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Kalman scores for the estimation of planned and unplanned missing individual observations in accelerated longitudinal designs

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A popular cost-effective way of collecting longitudinal data is the accelerated longitudinal design (ALD). In ALDs, participants from different cohorts are measured repeatedly but the measures provided by each participant cover only a fraction of the time range of the study. It is then assumed that the common trajectory can be studied by aggregating the information provided by the different converging cohorts. ALDs are, therefore, characterized by a very high rate of planned data missingness. Additionally, it is very common that most longitudinal studies present unexpected participant attrition leading to unplanned missing data. A way for analyzing this data is the latent change score (LCS) model within a Continuous-Time State-Space Modeling framework (CT-SSM). This CT-SSM model allows computing Kalman scores, which can be used to estimate individual observed and unobserved scores. We simulated an accelerated longitudinal design where we manipulated different conditions such as the sample size, the unplanned missing data mechanism (MCAR, MAR, MNAR), and the severity of the unplanned missingness. Results showed that the Kalman scores were able to estimate both (1) data points that were expected but unobserved and (2) data points that were outside the age range observed for each case (i.e., to estimate the individual trajectories for the complete age range under study). These results have important implications for practitioners in psychology and education because they make it possible to accurately forecast individual longitudinal trajectories and to make individual-level decisions considering the model predictions. This presentation summarizes part of the results of a recent publication: https://doi.org/10.1037/met0000664

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