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Refereed paper

Facilitating patient self-management through telephony and web technologies in seasonal influenza

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ABSTRACT

Purpose The aim of this project was to develop and test information technology implementations that could assist patients with influenza self-management in primary care settings. Although testing was conducted in the context of seasonal influenza, the project aimed to develop a blueprint that primary care practices could use in an influenza pandemic.

Methods Four primary care practice-based research networks (PBRNs) systematically designed, implemented, tailored and tested a tiered patient self-management technology model in 12 primary care practices during the peak of the 2007 to 2008 influenza season. Participating clinicians received a customised practice website that included a bilingual influenza self-triage module, a downloadable influenza toolkit and electronic messaging capability. As an alternative option, a bilingual, interactive seasonal influenza telephone hotline that patients could call for assistance was provided.

Results Influenza self-management web pages presented via nine customised practice websites received 1060 hits between February and April of 2008. The Self-management Influenza Toolkit was downloaded 76 times and 185 Influenza Self-Triage Module sessions

were completed via practice websites during the course of testing. Logs of the telephony hotline indicated 88 calls between February and April 2008. Seventy-two percent of callers had influenza-like symptoms and 18% were eligible for antiviral therapy. The Spanish language option was selected by 21% of callers. Qualitative feedback from 37 patients (29 English and 8 Spanish) and six clinicians from four PBRNs indicated ease of use, problem-free access and navigation, useful and adequate information that was utilised in various ways by patients and a high level of overall satisfaction with these technologies. Both patients and clinicians provided rich and meaningful feedback about future improvements.

Conclusions Primary care patients and their clinicians can adopt and successfully utilise influenza self-management technologies. Our pilot study suggests that web resources combined with telephony technology are feasible to set up and easy to use in primary care settings.

Keywords: influenza, pandemic, preparedness, primary care, technology

Background

Seasonal influenza reminds us each year of the unpredictable but historically proven threat of pandemic influenza. Preparedness and prevention are thus inherently linked. Recent accomplishments in the area of pandemic influenza research include efforts to map the substantial genetic diversity of circulating H5N1 viruses;[1] molecular characterisation of the 1918 virus and more in-depth analysis of the 1918 epidemic;[2] pathogenesis and transmissibility studies in mammalian models;[3–5] robust international preventive and planning initiatives;[6] study of the use of antiviral agents in early post-exposure prophylaxis;[7] testing and evaluation of prototype vaccines against H5N1;[8] and local, state and national preparedness programmes.[9]

Most pandemic preparedness projects have been conducted in large organisations or in the context of regional and governmental partnerships. Very little has been done to address preparedness in the primary care practices that will carry most of the burden of the initial patient influx as front-line responders. Seasonal influenza outbreaks can take practices to the edge of their capacity to maintain the level of care they usually provide. In addition, the introduction of new approaches and technologies that often require some level of practice redesign generates further challenges.[10]

Voluntary quarantine historically has been one of the most effective and least expensive ways to contain an infectious disease outbreak.[11] If primary care practices can keep and remotely manage their patients at home, through assisted self-management, they may significantly improve population outcomes in a pandemic event. New technologies, including specialised health information technology (HIT) promise newer and better approaches to improving efficiency, effectiveness and quality of patient care.

Our study identified and tested technology implementation models that can be incorporated into primary care practices to improve surge capacity (ability to manage a large influx of patients), enhance patient self-management (empowering patients to help themselves) and facilitate patient–provider communication in seasonal influenza outbreaks and, possibly, in a pandemic event.

Methods

Selection of influenza self-management technologies

A collaborative of primary care practice-based research networks (PBRNs)[a] conducted a systematic review of the literature, and obtained exemplars, national-level feedback from key informants and input from an expert panel of PBRN directors about technologies that are currently used or potentially could be used to improve primary care surge capacity and patient self-management in public emergency situations. The initial literature search identified over 1100 potential English language papers from four different electronic sources (MedLine, OVID, EMB and Cochrane Reviews). A group of reviewers then selected and reviewed 70 relevant publications using rigorous inclusion–exclusion criteria. References in these publications were also examined. Two promising technologies emerged from qualitative analysis using open coding and 'memoing' followed by the development of themes and categories by a review team. The two technologies that could be most easily implemented and accepted by patients and practices included customised practice websites and a telephony interactive voice response (IVR) system.

