Building a mortality baseline to monitor and estimate excess mortality associated with influenza epidemics and other events in Portugal.

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Objectives

1. To weekly monitor all cause mortality in order to detect periods with observed mortality higher then the expected;

2. To retrospectively estimate the number of excess deaths associated with specific events (influenza epidemics, heat waves, cold waves, etc).

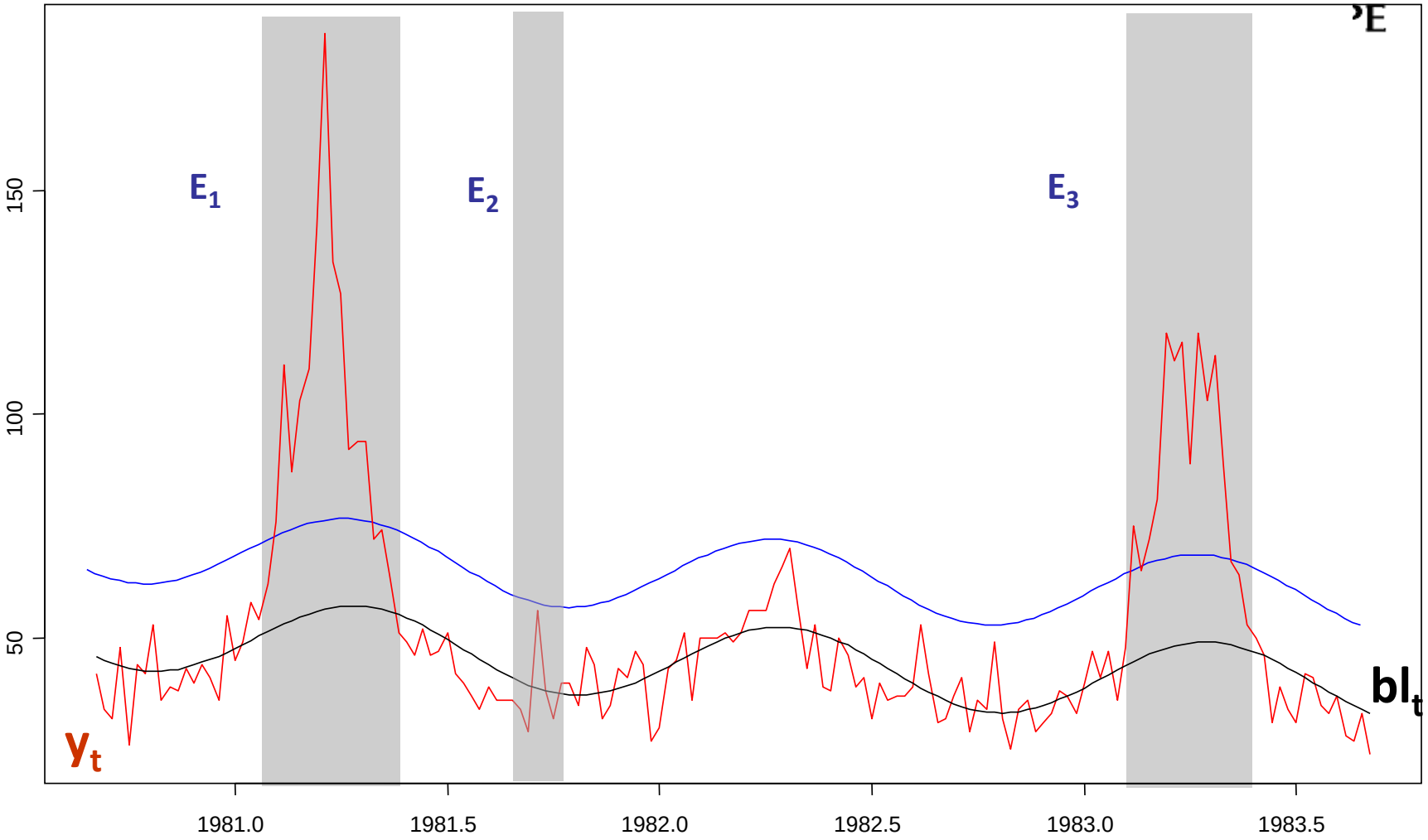
Baseline

- Expected weekly mortality in the absence of events known to be associated with excess mortality.

Method

1. Extract from the weekly mortality time series the time periods were an “event” associated with excess mortality has occurred;
2. Fit to this interrupted time series a statistical model that takes into account secular trend and seasonality (normal regression, poisson regression or seasonal ARIMA).

Method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Time

Event periods

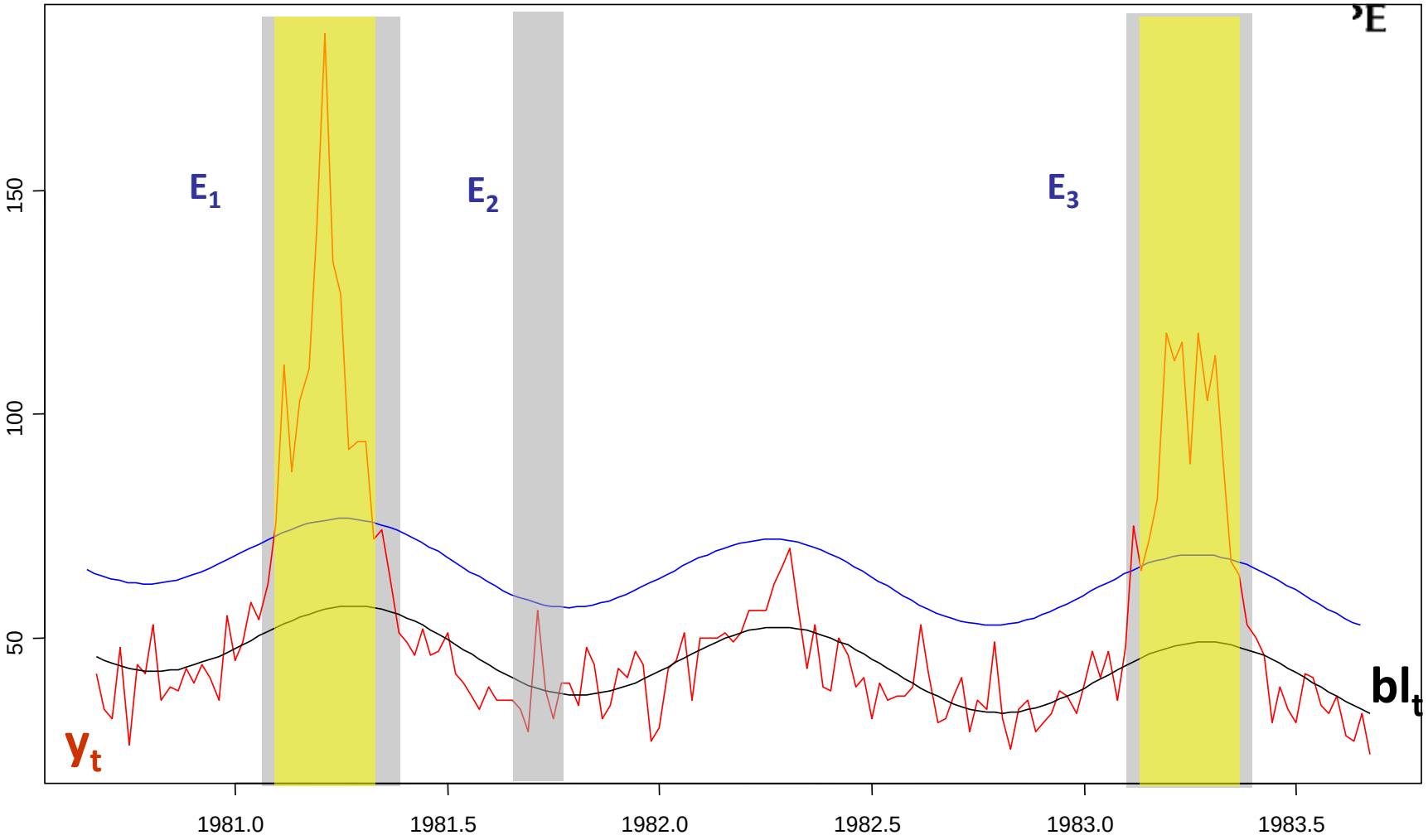
- **Influenza epidemics periods**: ILI rate above the baseline with non-sporadic circulation of influenza virus;
- **Heat waves:** at least three consecutive days with maximum air temperature above 32ºC (Lisbon criteria);
- ***Cold waves****: to be defined (Word Meteorological Organization definition).*
- ***Others:*** natural disasters, etc

