MEDINFO 2007
HISA Ltd Australia
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A Primary Care Physicians Web-Space

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Abstract

The Primary Care Physician Webspace (PCPW) is intended to provide a physician community with an array of support services. It provides an environment that augments and complements typical clinical management systems (CMS), links to them, and links physicians to each other, to the University of Waterloo, to regional healthcare facilities, and to local and remote information resources. CMS tend to lack Community of Practice (CoP) support, and portals tend to ignore the existence of a CMS. The PCPW addresses CoP in depth using advanced technologies built into a rapid development environment that provides software agent support for interaction with other systems, thereby addressing both challenges.

Keywords:

web-based system, communities of practice (CoP), consumer e-health, workflow, clinical information system

Introduction

Small and medium sized organizations underutilize modern information and communication technologies for communicating with their communities[1]. Relational databases, mapping, notifications, agents and advanced web-based technologies such as dynamic prototyping, are all examples of capabilities that could benefit organizations like a primary care physician's practice. The cost and complexity of deploying and maintaining such systems are major barriers to their more widespread use. The community that would benefit includes rostered patients, the general public, partner practitioners, associated staff, allied professionals, other service deliverers in the community such as pharmacies and hospitals, and, where applicable, medical residents and students.

The Centre for Family Medicine (CFFM), in Kitchener, Ontario, Canada - http://www.family-medicine.ca is a family health team[2] comprised of primary care physicians, their staff and allied professionals that, until recently, made no significant use of web-based technologies for communicating with their community. The team had chosen and deployed a CMS, but no public web site and no technology to support a broader, online community communications strategy had been acquired or designed.

In partnership with the University of Waterloo's Waterloo Institute for Health Informatics Research, the Computer Systems Group, a research group within the David R. Cheriton School of Computer Science at the University of Waterloo and the J.W. Graham Information Technology Trust, a Primary Care Physician's Webspace was created with the CFFM to help to address the Centre's online community communications needs.

Methodology

The following major steps were taken:

1. Establish an advisory panel of primary care physicians.
2. Identify the goals and objectives of primary care physicians related to Community of Practice (CoP) support as well as integration with other systems.
3. Analyze these goals and objectives and collaboratively define the needs of the physicians and the required capabilities of the system.
4. Design the system and review this with the advisory panel and a key primary care practice.
5. Using a locally-developed advanced rapid prototyping toolkit called the Web-based Informatics Development Environment (WIDE), create a demonstrable version of the system.
6. Evolve the system using the advisory panel and practice feedback through several iterations.
7. Demonstrate the system.

A key part of step two was to identify the various user communities and their corresponding information needs from the system. It is also important to note that some of the steps and sequences of steps were repeated several times. As the capabilities of the system became better understood by the advisory panel, their objectives shifted and so the requirements for the system changed.

Discussion

Communities served

Four communities are served by the system:

1. Rostered Patients and the General Public including Newcomers and Immigrants
2. CFFM Staff and Professionals

3. Prospective Medical Residents and Students
4. Other Physicians and the Medical Community

Rostered patients and the general public including newcomers and Immigrants

The cities of Kitchener, Waterloo and Cambridge and the surrounding townships that comprise Waterloo Region in Southwestern Ontario, Canada, are designated as underserviced by primary care professionals, according to the Government of Ontario[3]. Almost all doctor's offices in the region maintain a roster of patients who can make appointments to visit the office. For a family health team in Waterloo Region, such as the Centre for Family Medicine, rostered patients are their highest priority community. When the needs of that community have been met, any extra capacity within the team can be used to serve the general public. For example, the CFFM offers an extensive series of educational seminars on topics such as nutrition and diet, exercise, diabetes management and general health promotion. These seminars are first made available to rostered patients but anyone can ask to be registered if space permits.

In the PCPW the highest priority community to communicate with is the community of rostered patients. Basic information about the CFFM itself, including educational events and special clinics such as those for flu shots is of high importance to this community. As well, the PCPW provides directories of local pharmacies, medical labs and physiotherapists that are of use to this community and the general public. These directories include detailed contact information and maps that can produce driving directions. This information is especially valuable to residents of small and rural communities. Similarly, information for newcomers and immigrants is particularly valuable as Waterloo Region has the fifth highest per capita immigrant population of all urban areas in Canada, behind only Toronto, Vancouver, Hamilton and Windsor[4].

