Blue Button use by patients to access and share health record information using the Department of Veterans Affairs' online patient portal

Carolyn Turvey,[1,2] Dawn Klein,[1,2] Gemmae Fix,[3,4] Timothy P Hogan,[3,5,6] Susan Woods,[7,8] Steven R Simon,[9,10] Mary Charlton,[1,11] Mary Vaughan-Sarrazin,[1,12] Donna M Zulman,[13,14] Lilian Dindo,[2] Bonnie Wakefield,[1,15] Gail Graham,[16] Kim Nazi[16]

For numbered affiliations see end of article.

Correspondence to
Dr Carolyn L Turvey, Iowa City VA Health Care System (152), 601 Highway West, Iowa City, IA 52246, USA; carolyn.turvey@va.gov

Received 12 February 2014
Revised 20 March 2014
Accepted 1 April 2014
Published Online First 16 April 2014

ABSTRACT

Objective The Blue Button feature of online patient portals promotes patient engagement by allowing patients to easily download their personal health information. This study examines the adoption and use of the Blue Button feature in the Department of Veterans Affairs' (VA) personal health record portal, My HealtheVet.

Materials and methods An online survey presented to a 4% random sample of My HealtheVet users between March and May 2012. Questions were designed to determine characteristics associated with Blue Button use, perceived value of use, and how Veterans with non-VA providers use the Blue Button to share information with their non-VA providers.

Results Of the survey participants (N=18 398), 33% were current Blue Button users. The most highly endorsed benefit was that it helped patients understand their health history better because all the information was in one place (73%). Twenty-one percent of Blue Button users with a non-VA provider shared their VA health information, and 87% reported that the non-VA provider found the information somewhat or very helpful. Veterans' self-rated computer ability was the strongest factor contributing to both Blue Button use and to sharing information with non-VA providers. When comparing Blue Button users and non-users, barriers to adoption were low awareness of the feature and difficulty using the Blue Button.

Conclusions This study contributes to the understanding of early Blue Button adoption and use of this feature for patient-initiated sharing of health information. Educational efforts are needed to raise awareness of the Blue Button and to address usability issues that hinder adoption.

INTRODUCTION

The Institute of Medicine identified care coordination as one of 20 national priorities to improve the quality of healthcare.[1] Growing specialization and fragmentation of healthcare for patients with complex chronic conditions highlights the need for improved coordination between patients, providers, and both formal and informal caregivers. A key component of care coordination is efficient and accurate sharing of health information. However, timely and accurate communication between patients, their caregivers, and their multiple healthcare providers is often lacking, thereby jeopardizing patient safety and increasing healthcare cost.[2–7] In an international study of the healthcare systems in six countries, the USA fared the worst in care coordination, with 33% of patients reporting that either records did not reach the doctor's office in time for an appointment or doctors ordered an unnecessary medical test that had already been done.[8]

The US Office of the National Coordinator for Health Information Technology (ONC) promotes the expansion and use of electronic health records (EHRs) to address gaps in communication and care coordination. The ONC has specified core objectives for the meaningful use of EHRs,[9] which include providing patients 'with the ability to view online, download, and transmit their health information within four business days of the information being available to their eligible provider.' In response, many healthcare organizations have implemented the Blue Button feature as part of online patient portals.[10 11]

Blue Button is a registered service mark of the US Department of Health and Human Services and is most often indicated by a clickable blue circle on the online patient portal home page. The Blue Button allows patients to access components of their EHR, such as past and future appointments, problem lists, allergies, medications, laboratory results, procedures, vitals, and immunizations. With Blue Button access, patients can view, download, or print their information to share with trusted others. The Blue Button feature is currently available in patient portals provided by both public and private organizations such as the Department of Veterans Affairs (VA), the Department of Defense, Centers for Medicare and Medicaid Services, and United Healthcare Insurance. Hundreds of other organizations have also pledged to participate.[12]

VA deployed the Blue Button on August 29, 2010 as part of its online combined personal health record (PHR) and patient portal, My HealtheVet (MHV). Recent research reveals that a large portion of Veterans also seek care outside of the VA system, making information sharing and care coordination especially critical for them. The 2011 Survey of Veteran Enrollees' Health and Reliance upon VA indicated that 77% had alternative healthcare coverage.[13] Results from another recent survey of Medicare-eligible Veterans revealed that, among respondents who reported obtaining

To cite: Turvey C, Klein D, Fix G, *et al*. *J Am Med Inform Assoc* 2014;**21**:657–663.

medications from non-VA pharmacies, 38.4% reported never discussing those medications with VA physicians.[14]

There is a small but growing literature exploring which patient, provider, and technology characteristics predict positive attitudes towards online patient portals.[15–29] Both race and socioeconomic status have been associated with PHR adoption,[17 24 25] although not all studies find minority status to be a barrier.[30] The relation between health status and adoption has been mixed, with one study reporting that positive health predicts adoption,[28] while another found that high medical comorbidity was positively associated with use.[29] Emani *et al*[17] used Rogers' Diffusion of Innovation Model[31] and found that concepts such as ease-of-use or perceived value differed significantly between PHR users and non-users. Patients who have full access to the doctors' notes in their medical record report high satisfaction and little resulting distress.[32–35] Although these studies provide important insights into user characteristics and meaningful use of patient portals, they did not explore patient-initiated sharing of health information.

