

AN EVALUATION OF PROVIDER USE OF SECURE MESSAGING

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ABSTRACT

Christine Anne Nye: An Evaluation of Provider Use of Secure Messaging
(Under the direction of Rebecca Kitzmiller)

Patients value communication with their providers facilitated by electronic messaging. Further, communication via electronic messaging may help improve patient outcomes. The purpose of this study is to understand the relationships between providers' perceptions of and their use of secure messaging, a form of electronic messaging, in practice. Literature suggests that providers may encounter barriers as they integrate electronic messaging into their practice and that variation exists in how providers incorporate its use into their daily workflow. Gaps exist in our understanding of how barriers and workflow variations impact providers' use of electronic messaging and their subsequent effect on patient satisfaction and electronic messaging use. This study is a program evaluation and case comparison study of two outpatient clinics that use electronic messaging with their patients. Through analysis of surveys, secure messaging usage measures, direct observations, and semi-structured interviews, this study offers unique insight into contextual factors that impact electronic communication between patients and providers. The findings of this study suggest that effective use of team strategies and protocols may impact provider perceptions and use. Further research is necessary to understand how implementation of best practices suggested by this study may impact or transform use of secure messaging communication between patients and providers.

To my mother, Marilyn Patterson, and all my family and friends.
I could not have made it this far without your unwavering support.

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LIST OF ABBREVIATIONS

CMS	Centers for Medicare and Medicaid Services
EHR	Electronic Health Record
EM	Electronic Messaging
HIPAA	Health Insurance Portability and Accountability Act of 1996
HIT	Health Information Technology
HMO	Health Maintenance Organization
IOM	Institute of Medicine
MA	Medical Assistant
MU	Meaningful Use
NP	Nurse Practitioner
PA	Physician's Assistant
PC	Primary Clinic
PI	Principle Investigator
RN	Registered Nurse
SC	Specialty Clinic
SM	Secure Messaging
UTAUT	Unified Theory of Acceptance and Use of Technology

CHAPTER 1: INTRODUCTION

High quality patient-provider communication is linked to improved patient outcomes and satisfaction. Recent efforts to understand the nature of patient-provider communication and how to promote the best quality have increased (Gagnon et al., 2009). Attention has centered on the impact of communication on patient outcomes and satisfaction and how to help providers provide the highest quality communication. Studies correlate the quality of patient-provider communication with decreased mortality and increased quality of life (Keller, Gangnon, & Witt, 2014; Maly, Liu, Liang, & Ganz, 2015; Street, 2013; Zill et al., 2014). Communication between patients and providers is vital to healthcare. As patients examine and judge the quality of their care, they place the quality of communication with providers in high esteem. Communication between providers and patients requires reasonable access to providers and adequate time for patients to understand information provided by providers. Further, studies note that patients may value a collaborative and cooperative communication style; one that creates dialogue rather than the traditional power dynamic of a dominant provider and passive patient (Delbanco & Gerteis, 2015). Communicating with patients entails not only creating adequate physical and temporal space for access to providers and information, but promoting an appropriate method to ensure the information is received and understood by patients. These aspects of communication create the foundations for shared decision making. In medicine, shared decision making is a necessary component of patient centered care. The Institute of Medicine (IOM) notably encouraged patient centered care in their report “Crossing the Quality Chasm.” In this report, the IOM recommends redesigning healthcare to promote continuous healing relationships, customization of care to the

patient's values and needs, knowledge and information sharing, and transparency (Institute of Medicine, 2001). Underscoring this, connecting and communicating with patients is considered one of the six essential tasks of the modern clinician (Shorey & Spollen, 2014).

Communication between patients and providers takes place in a variety of formats. Though traditional communication occurs in a face-to-face encounter, electronically enabled communication has begun to receive greater recognition. In this regard, a systematic review examining the impact of an electronic system implementation, found that it improved communication by helping to focus interactions and positively impact the patient-provider relationship (Nguyen, Bellucci, & Nguyen, 2014). As technology-enabled communication becomes ubiquitous in general society, patients expect to communicate with their healthcare providers through electronic means (Xerox, 2014). Furthermore, the IOM encourages continuous access to the healthcare system through formats outside of face-to-face visits, such as by telephone or the internet (Institute of Medicine, 2001). Additionally, electronic communication is a tenet of the Patient-Centered Medical Home, within which providers are encouraged to offer online patient services and electronic visits (Paladine, Miller, White, & Feifer, 2010). One growing method of electronic communication is secure messaging.

Secure messaging, a form of electronic communication adherent to security guidelines, is an integral part of modern electronic health records (EHRs). Recently, secure messaging has come to the forefront as a technology-enabled method for enhancing patient-provider communication. The Centers for Medicare and Medicaid Services (CMS), particularly through their Meaningful Use (MU) program, sought to incentivize providers to communicate electronically with patients through secure messaging (Centers for Medicare & Medicaid Services, 2015). While largely understudied, findings note that providers hesitate to

communicate with patients using secure messaging due to several barriers including the quality and performance of the technology, effort of use, and social factors they encounter, along with concern regarding an appropriate technique to communicate electronically. However, of the few studies examining secure messaging, none connect provider concerns with actual use of this communication modality. Thus, a logical next step to improving electronic patient-provider communication via secure messaging is to gain a greater understanding of the impact of providers' concerns and experiences about this method of patient communication. This understanding will serve as a foundation for developing and implementing secure messaging best practices. Discovering best practices may help strengthen the dynamic relationship between electronic patient-provider communication and patient outcomes.

Problem Statement

Variation exists in how providers choose to manage electronic messaging (EM) with their patients. Studies note that providers encounter challenges in communicating effectively with patients through EM due to perspectives on performance, effort, job fit, social influence, and practice related concerns (Antoun, 2015; Atherton, Pappas, Heneghan, & Murray, 2013; Boukus, Grossman, & O'Malley, 2010; Hanna, May, & Fairhurst, 2012; Lau et al., 2012; Menachemi, Prickett, & Brooks, 2011; Pare et al., 2015). Due to a relative lack of evidence to guide providers in effective use of EM, the expected positive impact of this method of communication on patients may remain unrealized.

Local Problem

The large health system that served as the setting for with this project recognized the essential role provider-patient communication plays in overall patient satisfaction and improved health outcomes. To enhance the use of electronic communication modes, they promote patient

engagement through an electronic portal and electronic secure messaging. Leadership within this organization noted significant variation in the rate of secure messaging use among outpatient clinics. This organization was interested in understanding the causes of this variation as a basis from which to develop best practices to improve patient engagement through secure messaging means.

Purpose of the Project

To address this issue, I propose a project designed to thoroughly evaluate factors that may impact providers' daily use of secure messaging and examine the relationship between provider use and patient satisfaction. Using cross sectional data collected through direct observation, interviews, and surveys of providers and staff that use secure messaging, I will identify barriers and facilitators to provider use. Then, based upon providers' lived experiences along with the emerging evidence base, I will identify areas for improvement and provide recommendations for improving communication through secure messaging.

Practice Questions

1. What relationships exist between provider satisfaction, perceptions, and practices and their use of secure messaging?
2. What modifiable factors exist that have an impact on provider satisfaction and use?
3. What relationship exists between consistent provider use of secure messaging and patient reported satisfaction?

CHAPTER 2: REVIEW OF LITERATURE

Background

Federal programs such as CMS's Meaningful Use program and The *Federal Health IT Strategic Plan 2015-2020* (Centers for Medicare & Medicaid Services, 2015; Daniel, Deering, & Murray, 2014; Office of the National Coordinator for Health Information Technology, 2015) aim to empower individuals to better manage their own health by increasing access to their personal health information. These programs incentivize health care providers to offer access to patient information through electronic means, primarily patient portals (Irizarry, DeVito Dabbs, & Curran, 2015; Office of the National Coordinator for Health Information Technology, 2015). Further, these programs underscore the important role of patient-provider communication in health maintenance by setting the expectation for electronic messaging between patients and providers. Strategies to enable patients and providers to effectively use these tools are foundational to achieving improved patient outcomes associated with technology use. Research on electronic patient-provider communication often refers to "email" rather than "secure messaging." This difference is in large part related to the lag between current research and publication. For the purposes of this project, studies evaluating email use are included, as secure messaging is considered the most protected form of email but the function and intent remain the same. In this paper, the term electronic messaging (EM) will be used to describe all forms of electronic, asynchronous communication between patients and their providers including e-mail and secure messaging via patient portals. Later, as details of the project are discussed, the term secure messaging (SM) will be applied since this is the form of EM examined in this project.

Patient Portals

Patient portals are protected sites, often tethered to a clinic's Electronic Health Record, that provide patient access to a number of health tools (Brown, 2013; Otte-Trojel, de Bont, van de Klundert, & Rundall, 2014). Within the portal, patients may have access to a variety of functions including medication lists, after-visit summaries, clinician notes, allergy lists, and patient-provider secure messaging (Shaw & Ferranti, 2011). Secure messaging is defined as a method of EM that utilizes encryption and secured and protected web servers in order to prevent interception and promote the integrity of communication (Brown, 2013). Integrating secure messaging into other patient portal features allows patients to securely communicate with providers while accessing pertinent health related information.

Patient portals are increasingly associated with improved patient outcomes and positive views of patient-provider communication. Studies found positive correlations between portal use and hemoglobin A1c control, hypertension, depression, aspirin use, and health maintenance measures such as pneumovax administration for those with chronic conditions (de Lusignan et al., 2014; Goldzweig et al., 2013; Nagykalai, Chou, Aspy, & Mold, 2010; Shaw & Ferranti, 2011). Study results investigating the association between portal use and face-to-face services varied: some researchers found no correlation or impact of portal use on outcomes or patient engagement, while others noted increased use of clinical services (Garrido, Meng, Wang, Palen, & Kanter, 2014; Riippa, Linna, & Ronkko, 2014). Patients who reported higher levels of trust in their providers were more likely to be enrolled in a practice's portal (Lyles et al., 2013). From a patient-provider communication perspective, studies show that patients access their accounts to communicate with their providers (Goel et al., 2011; Jones, Weiner, Shah, & Stewart, 2015; Ralston et al., 2007). Patients believe that electronic access facilitates communication with their

providers; some even view it as a partial solution to short or stressful face-to-face visits (Kerns, Krist, Longo, Kuzel, & Woolf, 2013; Nazi, 2010; Zarcadoolas, Vaughn, Czaja, Levy, & Rockoff, 2013). A focus group study found that patients who expressed greater dissatisfaction in their relationship or communication with their providers had more of an interest in using portals (Zickmund et al., 2008) perhaps as a remedy for problematic issues between patients and providers (Zarcadoolas et al., 2013). Those who used the portal perceived that it had a positive impact on communicating with their providers (Bush, Connelly, Fuller, & Perez, 2015; Klein, 2007). A Kaiser Permanente study found that portal users were more likely to continue to see their provider rather than finding another provider or practice as compared to non-portal users (Garrido et al., 2014). Research suggests that patient engagement with portals and their embedded communication tools may have positive effects for patients.

