



THE UNIVERSITY OF
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Department of Statistics
DISSERTATION PROPOSAL

WALTER DEMPSEY

Department of Statistics
The University of Chicago

**Statistical Methods in Joint Modeling of Longitudinal
and Survival Data**

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ABSTRACT

In this proposal, we discuss standard and alternative approaches to the joint modeling of failure time T and longitudinal health-related variables Y_t , specifically where the terminating event is death. The reverse alignment method focuses on relatively simple temporal models for the joint distribution of the failure time and revival process Z_s , which is defined by temporal realignment at failure rather than recruitment, i.e. $Z_s = Y_{T-s}$. Some of the statistical implications of reverse alignment are considered, particularly with respect to the definition of treatment effects. We also provide methods for parameter estimation in the presence of censoring, and measure the corresponding loss of information. Proper alignment of the health processes for distinct patients has the potential to improve signal extraction and to make more effective prognostic use of past health values; linear alignment by failure is one choice, but not necessarily the most effective. Therefore, we also provide a systematic means for non-linear re-alignment by considering a family of smooth monotone transformations which conditional on the survival time and covariates map from the calendar time scale to a ‘biological time scale’. We end with an outline of the future research directions.

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