
Event-based Biosurveillance of Respiratory Disease in Mexico, 2007-2009: Connection to Influenza A(H1N1)v?

Authors:

Noele P. Nelson, John S. Brownstein, David M. Hartley

Presenter:

Noele Nelson, MD, PhD, MPH

Deputy Director for Operations and Research, Division Integrated Biodefense
ISIS Center, Georgetown University



Introduction

- Event-based biosurveillance, based on local- and regional-level Internet media reports, is a promising approach to early warning and situational awareness.
- In this study we report on the observations of the Argus biosurveillance system regarding respiratory disease in Mexico between October 2007 and May 2009.
- These results are compared to surveillance of US and Canadian media reports, as monitored by the HealthMap system, where media reporting on Influenza A (H1N1)v began in April 2009.



Background

- Argus is designed to report and track the evolution of biological events threatening human, plant, and animal health globally (excluding the United States).
- The system collects articles from local, native-language and select social media and interprets their relevance in accordance with a taxonomy of media reporting of infectious disease.
 - Direct indicators
 - Indirect indicators of disease (6 categories)
- Project analysts, fluent in approximately 40 languages collectively, monitor several thousand Internet sources daily, and write event reports generated from relevant articles.



Background

- A stage is assigned to observed events according to a previously-described heuristic model.

Stage 0	Potential Antecedent to a Biological Event
Stage 1	Unifocal Biological Event
Stage 2	Multifocal Biological Event
Stage 3	Infrastructure Strain
Stage 4	Infrastructure Collapse
Stage R	Recovery



Background

- HealthMap is an automated multi-lingual real-time disease outbreak detection, tracking and visualization system which, similar to Argus, relies on publically available media from the Internet for their data.



Methodology

- Reports of respiratory disease for the 2007-2008 and 2008-2009 respiratory disease seasons generated from relevant media articles were identified in the Argus archive.
- Argus reports of respiratory disease, including 2009 A(H1N1), in the Spanish and English language media in Mexico between October 1, 2007 and May 31, 2009 were reviewed.



Methodology

- The rate of reporting, defined as a function of time for the study period
 - Ratio of respiratory reports meeting inclusion criteria to the total articles in the archive from Mexican sources
- Shapiro-Wilk test
 - Assess the normality of the data
- Wilcoxon rank sum tests
 - Assess the statistical significance of the difference in mean rate of respiratory disease reporting and stage between seasons

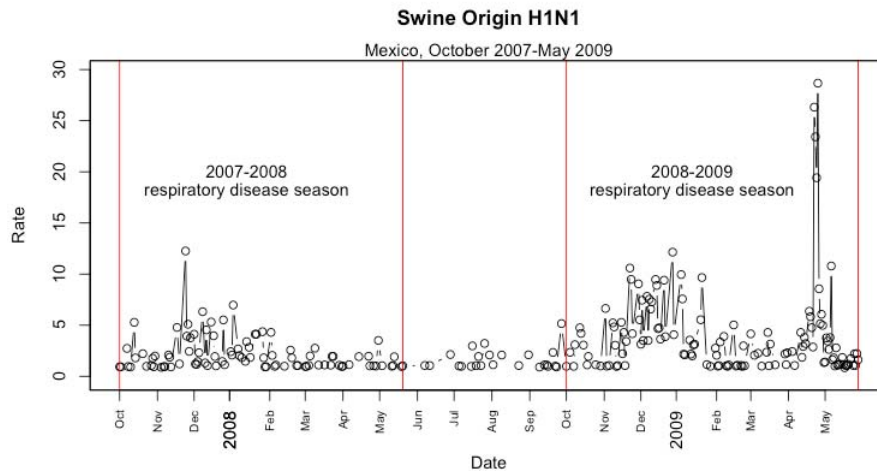


Methodology

- Argus Timeline of reports - January 1, 2009 to April 23, 2009
 - Randomly selected from sample of stage 2 or greater reports
 - English and Spanish sources in Mexico
- HealthMap Timeline of events – April 21-23, 2009
 - English and Spanish sources in the US and Canada



Results - Rate



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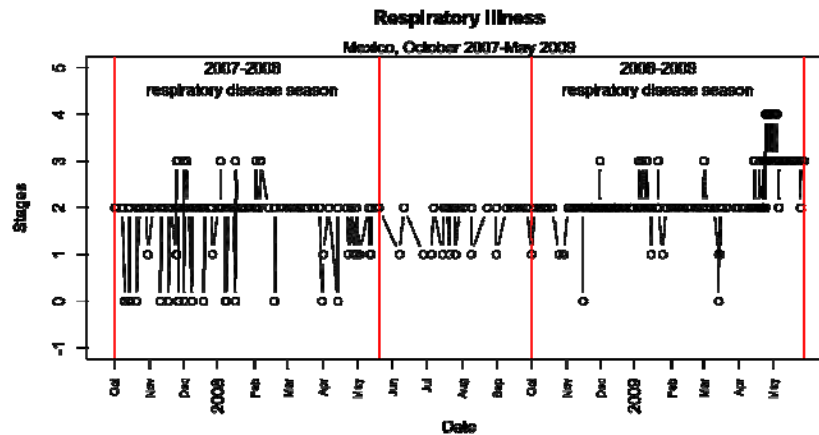
Results - Rate