Patients Will Use Electronic Messaging

Studies highlight that patients who have access to EM, take advantage of it to communicate with their providers. Many types of patients use it when available, or voice that they would use it if accessible (Garrido et al., 2014; Haun, Patel, Lind, & Antinori, 2015; Jones et al., 2015; Xerox, 2014; Ye, Rust, Fry-Johnson, & Strothers, 2010). Goel and colleagues (2011) found that 76% of patients enrolled in a portal used it to communicate with their providers. Others found similar results (Haun et al., 2015; Nazi, 2010). Results of patient focus groups note that patients' view email communication as a tool that helps with relationship building (Schiller, Christner, Stansfield, Watnick, & Mullan, 2013). Thus, researchers postulate that EM is not only about completing tasks, but may also represent the need to express and respond to emotions and establish a therapeutic patient-provider relationship (Ye et al., 2010; Zhou, Kanter, Wang, & Garrido, 2010). Researchers also suggest that the mechanism for

improving patient outcomes lies in the continuity, connectedness, and support for patient self-management that EM supports (Zhou et al., 2010). Thus, evidence suggests EM has an impact on overall patient care.

Researchers also seek to understand the impact EM may have on other areas of patient care. A retrospective cohort study performed by the Mayo clinic compared frequency of office visits before and after the first use of EM among 2,357 patients and found no significant change in the number of office visits before and after EM use (North et al., 2014). Other studies reported that patients with Diabetes Mellitus who communicated with providers using EM had better glycemic control as measured by Hemoglobin A1c levels (Alang & Trivedi, 2014; Baer, 2011; Garrido et al., 2014; Goldzweig et al., 2013; Zhou et al., 2010). Additionally, use of EM is positively associated with better management of cholesterol, heart failure, and blood pressure (Garrido et al., 2014; Goldzweig et al., 2013; Zhou et al., 2010). Studies also show improvement with adherence to health maintenance activities such as screening for nephropathy, retinopathy, colon cancer, cholesterol and blood pressure (Garrido et al., 2014; Goldzweig et al., 2013; Zhou et al., 2010). Another analysis suggested an association between EM frequency and better quality outcomes as well as improved patient satisfaction (Garrido et al., 2014; Goldzweig et al., 2013; Liederman & Morefield, 2003; Ye et al., 2010). While patients may desire to and be impacted by communicating electronically with their providers, EM must be available for patients to do so.

Provider Perspectives on Electronic Messaging

As providers adopt and utilize information communication technology, of which EM is a part, many factors must be taken into account. Increasingly, studies show that patients are more likely to enroll in portals when encouraged by their providers (Amante, Hogan, Pagoto, &

English, 2014; Goel et al., 2011; Lyles et al., 2013). Patients report better access, knowledge, and motivation to use EM when their providers use the tool as well (Antoun, 2015). Encouraging providers to use this feature is important to encouraging patient use. Unfortunately, the majority of research examines physician opinions about and use of EM. There is limited knowledge about EM use by other health care providers. A summary of the evidence is organized into the following sections: (1) prevalence of EM use among providers; (2) proposed theoretical lens for examining provider use of EM; (3) barriers and facilitators to provider use of EM; and (4) gaps in the evidence (Venkatesh, Morris, Davis, & Davis, 2003).

Prevalence of Provider EM with Patients

Despite the potential benefits experienced by patients, providers have been slow to adopt and effectively use EM as a tool. Many studies examine the use of EM, including email and secure messaging in state, national and international settings. A survey of 2,199 Spanish physicians found that 89.9% used EM with other providers while only 22.5% used this method to communicate with patients (Lupianez-Villanueva, Hardey, Torrent, & Ficapal, 2010). Others found that, physicians are much less likely to approve of or perceive email as an appropriate way to communicate with patients and manage patient care (Hanna, May, & Fairhurst, 2012; Popeski et al., 2015). Only 6.7% of physicians reported routinely accessing email to communicate with patients. Older physicians were half as likely to use email when compared to younger physicians (Boukus, Grossman, & O'Malley, 2010). Among Rhode Island providers, only 13.4% 'almost always' communicated with patients via electronic means, while nearly 25% of providers used this feature with other providers (Gordon, Baier, & Gardner, 2015). A statewide survey of 167 members of the American College of Physicians in Missouri found that 30% of physicians used email to communicate with patients (Siva, Lawlor, Smarr, Ge, & Fleming, 2011). However,

only 16% used it once or more per week (Siva et al., 2011). Additionally, 33% of physician respondents reported they would not want to use email at all in the future (Siva et al., 2011). The rate of Florida physicians reporting frequent use of email with patients did not change from 2005 to 2008 (Menachemi, Prickett, & Brooks, 2011). Moreover, an analysis of physician characteristics showed that primary care providers were more likely to use email routinely than other specialists (Boukus et al., 2010). A retrospective cohort study examining the use of patient initiated EM found that providers in medicine clinics received the most messages and that the proportion of outpatient interactions via EM increased annually (Cronin et al., 2015). Over a three year period, researchers found that providers across specialties were more likely to use EM than a face-to-face visit for patient encounters (Cronin et al., 2015). However, this perspective is not the norm. A study of Family Medicine faculty and residents reported discrepancies in their use of email with patients, with over 75% of faculty reporting use compared to less than 15% of residents (Paladine, Miller, White, & Feifer, 2010). Conversely, Crotty and colleagues (2013) found that 57% of residents communicated with patients through EM early on. These findings suggest that use of EM varies by age of provider as well as by specialty.

Research suggests that practices prioritize other types of health information technology (HIT) over EM. A national survey of 4,258 physician members of the American Medical Association found that, out of 16 HIT functions, email was rated third to last in availability and last in routine use (Boukus et al., 2010). Furukawa and colleagues (2014) note that approximately 50% of practices have the capability to exchange EM with patients and only one of three reported routine use, while the availability of other HIT was greater. Although most published studies of EM occurred prior to MU program, evidence suggests that adoption and use of EM has been lower than other types of HIT.

Electronic Messaging Workflow and Practices

The ways practices choose to incorporate EM into their workflow may impact provider use including how messages are routed, provider time management, reimbursement for provider time, and preparing patient expectations for appropriate EM communication. Research examining workflow for electronic messaging found that email routing patterns may vary across clinical settings (Baer, 2011; Bishop, Press, Mendelsohn, & Casalino, 2013; Eaton, 2012; Johnson, Garrido, Christensen, & Handley, 2014; Ozkaynak et al., 2014). Some practices allow patients to direct their messages to specific people or work groups including nursing, front desk, or their provider, while others use a general inbox (Bishop et al., 2013; Johnson et al., 2014). Once an email is received by a practice, it may first be handled by the provider, or triaged by other members of the healthcare team such as registered nurses (RNs), medical assistants (MAs), case managers, or patient service representatives (Baer, 2011; Bishop et al., 2013; Eaton, 2012; Johnson et al., 2014). When non-providers are the first health care personnel to receive patient email, clinics provide specific training and develop protocols to guide team member interaction and response (Bishop et al., 2013; Rodriguez, 2010). Often, routine messages are handled by the health care team, while more complex messages are forwarded on to a provider (Bishop et al., 2013; Johnson et al., 2014). , there is scant evidence to support best practice for routing EMs.

In addition to the method of routing, EM workflow may also be impacted by time management and payment. A few studies report other logistical aspects of using electronic messaging such as how to incorporate its use into the daily workflow or how to manage cost. Researchers suggest methods to address these issues. For instance, schedules might include time for EM, adjusting face-to-face appointments to treat answering EM as an electronic visit, or allowing providers to self-determine the number of face-to-face versus electronic visits to

accommodate (Bishop et al., 2013). Authors also suggest that payment should be considered as compensation for time providing care through EM, a sentiment echoed by approximately 40% of physician respondents who felt that insurance companies and patients should bear the cost care via EM (Brown, 2013; Siva et al., 2011). Some clinics report charging patients for EM, while others negotiated reimbursement with private insurance companies (Bishop et al., 2013; Brown, 2013). Practices that incorporate time and compensation for responding to EM may have better provider buy-in, although there is no evidence at this time. This is further complicated by reimbursement models that move away from the traditional fee-for-service method, such as Health Maintenance Organizations (HMOs) that reimburse per patient rather than per service. Practices that embrace alternative reimbursement strategies may not be as impacted by a perceived lack of reimbursement.

Research also indicates educating patients on the appropriate use of electronic messaging may play a role in provider acceptance of EM. Eaton (2012) reports providing patients with education regarding communication that is appropriate and inappropriate prior to initiating EM. Others may have warnings in place for patients to see before they send a message (Bishop et al., 2013), however, these practices are fairly under used. A survey reported that 94% of respondents who used EM with patients did not have a written policy in place or provide guidelines to patients on how and when to properly use EM (Siva et al., 2011). Since studies note that providers express concern about medicolegal risk, patient education may play an important role in reducing provider fears (Atherton, Sawmynaden, Sheikh, Majeed, & Car, 2012).

Volume

Studies report the volume of messages received by clinics vary widely. Researchers found that volumes varied from 5 to 50 per provider per day (Bishop et al., 2013). In Spain, providers received an average of 5 messages per day (Ruiz, Garcia, & Riquelme, 2014), while in California, providers received an average of 17.3 EMs per day (Johnson et al., 2014). Studies note that the volume of EM a practice receives varies by medical specialty. One study found that orthopedic clinics' EM interactions constitute over 10% of all outpatient interactions, including face-to-face clinic visits (Shenson, Cronin, Davis, Chen, & Jackson, 2015). Providers not only respond to a patient initiated message, they also initiate messages to patients (Johnson et al., 2014). Providers sent an average of 2.7 responses to patient initiated secure messages per day (Garrido et al., 2014). Clinics report that they aim to respond to electronic messages within 24 to 48 business hours (Eaton, 2012; Garrido et al., 2014). Further, a study found that teams responded to messages more quickly as volume increased suggesting teams increased efficiency by constructing better workflows (Garrido et al., 2014). It is important to note that providers' EHR inboxes are also used for other types of patient care communication (e.g., laboratory test results). Murphy and colleagues (Murphy et al., 2016) found that, on average, primary care providers received 77 messages per day, while specialists received 29 messages to their inboxes per day. Thus, it is reasonable to expect high volumes of EM will increase demands on provider time

Time

Reviewing and responding to patient EM takes time. Providers estimated taking two to three minutes per message to generate a response to patients' EM (Johnson et al., 2014). Garrido and colleagues (2014) had similar findings and estimated a daily impact of 15 minutes across

study participants. However, others found that managing EM required an hour each day (Ruiz et al., 2014). Use of secure messaging and other forms of telehealth communication are expected to continue to expand in response to patient demand. Some experts anticipate that such formats may begin to replace face-to-face visits (Weiner, 2012). Although, providers may be open to new technology that facilitates patient communication about simple matters, some do not see a need to increase electronic communication and decrease face-to-face interactions (Hanna et al., 2012). Since time providers invest in EM varies, understanding message content may help identify methods for preserving valuable time.