Excess mortality

- **Excess mortality period:** period of time were the observed mortality is above the 95% confidence limit of the baseline for two or more consecutive weeks;

- **Number of excess deaths associated with an event:** difference between the observed number of deaths and the expected (baseline) during the excess mortality period that is contained in the event period.

Method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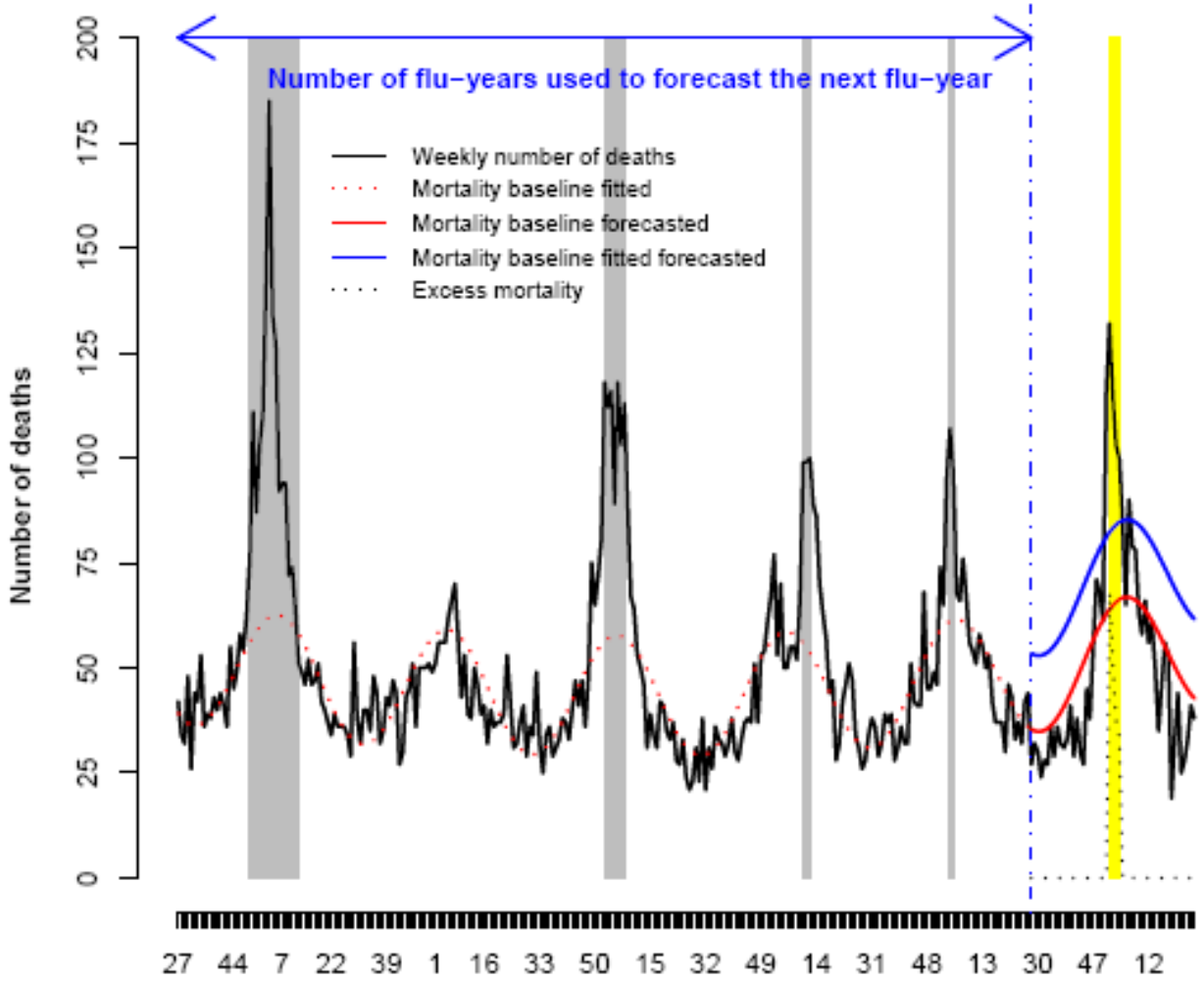
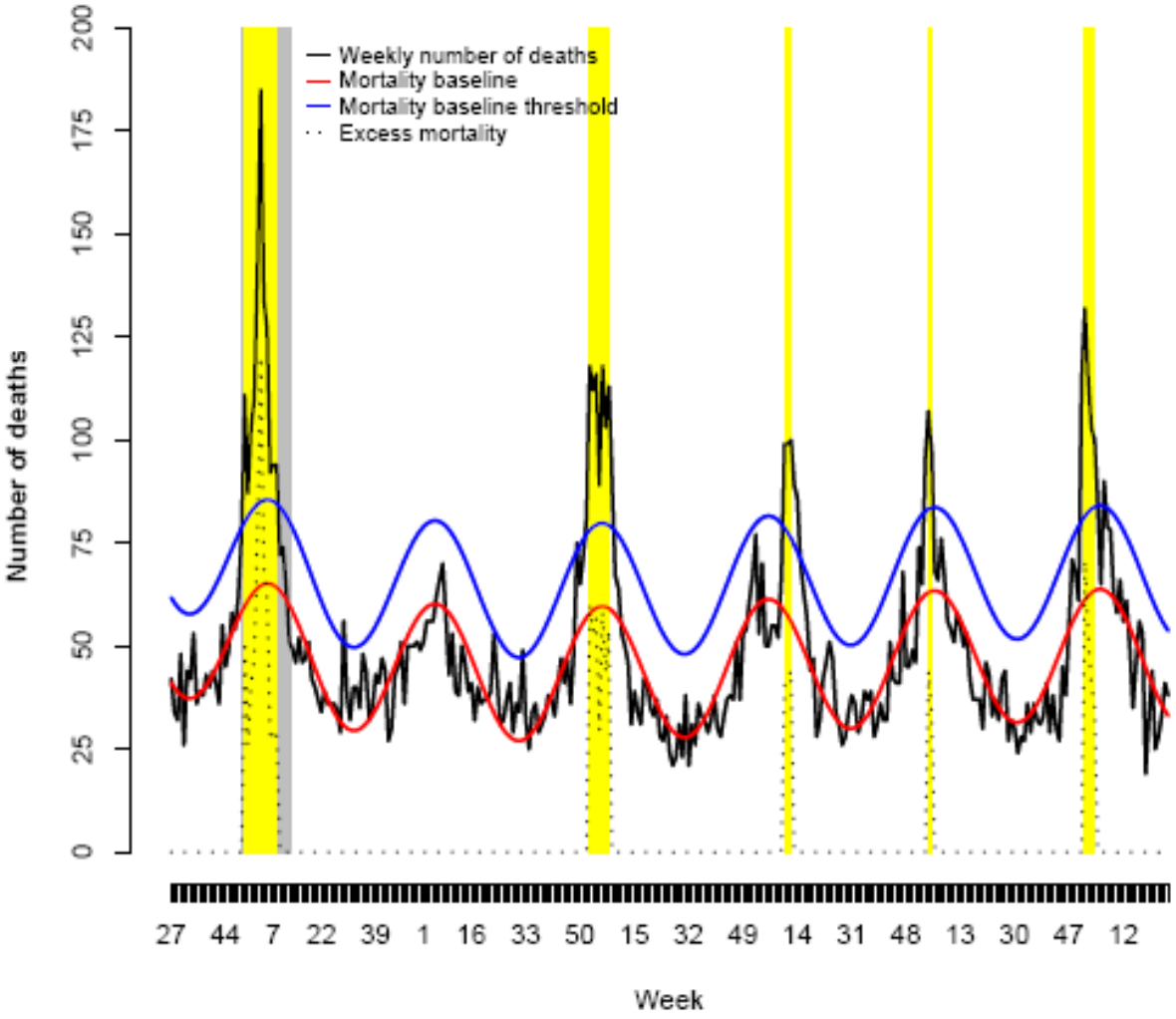
Time

