Excess mortality in Europe in the winter season 2014/15, in particular amongst the elderly.

An analysis of all-cause mortality from 15 European countries participating in the EuroMOMO network (www.euromomo.eu) shows an unusually high excess mortality among the elderly during the 2014/15 winter season. This excess can roughly be translated into 217,000 premature deaths amongst the 94 million seniors over 65 years of age in the European Union-28. Many of these deaths are likely to be caused by influenza, although other factors may also contribute.

Mortality in a population has a regular seasonal pattern, with higher mortality observed during the winter months compared to the summer months, see figure 1. This seasonality in mortality is driven predominately by deaths among the elderly. The pattern can be ascribed to various factors including seasonal transmission of influenza and other respiratory virus infection, as well as increased deaths from bacterial infections including bacterial pneumonia, and cardiovascular diseases in the winter. During periods with extreme cold weather, increases in mortality may be observed, which may be explained by a direct effect of "cold snaps" on the risk of death, especially among elderly and vulnerable groups in the population.

Table 1 and Figure 1 shows the variation in the mortality pattern over the previous five winters and between age groups. In the 2014/15 winter season the highest mortality was seen among those aged 65 and over. The excess mortality rate was 231.3 per 100,000 above the baseline corresponding to 98,903 excess deaths in the participating countries. This is the highest number of excess deaths seen in the last five seasons and it is in marked contrast to the estimates from the 2013/14 season where the excess mortality was below the expected level. With an estimated population of 94 million above 65 years of age in the 28 countries of the European Union, this excess can be extrapolated to approximately 217,000 deaths among the elderly ≥65 years of age.

Among the age group 15 to 64 year, the number of excess deaths was 9,462 (equivalent to 5.9 per 100,000 population). This is higher than the winter seasons 2010/11, 2011/12 and last winter season 2013/14 but at a similar level to the 2012/13 winter season where the excess mortality rate was 5.5/100,000.

Variation between countries:
The excess mortality rate amongst those aged 65 and older varied between the participating countries, with higher excess mortality rates per 100,000 in Portugal (446), Hungary (324), Spain (302). The Netherlands (262), the UK excluding Northern Ireland (225), and in France with 193/100,000 population.

Estonia and Finland did not experience excess mortality and Denmark (70/100,000), Norway (62/100,000) and Sweden (97/100,000) had lower excess mortality per 100,000 inhabitants than most other countries.

Commentary

These results are produced by a statistical model analysing all-cause mortality. By using deaths from all causes as an outcome, we avoid the issues related to delays in registration of cause-of-death and uncertainties regarding the coding of the cause of death. However, the approach is also subject to a number of limitations. Increases in mortality from one cause of death may be outnumbered by decreases in other causes of deaths. Nevertheless, the analyses in a rapid communication, published in Eurosurveillance in March 2015 (http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=21065) showed that the increase in excess mortality coincided with an increased proportion of influenza detections in the European influenza surveillance schemes. This season influenza A (H3N2) virus was the predominant virus which is known to affect the elderly population disproportionally as compared with influenza A (H1N1) pdm09. Furthermore, the majority of the genetically and antigenically characterized influenza A H3N2 viruses that circulated in Europe during the 2014/15 season had drifted from the vaccine strain resulting in a lower influenza vaccine-effectiveness that anticipated. On this basis, and given past experience, it is likely that influenza contributed significantly to the excess deaths, though cold snaps and other respiratory infections are likely to have had contributed.

By contrast, influenza transmission in 2013/14 was limited and dominated by influenza A(H1N1)pdm09, where the impact of influenza on the elderly is reduced due to underlying cross-protective immunity, as previously observed during the 2009/10 influenza pandemic.

This report represents the second brief descriptive winter excess mortality summary provided by the EuroMOMO network. Interpretation of the data is qualitatively based on the knowledge of past events and the transmission of influenza which is known to impact considerably on all-cause mortality.