Content and Response

To fully understand secure messaging, it is important to know how providers respond to patient initiated messages. One study examined 50 rheumatology fellows' responses to a simulated patient email in order to assess appropriateness of their responses (Mittal et al., 2010). Message content analysis found that most fellows wrote appropriate, concise, and courteous messages (Mittal et al., 2010). Additionally, 92% of fellows acknowledged patient conditions that required urgent medical attention, but only 30% took active measures to contact the patient (Mittal et al., 2010). Further, no one encrypted their email message, although this was an expectation (Mittal et al., 2010). Another study of message content analysis, concluded that physicians' responses were typically short and direct (Ye et al., 2010). While training may improve knowledge and skills, researchers found that an educational intervention had no impact on how frequently residents checked EM (Mittal et al., 2010; Paladine et al., 2010). It is essential to understand facilitators and barriers to provider use since the lack of use may not be simply related to knowledge and training.

Framework for Understanding Facilitators and Barriers

Many studies examining facilitators and barriers to secure messaging utilize the Unified Theory of Acceptance and Use of Technology (UTAUT). The UTAUT integrates eight different technology acceptance models to provide a comprehensive way to understand factors that influence individual user behaviors (Venkatesh et al., 2003). UTAUT links internal and external processes and contextual factors to identify the greatest influences on individual decisions to utilize new, predominantly work-related, technology. Table 1 lists the four main constructs and their corresponding subconstructs.

Table 1: UTAUT Constructs and Subconstructs

Performance Expectancy	Effort Expectancy	Social Influence	Facilitating Conditions
Perceived Usefulness	Perceived Ease of Use	Subjective Norm	Perceived Behavioral Control
Extrinsic Motivation	Complexity	Social Factors	Facilitating Conditions
Job-fit	Ease of Use	Image	Compatibility
Relative Advantage			
Outcome Expectations			

Performance expectancy, effort expectancy, social influence, and facilitating conditions demonstrate the greatest relationship with technology acceptance and use (Venkatesh et al., 2003).

Performance Expectancy

Performance expectancy is defined as an individual's degree of belief that using a technology will help with their job performance (Venkatesh et al., 2003). In general, providers perceive that EM with patients may improve practice efficiency and patient care. However,

concerns about quality, lack of reimbursement, and a sound evidence base persist. Providers consider EM a convenient method to improve service (Atherton et al., 2012; Bergmo, Kummervold, Gammon, & Dahl, 2005; Lewis & Dicker, 2015; Popeski et al., 2015). Providers who perceive that EM promotes efficiency and improves patient care may use it more frequently (Bishop et al., 2013; Crotty, Mostaghimi, & Landon, 2013; Johnson et al., 2014; Popeski et al., 2015). Several studies report that providers believe that EM improves communication, patient empowerment, and the patient-provider relationship by increasing accessibility to the provider (Johnson et al., 2014; Popeski et al., 2015). Other benefits to EM include increased protection for both parties through self-documentation and self-directed asynchronous communication (Lewis & Dicker, 2015). However, providers continue to feel that more complex clinical issues should be handled during a face-to-face visit (Bergmo et al., 2005). Although, they may be adept at using EM, some providers may prefer to use the phone rather than EM when providers anticipate that the patient will have additional questions (Johnson et al., 2014). When compared to allied health professionals, physicians expressed less value and greater doubt about the potential to improve quality or efficiency (Popeski et al., 2015). For instance, many physicians saw how technology improved communication with other healthcare providers, but did not feel that this benefit extended to patients (Lupianez-Villanueva et al., 2010). Others felt that technology accentuated the disparities in access to medical care, since those who own electronic devices had greater access to providers than those with limited access. Thus, economic disadvantages lead to lack of electronic access to providers among the underprivileged (Hanna et al., 2012). Physicians specifically cite lack of reimbursement and formal accounting for the time spent electronically communicating with patients as a barrier, a concern not expressed by non-provider staff (Ozkaynak et al., 2014; Popeski et al., 2015; Rodriguez, 2010; Siva et al., 2011;

Ye et al., 2010). Further, providers may be waiting until better evidence proves the impact of EM on service, patient outcomes, and the patient-provider relationship since thorough reviews have been inconclusive (Antoun, 2015; Atherton et al., 2012).

Many articles address barriers and facilitators to EM as it pertains to providers' job fit including safety, liability, and security issues (Atherton et al., 2012; Hanna et al., 2012; Lupianez-Villanueva et al., 2010; Popeski et al., 2015; Rodriguez, 2010; Siva et al., 2011; Ye et al., 2010). Providers were unsure how to address the need for confidentiality and patient privacy when triaging electronic messages or providing coverage for out of the office providers (Lewis & Dicker, 2015; Siva et al., 2011; Ye et al., 2010). Providers also expressed uncertainty regarding how EM may impact the patient-provider relationship (Hanna et al., 2012). Concerns about increased workload and time associated with EM occurs across many health care disciplines. (Atherton et al., 2012; Bishop et al., 2013; Crotty et al., 2013; Hanna et al., 2012; Johnson et al., 2014; Lewis & Dicker, 2015; Lupianez-Villanueva et al., 2010; Popeski et al., 2015; Rodriguez, 2010; Ye et al., 2010). Providers express that using EM opens them up to a barrage of messages that may be long, vague, and difficult to answer or inappropriately urgent (Johnson et al., 2014; Lewis & Dicker, 2015; Ozkaynak et al., 2014; Popeski et al., 2015; Siva et al., 2011; Ye et al., 2010). Further, providers do not know when patients open or read a message they send and express concern about the potential lag (Lewis & Dicker, 2015; Popeski et al., 2015). Furthermore, providers feel that there is not enough guidance on how to manage EM with patients and that clear medical and legal direction on EM may help facilitate its use (Atherton et al., 2012; Hanna et al., 2012). Significant barriers in perceptions and job fit continue to hinder greater use of EM. This may be compounded by additional barriers in the effort it takes to become proficient in the technology itself.

Effort Expectancy

Effort expectancy is defined as the degree of effortlessness associated with using a technology (Venkatesh et al., 2003). The construction and model of the technology matter. Studies found that providers do not use electronic messaging if they lack computer and technical skills (Johnson et al., 2014; Ozkaynak et al., 2014; Popeski et al., 2015). Studies further reveal that lack of system integration, such as separate logins, burden users (Heyworth et al., 2013; Ozkaynak et al., 2014). Cook et al. (2013) found that redesigning providers' inboxes reduced burden. Following an inbox redesign, 50% of clinicians felt that it positively impacted their work and none believed it had a negative impact (Cook et al., 2013). Research findings also suggest that physicians were more hesitant to integrate EM into their workflow than MAs or RNs (Liederman, Lee, Baquero, & Seites, 2005). The effort required to integrate EM into every day workflow may inhibit effective use.

Social Influence

Social influence is the perception that other important individuals believe that the technology should be used (Venkatesh et al., 2003). Providers may perceive that patients do not value EM (Antoun, 2015; Hanna et al., 2012; Siva et al., 2011). Providers expressed that patient demand and appreciation for EM acted as a facilitator to its growth (Bishop et al., 2013; Johnson et al., 2014; Ozkaynak et al., 2014). Researchers found that patients often expect responses more quickly than practical for busy clinicians. Impractical patient expectations prompted another message or a telephone call to repeat the concern or express frustration over the slow response (Ozkaynak et al., 2014). This type of patient behavior may contribute to the fear providers' hold of being overwhelmed by continuous messages and may negatively impact providers' adoption or promotion of EM. Additionally, societal shifts and culture at large promote the integration of

technology into all facets of life, including healthcare, placing pressure on the healthcare system to adapt (Irizarry et al., 2015). As highlighted above, influence also comes from governing bodies, creating top-down pressure to adopt and integrate specific technology-mediated changes (Office of the National Coordinator for Health Information Technology, 2015). Rodriguez (2010) suggests that a shift in the culture of care delivery is essential to successful implementation of electronic messaging. A variety of social factors both positively and negatively affect providers' use of this technology.

Facilitating Conditions

Facilitating conditions capture individual beliefs that sufficient technical and organizational infrastructure is in place to support use of technology. Clinical organizations must provide training, reliable computers, efficient computer programs, internet access as well as sufficient time to engage in EM in order to promote use of this technology. Many studies found that physicians cite these factors as barriers to adopting and using health technology, including EM (Hanna et al., 2012; Liederman & Morefield, 2003; Lupianez-Villanueva et al., 2010; Menachemi et al., 2011). When management provides support as well as adequate resources for implementation and training, adoption and use improves (Bishop et al., 2013; Hanna et al., 2012; Wakefield et al., 2010). Studies note that improving the flow of messages within an EM tool and facilitating effective use of the tool improves the likelihood that physicians will use it (Cook et al., 2013). Since providers express concern that patients will overwhelm them with messages, strategies to set patient expectations about EM seem important. Studies suggest that discussing EM practices during an initial visit or displaying a warning to patients when they use EM is effective for reducing this burden (Popeski et al., 2015; Rodriguez, 2010). When patients send urgent requests or their message is difficult for a physician to respond to because of length or

complexity, physicians should have request a face-to-face visit (Johnson et al., 2014; Popeski et al., 2015). Policies that are adherent to HIPAA and offer clear guidance on medicolegal issues may also facilitate use of electronic messaging (Hanna et al., 2012; Luo, Logan, Long, & Bercovitch, 2009; Markus & Leatherwood, 2012; Ozkaynak et al., 2014; Wakefield et al., 2010).

Finally, physicians should consider developing effective patterns for reviewing and responding to patients' EMs. Johnson et al. (2014) suggests habits such as responding to secure messages throughout the day, setting limits (such as finishing responses before a certain time of day), mastering as many shortcuts as possible, and asking patients who send frequent messages to keep a personal log and send a message only once per week or less. Other strategies include prioritizing messages at or near the top of the inbox; using smart tools such as templated notes; responding in a brief, succinct writing style; redirecting messages to appropriate team members; and promoting new strategies or care pathways to manage messages (Johnson et al., 2014; Popeski et al., 2015). These strategies were reported as successful by EM super-users (Johnson et al., 2014). Although facilitating conditions do not appear to be insurmountable, when absent, physicians find it difficult to effectively engage in EM with patients.

