TITLE: Monitoring a developing pandemic with available data

AUTHORS: M.Luz Gámiz, Enno Mammen, M.D. Martínez-Miranda and Jens Perch Nielsen.

ABSTRACT:

In this talk we present a full dynamic system to monitoring and understanding the most important transitions in a developing pandemic: infection to infection, infection to hospitalization and hospitalization to death or recovery. While the latter transition is well defined and a follow-up-type survival analysis is possible, with the transition infection-infection and infection-hospitalization, the number of individuals involved are biased by dynamic definitions and underestimation leading to low quality exposure. Using data from the recent Covid-19 pandemic, and two different mathematical approaches to describe the two types of transitions, we are able to describe and forecast the spread and the severity of the pandemic, including relevant indicators such as the median time from admission in hospital to recovery or death depending on the admission date, or the probability that a patient who has been in hospital for a number of days can leave it alive.

One important feature of our modelling technique when applied to a developing pandemic is that it only relies on simple and publicly available data. This appealing feature implies that we have to deal with a missing link data problem in survival analysis where the individual follow-up is not registered.

Another important feature of our proposal is the dynamic modelling that allows not only the dynamic estimation, but the variation over time of the very definition of the underlying problem. Accounting for this requires developing a new statistical methodology for the analysis of longitudinal data where exposure is only vaguely understood, partly because the very definition of exposure might change over time.

KEYWORDS: Survival; Dynamic; Counting process; Hawkes process; Pandemic; Low-quality exposure.

References:

1. Gámiz, M.L., Mammen, E., Martínez-Miranda, M. D. and Nielsen, J. P. (2023a). Low quality exposure and point processes with a view to the first phase of a pandemic. arXiv:2308.09918.
2. Gámiz, M.L., Mammen, E., Martínez-Miranda, M. D. and Nielsen, J. P. (2023b). Monitoring a developing pandemic with available data. arXiv:2308.09919.
3. Gámiz, M. L., Mammen, E., Martínez-Miranda, M. D. and Nielsen, J. P. (2022). Missing link survival analysis with applications to available pandemic data. Computational Statistics & Data Analysis, 169, 107405.