

# Preface

Life expectancy is an essential concept in the analysis of time-to-event data, which can be encountered in many research fields. Traditionally life expectancy has been defined as the mean residual lifetime, and much research effort has been devoted to the topic until recently. Potential asymmetric nature of time-to-event data also triggered researchers' interests in nonparametric approaches to inferring the remaining lifetimes in the mid-1980s, which has recently revived as a robust yet practical summary measure for censored survival data. In this book, we review the history and research achievements first in the topic of the mean residual lifetime and then elaborate on recent developments in statistical inference on the quantile residual lifetime.

Chapter 1 introduces the basic concepts needed to investigate the properties of the quantile (residual life) function such as almost sure convergence, strong law of large numbers, Brownian motion and bridge, empirical and quantile process, counting process martingale, and the check function. In Chap. 2, we briefly overview statistical methods developed to infer the mean residual life function. In Chap. 3, the quantile (residual life) function is defined and its properties are described, and recently developed inference methods are reviewed in detail. In Chap. 4, we elaborate on the extension of the results reviewed in Chap. 3 to the competing risks setting. In Chap. 5, we discuss some issues in inference on the quantile (residual life) function and review alternative methods based on the empirical likelihood and a Bayesian approach. In Chap. 6, we touch on a design aspect based on the quantile (residual life) function. In Appendix, we provide R codes that were written for the numerical examples throughout the book.

The targeted audience would be graduate students and researchers both in the academia and in the industry who are interested in learning theory and application of the quantile (residual life) function. Numerical examples in the book use small datasets, so that the readers can easily follow detailed calculations of the mathematical formulas, coupled with provided `R` codes. Real examples based on a dataset from a clinical trial are also included. At the end of each main chapter, future research directions are also suggested to stimulate researchers to move the field forward.

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