

USING SECURE MESSAGING TO IMPROVE PATIENT-TO-PROVIDER  
COMMUNICATION AMONG ACTIVE DUTY SERVICE MEMBERS

by

Stephanie Linn Burleson

---

Copyright © Stephanie Linn Burleson 2020

A DNP Project Submitted to the Faculty of the

COLLEGE OF NURSING

In Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF NURSING PRACTICE

In the Graduate College

THE UNIVERSITY OF ARIZONA

2020

THE UNIVERSITY OF ARIZONA  
GRADUATE COLLEGE

As members of the DNP Project Committee, we certify that we have read the DNP project prepared by Stephanie Linn Burleson, titled Using Secure Messaging to Improve Patient-to-Provider Communication Among Active Duty Service Members and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

*Jane M Carrington* Date: Dec 5, 2019  
Jane M. Carrington, PhD, RN, FAAN

*Sara J. Edmund* Date: Dec 5, 2019  
Sara J. Edmund, DNP, RN, FNP-C, PMHNP-BC

*Angela Y. Stanley* Date: Dec 5, 2019  
Angela Y. Stanley, DNP, APRN-BC, NEA-BC, PHCNS-BC

Final approval and acceptance of this DNP project is contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend that it be accepted as fulfilling the DNP project requirement.

*Jane M Carrington* Date: Dec 5, 2019  
Jane M. Carrington, PhD, RN, FAAN  
DNP Project Committee Chair  
College of Nursing



## TABLE OF CONTENTS

LIST OF FIGURES .....	5
LIST OF TABLES .....	6
ABSTRACT .....	7
<b>INTRODUCTION</b> .....	<b>8</b>
<b>Problem Statement</b> .....	<b>8</b>
<b>Local Problem</b> .....	<b>9</b>
<b>Purpose, Aims and Objectives</b> .....	<b>10</b>
<b>Project Question</b> .....	<b>10</b>
<b>Conceptual Framework</b> .....	<b>11</b>
<b>Concepts</b> .....	<b>11</b>
<b>Literature Synthesis</b> .....	<b>13</b>
<b>Summary</b> .....	<b>15</b>
<b>METHODS</b> .....	<b>16</b>
<b>Setting</b> .....	<b>17</b>
<b>Ethical Considerations</b> .....	<b>17</b>
<b>Human Subjects Protection</b> .....	<b>17</b>
<b>RESULTS</b> .....	<b>18</b>
<b>DISCUSSION</b> .....	<b>20</b>
<b>Aim 1: Barriers to Use</b> .....	<b>20</b>
<b>Aim 2: Interventions</b> .....	<b>21</b>
<b>Aim 3: Embraced Features</b> .....	<b>22</b>
<b>Summary</b> .....	<b>22</b>
<b>Strengths and Limitations</b> .....	<b>23</b>
<b>Framework</b> .....	<b>23</b>
<b>Future Work</b> .....	<b>24</b>
<b>Conclusion</b> .....	<b>25</b>

TABLE OF CONTENTS – *Continued*

APPENDIX A: EVIDENCE EVALUATION TABLE.....	26
APPENDIX B: EVIDENCE SYNTHESIS TABLE .....	37
APPENDIX C: INTERVIEW GUIDE.....	39
APPENDIX D: THE UNIVERSITY OF ARIZONA INSTITUTIONAL REVIEW BOARD APPROVAL LETTER.....	41
REFERENCES .....	43

## LIST OF FIGURES

<i>FIGURE 1.</i>	Patient-to-provider communication model.....	12
<i>FIGURE 2.</i>	Revised patient-to-provider communication model.....	24

## LIST OF TABLES

TABLE 1.	<i>Respondents' feedback</i> .....	18
TABLE 2.	<i>Commonalities</i> .....	19

## ABSTRACT

***Problem Statement:*** Secure messaging has the ability to improve patient-to-provider communication and patient self-management skills; however, low usage rates among Active Duty Service Members (ADSM) decreases its potential to initiate self-care management behavior and increase access to timely healthcare. Little is known about the barriers of secure messaging use in this population.

***Purpose:*** Identify barriers to secure messaging adoption and use among ADSM.

***Methods:*** In this system assessment project, 10 individual interviews with ADSM and three interviews with providers will be conducted in a primary care clinic in Sigonella, Italy to assess behavior, attitudes and perception of secure messaging.

***Significance:*** Barriers reported by ADSM were difficulty accessing website and lack of patient knowledge of secure messaging features. It is unclear if ADSM receive formal education on how to navigate secure messaging prior to their use at the primary clinic. Therefore, employing educational and skill-based interventions to address these barriers, prior to use at the primary care clinic, should improve secure messaging utilization among ADSM and, ultimately, increase patient-to-provider communication.

## **INTRODUCTION**

### **Problem Statement**

Lack of communication between patient and provider often impedes opportunities for shared decision-making and self-care management behaviors and ultimately leads to poor healthcare quality (Institute of Medicine [IOM], 2001; Westat, 2013). Conversely, a patient who is able to contribute and engage in the decision-making process has stronger self-care management behaviors and improved health outcomes (IOM, 2001; Westat, 2013).

The Institute of Medicine (IOM) recommends digital communication as an effective means to meet the healthcare needs of patients (Hsaio et al., 2011). Secure messaging (SM) is a category of digital communication which allows for asynchronous and secure communication via email between patients and providers wherein patients have the ability to contact the healthcare team at any time outside of clinic visits (Hsaio et al., 2011). As part of the HITECH Act and American Recovery and Reinvestment Act of 2009, the Centers for Medicare and Medicaid Services (CMS) incentivizes providers to use SM with 5% of their patients (Haun, Lind, Shimada, & Simon, 2014; HealthIT.gov, 2014). The Defense Health Agency (DHA) has aligned with CMS and set forth a 50% enrollment goal for empaneled patients in military primary care clinics (Bureau of Medicine and Surgery [BUMED] SM Community of Practice, 2015). This technology is patient and family centered and has shown to improve patient-to-provider communication, utilization of services, and quality of care and reduces healthcare costs (Haun et al., 2014; Hsaio et al., 2011).

Although well received by patients and clinicians, SM in the healthcare industry has been poorly adopted and utilized by patients (Hsaio et al., 2011). Hahn et al. (2014) identified lack of

patient knowledge about registration, familiarity with website leading to login challenges, and uncertainty regarding when to access. Additionally, individuals with low health literacy rates have significant problems understanding and navigating basic healthcare information and services to make appropriate, informed decisions about their healthcare (U.S. Department of Health and Human Services [USDHHS], 2000). Current research describing Active Duty Service Members (ADSM) behaviors and attitudes of SM use and adoption is insufficient and precludes appropriate and effective interventions. Therefore, to facilitate adoption and utilization, more information about said behaviors and attitudes must be ascertained in order to provide effective education and skill building for patients (Haun et al., 2014).