Quantitative analyses assessing the impact of influenza on mortality will follow from the FluMOMO project, where influenza activity will be included in the statistical model to directly estimate the effect of influenza, controlled for the effect of extreme ambient temperatures.

Table 1 – Pooled analysis of excess deaths during the winter season (week 40 – week 20) per 100,000 inhabitants. The numbers are expressed as rate of deaths per 100,000 population above the forecasted (expected) baseline produced by the EuroMOMO statistical algorithm. Numbers in brackets are 95% confidence intervals (data from week 26, 2015)

Winter season	0 - 4	5 – 14	15 - 64	65 +	Total
2010/11	0.9 (0.1;1.6)	0.4 (0.2;0.6)	4.4 (4.0;4.8)	24.5 (17.8;31.2)	7.4 (6.1;8.7)
2011/12	1.9 (1.1;2.6)	0.3 (0.2;0.5)	2.3 (1.9;2.7)	106.5 (99.7;113.2)	20.6 (19.3;22.0)
2012/13	2.0 (1.3;2.8)	0.6 (0.4;0.7)	5.5 (5.1;5.9)	128.6 (121.8;135.5)	26.9 (25.6;28.2)
2013/14	1.7 (1.0;2.5)	0.1 (-0.1;0.2)	1.9 (1.5;2.3)	-11.5 (-18.3;-4.7)	0.2 (-1.1;1.5)
2014/15	1.4 (0.6;2.1)	0.5 (0.4;0.7)	5.9 (5.5;6.3)	231.3 (224.2;238.4)	44.3 (43.0;45.7)

