Boards and the five Health and Social Care Trusts in Northern Ireland – these different types of area are

collectively called CCG/HBs here. Patients were allocated to CCG/HBs using the patient's postcode (rather than their GP's postcode). For the incidence rate analyses the patients' postcodes at start of RRT were used. For the prevalence rate analyses the postcodes at the end of the latest year were used. Each postcode was linked to the ONS postcode directory (ONSPD) to give the CCG/HB code. The ONSPD contains National Statistics data © Crown copyright and database right 2017 and also Ordnance Survey data © Crown copyright and database right 2017.

Areas included in the UK Renal Registry 'covered' population

One renal centre (Cambridge) was unable to submit 2015 or 2016 data to the UKRR by the closing of the database. As a consequence, coverage of the UK was complete for only four of the six years used in these analyses (2011–2014 complete, 2015–2016 not complete). CCGs affected by the lack of Cambridge's data have been highlighted in the relevant tables.

The 2011 to 2014 data were used to decide which CCG/HBs should be excluded from the calculation of age and sex standardised incidence rates due to missing patient-level data. Those CCG/HBs where greater than 15% of the incident RRT population from 2011 to 2014 were incident patients of the Cambridge renal centre were not included in the analysis for 2015 or 2016. These CCG/HBs were included for 2011–2014. CCG/HBs where less than 15% of the 2011–2014 data were from Cambridge were included in the analyses and where the percentage was between 5% and 15% are flagged in table 1.3 as their results are likely to be underestimated. Data on

RRT and transplant prevalent patients in 2014 were used to decide which CCG/HBs should be excluded from the calculation of 2015 and 2016 age and sex standardised prevalence rates on RRT and transplant due to missing patient-level data. The same rules as for the incidence rates were applied for exclusion/inclusion criteria, with CCG/HBs excluded if more than 15% of the relevant prevalent population in 2014 were patients of Cambridge renal centre and CCG/HBs included in the analyses if less than 15% of the 2014 data were from Cambridge (with the CCGs flagged in the relevant tables if the percentage was between 5% and 15% as their results are likely to be underestimated).

Population data

Mid-2016 population estimates by CCG/HB, sex and age group were obtained from the Office for National Statistics (ONS) website (www.ons.gov.uk), the Northern Ireland Statistics and Research Agency (NISRA) website (www.nisra.gov.uk) and the National Records of Scotland website (www.nrscotland.gov.uk). These mid-2016 population estimates are projections based on the 2011 Census data. The CCG/HB populations range from 21,900 (Orkney) to 1.16 million (Greater Glasgow and Clyde).

The analysis for each year uses this mid-2016 population data. As the analyses only cover six years this was a reasonable approximation.

Calculation of rates and rate ratios

Crude rates

The crude rates, per million population (pmp), were calculated for each CCG/HB for each year:

$$1,000,000 * (\text{observed number}) / (\text{population size})$$

For the combined years analyses the observed cases are summed over the available years and the population is multiplied by the number of years that the area has been covered. This is a rate per million population **per year**. It is an average over the available years.

Confidence intervals have not been calculated for these (single or combined years) rates but, if required, an assessment can be made of whether the rate for a given area is consistent with the rate in the whole covered population. This can be done by using the figures

provided here showing the confidence intervals around the overall average rates for a range of CCG/HB population sizes. These are figures D.1 and D.2 for incidence rates, and D.3 and D.4 for prevalence rates.

Note that when using the confidence interval figures to assess how different an area's combined years crude incidence rate is from the overall average, the population looked up on the x-axis should be the area's population multiplied by the number of years of data that has been used (i.e. generally six). In doing this, the confidence intervals obtained become narrower, consistent with the analysis now being based on more than one year of data.

These confidence intervals have been obtained using the Normal approximation to the Poisson distribution. For the incident analyses, confidence intervals have only been calculated around the overall average for

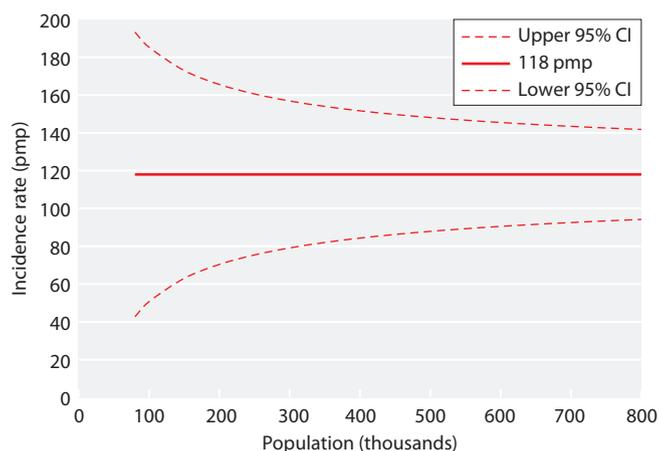


Fig. D.1. 95% confidence limits for incidence rate of 118 pmp for population size 80,000–800,000