### **Local Problem**

In Sigonella, Italy, utilization of SM among ADSM's at the Flight Line Clinic, a military primary care clinic, is less than 4% despite the technology being available since 2016 (BUMED Secure Messaging Community of Practice, 2015). SM is a web-based program that allows patients and healthcare staff (physicians, nurse practitioners, physician assistants, nurses and support staff) to communicate via secure, asynchronous messaging from any device with internet capability (McKesson Canada, 2015). The program is also a patient portal used for educational material, preventive care reminders, prescription refills, lab or radiology results and the ability to request appointments (McKesson Canada, 2015). It is an invaluable tool that has increased access to care capacity and improved patient self-management behavior and communication between patients and providers (Business Wire, 2016). In 2016, the Department of Defense (DOD) and the DHA awarded McKesson \$139 million for a five-year contract for RelayHealth, now known as SM (Business Wire, 2016). Despite the many patient benefits and features of SM,

low utilization among ADSM's raises the question of misalignment of government funding amid a time of national fiscal constraint.

### **Purpose, Aims and Objectives**

The purpose of this project is to identify actual or perceived barriers of 10 ADSM's regarding the utilization of SM (Polit & Beck, 2017). At the conclusion of this project, patient barriers will be identified and inform further projects that develop and implement effective patient-centered interventions using the Plan-Do-Study-Act (PDSA) model to increase patient-provider communication.

On a micro level, the stakeholders involved in this project are patients, clinic healthcare staff (providers, nurses, health technicians [HT], Hospital Corpsmen [HM], and clerks), and clinic leadership (Department Head [DH] and Officer-in-Charge [OIC]) (Moran, Conrad, & Burson, 2016). Stakeholders affected on the macro level are the local hospital leadership (Director of Branch Clinics [DBC], business operations and Commanding Officer [CO]), BUMED, DHA, and, ultimately, Congress (Moran et al., 2016).

### **Project Question**

The following questions will guide this system assessment project.

1. What issues discussed by patients impede patient-to-provider communication by impeding SM adoption?
2. After identification of barriers, what interventions can be deployed to increase adoption and utilization of SM by active duty service members in a primary care clinic?
3. What features and functions of SM are embraced by patients?

## **Conceptual Framework**

Improving patient-to-provider communication via SM requires knowledge of the human factors that create barriers of adoption and utilization among patients. In order to improve overall system efficiency and effectiveness one must first understand and evaluate human behavior and interactions within an environment or system (International Ergonomics Association (IEA), 2018; National Research Council, 2011). Human factors are methods of examining how people, based on their behavior, abilities and characteristics, interact with things in their environment such as technology, equipment, or activities (National Research Council, 2011). The ultimate goal of human factors is to improve “system efficiency and effectiveness, safety, health, comfort and quality of life” (IEA, 2018; National Research Council, 2011, p. 61).

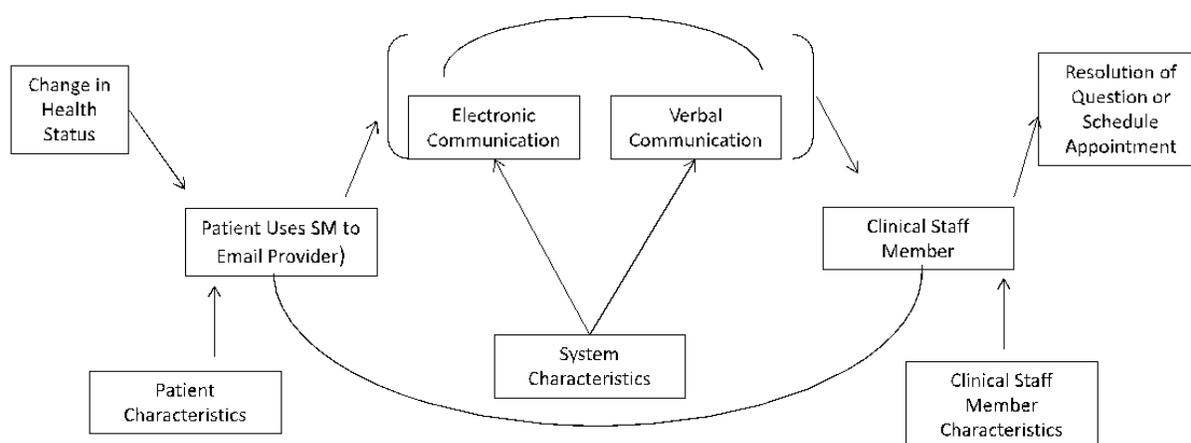
*Effective Nurse-to-Nurse Communication* is a framework based on human factors and describes the communication process among nurses interacting with patients who are experiencing a clinical event (Carrington, 2012). The effectiveness of the communication is influenced by several factors: communication system (electronic & verbal tools); the nurse’s perception of the event; and, personal attributes and characteristics of the nurse, such as education, skill set, and attitudes (Carrington, 2012).

### **Concepts**

The *Effective Nurse-to-Nurse Communication Framework* can be applied to the understanding of patient-to-provider communication. Five concepts within the framework describe how a message is communicated, using both electronic and verbal tools to achieve a patient outcome: clinical event, responding nurse, electronic health record (EHR) and/or verbal

hand-off, receiving nurse and outcome (Carrington, 2012). These concepts can be adapted to patient-to-provider communication and will be discussed in the proceeding sections.

A clinical event is any patient question or perceived change in health status based on characteristics, education, and health experiences. If the clinical event meets the threshold for communication with a provider, the patient will use SM. The provider is defined as any staff member of the clinic (providers, nurses, HT, HM, & clerks). Interpretation of the message is based on scope of practice, skill set, attributes of the staff member, and influences how the message is received and responded to and ultimately determines the outcome of the message, which could be resolution of the question or appointment scheduled. The adapted framework is depicted below.



Concept Level of Framework

**FIGURE 1.** Patient-to-provider communication model. (Adapted from Carrington's Communication Model. Carrington J. M. (2012). Development of a conceptual framework to guide a program of research exploring nurse-to-nurse communication. *CIN: Computers, Informatics, Nursing*, 30(6), 293-299.)

### **Literature Synthesis**

A literature search to “identify barriers of secure messaging to inform adoption and use among ADSM in a military primary care clinic” was conducted from January 2018 to March 2018 using PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and Google Scholar. A PubMed search using keywords and MeSH term, “secure messaging,” yielded 167 articles. An additional search performed using keywords and MeSH terms, ("Military Personnel" OR "Military Medicine" OR military OR "active duty") AND ("secure message" OR "secure messages" or "secure messaging" OR "asynchronous messaging" OR "Patient Portals"), resulted in six articles. A CINAHL search using keywords and MeSH terms, ("Military Personnel" OR "Military Medicine" OR military OR "active duty") AND ("secure message" OR "secure messages" or "secure messaging" OR "asynchronous messaging" OR "Patient Portals"), resulted in two articles. A CINAHL search only using keywords and MeSH terms, (“secure messaging” AND “secure message” AND “asynchronous messaging”), yielded four articles. One additional article was found using Google Scholar at a later date.