Prior to the launch of the Blue Button, two online surveys were conducted to examine the use of MHV for information sharing. Veterans reported high interest in using MHV to share information with family caregivers and non-VA providers, yet only a small percentage (4%) had actually done so.[36 37] The following study is based on this prior work in MHV and in patient portal adoption in general. It used a technology adoption model comparable to the one used by Emani *et al*[17] to inform the development of an online survey of MHV users. This survey aimed to characterize users of the Blue Button, its perceived impact on their health, and its role in information sharing with non-VA providers.

METHODS

My HealtheVet

VA's national online patient portal PHR, MHV, was launched in 2003. MHV enables VA patients who have verified their identity and achieved 'premium account' status to view information from their VA EHR. MHV has gradually added functionality including current and past medications, refilling VA medications, laboratory results, scheduled appointments, wellness reminders, and secure messaging with healthcare teams. As of January 2014, the MHV PHR portal has more than 2.6 million registrants (37% of the VA patient population), with more than 1.4 million VA patients having authenticated to a premium account (25% of the VA patient population).

At the time of this survey, March through May 2012, the VA Blue Button feature provided Veterans with an electronic file of their self-reported information (eg, self-entered medications and supplements), and VA patients with a premium account could also select EHR data including: VA appointments, laboratory test results, allergies, and prescription medication information. In January 2013, VA significantly expanded the Blue Button to include more types of information from the EHR, and added the VA Continuity Care Document (CCD), which summarizes key clinical data. More than 955 000 Veterans have used the Blue Button and downloaded more than 5.7 million Blue Button files.

Study population

Since October 2007, VA has measured Veterans' satisfaction with MHV using an online survey based on the American Customer Satisfaction Index (ACSI).[21] The ACSI survey is an industry standard for evaluating government and private websites. Data presented here originate from custom questions asked during the ACSI survey administered between March 12, 2012 and May 21, 2012. A 4% random sample of the 2 705 131 people who visited four or more pages during the study period was invited to participate. Of the 41 237 who accepted the survey invitation (acceptance rate ~38%), 25 155 answered the custom questions, resulting in a survey completion rate of 61%. To avoid duplicate respondents, all were asked if they had taken the survey in the previous 3 months, and the 4949 replying 'yes' were excluded from the analyses. An initial question asked all respondents about whether or not they had used the Blue Button feature of MHV. Respondents who did not answer this question (N=571) or endorsed 'not sure' (N=1237) were excluded, yielding a total sample size of 18 398.

Survey design and content

Survey questions were designed in collaboration with the MHV Program Evaluation Workgroup and the VA *e*Health Quality Enhancement Research Initiative to address key domains related to: (1) barriers to and facilitators of Blue Button use; (2) impact of the Blue Button on health management; and (3) whether Veterans use the Blue Button for care coordination with non-VA providers. Based on participants' response to a question about Blue Button use, three main groups were segmented for analysis: (1) non-users, ie, MHV users who never used Blue Button; (2) past users, ie, MHV users who used Blue Button once or more, but had no plans to use it again; and (3) current users, ie, MHV users who use Blue Button and plan to continue to use it.

Multiple choice questions were based on the Unified Theory of Adoption and Use of Technology (UTAUT) of Venkatesh *et al*,[38] with response choices corresponding to key theoretical concepts. For example, when past and non-users were asked why they did not use the Blue Button, Veterans could respond that they (1) were not aware of the Blue Button (knowledge/awareness), (2) do not believe the Blue Button is useful (perceived value), (3) prefer to use other methods to keep track of health information (relative value), or (4) do not know how to use the Blue Button (usability). As many of the questions allowed multiple response choices, the total number of endorsements for response choices can exceed the total sample size for these questions.

The online survey also included questions about demographics, self-rated computer ability, whether the Veteran has a system for organizing health information (yes/no), the degree to which the respondent values having a record of personal healthcare on a 5-point scale, and self-rated health on a 5-point Likert scale. Self-rated health was converted into a dichotomous variable indicating 'good' to 'excellent' vs 'fair' or 'poor' health status. Age was grouped into five categories: 18–39, 40–49, 50–59, 60–69, 70–79, and 80 or more years. The survey did not include questions about race or income. Respondents could also indicate whether they had been diagnosed with various health conditions: high blood pressure, high cholesterol, pain, arthritis, diabetes, orthopedic problems, mental health problems, heart disease, lung disease/asthma, previous heart attack, cancer, ulcer or stomach disease, spinal cord injury, anemia or other blood disease, or heart failure. The study was reviewed by the local institutional review board and the local VA Research and Development Committee for secondary data analysis.

