QualityWatch

Focus on hip fracture: Trends in emergency admissions for fractured neck of femur, 2001 to 2011

Appendix 1: Methods

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This appendix accompanies the QualityWatch report *Focus On Hip Fracture: Trends in emergency admissions for fractured neck of femur, 2001 to 2011.*

QualityWatch is a major research programme providing independent scrutiny into how the quality of health and social care is changing over time. Developed in partnership by the Nuffield Trust and Health Foundation, the programme provides in-depth analysis of key topics and tracks an extensive range of quality indicators. It aims to provide an independent picture of the quality of care, and is designed to help those working in health and social care to identify priority areas for improvement. The programme is primarily focused on the NHS and social care in England, but will draw on evidence from other UK and international health systems.

The QualityWatch website **www.qualitywatch.org.uk** presents key indicators by area of quality and sector of care, together with analysis of the data. This free online resource also provides research reports, interactive charts and expert commentary.

Appendix 1: Methods

We used ten years of Hospital Episode Statistics (HES) data for the years 2001/02 to 2010/11. HES data cover all day-case and inpatient admissions in NHS hospitals in England, as well as private patients treated in NHS hospitals, patients resident outside England, and care delivered in the independent sector funded by the NHS (Health and Social Care Information Centre, 2013).

The records in HES are based on the consultant episode covering the period of time the patient was under the care of one consultant. In order to capture deaths that occur outside hospital following discharge, HES data were linked with deaths data from the Office for National Statistics (ONS). Records of all deaths that occurred during, and up to a year following, the analysis period were obtained from the ONS.

Hip fractures were identified by the presence of an ICD-10 code of S72.0, S72.1 or S72.2 in the first episode's primary diagnosis. All analyses were confined to emergency admissions, and admissions for patients under the age of 65 were excluded. Admission rates were directly standardised by age and sex to the European Standard Population to allow comparison over time. The denominator for the admission rates was the ONS mid-year population estimates of local authority of residence. 95% confidence intervals were calculated using Byar's method (Breslow and Day, 1987).

Overall bed days were directly standardised to the age and sex admission profile of hip fracture patients in 2001/02 to allow comparison across years, with the denominator being mid-year local authority of residence population estimates. The directly standardised bed days were then converted into average lengths of stay per hospital admission to aid interpretability.

Mortality within 30 days of admission was calculated by linking HES hospital records to ONS mortality data. Linked deaths were assigned according to Information Centre guidance (Health and Social Care Information Centre, 2010) where the difference between admission date and date of death was 30 days or less. Rates were directly standardised to the admission profile of hip fracture patients in 2001/02. 95% confidence intervals were calculated using Byar's method.

Readmissions were defined as patients admitted as an emergency within 0 to 27 days (inclusive) following discharge from a previous emergency admission for hip fracture. Rates were directly standardised to the admission profile of hip fracture patients in 2001/02.

For the purposes of determining the proportion of patients operated on within 48 hours of admission, we used the difference, in days, between date of admission and the date of the first operation occurring within the spell as the numerator. This may potentially overestimate the exact proportion of admissions as exact times of events are not provided in HES, only dates.

The denominator was the total number of emergency admissions for hip fracture. 95% confidence intervals were calculated using the Wilson Score method (Altman and others, 2000). This analysis excluded patients not having any procedure following hip fracture.

All analyses based on local deprivation measures were performed using deciles of the Indices of Multiple Deprivation 2010 (Department for Communities and Local Government, 2011) allocated via the patient's postcode to the Lower layer Super Output Area (LSOA) of residence. Decile one comprised the most deprived areas while decile ten contained the least deprived areas. Records lacking the LSOA were excluded from the analysis. Admission rates, 30-day mortality rates and 28-day readmission rates by deprivation decile were indirectly standardised by age and gender. 95% confidence intervals were also calculated using Byar's method. Analyses at the sub-national level (local authority and provider level) were indirectly standardised by, age, gender and, where possible, deprivation. For analysis at the individual level, Kaplan-Meier survival curves were calculated for 30-day and 365-day post-admission mortality. Statistical analysis was performed using SAS version 9.3 (Statistical Analysis Software, 2011).