A total of 179 articles were retrieved and five duplicates deleted. There were 174 articles reviewed by title and abstract and 136 were discarded based on inclusion and exclusion criteria. Inclusion criteria were articles that examined patient barriers to SM or patient portals with embedded SM features, adults, English language and humans. Articles were excluded if the participants included pediatrics or patient portals that did not include SM. In addition, consensus statements, guidelines, opinions or reports of expert committees were excluded. Of the 38 articles reviewed in full, 28 articles were discarded based on content not pertaining to the clinical question. These articles focused on electronic health records, email communication and use

between clinic staff and providers, and measurements of office utilization and primary care prevention rates using SM. Ten articles were retained for synthesis as noted in Appendix A as they contained all elements of the clinical question: barriers identified among adult patients using SM (Goel, Brown, Williams, Cooper, Hasnain-Wynia, & Baker, 2011; Graetz, Gordon, Fung, Hamity, & Reed, 2016; Haun, Lind, Shimada, & Simon, 2013; Haun, Lind, Shimada, Martin, Gosline, Antinori, & Simon, 2014; Haun, Patel, Lind, & Antinori, 2015; Lyles, Harris, Jordan, Grothaus, Wehnes, Reid, & Ralston, 2012; Shimada et al., 2013; Smith, O'Connor, Aitken, Curtis, Wolf, & Goel, 2015; Thompson, Reilly, & Valdez, 2016; Wade-Vuturo, Mayberry, & Osborn, 2013).

The strength of the research was assessed using Melnyk and Fineout-Overholt's *Hierarchy of Evidence for Nursing Intervention Study* tool (Melnyk & Fineout-Overholt, 2011). The tool has seven levels of evidence (Level I-VII). The highest level (Level I) recognizes systematic review or meta-analysis of randomized control trials (RCT) (Melnyk & Fineout-Overholt, 2011). The remaining categories, in order of importance, are: RCTs (Level II), non-randomized controlled trials or quasi-experimental (Level III), cohort study or case-control studies (Level IV), meta-synthesis of qualitative or descriptive studies (Level V), qualitative or descriptive single studies (Level VI), and lastly, expert opinion (Level VII) (Melnyk & Fineout-Overholt, 2011).

Of the 10 articles noted in Appendix B, only one was a systematic review (Level I), and, thereby, considered the most robust study design to test cause and effect relationships (Melnyk & Fineout-Overholt, 2011) Two articles were Level III, one article Level IV, and the remaining

articles were qualitative or descriptive single studies (Level VI) (Melnyk & Fineout-Overholt, 2011).

### **Summary**

All 10 articles identified barriers to SM use among adult patients, and the majority had good response rates to surveys (Goel et al., 2011; Graetz et al., 2016; Haun et al., 2013; Haun et al., 2014; Haun et al., 2015; Lyles et al., 2012; Shimada et al., 2013; Smith et al., 2015; (Thompson, Reilly, & Valdez, 2016; Wade-Vuturo, Mayberry, & Osborn, 2013). Common barriers identified among the studies were lack of knowledge of portal or SM use, portal complexity, privacy or security concerns, forgetting to enroll, lack of interest, negative attitude towards technology, not owning a computer or lack of internet access, difficult password recovery and low technical literacy (Goel et al., 2011; Graetz et al., 2016; Haun et al., 2013; Haun et al., 2014; Haun et al., 2015; Lyles et al., 2012; Shimada et al., 2013; Smith et al., 2015; Thompson, Reilly, & Valdez, 2016; Wade-Vuturo, Mayberry, & Osborn, 2013). Four articles associated health literacy (HL) rates with SM use; specifically, higher rates of HL were associated with SM use, and patients with lower HL rates were more likely to request assistance support for SM use (Haun et al., 2013; Haun et al., 2014; Haun et al., 2015; Smith et al., 2015). However, despite the strengths mentioned above, six studies did not measure health or computer literacy and the majority had poor minority representation (Goel et al., 2011; Graetz et al., 2016; Lyles et al., 2012; Shimada et al., 2013; Thompson, Reilly, & Valdez, 2016; Wade-Vuturo, Mayberry, & Osborn, 2013).

Internal and external validity among the 10 articles was confounded by several limitations. The majority of studies were located at one site and had minimal minority representation, and many of the responses were self-reported.

Several gaps in the literature were noted to include no inclusion of underrepresented minority populations, young adults, and patients with chronic conditions (i.e., diabetes, asthma or hypertension). The barriers to SM in these populations is not well known. In addition, very few of the articles controlled for internet connectivity; therefore, it is unknown if SM use is related to lack of opportunity or interest. Lastly, although health literacy was addressed in four of the studies and electronic health literacy in three studies, this factor could be a significant barrier to SM use but has not been studied enough to correlate.

## **METHODS**

The identification of self-reported, subjective perceptions and barriers of adoption and SM use is necessary to understand participant beliefs and perceptions (Polit & Beck, 2017). The results will contribute to the design of educational interventions to increase SM utilization (Polit & Beck, 2017). The quality improvement (QI) leader conducted 13 individual interviews with patients (n=10) and providers (n=3) over 14 days. A written list of questions was used to guide the interaction (Appendix C); however, participants were granted many opportunities to respond and the QI leader was able to clarify or explore responses, if indicated (Polit & Beck, 2017). The QI leader manually recorded participant responses.

The key stakeholders that have an interest in or are affected by the outcomes of this project are providers, nurses, clinic support staff, patients, military hospital leadership, BUMED, DHA and congress (Polit & Beck, 2017).

### **Setting**

This project will take place at a military primary care clinic in Sigonella, Italy where the QI leader for this systems assessment project is currently employed. The project population was United States Active Duty Service Members enrolled at the clinical site for medical services. The ADSM was not to have used SM more than twice in a year and scheduled for a medical appointment.

### **Ethical Considerations**

The aim of the systems assessment is to understand the causes related to the low use of SM among ADSM's in order to improve patient health outcomes, self-management behavior and patient satisfaction through increased patient-provider communication. Participation by ADSM's and providers is essential to acquire insight into the problem in order to achieve the project's aims and overall improvement of ADSM health (Polit & Beck, 2017). There is little to no risk to the participants taking part in this systems assessment (Polit & Beck, 2017).

### **Human Subjects Protection**

Approval for the project was granted by the University of Arizona Institutional Review Board (Appendix D). All participants were given the opportunity to accept or decline participation in the interview process. Those who elected to participate provided informed consent verbally. In an effort to minimize coercion or undue influence related to the military rank structure, the QI leader did not wear the military uniform or utilize military rank during the identification of participants and interview process. No personally protected information (PII) was collected during this project.

## RESULTS

Five male and five female ADSM's, were interviewed at Flight Line Clinic in Sigonella, Italy in October 2019. The three primary care providers were also interviewed in the same setting and timeframe. Four additional ADSM's reported unfamiliarity with SM and five ADSM's declined to participate. These groups were not interviewed. All ADSM's met inclusion criteria and voluntarily agreed to participate in the QI project. There was no additional incentive or benefit extended to anyone.