Monitoring excess mortality

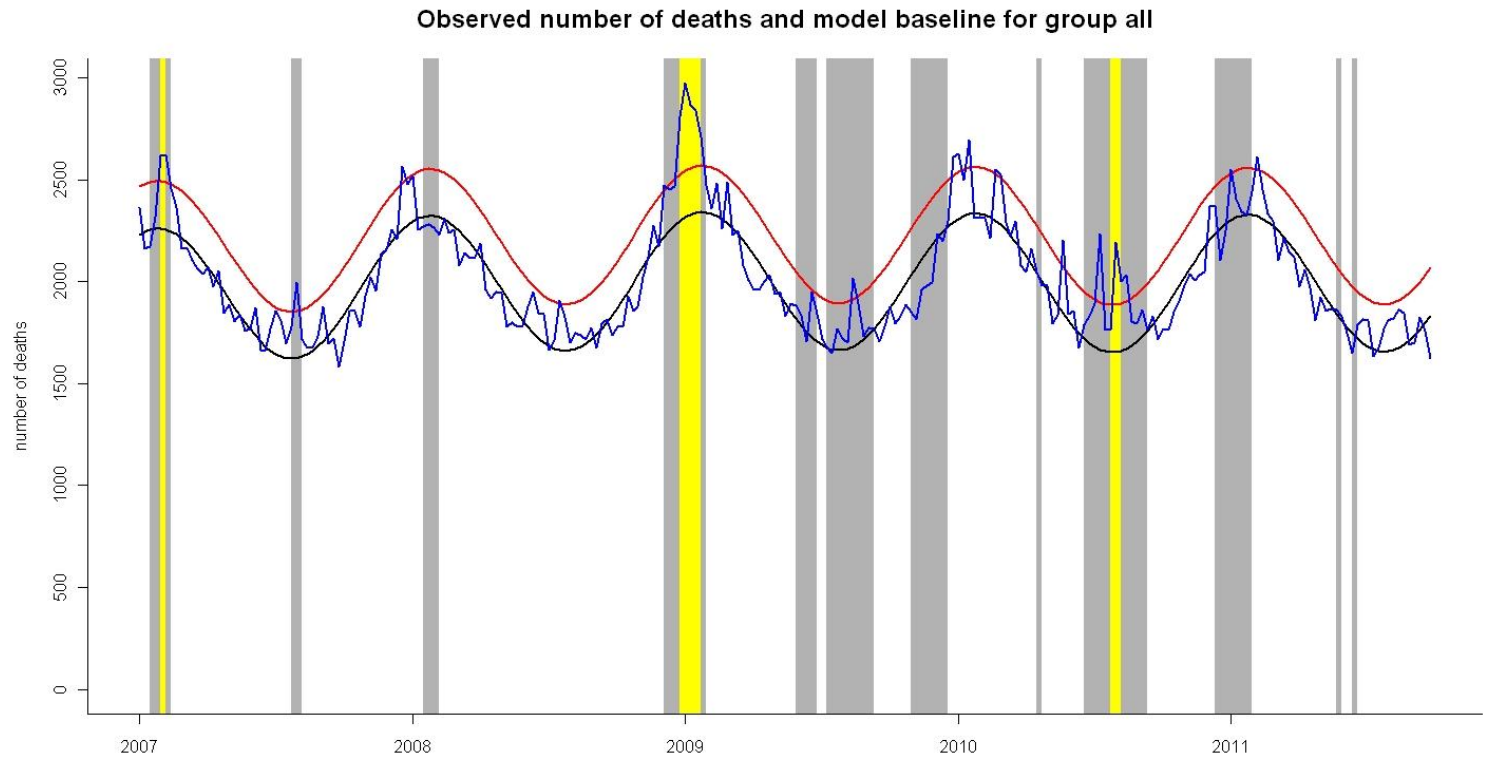


Estimating excess mortality



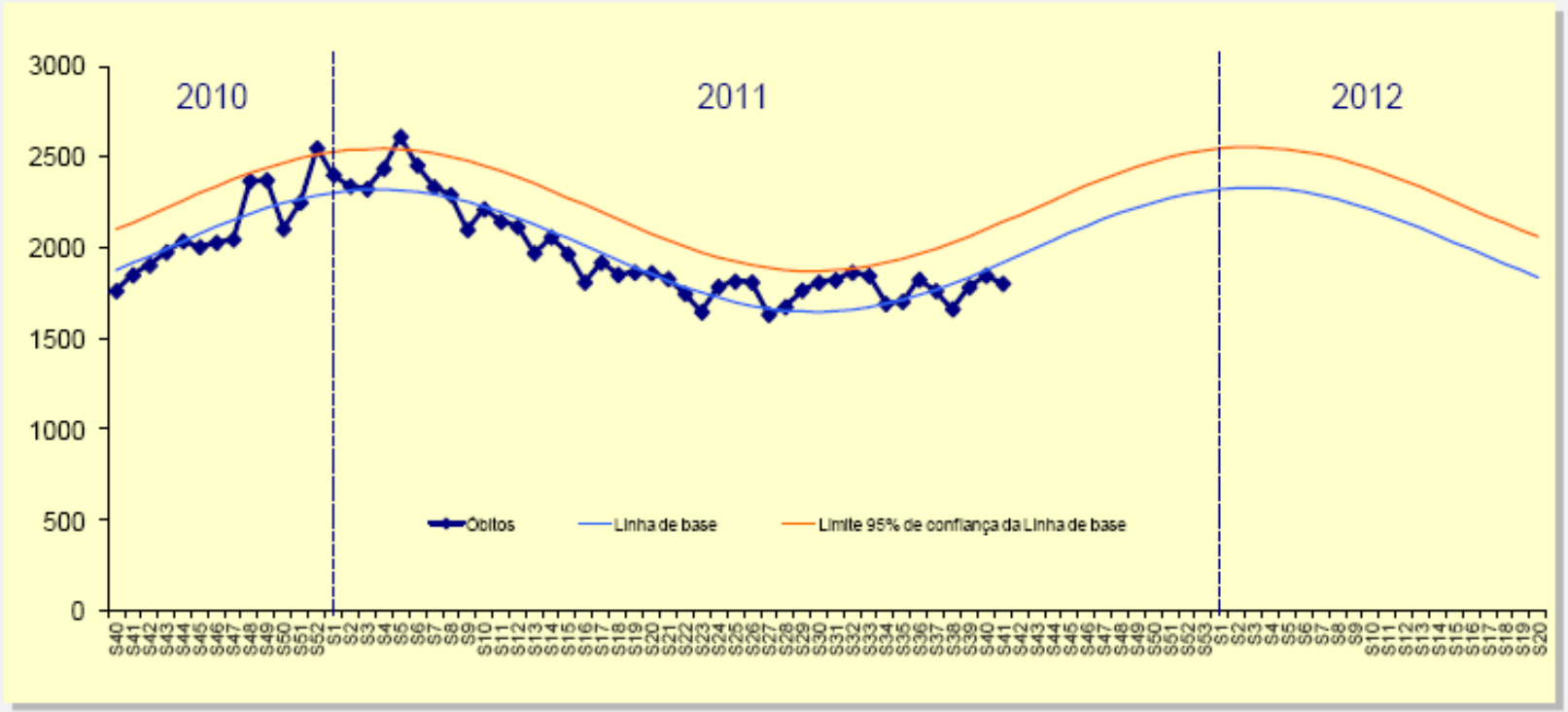
Monitoring excess deaths results

Baseline used to monitor 2011-2012 influenza season (all ages, all causes) is the projection based on the model fitted to the period week 20/2007 to week 39/2011.



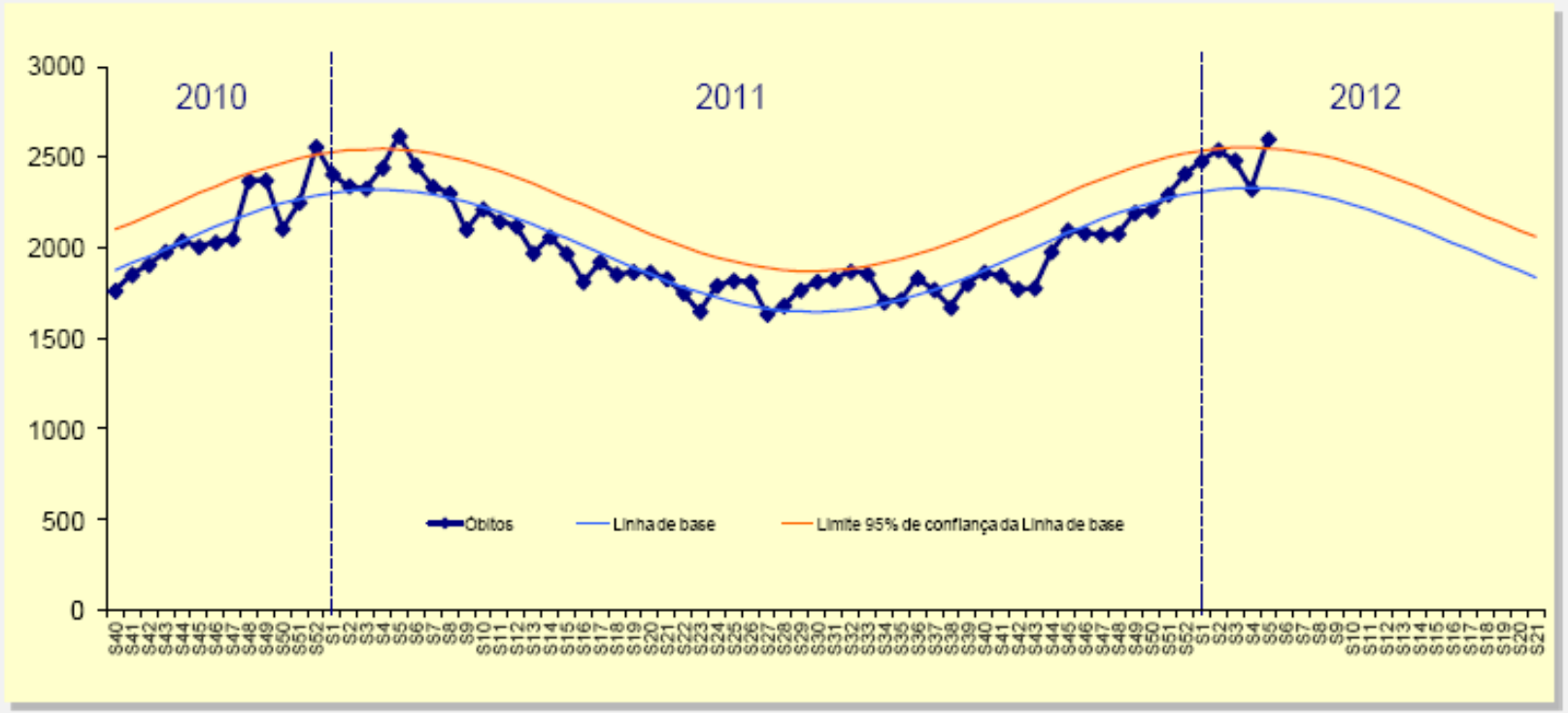
Monitoring excess deaths results

Week 40/2011.



