Association of Secure Messaging with Primary Care In-Person and Telephone Visits Among Veterans: a Matched Difference-in-Difference Analysis

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BACKGROUND: Secure messaging (SM) between patients and primary care teams has expanded care access but may impact other clinical encounters.

OBJECTIVE: To study associations between SM use and primary care in-person and telephone visits in the Veterans Health Administration (VHA).

DESIGN: The SM feature of VHA's patient portal, MyHealth*e*Vet, supports asynchronous communication between patients and primary care teams. To study the impact of SM on in-person and telephone visits, two analyses were performed: (1) a retrospective pre-/post-analysis comparing changes after initiating SM use and (2) a difference-in-difference comparison among SM users and non-users 1 year before and after index SM use. Matching to non-users was by primary care team, demographics, and predicted propensity of SM use by Nosos comorbidity score and drive time to clinic.

PATIENTS: In 2016, 154,053 Veterans initiated SM from all primary care patients (N = 5,891,893); 25,683 were propensity-matched to controls (N = 49,266) from the same primary care team not using SM.

MAIN MEASURES: Primary care provider in-person visits and telephone contacts between patients and their primary care team were assessed 1 year prior and post index SM.

KEY RESULTS: Overall, primary care in-person visits decreased 13.3% ($p < 0.0001$); telephone visits increased 13.5% ($p < 0.0001$). In the matched analysis, in-person primary care visits decreased by 16.0% ($p < 0.0001$) by SM users and 9.9% ($p < 0.0001$) among controls, resulting in a across-group decrease of 6.1% in-person visits after SM initiation. Telephone visits increased by 11.0% ($p < 0.0001$) for SM users and 4.5% for controls ($p < 0.0001$) resulting in an across-group increase of 6.5% telephone visits after SM initiation.

CONCLUSIONS: Use of SM was associated with decreased in-person visits and increased telephone visits. This may improve clinic appointment availability, while increasing time commitments for providers for non-traditional forms of access.

KEY WORDS: secure messaging; primary care; veteran; access.

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INTRODUCTION

Non-traditional health care delivery modalities, such as secure messaging (SM), which is a secure email service provided via online patient portals, have the potential to increase communication between patients and their medical providers and have become more widely available.[1] Within the Veterans Health Administration (VHA), the MyHealth*e*Vet patient portal includes a SM feature that allows Veterans to communicate directly with members of their care team about non-urgent health matters. Patients may send messages 24/7 with a response expected from the health care team within 3 business days.[2] Within the Patient-Aligned Care Team, SMs sent via the MyHealth*e*Vet platform are received by all team members and assigned to a specific team member, typically the provider, to address. Messages can be reassigned within the team by any members, and all members may call the patient directly to clarify and triage issues. SM is available to all VHA patients who complete a one-time authentication process and obtain a premium MyHealth*e*Vet portal account.[3] In particular, SM use in VHA has grown over time with 26% of VHA patients having sent a SM as of February 2020 and over 94 million total SMs having been initiated by VHA patients and their health care teams since 2008.[4]

Previous research has demonstrated that SM use can impact patterns of health care utilization and access. Within VHA, adoption of SM has been associated with reductions in urgent care use with early adopters of SM experiencing a greater decrease than late adopters.[5] In qualitative surveys, members of the VHA care team also emphasized the enriched and efficient communication that SM allows, as well as improved access to care before, during and after a clinical encounter.[6] However, it is possible that this additional communication option may affect provider workload in unexpected ways. For example, in other health care systems, SM has been associated with reductions in annual office visits among SM users, but with a corresponding increase in telephone visits.[7] At the same time, responding to and initiating messages with patients may not fall equitably across provider categories.[8] Such findings suggest that with increased ability to communicate through SM, health care systems may be able to reduce in-person visits, but at the cost of answering additional SMs and phone calls. However, research on the impact of this technology and its effect on provider workload is limited.