Gaps in Literature

Gaps in the literature examining physician use of EM fall into three main categories. First, studies fail to explore the relationship between provider attitudes and use of messaging. Next, there is little evidence that correlates consistent provider use of EM with patient outcomes or satisfaction. Finally, recommendations for how to improve provider use lack sound evidence, therefore "best practices" are difficult to ascertain from the available published literature. The majority of studies use interviews and self-reported data to capture best practice, however, these studies do not measure acceptance or use of EM. it is difficult to understand the real impact of

physician perceptions on actual use. Of the studies that recommend specific strategies to improve physician engagement, the majority fail to measure better provider or patient utilization rates (Bishop et al., 2013; Brown, 2013; Eaton, 2012; Johnson et al., 2014). , studies that examine discrepancies in workflow and technology fit did not link workflow and provider attitudes with patient satisfaction and data relevant to patient outcomes (Ozkaynak et al., 2014). Cause and effect relationships between physician behaviors, contextual factors, and patient outcomes remain largely unknown. There is a significant lack of intervention research that targets improving provider use of EM (Gagnon et al., 2009). One mixed-method study evaluated an intervention to reduce provider expressed burden in relation to secure messaging, however, this study did not include analysis of messaging frequency, volume, or response times (Cook et al., 2013). The impact of the intervention on factors associated with burden remain unknown. There is limited evidence of effective interventions for promoting the adoption of EM for healthcare providers.

The purpose of this study is to evaluate relationships and influence between provider attitudes and EM use. Since this project seeks to identify factors that may facilitate or hinder use of EM in outpatient practices, it is logical to utilize a theory with constructs known to impact use and behavior through the UTAUT. This project will address several limitations: (1) correlate provider expressed burdens and perceptions with quantitative measures of provider use, and (2) utilize quantitative measures of use and qualitative observations of workflow and practices to identify potential best practices. Findings from this project will be foundational for future work to improve EM practices.

CHAPTER 3: STUDY DESIGN & METHODOLOGY

Design

This is a descriptive, cross-sectional, mixed methods case comparison of provider (secure messaging) SM use in two outpatient clinics of an academic health system in the Southeastern United States, hereafter referred to as Academic Health. The literature review focuses on a mix of EM methods. This study's focus is on SM as this is the format used by the study's health system. A descriptive study is appropriate for examining provider perceptions of and interactions with secure messaging since there is limited research on this topic. This approach allowed me to capture chronological flow and develop explanations, while focusing on ordinary events in natural settings (Miles & Huberman, 1994). This project received Institutional Review Board (IRB) approval from the University of North Carolina at Chapel Hill and the academic health system.

Setting

In 2013, Academic Health implemented the SM component of its electronic health record and established the expectation that providers respond to patient initiated messages within 72 business hours. Providers were not expected to monitor incoming messages after hours. Patients received a universal message informing them not to use SM for urgent or emergent health concerns, and to expect a response within 72 business hours. Providers did not receive workload credit or financial remuneration for time spent responding to patients' SMs. To provide the greatest likelihood of capturing both facilitators and barriers to SM, two clinics with variation in the volume of SMs received from patients and number of hours until read by a healthcare team

member were chosen for study; one considered a high-achieving user and one considered a low-achieving user.

The primary care (PC) clinic, with three geographically dispersed locations clinics, provided primary care and sports medicine services. This clinic employed a total of 12 providers; eight physicians and four physician assistants (PAs), in addition to support staff. The specialty clinic (SC), located in the in the same region as PC, operates from a single clinic. SC provided medical and surgical services related to otolaryngology, head, and neck diseases. Medical specialties and support services include audiology, speech pathology, a voice care lab with speech pathology, a vestibular lab for testing and rehabilitation, a cochlear implant clinic, laboratory, nutrition, social work, radiology, radiation and medical oncology, and physical therapy. Oral and Maxillofacial Surgery is also housed within the clinic. The clinic had 27 providers including 25 physicians and two PAs, in addition to support staff. SC providers work in the clinic as well as rotations in an inpatient setting.

Subjects/Sample

Because SM augments face-to-face provider-patient communication, we recruited primary care and specialty care providers (e.g. physicians, PAs, RNs, MAs). Administrative staff were also recruited in order to provide additional information about SM workflow processes and organizational strategies designed to support the use of SM. Employees were selected based upon the following inclusion criteria: worked greater than 20 hours per week, employed in the practice greater than 3 months, and used SM to communicate with patients. Employees that did not meet these characteristics were excluded.

Following IRB approval, clinic managers were contacted by email. Following approval by clinic managers, an introductory email was distributed to clinic employees. This email

described the nature of the survey, semi-structured interview and observation process, participants' role, confidentiality and risk/benefits of participation as outlined in the IRB consent form. Participants were invited to complete the online survey via an embedded link in the email. Potential participants received three additional email invitations, spaced one week apart.

To identify key informants for semi-structured interviews and direct observations of SM use, the PI first analyzed results from the survey and SM use statistics. To gain the greatest perspective about SM, users were organized into the following categories to be key informants: satisfied, unsatisfied, high volume users, quick responders, low volume or slow responders. Key informants were then sent an email invitation to participate in a semi-structured interview and direct observation. Verbal consent was obtained; participants had the opportunity to decline participation (withdraw responses to any and all data collected to date) at any time during the course of the study. No compensation was offered.

Table 2: Study Measures

Quantitative	Qualitative
Provider perceptions via Likert scales	Semi-structured interviews
Volume of SM sent to each provider	Direct observations
“Responsiveness:” Percent of messages opened by healthcare team member within 72 hours	
Press Ganey patient satisfaction scores	
Patient portal and SM usage rates	

Measures and Analysis

Table 2 provides a list of data collection instruments and methods used in this project.

A 41-item survey (Appendix 1: survey) was developed using sources from the literature and was designed to assess provider satisfaction with and perceptions of SM and their beliefs about the effect of SM on care, liability, and asynchronous communication with patients (Crotty,

Mostaghimi, & Landon, 2013; Keplinger et al., 2013; Venkatesh, Morris, Davis, & Davis, 2003). Provider satisfaction with SM was assessed using nine questions adapted from Keplinger and colleagues (2013). Eight of these items represented true/false statements. For example, “Secure messaging increases my workload.”. The final item asked “Given the choice, you would endorse electronic communication between patients and providers” on a scale of 1=strongly agree to 5=strongly disagree. Thirty-one items from the UTAUT were included with minor modifications to indicate that SM was the technology of interest and clinic was the practice setting (Venkatesh, Morris, Davis & Davis, 2003). The remaining items were adapted from a study conducted by Crotty, Mostaghimi, & Landon (2013). Finally, data was collected from the EHR to determine SM volume and responsiveness per provider and per clinic. Reports included the volumes of SMs received, the percentage at which each clinic and provider responded to SM within 72 hours, and the average number of hours for a SM to be read per provider. The strength of the association between each survey construct and the volumes of SM and responsiveness were measured using Pearson correlation coefficient to determine the relationship between provider perceptions of SM and SM use.

The second phase of the study utilized semi-structured interviews and direct observations of SM use by key informants to identify modifiable factors that affect provider perceptions and use of SM. Using an interview guide derived from Johnson and colleagues’ (2014) study of secure messaging (Appendix 2: semi-structured interview guide), participants were asked about their experiences with SM. These interviews lasted between 5 and 20 minutes, were conducted in providers’ offices, and were audio recorded. Recordings were later combined with field notes. Simultaneously with the interview, the PI directly observed each key informant as they interacted with SM. Participants were asked to describe their actions out loud. These observations were also

audio recorded. All recordings were later combined with field notes to capture each participants' experience with SM. Each document was reviewed to identify facilitators and barriers to SM use. The data were abstracted into an Excel matrix and sorted to identify themes.

In the final phase of the analysis, the PI explored the association between SM use by providers and patient portal enrollment and patient satisfaction with communication because literature suggests that provider use or endorsement of EM with may increase enrollment and patient satisfaction (Amante, Hogan, Pagoto, & English, 2014; Goel et al., 2011; Lyles et al., 2013). A report was obtained that showed the 6-month volume of patients seen by each clinic, numbers of patients with an active patient portal account, numbers of patients who accessed their patient portal during the 6-month window, and numbers of patients that sent a SM to providers at each clinic. This report also calculated the percentages of each value out of the total numbers of patients seen. Further, three items from Press Ganey Patient Satisfaction Survey were collected to represent patient satisfaction with their provider and communication with their providers: (1) overall rating of their doctor; (2) likelihood of recommending the provider's office; and (3) doctor's quality of communication. The overall doctor rating used a scale of 0-10 with 0 representing poor and 10 high. The scale for recommending the providers' office and communication quality both had three items: no, yes- somewhat, and yes-definitely. Analysis was conducted for each clinic as individual provider data was not available. Simple statistics were used to describe trends and compare performance between clinics.

CHAPTER 4: RESULTS

Summary

This study utilized identified measures to understand the relationships between providers' perceptions and use of SM in practice. Contextual richness provided by qualitative data from managers as well as interviews and observations with providers and various staff, offers insight into the nature of the relationships identified. Results are structured in the following format: 1) clinic details as reported by clinic managers; 2) survey sample details and results; and 3) results from study aims. Figure 1 provides a review of provider measures utilized in this study.