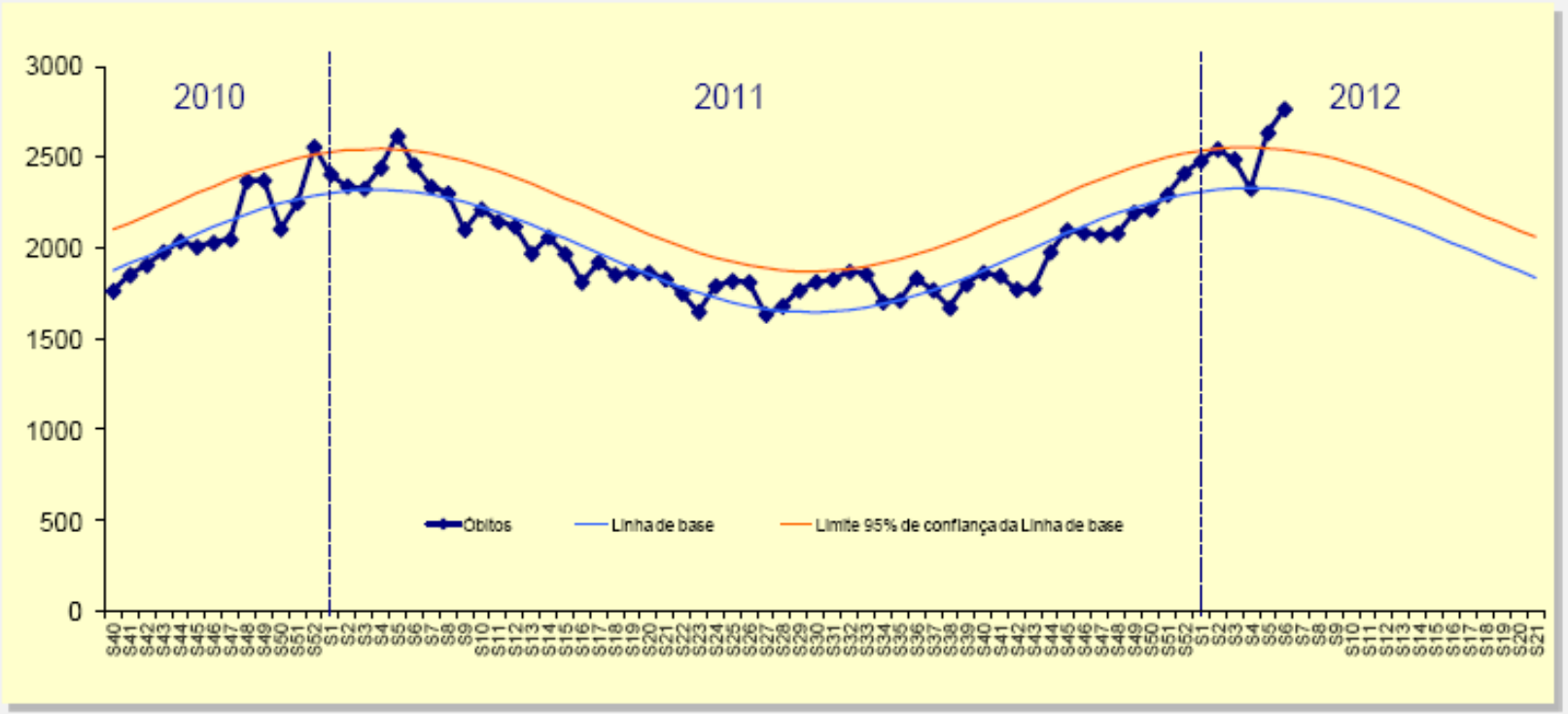
Monitoring excess deaths results

Week 5/2012.



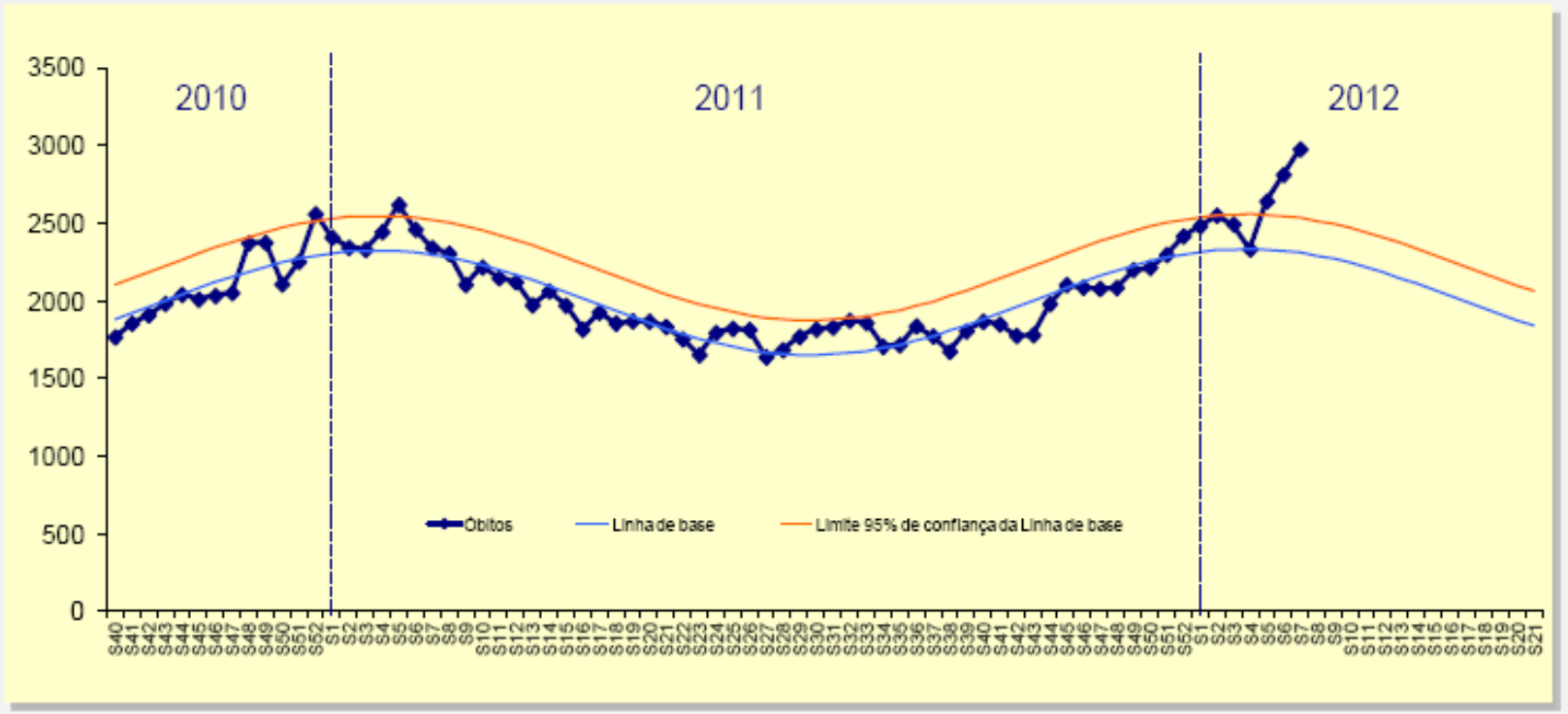
Monitoring excess deaths results

Week 6/2012.