Within VHA, SM content typically addresses routine inquiries. Analyses by other VHA research teams have found of nearly 400 SM threads within VHA that the majority of patient and provider messages included logistical content, illustrating efforts to organize and coordinate care,[9] while another analysis of 1000 threads found that the majority of messages were transactional, focusing on issues like prescription renewals, other medication issues, and health issues.[10] This is similar to SM use in other systems, as illustrated by a systematic review of patient-provider email communication which found the majority of emails were for routine issues.[11] However, this does not mean urgent and non-routine issues never appear in message content. Urgent issues may include high-risk symptomology, such as chest pain or breathing concerns,[12] self-harm or suicidality,[13] and other unresolved or urgent medical issues.[14] This may imply that providers need and do follow-up with patients in ways that extend beyond in-person appointments.

These previous studies, which considered SM use patterns and content of such messages within the VHA, did not address how SM impacts other existing modalities of health care delivery. Therefore, the objective of this study was to assess changes in how VHA primary care was accessed after patient initiation of SM. Specifically, we investigated the impact of SM use on traditional VHA in-person clinic visits and telephone visits in an effort to understand the impact of SM on more traditional physician workloads. We hypothesized that the ease and convenience in communication afforded by SM would shift primary care use away from in-person visits. We further hypothesized that telephone encounters would increase, largely because the telephone offers a complementary means to engage in synchronous communication and clarify concerns that may not have been fully articulated or resolved through SM.

METHODS

Study Design

To better understand the impact of SM on primary care team workload via in-person and telephone visits, two retrospective cohort analyses were conducted. The sample population included all established primary care patients with an assigned primary care provider in the Primary Care Management Module (PCMM). Of these, a cohort of registered MyHealth*e*Vet users who sent an index SM in calendar year 2016 were selected (N = 154,053). Of this group, a subset of 25,683 patients were matched across provider, age, and gender to 49,266 control patients who did not send a SM in the same timeframe. Controls were selected from the same primary care team based on age, gender, percent service connection, and urban/rural residence. We defined the pre- and post-periods as the 1 year prior to and 1 year after index SM, respectively.

Data Sources

The selection of both cases and controls relied upon nationwide VHA administrative data from the Corporate Data Warehouse. The primary care provider (PCP) was identified according to the care giver assigned in PCMM. Patient demographics (e.g., age, gender, marital status, race, and service-connected percentage) were identified via the Assistant Deputy Under Secretary for Health (ADUSH) enrollment file. Residential rurality and the travel time to primary care, in minutes, originated from the Planning Systems Support Group (PSSG) files.

Outcomes

Outcomes included the number of annual in-person primary care visits, which included visits with both physicians and non-physician providers (i.e., nurse practitioners and physician's assistants). The number of documented telephone contact included calls between patients and assigned primary care team members and included both unscheduled and scheduled calls.

Covariate Variables

Marital status was classified as either married, divorced/separated/widowed, single, or unknown. Service-connected disability was categorized as 0 or missing, 1–49%, or 50% or more. Race was categorized as white, black, or other where other includes unknown and all other races (e.g., Pacific Islander, Asian, multi-racial). Residential rurality was defined using the VA designation as urban, rural, or highly rural, where rural and highly rural were combined as a single rural category. To measure comorbidity, we used the Nosos risk score,[15] a modified version of the Centers for Medicare and Medicaid (CMS) Hierarchical Condition Categories Version 21 risk scores, which predicts expected health care costs based upon demographic and ICD-9 or ICD-10 diagnoses.[16]

Table 1 Characteristics of Secure Messaging (SM) Initial Users and Matched Case-Control Study Subjects