CFFM staff and professionals

Although the CFFM has an extensive e-mail system and makes very good use of it, it is a challenge to keep ten physicians and between twelve and fifteen other associated staff and professionals informed of special events, meetings and presentations. As an added complication, the CFFM physicians work from four offices in the cities of Kitchener and Waterloo and the village of Wellesley, Ontario which is approximately 27 kilometers (17 miles) from the downtown Kitchener site. The PCPW can significantly reduce the challenge of keeping the group informed of upcoming events. As well, the CFFM staff can see immediately what patients and the broader community are being told about upcoming CFFM events.

For after-hours calls from local pharmacies, physicians usually fax their on-call hours and contact information to a list of organizations. The PCPW includes a capability to provide that information to these organizations in a more secure and reliable manner.

Prospective medical residents and students

Waterloo Region has a great deal to offer prospective medical residents and students in the context of the CFFM. Residents who seek a placement in what is primarily an urban setting but also want to experience a rural community can find the CFFM to be ideal. The PCPW contains extensive links to community information about topics as diverse as regional hiking and biking trails, bus routes, arts and cultural information and social services. After attending a public lecture at the Perimeter Institute for Theoretical Physics or spending an evening with the Kitchener-Waterloo Symphony, a CFFM resident could attend a clinic in the village of Wellesley that serves a large old-order Mennonite community whose residents frequently arrive at the doctor's office in a horse and buggy.

Other physicians and the medical community

Some of the physicians at the CFFM actively teach, research and write about innovative topics in the field of Family Medicine. The PCPW currently includes several presentations and papers on the topic of the environmentally friendly doctor's office. As well, documents have been prepared to present a range of options for presenting, accessing and participating in meetings and presentations over the internet. For example, one to one meetings where no patient information is discussed can often be presented using simple internet mechanisms such as Skype[5] or Windows Live™ Messenger[6]. Presentations with a wider audience might be broadcast with a system like ePresence[7] and an event that includes secure videoconferencing requirements might be best suited to a system that is based on the OTN/North Network[8] environment.

Requirements elicitation

As previously mentioned in the Methodology section, this project involved an extensive, iterative requirements elicitation process. The cost of such a process in a traditional, commercial consulting context would have rendered the process completely infeasible. Nevertheless, it did require several weeks of meetings and discussions to educate the advisory panel about the capabilities of and issues related to current information technology and to reconcile different goals and objectives amongst the members of the panel.

A key technology that was used in the creation of the PCPW is called "Model-Driven System Generation" (MDSG). This innovative technology, which is a feature of the WIDE toolkit[9], provides an environment where the application model and operational system are always synchronized – there is no architectural gap between the model and the implementation. In traditional software

development, the phenomenon of "model drift", where the model and implementation are initially synchronized but soon separate, is very common. Without MDSG it would not have been possible to create the PCPW without a much larger budget. It was essential to this project to be able to develop a rapid prototype of a proposed feature, explore how the feature operated with the advisory panel and then either discard it as undesirable or change the model to improve it.

Content

Content in the PCPW can be classified as either original or secondary material. Original material is created mostly by CFFM professionals and staff and secondary material is sourced externally. Of the secondary material, some is presented within the CFFM with appropriate credit and some is presented as links to external web sites.

Original material includes the following:

- information about the CFFM, including vision and plans, physical sites and pictures, hours and contact information
- frequently asked questions
- medical nutrition information for patients
- information about the basics of health care in the region
- research papers and presentations
- Secondary material presented within the site includes directories of:
- pharmacies
- medical labs, and
- physiotherapists
- Secondary material presented as links to external sites includes:
- community and social services
- arts and cultural resources
- community events
- transportation around the region
- Medical-resident matching services

For all of this content, sustainability was a key concern. Specifically, it was essential that the information always be as up-to-date, comprehensive, relevant and authoritative as possible. As well, maintenance of the information should be as easy and inexpensive as possible, ideally at no cost. The following sources of information that met the sustainability criteria were levered where possible:

- Waterloo Regional Arts Council (arts and cultural information)
- Community Information Centre of Waterloo Region

When no single source of information was available that met the criteria, the WIDE toolkit provided options for amalgamating several sources of information into a single result. For example, the directory of pharmacies was created and is maintained by amalgamating and monitoring ten different data sources:

- four brand-name drug store web sites
- two employer association web sites
- four community business directories

As is inevitable with such diverse data sources, inconsistencies have been discovered and are reported back to the maintainers of the original data.

