Journal of Telemedicine and Telecare
2014, Vol. 20(8) 476–480

DOI: 10.1177/1357633X14537771
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A mobile-phone immunization record in Ontario: uptake and opportunities for improving public health

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Summary

A free iPhone app was designed to help parents in Ontario track their children's vaccination records. It was launched in the iTunes app store on 20 November 2012. There were 4867 downloads in the following 12 months. We observed that downloads of the app were correlated with media coverage. Usage of the app was measured by app opens and the time spent in the app per open: on average there were 53 opens per day and 126 seconds spent per open. Users expressed concerns about the privacy of health information and accessibility by people of lower socioeconomic status, who were less likely to be smartphone owners. A national version of the app is now being developed for multiple mobile phone types. There is potential to develop additional features such as mobile adverse event reporting, vaccine vial barcode scanning and integration with immunization registries. Immunization is an area in which a mobile solution is very useful.

Accepted: 22 April 2014

Introduction

Each province or territory in Canada has its own publicly-funded immunization schedule. In Ontario, where more than 38% of the Canadian population live, immunization is provided free of charge at regularly scheduled childhood visits and through school based programmes. Immunization for measles, mumps, rubella, tetanus, diphtheria, and polio is mandatory for Ontario students unless parents obtain an exemption for philosophical, religious or medical reasons.

The current method of tracking paediatric immunizations in Ontario is based on paper cards given to parents at the time of vaccination, starting at the 2-month visit. If the paper record is forgotten at the next immunization encounter, a new one is started or information is given to the person to update the original record themselves. Parents are encouraged to maintain these paper records on behalf of their children until they reach adulthood.

Because immunizations are increasingly being delivered by multiple health care providers (such as physicians, pharmacists and public health nurses) and people are increasingly mobile, these records can become disorganized and fragmented. In addition, there is no digital backup of the data and no real-time transfer of vaccination status to public health officials. In many cases, parents are expected to mail, fax or deliver in person a copy of the paper card as proof of immunization. In the past few years, there have been increasing numbers of suspension warnings sent to parents to provide proof of vaccination if their child is to remain in school.

Paediatric immunization records are only collected and stored by public health units after a child enters licensed daycare or school. There are no population based records for non-school age or home-schooled children. Immunization information is part of local public health databases, but not part of a central registry (a population-based, confidential system, which contains vaccination history).

A survey revealed that by the time a child was seven years old, 30% of parents had misplaced their child's paper immunization record.[1] Fifteen percent had incomplete records and at least 24% of cards contained data entry errors. The current system therefore leaves room for improvement. We have developed a mobile iPhone app, ImmunizeON, that allows people to track their and their family's vaccinations.

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Mobile phone app

A free iPhone app was designed at the Ottawa Hospital Research Institute to help parents in Ontario track their children's vaccination records. The app provides a simple, mobile mechanism to help people keep their and all of their family's immunization information in one place. To create a new record, the user is prompted to enter the following information: first name, last name, gender, and date of birth. Other, optional information includes the Ontario Hospital Insurance Plan number and the name of the user's physician. The app contains the recommended provincial immunization schedule, which interacts with the user-entered demographic information to provide a customized schedule. It is designed for children born after August 2011, which is the last time the provincial schedule was updated. Parents can enter data manually to create records for older children and adults.

Each vaccination visit (i.e. at two months and four months of age) lists the recommended vaccine and allows parents to check them off with the date given, storing the information directly in their iPhone. The app creates a virtual immunization record similar to the existing paper record used in Ontario. The digital record can be printed or emailed directly from the phone. By linking with the calendar feature of the iPhone, the app is also capable of reminding parents when their child's vaccination appointments are coming up or overdue.

The app also provides public health officials with a method of communicating with users using rolling banners on the app's front page to provide information such as ''How to reduce your child's pain from immunization'', which refers to Toronto public health's tips for reducing the pain from immunization. The app has direct links to official sources of information about vaccines, such as from the Public Health Agency of Canada. It is able to let users know if there are outbreaks of vaccine-preventable diseases in their area based on the Council on Foreign Relations global outbreak map.