Characteristic	SM initial users	Matched SM initial users	Matched SM non-users
Provider teams (*N*)	8002	4745	4734
Clinics (*N*)	984	871	873
Patient (*N*)	154,053	25,683	49,266
Female *N* (%)	23,410 (15.2)	1085 (4.2)	1246 (2.5)
Age, in years mean (SD)	54.4 (16.0)	62.3 (13.9)	65.3 (12.7)
Nosos score, mean (SD)	1.10 (1.60)	0.72 (0.79)	0.61 (0.77)
Race *N* (%)			
White	119,540 (77.6)	19,657 (76.5)	35,585 (72.2)
Black	26,650 (17.3)	3219 (12.5)	7441 (15.1)
Other*	7863 (5.1)	2807 (10.9)	6240 (12.7)
Urban residence *N* (%)**	109,992 (71.4)	19,004 (74.0)	35,700 (72.5)
Service connection *N* (%)			
0: 0% or missing	54,378 (35.3)	17,231 (67.1)	38,435 (78.0)
1: < 50%	33,580 (21.8)	3004 (11.7)	4112 (8.3)
2: ≥ 50%	66,095 (42.9)	5448 (21.2)	6709 (13.6)
Married *N* (%)			
Married	89,816 (58.3)	17,399 (67.7)	35,088 (71.2)
Divorced/separated/widowed	39,752 (25.8)	6301 (24.5)	11,444 (23.2)
Single	21,420 (13.9)	1954 (7.6)	2717 (5.5)
Unknown	3065 (2.0)	29 (0.1)	17 (0.0)
Drive time, in min, mean (SD)	20.5 (14.6)	20.5 (14.1)	20.6 (14.4)

**Other including unknown and all other races other than white and black*
†The percentage of rurality excludes patients with missing values, i.e., unknown rurality status

Analyses

We first described the patient characteristics of the overall VHA SM cohort of patients who sent an index SM in calendar year 2016. The differences in the number of PCP office visits and documented telephone contacts were compared using a within SM user paired *t* test of the difference in means between the pre- and post-periods.

Among the index SM users are a subset of 25,683 patients that matched 49,266 control patients who did not send a SM in the same timeframe. Controls were drawn from all patients with a primary care visit in calendar year 2016 and matched to SM users in multiple stages. In the first stage, controls were selected from all patients on the same primary care team as an index SM user of the same age, biological sex, and percent service connection, marital status and rural or urban residential address. Index SM users and that did not match any controls were dropped, and similarly controls that did not match any index SM user were dropped. In the final stage, a propensity score was estimated on this subset of matched patients using a logistic regression model of the probability of SM use as a function of Nosos comorbidity risk score and drive time to the nearest primary care clinic. For each SM user, we derived a caliper around their predicted propensity score of 0.20 standard deviations and matched them to all of the controls within this caliper. To assess balance across groups after matching, we constructed bootstrap 95% confidence intervals for the mean standardized difference for each of the matching criteria.

Within the matched analysis, outcomes were compared across the pre- and post-periods among SM users and non-users, respectively, using a paired *t* test for the difference in means. In addition, the across group differences within pre- and post-periods were assessed by the *t* test. The authors had full access to and take full responsibility for the integrity of the data. All analyses were conducted using R Core Team (2019)[17]. The study was approved by the University of Iowa Institutional Review Board and the Iowa City VA Healthcare System Research and Development Committee. It was determined to be a non-human subject research.

RESULTS

Characteristics of all patients (*N* = 154,053) within the VHA who started using SM in 2016 are provided in Table 1. Patients who used SM in 2016 were, on average, 54.4 years old (SD = 16.0), 71.4% (*N* = 109,992) lived in an urban area, 77.6% (*N* = 119,540) White, and 15.2% (N = 23,410) were female. Patient characteristics of the matched study population are also provided in Table 1. The matched cohort of initial users of SM (*N* = 25,683) were, on average, 62.3 (SD = 13.9) years old, mostly white (*N* = 19,657; 76.5%), married (*N* = 17,399; 67.7%), and urban residents (*N* = 19,004; 74.0%). The matched controls were on average 65.3 (SD = 12.7) years old with 72.2% (*N* = 35,585) being white, 71.2% (*N* = 35,088) married, and largely living in urban areas (*N* = 35,700; 72.5%). Matched SM users and controls did not statistically differ by service connection percentage, marital status, Nosos comorbidity risk, rurality, or drive time. When considering the 95% bootstrapped confidence intervals of the means standardized differences, only Nosos score, gender, and numeric age were unbalanced.

