

Screening for Osteoporosis in Postmenopausal Women: A Case Study in Interval Censored Competing Risks Data

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Abstract

Current US Preventive Services Task Force encourages osteoporosis screening using bone mineral density but does not specify a screening interval or ages to start and stop testing using an evidence based rationale. The current analysis explores these issues using data from the Study of Osteoporotic Fractures, the longest running cohort study of osteoporosis in the United States. Complications arise: time to osteoporosis in individuals free of osteoporosis, prior fracture, and previous preventive treatment, is subject to potentially dependent censoring by fracture and preventive treatment. Endpoint definition is addressed in a competing risks framework, with a certain cumulative incidence function correctly defining the risk of osteoporosis for the screening population. The analysis of this quantity is based on intermittent bone mineral density testing. Likelihood based inference, both full and "naive", is investigated for such interval censored competing risks data, using a direct modelling strategy for the cumulative incidence functions. The screening interval is defined as a fixed time for a specified percentage of non-osteoporotic women to develop osteoporosis, accounting for the potentially dependent competing risks, which involves the use of so-called competing risks quantiles. The competing risks analysis illustrates how osteoporosis risks may be precisely quantified and used to develop evidence based policy for osteoporosis screening.

Keywords: Screening; Competing risks; Interval censoring; Parametric models; Maximum likelihood.

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