Longitudinal Data Analysis: statistical methods for analysing longitudinal changes in health related quality of life which account for deaths and impute for longitudinal missing data.

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Dedicated to Frankie Bowe
(4-2-1936 to 16-2-2008)

&

Leo Bowe

Born 10-03-2009

In memory of my father who passed away while I was completing this thesis.
Dearly loved and sadly missed.

He always encouraged me to see things differently and he would be very proud of the
“doctor” as he always called me from childhood.

I would also like to dedicate this thesis to my beautiful nephew Leo who has brought so
much joy to my family since the passing of his grandfather.
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This paper is based on the contents in Chapter 4 (see Appendix 8.1 for paper).


The statistical methods used in this paper have contributed to the methods applied in Chapters 6 and 7 (see Appendix 8.1 for paper).

Conference Presentations


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SYNOPSIS

Analysis of data from longitudinal studies is made more complex by the death of study participants over time. Many statistical methods depend on complete case analysis, meaning that data for participants who die are often removed from the analysis and reported and/or sometimes analysed separately. This complete case analysis approach limits longitudinal analysis to survivors, who often begin or remain in better health than those who died, and hence researchers may miss important changes over time in the total cohort.

Many longitudinal studies that aim to measure changes in physical and mental health over time use the SF-36 instrument, a 36-item health questionnaire. However, there is no score on the SF-36 to reflect death. In recent years various methods to assign a score for death have been suggested but in most cases need greater validation and development across a variety of longitudinal studies.

This thesis discusses four methods for analysing longitudinal changes in health related quality of life; three methods for incorporating death into longitudinal studies of elderly populations and another method that attempts to deal with longitudinal missing data which may be missing not at random:

- Method 1 - Transforming the SF-36 Physical Component Summary score (PCS) to a probability of being healthy in three years;
- Method 2 - Converting the Short Form - 36 health survey into the Short Form - 6 Domains (SF-6D) to extrapolate a PCS value for death;
- Method 3 - Adapting the Health Outcomes Study (HOS) case-mix method to predict the probability of being Alive and in Same/Better health in 3 years;
method 4 - Longitudinal multiple imputation approach using Fully Bayesian methods.

The four methods were applied to data obtained from the Australian Longitudinal Study on Women's Health (ALSWH). This is a longitudinal, population-based survey that examines the health of three large cohorts of community-dwelling Australian women over a 20 year period (1996-2016) with follow-up surveys every three years. To demonstrate each method, a case study was used to determine whether or not there were statistically significant differences in elderly women with and without diabetes over time. The main focus was the impact of including deaths and other missing data over time. The analyses found that the inclusion of those who died impacted more heavily on those women with diabetes. The difference in predicted health in 3 years for women with and without diabetes became greater over time when deaths were reinstated with a value. Longitudinal multiple imputation of intermittent missing outcome and covariate data reduced the impact of the deaths on both groups over time. Finally, all four methods suggest that ignoring deaths and other missing data can lead to biased results towards study survivors.

The recommendation is that researchers using the SF-36 to study the longitudinal change in quality of life of elderly populations over time need to consider using methods which account for deaths and other missing data. These results can then be compared to analyses which ignore deaths and other missing data. This will result in less biased findings from longitudinal studies of ageing populations.