Primary Care Use. The number of in-person primary care visits decreased during the study period for the entire SM cohort from 1.58 to 1.37 (− 0.21 visits) or 13.3% (Table 2). In the matched analysis, both SM users and non-users had a

Table 2 Use of In-Person Primary Care Pre- and Post-initiation of Secure Messaging

In-person visits	All SM Initial Users	Matched design	
		SM Initial Users	SM Non-Users
	N = 154,053	N = 25,683	N = 49,266
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Pre-SM (visits/year)	1.58 (1.57, 1.59)	1.44 (1.43, 1.45)	1.11 (1.10, 1.12)
Post-SM (visits/year)	1.37 (1.36, 1.38)	1.21 (1.19, 1.23)	1.00 (0.99, 1.01)
Within-group change			
Visits/yea	− 0.21 (− 0.22, − 0.20)*	− 0.23 (− 0.26, − 0.21)*	− 0.11 (− 0.12, − 0.09)*
Percent	− 13.3%	− 16.0%	− 9.9%
Across group change Percent		−6.1%	

*p value < 0.0001

reduction in in-person clinic visits. For matched SM users, the annual number of primary care visits decreased from 1.44 to 1.21 (− 0.23 visits) or 16%, from the year prior to SM initiation to the year after SM use. Over this same period, matched non-SM users demonstrated an average decrease from 1.11 to 1.00 (− 0.11 visits) or 9.9%. This represents a difference-in-difference in-person visit reduction of 6.1% ($p < 0.0001$) for SM users compared to non-SM users.

Telephone Visits. On the contrary, the number of telephone visits increased during the study period for the entire SM cohort from 2.74 to 3.12 (+ 0.37 telephone visits) or 13.5% (Table 3). In the matched analysis, both SM users and non-users had an increase in telephone visits. For matched SM users, the annual number of telephone visits increased from 2.45 to 2.72 (+ 0.27 telephone visits) or 11.0%, from year prior to SM initiation to year after SM use. Over this same period, matched non-SM users demonstrated an average increase from 1.76 to 1.84 (+ 0.08 telephone visits) or 4.5%. This represents a difference-in-difference telephone visit increase of 6.5% ($p < 0.0001$) for SM users compared to non-SM users.

Table 3 Use of Telephone Care Pre- and Post-initiation of Secure Messaging

Telephone encounters	All SM initial users	Matched design	
		SM initial users	SM non-users
	N = 154,053	N = 25,683	N = 49,266
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Pre-SM (n/year)	2.74 (2.72, 2.77)	2.45 (2.41, 2.51)	1.76 (1.72, 1.79)
Post-SM (n/year)	3.12 (3.10, 3.14)	2.72 (2.68, 2.78)	1.84 (1.80, 1.87)
Within-group change			
n/year	0.37 (0.34, 0.41)*	0.27 (0.20, 0.34)*	0.08 (0.03, 0.12)*
Percent	13.5%	11.0%	4.5%
Across group change Percent		6.5%	

*p value < 0.0001

DISCUSSION

In a large, integrated health care system, we found that the initiation of secure messaging resulted in a decrease in in-person primary care clinic visits and an increase in telephone visits. The between-group difference for SM users and matched controls resulted in an almost 1-for-1 replacement of in-person visits (6.1% reduction) with telephone visits (6.5% increase). SM use offers patients and providers new capabilities to communicate.[9] Our findings implicate a (modest) shift in patient utilization and provider workload away from in-person visits to telehealth as patients adopt SM. As SM increases, the VA and other health systems will need to consider the potential increase in in-person appointment availability with the demands for online communication and increased time commitment for telephone visits. This is particularly relevant as the time commitment for an in-person appointment within the VA is 30 min for established patients returning for care or 60 min for new patients, whereas a documented telephone encounter can range from 5 to 30 min.