First, bivariate relationships between patient characteristics and Blue Button use were examined; then multivariate analyses were conducted. Patient demographics, self-rated computer ability, health status, use of a system for organizing health information, and the perceived value of access to health records were compared across the three Blue Button use categories using the χ^2 test. Use of the Blue Button by current users, specifically use related to care coordination with non-VA providers, was also examined.

Table 1 Characteristics of Blue Button user groups: non-user, past user, current user (N=18 398)

Characteristic	Non-user N=11 671	Past user N=732	Current user N=5995	p Value
Age range (years), n (%)				<0.0001
18–39	300 (2.6)	22 (3.0)	126 (2.1)	
40–49	923 (7.9)	64 (8.9)	443 (7.5)	
50–59	2145 (18.6)	138 (19.1)	1162 (19.6)	
60–69	5829 (50.5)	379 (52.5)	3023 (51.0)	
70–79	1691 (14.6)	87 (12.0)	934 (15.8)	
80+	659 (5.7)	32 (4.4)	243 (4.1)	
Gender (% male)	10 108 (90.6)	641 (91.6)	5244 (91.7)	0.05
Self-rated health status (% fair or poor)	2695 (23.1)	154 (21.0)	1375 (22.9)	0.44
Number of illnesses range 0–15, mean (SD)	3.8 (2.3)	4.1 (2.5)	3.9 (2.3)	<0.0001
Self-rated computer ability, n (%)				
Beginner	684 (5.9)	40 (5.5)	179 (3.0)	<0.0001
Intermediate	4469 (38.3)	223 (30.5)	1701 (28.4)	
Advanced	6518 (55.9)	4,69 (64.1)	4115 (68.6)	
Has a system for organizing health information (% yes)	5431 (46.5)	385 (52.6)	3334 (55.6)	<0.0001
Values having own record of health (% somewhat, very, or extremely important)	94.8	91.7	95.5	<0.0001

Multivariate logistic regression models were generated to determine respondent characteristics that were independently associated with past and current Blue Button use. Similarly, a single multivariate logistic regression model was also generated for current users only to determine respondent characteristics that were independently associated with sharing health information generated by the Blue Button with non-VA providers. Preparatory stepwise regression was used to determine which of the 15 medical conditions was independently associated with Blue Button current users, or with sharing of Blue Button data with non-VA providers. Only those illnesses remaining in the preparatory model with a p value of 0.05 or lower were included in the final logistic regression models. All statistical analyses were conducted using SAS statistical software V.9.3.

RESULTS

Blue Button adoption

Table 1 presents the demographic, health and user characteristics for each user group. Of the total sample (n=18 398), 33% (n=5995) were current users, and 63% (n=11 671) had never used Blue Button (non-users). A small minority, 4%, (n=732) had tried the Blue Button at least once, but no longer used it (past users). Self-rated computer ability, a system to organize health information, and user's perception of the high value of having one's own health record showed the strongest bivariate association with Blue Button use.

Two separate logistic regression models compared current and past users with the non-user group (table 2). ORs and 95% CIs were calculated to determine how each variable increased the odds of using the Blue Button. Age categories and self-rated computer ability were treated as ordinal variables because each category represented an increase in either age or computer ability. When the 95% CI includes 1.0 within its range, the association is not statistically significant. These regression models revealed that computer ability and having a system for organizing health information yielded the largest ORs in both models. When comparing current users with non-users, the odds of

Table 2 Multivariate analysis of characteristics associated with Blue Button use groups

Characteristic	Predictor variables coding	OR (95% CI) current user (n=5995) vs non-user (n=11 671)	OR (95% CI) past user (n=732) vs non-user (n=11 671
Age	Age group 18–39-year-olds=0, remaining coded in increments from 1 to 5	1.00 (0.97 to 1.04)	0.96 (0.89 to 1.04)
Female gender	Female=1	0.82 (0.73 to 0.93)**	0.79 (0.60 to 1.05)
Self-rated health status	Poor or fair=1	0.94 (0.87 to 1.02)	0.95 (0.77 to 1.15)
Health conditions			
Pain		1.06 (0.99 to 1.14)	1.26 (1.07 to 1.51)**
Diabetes		1.02 (0.95 to 1.09)	0.84 (0.71 to 0.99)*
Orthopedic problems		1.07 (0.99 to 1.16)	1.10 (0.92 to 1.32)
Mental health		0.96 (0.89 to 1.04)	1.26 (1.06 to 1.52)**
Lung disease/asthma		1.14 (1.04 to 1.25)**	1.31 (1.07 to 1.61)**
Self-rated computer ability	Beginner=0 Intermediate=1 Advanced=2	1.60 (1.51 to 1.70)***	1.29 (1.13 to 1.49)***
Has a system for organizing health information	Yes=1, No=0	1.38 (1.29 to 1.48)***	1.37 (1.18 to 1.63)***
Values having own record of health	0=Not at all or a little important 1=somewhat, very, or extremely important	1.06 (0.91 to 1.23)	0.58 (0.43 to 0.78)**

*p<0.05; **p<0.01; ***p<0.001.

