Characterizing the health and information-seeking behaviours of Ontarians in response to the Zika virus outbreak

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Abstract

Objectives The purpose of this study is to describe the impact of the 2016 Zika virus (ZIKV) outbreak on the health-seeking and information-seeking behaviours of Ontarians.

Methods A timeline that included events and announcements from health agencies was constructed to describe the unfolding of the ZIKV outbreak between January 1 and September 30, 2016. In order to gain an understanding of the information and health-seeking behaviours of Ontarians, data from the following sources were collected and analyzed descriptively over time in 1-week intervals: trends in web searches, calls to a provincial telemedicine advice line, test submissions to the provincial laboratory and Zika-related media coverage.

Results The World Health Organization's declaration that the ZIKV outbreak was a public health emergency of international concern (PHEIC) prompted a surge in media coverage peaking at 165 articles in a 1-week period. Concurrently, the frequency of Zika-related web searches was at its highest over the time period of the study, weekly telemedicine calls requesting Zika-related information were at their highest (177 calls/week) and requests for laboratory testing increased (162 patients submitting specimens/week).

Conclusions Understanding the public response to novel and re-emerging infectious disease outbreaks as they unfold has the potential to facilitate timely public messaging for disease prevention, enable resource planning and inform effective public health action.

Résumé

Objectifs Décrire les incidences de l'éclosion de virus Zika de 2016 sur les comportements favorisant la santé et les comportements de recherche d'information des Ontariens.

Méthode Nous avons construit une chronologie des activités et des annonces des organismes de santé pour décrire le déroulement de l'éclosion de virus Zika entre le 1^{er} janvier et le 30 septembre 2016. Afin de mieux comprendre les comportements de santé et de recherche d'information des Ontariens, nous avons recueilli des données des sources suivantes et nous en avons fait l'analyse descriptive à intervalles d'une semaine : les tendances des recherches sur le Web, les appels à un centre de conseils provincial de télémédecine, les demandes d'épreuves présentées au laboratoire provincial et la couverture médiatique du virus Zika.

Résultats Quand l'Organisation mondiale de la santé a déclaré que l'éclosion de virus Zika était une « urgence de santé publique de portée internationale », il y a eu une poussée soudaine de la couverture médiatique, avec un sommet de 165 articles publiés au cours d'une même semaine. En parallèle, la fréquence des recherches sur le Web liées au virus Zika ont culminé durant la période

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de l'étude, tout comme les appels au centre de télémédecine pour demander de l'information sur le virus Zika (177 appels par semaine), et les demandes d'épreuves de laboratoire ont augmenté (162 patients par semaine ont soumis des spécimens).

Conclusions La compréhension des réactions du public aux éclosions de maladies infectieuses nouvelles et réémergentes au fur et à mesure de leur déroulement pourrait faciliter la création de messages d'intérêt public opportuns pour prévenir ces maladies et permettre de planifier les ressources et d'améliorer l'efficacité des interventions de santé publique.

Keywords Re-emerging infectious disease · Infectious disease outbreaks · Zika virus · Health behaviour

Mots-clés Maladies infectieuses réémergentes · Éclotions de maladies infectieuses · virus Zika · Comportement en matière de santé

Introduction

On February 1, 2016, the World Health Organization (WHO) declared the link between Zika virus (ZIKV) and the recent cluster of newborns in Brazil with microcephaly and other neurological disorders to be a Public Health Emergency of International Concern (PHEIC) (World Health Organization 2016a). By April 2016, sufficient scientific evidence had been published to support the causal relationship between ZIKV and neurological disorders, including microcephaly (Centers for Disease Control and Prevention 2016a).

ZIKV infection is primarily a mosquito-transmitted disease, with additional transmission through sexual and maternal-to-foetal exposures. ZIKV virus has spread throughout the Americas, with mosquito-borne transmission in Mexico, the Caribbean, Central America, most of South America, Florida and Texas. The primary vector of ZIKV is *Aedes aegypti*, a mosquito species not established in Canada (Public Health Ontario 2016). Therefore, the risk of ZIKV infection in Canadians is primarily through travel to areas with local mosquito-borne ZIKV transmission (Government of Canada 2016a). In 2014, Canadians made 2.4 million leisure trips to the Caribbean and 1.5 million leisure trips to Mexico, areas which have experienced active ZIKV transmission in the latter part of 2015 and throughout 2016 (Canadian Tourism Research Institute 2015). The emergence of ZIKV in the Americas, the uncertainty surrounding modes of transmission and the impacts on particular populations, especially women in early pregnancy, likely resulted in concern and anxiety among the traveling public.

