

Infobutton usage in Patient Portal MyHealth

Jie Long, PhD¹, Nathan C. Hulse, PhD^{1,2}, Cui Tao, PhD³

¹Intermountain Healthcare, Salt Lake City, UT; ²Department of Biomedical Informatics, University of Utah, Salt Lake City, UT; ³University of Texas School of Biomedical Informatics, Houston, TX;

Abstract

Infobuttons have proven to be an important element in modern electronic health records (EHR), providing educational materials to both providers and patients. However, the usage of infobuttons in personalized health records (PHR) is only lightly documented in the literature. Patient-facing infobuttons pose a new challenge because patients have different questions and educational levels than professional users in EHRs. In this paper, we present usage data for patient-facing infobuttons that have recently been integrated in *Intermountain Healthcare's* patient portal MyHealth. We summarize use patterns by usage classified in modules, electronic resources (eResource), and infobutton sessions. Based on the analysis, we propose further enhancements to the current implementation of infobuttons in MyHealth.

Introduction

Information gaps at the point-of-care have been well documented in the medical literature, and they pose a real risk in ensuring that current best practice is reflected the care that patients receive^{1,2}. Several approaches to addressing these information needs have been presented in the informatics literature^{3,4}. One of the more notable means for addressing this issue is the infobutton, a context-aware linking resources that points users to relevant clinical reference materials at the point of care, typically accessed in clinical workflows while users are engaged with routine tasks in electronic health records^{5,6}. The importance of the infobutton has been elevated in recent years through the development and refinement of international standards and implementation guides in Health Level Seven (HL7) as well as its inclusion in the Meaningful Use criteria, as part of the United States government incentive program for broadening the uptake and usage of key features within electronic health records (EHR)⁷.

Infobuttons provide context-aware information to providers and patients. A system, such as EHR or PHR, sends information about user, patient, concept, and environment, to an infobutton requester and gets back a list of suggested resources. The suggested resources are context-aware to reflect different input parameters. For example, subtopic pregnancy only shows up if the patient gender is female and among a certain range of patient age. The usage of infobuttons from EHR is mostly for provider education. There are many successful usages of infobuttons in EHR systems⁸.

Putting infobuttons in personalized health records (PHR) system, however, poses a new challenge. Patients have a different emphasis than physicians while accessing the health records. Patients have a wider scale of literacy and abilities to pursue and understand clinical information. Even the resources available to patients are often different than that which providers have, due to contractual and access limitations. Patients access the system from the public network and want fast access. The infobutton provides fast and easy access for patients to better understand clinical terms as well as lab results. The context-aware information provided by the infobutton could be a good fit for the patient's need for information relevant to conditions, medications, and labs relevant to their own health.

Recently we implement infobuttons for MyHealth⁹, a PHR system in Intermountain Healthcare. In this paper, we present the initial usage of infobuttons in MyHealth. The usage data is collected from our logging system from both infobutton and MyHealth. We analyze the usage by eResources, modules, and sessions. By analyzing the usage, we hope to better understand the use pattern of infobuttons in PHRs and therefore to be able to enhance the functions of infobutton for the use of patients. The analyses of use patterns will help researchers to better design and implement infobutton following the HL7 standard from inside and outside of Intermountain Healthcare. The usage of eResources reflects user's preference that will help designers to list eResources with priorities and stakeholders to evaluate the purchase of certain eResources.

Background

Intermountain Healthcare is a not-for-profit integrated healthcare delivery system based in Salt Lake City, Utah. It provides healthcare for the entire state of Utah and parts of southeastern Idaho. Intermountain maintains 22 inpatient hospitals (including a children’s hospital, an obstetrical facility and a dedicated orthopedic hospital), more than 185 outpatient clinics, and 18 community clinics serving uninsured and low-income patients. Intermountain provides primary and specialty care for approximately half of the residents of the state of Utah. They include inpatient and outpatient EHRs, a decision support framework, an infobutton manager platform, and a patient portal. They have been widely-regarded as ‘state-of-the-art’ and are well recognized in the literature for supporting best care practice with clinical decision support interventions¹⁰. Intermountain’s infobutton manager (a key component of this effort) is used regularly and its development and uptake have been detailed previously¹¹⁻¹³.

Infobuttons have been in use at Intermountain Healthcare for over 15 years. They have been integrated in two separate clinical systems, including usage from 4 major modules within these systems. Usage has steadily increased over the years, with over 1,700 unique monthly users, accounting for over 18,000 infobutton sessions per month.

