# Likelihood-based estimation for multistate models subject to IBNR- and RBNS effects

Kristian Buchardt [*1], Christian Furrer [†2], and <u>Oliver L. Sandqvist</u> [‡2,3]

[1]AP Pension, Østbanegade 135, DK-2100 Copenhagen Ø, Denmark.
[2]Department of Mathematical Sciences, University of Copenhagen,
Universitetsparken 5, DK-2100 Copenhagen Ø, Denmark.
[3]PFA Pension, Sundkrogsgade 4, DK-2100 Copenhagen Ø, Denmark.

## Abstract

Life and health insurance policies generate longitudinal biometric data in the form of records on the occurrence and timing of certain events. Multi-state models provide a natural and parsimonious way to represent such data-generating mechanisms and are therefore commonly used for both pricing and reserving. However, complete observation of the event history is typically rendered impossible due to left-truncation and right-censoring, but also due to the presence of incurred-but-not-reported (IBNR) and reported-but-not-settled (RBNS) claims. While the latter mechanisms have received some attention in the non-life insurance literature under recurrent event models, see e.g. [1] and [2], the corresponding problem in life insurance is largely unexplored. In this talk, I will discuss how to accommodate these mechanisms in the estimation of a general multistate model using thinning-based methods to accommodate IBNR (reporting delays) and missing-data techniques to accommodate RBNS (incomplete event adjudication). We are motivated by the need for predictive models in pricing and reserving that capture trends in a timely fashion. The practical relevance is illustrated via a numerical study using simulations as well as via a data application based on a large Danish insurance portfolio that has been anonymized and slightly altered so as not to reveal any confidential information about the individual subjects or the insurance portfolio.

**Keywords:** Event history analysis; incomplete event adjudication; reporting delay; thinning; two-step M-estimation.

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[*]E-mail address: kristian@buchardt.net
[†]E-mail address: furrer@math.ku.dk
[‡]E-mail address: oliver.s@math.ku.dk

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