Canadians' perception of their risk of ZIKV infection and subsequent information and health-seeking behaviour are not well understood. It is known from other public health events that an individual's perception of risk influences their behaviour (Liang and Scammon 2013). Studies analyzing health-seeking behaviour during an infectious disease outbreak have found that there is an immediate and rapid increase in information seeking following the announcement of an outbreak (Tausczik et al. 2012). Information-seeking behaviours are stimulated by information needs, and disease prevention is aided through the transfer of health-related information. Understanding health-seeking behaviours can facilitate the dissemination of accurate health-related information to the public (Pang et al. 2015).

The purpose of this study is to describe the impact of the ZIKV outbreak on the information and healthcare-seeking behaviours of Ontarians. Gaining an understanding of how ZIKV

unfolded from an Ontario perspective can help inform future planning for emerging and re-emerging infectious diseases.

Methods

Timeline

A timeline was constructed to describe the unfolding of the ZIKV outbreak between January 1 and September 30, 2016. The timeline included announcements from the WHO, the Public Health Agency of Canada (PHAC), the Ontario Ministry of Health and Long-Term Care (MOHLTC) and United States Centers for Disease Control and Prevention (CDC) based on emerging scientific evidence as well as media coverage during the evolving outbreak. The following key events were used in figures as reference points:

- WHO's declaration that Zika was a PHEIC on February 1, 2016 (World Health Organization 2016a)
- PHAC's announcement of the first sexually transmitted case of ZIKV infection in Ontario on April 25, 2016 (Government of Canada 2016b)
- WHO's issuance of an advisory on preventing the transmission of ZIKV during the Olympic Games on May 28, 2016 (World Health Organization 2016b)
- CDC's travel advisory to pregnant women regarding visiting the Wynwood neighbourhood in Miami (the result of the first evidence of local transmission in the continental USA) on August 1, 2016 (Centers for Disease Control and Prevention 2016b)

Data sources

In order to describe the information and healthcare-seeking behaviours of Ontarians in response to Zika-related announcements from health agencies and the resultant media coverage, data from the following sources were collected: Zika-related media coverage, Google Trends, Telehealth Ontario and Public Health Ontario Laboratory (PHOL). The collection period for each data source was from January 1 to September 30, 2016, with the exception of Telehealth Ontario where the collection period started on January 11, 2016, the date call tracking by Telehealth on this topic began.

Media coverage

Media coverage concerning health-related issues can be a contributing factor to an individual's perception of risk and can prompt information and health-seeking behaviours (Hogue et al. 2012). Media coverage consisting of print, broadcast, online and radio were collected from Infomart and extracted into an Excel format. Infomart is a software platform that delivers reliable news and social data. It is used by organizations to gain an in-depth understanding of their organization's media impact (Infomart 2016). The search for Zika-related media coverage was filtered by the following search terms "Zika" and "virus" and a date range from January 1 to September 30, 2016. Obituaries and stock market reports were excluded, the geographic location was filtered to "Canada" and the publication location of news reports was filtered to "Canada" and/or "Ontario". Duplicates were removed from the dataset as this study was interested in the media attention surrounding the announcements rather than the geographic reach of media coverage. Duplicates were considered to be media stories with a matching date, publication, matching or similar title, matching or similar lead line, byline and matching or similar word count with plus or minus 10 words. Identical stories that appeared either 1 day apart and/or appeared in both print and online were also considered duplicates and these were removed.

Google trends

Google is the most-used search engine for accessing health-related information (Seifter et al. 2010). The use of Google Trends to assess search trends can act as an indicator of how health-related media coverage affects online information health-seeking behaviours of individuals (Eysenbach 2006). Data from Google Trends were extracted to provide a summary of queried search terms, phrases and keywords over a specified time period. Each search term is divided by the total number of overall searches in order to compare a search term's relative popularity, scaled between 0 and 100, during the time period (Google Trends 2016). The following search terms were used in Google Trends to assess search trend data from January 1 to September 30, 2016: "Zika", "Zika virus", "Zika symptoms" and "Zika mosquito". These search terms were filtered by country (Canada) and region (Ontario).

Telehealth Ontario

Telehealth is a free and confidential telemedicine service provided by the MOHLTC that allows Ontario residents to speak to a registered nurse with their medical or health questions any time of the day or night. This service is designed to provide information and health-related advice. It is not a service to be used in the event of an emergency (Ontario Ministry of Health

and Long-Term Care 2016). The number of calls to Telehealth regarding Zika-related questions or requests for health information was aggregated by week for the period from January 11 to September 30, 2016.