Regression analysis

Analysis was performed to explore any changes over time in the gaps in the outcome measures between socioeconomic groups. For each outcome measure, two regression models were fitted: the first using data between 2001/02 and 2003/04 (the start of the study period); and the second using data between 2008/09 and 2010/11. Three years' of data were used in each model to reduce any random fluctuations that might occur in the annual event rates. Figure 3.10 shows the regression lines of best fit for the indirectly age and sex-standardised admission ratios by deprivation quintile for 2001/02–2003/04 (model A) and 2008/09–2010/11 (model B). Both regression equations were statistically significant (model A: $F=121.8$, $p<0.0001$, $r2=0.94$; model B: $F=312.2$, $p<0.0001$, $r2=0.97$). The slope index of deprivation, provided by the regression model coefficients, became steeper over the study, decreasing from -25.6 to -35.0. This difference was found to be statistically significant.

Figure 3.11 shows the regression lines of best fit for the indirectly age and sex-standardised 30-day mortality ratios by deprivation quintile for 2001/02–2003/04 (model C) and 2008/09–201011 (model D). Both regression equations were statistically significant (model C: $F=48.8$, $p=0.0001$, $r2=0.86$; model D: $F=144.9$, $p<0.0001$, $r2=0.95$). Again the slope index of deprivation became steeper over the study, decreasing from -20.0 to -32.9. Again, this difference was found to be statistically significant.

Figure 3.12 shows the regression lines of best fit for the indirectly age and sex-standardised 28-day readmission ratios by deprivation quintile for 2001/02–2003/04 (model E) and 2008/09–201011 (model F). Both regression equations were statistically significant (model E: $F=27.16$,

p=0.0008, r2=0.77; model F: F=198.7, p<0.0001, r2=0.96). The slope index of deprivation became steeper over the study, decreasing from -21.1 to -32.0. This change was not found to be statistically significant.

In addition, we are aware that the above interpretations may be subject to ecological fallacies and so the analyses were also undertaken with patient-level Cox regression models that tested the change in slope as interaction terms. The hazard ratios in the models were adjusted for age, gender and financial year of discharge, and included an interaction term between deprivation decile and financial year of discharge. The interaction term was found to be statistically significant for mortality (p < 0.01), but was not significant for readmissions (p = 0.121). The results can be seen below in figures A1.1 and A1.2.