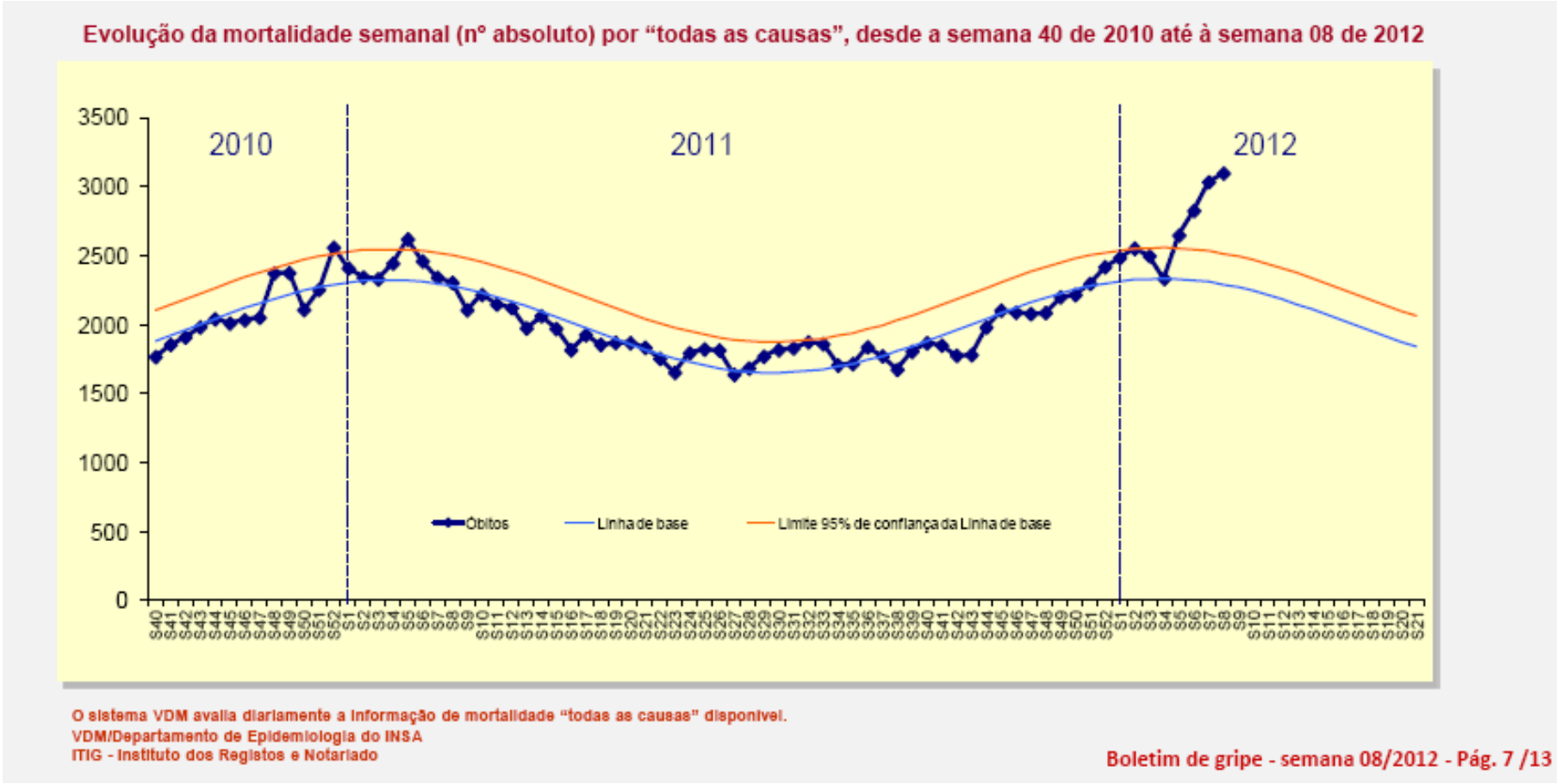
Monitoring excess deaths results

Week 7/2012.



Monitoring excess deaths results

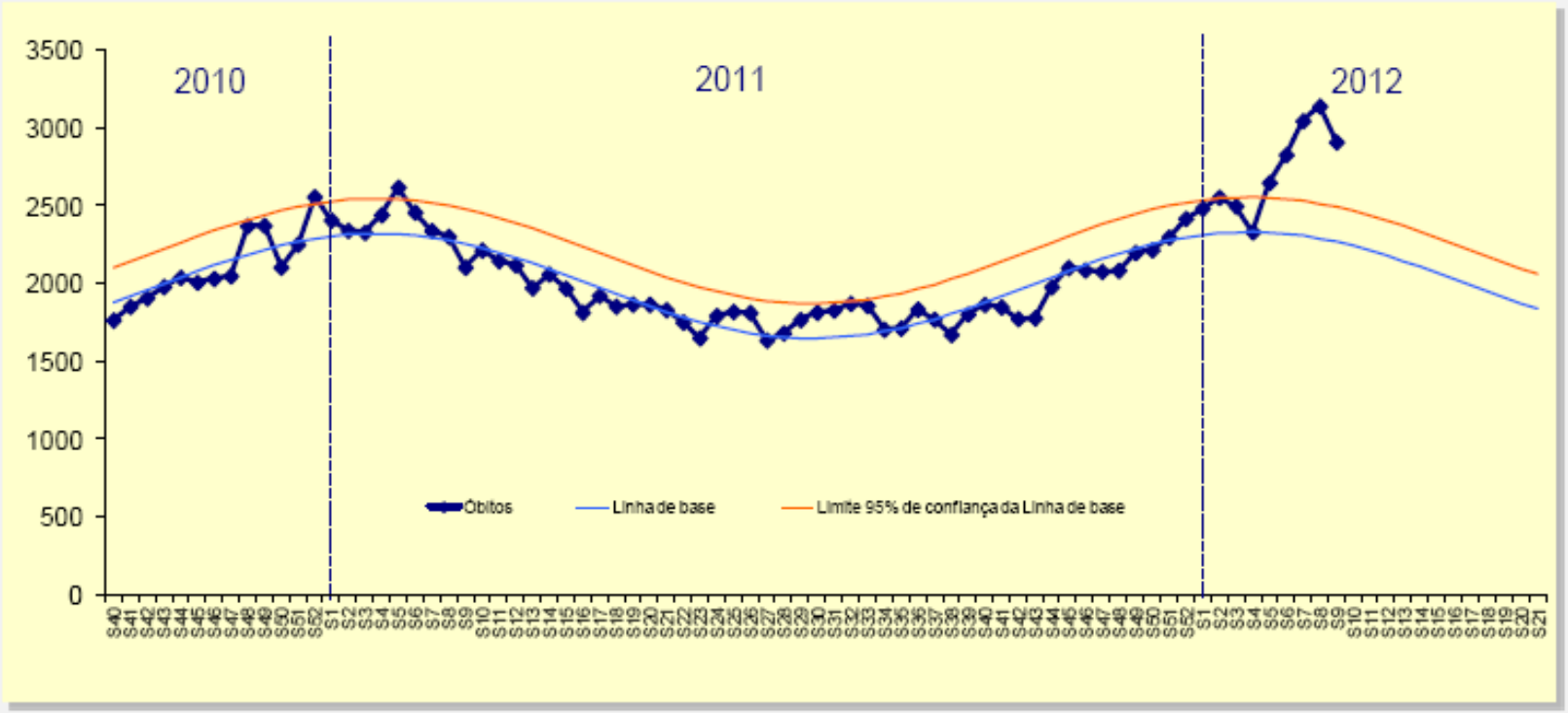
Week 8/2012.



Monitoring excess deaths results

Week 9/2012.

Evolução da mortalidade semanal (n° absoluto) por "todas as causas", desde a semana 40 de 2010 até à semana 09 de 2012



sistema VDM avalia diariamente a informação disponível sobre a mortalidade "por todas as causas" disponível.

