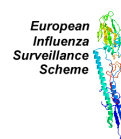


# Five winters of influenza activity in Europe: an evaluation of the indicators used to measure activity and an assessment of the timing, length and spread of influenza

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## Background

The European Influenza Surveillance Scheme (EISS) has collected clinical and virological data on influenza activity since 1996 ([www.eiss.org](http://www.eiss.org)). The aim of the EISS project is to reduce the morbidity and mortality associated with influenza in Europe. Currently, EISS includes 24 countries, 32 national reference laboratories, at least 12,000 sentinel physicians and covers a total population of 458 million inhabitants.

Increased influenza activity in a country usually lasts 6-12 weeks. We used the clinical and virological data in the EISS database, collected over five influenza seasons (1999/00 to 2003/04), to assess three questions:

1. Are the sentinel clinical reports collected by EISS each winter a good measure of influenza activity?
2. Based on the sentinel clinical reports, how long is a typical influenza season in Europe?
3. Based on the sentinel clinical reports, is there a west-east or north-south spread of influenza activity across Europe?

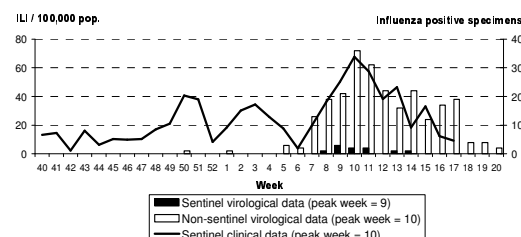
## Methods

EISS uses three indicators to assess influenza activity in Europe:

1. Clinical data collected by sentinel physicians;
2. Virological data collected by sentinel physicians;
3. Virological data collected from non-sentinel sources (e.g. hospitals).

The analysis was based on the peak level of influenza activity for each indicator (Figure 1).

Fig. 1: Example of indicators and peak levels, Netherlands, 2002-2003 season



The validity of the clinical sentinel reports was assessed by comparing the sentinel clinical indicator with the two virological indicators for each country (N=17). The length of an influenza season was calculated by subtracting the earliest and latest weeks of peak clinical activity across Europe for each season. The geographical spread of influenza was assessed by plotting the peak week of clinical activity for each country and season against the longitude and latitude of the central point of each country (N=20).

## Results

### 1. Validity of the sentinel clinical reports

We found a very good match between the clinical sentinel data and the sentinel virological data (Table 1; overall match of 80%, +/- 1 week difference in peaks). We also found a good match between the clinical sentinel data and the non-sentinel virological data (Table 1; 71%, +/- 1 week difference in peaks).

### 2. Length of an influenza season in Europe

The length of increased influenza activity in Europe as a whole was typically 3-5 months (see Table 2). This is illustrated in Figure 2, with data from three selected countries.

### 3. Spread of influenza activity across Europe

The data indicate (Table 2) that there was a west-east spread of influenza activity in three of the previous five winters (2003-2004,  $p=0.000$ ; 2002-2003,  $p=0.002$ ; 2001-2002,  $p=0.055$ ). In one of these seasons (2001-2002,  $p=0.023$ ), there was also a south-north spread.

## Conclusions

We found that the clinical sentinel reports collected by EISS are a valid indicator of influenza activity. We also found that, for Europe as a whole, increased influenza activity lasts for 10-22 weeks. This has important implications for the EISS co-ordination centre, as it has to be alert and monitor influenza activity for 2-5 months each winter. It also highlights the need for EISS to present country-specific data.

The possibility of a west-east (and south-north) spread of influenza activity across Europe needs to be confirmed with more detailed mapping analyses. The long period of increased influenza activity and the possibility of a west-east spread may have important consequences for influenza pandemic planning in Europe. For example, these findings could help with the planning and efficient allocation of resources (e.g. antivirals and vaccines) in Europe before and during a pandemic.

Table 1: Validity of the sentinel clinical reports, assessment based on five winters (N=17\*)

Peaks	Total number of paired peaks compared	Difference of +/- 1 week (%)	Difference of +/- 2 weeks (%)
Clinical sentinel vs. virological sentinel	61	49 (80.3%)	58 (95.1%)
Clinical sentinel vs. virological non-sentinel	35	25 (71.4%)	31 (88.6%)

\* Belgium, Czech Republic, Denmark, England, France, Germany, Ireland, Italy, the Netherlands, Portugal, Romania, Scotland, Slovak Republic, Slovenia, Spain, Switzerland and Wales.

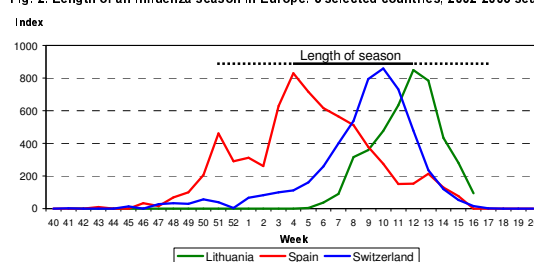
Table 2: Spread of influenza in Europe based on peak levels of clinical sentinel reports, five winters (N=20\*)