Infobuttons have been made available for patient use from our patient portal, MyHealth, supporting 5 modules, including medications, test and procedures, health concerns, allergies, and microbiology results. MyHealth is actively used by Intermountain’s patients, with tens of thousands of logins per month. The implementation has been updated from a legacy, internally-built system to the general OpenInfobutton¹⁴. This implementation has been augmented with local services, supporting internal logging, integration with terminology services, and enhancements to satisfy local security requirements. This is the first exposure of infobuttons to the public network in Intermountain Healthcare. In this paper, we analyze the current usage of infobuttons in MyHealth to understand use patterns in pursue of enhancing the future implementation and therefore achieving a more user-friendly interface.

Data Collection

The data for infobutton usage is collected from an internally implemented monitoring process. The process records ten parameters for each click from end users on the content brought up with infobuttons. The ten parameters are demonstrated in Table 1. In this table, we list the name of all the parameters, the content as explanations for each parameter, and example for some sample values. Numeric Concept Identifier (NCID) has been widely adapted in our implementation as a unique identifier.

Table 1. Ten parameters for infobutton monitoring

Name	Content	Example
Event type	A constant value to identify records for infobutton.	220
Concept id	The NCID of the queried concept.	NCID 83006 for <i>Diabetes mellitus type II</i> .
User role id	The NCID for a user’s role.	NCID for Physician: 322 NCID for Patient: 691
User id	The NCID for a user.	NCID 123456 for a test user
eResource id	The numeric id for an eResource.	Krames: 541 Mayo clinic: 405 Lab test online: 402 MedlinePlus: 369
Session id	The numeric id for an infobutton session. It is a concatenation of user id, concept id, and system time when a click happens.	Session id 123456-83006-1386301204891 for patient NCID- <i>Diabetes mellitus type II</i> - milliseconds.
Subtopic	The free text of a subtopic for an eResource.	“Patient education” “Overview”
Patient id	The NCID for a patient who owns the record.	NCID 654321 for a test patient
Sequence number	The number of consequent clicks in the same session.	The value for the first click in a session is 1, for the second click is 2, and so on.
Module id	The NCID of the module in MyHealth.	NCID for Health concerns: 50450223 NCID for Medication: 50450222 NCID for Tests and procedures: 50450225

Usage of MyHealth’s infobutton supported modules

MyHealth is the only PHR system in Intermountain Healthcare. Since the beginning of the year 2014, MyHealth has an overall average of 986,918 page views with 175,017 visitors per month, where there are 685,006 unique visitors in total.

In Table 2, the infobutton supported modules are marked as “Y”. Krames is a contracted resource and is supported for all the modules. The eResource of NIH Senior Health and Medical Home Portal are context aware, which provides infobutton only for patients above age 65 years and under age 18 years respectively.

Table 2. Infobutton supported modules and eResources

	Tests and Procedures	Microbiology	Medication	Health Concerns	Allergies
Krames	Y	Y	Y	Y	Y
Lab tests online	Y	Y			
Mayo Clinic	Y		Y	Y	
Medline Plus			Y	Y	Y
Drugs.com			Y		
NIH Senior Health				Y	
Medical Home Portal				Y	
Health finder				Y	

The infobutton hits in the various supported modules for the most recent 4 months are shown in Figure 1. The vertical axis is the number of page views. The data is based on an average of 48,079 monthly visitors in these modules for the past four months.

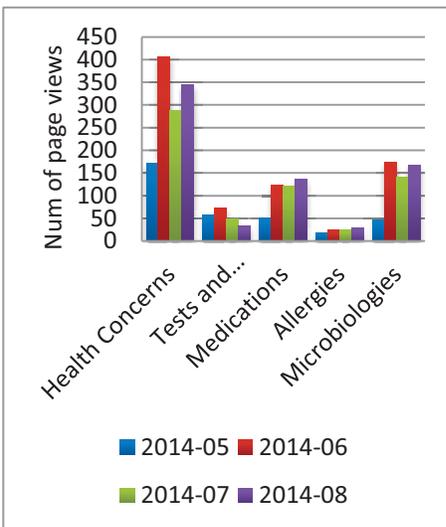


Figure 1. Total hits by modules.

