Using the Internet to Detect Emerging Outbreaks—Armchair Epidemiology

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I was trained as a shoe-leather epidemiologist in 1969 by the legendary Alex Langmuir, founder of the Epidemic Intelligence Service at the Centers for Disease Control and Prevention, to which I had been assigned as a young Public Health Service officer. The small gold pin I still wear on occasion is in the shape of the bottom of a shoe, with a prominent hole in its sole, indicating it was worn through from walking door to door seeking cases of infectious disease. The guiding principle of all shoe-leather epidemiology is early recognition of contagious disease and its manner of spread, to enable early initiation of effective control activities.

The advent of the internet brought a potential new dimension to epidemiology, particularly after the SARS-CoV-1 pandemic of 2002-2004. An old friend, Larry Brilliant, called me one day to say he had been awarded the TED prize and invited to suggest an innovative initiative for which to use the prize money and showcase at the 2005 TED event, and was looking for suggestions. I told Larry I was intrigued by the discovery that a Canadian-based “web crawler” had, in retrospect, identified reports, in Chinese newspapers, of unexplained respiratory infections that heralded the start of the outbreak, long before the world was alerted to SARS-CoV-1. I suggested he propose something along that line. He did and used the 2005 TED Prize money to support creation of a web-based “early warning system” for infectious outbreaks. Soon after, he was hired by Google as the inaugural CEO of Google.org, Google’s initial philanthropic arm, and spent the next few years leading a team in developing many web-based systems for the early detection of infectious diseases. Larry and his wife, Girija, thanked me by treating the Sommers to a “night on the town in Las Vegas Vegas at Cirque du Soleil” before Larry and I participated, the following morning, in the Opening Session of the Annual Meeting of the American Academy of Ophthalmology.

This was one of several initiatives from which emerged the concept of “syndromic surveillance,” which quickly mushroomed into ever-imaginative methods for using the web to detect emerging outbreaks and their characteristics. Some attempts focused on news reports, as noted above, but more sophisticated approaches studied the rate at which medications were being purchased at pharmacies, publicly available reports emerging from state laboratories and outpatient clinics, and key terms that people were searching on the web. This new, potentially powerful supplement to “shoe-leather” epidemiology might be referred to, by us old-timers, as “armchair” epidemiology, but not disparagingly. I have little doubt that as infectious disease and information scientists work increasingly closely, using the latest advances in machine learning and artificial intelligence along with the development and introduction of improved, dispersed detection techniques, we will indeed be better prepared to identify, control, and contain future pandemics.

The article in this issue of JAMA Ophthalmology by Ferres et al nicely illustrates untapped uses lurking in the innovative interrogation of data contained in the World Wide Web. They convincingly correlate the decline in web searches for “conjunctivitis” coincident with the introduction of public health interventions to control the spread of the present pandemic of COVID-19 (adjusted for the incubation period of the adenovirus), suggesting that the public health measures introduced to control COVID-19 also interrupted the spread of adenoviral conjunctivitis. As controls, they demonstrate no such fall in web searches for corneal abrasion or posterior vitreous detachment. I’d be surprised if this is not the first of many such correlations that will be sought, and refined, in the future, and become a valuable means of gaining insights that have until now eluded us about both infectious and non-infectious diseases, and their many characteristics.

While there is no way of knowing which aspects of the COVID-19 interventions were most responsible for the seeming interruption in the spread of adenoviral conjunctivitis (masking, social distancing, excessive hand washing), this is an early glimpse of where “armchair” epidemiology will one day lead us. The best is surely yet to come.

ARTICLE INFORMATION

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REFERENCES