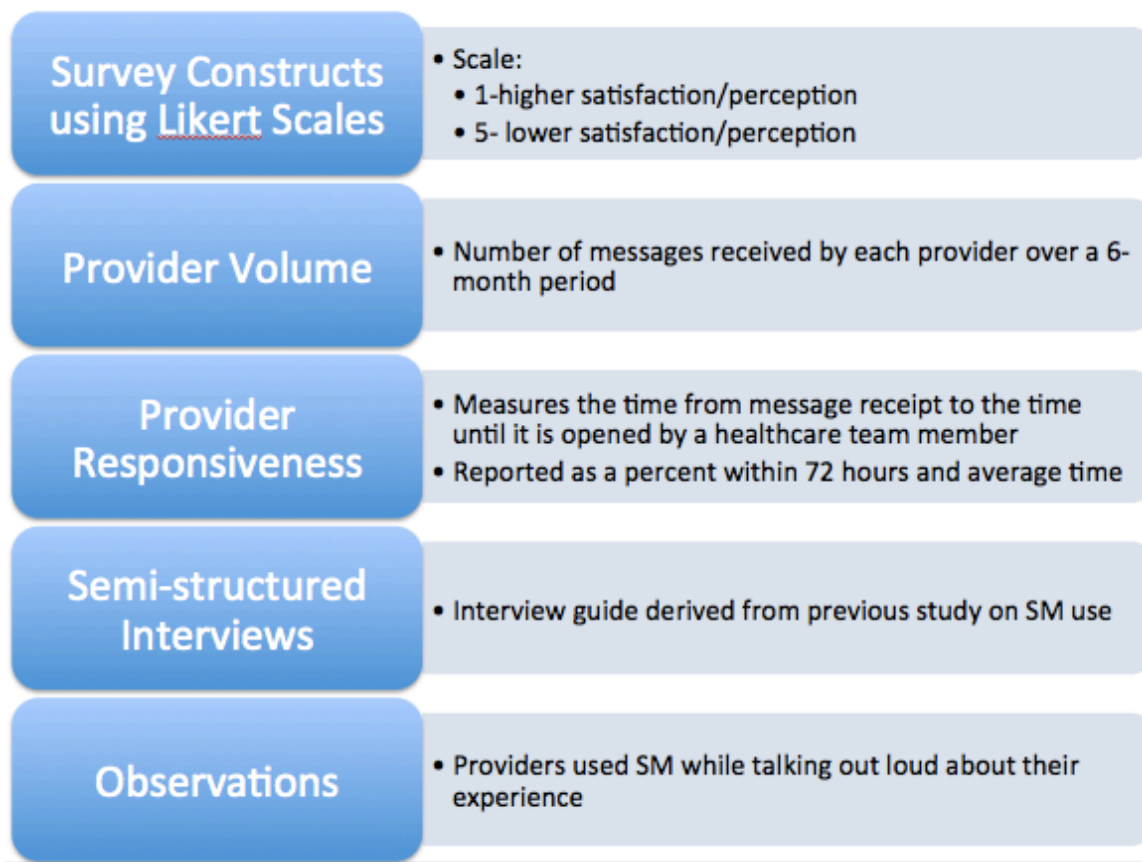


Figure 1: Provider Measures Utilized in this Study

Clinic Details

Clinic managers from both PC and SC described the workflow and practices surrounding SM within their clinics. Within the PC clinics, each provider has a pool, or centralized “inbox” where all messages are delivered, built for SM that they and their assistants can access. It also allows for other staff to log in to the pool if they are assigned to cover during vacation or sick time. Each provider is ultimately responsible for responding to all medical questions. However, the provider may delegate the task of writing responses to the nurse or assistant, following providers’ verbal directions. It is expected that messages are answered daily, or at the latest within 72 hours of receipt of messages sent by the patient or proxy. Providers are not expected to immediately respond to a message if it is received outside of office hours. There is no designated time set aside for providers to respond to messages. Within PC, providers are trained

by shadowing a senior provider. The clinic also attempts to select an experienced assistant for the provider to help with orientation to the system. Reports are available on usage, volume, and responsiveness for each provider but no financial incentive is in place.

Every PC staff member and physician is responsible for talking with the patient regarding electronic communication. From check in to check out, everyone is expected to encourage patients to use the patient portal. After checking vital signs and performing a medical intake, assistants will inquire if patients have signed up for the patient portal. If a patient has not, the MA will show them kiosks available for signing up while the patient is waiting for the provider.

At SC, providers are also expected to respond to a SM within 72 business hours. Within SC, messages are sent into a general pool, rather than to an individual provider. Messages are triaged and responded to, and if necessary, forwarded to a provider for review and response. If providers are planning to be away, their in-basket is assigned to the nurse or another provider for review. As in PC, providers are ultimately responsible for responding to messages. Providers receive training on using electronic messaging during orientation. Providers received feedback via the reports on usage, volume and responsiveness for SM. Similar to PC, no financial incentives or penalties are in place. Providers receive no designated time to answer SM. If a message is received outside of office hours, providers are not expected to immediately respond.

Survey Results and Sample Details

Eighteen of 37 (48.6% response rate) providers from the two study clinics participated in the survey. Four respondents self-identified as part of the primary care clinic (3 physicians and 1 PA), twelve self-identified as part of the specialty clinic (10 physicians and 2 PAs), and two failed to identify their clinic (unknown provider type). Of the survey respondents, 6 were female and 12 male. Half of the respondents (n=9) had been at their current practices for more

than 5 years, while one third (n=6) had been at their current practice for 2 years or less. Most respondents were very experienced in their provider roles, with half of the respondents working in their current roles for over 10 years (n=9), while only 2 had 2 years or less of experience. Two-thirds of respondents (n=12) had been using SM for 3-5 years, indicating that they had been at the practice since patient-provider SM was initiated, while one-third (n=6) of providers had been using SM for 2 years or less. The majority of providers were not new to using EM, including email, with patients. One-third of respondents (n=6) had used EM with patients for 6 years or more, with only two having less than 2 years of experience. See Figures 2 through 6 for details.