Laboratory data

The aggregate number of weekly laboratory submissions for ZIKV infection testing per person, regardless of testing status and reason for submission, was collected. Only the first submission for each unique patient was reported. Any concurrent or subsequent specimens were removed and not included in the total count as this study focused on healthcare-seeking behaviour. Aggregation was done based on the date received and collated weekly. The aggregate number of confirmed cases per week was also collected.

Analysis

Daily data were aggregated into weekly totals. All analyses were descriptive; no causal inferences were made.

Ethics approval

The protocol for this study was submitted to the Public Health Ontario Ethics Review Board and was determined to be exempt from ethics review. Personal health information and personal information were not used in this study.

Results

Timeline

Events and announcements from various health agencies regarding the evolving outbreak were assigned to one of three temporal periods during which important events or developments related to the emerging Zika virus epidemiology occurred:

- January through March 2016, during which time the WHO declared that Zika was a PHEIC (February 1, 2016) (World Health Organization 2016a) and the first case of travel-related ZIKV infection was identified in Ontario (February 19, 2016) (Ministry of Health and Long-Term Care 2016)
- April through June 2016, during which scientific evidence proving the causality between Zika and microcephaly and other neurological disorders was established (especially the CDC release on April 13, 2016) (Centers for Disease Control and Prevention 2016a) and the first case of sexually transmitted ZIKV infection in Ontario was identified (April 25, 2016) (Government of Canada 2016b)

- July through September 2016, during which the first case of female-to-male sexual transmission was reported in New York City on July 15, 2016 (Centers for Disease Control and Prevention 2016c) and the first report of local vector-borne transmission of ZIKV in continental USA was announced (August 1, 2016), prompting a travel advisory to pregnant women to limit non-essential travel to an affected area in Miami, Florida (Centers for Disease Control and Prevention 2016b)

Additional events and announcements are summarized in Fig. 1.

Media coverage

Three peaks in Canadian media coverage occurred during the study period. These peaks occurred from January 24 to February 6, April 24 to April 30, and July 10 to August 13. The period from January 24 to February 6 saw the largest amount of media coverage, with 165 media stories published/broadcast during the week of January 24, and 105 media stories during the week of January 31. Prior to January 24,

the weekly range of media stories was 0–19. The second peak in media coverage occurred during the week of April 24, when media coverage in Canada totalled 49 stories in comparison to the 3 weeks prior when the average number of Zika-related stories per week was 12. The third period with an increase in media coverage occurred between July 10 and August 13. Three hundred and eighty-four media stories were generated during this period, and the average number of media stories that were broadcast or published per week was 77. The average number of stories generated between the second and third periods of increased media coverage was 19 per week (Fig. 2).

Google trends

The highest relative popularity of Zika-related searches was observed during two time points in the study period. The first and largest increase was from January 24 to February 6. Query searches for “Zika” resulted in relative popularity of 93 during the week of January 24 and 100 during the week of January 31, compared to all Google queries on the topic in the same region during the same time. Prior to January 24, searches for “Zika” resulted in a relative popularity of 0–12 out of a scale

Fig. 1 Zika timeline (January 1 to September 30, 2016)

Fig. 2 Distribution of Zika-related media coverage from Canadian news outlets (January 1 to September 30, 2016)

of 100. The second increase was from July 31 to August 6. Searches for the term “Zika” during this week resulted in a relative popularity of 33 compared to “Zika” queries from February 7 to July 30, which averaged a relative popularity of 15 (Fig. 3).

Telehealth Ontario

Zika-related information-seeking call volume was at its peak in the early period of the outbreak with the largest number of calls occurring from January 25 and February 7, 2016. The total number of calls during this period was 177 compared to 14 calls from January 11 and January 24, 2016 (Fig. 4).

Laboratory data

The distribution of weekly laboratory requests for ZIKV infection testing was highly variable with three peaks in test requests occurring from January 31 to March 3, April 24 to May 7, and August 7 to 27. The average number of weekly requests for testing during each of these periods was 245, 216 and 262, respectively (overall weekly average = 170; range = 1–283). The aggregate number of requests for testing over the study period was 6637. The largest increase in test requests occurred between January 31 and February 6. While 100 test requests were submitted from January 1 to January 30, 232 test requests were submitted from January 31 to February 6 (Fig. 5). The cumulative number of confirmed cases by the

end of the study period was 211 (average = 5 confirmed cases per week; range = 0–23 per week). The weekly distribution of confirmed cases is also highly variable with several peaks evident (Fig. 6).