The interviews revealed participants receiving care from the Flight Line Clinic use SM to complete the annual Periodic Health Assessment (PHA). The PHA is an annual military requirement for ADSM's. Flight Line Clinic mandates ADSM's to notify the clinic via SM upon completion. Upon notification, the ADSM can schedule an appointment with their respective primary care manager (PCM) and complete the final step of the PHA process. All respondents accessed SM from their government computer at work 1-2 times per year with the primary reason to complete their PHA; whereas two respondents used SM to schedule appointments.

TABLE 1. *Respondents' feedback.*

<b>Feedback</b>	<b>Meaning</b>
"I don't know what else it can be used for?" "Not sure what else you can use it for?"	Respondents were unsure what other features were available to them within the SM system when asked the question, "What would they prefer to use SM for?"
"Once logged in, it was easy." "Pretty easy to use except for finding PCM." "Don't have to talk to five different people. More efficient." "Good for people that are nervous to talk on the phone."	Respondents found SM convenient and efficient to use once into the system. They were pleased to have alternative options of communication other than telephone or face-to-face.

Once all the interviews were conducted, the most frequently shared items were organized in Table 2. The commonalities are PHA use, access from government computer, usage of SM 1-2 times per year, ease of use once logged onto site, convenience, plan to continue using, difficulty accessing website, good option for those who dislike talking on the phone or coming into the clinic and suggested additional uses for medication renewal, notification of test results, email notification, schedule appointments and simple questions to PCM.

TABLE 2. *Commonalities.*

---

Used SM to complete online PHA (n=8)

Accessed SM from their government computer at work (n=9)

Used SM 1-2 times per year (n=9)

SM was easy to use and navigate once logged into site (n=8)

SM was convenient and saved time (n=9)

Plan to continue to use SM (n=9)

Difficulty accessing the website; finding PCM (n=2), finding website (n=2), trouble logging in (n=3)

Good alternate means of contact if dislike talking on the phone or coming into the clinic (n=7)

Suggested uses: medication renewal (n=1), test results (n=1), email notification (n=2), schedule appointments (n=1) and simple questions to PCM (n=4)

---

Seven respondents cited problems in the course of their SM usage. They had difficulty accessing SM due to problems logging in or finding the website. Two had problems locating their PCM once in the SM system. They were unable to send the required notification to their PCM advising completion of the first step in the PHA process. The notification is further confounded by the requirement of the ADSM to manually update the SM system with the appropriate PCM as indicated (i.e., reassignment, PCM change).

Once logged in and with a current PCM located, eight respondents reported the website to be easy to navigate and use. They found SM convenient in addressing their healthcare needs and for inquiring about simple health or administrative issues. They liked the delivery of notifications in their personal emails from SM, which alerted them of a message from their PCM. They also liked that their issues were addressed quickly by the PCM. Seven respondents commented that SM is a good alternative to calling the clinic or walking in as they disliked talking on the phone. All nine respondents planned to continue to use SM for their online PHAs.

All three primary care providers interviewed for this project were employed at the Flight Line Clinic. They all reported knowing about SM and remember signing up for an account, but all denied ever using it for patient care.

## **DISCUSSION**

Based on the feedback from the respondents, the three aims of this quality improvement project are addressed as follows.

### **Aim 1: Barriers to Use**

Actual or perceived barriers that impede adoption of SM usage as reported by ADSM's include inability to locate website, forgotten password, inability to locate PCM in the system after relocating to a new duty station, and lack of awareness of features. Two respondents stated, "I don't know what else it can be used for?" and "Not sure what else you can use it for?" when asked, "What would they prefer to use SM for?"

When asked, "What would you prefer to use SM system for?" many of the respondents replied with several answers: simple questions to their PCM, medication renewal, test results, appointment requests, and notifications to their personal email about a new SM email. These

desired tasks are already active features of the system, which illustrates that the respondents do not know the full capabilities of SM as they only use it once a year to initiate their PHAs.

All ADSM's must overcome the above-mentioned barriers since accessing the system is mandatory in order to complete their annual PHA, so they have to find a way to overcome these barriers. One respondent called the clinic, and another called the company for assistance with accessing SM and reported frustration with the process. All respondents accessed the system eventually and completed their PHA.

### **Aim 2: Interventions**

ADSM's enrolled for medical care at the Flight Line Clinic are required to use SM on at least an annual basis, for PHAs. However, it is unknown if any formal training is disseminated from the clinic or any other capacity regarding utilization of the SM system (i.e., orientation, online training).

To increase patient-to-provider communication and optimize SM capability and functionality, an educational training opportunity for the user is recommended. This formal training intervention would be developed and facilitated by the clinic. Different media should be considered such as video, print and verbal. A compilation of videos to demonstrate step-by-step instructions for logging in, changing PCM, setting notifications in personal emails, utilizing common features (e.g., medication refill, requesting appointment, patient education, etc.) and accessing the SM website's help desk for password and systems issues. The videos could be maintained on various military-affiliated websites (i.e., military base, hospital & clinic).

Print media would also be step-by-step instructions with words and pictures to guide the user. It would be disseminated to the patient upon request for assistance and during patient

interactions or encounters. Patients would also be directed to the videos located on the various internet sites.

Such visual and verbal instruction modalities would enhance ADSM's knowledge of the SM system, allowing them to use it for other medical reasons beyond the annual PHA. Once educated about all the features, most out of convenience would utilize these features and make less visits or phone calls to the clinic.

### **Aim 3: Embraced Features**

Over the course of the interviews, over half of the respondents favorably reported several features of SM. One feature highlighted by respondents was the convenience and ease of use once on the website. Respondents said, "Once logged in, it was easy," "Pretty easy to use except for finding PCM," and "Don't have to talk to five different people. More efficient." The other feature that over half of respondents liked about using SM was not talking on the telephone or coming into the clinic to address their concerns. One respondent commented, "Good for people that are nervous to talk on the phone."

Respondents did not embrace individual SM features such as medication renewal, instead the overall asynchronous feature of SM was championed which allowed patients the sense of convenience and ease in communicating their needs with their PCM.

### **Summary**

There are many factors to impede SM adoption and ultimately affect patient-to-provider communication. As a result of the interviews, several key points emerged from this QI project. All ADSM's seen at the Flight Line Clinic are mandated to use SM for their PHA, which occurs once a year. Outside of this yearly requirement, SM is rarely used due to patient difficulty

accessing website and lack of patient knowledge of SM features. Access difficulties aside, the convenience and ease of sending messages anytime of the day and avoiding calling or coming into the clinic to address their concerns were positive aspects of the system. SM is mainly accessed at their government computer during working hours. It is unknown if any formal or informal SM training is given to ADSM's however, it would be beneficial to provide training and education to access and navigate the SM system.