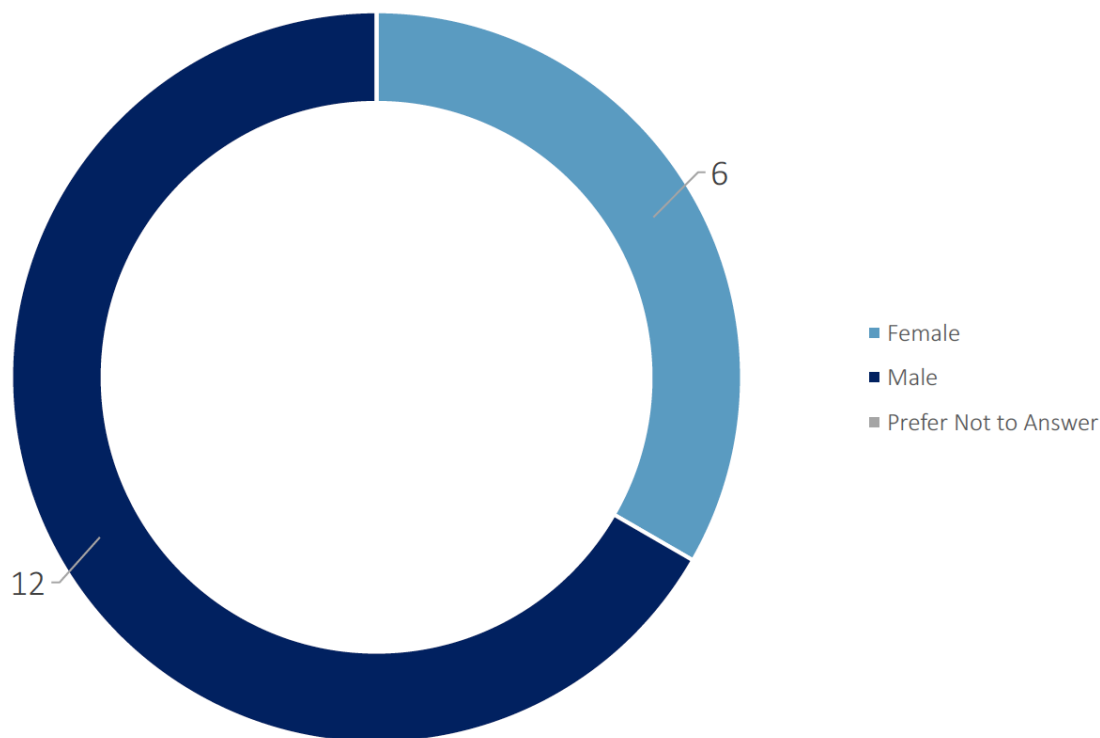


Figure 2: Gender of Survey Respondents

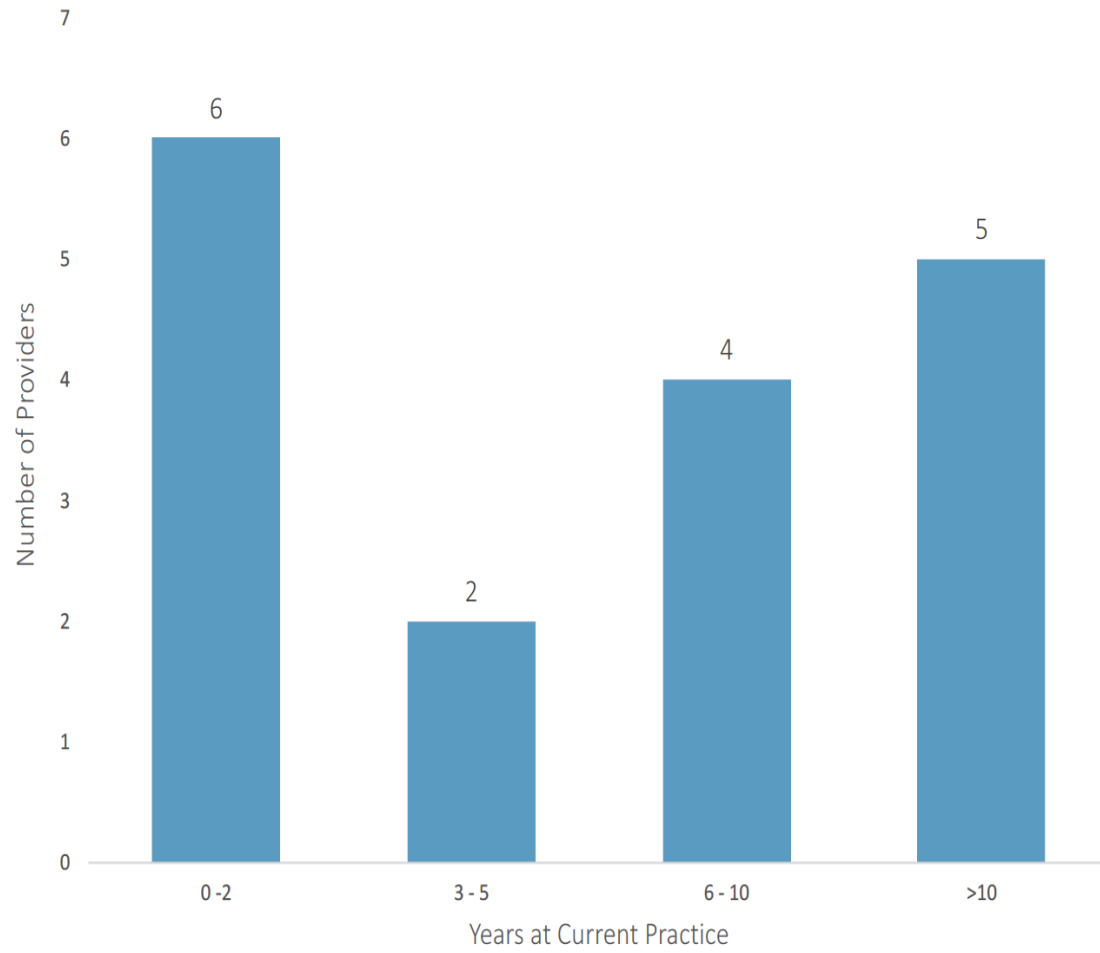


Figure 3: Respondents' Number of Years at Current Practice Site

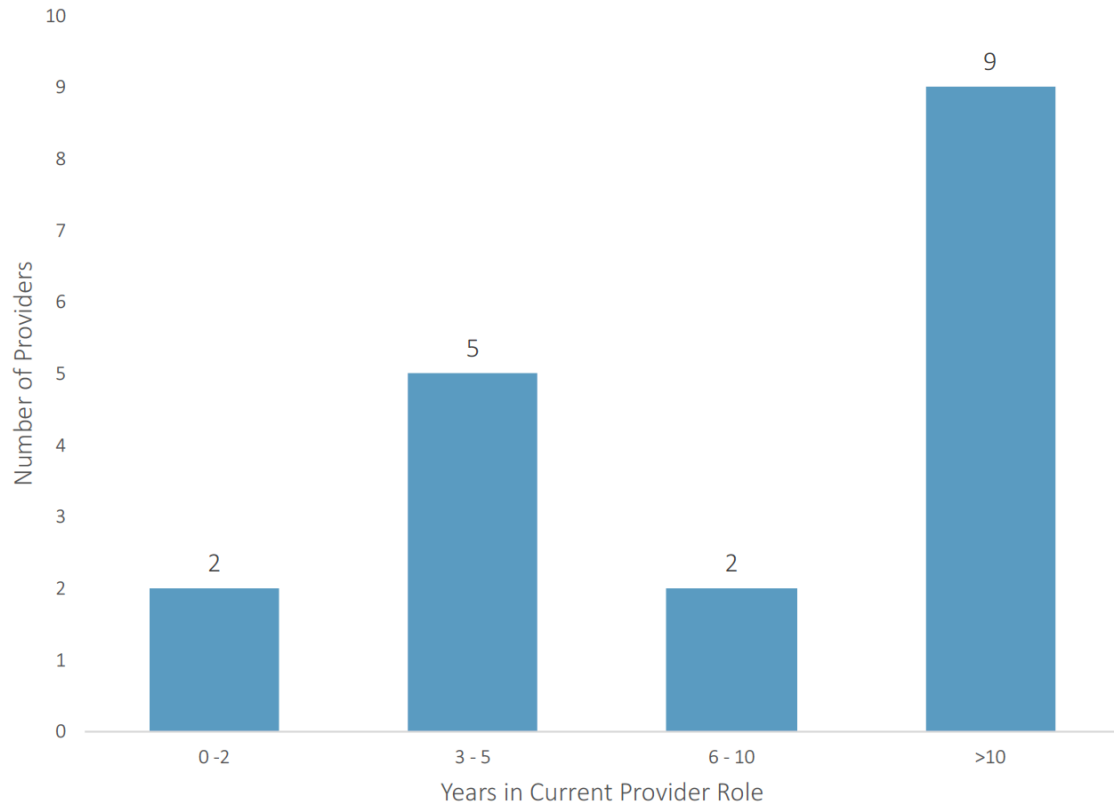


Figure 4: Respondents Number of Years Practicing in Current Provider Role

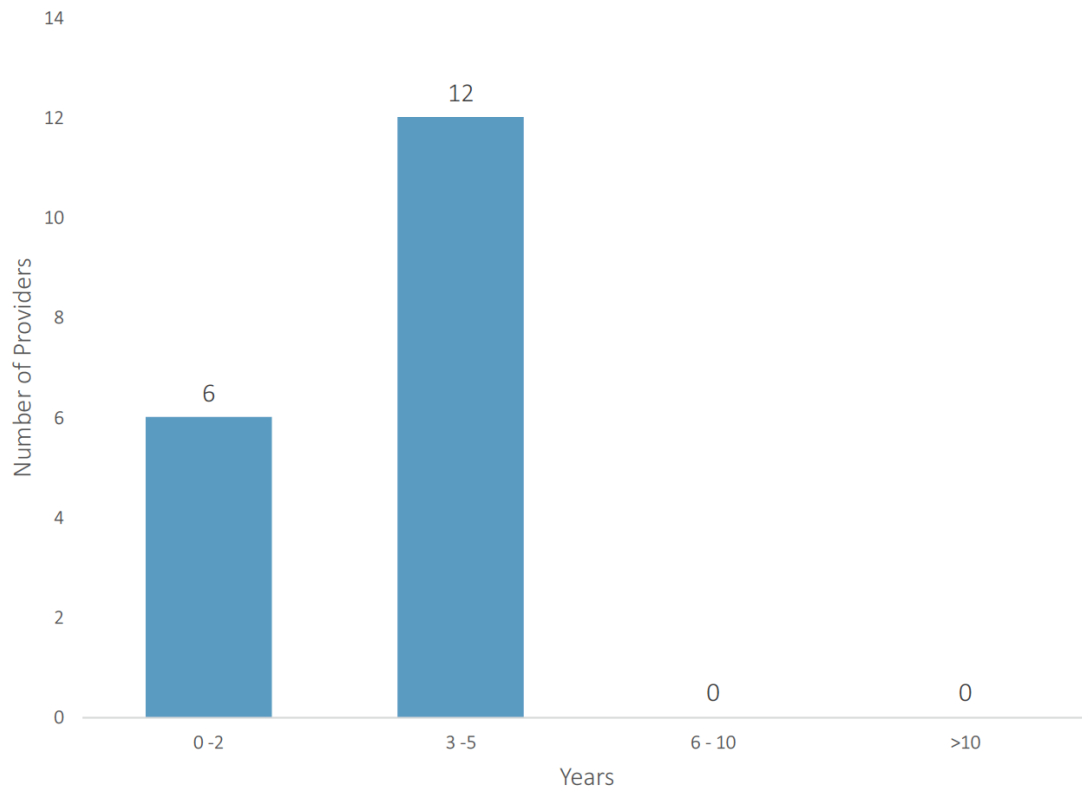


Figure 5: Survey Respondents' Number of Years Using SM with Patients

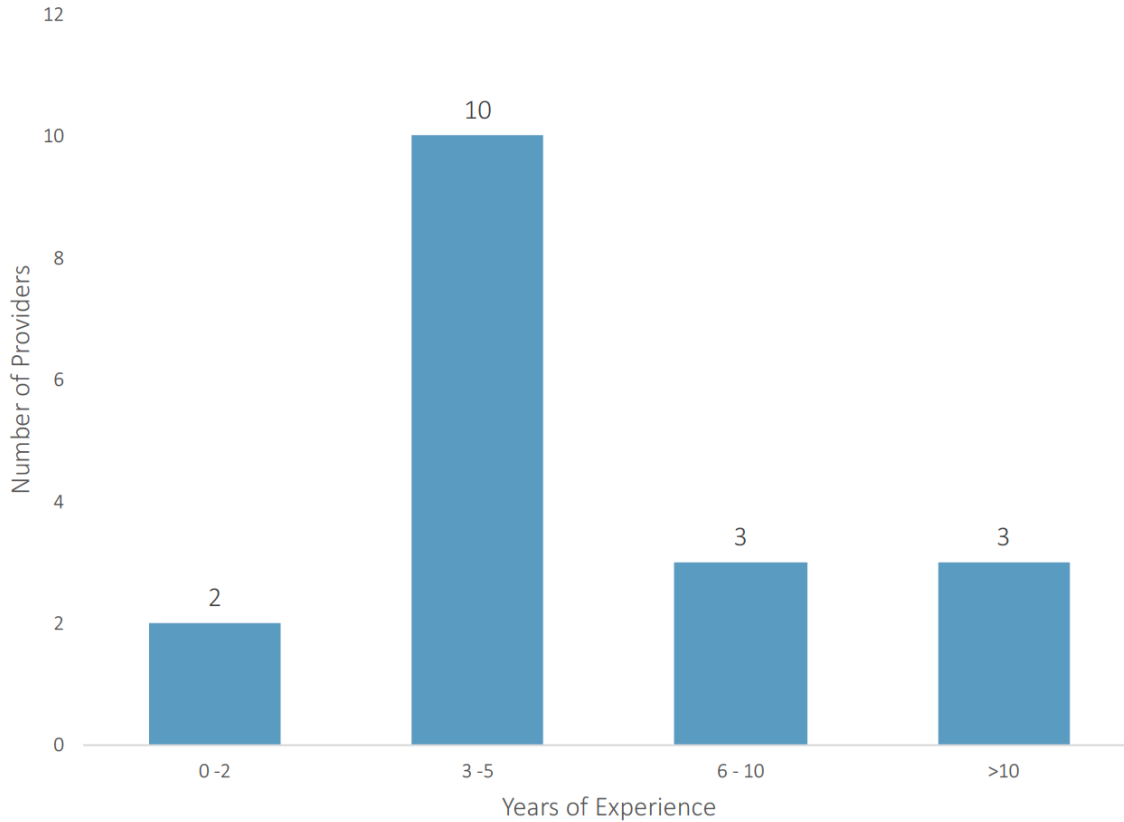


Figure 6: Survey Respondents' Number of Years of Experience Using EM with Other Providers

In the survey, nearly two-thirds (n=11) of the respondents indicated that patients still e-mail them outside of the SM feature of their patient portal. Nearly 75% (n= 8) of those providers indicated that they referred those patients to their patient portal. Additionally, nearly three-quarters (n=13) of the respondents indicated that they consistently check for SMs throughout their day. Less than one-quarter (n=4) reported checking for SMs at home including 2 providers from PC and 2 from SC, though it is not required by the organization. See Figures 7 and 8 for details.