Season	Number of countries	Length of season in weeks (months)**	West-East spread ( $R^2$ )	p-value	South-North spread ( $R^2$ )	p-value	Dominant virus in Europe
2003-2004	19*	18-22 wks (4.5-5.5 mths)	0.5701	<b>0.000</b>	0.0012	0.888	A(H3)
2002-2003	16	14-18 wks (3.5-4.5 mths)	0.5046	<b>0.002</b>	0.0498	0.406	A(H3) & B
2001-2002	15	14-18 wks (3.5-4.5 mths)	0.2553	0.055	0.3366	<b>0.023</b>	A(H3) & B
2000-2001	14	13-17 wks (3.25-4.25 mths)	0.1216	0.222	0.170	0.561	A(H1) & B
1999-2000	13	10-14 wks (2.5-3.5 mths)	0.1266	0.356	0.203	0.561	A(H3)

\* Belgium, Czech Republic, Denmark, England, France, Germany, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Scotland, Slovak Republic, Slovenia, Spain, Switzerland and Wales.

\*\* This was calculated by first subtracting the latest and earliest peak weeks of clinical activity. To obtain the total length of the season (see Figure 2), we then added 3-5 weeks of pre-peak activity (for the earliest country) and 3-5 weeks of post-peak activity (for latest country).

Fig. 2: Length of an influenza season in Europe: 3 selected countries, 2002-2003 season

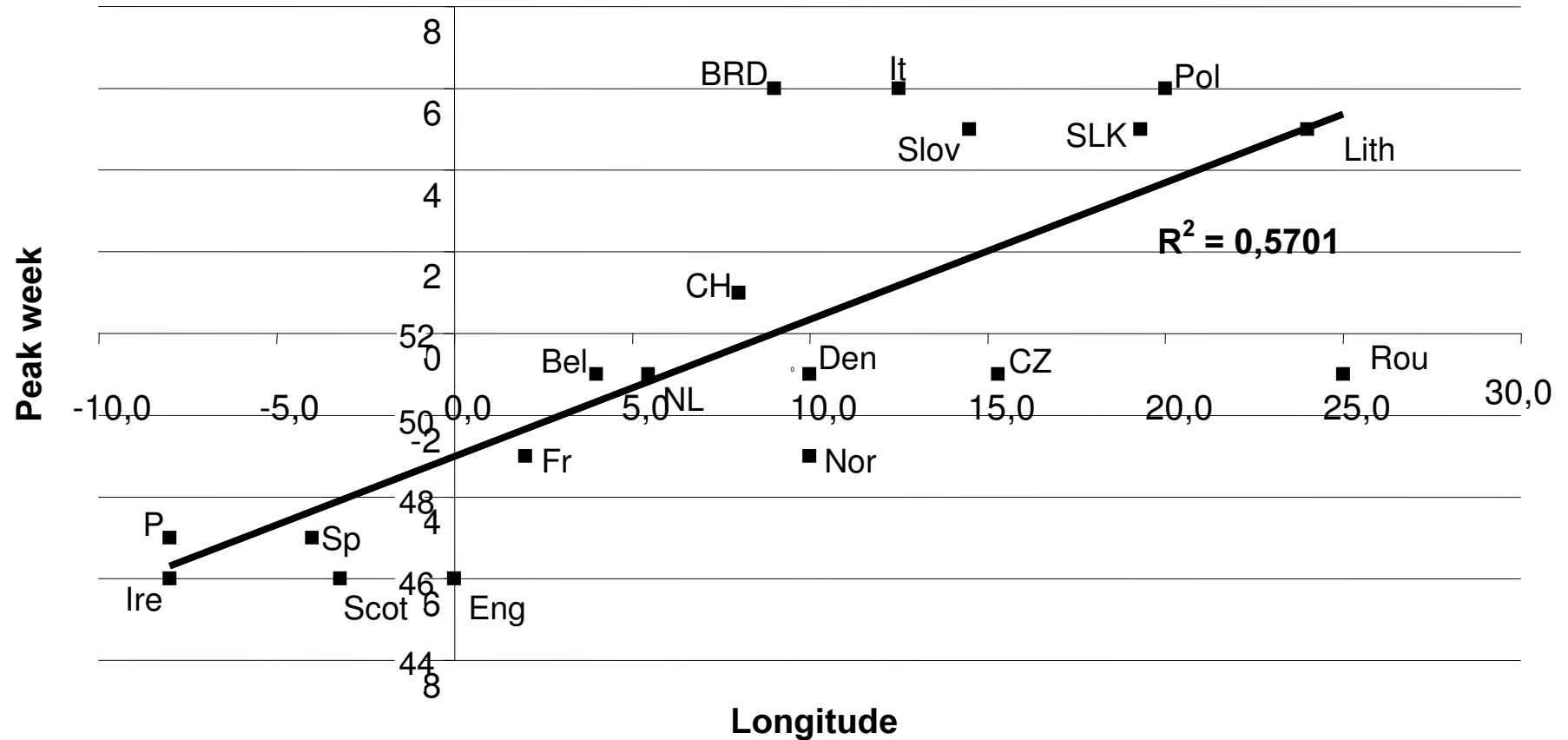


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## Peak week versus the longitude of each country: 2003-2004 season (N=19\*)



\* Belgium, Czech Republic, Denmark, England, France, Germany, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Scotland, Slovak Republic, Slovenia, Spain, Switzerland and Wales.