SM as part of patient portals may enhance direct access to the provider team and lower the need for in-person visits. SM offers a way to bypass potential long wait-times and complicated processes of telephone triage systems and directly contact the provider team whom a patient knows and trusts. In qualitative interviews performed by Haun et.al., veterans were not only satisfied with SM but found that it was a useful way to communicate with the health care team.[18] In addition to this enhanced continuity and access, SM may also support self-management[19–22] and system navigation. If messages are logistical or transactional in content,[5,9,10] direct asynchronous communication may enhance the navigation of care. Though it is uncommon, the use of SM for urgent medical issues such as suicide ideation or chest pain presents a challenge for health care systems to manage. Further, in our study, first time users of SM were younger than the general VA population; however, in our matched analysis, we demonstrate that even among an older population with average age of 65, adopting SM resulted in shift to SM and telephone care. Thus, SM may enhance access across age groups to improve communication, system navigation, and potentially patient activation reducing the need for in-person visits. However, it may also yield disparate access for new versus established patients[23,24] as in many health systems it is at the first in-person appointment that patients gain access to web portal sign-up information. It is also worth noting that a patient portal account does not imply active portal use. For example, in September 2020, 55.4% of Veterans were enrolled in MyHealth*e*Vet nationally, but active unique secure message senders accounted for only 18.9% of the total Veteran patient population.

The association between SM use and reduced in-person visits may improve the availability of clinical appointment slots. Adoption of SM may free of up appointment for clinics to move closer to open access scheduling and improve same day access. The shift of in-person chronic management to virtual care through SM and telehealth may allow physicians to address urgent concerns in-person, same day, which have demonstrated to reduce ED visits.[25]

Of note, the potential enhanced virtual and in-person access needs to be taken in consideration with the increasing time commitment of non-traditional forms of enhanced access. Burnout among primary care providers is prevalent and increasing.[26,27] The Implementation of Patient-Centered Medical Home with adequately staffed teams and panel sizes within standard capacity may lower burnout. However, added tasks of SM and telephone may increase burnout if not properly delegated.[28] Guidelines on task delegation and proper communication by means of SM need further development.[6,9] Further, health systems need to consider time allocation to these added modalities and shifts from in-person care, scheduling in time for providers and team members to timely and sufficiently complete these added tasks, and how to triage urgent medical or patient safety concerns for immediate attention when they arise[8,14]. In addition, other technologies may have a role in mitigating the added provider time, including automated messaging systems that can be used to address simple questions or requests.[29]

This study adds to our understanding of the potential unintended consequences of expanding access to SM. First, the shift from in-person appointments to alternative communication techniques must carefully be considered in terms of provider burnout, time allocation, and the robustness of existing contact options, such as the telephone system. Second, patients and providers should be educated on what content is appropriate to share via SM. Reminders within the SM platform may aid in ensuring the right information is being requested and replied to. Further best practices to handle miscommunication, unintended tone, and unresolved patient or provider issues should be in place. Lastly, support services to triage phone calls to the appropriate level of care may be needed.

This analysis has several limitations that may motivate future work. First, we did not analyze the number of SMs after initiation or the content of the SM. Therefore, we were not able to quantify the workload of SM associated with telephone visits and reduction in in-person visits. Second, our matching process limited our analytic population to older Veterans. Findings among younger veterans more likely to adopt these modalities of communication may be different. Despite this, the matching mechanism is a strong approach to overcome potential confounding from policy initiatives occurring during the study period. Third, even with a robust matching process and difference-in-difference design, our observations reveal statistical associations, rather than a causal pathway between SM and telephone or in-person visits. Fourth, the study was conducted in a single health care system and considered the visit behaviors only within the first year after patient initiation of SM. These results may not be generalizable over time or in other systems. Lastly, clinical outcomes and patient and provider satisfaction were not assessed.

Conclusion. Adoption of secure messaging resulted in a shift away from traditional in-person care. These findings highlight the importance of understanding the impact of non-traditional forms of enhanced access upon traditional models of care delivery. Future work should evaluate the long-term impact of SM on provider workload and burnout, patient satisfaction, and the impact on provider-patient relationship.

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Data Availability *Available to researchers with VA accreditation.*

Compliance with Ethical Standards:

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

Code availability: *Available to interested readers by contacting Dr. O'Shea*

Protocol: *Available to interested readers by contacting Dr. Kaboli*

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