Table 3 Current users' use of the Blue Button

Questions and response choices	N (%)*
On a scale from 1 (not at all satisfied) to 10 (extremely satisfied), please rate your overall satisfaction with the Blue Button Feature of My HealtheVet (N=5995)	
1–3	313 (5.2)
4–6	1182 (19.7)
7–10	4500 (75.1)
How did you use the VA Blue Button? (n=5995)	
I used it to view my health information on the My HealtheVet website	4765 (79.5)
I used it to create an electronic file of my health information (eg, saved a file to my computer)	1928 (32.2)
I printed a paper copy of my health information	1537 (25.6)
What information were you interested in? (n=5950)	
My laboratory results	4280 (71.4)
My current VA medication list	3466 (57.8)
My entire VA medication history	2566 (42.8)
A list of my providers and their contact information (self-entered into My HealtheVet)	877 (14.6)
My list of medications, prescribed outside of the VA (self-entered into My HealtheVet).	681 (11.4)
My list of over-the-counter, supplement, or herbal medications (self-entered into My HealtheVet)	391 (6.5)
What did you do with your Blue Button print out or file? (n=5950)	
I read it	3698 (61.7)
I saved it for my records	2796 (46.6)
I shared it (or plan to share it) with my spouse, child, or other family member	707 (11.8)
I shared it (or plan to share it) with my non-VA healthcare provider	579 (9.7)
I did not keep the information (eg, deleted the file or threw away the print copy)	373 (6.2)
I shared it (or plan to share it) with my VA healthcare provider	340 (5.7)
What information on the Blue Button print out did you want to show your care provider? Check all that apply (n=813)†	
My laboratory results	644 (79.2)
My current VA medication list	442 (54.4)
My entire VA medication history	235 (28.9)
My list of medications prescribed outside of the VA (self-entered into My HealtheVet).	136 (16.7)
My List of over-the-counter, supplement, or herbal medications (self-entered into My HealtheVet)	116 (14.3)
What did your provider do with the Blue Button print out? Check all that apply? (n=813)†	
He or she used it to review recent laboratory results	411 (50.5)
He or she filed it in my medical record	304 (37.4)
He or she used it to review my complete medication list	301 (37.0)
He or she used it to find other health information	106 (13.0)
He or she did not look at it	71 (8.7)
How helpful do you think your care provider found the Blue Button information in making decisions about your care? (n=813)†	
Very helpful	425 (52.3)
Somewhat helpful	112 (13.8)
Not at all helpful	15 (1.8)
Don't know	261 (32.1)

*Percentages may total more than 100 because respondents could endorse more than one response.
†Of Veterans endorsing sharing or planning to share their information with non-VA and/or VA provider.
VA, Department of Veterans Affairs.

using the Blue Button increased 60% for each incremental increase in self-rated computer ability. The odds of using the Blue Button increased 38% if the veteran reported having a system for organizing his or her health information. Age was not associated with Blue Button use.

Non-users were asked to select the reason(s) they did not use the Blue Button from a list of response choices. The majority (61.3%) indicated that they were not aware of the Blue Button. Those who *were* aware of the Blue Button stated that they did not use it because they did not know how (34.4%), they only use MHV for prescription renewal (26.0%), they preferred to use other methods to keep track of their health information (11.3%), or they did not know where the Blue Button was located (9.5%). The least commonly selected reason for not using the Blue Button was that the Veteran did not think it would be useful (9.0%).

Similar follow-up questions were asked of past users. Of these, 40% reported that, when using the Blue Button, they could not find what they were looking for, 22% indicated that the information in the file/printout was not useful, and 17% reported that they did not know how to use it. In addition, 12% reported that the file or printout was too long, and 9% endorsed that they would rather use another way to store their health information.