### **Strengths and Limitations**

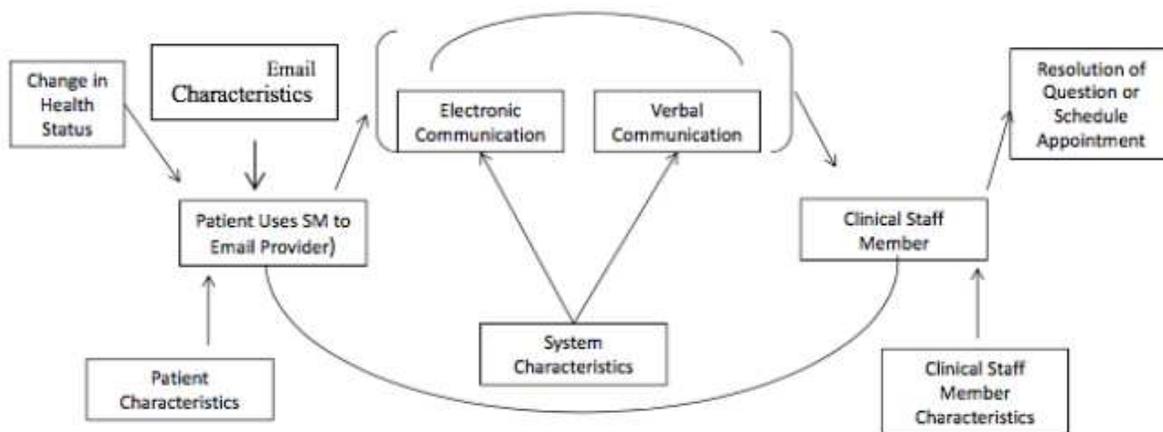
The strengths of this QI project were the project leader's ability to be on site to interact one-on-one with the respondents. Asking direct and probing questions in real time enhanced the level of detail of the respondents' answers, allowing more in-depth knowledge of the barriers to use.

In hindsight, the provider interviews were not relevant to understanding the barriers to SM use among ADSM's, since none of the providers used SM. If they had, it would not have provided value in addressing the aims of this project (i.e., barriers to use, potential interventions and features and functions most commonly used). The other limitation of this QI project was not inquiring if the respondents were given educational training on how to use SM. Based on the answers given by the majority of respondents one can assume they did not receive any training on the system. It would be helpful to understand where and how they received instructions on how to use SM.

### **Framework**

When revisiting the framework used to guide this project, I found that the specifics of how messages are sent. Looking at the framework now, another concept should be added the

means of sending the message. Please see updated framework below (Figure 2). Another limitation is the actual framework used, *Effective Nurse-to-Nurse Communication* (Carrington, 2012). This particular QI project does not examine how messages are sent between systems, or people in this case. It instead looks at people's attitudes and beliefs about accessing the system that sends messages to achieve a desired outcome. This framework would be more useful during implementation of the interventions to describe how people feel about communication through SM.



### Concept Level of Framework

**FIGURE 2.** Revised patient-to-provider communication model. (Adapted from Carrington's Communication Model. Carrington, J. M. (2012). Development of a conceptual framework to guide a program of research exploring nurse-to-nurse communication. *CIN: Computers, Informatics, Nursing*, 30(6), 293-299.)

### Future Work

This QI project identified several actual and perceived barriers to impede SM utilization and SM features that are embraced among ADSM's. Barriers disclosed by respondents could be minimized or eliminated by providing educational interventions; ideally, before or during a member's initial encounter with SM. Interventions should be tailored to adult learners and

readily accessible. Use of mixed media (e.g., print, video, & verbal) would be recommended as an opportunity to meet a variety of learners needs. Recommend future QI projects to explore implementation of educational interventions utilizing the Plan-Do-Study-Act (PDSA) model.

### **Conclusion**

Electronic email is an effective means to meet the healthcare needs of patients and promote communication between patient and provider (Hsaio et al., 2011; IOM, 2001). The DOD currently uses SM, which allows ADSM's to communicate via secure email with their provider outside of clinic hours regarding their health concerns. However, SM has been poorly utilized by ADSM's. The barriers identified in this QI project can be used to develop educational training interventions for ADSM's, increase SM utilization and improve patient-to-provider communication.

APPENDIX A:  
EVIDENCE EVALUATION TABLE

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
<p>Goel, Brown, Williams, Cooper, Hasnain-Wynia, &amp; Baker (2011)</p> <p>Patient reported barriers to enrolling in a patient portal.</p> <p><i>Journal of the American Medical Association, 18(Supplement_1), i8-i12.</i></p>	<p>Identify patient reported barriers to patient portal use</p> <p>Reasons for not enrolling in portal</p> <p>Reasons for not attempting enrollment</p> <p>Perceived benefits of portal</p>	None	Observational	<p>N=159</p> <p>Female=72%</p> <p>Age=51 years</p> <p>Black=48%</p> <p>College=70%</p>	<p>Telephone survey 28-43 questions</p> <p>\$10 gift card</p>	<p>Response rate=65%</p> <p>Not enrolling: 63% never attempted despite receiving order (invite).</p> <p>Not attempting: 63% d/t lack of information or motivation, 30% negative attitudes, 8% computer related obstacles</p> <p>Majority liked portal features. Black pts less likely than white pts to consider features assisting self-mgmt such as managing medical problems (58% vs82%, p&lt;0.05).</p>
<p>Graetz, Gordon, Fung, Hamity, &amp; Reed (2016)</p> <p>The digital divide and patient portals: internet access explained differences in patient portal use for secure messaging by age, race, and income. <i>Medical</i></p>	<p>Learn which sociodemographic diff in patient portal use for SM can be explained by computer and internet access and patient care preferences</p>	None	Quasi-experimental one study	<p>Stratified random sample</p> <p>Kaiser Permanente N. Ca delivery system</p> <p>&gt;18 yo + at least 1 chronic disease</p> <p>N=1041</p>	<p>Intro to study letter sent to 1360 eligible patients offering participation via paper questionnaire, email survey, telephone interview</p> <p>Incentive \$5 gift card</p>	<p>Response rate=76% (n=1041)</p> <p>Registered in portal=71% used SM=55%</p> <p>Registered; not used SM=33%</p> <p>Demographics a/w SM use: higher income and education (p&lt;.001); Less likely to use SM: male</p>

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
<i>Care, 54(8), 772-779.</i>				Female=56% >45yo=89% White=59% Married=62% <\$40,000=27% </=HS diploma=29% Daily internet use=57% Own computer=72% Mobile device=21% Prefer care in-person /phone=68%		(p<.05), older (p<.01), Asian or black (p<.05).  Have internet/demographics a/w SM use: higher education (p<.01) Less likely to use SM: male (p<.01), rare use of internet (p<.001), does not own computer (p<.01)  Have internet/care pref/demographics a/w SM use: higher education (p<.01), online (p<.001) Less likely to use SM: male (p<.01), rare use of internet (p<.001), does not own computer (p<.01) Strongest mediator: uses personal computer for internet: race 52%, income 60% education 38% (p<0.001) HL or computer literacy not accessed
Haun, Lind, Shimada, Martin, Gosline, Antinori, & Simon	Describe belief, attitudes, perceptions of SM	TAM (Technology Acceptance	Prospective descriptive qualitative	Recruited n=33 Complete data n=32	Data collection: Baseline & 3-month f/u	Same as above  3-month f/u:

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
(2014)  Evaluating user experiences of the secure messaging tool on the Veterans Affairs' patient portal system. <i>Journal of Medical Internet Research</i> , 16(3).	use  Patterns of use  Barriers/facilitators  Strategies for incr. SM use	Model)  Theory of Planned Behavior- predicting user adoption & evaluation of SM from user perspective	study & mixed methods	Registered for HealthVet  2 VA Medical Ctrs (NE & SW)  Randomization used for contact lists 120 people from each site  \$50 incentive	Survey: 13 item demographic HL: BRIEF (self rpt) & REALM (administered) Electronic HL: eHEALS & CEW  Interviews: open-ended; experiences with SM use (beliefs, attitudes, subjective norms, perceived behavior control & intention toward SM use)  In person user testing of SM  SM content review of in/outgoing messages x 3m	84% used SM at least once month compared with baseline 36%  Used more after learning about features in study; greater confidence and understanding  Recommend: patient targeted marketing, education, skill building
Haun, Lind, Shimada, & Simon (2013)  Evaluating secure messaging form the Veteran perspective:	ID's high/low volume users  Describe diff between high/low volume users	TAM (Technology Acceptance Model):  Theory of	Prospective descriptive qualitative study & mixed methods	Recruited n=33 Complete data n=32 Registered for HealthVet 2 VA Medical	Data collection: Baseline & 3-month  Survey: 13 item HL: BRIEF (self rpt) & REALM	(n=18) 55% initiated SM threads  Participants had higher HL than general population & adequate computer literacy

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
<p>informing the adoption and sustained use of a patient-driven communication platform. <i>Annals of Anthropological Practice</i>, 37(2), 57-74.</p>	<p>Understand how people use SM</p> <p>Inform interventions to increase adoption/use</p>	<p>Planned Behavior-predicting user adoption &amp; evaluation of SM from user perspective</p> <p>Medical Anthropology: Applies meaning to the understanding of SM as communication &amp; self-mgmt. tool</p>		<p>Centers (NE &amp; SW)</p> <p>\$50 incentive</p> <p>Ave age = 60% Male=79% H.S.=63% White=67%</p> <p>SM use: 6 month=30% once monthly=36% few times yr=49% satisfied w/ SM=82%</p>	<p>(administered) Electronic HL: eHEALS &amp; CEW</p> <p>Interviews: open-ended; experiences with SM use (beliefs, attitudes, subjective norms, perceived behavior control &amp; intention toward SM use)</p> <p>SM content review of in/outgoing messages x 3m</p>	<p>skills</p> <p>Valued SM comms &amp; timeliness used for: general consults, med refills, appts, test results.</p> <p>Benefits: resource &amp; comms efficiency</p> <p>Facilitators: convenience &amp; SM user friendly features Barriers: initiation &amp; knowledge, privacy/security concerns, prohibited personal expression, clinician resistance</p> <p>Sugg for improve: ease of use/features, screen visualization, access and awareness, education, marketing</p> <p>Themes high vol users: convenient form of comms, knows purpose of SM use, have a need, preference to alt. form of comms Low vol users: no need for comms/healthy, limited</p>

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
						<p>knowledge about SM, misaligned expectations, experiencing clinician resistance</p> <p>Recom: pt targeted mktng, education, skill building Clinician: SM training, education, incentive to use SM</p>
<p>Haun, Patel, Lind, &amp; Antinori (2015)</p> <p>Large-scale survey findings inform patients' experiences in using secure messaging to engage in patient-provider communication and self-care management: a quantitative assessment. <i>Journal of Medical Internet Research</i>, 17(12).</p>	<p>Assess veterans reported experience with SM</p> <p>Evaluate factors that predict use and perceptions a/w using SM</p>	None	Cross sectional	<p>2 VA medical centers Boston, MA &amp; Tampa, FL</p> <p>Eligible n=2073 N=819 (randomized sample)</p> <p>Male=87% White=86% At least high school education=61% &gt;=\$35,001=53% Daily computer use=81% Daily internet use=80%</p>	<p>Written survey via mail</p> <p>\$10 incentive</p> <p>BRIEF (BRIEF/REALM r=0.42, p&lt;0.01; BRIEF/STOFHLA r=.61, p&lt;.01)</p> <p>CEW (Cronbach alpha's: computer fluency=.72, email fluency=.75, web navigation=.64, web editing=.79) eHEALS internal consistency</p>	<p>Response rate= 40% (n=819)</p> <p>SM frequent use: younger age (p=.039), higher levels education (p=.025) &amp; income (p=.003) minorities at least once monthly (p=.086)</p> <p>Higher levels of HL &amp; eHealth literacy report more SM frequent use (p=.007) &amp; greater satisfaction (p=.002). Lower HL more likely to request education and support (p&lt;.001).</p> <p>80% felt other Veterans would benefit from education use/access.</p>

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
				Use SM >6m=61% Use SM at least once yr=59%	reliability =.88, test-retest reliability baseline->6m f/u .68-.40	40% reported SM tool could be improved to make more useful.  Perceptions of the usefulness of SM a/w frequency of use  Recom: screening pts for health literacy & eHealth literacy to identify educational needs/support for SM Providing pt education on benefits and use of SM
Lyles, Harris, Jordan, Grothaus, Wehnes, Reid & Ralston (2012)  Patient race/ethnicity and shared medical record use among diabetes patients. <i>Medical Care</i> , 50(5), 434-440.	The influence of race/ethnicity & provider factors on SMR use and barriers for non-use among racial/ethnic groups	None	Cross-sectional study	873 eligible n=718 (84% SMR users & 74% non-SMR users)  white=59% black=15%, Asian=13% other=11%	Electronic survey	Response rate=79% (n=718) Missing data: income=13%, barriers to use=30% (36% Asian, 41% black, 44% other)  SMR users-younger <64 yo (64%), more education (80%), higher incomes >\$50k (58%)  Black internet users had 75% odds of decreased SMR use  Barriers: access to computer

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
						or internet (41%), Attitudes/preferences & knowledge/technical literacy (11-15%)
<p>Shimada, Hogan, Rao, Allison, Quill, Feng, Phillips, Nazi, Haidary &amp; Houston (2013)</p> <p>Patient-provider secure messaging in VA: variations in adoption and association with urgent care utilization. <i>Medical Care</i>, 51, S21-S28.</p>	<p>Identify facility characteristics a/w higher SM adoption (opt-in rates)</p>	<p>None</p>	<p>Retrospective cohort study</p>	<p>Eligible=132 VA facilities n=121; had linkable survey data eligible=139 MHV coordinators</p>	<p>Survey of MHV coordinators</p>	<p>Response rate=92% (n=126; MHV coordinators)</p> <p>Opt-in rates higher at facilities where SM use was high priority (1.89% vs 1.48%; p=0.04), time spent registering pt (p=0.05%) &gt;20h/wk (2.5%) vs &lt;16h/wk (2.1%), volunteer help (2.13% vs 1.52%; p=0.006), availability of desk top computer/room (2.54% vs 1.69%; p=0.008)</p>
<p>Smith, O’Conor, Aitken, Curtis, Wolf, &amp; Goel (2015)</p> <p>Disparities in registration and use of an online patient portal among older adults: findings from the LitCog cohort. <i>Journal of the</i></p>	<p>Determine if socio-demographic factors and HL are a/w registering for account and usage</p>	<p>None</p>	<p>Quasi-experimental one group</p>	<p>Part of HL and Cognitive Function among Older Adults study in 2008 (LitCog).</p> <p>Chicago, IL Recruited: (IM clinic and 5 federal health centers) Identified=3176</p>	<p>2 face-to-face interviews</p> <p>Health Lit test: Newest Vital Sign</p> <p>Age, gender, race, education, chronic conditions (0-2+)</p>	<p>Offered code=93% Registered=58% /No=41%</p> <p>Likely to register: male (65%; p=0.034), white (72%; p&lt;.001), educated (p&lt;.001), fewer chronic conditions (p=.001), adequate HL (73%; p&lt;.001), marginal HL (46%; p&lt;.001) Healthier pt more likely to</p>