Figure A1.1: Mortality within 30-days hazard ratios, with 95% confidence intervals, for deprivation by financial year of discharge following admission for hip fracture
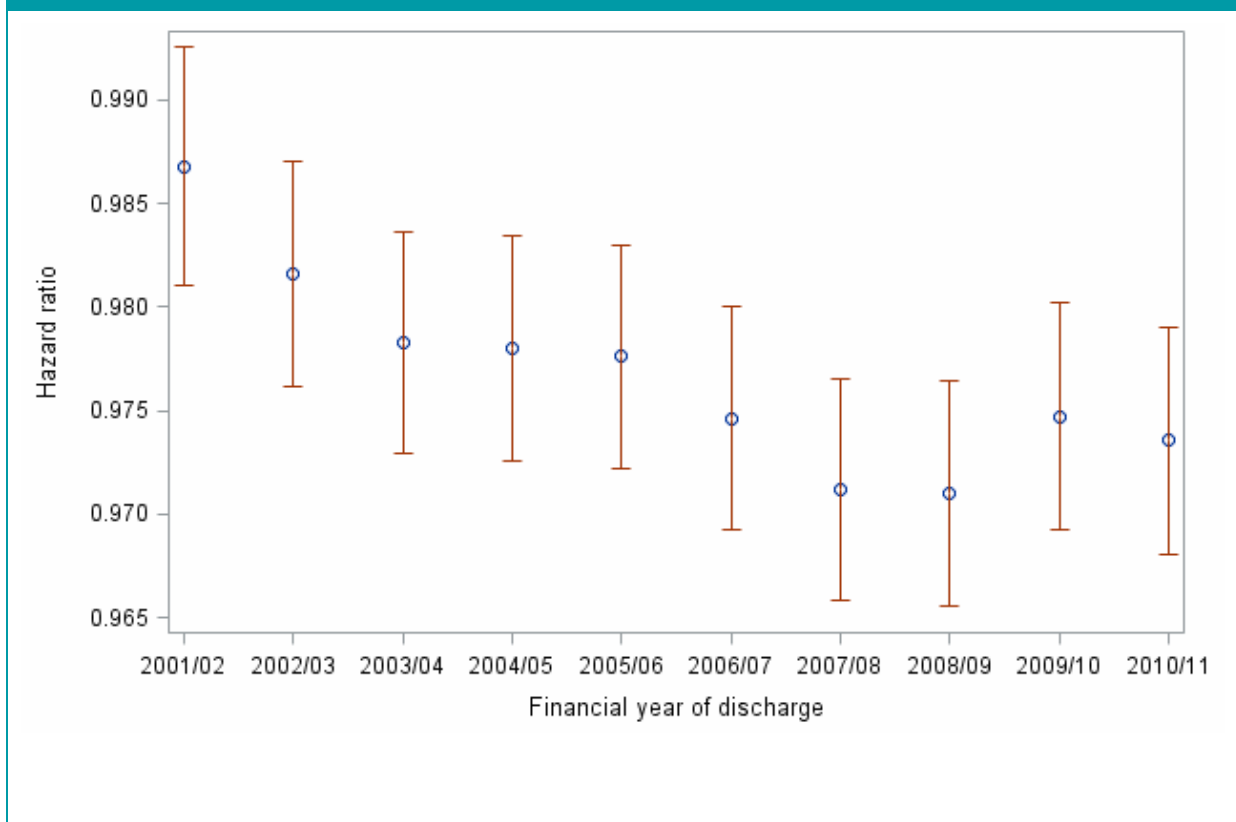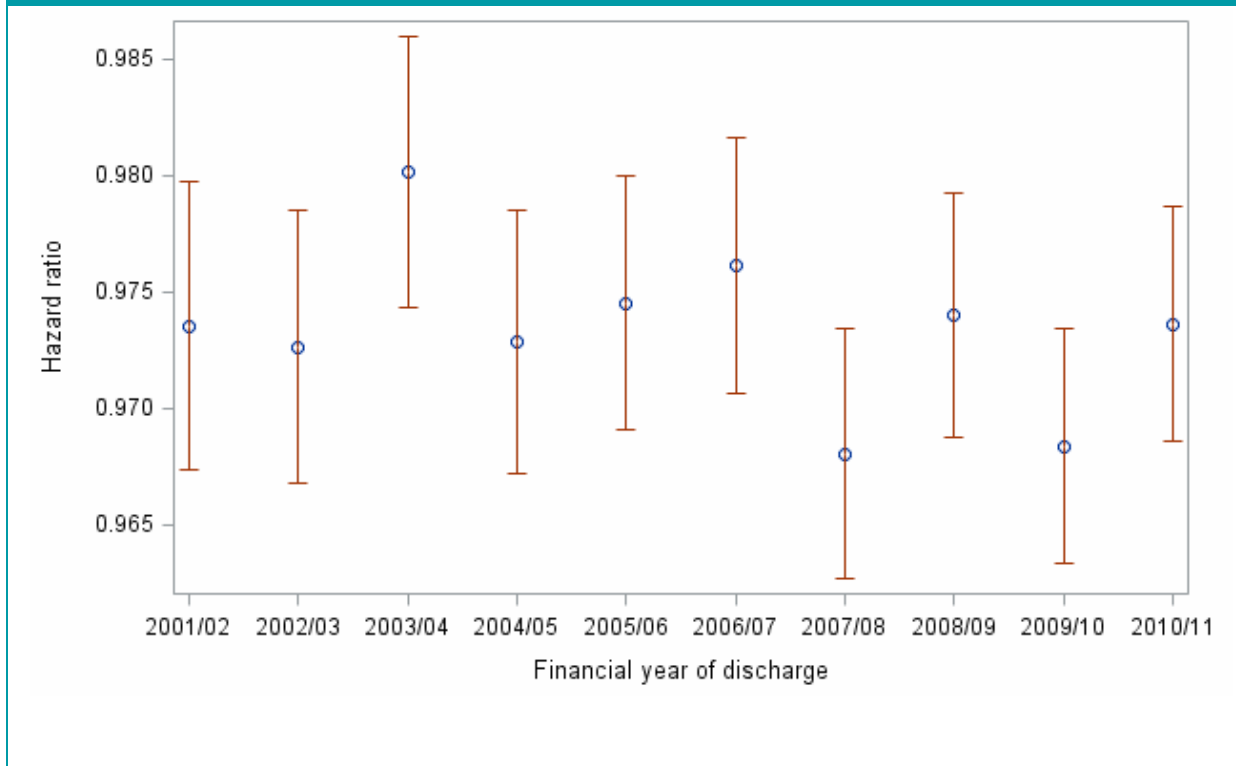
Figure A1.2: Readmission within 28-days hazard ratios, with 95% confidence intervals, for deprivation by financial year of discharge following discharge for hip fracture

References

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