Current Blue Button users

Table 3 presents the responses of current users to a series of questions characterizing their Blue Button use. When asked to rate their satisfaction with the Blue Button on a scale from 1 ('not at all satisfied') to 10 ('extremely satisfied'), 75.1% gave the Blue Button a rating of 7 or higher. The information that respondents were most interested in accessing included their laboratory results (71.4%) and current VA medication list (57.8%). Sharing the Blue Button printout or file was not common, with only 11.8% sharing it with a family member,

Table 4 Veteran-reported impact of Blue Button on quality of healthcare

Question and response choices	N (% somewhat or completely agree)
Please indicate whether or not you agree with the following statements (n=5995)	
The Blue Button feature helps me understand my health history better because all the information is in one place	4393 (73.3)
The Blue Button feature makes it easier to monitor laboratory results	4330 (72.2)
The Blue Button feature makes it easier for me to give others, such as healthcare providers or family members, important medical information	4071 (67.9)
The Blue Button feature has helped me better manage my health in general	3878 (64.7)
The Blue Button feature has helped me to go to my medical appointments at the appropriate time	3382 (56.4)
The Blue Button feature helps me understand better which medications I need to be taking.	3237 (54.0)

9.7% sharing it with a non-VA provider, and 5.7% sharing it with a VA provider. Laboratory results (79.2%) and the VA medication list (54.4%) were the most frequently endorsed type of information shared with care providers.

Among current users, self-reported impact of the Blue Button was high (table 4), with 73.3% reporting that it helps them understand their health history better because it is all in one place, 72.2% reporting that it helps them monitor their laboratory results better, and 67.9% reporting that it makes it easier for them to give others important information about their health.

Table 5 Current users and the Blue Button printout for care coordination with non-VA providers

Questions and response choices	N (%)
Do you see any healthcare providers who are not affiliated with the VA? (n=5995)	
Yes	2633 (43.9)
No	3362 (56.1)
How do your VA providers and non-VA providers communicate about your healthcare? (n=2633)	
I share information between them	1381 (52.4)
I do not know how they communicate	390 (14.8)
They do not communicate	389 (14.8)
They exchange medical records via mail or fax	344 (13.1)
They speak by phone	48 (1.8)
How satisfied are you with the communication about your medications and healthcare between your VA providers and the providers outside of the VA? (n=2633)	
Not at all satisfied	325 (12.3)
A little satisfied	251 (9.5)
Somewhat satisfied	718 (27.3)
Very satisfied	912 (34.6)
Completely satisfied	428 (16.2)
Have you ever shared the Blue Button printout with your non-VA providers? (n=2633)	
Yes	550 (20.9)
No	2083 (79.1)
How helpful do you think your non-VA care provider found the Blue Button information in making decisions about your care? (n=550)	
Don't know	68 (12.3)
Not at all helpful	1 (0.2)
Somewhat helpful	106 (19.2)
Very helpful	376 (68.2)

*Percentages may not add to 100 because of rounding. Some percentages may exceed 100 because multiple responses were possible.
VA, Department of Veterans Affairs.

Sharing of Blue Button printout with non-VA providers

Table 5 addresses current users' Blue Button use in sharing health information with non-VA providers, with 43.9% reporting having a provider not affiliated with the VA. When asked how their VA and non-VA providers communicate, 52.4% reported 'I share information between them'. Options indicating that the providers are responsible for information sharing were endorsed far less frequently. One out of five (20.9%) current users who reported having a non-VA provider stated that they share Blue Button information with these providers. Of these, 68.2% thought their non-VA provider found it 'very helpful', and 19.2% found it 'somewhat helpful'. In a multivariate logistic regression analysis (table 6), the dichotomous outcome was use of the Blue Button for care coordination (=1) or not (=0), and the predictor variables were the demographic and computer use variables found in the first column. Use of the Blue Button for care coordination was most likely in patients with diabetes or lung disease, individuals who rated their computer ability higher, and those who had a system for organizing their health

Table 6 Multivariate logistic regression testing the associations between demographic, health, self-rated computer ability, health information management, and sharing of Blue Button with non-VA providers (N=2633)

	Comparison groups	OR (95% CI)	p Value
Age		0.99 (0.90 to 1.11)	0.89
Gender		1.10 (0.74 to 1.56)	0.63
Self rated health	Fair or poor=1 All other choices=0;	1.04 (0.92 to 1.1)	0.74
Health problems*			
Diabetes	Yes=1, No=0	1.38 (1.1 to 1.7)	0.002
Lung disease	Yes=1, No=0	1.53 (1.2 to 1.9)	0.0007
Self-rated Computer ability	Beginner,=0; Intermediate=1, Advanced=2	1.40 (1.14 to 1.71)	0.0013
System for organizing health information	Yes=1, No=0	1.68 (1.36 to 2.08)	0.0001
Values own record of health information	0=Not at all or a little important 1=somewhat, very, or extremely important	2.01 (0.99 to 4.07)	0.052

*Prior to conducting the final model, a stepwise multiple regression including all health variables was conducted to determine which had an independent association with sharing of the Blue Button. Variables with p<0.05 in the stepwise regression model where then included in the final model above with other demographic and health variables.
VA, Department of Veterans Affairs.

information. The odds of using the Blue Button for care coordination increased 68% for Veterans who had a system for organizing their health information.

