Estimating Global and Country-Specific Excess Mortality During the COVID-19 Pandemic

Estimating the true mortality burden of COVID-19 for every country in the world is a difficult, but crucial, public health endeavor. Attributing deaths, direct or indirect, to COVID-19 is problematic. A more attainable target is the “excess deaths”, the number of deaths in a particular period, relative to that expected during “normal times”, and we develop a model for this endeavor. The excess mortality requires two numbers, the total deaths and the expected deaths, but the former is unavailable for many countries, and so modeling is required for such countries. The expected deaths are based on historic data and we develop a model for producing estimates of these deaths for all countries. We allow for uncertainty in the modeled expected numbers when calculating the excess. The methods we describe were used to produce the World Health Organization (WHO) excess death estimates. To achieve both interpretability and transparency we developed a relatively simple over-dispersed Poisson count framework, within which the various data types can be modeled. We use data from countries with national monthly data to build a predictive log-linear regression model with time-varying coefficients for countries without data. For a number of countries, subnational data only are available, and we construct a multinomial model for such data, based on the assumption that the fractions of deaths in sub-regions remain approximately constant over time. Our inferential approach is Bayesian, with the covariate predictive model being implemented in the fast and accurate INLA software. The subnational modeling was carried out using MCMC in Stan or in some non-standard data situations, using our own MCMC code. Based on our modeling, the point estimate for global excess mortality, over 2020–2021, is 14.8 million, with a 95% credible interval of (13.2, 16.6) million.

This is joint work with William Msemburi, Victoria Knutson, Serge Aleshin-Guendel and Ariel Karlinsky.

Dr. Wakefield is available to meet with faculty, postdocs, and students. Please contact Porchia Arnold, (Porchia.Arnold@emory.edu) if interested by September 21, 2022.

The seminar zoom link is https://zoom.us/j/98951139922.