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## **Modelling Mortality: the Effect of Small Population Size on Parameter Estimation**

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There is sampling variation in the death of a certain population, hence noise to the parameter estimates while modelling. By proposing a parameter bootstrap method we firstly investigate the impact of population size on the uncertainty of parameter estimates and projection. Then we carried out likelihood ratio test (LRT) for the population size based systematic parameter difference as well as investigating the power of the LRT. At last we test if information in the parameter estimates of population A can be applied to population B, by fixing at least one parameter of B to A with the application of LRT. We select the number of death and exposure from England and Wales, males and females, aged from 50-89 last birthday, during year 1961-2011. The modelling process is carried out based on the second generation of CBD mode. We find increasing the size of population can significantly reduce the variance of estimates. We identify bias in parameter projection between smaller sized populations and England and Wales. We developed distribution of the test statistic under the chi-square approximation. In addition, we also carried out LRT based on the bootstrapped distribution of test statistic for parameter fixing testing.