[a] The PBRN collaborative included the Oklahoma Physicians Resource/Research Network (OKPRN), the South Texas Ambulatory Research Network (STARNet), the State Networks of Colorado Ambulatory Practices and Partners (SNOCAP), the Wisconsin Research and Education Network (WREN), and the South Florida Practice-Based Research Network (SoFla-PBRN)

All participants, including patients and clinicians, were recruited through an informed consent process that was approved by the institutional review board (IRB) of the particular PBRN.

Patient self-triage script

A seasonal influenza patient self-triage script was developed with the help of the multidisciplinary PBRN stakeholder group in late December of 2007. We consulted with national experts and received input from a number of clinicians in several PBRNs. Then we examined existing triage protocols, compared them to our protocol, and circulated updated versions among our research group. Several draft versions were developed and piloted sequentially. We analysed our own influenza surveillance databases to determine the patterns of symptoms in various patient groups during past influenza seasons in order to refine the triage script. Patient safety was also considered. For example, we asked patients about acute rash associated with the current illness (to probe for a possible meningococcal disease). We also expanded the official influenza-like illness (ILI) criteria of the Centers for Disease Control and Prevention (CDC) to include additional, but optional, symptoms, such as sore throat, nasal congestion, muscle aches and runny nose. Further refinements allowed us to limit the completion of the telephone triage protocol to about three minutes. Finalised English and Spanish influenza self-triage scripts are available from the following website: www.okprn.org/IVR/SIPSTS.pdf

Practice websites

During the course of the 2007 to 2008 influenza season, we provided nine primary care practices with influenza self-management websites. The availability of web resources was advertised in each practice through flyers, advertisements and verbal communication. Systematic advertising was not possible due to the budgetary limitations of the project and the lack of infrastructure to contact the entire patient panel (approximately 5000 patients per practice) in a timely manner in most practices. The bulk of the implementation took place in early February and in March. We also utilised practice websites for testing with healthy volunteers in late April (a second wave of testing). The implementation coincided with the second half of the peak and the tail end of the 2007 to 2008 influenza season.

The collaborative utilised the okprn.org domain to set up and deliver web content for participating primary care practices. The design and dissemination of the nine websites was carried out through the production of a generic template with pages and content that could later be serialised and customised. This included copying template site pages and tailoring them to the needs of individual practices (e.g. changing headers, content, colour scheme and images, adding links etc). The web template contained the following pages:

- A 'Home page' including a welcome message and highlighted links to influenza self-management resources.
- An 'About us' page that provided a short description of the specific practice and its services, with optional links to clinicians' pages containing short biographies and photos.
- A 'Resources' page that could be tailored to the practice by adding links to existing patient resources (e.g. downloadable forms, patient education materials etc).
- A 'Flu toolkit' page designed specifically for influenza self-management resources that included a bilingual (English and Spanish), web-enabled version of the patient self-triage protocol and a downloadable 'Influenza stay-at-home toolkit' document. Cultural and linguistic accuracy of the Spanish version was verified by one of our bilingual faculty physicians.
- A 'Contact us' page listing the address of the practice, office hours, contact information, driving directions to the practice and a link to an interactive online map of the practice location.

Each page also had a standard footer with links to popular and useful health content and a header with a link for email communication, when requested.

Practice web pages were created utilising standard web technologies including plain HTML, Cascading Style Sheets (CSS) and JavaScript, which all popular browsers can properly render. Only simple JavaScript was used in order to improve user experience with the interactive 'Influenza self-triage module'. The source codes of individual pages can be downloaded freely from the web. As an example, the home page of a practice can be visited at www.okprn.org/MedinaValley and the source code for the page can be downloaded via the okprn.org/MedinaValley/MV.zip link.

In order to track the utilisation of web resources, we implemented a combination of standard web statistics packages available via web hosting entities in combination with the free Google Analytics (www.google.com/analytics/). Each of these analytics packages was capable of tracking hits and visits to individual pages and they also provided detailed reports on web traffic and utilisation of individual components.

Participating clinicians asked us to customise their websites to fit the style and specific mission of their practices. Practice websites were tailored through consecutive quality improvement cycles. Practices sent update requests via email or phone in addition to

requests channelled through network project leaders. These updates were then posted at okprn.org, including new images, links to additional resources, text corrections or updates etc. Each practice had a distinctive URL under the 'okprn' domain. Clinicians and patients visited their sites and provided follow-up feedback about past improvements as well as communicating new ideas for improvements.