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
<i>American Medical Informatics Association</i> , 22(4), 888-895.				1904 random selected for mailer  Final sample from academic general IM clinic, NW Medical Faculty Fd  N=534 Female=70% White=65% 65+ yo= 39% Grad degree=33% Chronic cond 1 (34.1%), 2+ (49%) Adequate HL=60%		register  SM use: 90% messaged HL p<.001: Adequate=93% Marginal=86% Limited=61% Men (95%)>women (87%) (p=.03) Chronic cond (p=.042): 0 = 85% 1 = 95% 2+ = 86% Males with adequate HL more likely to use SM; lower HL less likely to use SM  Barriers: usability, forgetting to enroll, lack of interest, neg attitude toward technology Recom: focus on registration, monitor home connectivity, allow for smartphone interface
Thompson, Reilly & Valdez (2016) Work system barriers to patient, provider, and caregiver use of	Applied HF/E paradigm to assess individual, work system/unit, organization,	HF/E paradigm by Karsh	Systematic review	N=60	Abstract/full text screening based on inclusion/exclusion criteria -work system	N=28 tech functions & features-most freq reported barrier. Challenging content, inadeq. Privacy/security settings, missing

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
personal health records: A systematic review. <i>Applied Ergonomics</i> , 54, 218-242.	external environment factors to use by patient, provider, caregiver PHR use  PHR=internet-based set of tools that allow people to access & coordinate health information such as SM Barriers=factors a/w decreased PHR use				barriers to use by pt, provider, caregiver based on HF/E paradigm -empirical peer-reviewed	functionality, limited platform options. N=22 task demands, complexity, difficulty. Encountered using PHR such as unintuitive navigation and password recovery N=15 extra organizational rules/standards/legislation enforcement. PHR's operability with HER, ability/inability to contact multiple providers, 3 <sup>rd</sup> party access to PHR N=14 time and sequence demands. Provider/system response times and PHR fit with patient's daily routines N=13 financial resources N=10 industry social influences N=11 industry workforce characteristics N=9 availability of usable technology
Wade-Vuturo, Mayberry & Osbornn (2013)	Understand why portal users with T2DM use SM and why they do not	None	Mixed methods	Adults w/ T2DM @ Vanderbilt Medical Center n=54	Survey in person/phone/mail 9 focus groups	Benefits: better pt satisfaction, efficiency & quality of in office visits, access to care outside of in

Author/Article	Qual: Concepts or Phenomena Quan: Key Variables Hypothesis Research Question	Theoretical Framework	Design	Sample (N)	Data Collection (Instruments/Tools)	Findings
Secure messaging and diabetes management: experiences and perspectives of patient portal users. <i>Journal of the American Medical Informatics Association</i> , 20(3), 519-525.				9 focus groups (4 low-user & five high user)  Female=65% White=76% Black=20% Ave age=57 yo >\$44k=77%		office visits  Barriers: preconceived beliefs/rules about SM, prior negative experiences with SM,  Perceptions of provider endorsement: pt's assumption about providers' opinion about SM & providers' instruction about SM  No differences in SM use by age, gender, race, income, education Recommendations: more SM education from providers (discuss SM utility/benefits/process during office visit) & providers have protected time to devote to patient messages

HL=health literacy; SM=secure messaging; comms=communication; REALM=Rapid Estimate of Adult Literacy in Medicine; CEW=Computer-Email-Web; eHEALS=eHealth Literacy Scale; PHR= personal health record use; HF/E= Human factors/ergonomics; HER=electronic health record; SMR=secure medical record; MHV=My Healthe Vet; T2DM=type 2 diabetes

APPENDIX B:  
EVIDENCE SYNTHESIS TABLE

	<b>Secure Messaging</b>	<b>Patient Barriers</b>
<b>Level of Evidence I</b>		
Thompson, Reilly & Valdez (2016)	+	+
<b>Level of Evidence III</b>		
Smith, O’Conor, Aitken, Curtis, Wolf & Goel (2015)	+	+
Graetz, Gordon, Fung, Hamity, & Reed (2016)	+	N/A
<b>Level of Evidence IV</b>		
Shimada et al. (2013)	+	N/A
<b>Level of Evidence VI</b>		
Haun, Lind, Shimada & Simon (2013)	+	+
Haun, Lind, Shimada, Martin, Gosline, Antinori & Simon (2014)	+	+
Lyles, Harris, Jordan, Grothaus, Wehnes, Reid & Ralston (2012)	+	+
Wade-Vuturo, Mayberry, & Osborn (2013)	+	+
Goel, Brown, Williams, Cooper, Hasnain-Wynia, & Baker (2011)	+	+
Haun, Patel, Lind & Antinori (2015)	+	+

APPENDIX C:  
INTERVIEW GUIDE

## INTERVIEW GUIDE

1. Do you use secure messaging system?
2. Tell me about your experience with secure messaging system.
3. Would you say secure messaging system is easy to use? How could it be made easier to use?
4. What was it like to use secure messaging system?
5. What device did you use when accessing secure messaging system? (smart phone, computer, laptop, iPad?)
6. How often per month do you use the secure messaging system?
7. What does secure messaging system do well?
8. What do you think the benefits are of using secure messaging system?
9. What does secure messaging system not do well? Tell me more about those.
10. If you use secure messaging system, do you plan to continue using it? Why, why not?
11. What did you use secure messaging system for? What types of things?
12. What would you prefer to use secure messaging system for? What would need to be changed to meet this need?