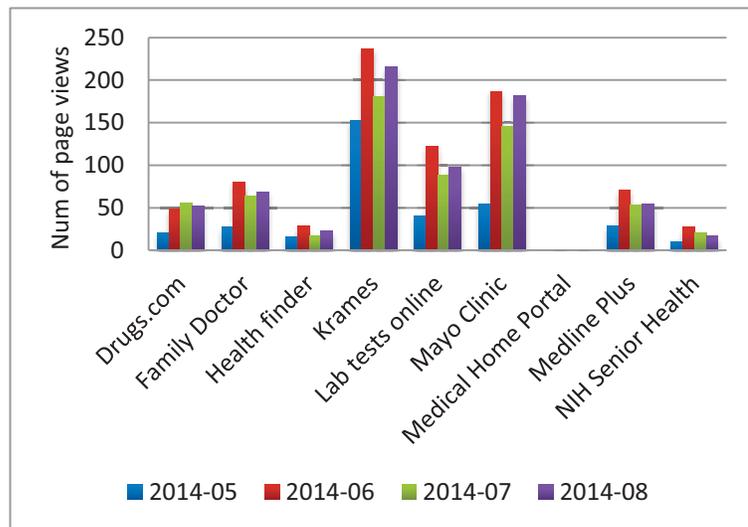


Figure 2. Total hits by eResource.

In the past four months, the Health Concerns module (derived from the patient’s problem list) had the highest usage over all the other infobutton supported modules, as shown in Figure 1. The usage of each module generally grew from May to August 2014. The module of Tests and Procedures has the most page views but relatively fewer hits because the design does not display infobuttons by default. The design is further discussed in the Discussion section.

We also show the usage by each eResource in Figure 2 and 3. Figure 2 demonstrates the total hits of each eResource in months while Figure 3 demonstrates the number of monthly average hits in modules. Two eResources, Krames and Mayo Clinic has the highest overall usage. Krames has been displayed as the first eResource by default for all the modules while Mayo Clinic is displayed in three out of the five modules. Noticeably, Lab tests online and drugs.com have good usage respectively although they only support few modules.

A session is defined as a user clicks on an infobutton, which opens the list of all the returned eResources. The number of clicks on the eResources in the same session is recorded and displayed in Figure 4. There are 73% for

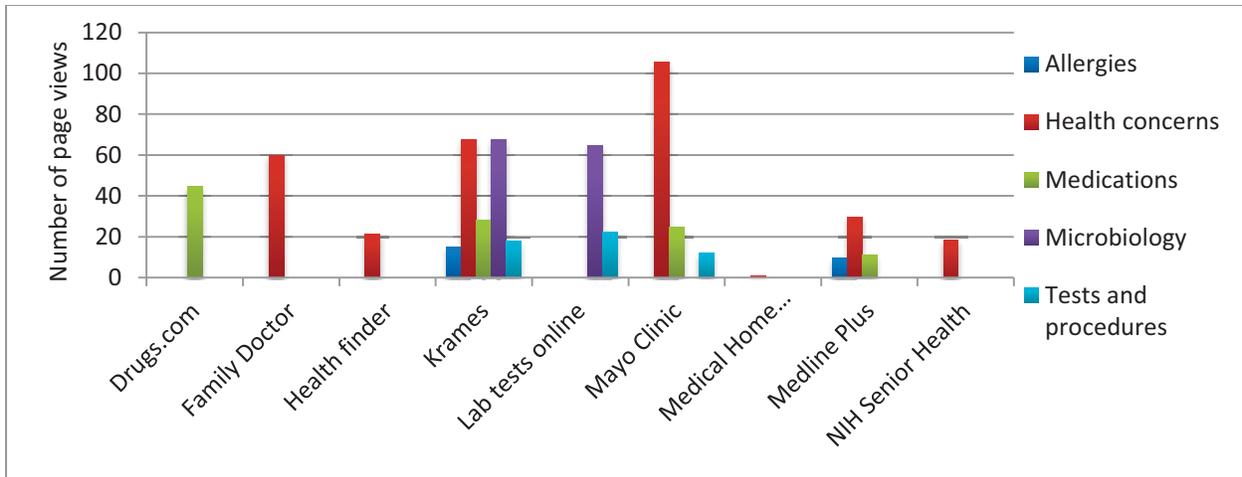


Figure 3. Average monthly usage of eResources classified by modules.

only 1 click on eResources before leaving the session. Less than 8% of the user infobutton sessions had clicks more than 2 eResources.

Results and Discussion

The imaging module originally had infobutton access in our testing environment but was subsequently removed before a production release because of poor content returned by the current infobutton resources in this domain. However, the hits on imaging module are relatively high, ranking the second of all the modules in MyHealth. In addition, imaging is one of the official module defined in infobutton’s HL7 standard. In future, we may consider improving the current performance of infobutton manager to support imaging module.

