Fisher information in window censored renewal process data and its applications

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Abstract   Suppose we have a renewal process observed over a fixed length of time starting from a random time point and only the times of renewals that occur within the observation window are recorded. Assuming a parametric model for the renewal time distribution with parameter $\boldsymbol{\theta}$, we obtain the likelihood of the observed data and describe the exact and asymptotic behavior of the Fisher information (FI) on $\boldsymbol{\theta}$ contained in this window censored renewal process. We illustrate our results with exponential, gamma, and Weibull models for the renewal distribution. We use the FI matrix to determine optimal window length for designing experiments with recurring events when the total time of observation is fixed. Our results are useful in estimating the standard errors of the maximum likelihood estimators and in determining the sample size and duration of clinical trials that involve recurring events associated with diseases such as lupus.