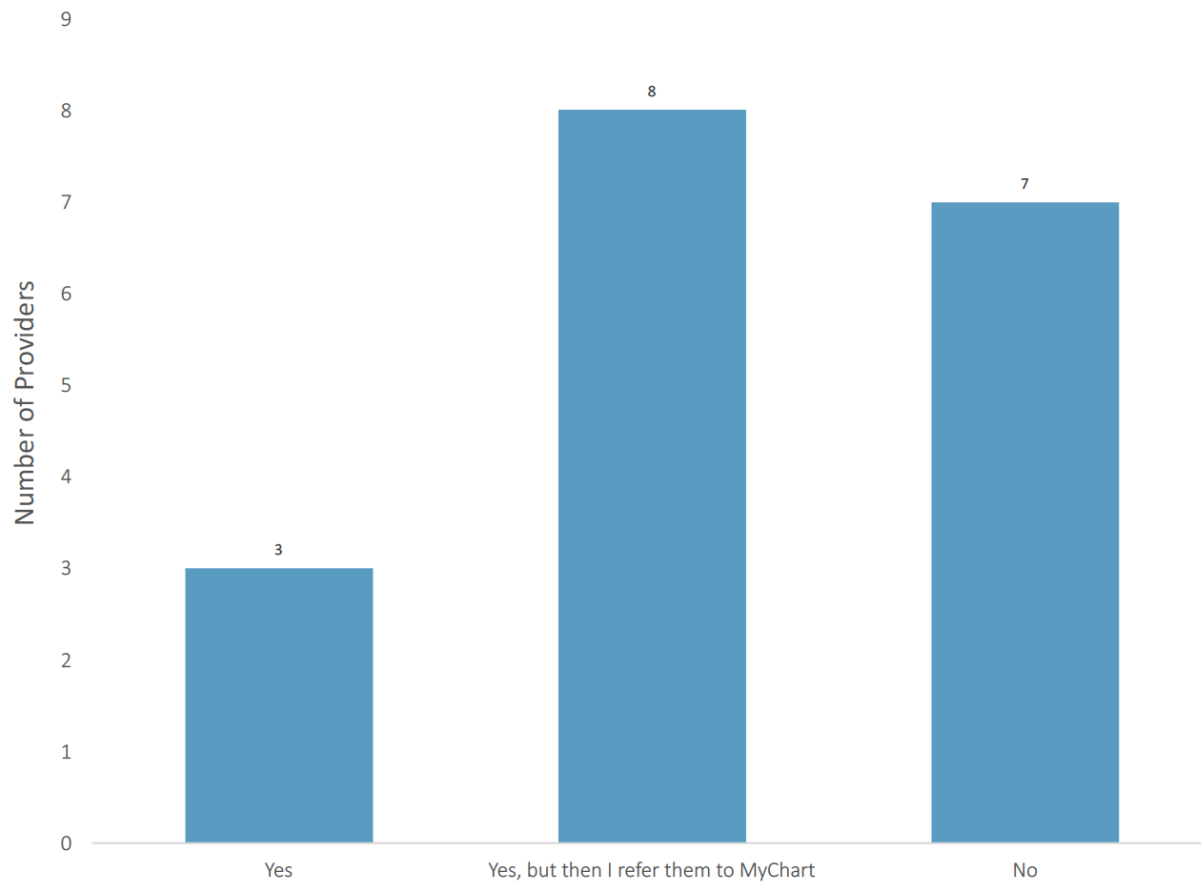


Figure 7: Survey Respondents' Use of Email Outside of SM from Patient Portal

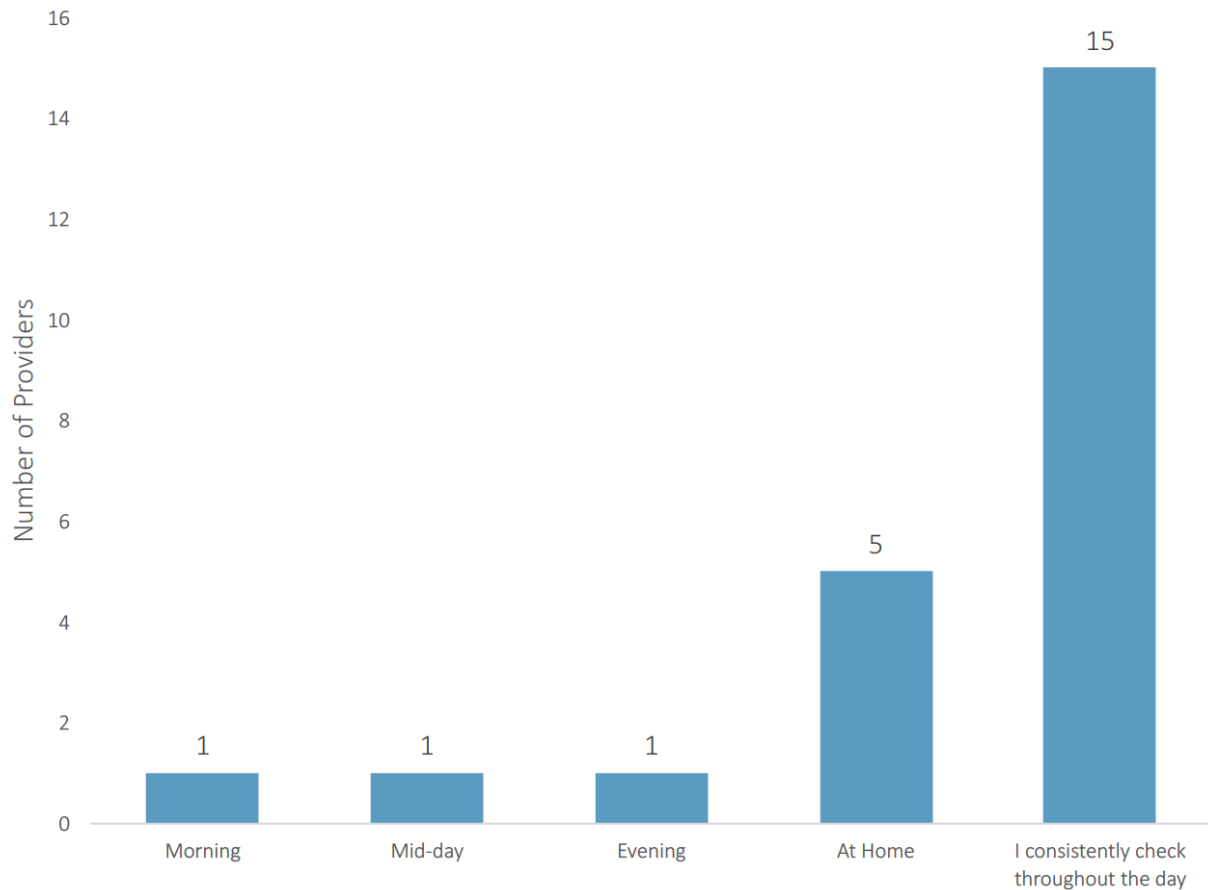


Figure 8: Survey Respondents' Timing of Checking for SMS

Missing survey data was substituted with the mean score of the appropriate clinic. Due to small and uneven sample sizes, there was no attempt to calculate statistical significance. From the survey respondents, eight providers (five physicians and three PAs) participated in interviews and direct observations. In addition, interaction with providers lead to the inclusion of three additional nurses and medical assistants, later identified using the term “support staff”, for participation in abbreviated interviews. Two physicians, one PA, and one support staff participated from PC while three physicians, two PAs, and two support staff participated from SC.

Aim 1: Relationship between provider satisfaction and perceptions and use of SM.

Provider satisfaction and perceptions

Overall, respondents were slightly satisfied, mean score = 2.86 (where 1 represents “highly satisfied”), with secure messaging. PC respondents were more satisfied (mean = 2.44) than SC providers (mean= 2.94). Responses ranged from 1.44 to 4. Scores for performance expectancy, or the perception that SM will improve work tasks, ranged from 1.33 to 3.33. Providers expected some gain from SM (mean score = 2.87) with PC expecting more benefit (mean=2.81) than SC providers (mean=2.88). Provider perceptions of ease of use, or effort expectancy was 2.39, with both PC providers (mean=2.33) and SC providers (mean= 2.36) responding fairly equally. Scores for social influence, or the perception that powerful members of the organization favorably view secure messaging, ranged from 1.5 to 3.75. PC providers perceive greater social influence (mean= 1.75) than SC (mean=2.55). While all providers perceived adequate facilitating conditions (mean= 2.28), defined as sufficient technical and organizational infrastructure, PC providers perceive greater support (mean= 1.94) than SC (mean= 2.57).

Survey results indicate that providers showed slightly positive attitudes about SM use. PC respondents had a more positive perception (mean= 2.04) than SC respondents (mean = 2.58). Regarding questions on how use of SM might impact patient care, respondents indicated a slightly positive view overall (mean= 2.32) with scores ranging from 1.5 to 3. PC respondents had a slightly more positive view (Mean = 2), then SC respondents (mean= 2.36). Both groups of providers were concerned about liability (mean = 3.33), with scores ranging from 1.33 to 4.67. PC providers were more concerned about liability (mean= 3.67) than SC providers (mean = 3.1). When considering the role and comfort of using SM as a means for providing care, providers

were generally comfortable (mean=2.41; range 1.5 to 4.5), with PC respondents expressing greater comfort (mean=1.88) than SC respondents (mean = 2.64).

Overall, all respondents' scores were close to neutral (score of 3). PC respondents, for the most part, were slightly more positive than SC respondents. Given that most of the survey respondents have been using SM since its initiation, it is unclear how the perceptions and attitudes of these providers may have changed overtime. Means of each construct including standard deviation are displayed in Figure 9.