DISCUSSION

In this survey of individuals who use the VA online patient portal, MHV, approximately one in three currently use the Blue Button to access, store, or share their health information. Of Blue Button users with a non-VA provider, one in five has specifically used this tool to share their information. Blue Button users reported that this feature yields a range of health benefits, including a better understanding of their health history because all information is in one place, greater ease of monitoring laboratory results, and improved understanding of medications.

Use of the Blue Button for care coordination was most common among individuals with diabetes or chronic lung disease, and for patients who indicated that they had a system for organizing their health information. Laboratory results generated through the Blue Button was the information most likely to be shared with providers.

Non-use of the Blue Button is a function of patient lack of knowledge about the feature rather than patients not valuing it. Within the concepts explored from Venkatesh *et al*'s[38] UTAUT, low knowledge appears to be the biggest barrier, but users also indicated usability as a significant obstacle. Even among respondents with the computer ability to use a patient portal and to respond to an online survey, 34% reported that they did not use the Blue Button because they did not know how, and 9% endorsed that they did not know where the Blue Button was on the site. Therefore, the Blue Button feature was even challenging to respondents with considerable computer ability. Notably, almost half of the non-users have a system for organizing their health information. This group may be more motivated than those without a system to adopt the Blue Button in the future if the VA clearly demonstrates the advantage of the Blue Button relative to the Veterans' current system.

Of current users who reported having a non-VA provider, 21% reported sharing the Blue Button printout with their provider. Although 21% is promising, it is hoped that a greater proportion of Veterans with non-VA providers will harness this tool's ability to improve care coordination. Given these results and prior usability research with the MHV site,[39] a redesign of the MHV website is in progress.

Reports from other patient portals and PHRs agree that usability and patient comfort navigating the site limits patient portal adoption.[16 17 19–21 40–45] Compared with other forms of successful consumer technology, such as smart phones or online banking, patient portals may require more concerted awareness-raising and educational efforts. Although people have had prior experience with phones and banking, it cannot be assumed that patients have had comparable prior experience reviewing and managing their medical records. Therefore, patients may need greater education about potential benefits and efficiencies of patient portals to promote meaningful use.

When asked how their providers communicate, respondents endorsed that they themselves were primarily responsible for sharing health information. Although several health information technology initiatives promote provider-to-provider communication,[2 46 47] patients are reporting that they are often the most important means of sharing information. This underscores the importance of the Meaningful Use Stage 2 Core Objective of providing patients with the ability to download and share their health information. Currently, VA and other healthcare systems are developing functionality that allows patients to transmit electronically a comprehensive health summary.

This study has several limitations. This was a voluntary online survey of MHV site visitors. Survey completion rates may have biased the sample in unknown ways. Race and income were not assessed, so the effect of these important variables is unknown. Another study limitation is that many of the outcomes were self-reported with no independent verification.

CONCLUSIONS

This study contributes to our understanding of the early use of the Blue Button and patient portals in patient health management and sharing of health information. Blue Button users value having all their health history in one place and the greater ability to monitor and share information, particularly laboratory results. Those who use the Blue Button value it and endorse high rates of satisfaction. The barriers to Blue Button use reveal that addressing usability issues and taking into account patient experience in interface design will be critical to continued adoption of this feature.[48] Finally, future work on the demonstrable impact of the Blue Button on health behavior and outcomes, both self-report and independently assessed, is needed to better quantify the value of patient-facing health information technology.

Author affiliations
[1]Iowa City VA Health Care System, Comprehensive Access and Delivery Research and Evaluation (CADRE) Center, Iowa City, Iowa, USA
[2]Department of Psychiatry, The University of Iowa Carver College of Medicine, Iowa City, Iowa, USA
[3]Edith Nourse Rogers Memorial Veterans Hospital, Center for Healthcare Organization and Implementation Research (CHOIR), A VA HSR&D Center of Innovation, Bedford, Massachusetts, USA
[4]Department of Health Policy and Management, Boston University School of Public Health, Boston, Massachusetts, USA
[5]Edith Nourse Rogers Memorial Veterans Hospital, eHealth Quality Enhancement Research Initiative, National eHealth QUERI Coordinating Center, Bedford, Massachusetts, USA
[6]Division of Health Informatics and Implementation Science, Department of Quantitative Health Sciences, University of Massachusetts Medical School, Worcester, Massachusetts, USA
[7]Portland VA Medical Center, Health Services Research & Development, Portland, Oregon, USA
[8]Department of Medical Informatics & Clinical Epidemiology, Oregon Health & Science University, Portland, Oregon, USA
[9]Veterans Affairs Boston Healthcare System, Section of General Internal Medicine, Boston, Massachusetts, USA
[10]Division of General Medicine and Primary Care, Brigham and Women's Hospital, Boston, Massachusetts, USA
[11]Department of Epidemiology, The University of Iowa College of Public Health, Iowa City, Iowa, USA
[12]Department of Internal Medicine, The University of Iowa Carver College of Medicine, Iowa City, Iowa, USA
[13]Veterans Affairs Palo Alto Health Care System, Center for Innovation to Implementation, Menlo Park, California, USA
[14]Division of General Medical Disciplines, Stanford University, Stanford, California, USA
[15]University of Missouri Sinclair School of Nursing, Columbia, Missouri, USA
[16]Veterans and Consumers Health Informatics Office, Office of Informatics & Analytics, Veterans Health Administration, Washington, DC, USA

Correction notice This article has been corrected since it was published Online First. The author 'Tim Hogan' has been changed to ''Timothy P Hogan'.

