Rate Estimation in the presence of Interval Censoring

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Abstract

Estimating incidence and recovery rates from longitudinal field surveys of malaria infection status inevitably involves doing so from interval censored data. Rate calculation, in its simplest version, requires dealing with a difficult mathematics problem; namely, the embedding problem for Markov chains. This problem has been in the mathematics literature for 80+ years, and there is no definitive solution for it to-date. Beginning with a discussion of the Garki malaria surveys in Nigeria (1970 - 1975) and an urban malaria control program in Dar es Salaam, Tanzania (2004 - 2008), we show how partial solutions to the embedding problem have played a central role in representing infection dynamics and in evaluating interventions. This work has led to more refined mathematical challenges relating to the embedding problem and to some data analytic challenges for longitudinal surveys that have been unanswered for 41 years. We discuss both the mathematical and empirical issues, thereby outlining an interesting research agenda looking ahead.