Usage data

The app was made available in the iTunes app store on 20 November 2012. There was no formal media or press event to mark the launch. A press release was posted on the website of the Ottawa Hospital Research Institute, and some Canadian newspapers ran stories about the app.

Downloads from the app store were tracked using iTunes Connect. This provided reports on the number of daily downloads, and summaries by week and month. We tracked the number of downloads starting on 26 November 2012. After one year there had been 4867 downloads. The maximum number of downloads occurred in the week of 3–9 December 2012 with 1138 downloads. The week of 14–20 January 2013 had the second highest number of downloads with 609 downloads. The first software update was released in the app store on 11 April 2013. This update included bug fixes, iPhone 5 compatibility and improvements for the user interface. We added the ability to track influenza vaccine records and included more information for users, such as a comprehensive list of Canadian vaccines. By 3 November 2013, 60% of the app downloads had been updated (Figure 1).

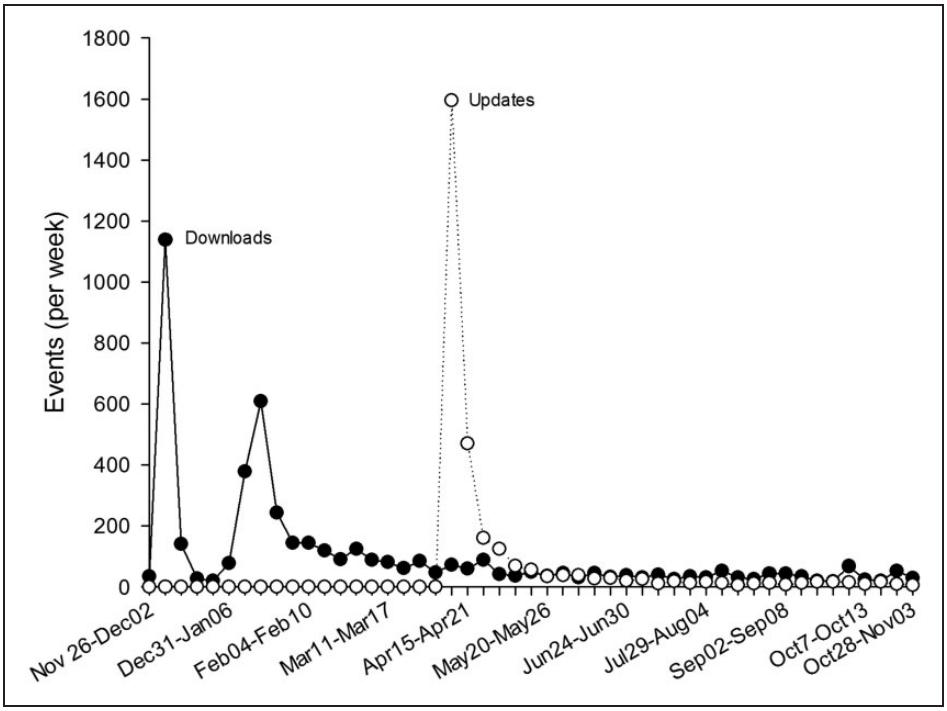

Figure 1. Numbers of downloads and updates.

Fifty seven percent of downloads occurred within eight weeks of the initial release of the app (26 November to 27 January). In the week preceding the largest number of downloads, there was increased media activity through newspaper articles and dissemination on Twitter (Figure 2). We received feedback from users through an email link built into the app. The number of feedback comments was associated with the number of downloads (Figure 2).

We obtained data on app usage and duration of use while in the app from a mobile technology company (Urban Airship Inc). The number of app opens and the average time spent using the app was reasonably constant from 25 March to 3 November 2013 (Figure 3). On average there were 53 opens per day and 126 seconds spent per open. This suggests that people were using the app to input data or acquire information.