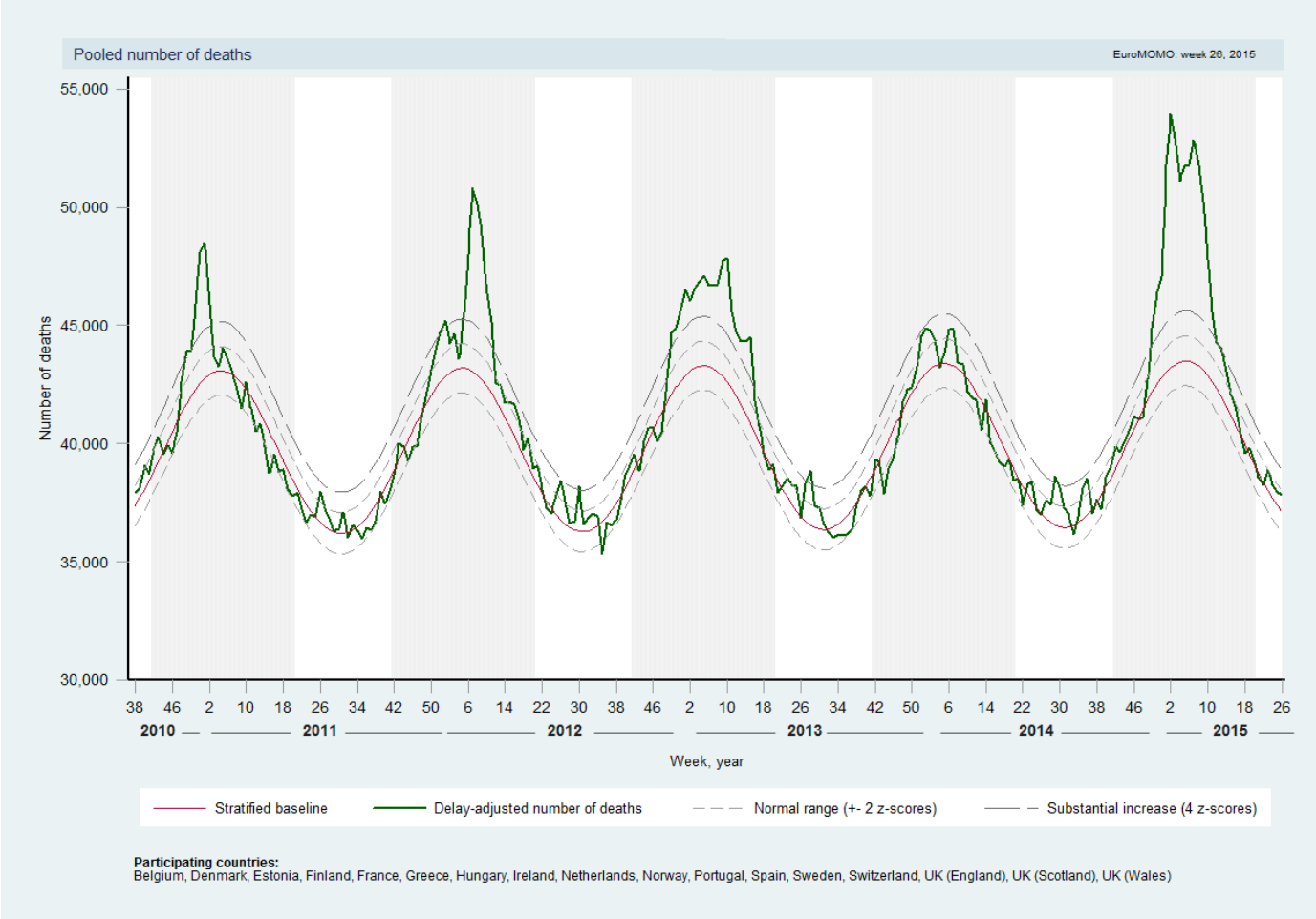

Figure 1 - Pooled weekly total number of all-cause deaths, expected deaths (baseline), 2 and 4 z-score levels, 2010-2015, In grey: Period included in the analysis of the winter seasons.