DM/Departamento de Epidemiologia do INSA / Instituto dos Registos e Notariado (IRN) / Instituto de Tecnologias de Informação na Justiça (ITIJ)

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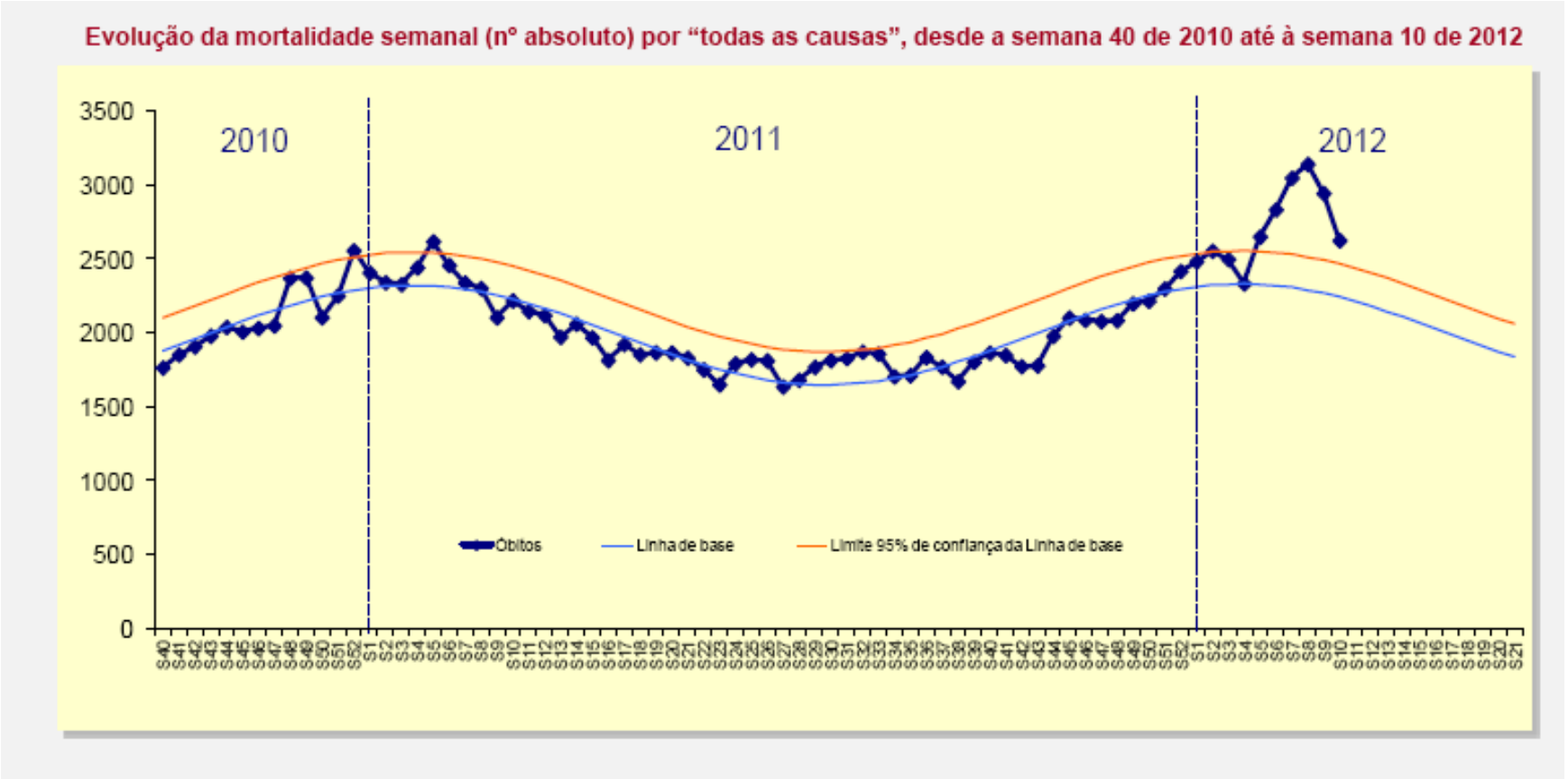