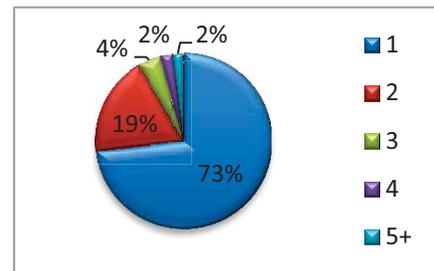


Figure 4. Distribution of Clicks per session.

An interesting, unanticipated finding in our early results has shown relatively poor usage patterns of infobuttons in the Tests and Procedures module. However, the module of Tests and Procedures (derived from the patient’s lab list) in MyHealth is the module with the most of the page views. Comparing to the total hits of Tests and Procedures in MyHealth, the usage of this module is relatively low in Figure 1. Upon further investigation, we learned from the MyHealth development team that they often group related results of Tests and Procedures into a single entry as the default configuration, forcing the user to expand the selection in order to review details. We show screenshots of grouping (image on the left) and ungrouping (image on the right) in Figure 5. As demonstrated in Figure 5 as an example of grouping, three records of ‘CBC without diff’ on the right are grouped as 1 item on the left. This grouping behavior led to an inability for them to pass a single infobutton concept to the infobutton manager, and as such, they didn’t show the infobutton in these circumstances. Given that this is the default view for patients, many patients weren’t being presented the infobuttons at all. We plan to work with them going forward to make the infobuttons more visible in these areas, especially since they represent the most traffic to the MyHealth portal to begin with.

Krames’ library was the most visited resource, which was not surprising, given that it was implemented as the highest ranked resource in our implementation. Mayo Clinic has the highest usage among all the contract-free eResources, ranking after Krames as the second mostly used of all the eResources. One reason is that Mayo Clinic supports 3 out of 5 modules, as shown in Figure 3. The familiarity of the name to users may contribute a factor for the high usage. Given the case that Mayo Clinic is displayed as the last eResource in our current design but has a high usage, we may consider to give it a higher rank in our list so the visibility of a useful eResource can be improved and therefore help people access it faster.

The majority of patient infobutton users (73%) leave infobutton web page after a single click, as shown in Figure 4. Our initial data makes it apparent that users are looking for results in a quick fashion and may not have much

