

EARLY ESTIMATES OF THE EXCESS MORTALITY ASSOCIATED WITH THE 2008-9 INFLUENZA SEASON IN PORTUGAL

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The aim of this study was to estimate the excess mortality associated with the influenza activity registered in Portugal between week 49 of 2008 and week 5 of 2009. For this purpose available mortality data from the Portuguese Daily Mortality Monitoring (VDM) System were used. Several estimates of excess deaths associated with the recent recorded influenza activity were determined through statistical modelling (cyclic regression) for the total population and disaggregated by gender and age group. The results show that the impact of the 2008-9 influenza season was 1,961 excess deaths, with approximately 82% of these occurring in the age group of 75 years and older.

Background

At the end of 2008, Portugal was one of the first countries in Europe to experience an intense influenza activity that lasted a few weeks into 2009 [1]. High influenza incidence rate estimates were observed although the epidemic peak was below the previously observed maximum values. It was expected that this influenza activity should have an impact on mortality, as shown by other studies [2-3]. Available data from the Portuguese Daily Mortality Monitoring (VDM) System were used to quantify the impact. Since mid-2007, this system has been receiving information on daily mortality registered in all Portuguese Civil Register Offices from centralised databases hosted by the Institute of Information Technology in Justice at the Ministry of Justice. This study sought to give evidence of the impact of influenza activity on mortality by calculating estimates of excess deaths associated with influenza, and to test the VDM System.

Methods

Influenza activity

The information on influenza activity consisted of weekly estimates of influenza-like illness (ILI) incidence rates obtained by the Portuguese general practitioners (GP) sentinel network (Rede Médicos-Sentinela) [4] from week 41 of 2006 to week 7 of 2009 (up to 15 February 2009, inclusive). This period comprises the seasons 2006-7, 2007-8 and part of 2008-9.

Mortality

Weekly aggregated mortality data from week 1 of 2007 to week 7 of 2009 (up to 15 February 2009, inclusive) generated by the Daily Mortality Monitoring (VDM) System were used. Data were disaggregated by gender and age group (65-74 and ≥ 75 years).

Methods for calculating the estimated number of excess deaths

Statistical modelling was used to calculate the estimated number of excess deaths associated with the 2008-9 influenza epidemics.

First, all types of events potentially associated with excess mortality in the period from week 1 of 2007 to week 7 of 2009 (up to 15 February 2009, inclusive), were identified (Table 1). The periods of influenza epidemic were defined as the set of consecutive weeks with influenza virus detected and ILI incidence rate above the upper 95% confidence limit of the ILI incidence rate baseline. The heatwave period was defined as the weeks in which high temperatures were registered (two or more consecutive days with temperatures above 32°C). In both kinds of events an additional week was added to account for eventual delay of impact.

A cyclical regression model was fitted to the mortality time series after excluding the event periods (Table 1). This type of model is a multiple linear regression model whose independent variables are functions of the time sequence to adjust for the existence of long term trends and the seasonal annual pattern of mortality.

The weekly mortality predicted by the model was considered as the baseline mortality in the absence of the events potentially associated with excess mortality.

The period of excess mortality attributed to the 2008-9 influenza epidemic was defined as the set of consecutive weeks that began with two values of the observed number of deaths above the upper 95% confidence limit of the baseline and ended with two consecutive mortality values below the same limit.

TABLE 1

Events potentially associated with excess mortality observed in the period from week 1 of 2007 to week 7 of 2009 in Portugal

Event	Period (week/year)	Number of weeks
2006-7 influenza epidemic	3/2007 to 9/2007	7
July 2007 heatwave	30/2007 to 32/2007	3
2007-8 influenza epidemic	3/2008 to 7/2008	5
2008-9 influenza epidemic	49/2008 to 6/2009	10

The Figure represents a series of data, identifying the influenza epidemics and heatwave events and the baseline obtained by cyclical regression. The estimated excess deaths attributed to the 2008-9 influenza epidemic was obtained by summing the differences between the observed and the baseline mortality during the period of excess deaths, represented by dark blue bars in the Figure.

The excess deaths associated with the 2008-9 influenza season were computed by gender and age groups. Confidence intervals of the excess death estimates at 95% level were calculated by approximation to the normal distribution, using as standard error the product of the square root of the number of weeks with excess mortality by the standard deviation of the model residual. Excess mortality rates per 100,000 inhabitants were produced using the estimates of the Portuguese population at the end of 2007 [5].

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

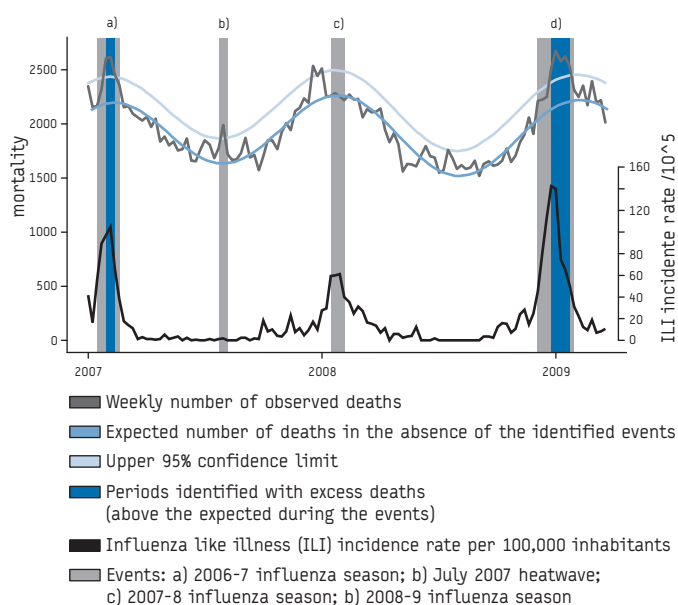


TABLE 2
Estimates of crude number of excess deaths and excess death rates, associated with 2008-9 influenza season in Portugal, in total, by sex and by age groups

	Excess deaths (95% CI)	Excess death rate/100,000 inhabitants
Total	1,961 (1,567-2,355)	18
Sex		
Men	703 (526-880)	14
Women	1161 (936-1,386)	21
Age group		
65-74	119 (75-163)	12
>=75	1,615 (1,317-1,913)	191

Statistical analysis was performed using R (www.r-project.org) package Flubase [6].

Results

The last influenza season (2008-9) was marked by more intense activity and earlier onset than the two previous seasons, with a medium to high activity between weeks 49 of 2008 and 5 of 2009, reaching a maximum value at the turn of the calendar year (Figure).

The main results indicate that although the epidemic lasted for nine weeks (from week 49 of 2008 to week 6 of 2009) excess mortality was observed only during five weeks (from week 52 of 2008 to week 4 of 2009). The overall impact was estimated to have resulted in 1,961 excess deaths, corresponding to an excess death rate of 18 per 100,000 inhabitants. The results also indicate that the impact was higher in women than in men and that 82% of the total estimated number of excess deaths occurred in individuals aged 75 years and older (Table 2).

Discussion and conclusions

The overall estimated number of excess deaths for the 2008-9 influenza season is within expected values. Past experience has shown that influenza activity and intensity can vary widely as does the respective attributable mortality. For Portugal, previous studies estimated an average of 1,773 and 2,475 deaths per epidemic period [2, 7-8].

Our results demonstrate that the currently existing tool for rapid mortality surveillance (VDM) can be used to promptly identify and estimate the impact of such public health events. A more accurate estimate could only be obtained if official routine mortality data were available.

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