- Increased prominence of respiratory disease reporting frequency in Mexican Internet sources during the 2008-2009 influenza season relative to 2007-2008.
- Mean rate of reporting:
 - October 1, 2007 and May 31, 2008, 2.19
 - October 1, 2008 and May 31, 2009, 4.08
 - $p < 0.0001$

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Results - Stage



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Results - Stage

- Stage of reports
 - October 1, 2007 and May 31, 2008
 - Staged at 2 or less
 - Mean stage = 1.80
 - October 1, 2008 and May 31, 2009
 - Stage 2 and occasionally stage 3
 - Mean stage = 2.35
 - p-value < 0.0001

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Results – Timeline, Argus

Date	State	Report Summary	Stage
1/5/09	Durango	Demand at El Salto Hospital Increases 100%	2
1/6/09	Veracruz-Llave	Respiratory Diseases Responsible for 30% of Consultations at Panuco Clinic	2
1/8/09	Chihuahua	Delicias Pharmacy Runs Out of Respiratory Medicines	2
1/12/09	Chihuahua	Cases Increase in Juarez; Children Most Affected	2
1/16/09	Nayarit	Acute Respiratory Infections Increase Daily during Winter	2
2/9/09	Queretaro de Arteaga	Cases Increased in San Juan del Rio	2
2/26/09	Chiapas	Acute Respiratory Diseases Primary Cause for Consultations in South	2
3/9/09	Tlaxcala	Classes Suspended at Secondary School for 25 Cases of Influenza in Istacuilta	2
3/18/09	Veracruz-Llave	106 Acute Respiratory Infections Treated at Tantoyuca Hospital in Last Month	2
4/1/09	Baja California Sur	Cases Increased in Loreto Recently; Hundreds of cases of respiratory diseases	2
4/2/09	Veracruz-Llave	60% of La Gloria Community Affected by "Strange Outbreak"	2
4/6/09	Durango	Demand from Respiratory Diseases Remains High at El Salto Hospital	2
4/8/09	Veracruz-Llave	30% of La Gloria Affected by Respiratory Disease; Influenza Ruled Out; Cannot Scientifically Implicate Hog Farm in Cases	2
4/21/09	Mexico (general)	International Pharmaceutical Moves Forward in Plans to Manufacture Influenza Vaccine	3
4/22/09	Distrito Federal	120 Clinical Cases of Influenza at Hospitals in Distrito Federal, At Least 2 Nurses Affected, Hospital Staff Report Lack of Personal Protection	2

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Results – Timeline, HealthMap

Date	Location	Report Summary
04/21/2009	San Diego and Imperial County, California	U.S. public health authorities are investigating two cases of swine flu in unrelated children in California, a development that has officials in Canada and elsewhere on alert.
04/23/2009	San Diego and Imperial County, California, San Antonio, TX, Mexico City, Mexico; San Luis Potosí, Mexico; Oaxaca, Mexico; Baja California, Mexico	More US swine flu cases, Mexico illnesses raise pandemic questions
04/23/2009	Canada; Mexico; California; Texas;	Canadian health officials eye Mexican outbreak - Reuters
04/23/2009	Mexico City, Mexico	Canadians returning from Mexico urged to be on alert for flu-like symptoms
04/23/2009	Cornwall, Ontario; Mexico	Health officials on watch after mystery Mexican outbreak
04/23/2009	San Diego; San Antonio, Texas; Steele High School, Cibolo, Guadalupe County, TX, USA; California; United States; Texas	CDC confirms 7 human cases of swine flu
04/23/2009	California; Texas; Oaxaca; Mexico City; San Luis Potosí; Baja California	Doctors warned to watch for mystery illness in tourists returning from Mexico

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Conclusions

- An increased prominence of respiratory disease reporting frequency existed in Mexican Internet sources during the 2008-2009 influenza season relative to 2007-2008.
- Stage of respiratory disease reports in the media in the 2008-2009 season scored significantly higher in terms of social disruption than reports in the media in the 2007-2008 season.
- Respiratory disease was prevalent in parts of Mexico, and reported as unusual, much earlier than the microbiological recognition of influenza A(H1N1)v in late April, 2009.



Conclusion

- Increased media reporting frequency, longer duration of the respiratory disease season and significantly increased stage (social disruption) together provide evidence of an anomalous season.
- Through the analysis of data over time, media reporting baselines can be generated and media signals of anomalous activity identified, providing clues to emerging outbreaks.



Conclusion

- Event-based surveillance
 - Tool complementary to traditional public health surveillance methods utilized to identify an outbreak and track its progression
 - Can cue public health professionals to look for an emerging or changing pathogen earlier than would otherwise occur
 - Can provide a means for monitoring the spread of disease and severity in a population or region.



Thank you