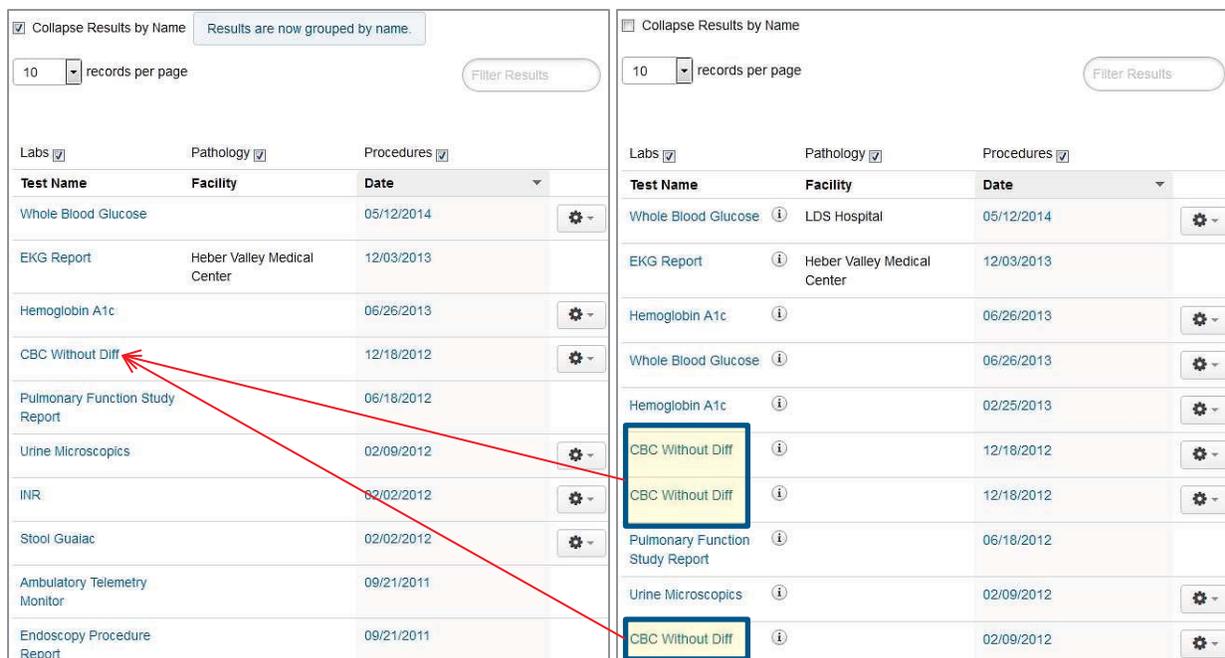


Figure 5. User interface of grouping and ungrouping results in Tests and Procedures module

patience to review multiple results. As such, we feel it of utmost importance that the results presented are highly relevant and useful.

Conclusion

The overall usage of infobuttons by our patient population has given some encouraging initial results, but we feel that there is room for improvement going forward. As we learn more about what patients are looking for and tune the infobutton to address their information needs, we feel that they will have ready access to clinical answers to improve their service.

References

1. Covell DG, Uman GC, Manning PR. Information needs in office practice: are they being met? *Ann Intern Med.* 1985;103(4):596-9.
2. Ely JW, Osheroff JA, Chambliss ML, Ebell MH, Rosenbaum ME. Answering physicians' clinical questions: obstacles and potential solutions. *J Am Med Inform Assoc.* 2005;12(2):217-24.
3. Hauser SE, Demner-Fushman D, Jacobs JL, Humphrey SM, Ford G, Thoma GR. Using wireless handheld computers to seek information at the point of care: an evaluation by clinicians. *J Am Med Inform Assoc.* 2007. Nov-Dec;14(6):807-15. Epub 2007 Aug 21.
4. Goldbach H, Chang AY, Kyer A, Keshogileng D, Taylor L, et al. Evaluation of generic medical information accessed via mobile phones at the point of care in resource-limited settings. *J Am Med Inform Assoc.* 2014 Jan-Feb;21(1):37-42. doi: 10.1136/amiajnl-2012-001276. Epub 2013 Mar 27.
5. Cimino JJ, Elhanan G, Zeng Q. Supporting infobuttons with terminological knowledge. *Proc AMIA Annu Fall Symp.*1997;528-32.
6. Maviglia SM, Yoon CS, Bates DW, Kuperman G. KnowledgeLink: Impact of context-sensitive information retrieval on clinicians' information needs. *J Am Med Inf Assoc.* 2006;13:67-73.
7. Del Fiol G, Huser V, Strasberg HR, Maviglia SM, Curtis C, Cimino JJ. Implementations of the HL7 Context-Aware Knowledge Retrieval ("Infobutton") Standard: challenges, strengths, limitations, and uptake. *J Biomed Inform.* 2012 Aug;45(4):726-35. doi: 10.1016/j.jbi.2011.12.006. Epub 2012 Jan 2.
8. Del Fiol G, Curtis C, Cimino JJ, Iskander A, Kalluri ASD, Jing X, Hulse NC, Long J, Overby CL, Schardt C, Douglas DM. Disseminating Context-Specific Access to Online Knowledge Resources within Electronic Health Record Systems. *MedInfo.* 2013: 672-676
9. MyHealth patient portal. Available at: <https://myhealth.intermountainhealthcare.org/>. Accessed on September 25, 2014.
10. Clayton PD, Narus SP, Huff SM, et al. Building a comprehensive clinical information system from components. The approach at Intermountain Health Care. *Methods Inf Med* 2003;42:1-7
11. Reichert JC, Glasgow M, Narus SP, Clayton PD. Using LOINC to link an EMR to the pertinent paragraph in a structured reference knowledge base. *Proc AMIA Annu Fall Symp.* 2002.;652-6.
12. Del Fiol G, Rocha RA, Clayton PD. Infobuttons at Intermountain Healthcare: utilization and infrastructure. *Proc AMIA Annu Fall Symp.* 2006;180-4.
13. Del Fiol G, Haug PJ, Cimino JJ, Narus SP, Norlin C, Mitchell JA. Effectiveness of topic-specific infobuttons: a randomized controlled trial. *J Am Med Inform Assoc.* 2008 Nov-Dec; 15(6): 752-759. doi: 10.1197/jamia.M2725
14. Open Infobutton. Available at: <http://www.openinfobutton.org/>. Accessed on September 25, 2014.