*Adapted from Hsaio, A., Bazy-Assad, A., Benin, A., Tolomeo, C., Belton, B.M., Edmonds, D. (2011). Secure messaging in a pediatric respiratory medicine setting—final report. Contract No. HHS290200600015, TO#2). Rockville, MD: Agency for Healthcare Research and Quality.*

APPENDIX D:  
THE UNIVERSITY OF ARIZONA INSTITUTIONAL REVIEW BOARD APPROVAL  
LETTER



Human Subjects  
Protection Program

1618 E. Helen St.  
P.O. Box 245137  
Tucson, AZ 85724-5137  
Tel: (520) 626-6721  
<http://hgw.arizona.edu/compliance/home>

**Date:** June 17, 2019  
**Principal Investigator:** Stephanie Linn Burlison  


---

**Protocol Number:** 1906702648  
**Protocol Title:** Using Secure Messaging to Improve Patient-to-Provider Communication Among Active Duty Service Members  


---

**Determination:** Human Subjects Review not Required  


---

**Documents Reviewed Concurrently:**

**Data Collection Tools:** *Interview Guide.docx*  
**HSPF Forms/Correspondence:** *Advisor Confirmation Email.pdf*  
**HSPF Forms/Correspondence:** *Burlison\_IRB determination\_v2019-02-25.pdf*  
**Informed Consent/PHI Forms:** *Disclosure form-Determination.docx*  
**Informed Consent/PHI Forms:** *Disclosure form-Determination.pdf*  
**Other Approvals and Authorizations:** *18-403 EPA- UofA & USNH Stigonella - Fully Executed.pdf*  
**Recruitment Material:** *Recruitment Email.docx*

**Regulatory Determinations/Comments:**

- Not Research as defined by 45 CFR 46.102(l): As presented, the activities described above do not meet the definition of research cited in the regulations issued by U.S. Department of Health and Human Services which state that "Research means a systematic investigation, including research development, testing, and evaluation, designed to develop or contribute to generalizable knowledge. Activities that meet this definition constitute research for purposes of this policy, whether or not they are conducted or supported under a program that is considered research for other purposes. For example, some demonstration and service programs may include research activities. For purposes of this part, the following activities are deemed not to be research."

The project listed above does not require oversight by the University of Arizona.

If the nature of the project changes, submit a new determination form to the Human Subjects Protection Program (HSPF) for reassessment. Changes include addition of research with children, specimen collection, participant observation, prospective collection of data when the study was previously retrospective in nature, and broadening the scope or nature of the study activity. Please contact the HSPF to consult on whether the proposed changes need further review.

The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).

## REFERENCES

- Business Wire. (2016). McKesson awarded \$139M department of defense contract for patient engagement and interoperable secure messaging solutions. Retrieved from <https://www.businesswire.com/news/home/20160406006059/en/McKesson-Awarded-139M-Department-Defense-Contract-Patient>
- Carrington, J. M. (2012). Development of a conceptual framework to guide a program of research exploring nurse-to-nurse communication. *CIN: Computers, Informatics, Nursing*, 30(6), 293-299.
- Goel, M. S., Brown, T. L., Williams, A., Cooper, A. J., Hasnain-Wynia, R., & Baker, D. W. (2011). Patient reported barriers to enrolling in a patient portal. *Journal of the American Medical Informatics Association*, 18(Supplement\_1), i8-i12.
- Graetz, I., Gordon, N., Fung, V., Hamity, C., & Reed, M. E. (2016). The digital divide and patient portals: Internet access explained differences in patient portal use for secure messaging by age, race, and income. *Medical Care*, 54(8), 772-779.
- Haun, J. N., Lind, J. D., Shimada, S. L., & Simon, S. R. (2013). Evaluating secure messaging form the veteran perspective: Informing the adoption and sustained use of a patient-driven communication platform. *Annals of Anthropological Practice*, 37(2), 57-74.
- Haun, J. N., Lind, J. D., Shimada, S. L., Martin, T. L., Gosline, R. M., Antinori, N., ... & Simon, S. R. (2014). Evaluating user experiences of the secure messaging tool on the Veterans Affairs' patient portal system. *Journal of Medical Internet Research*, 16(3).
- Haun, J. N., Patel, N. R., Lind, J. D., & Antinori, N. (2015). Large-scale survey findings inform patients' experiences in using secure messaging to engage in patient-provider communication and self-care management: A quantitative assessment. *Journal of Medical Internet Research*, 17(12).
- Hsaio, A., Bazy-Assad, A., Benin, A., Tolomeo, C., Belton, B.M., Edmonds, D. (2011). Secure messaging in a pediatric respiratory medicine setting—final report. (Contract No. HHS290200600015, TO#2). Rockville, MD: Agency for Healthcare Research and Quality.
- Institute of Healthcare Improvement. (2018). *Science of improvement: Testing changes*. Retrieved from <http://www.ihl.org/resources/Pages/HowtoImprove/ScienceofImprovementTestingChanges.aspx>
- Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century*. Washington, DC: The National Academies Press.

- International Ergonomics Association. (2018). Retrieved from <http://www.iea.cc/whats/>
- Lyles, C. R., Harris, L. T., Jordan, L., Grothaus, L., Wehnes, L., Reid, R. J., & Ralston, J. D. (2012). Patient race/ethnicity and shared medical record use among diabetes patients. *Medical Care, 50*(5), 434-440.
- Melnyk, B. M. & Fineout-Overholt, E. (2011). *Evidence-based practice in nursing & healthcare: A guide to best practice* (2nd ed.). Philadelphia, PA: Lippincott Williams & Wilkins.
- McKesson Canada. (2015). *RelayHealth*. Retrieved from <https://relayhealth.ca/home>
- National Research Council. (2011). What is human factors? In *Health care comes home: The human factors* (pp. 61-74). Washington, D.C.: The National Academies Press.
- Polit, D. F. & Beck, C. T. (2017). *Nursing research: Generating and assessing evidence for nursing practice* (10th ed.). Philadelphia, PA; Lippincott Williams & Wilkins.
- Shimada, S. L., Hogan, T. P., Rao, S. R., Allison, J. J., Quill, A. L., Feng, H., ... & Houston, T. K. (2013). Patient-provider secure messaging in VA: Variations in adoption and association with urgent care utilization. *Medical Care, 51*, S21-S28.
- Smith, S. G., O'Connor, R., Aitken, W., Curtis, L. M., Wolf, M. S., & Goel, M. S. (2015). Disparities in registration and use of an online patient portal among older adults: Findings from the LitCog cohort. *Journal of the American Medical Informatics Association, 22*(4), 888-895.
- Thompson, M. J., Reilly, J. D., & Valdez, R. S. (2016). Work system barriers to patient, provider, and caregiver use of personal health records: A systematic review. *Applied Ergonomics, 54*, 218-242.
- U.S. Department of Health and Human Services. 2000. *Healthy People 2010*. Washington, DC: U.S. Government Printing Office. Originally developed for Ratzan, S. C., Parker, R. M. 2000. Introduction. In *National Library of Medicine Current Bibliographies in Medicine: Health Literacy*. Selden, C. R., Zorn, M., Ratzan, S. C., Parker, R. M. (Eds.). NLM Pub. No. CBM 2000-1. Bethesda, MD: National Institutes of Health, U.S. Department of Health and Human Services.
- Wade-Vuturo, A. E., Mayberry, L. S., & Osborn, C. Y. (2012). Secure messaging and diabetes management: Experiences and perspectives of patient portal users. *Journal of the American Medical Informatics Association, 20*(3), 519-525.
- Westat, R. M. (2013). *Findings and lessons from the AHRQ ambulatory safety and quality program*. (AHRQ Publication No. 13-0067-EF). Rockville, MD: Agency for Healthcare Research and Quality.