Monitoring excess deaths results

Week 10/2012.



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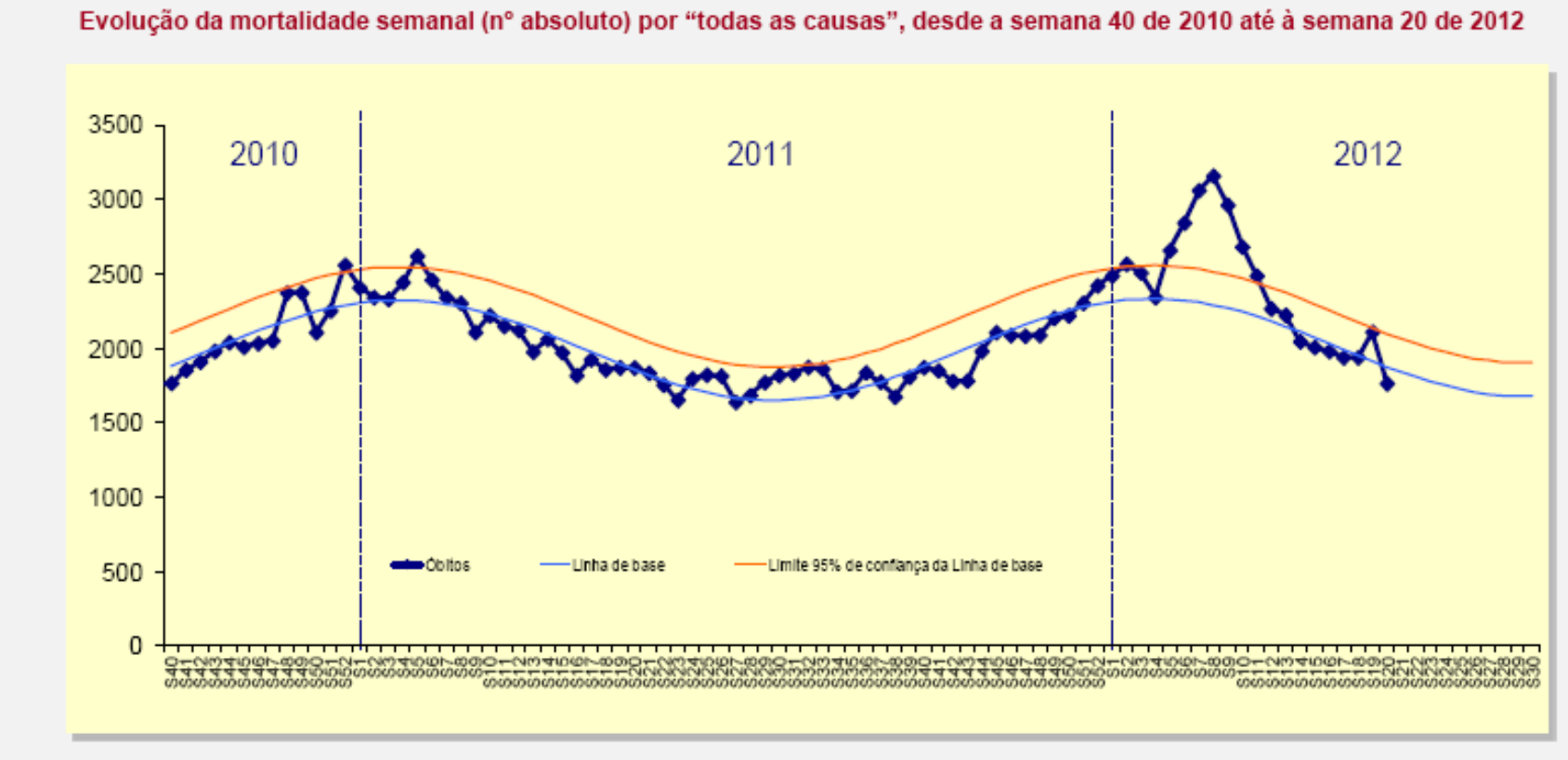
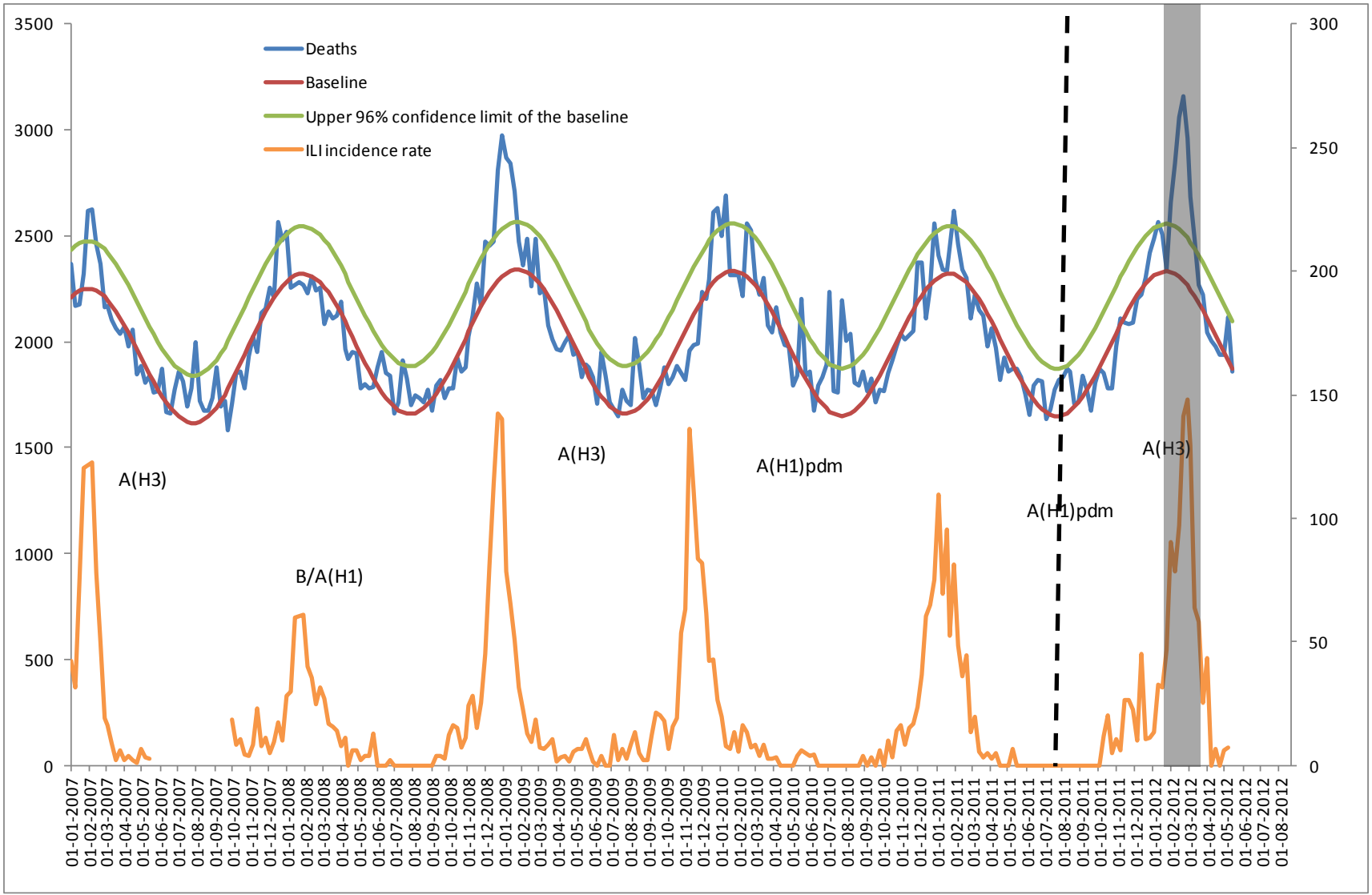
Monitoring excess deaths results