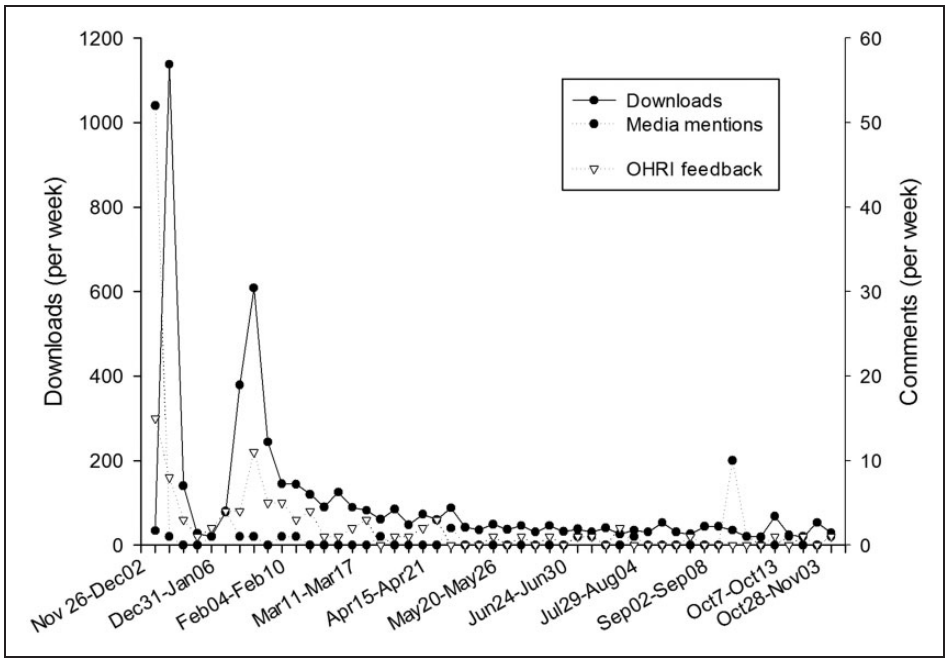

Figure 2. Numbers of downloads, feedback comments and media mentions.

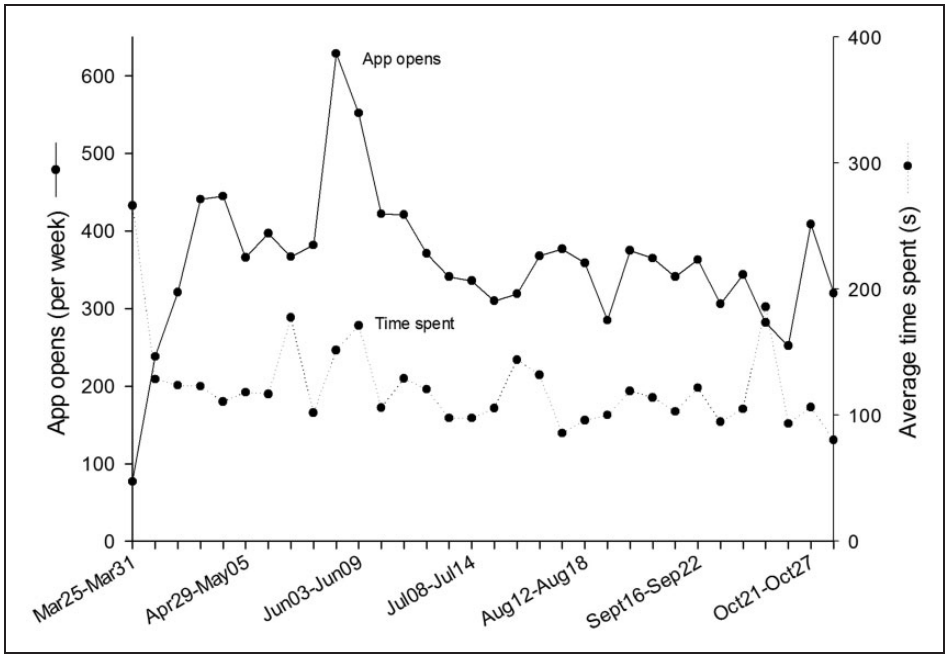

Figure 3. Number of app opens and the average time spent in the app.