Acknowledgements We acknowledge the assistance of Carrie Franciscus at the Iowa City VA Health Care Center for her work preparing data for analysis.

Contributors CT was the principal investigator of the study and had primary responsibility for writing the manuscript. CT, DK, GF, SW, SRS, MC, MV-S, DMZ, LD, BW, and KN contributed to the study design. CT, DK, GG, and KN were involved with the study implementation and data collection. CT, DK, TH, MV-S, and KN were involved in the analysis and interpretation of the data. All authors contributed to drafting the article or revising it critically for intellectual content.

Funding This work was supported by the Department of Veterans Affairs, Health Services Research & Development, eHealth Quality Enhancement Research Initiative (RRP 11–407). The views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs.

Competing interests None.

Ethics approval University of Iowa Institutional Review Board.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1 Adams K, Corrigan JM. *Priority areas for national action: transforming health care quality*. Washington, DC, The National Acadmic Press, 2003.
2 Bodenheimer T. Coordinating care: a perilous journey through the health care system. *N Engl J Med* 2008;358:1064–71.
3 Grossman JM, Bodenheimer TS, McKenzie K. Hospital-physician portals: the role of competition in driving clinical data exchange. *Health Aff* 2006;25:1629–36.
4 Jha AK, Chan DC, Ridgway AB, *et al*. Improving safety and eliminating redundant tests: cutting costs in U.S. hospitals. *Health Aff* 2009;28:1475–84.
5 Kripalani S, LeFevre F, Phillips CO, *et al*. Deficits in communication and information transfer between hospital-based and primary care physicians: implications for patient safety and continuity of care. *JAMA* 2007;297:831–41.
6 Smith PC, Araya-Guerra R, Bublitz C, *et al*. Missing clinical information during primary care visits. *JAMA* 2005;293:565–71.
7 Stewart BA, Fernandes S, Rodriguez-Huertas E, *et al*. A preliminary look at duplicate testing associated with lack of electronic health record interoperability for transferred patients. *J Am Med Inform Assoc* 2010;17:341–4.
8 Schoen C, Osborn R, Huynh PT, *et al*. Taking the pulse of health care systems: experiences of patients with health problems in six countries. *Health Aff* 2005;Suppl Web Exclusives:W5-509–525.
9 Center for Medicare Services; 2013.
10 CCSI commends VA for expanding blue button enhanced features will strengthen continuity of care for veterans and families. in Business Wire 2013. http://www.businesswire.com/news/home/20130326005057/en/CCSi-Commends-VA-Expanding-Blue-Button.
11 Hogan T, Nazi KM, Luger TM, *et al*. Technology-assisted patient access to clinical information: an evaluation framework for "Blue Button" *JMIR Res Protoc* 2014;3:e18.
12 Putting the I in HealthIT: Who is Pledging It? http://www.healthit.gov/patients-families/pledge-members.
13 2011 Survey of Veteran Enrollees' Health and Reliance upon VA. http://www.va.gov/HEALTHPOLICYPLANNING/SOE2011/SoE2011_Report.pdf
14 Stroupe KT, Smith BM, Hogan TP, *et al*. Medication acquisition across systems of care and patient-provider communication among older veterans. *Am J Health Syst Pharm* 2013;70:804–13.
15 Agarwal G. Personal health records–an overview of the changing face of family practice. *Fam Pract* 2013;30:363–4.
16 Agarwal R, Anderson C, Zarate J, *et al*. If we offer it, will they accept? Factors affecting patient use intentions of personal health records and secure messaging. *J Med Internet Res* 2013;15:e43.
17 Emani S, Yamin CK, Peters E, *et al*. Patient perceptions of a personal health record: a test of the diffusion of innovation model. *J Med Internet Res* 2012;14:e150.
18 Logue MD, Effken JA. Modeling factors that influence personal health records adoption. *Comput Inform Nurs: CIN* 2012;30:354–62.
19 Logue MD, Effken JA. An exploratory study of the personal health records adoption model in the older adult with chronic illness. *Inform Prim Care* 2012;20:151–69.
20 Logue MD, Effken JA. Validating the personal health records adoption model using a modified e-Delphi. *J Adv Nurs* 2013;69:685–96.
21 Nazi KM. Veterans' voices: use of the American Customer Satisfaction Index (ACSI) Survey to identify My HealtheVet personal health record users' characteristics, needs, and preferences. *J Am Med Inform Assoc* 2010;17:203–11.