…Week 20/2012.



Monitoring excess deaths results

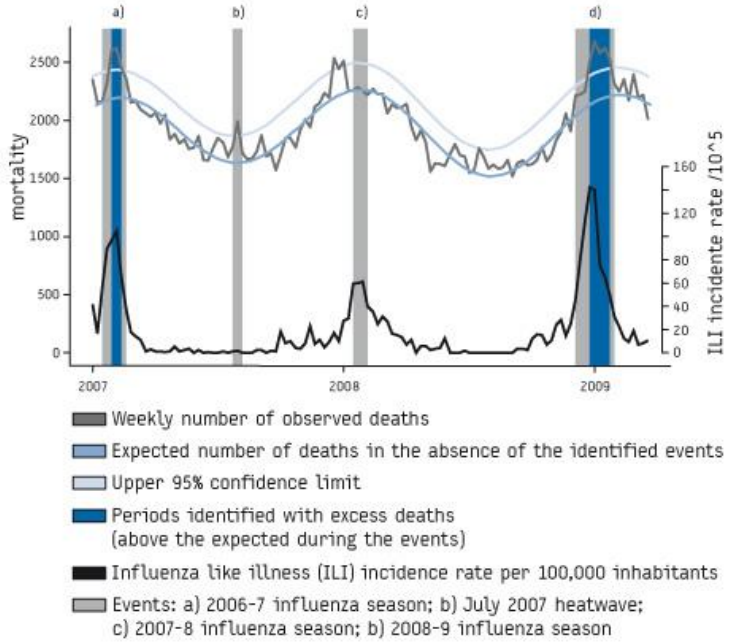


Retrospective estimation excess deaths results

- Used to obtain early estimates of excess deaths associated with 2008-2009 influenza epidemic: 1961 all cause excess deaths (Nogueira et al Eurosurveillance 2009)

FIGURE

Observed and expected weekly total mortality, weekly influenza incidence rates and potentially associated events; Portugal, January 2007 to February 2009



Retrospective estimation excess deaths results

- Used to estimate excess mortality associated with influenza (cause specific and age group) in the period of 1980 to 2004 in Portugal. (Nunes et al Plos One 2011)
- In the period of 1980 to 2004 we estimated an average excess deaths of 2475 and a rate of 24 deaths /10^5 inhabitants, (range zero to 8514);
- Seasonal excess deaths were highly correlated with ILI attack rates (rho 0.63 to 0.83);
- Method was applied to a control time series (injuries deaths) residual excess deaths found.

Limitations

- Needs the retrospective identification of event periods using external data (influenza epidemics, heat waves, cold waves, ?);
- If applied at the European level requires harmonization of events definitions?
- Overestimates excess deaths in comparison with regression techniques that uses covariates (influenza activity indicators, climate indicators, etc);
- Difficulties in fitting to population groups with low number of deaths per week.

Advantages

- The baseline is estimated using more mortality data than classical Serfling approach – does not eliminate all winter and summer data (Euromomo);
- Allows for prospective estimation of the baseline for real time excess mortality monitoring;
- It can be used for retrospective excess deaths estimation when covariates are not accessible;
- Estimates at the same time excess deaths associated with events of different nature (influenza epidemics, extreme climate events, disasters, etc);
- It is implemented in a R package Flubase.

References

Nunes B, Natario I, Carvalho L. Flubase: Baseline of mortality free of influenza epidemics. R package version 1.0. 2009. Available from: http://cran.r-project.org/web/packages/flubase/index.html

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Thank you for your attention!