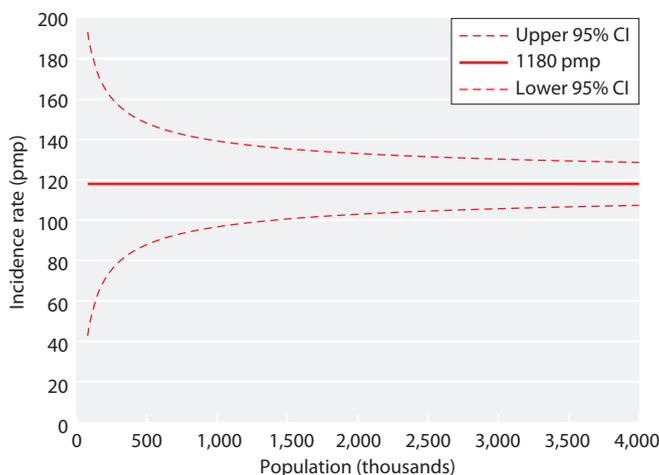


Fig. D.2. 95% confidence limits for incidence rate of 1180 pmp for population size 80,000–4 million

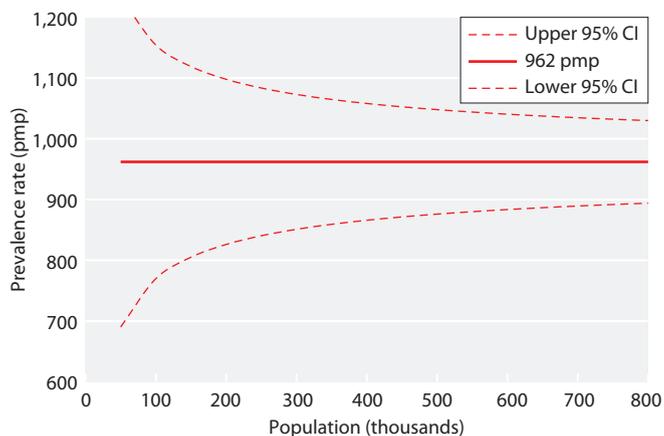


Fig. D.3. 95% confidence limits for prevalence rate of 962 pmp for catchment population size 50,000–800,000

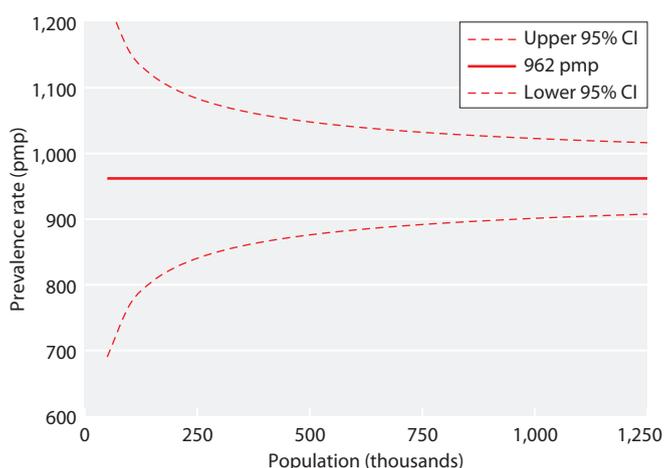


Fig. D.4. 95% confidence limits for prevalence rate of 962 pmp for catchment population size 50,000–1.25 million

populations of over 80,000. This is because below this level the number of cases you would expect per area is low – with low expected numbers the Poisson distribution is skewed and the Normal approximation to it is not appropriate. Due to prevalence rates being higher, confidence intervals can be obtained using this method for lower population sizes.

Standardised incidence/prevalence ratios (SIR/SPR or SR)

There are large differences in incidence and prevalence rates for RRT between age and sex groups. As there are also differences in the age/sex breakdowns of the different areas it is useful to produce estimates standardised for age and sex. The method used is *indirect* standardisation.

Observed cases (O_i) were calculated by summing all cases in all age and sex bands for each CCG/HB. Expected

cases (E_i) for each CCG/HB were calculated as follows:

Overall crude rates (for each year) were calculated for the whole covered population (the *standard population*) by summing the observed numbers, over the CCG/HBs, for each age/sex band and dividing this by the total covered population in that age/sex band. These crude rates (by age/sex band) were then multiplied by the population each CCG/HB has in each band to give the number of cases expected in that band if that CCG/HB had the same rates as the standard population.

These expected numbers were then summed over the age/sex bands to give an expected total number of cases in each CCG/HB. The age/sex SR for CCG/HB i is then O_i / E_i .

The expected number of cases is the number you would see if the rates seen in the standard population applied to that individual CCG/HB's age/sex breakdown. Confidence intervals (95%) were calculated for each area using an error factor (EF) as follows:

$$\text{Lower confidence limit} = \text{SR}/\text{EF}$$

$$\text{Upper confidence limit} = \text{SR} \times \text{EF}$$

$$\text{Where } \text{EF} = \exp(1.96/\sqrt{(O_i)})$$

A SR of one indicates that the area's rate was as expected if the age/sex rates found in the total covered population applied to the CCG/HB area's population structure; a value above one indicates that the observed rate was greater than expected given the area's population structure, if the lower confidence limit was above one this was statistically significant at the 5% level. The converse applies to standardised ratios below one.

The combined years analyses are similar to the above except that the observed and expected numbers are summed over the years.

Remaining variability between rates

Even after standardisation there remains a large amount of variability between CCG/HBs – as can be seen by the large numbers of notably low or high standardised ratios. This is partly because these ratios have only been adjusted for age and sex and not for ethnicity or any other factors. Higher rates are expected in populations with a high percentage of patients from South Asian or Black backgrounds and so it is hoped that in the future the UKRR will also do analyses further standardised for ethnicity.

