## Appendix 2: Sample Size Calculations

For the sample size calculations we used a 2-sided log rank test for equality of survival curves, with 80% power at a 5% level of significance (alpha). In the pre-intervention (control group) we assumed a 1-year mortality rate of 30%, 30-day mortality of 10% and a 2-year second hip fracture rate of 6%.

For the mortality outcomes there is no loss to follow up as information on date of death is obtained through linked ONS mortality data, whilst for second hip fracture we allowed for 30% loss to follow up due to mortality. To detect a 5% absolute difference in 1-year mortality (equivalent to a hazard ratio of 0.81), the total sample size required for an individual hospital was 1214 patients in each group with 683 expected events. For an intervention occurring towards the end of the time series, allowing for unequal size groups in a ratio of 4:1 would require 3068 patients in the time period before the intervention, and 1023 in the post-intervention period, with 1186 expected events. To detect a 3% absolute difference in 30-day mortality (10% versus 7%), a hazard ratio of 0.69, assuming equal size groups requires 1356 in each group (a total 2712 patients and 231 events). With unequal size groups in the ratio of 4:1, this is 3514 pre- and 1171 post-intervention (4685 total with 441 events).

The sample size required in an individual hospital to detect a 3% absolute difference in second hip fracture (6% versus 3%) was 890 in equal sized pre- and post-intervention groups (1780 total with 68 events) assuming 30% loss to follow up due to mortality. Allowing for unequal sized groups (4:1), as for an intervention occurring towards the end of the time series, a sample size of 2504 pre-intervention and 835 post-intervention was required (3338 total with 152 events).

Within individual hospitals our actual sample size ranged from: 1030 to 5895 primary hip fractures, 238 to 1687 deaths at 1-year, 60 to 489 deaths at 30-days and 41 to 206 second hip fractures. Effect sizes for interventions were pooled across hospitals in the meta analysis, with the sample size of the cohort of hip fracture patients across all hospitals included in this study being 33,152, with 9662 deaths at 1-year, 3033 deaths at 30-days and 1288 second hip fractures.