We integrated influenza self-management resources into a more extensive body of practice-specific information to attract and retain our audience. This approach seemed to be prudent, since most primary care practices in the USA do not have practice websites. Some practices may have a website, but they lack control over it or don't have the expertise to edit and post web content. Two participating practices already had websites. We offered these practices two options: the self-management site could be linked to existing information posted on their websites or we could copy and present existing information on the influenza self-management site within their websites.

Telephony technology

A comprehensive search of candidate telephony technologies was conducted via the internet, through conversations with key informants that included primary care clinicians and by direct contact with various companies that globally develop and provide IVR solutions. From these sources we determined that telephony resources capable of delivering basic IVR functions for a typical primary care practice should have the following characteristics:

- The system must be affordable (see details below).
- Setting up and daily operation must be relatively simple with some guidance.
- The system must provide call-in menu options with at least 20–30 outgoing messages (OGMs).
- Operators should be able to edit IVR trees (option logic) and OGMs easily and promptly.
- A call simulator or call test function can make testing of IVR trees much easier.
- User activities must be logged by the system (the level of logging may be tiered).
- The system be able to interface with standard technologies (e.g. computers, regular phone lines).
- Voice mail and automatic call redirection options are desirable, but not essential.
- A reverse 911 (outbound) call function has significant potential, but is not essential.
- Survey and polling functions can also be very useful, but are not essential.

Through systematic deliberation and comparison, the research team settled on the IVM Answering Attendant Software package from NCH Software (Canberra, Australia). The website of the software can be found at www.nch.com.au/ivm/index.html. The software packages are tiered and work well with standard computer systems (e.g. Windows, Linux and Mac). Fully functional trial versions of these packages can be downloaded from the above site and tested. Once the IVR software was installed, we digitally recorded and incorporated OGMs based on the patient self-triage script we had formulated for practice websites.

The telephony software was interfaced with a simple and inexpensive full voice modem computer card (Jaton WinCOMM v.92). The card was installed in a generic Windows® XP desktop computer with no special features. Since the IVR application was 'lean', it utilised only a limited amount of system resources. This made practically any recently manufactured home computer able to handle sequential calls from a limited population (e.g. the patient panel of one or several practices). For multiple concurrent calls, more than one phone line might be necessary. The NCH software can handle multiple simultaneous calls, but we have not tested this scenario. Since our complete IVR tree took less than three minutes to complete, callers who phoned the line concurrently waited only a couple of minutes for the line to become free. If necessary, the capacity could be scaled up with additional phone lines or a more sophisticated local phone system.

A step-by-step 'How to' document that provides detailed instructions on setting up these influenza self-management resources in primary care practices can be downloaded from the following link: www.okprn.org/IVR/HowTo.pdf

Semi-structured patient and clinician interviews

Following technology testing, a convenience sample of patients was selected at random from participants who used the website or the telephone hotline. We completed 29 English and eight Spanish language patient interviews to obtain information about satisfaction with and utility of influenza self-management websites and the Seasonal Influenza Hotline. Patient feedback sessions were recorded onto digital media, which were then professionally transcribed. A qualitative analysis team met several times to compare and discuss their individual findings and generate propositions regarding categories and relationships among categories using the constant-comparative method. This process proceeded until theoretical saturation of all categories was achieved. Similarly, three clinicians were interviewed to gauge the involvement of clinicians in, and their perceptions of, patient self-management technologies within their practices.

Results

Practice websites

Aggregated website utilisation characteristics are summarised below (see Table 1). Website hits for all practices indicate the total number of user requests for individual pages, while visits show the number of distinct user sessions.

Table 1 Hits and visits to influenza self-management websites

Month	Hits (individual pages)	Visits (complete sessions)
February	358	37
March	154	27
April (2nd wave)	548	64
Sum	1060	128

Analysis of utilisation characteristics indicated that websites received most hits at and after the lunch hour on a typical day, measured at the location of the server (Eastern Time). Session tracking information also showed that patients used only a limited number of operating systems and types of browsers to reach self-management websites.

Downloads of the Stay-At-Home Influenza Toolkit document reflected general web traffic, but the peak of downloads occurred in February. The number of Influenza Self-triage Module sessions per month continued to increase due to a second wave of testing (see Table 2).