22 Nazi KM. The personal health record paradox: health care professionals' perspectives and the information ecology of personal health record systems in organizational and clinical settings. *J Med Internet Res* 2013;15:e70.
23 Nazi KM, Hogan TP, McInnes DK, *et al*. Evaluating patient access to Electronic Health Records: results from a survey of veterans. *Med Care* 2013;51:S52–56.
24 Or CK, Karsh BT. A systematic review of patient acceptance of consumer health information technology. *J Am Med Inform Assoc* 2009;16:550–60.
25 Patel VN, Abramson E, Edwards AM, *et al*. Consumer attitudes toward personal health records in a beacon community. *Am J Manag Care* 2011;17:e104–120.
26 Patel VN, Dhopeshwarkar RV, Edwards A, *et al*. Consumer support for health information exchange and personal health records: a regional health information organization survey. *J Med Syst* 2012;36:1043–52.
27 Tang PC, Black W, Young CY. Proposed criteria for reimbursing eVisits: content analysis of secure patient messages in a personal health record system. *AMIA Annu Symp Proc* 2006:764–8.
28 Weingart SN, Rind D, Tofias Z, *et al*. Who uses the patient internet portal? The PatientSite experience. *J Am Med Inform Assoc* 2006;13:91–5.
29 Yamin CK, Emani S, Williams DH, *et al*. The digital divide in adoption and use of a personal health record. *Arch Intern Med* 2011;171:568–74.
30 Wen KY, Kreps G, Zhu F, *et al*. Consumers' perceptions about and use of the internet for personal health records and health information exchange: analysis of the 2007 Health Information National Trends Survey. *J Med Internet Res* 2010;12:e73.
31 Rogers E. *Diffusions of innovations*. 5th edn. New York: Free Press, 2003.
32 Delbanco T, Walker J, Bell SK, *et al*. Inviting patients to read their doctors' notes: a quasi-experimental study and a look ahead. *Ann Intern Med* 2012;157:461–70.
33 Delbanco T, Walker J, Darer JD, *et al*. Open notes: doctors and patients signing on. *Ann Intern Med* 2010;153:121–5.
34 Feldman HJ, Walker J, Li J, *et al*. OpenNotes: hospitalists' challenge and opportunity. *J Hosp Med* 2013;8:414–7.
35 Leveille SG, Walker J, Ralston JD, *et al*. Evaluating the impact of patients' online access to doctors' visit notes: designing and executing the OpenNotes project. *BMC Med Inform Decis Mak* 2012;12:32.
36 Turvey CL, Zulman DM, Nazi KM, *et al*. Transfer of information from personal health records: a survey of veterans using My HealtheVet. *Telemed J E Health* 2012;18:109–14.
37 Zulman DM, Nazi KM, Turvey CL, *et al*. Patient interest in sharing personal health record information: a web-based survey. *Ann Intern Med* 2011;155:805–10.
38 Venkatesh V, Morris MG, Davis GB, *et al*. User acceptance of information technology: toward a unified view. *MIS Quarterly* 2003;27:425–78.
39 Haggstrom DA, Saleem JJ, Russ AL, *et al*. Lessons learned from usability testing of the VA's personal health record. *J Am Med Inform Assoc* 2011;18(Suppl 1):i13–17.
40 Archer N, Fevrier-Thomas U, Lokker C, *et al*. Personal health records: a scoping review. *J Am Med Inform Assoc* 2011;18:515–22.
41 Burton LC, Anderson GF, Kues IW. Using electronic health records to help coordinate care. *Milbank Q* 204;82:457–81.
42 Fowles JB, Kind AC, Craft C, *et al*. Patients' interest in reading their medical record: relation with clinical and sociodemographic characteristics and patients' approach to health care. *Arch Intern Med* 2004;164:793–800.
43 Halamka JD, Mandl KD, Tang PC. Early experiences with personal health records. *J Am Med Inform Assoc* 2008;15:1–7.
44 Katz SJ, Nissan N, Moyer CA. Crossing the digital divide: evaluating online communication between patients and their providers. *Am J Manag Care* 2004;10:593–8.
45 Tang PC, Ash JS, Bates DW, *et al*. Personal health records: definitions, benefits, and strategies for overcoming barriers to adoption. *J Am Med Inform Assoc* 2006;13:121–6.
46 Bodenheimer T, Lo B, Casalino L. Primary care physicians should be coordinators, not gatekeepers. *JAMA* 1999;281:2045–9.
47 Halamka J, Overhage JM, Ricciardi L, *et al*. Exchanging health information: local distribution, national coordination. *Health Aff* 2005;24:1170–9.
48 Ralston JD, Coleman K, Reid RJ, *et al*. Patient experience should be part of meaningful-use criteria. *Health Aff* 2010;29:607–13.