As well, regular and comprehensive checking of the site is performed automatically. Broken links to external web sites, missing images and spell checking are all performed by autonomous agents without any administrative intervention and only the results are reported to the system administrator.

Future work

The CFFM would like to explore closer connections with the hospital information systems of the two general hospitals in Kitchener-Waterloo in order to provide the primary care physicians with better access to the medical records of their patients. This integration step is currently being investigated.

As the new Downtown Kitchener Health Sciences Campus of the University of Waterloo is built, the PCPW should be extended to communicate with and enhance the online systems of the new School of Pharmacy, the School of Optometry and the new Kitchener satellite of McMaster University's Michael G. DeGroote School of Medicine.

Conclusions

The Primary Care Physician's Webspace has demonstrated a capable primary care physician support solution that allows the augmentation of commercial Clinical Management Systems with advanced web-based capabilities. It shows what can be gained by using tools, such as the WIDE toolkit, that significantly reduce barriers to partner development and understanding, and allow frequent and rapid revisions. This is particularly important when new types of requirements, such as support for CoP and little user knowledge of potential solutions exist. The PCPW allows significant systems support in the primary care setting using internet-based, browser accessible technologies.

Acknowledgements

This work was supported by the J.W. Graham Information Technology Trust.

References

[1] Cowan, D.D., Fenton, S., Muholland, D.W., *Lowering Technological Barriers to Developing, Deploying and Maintaining Web-based Interactive Information Systems,* International Journal of Technology, Knowledge and Society, Vol. 1, Issue 4, 2005, pp. 175-182.

[2] Government of Ontario, Ministry of Health and Long-term Care website: Understanding Family Health Teams http://www.health.gov.on.ca/transformation/fht/fht_understanding.html , November 14, 2006.

[3] Government of Ontario, Ministry of Health and Long-term Care website: *Underserviced (LADAU) for General/Family Practitioners* http://www.health.gov.on.ca/english/providers/program/uap/listof_areas/gp_ladau.pdf , November 14, 2006.

[4] Region of Waterloo Public Health website: *A Profile of Immigrants in Waterloo Region* http://chd.region.waterloo.on.ca/web/health.nsf/0/4AD3E53C78B52E5085256E780060EDDD/$file/ImmigrantsProfile.pdf?openelement , January, 2004.

[5] http://www.skype.com

[6] http://get.live.com/messenger/overview

[7] http://www.epresence.tv

[8] http://www.northnetwork.com

[9] Cowan, D.D., Fenton, S., Mulholland D.W., *The Web-based Informatics Development Environment (WIDE)*, http://csg.uwaterloo.ca/wide.htm , November 14, 2006.

[10] Hildreth P. and Kimble C., *Knowledge Networks: Innovation through Communities of Practice*, Idea Group Publishing.

[11] Kimble C., Hildreth P. and Wright P., *Communities of Practice: Going Virtual, Chapter 13 in Y. Malhotra (Ed.) Knowledge Management and Business Model Innovation*, Idea Group Publishing, Hershey (USA)/London (UK), 2001, pp 220 - 234.

[12] Kimble C., Li F. and Barlow A. Effective Virtual Teams through Communities of Practice, University of Strathclyde Management Science Research Paper No. 00/9, 2000

[13] Pan Shan L., and Leidner D., "Bridging communities of practice with information technology in pursuit of global knowledge sharing," *The Journal of Strategic Information Systems* (J. strateg. inf. syst.) ISSN 0963-8687 2003, vol. 12, no 1, pp. 71-88 Elsevier Science.

[14] Wenger, Etienne, McDermott, Richard, and Snyder, William, *Cultivating communities of practice: A guide to managing knowledge*, Harvard Business School Press, 2002.

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