Table 2 'Influenza toolkit' downloads and 'Self-triage module' web sessions

Month	Influenza toolkit downloads	Self-triage module sessions
February	45	27
March	9	41
April	22	117
Sum	76	185

Seasonal influenza hotline

The telephony software allowed us to log patient actions as they navigated through the IVR tree. Analysis of three months worth of logs yielded some interesting observations that we have summarised as follows:

- A total of 88 calls were placed in February, March, and April of 2008.
- Nineteen callers selected the Spanish IVR tree (21% of all callers).
- Sixty-three callers had influenza-like symptoms (72% of all callers).
- Twenty callers did not have influenza-like symptoms (23% of all callers).
- Five calls were terminated by the caller after the greeting (5% of all calls).
- Five callers indicated that they had a rash associated with their illness (5% of all callers).
- Six callers had a sick child of less than 5 years old (7% of all callers).
- Fifty-two callers listened to all the educational messages (59% of all callers; 82% of those with influenza-like symptoms).
- Sixteen callers experienced an onset of symptoms within the previous 36 hours and therefore they were eligible for antiviral therapy (18% of all callers; 30% of those who listened to the educational messages).

Telephony technology utilisation data indicated that a significant number of patients opted for the Spanish version of the hotline, the majority indicated that they had influenza-like symptoms, most of those with symptoms proceeded to access patient education and a considerable portion of patients were eligible for antiviral therapy. These patients were then prompted by the system to consult with their doctor about antiviral prophylaxis.

Patient and clinician feedback

Patients indicated a high level of overall satisfaction with these technologies, the mode of delivery and the specific structure and content of self-management resources. We received no significant technical complaint or negative comment about the websites or the telephone hotline. On the other hand, constructive suggestions have been collected for future improvement and expansion of self-management resources. Patients showed a level of enthusiasm about both the project and the specific resources that seemed to go beyond the foreseeable effect of participation.

Qualitative analysis based on individual semi-structured interviews with patients revealed several themes that cut across the spectrum of information received from users of self-management websites and telephony technology. Overall satisfaction with both

technologies, measured as the proportion of definitely positive comments, was high (see Table 3). Overall satisfaction with the website was indicated by a 96% positive comment rate while the telephone hotline received a 90% positive rating. The level of satisfaction with specific areas of technology use is detailed in Table 3.

Patients told us that it was very easy to access information via websites and the hotline. The majority of patients indicated that self-management information had some impact on their decisions about what to do when they thought they might have been ill with influenza. The most prominent categories for changes in patient behaviour or decision making are listed in Table 4.

Patients also ranked the most useful features of self-management resources (see Table 5). Feedback suggested that the technology intervention was successful in achieving the main objective of this project, i.e. to assist patients to manage their influenza symptoms at home.

In the course of the feasibility and acceptability testing, we received a considerable volume of feedback from patients, clinicians and experts about potential improvements in future implementation. Patient feedback ranged from reports of typographical errors on practice websites to the extension of these technologies to other health problems. The most pertinent improvement ideas are listed below:

- Add a 'rewind' function to the telephone hotline (the most important feature of the website compared to the hotline turned out to be the ability for self-paced learning).
- Include more tabbed menu options to improve 'drill-down' capabilities on websites.
- Make a web page available that summarises 'take-home' messages (e.g. Ten tips on how to prevent/care for influenza).
- More information on influenza pathogenesis, options for symptom management and the normal course of the disease.
- Links to localised influenza surveillance information (types of circulating viruses, rates of morbidity and mortality etc. in a community or region).
- An option for contacting a healthcare professional for personal advice (by phone or email).
- Extension of the self-management technologies to other conditions (e.g. asthma).