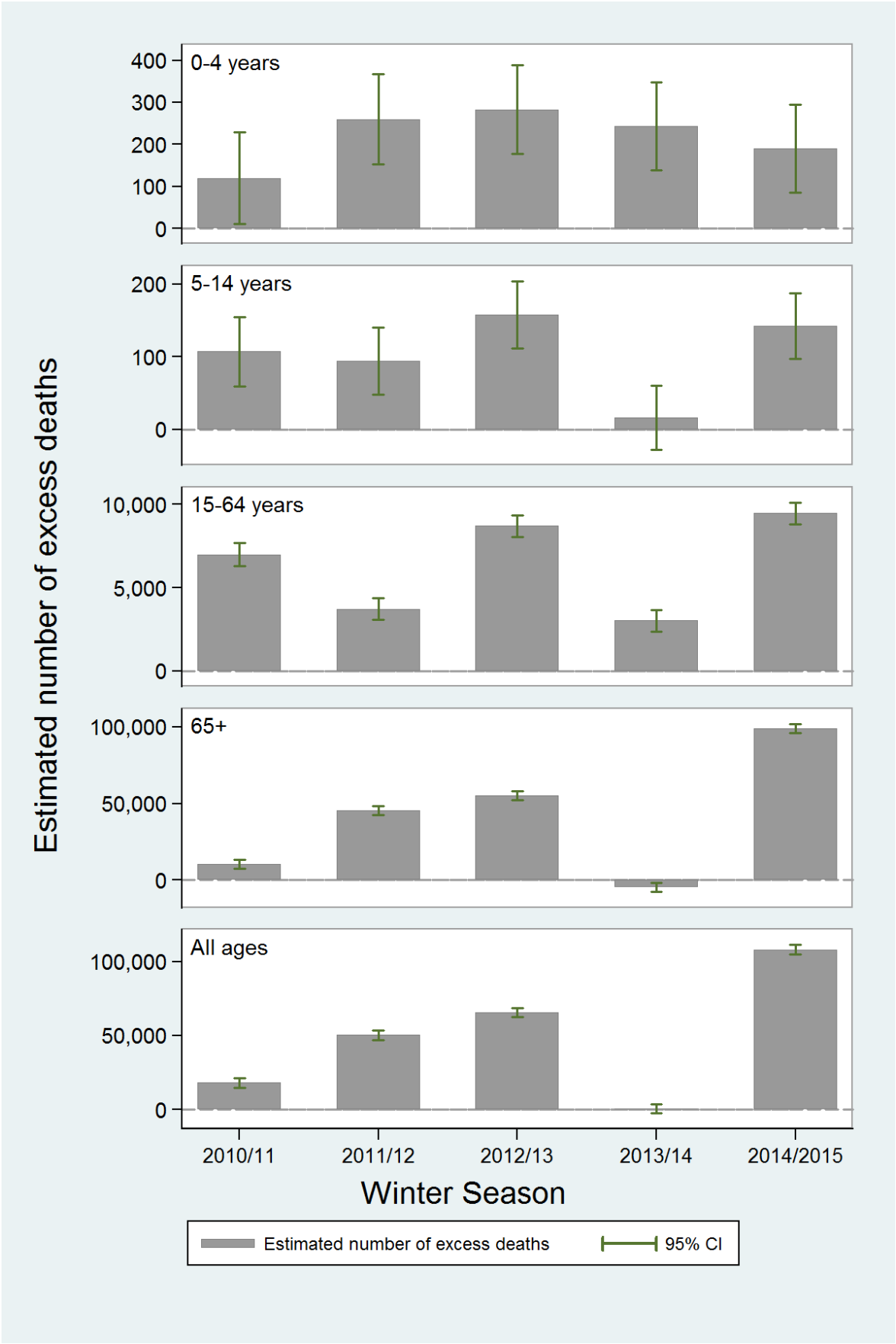

Figure 2 - Estimated number of excess deaths by age group for winter seasons 2010/11 to 2014/15

Background and methods

EuroMOMO is a network for monitoring weekly all-cause mortality across participating European countries in order to detect mortality in excess of normal seasonal mortality levels in a timely manner, EuroMOMO has been monitoring weekly excess all-cause mortality continuously since the H1N1 pandemic in 2009. The number of participating countries or regions of countries has increased over the five years and is currently 18, thus covering large geographical areas in Europe from north to south and east to west.

Although EuroMOMO's first aim is to detect and report acute weekly excess mortality above normal seasonal levels in a timely manner, annual pooled estimates of winter excess mortality may be useful to assess the burden of epidemics and to compare seasons; this is what is presented in this report.

Definitions

- **Winter season** was defined as the period from week 40 to week 20 the following year.
- **Excess deaths** were defined as observed deaths minus expected deaths
- **Excess mortality rates** were calculated, thus allowing comparison of mortality patterns between different populations and time periods.

Pooling and model

A common statistical algorithm (A-MOMO) is used in each of the EuroMOMO-participating countries to generate weekly estimates of age group-specific excess number of deaths, and z-scores are used to compare across countries. The algorithm is a time-series Poisson regression model with number of weekly deaths as a dependent variable adjusting for trend and seasonal variation. The algorithm also corrects for the delay observed between data collection and data processing in each country.

For the present analyses we used the weekly stratified EuroMOMO pooled method. Data from week 39, 2010 to week 26, 2015 where data were available from all participating countries, were used to model total and age group specific (<5, 5–14, 15–64 and ≥65 years) weekly numbers of expected (baseline) and excess deaths, stratified by participating countries.

Population numbers were obtained from EuroSTAT and used to calculate mortality rates.

For this report, data from the following countries or region of countries were included: Belgium, Denmark, Estonia, Finland, France, Greece (7 counties), Hungary, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom (England, Scotland and Wales). This represented an underlying population of 244.5 million inhabitants. Results of pooled analyses may vary from previous winter summaries depending on participating countries, updates of data and as a result of the period applied for the baseline calculation.