

Effects of the El Niño Southern Oscillation on Influenza Peak Activity Timing

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Objective

This study aimed to explore the effects of El Niño and La Niña events on the timing of influenza A peak activity in European countries.

Introduction

Influenza causes a significant burden to the world every year. In the temperate zone, influenza usually prevalent in the winter season, however, it is hardly predictable when the influenza epidemic will begin and when the peak activity will come. Influenza has a peak in early winter sometimes and a peak in late winter in another year. However, it is not well known what determines these epidemics timing, and the global climate change is expected to influence the timing of influenza epidemics.

Methods

The weekly influenza surveillance data of 5 European countries (UK, Norway, Germany, Greece, and Italy) from January 2005 to July 2018 were retrieved from WHO FluNET database. UK and Norway are considered the northern part of Europe, otherwise Germany, Greece, and Italy are considered western southern part. The El Niño southern oscillation (ENSO) were retrieved from Korean Meteorological Administration. We used the definition of El Niño as the positive sea surface temperature anomalies (≥ 0.5 degree in Celcius), while La Niña events are negative anomalies (≤ -0.5 degree) of 3 months moving average. The weeks with the highest activities of influenza A and B in each season were identified and coded as 1, 2, 3 if the peak appeared the 1st 2nd and 3rd week from the beginning of the year respectively. The influenza data of 2008/2009 and 2009/2010 were excluded from the analysis to eliminate the bias due to a pandemic influenza outbreak. We compared the means of these peak weeks according to the presence of the anomalies using the general linear model with Scheffe multiple comparison and Wilcoxon signed rank sum test.

Results

From January 2005 to July 2018, there were 3 El Niño and 5 La Niña events by the ENSO excluding 2009 El Niño. The influenza A peak activity was observed at 9th week (mean \pm SD, 8.7 \pm 4.8) from the beginning of the year in no anomaly event, but the peak appearance timing was significantly shortened to 6th week (6.2 \pm 2.7) and 5 week (5.1 \pm 3.9) when El Niño and La Niña events occurred, respectively (both $p < 0.05$). Influenza A made the peak at usually 10 week (9.9 \pm 5.0) in northern 2 countries in no anomalies, but at 6th (6.4 \pm 3.9) week in any events of an anomaly in the surface sea temperature ($p = 0.072$). In the southern 3 countries, influenza peaks were observed at 8th (7.9 \pm 4.8) week in usual without anomalies, but at 5th (5.0 \pm 3.3) week in El Niño or La Niña events ($p = 0.049$).

Conclusions

Both El Niño and La Niña affect the timing of influenza A peak activity; the ENSO associated the early emergency of peak influenza activities in European countries.

References

1. Fisman DN, Tuite AR, Brown KA. 2016. Impact of El Niño Southern Oscillation on infectious disease hospitalization risk in the United States. *Proc Natl Acad Sci USA*. 113(51), 14589-94. [PubMed](https://doi.org/10.1073/pnas.1604980113)
<https://doi.org/10.1073/pnas.1604980113>
2. Oluwole OSA. 2015. Seasonal Influenza Epidemics and El Niños. *Front Public Health*. 3, 250. [PubMed](https://doi.org/10.3389/fpubh.2015.00250)
<https://doi.org/10.3389/fpubh.2015.00250>



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3. Zaraket H, Saito R, Tanabe N, Taniguchi K, Suzuki H. 2008. Association of early annual peak influenza activity with El Niño southern oscillation in Japan. *Influenza Other Respir Viruses*. 2(4), 127-30. [PubMed](#)
<https://doi.org/10.1111/j.1750-2659.2008.00047.x>



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