# Syndromic surveillance with death data: Is crude mortality data suitable for real time surveillance?

**Liselotte van Asten Ph.D[1]., M.Sc., Cees van den Wijngaard M.Sc[1]., Carel Harmsen[2], Rianne van Gageldonk M.Sc., Wilfrid van Pelt Ph.D. [1], Hans van Vliet M.D. [1], Marianne van der Sande M.D. Ph.D.[1], Marion Koopmans D.V.M., Ph.D. [1]**

[1]*Centre for Infectious Disease Control, National Institute of Public Health and the Environment, Bilthoven, The Netherlands,* [2]*Statistics Netherlands*

## Objective

To evaluate the potential of mortality data in the Netherlands for real-time surveillance of infectious events.

## Background

Crude mortality could be valuable for infectious disease surveillance if available in a complete and timely fashion. Syndromic surveillance with weekly deaths has been demonstrated to be useful in France. Such data can be of use for detecting, and tracking the impact, of unusual health events (e.g. pandemic influenza) or other unexpected or unknown events of infectious nature. To evaluate whether these aims can be achieved with crude mortality monitoring in the Netherlands, we investigated trends in death notifications and we tested whether retrospective crude mortality trends, at different days of delay, reflect known trends in infectious pathogens that are associated with death (such as influenza).

## Methods

In the Netherlands deaths are notified to 'Statistics Netherlands' (CBS), with a coverage of 100% (population: 16 million). The trends in the delay of death notifications was investigated for 2005. Furthermore trends in total deaths (notifications retrospectively completed and set to true date of death by Statistics Netherlands) were compared with trends in notifications at different levels of delay (information available from 1-14 days after true date of death). We used linear regression models to characterize the relationship between weekly crude mortality and known trends of infectious pathogens (respiratory, gastrointestinal and neurological, based on laboratory surveillance). Besides the current pathogen counts we also evaluated lagged values (1 to 5 weeks). For multivariate models a forward stepwise regression approach was used.

## Results

An average of 400 deaths occur daily. Data from 2005 show that the earliest notifications occur one day after death (median 2,2% is notified, IQR: 0, 7-3,1), increasing steadily until over 50% of deaths are notified and processed with a total 4 day delay. By 7 days almost all deaths are notified (median 92,8% IQR: 89,8-94,2) and after 2 weeks virtually all deaths are notified (median 99,3% IQR: 98,9-99,8) (fig.1).

Modeling the total mortality for 2005, showed that the explained variance was high (adjusted $R^2$: 0.77), with influenza isolates, RSvirus, and rotavirus as significant predictors. Notification data available at a 7 and 14 day delay show almost exactly the same results (risk ratio's and explained variance) as when modeling total deaths. At a 4 day delay the model starts to diverge from the model on the total data: β's strongly decrease. Synchrony with the total data further deteriorates for data with a shorter delay, although the explained variance remains high down to a 2 day delay ($R^2$: 62%).

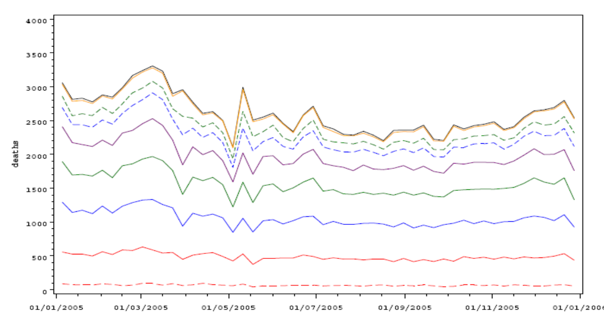


Fig.1. Total deaths (top line) vs. deaths notified within 14, 7, 6, 5, 4, 3, 2, 1 days (lower lines) in 2005.

## Conclusions

Real time crude mortality surveillance is expected to be reliable when using data with a 1 to 2 week delay. Feasibility of working with a 4 day delay or less needs further exploration (50% of deaths are reported within 4 days). Data on number of deaths by date of notification (thus disregarding actual death dates) will be less suited for early warning purposes. Longer retrospective time series, and a pilot study of real-time daily and weekly mortality analyses will help to further understand the potential of real time monitoring of overall mortality.