1. Generalized Additive Model assuming a Negative Binomial distribution to account for overdispersion of deaths during the period we study[1]. The model includes a log-linear long term trend over weeks since start of observation () by and , cyclical penalized splines for the seasonal effect over week-of-year (), penalized splines for the age effect, and a smooth interaction between age and seasonality. The smooth effects are stratified by sex. Indicator variables have been added for the first and last weeks of a year and for week 22 (). The effect for these “special days” is estimated by age and sex. The basic structure of the model is as follows:

Where are the expected deaths in a given week, are the exposure times, and are smooth functions.

1. The second approach is a Generalized Additive Model assuming a Poisson distribution with the same structure as above.
2. The third approach is a Generalized Linear Model assuming a Poisson distribution used to estimate baseline mortality during influenza epidemics and known as Serfling model[2,3]. The basic structure of the model is as follows:
3. We constructed an empirical baseline mortality based on the average mortality rate over the previous five years 2015-19 within each week and stratum. The associated deaths from this approach result from multiplying the average death rates by the population exposed to the risk.