



The Computerworld Honors Program

Honoring those who use Information Technology to benefit society

Final Copy of Case Study

LOCATION:
*Toronto, Ontario,
Canada*

YEAR:
2011

STATUS:
Laureate

CATEGORY:
Innovation

ORGANIZATION:
St. Michael's Hospital - Toronto, Canada

ORGANIZATION URL:
<http://www.stmichaelshospital.com>

PROJECT NAME:
BIO.DIASPORA

PROJECT OVERVIEW

In 2003, the worldwide SARS outbreak identified an urgent need to improve pandemic preparedness and response strategies on a global scale. Many countries were ill-equipped to manage the outbreak that led to thousands of infections, hundreds of deaths and billions of dollars in economic losses. More recently, the H1N1 'swine flu' epidemic evolved into a worldwide pandemic with enormous global health and economic consequences. With more than two billion passengers flowing through the global airline transportation network every year, infectious disease events that once were localized can now rapidly transform into global epidemics, threatening global health, security and prosperity. Although future epidemics like SARS and H1N1 are inevitable, there is limited research into the role of air travel as a conduit for the spread of infectious diseases. National and international pandemic influenza plans do not currently account for global patterns of commercial air traffic and their implications on preparedness and response strategies. Research into global population mobility is also limited by a lack of accessible data on worldwide patterns of commercial air traffic. To address this knowledge gap, a multidisciplinary team led by Dr. Kamran Khan based at St. Michael's Hospital in Toronto, Canada developed BIO.DIASPORA (www.biodiaspora.com) – a scientific platform that enables methodological and applied research into the relationship between commercial air travel and the global spread of emerging infectious disease threats. Research findings were compiled in a 122-page report to the Public Health Agency of Canada entitled: "The BIO.DIASPORA Project: An Analysis of Canada's Vulnerability to Emerging Infectious Disease Threats via the Global Airline Transportation Network." The system was used to accurately predict how the H1N1 virus would spread worldwide after arising in Mexico in early 2009. Dr. Khan's team analyzed the flight itineraries of more than 2.3 million passengers departing Mexico on commercial flights during the months of March and April to predict the global spread of H1N1. The findings, published in the New England Journal of Medicine, demonstrated that the international destinations of air travelers leaving Mexico were highly predictive of where cases of H1N1 first showed up around the world. What's significant about this project is that

it has developed a system for integrating and analyzing information about worldwide air traffic patterns with information on global infectious disease threats at a moment's notice. This allows countries to get ahead of the curve and start adopting preventive measures to respond to an outbreak before it even reaches an airport, protecting the health of the entire global community. To create the BIO.DIASPORA architecture, three key software solutions were fused together. ESRI's geographic information system (GIS) technology provided powerful visualization that brought the data to life through a range of compelling Web maps; SAS business analytics software integrated and managed data; and MATLAB technical computing software was used for data analysis and numeric computation. A wide range of data sources were then secured and integrated including worldwide passenger ticket sales for over two billion passengers, global flight schedules, real-time flight status data and global airport data.

SOCIETAL BENEFITS

BIO.DIASPORA provides a reliable early warning system for global infectious disease threats. The system has, for the first time, provided a very accurate picture of how infectious diseases will spread around the world. This allows countries worldwide to respond to health threats earlier and more intelligently than ever before.

PROJECT BENEFIT EXAMPLE

The BIO.DIASPORA project has benefited Canada while concurrently benefiting other countries by strengthening global public health security. The system has provided a more sophisticated understanding of Canada's continually evolving relationship with the world's cities via the global airline transportation network. In addition to predicting the geographic spread of the H1N1 virus, the system was also used to identify potential health threats during the 2010 Vancouver Winter Games. [Appendix 1 – Figure 1] By studying travel patterns into Vancouver and the sites of previous Winter Games, the BIO.DIASPORA team – in partnership with a team at Harvard University that created an Internet-based global infectious disease surveillance system called HealthMap – found that nearly two-thirds of visitors to the Vancouver Games would arrive from only 25 cities around the world. They were then able to identify public health issues in these locations through HealthMap, which included measles, mumps, E.coli and H1N1. While none of the health threats were deemed serious, the system provided health authorities with a means to proactively prepare for potential disease outbreaks. Similarly, the system was used to study potential disease outbreaks during the Hajj – the annual pilgrimage to Mecca; during the recent unrest in Egypt (avian influenza) [Appendix 1 – Figure 2]; after the earthquake in Christchurch, New Zealand (measles) [Appendix 1 – Figure 3]; and to analyze the cholera outbreak in Haiti and its potential risk for international spread. [Appendix 2] With BIO.DIASPORA, the world now has a system that can help enhance emergency preparedness during large-scale international events including sporting events, religious pilgrimages, economic summits and global expositions. During the H1N1 pandemic, the results of the project were requested by and provided to the Ontario Agency for Health Protection and Promotion, and the Public Health Agency of Canada. The project has also generated significant interest from the US Centers for Disease Control and Prevention, the US Department of Defense, the European Centre for Disease Prevention and Control, and the World Health Organization. Dr. Michael Gardam, director of infectious diseases prevention and control for the Ontario Agency for Health Protection and Promotion, said: "While it is generally understood that air travel can transport infectious diseases around the world, The BIO.DIASPORA Project, has for the first time, provided a very accurate picture of not only where diseases will travel, but how often and when. This work provides the world with a potent



early warning system for emerging infectious diseases." The system has allowed for better understanding of how Canada and its major regions and municipalities are connected with the international community through the global air travel; how this global connectivity translates into domestic vulnerability to imported infectious diseases; and how Canada can best mitigate risks and consequences of threats through preventive measures. Through the system, Canada will be able to strengthen its domestic disease surveillance, control and response systems; strengthen public health security in commercial air travel and develop global partnerships to confront common threats

IS THIS PROJECT AN INNOVATION, BEST PRACTICE? Yes

ADDITIONAL PROJECT INFORMATION

Currently, the BIO.DIASPORA team is collaborating with the developers of HealthMap – an Internet-based global infectious disease surveillance system created at Harvard University – to integrate real-time information about global infectious disease activity with BIO.DIASPORA's capabilities to understand and analyze global population mobility in real-time. Together, this collaboration significantly enhances global situational awareness of infectious disease threats in the world. The team is also currently working with HealthMap and partners in the European Union to leverage this new knowledge to better prepare for infectious disease threats during the 2012 Summer Olympic Games in London, England.