Discussion

This study describes a number of metrics assessing information and healthcare-seeking behaviours in Ontario related to the evolving ZIKV outbreak. Although it is not possible to draw causal conclusions based on these results, announcements from major health agencies were followed by media coverage and this may have had an influence on Ontarians’ perception of the risk of the virus. For instance, the WHO’s declaration that the ZIKV outbreak was a PHEIC prompted a surge in media coverage. Concurrent with the WHO declaration, the frequency of Zika-related queries on Google was at its peak and requests for laboratory testing increased from 1 test request the week of January 3, 2016, to 232 test requests the week of January 31, 2016. The immediate spike in requests for laboratory testing may be an indicator of individuals’ perception of their risk, leading to healthcare-seeking behaviours, or the effect of health care practitioners’ increased awareness of ZIKV when examining patients with relevant travel histories.

Fig. 3 Relative popularity of Zika-related Google search terms in Ontario, Canada (January 1 to September 30, 2016)

Fig. 4 Distribution of Zika-related information-seeking calls to Telehealth in Ontario, Canada (January 11 to September 30, 2016)

Fig. 5 Distribution of the number of patients who had specimens submitted by clinicians for ZIKV infection testing in Ontario, Canada (January 1 to September 30, 2016)

Similarly, announcements that would have hit “close to home” for many Ontarians may have played a role in

Ontarians’ perception of risk, thus encouraging information and healthcare-seeking behaviours. Notable announcements

Fig. 6 Confirmed Zika cases in Ontario, Canada (January 1 to September 30, 2016)

were the first case of sexually transmitted ZIKV in Ontario and confirmation of local transmission of ZIKV in Miami, Florida, given that Florida is the most common US travel destination for Canadians (Statistics Canada 2015).

Research examining the trends in infectious disease outbreaks and healthcare-seeking behaviour suggest that these behaviours are heightened by official announcements from public health authorities and the news coverage surrounding these announcements (Southwell et al. 2016). However, there is minimal research on real-time information and healthcare-seeking behaviour during novel and re-emerging infectious disease outbreaks. This is an area of research that is becoming increasingly important as the frequency of the appearance of these outbreaks has increased over the previous 1 to 2 decades (Jones et al. 2008).

It was initially anticipated that the Rio 2016 Olympics would generate an increase in information and healthcare-seeking behaviour, especially given critics who argued that not cancelling the 2016 Olympic Games and Paralympic Games would further facilitate the spread of the virus and who condemned the WHO for not taking action (Attaran 2016). In the end, the games were not cancelled, the controversy did not trigger an increase in information and healthcare-seeking behaviour in Ontario as assessed by the study metrics, and the WHO confirmed that there were no Olympic-associated cases of ZIKV infection (World Health Organization 2016c).

Limitations

Several limitations of these data sources should be considered when interpreting the results. There are limitations associated with the use of Google Trends, in that the data are relative and not absolute. The available data are based on a sample of Google searches. Google Trends adjusts search data to make comparisons between terms easier. Google states that it uses an unbiased sample, but as it only uses a percentage of searches from the relative popularity of those searches, these data may not be representative of the population using Google. To eliminate duplicate searches, Google Trends eliminates repeated searches performed by the same person over a specified period of time. The specified period of time is not indicated (Google Trends 2016). In terms of the lab data analyzed, the number of patients who had specimens submitted by clinicians to the provincial public health laboratories does not represent the actual number of patients who may have sought care for Zika-related health concerns, since some may not have met the criteria for testing at the time of their clinical assessment. In addition, trends in laboratory submissions should be interpreted with caution because there were significant changes to testing practices and eligibility over the study period. Prior to January 29, 2016, testing was not performed on asymptomatic individuals with a relevant travel history. This criterion changed to include testing of asymptomatic pregnant women with a relevant travel history. It is

also important to note that the day that a case was confirmed as positive does not reflect the date that the specimen was collected, submitted and received by the PHOL. There was very high variability in time intervals between exposure, specimen collection, testing and reporting.

Despite these limitations, there is an opportunity for future research in the area of real-time information and healthcare-seeking behaviours during the evolution of a novel and re-emerging infectious disease. While this study took a retrospective look at how the ZIKV epidemic unfolded, future examination of behavioural patterns in real-time with the use of internet-based data tools along with traditional tools may help to establish how people respond to multiple events over the evolution of an outbreak.

Conclusion

Understanding how the public responds to novel and re-emerging infectious disease outbreaks as they unfold is important for public health planning. These results suggest that the public seeks information and health services as soon as the outbreak is publicized through the media. This presents an opportunity for service provision and preventive public health messaging if they are made available in a timely fashion. Delays in generating public health messaging may lead to missed opportunities to communicate with the public since web searches and calls to telemedicine lines decline as the outbreak unfolds.

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Compliance with ethical standards

Conflict of interest None to declare.

Ethics approval The protocol for this study was submitted to the Public Health Ontario Ethics Review Board and was determined to be exempt from ethics review. Personal health information and personal information were not used in this study.

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