Obstacles

One of the main concerns expressed by policymakers about the use of the app was the privacy of health information.[2] The possibility of losing a mobile device and having the information available to other people was also a concern. In Ontario the primary legislation regarding the use and disclosure of health information is the Personal Health Information Protection Act. Since the app is intended to assist a person with their own health information, and there is no storage of the health information by the provider of the app, the legislation does not generally apply. We therefore notified users about the potential risk to their health information and provided options for them to protect the security of their health information. For example, people are notified about the risk to their health information on the app site, on the tour of the app and when they attempt to transmit their immunization record by email. The app recommends users to password-protect their phone and provides an option to password-protect the app. It also recommends using the FindMyiPhone app,[3] which allows users to locate and communicate with their device if it is lost or stolen. Future research could investigate the effect of privacy concerns on the adoption of health related apps.

Other limitations of the app are ensuring that the reading level of the information on the app is appropriate for lower educational levels. There was also concern from public health officials that since the app could only be used on iPhones there might be inadvertent discrimination against people of low socioeconomic status who have lower rates of smartphone usage compared to higher income groups. A possible solution is to create a parallel web or software version that can be used on personal computers, which are more widely available.

Opportunities for improving immunization information systems

After the app was released there was interest amongst public health officials about the possibility of using it as part of public health immunization. Consequently, we received federal funding to develop the app into a national version for the Canadian Public Health Association. The national version of the app, ImmunizeCA, builds on the functionality provided by the Ontario version. It is bilingual, written in plain language suitable for a grade 7–8 reading level, and contains schedules for all provinces and territories in Canada. It is being developed in partnership with the Canadian Public Health Association and funded by the Public Health Agency of Canada. It has been developed for multiple devices such as iOS, Android and Blackberry phones, as well as tablet computers. The national app contains both paediatric and adult immunization schedules, as well as travel and influenza vaccination details. It also includes a frequently-asked questions section on vaccinations, which was developed by an expert reference group, and enhanced immunization pain management information.

Further work being explored with this app is the possibility of using it to scan new 2D barcodes on vaccine vials. These barcodes contain the Global Trade Identification Number (GTIN) and the lot number of the vaccine. Uploading this information directly into the app would be valuable in the event of problems with a specific product. If a particular lot was found to be ineffective or to have a higher risk of an adverse event, a notification could be sent out to the users and the mobile phone could notify the user whether any family member had received a vaccine from that lot. The app could also be used to transmit information for the purposes of linking to a vaccine registry or for adverse event reporting. To do this, authentication of the information in the app would be necessary. This could be done by recording the health care provider's signatures directly on the device with a stylus and then the app would lock the information so that the user could not change it.

The app also has the potential to alter a person's perceptions about immunization and on-time immunization rates. Several of the factors that are linked with failing to be immunized are directly addressed by the app. These include notifying people about a vaccination appointment, notifying them of vaccine-preventable disease outbreaks and providing access to accurate, official sources of information.[4] Future research could examine the extent and direction of the impact of the app on immunization attitudes and on-time immunization.

Conclusion

As electronic medical records have come into more general use, medical information has become increasingly portable, personalized and participatory. This has begun to stimulate patients to become more involved in their own healthcare. Immunization is an area in which a mobile solution is very useful. Increasingly people are not immunized consistently by the same health care provider at the same location: they may be immunized by their primary care provider, by nurses, pharmacists, at school or at travel clinics. An immunization information system therefore needs to allow people to be in charge of their own health information. Ideally, the information should be authenticated and some of it should then flow to central registries. The launch of the Ontario app revealed certain obstacles to the use of apps for managing personal medical information, but also identified opportunities for improving public health information systems in Canada.

Acknowledgements

The work was supported by the Canadian Association for Immunization Research and Evaluation. The development of the app was supported by the Ottawa Technology Transfer Network and the Federal Economic Development Agency Applied Research and Commercialization Initiative. Dr Wilson is supported by a Chair in public health policy at the Department of Medicine, Ottawa Hospital and the Ottawa Hospital Research Institute.

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