Table 3 The level of satisfaction with specific areas of technology use

Area of satisfaction	Satisfaction in OKPRN ($n = 10$) %	Satisfaction in SNOCAP ($n = 19$) %
Ease of accessing information	88	90
Problem-free experience with resources	98	90
Usefulness and adequacy of information	98	92
Recommended resources to family and friends	95	95
Overall satisfaction with technologies	92	95

Table 4 Ways in which information altered user behaviour or decisions

Ways in which information changed behaviour/decision making	Number of times mentioned
'I would give it some more time to see if I really need to see the doctor'; 'I would give suggested interventions a try first'; 'It gives me tips how to feel better until I can see the doctor'	9
'It made me more conscious about my hygiene'; 'It helped me remember to wash my hands more frequently'; 'Told me what to do if my temperature reaches 104 degrees (°F)'	5
'Most likely, it will not influence my decision, I would still see my doctor'; 'Not likely, I have lots of lung problems anyway'; 'No, it did not [change my decision], I always end up in the hospital if I get sick'	3
'I felt more secure in knowing what to do'	2

Table 5 The most useful features of self-management patient resources

Most useful features	Number of times mentioned
Self-management resources helped me take care of myself	10
They helped me treat my influenza symptoms	6
They emphasised the importance of hydration and/or rest	6
They helped me decide to stay home or see the doctor	6
It was easy to navigate/browse resources (self-paced learning)	6
They taught me personal hygiene measures	3
They told me what medications to take and when	3
A Stay-At-Home Toolkit was made available	2

Spanish language feedback received from patients (n = 8) mirrored most of the trends described in English-speaking patient groups. The level of overall satisfaction with self-management resources was similarly high and the same features were emphasised by patients that included: fast, easy, self-paced learning, adequate and informative materials, very few technical problems and considerable impact on decision making. However, there were several areas where patient comments shed light on issues that were specific to this population. For example, Spanish speaking patients mentioned significantly (ten times) more frequently that they either had not known what influenza symptoms to watch for prior to using self-management resources or that suggestions for recognising and managing symptoms were very helpful and educational. They also emphasised that they intended to 'follow the instructions closely'.

Three physicians who posted customised websites in their practices provided feedback about their experience. They felt that the websites needed to provide more information about the practice, to be 'warmer' in colour and design and to better engage patients. They felt that these websites can help patients find a practice that fits their personal preferences. They recommended several improvements to the site design, particularly additional links. They also recommended that websites offer additional tools, such as practice questionnaires, mood assessment surveys and cardiovascular risk calculators.

A more detailed report on feedback received from patients and clinicians can be downloaded from the following web address: www.okprn.org/IVR/Summary.pdf

Discussion

This study contributes to the literature in several ways. The overwhelming majority of research on technology implementations in infectious disease emergencies has been done in hospitals, emergency departments and public health settings. Information about the feasibility and acceptability of the use of these technologies in primary care settings is limited. Although in a limited number of practices and over a short period of time, we have shown that computerised patient self-management technologies can be designed, implemented and sustained in primary care practices. These results suggest that practice websites and telephony resources may help patients manage their influenza symptoms and empower practices to offer alternative means of patient care. These improvements in turn may have the potential to slow the rate of influenza transmission in a local community.

Our study has several limitations. First, the scope of this investigation was limited to specific areas of improving primary care surge capacity through the use of technology and therefore we could not take into account all important factors that may help or hinder practices to efficiently manage a significant influx of patients. Second, instead of modelling a pandemic scenario that has its own limitations, we chose to test technology implementations in the course of a seasonal influenza outbreak. Although more realistic, this approach may lack the immediacy of a true public emergency and the extent of pressure that may be on the primary care practice to innovate or shift modes of operation to cope with the surge. Third, due to administrative constraints, we were not able to start testing

technology implementations before February (the peak of the 2007 to 2008 influenza season in the USA). An earlier start would have resulted in more substantial utilisation and participant feedback.

In addition, our pilot study did not include the development of resources that may be suitable for participants with various disabilities (e.g. visual or hearing problems). Future studies should include technology components that empower these populations. The scope of the study was not extended to the measurement of patient outcomes. More research is needed to determine whether these technologies improve patient outcomes, including number of visits to the primary care office and emergency department, number of hospitalisations and actual steps taken by patients in response to triage and education.

Conclusions

The results of this study suggest that providing patients access to self-management technologies in local communities through tailored practice websites and telephony solutions could improve the capabilities of practices to reach out and educate patients and help them with seasonal influenza self-management. Using seasonal influenza as a model, these approaches may, in certain scenarios, facilitate practice surge responses not just in annual influenza epidemics, but perhaps in a pandemic scenario as well. Patient and clinician feedback revealed that typical primary care practices can adopt and incorporate low-cost influenza self-management resources into practice websites and telephony applications with a high rate of satisfaction, providing added value to their patients.

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CONFLICTS OF INTEREST

None.

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