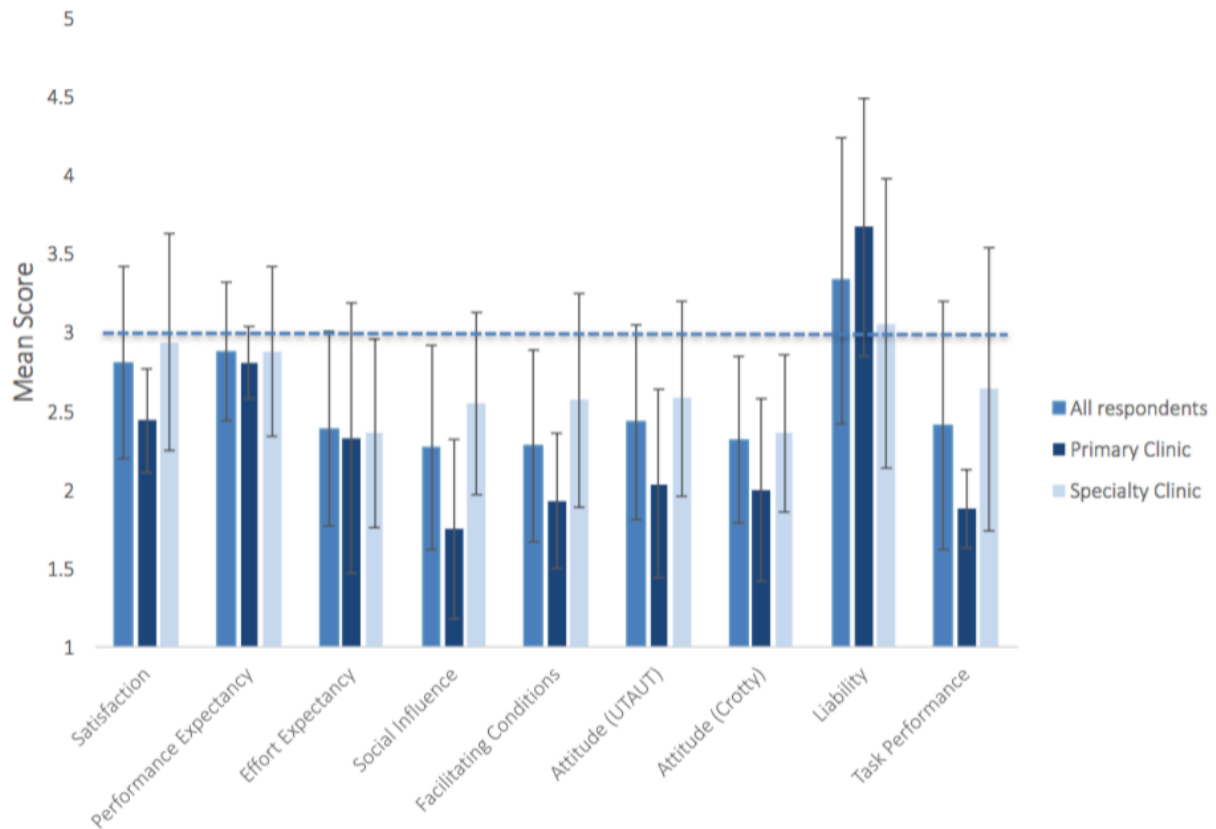


Figure 9: Mean, Standard Deviation, and Standard Error by Construct and Clinic

Correlations of satisfaction with survey constructs

When correlating the constructs with one another, several constructs showed moderate to strong relationships with satisfaction. The lowest correlations with satisfaction included social influence ($r=0.04$) attitude ($r=0.2$), liability ($r=0.18$), and task performance ($r=0.19$). These suggest that higher levels of reported satisfaction have negligible relationships with the perception of social influence, attitudes toward the technology, its impact on care, or comfortability with communicating with patients via SM. The construct of effort expectancy was moderately correlated with satisfaction ($r=0.53$), indicating that those who perceived less effort to be required to use SM also reported higher levels of satisfaction. Performance expectancy also had a moderate correlation with satisfaction ($r=0.56$), indicating that providers who perceived some benefits to their work through using SM, also reported higher satisfaction.

A moderate correlation also existed between satisfaction and facilitating conditions ($r=0.63$), suggesting that providers who reported higher levels of satisfaction also perceived greater organizational supports to be in place.

SM volume and provider responsiveness

Analysis revealed that in a 6-month period, PC providers received significantly more SM ($n=11,871$) than SC providers ($n=1,473$). For PC respondents included in this study ($n=4$), SM volume represented 30% of the total clinic volume of SMs. On average, each PC participant received 876 messages and opened messages within 6.9 hours of receipt. For SC providers included in this study ($n=12$), SM volume represented 87% of the total clinic's SMs. On average, each SC participant received 106 messages in a 6-month period and opened messages within 78 hours of receipt. The organization expects providers to read secure messages within 72 hours of receipt. PCs achieved this goal 98.75% of the time, while SPs achieved this goal 68% of the time. See Figures 10 and 11 to see these numbers.

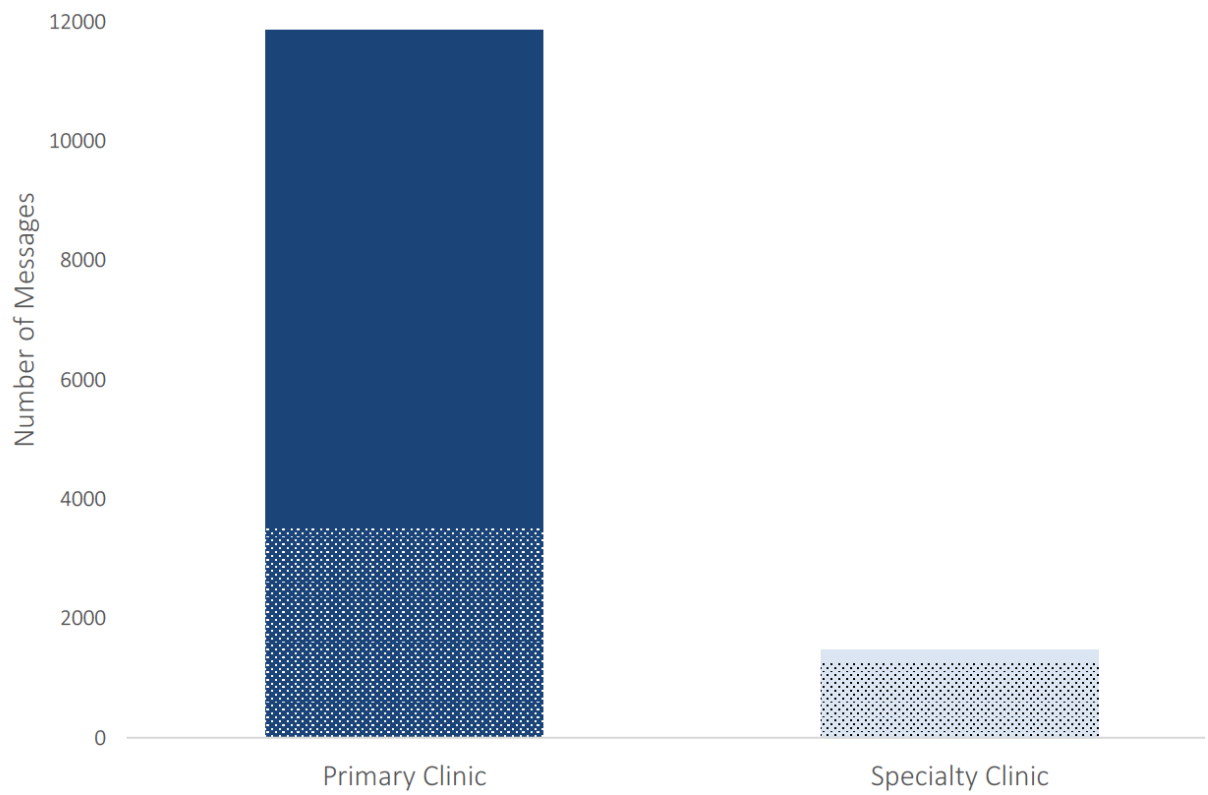


Figure 10: Message Volume by Clinic

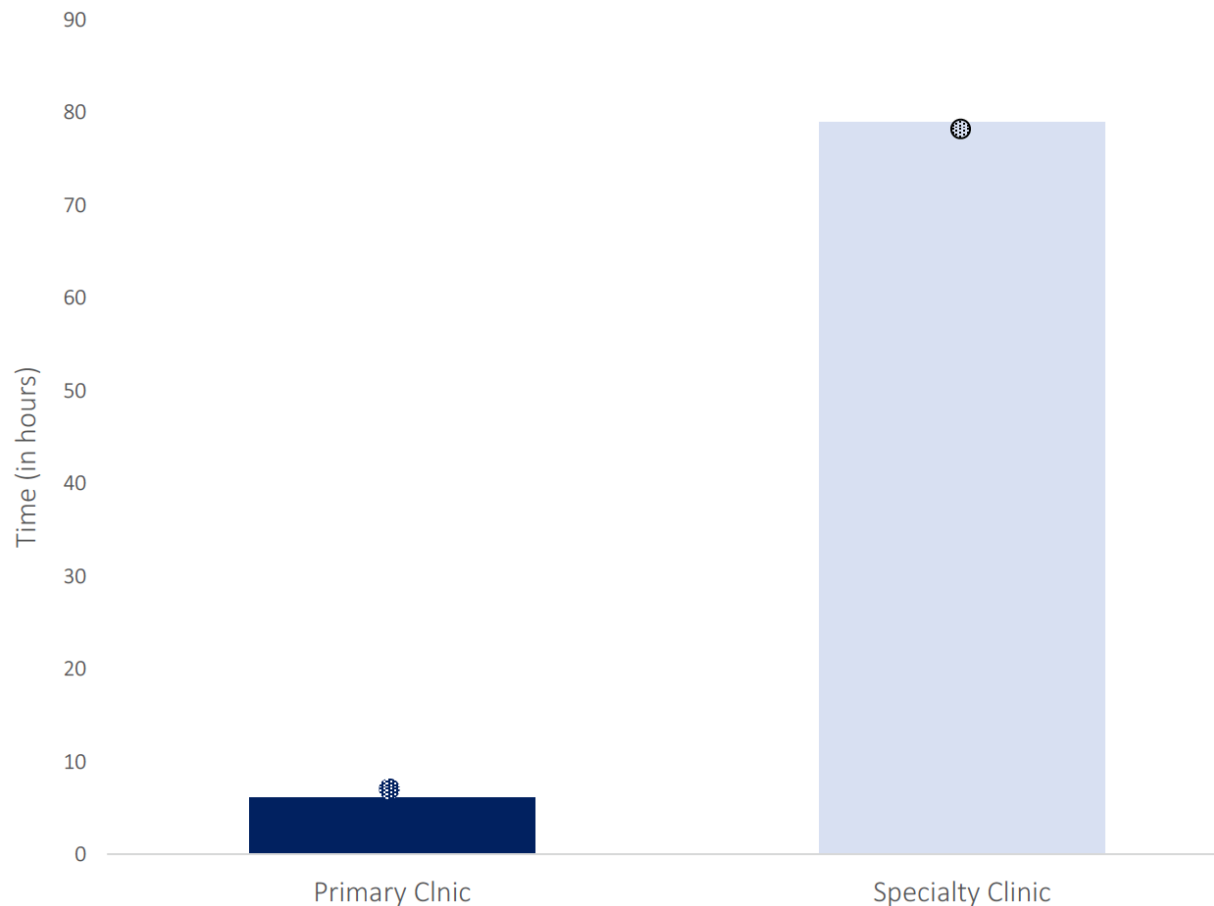


Figure 11: Message Responsiveness by Clinic

Associations between provider perceptions and use

Pearson correlations between survey constructs and SM usage measures revealed that greater satisfaction (where 1 = highly satisfied) was weakly correlated with higher SM volumes ($r = -0.32$) indicating a weak relationship where more satisfied users have higher volumes. Provider satisfaction and responsiveness was also weakly correlated ($r = 0.38$) indicating that providers with greater satisfaction may have shorter response times. No relationship was found between performance expectancy and SM volume ($r = -0.06$), indicating that this construct may not be impacted by volume. However, performance expectancy and responsiveness had a weak correlation ($r = 0.33$), showing that providers who perceived greater gains from SM had shorter response times. Effort expectancy and volume had a correlation coefficient of -0.1 , also

indicating a negligible relationship with volume. A weak correlation existed ($r=0.24$) with responsiveness. Social influence showed the greatest correlation with volume with a correlation coefficient of -0.68 . This suggests a moderate to strong relationship where users with a high perception of social influence to use SM have greater volumes. However, social influence and responsiveness had a weak correlation ($r=0.39$) suggesting that social influence may have a small impact on how quickly providers open their SMs. Next, facilitating conditions appeared to have a moderate relationship with volume with a correlation coefficient of -0.42 , suggesting that individuals with a greater degree of belief that technical and organizational support is in place have higher volumes of SM. Facilitating conditions and responsiveness showed a strong relationship ($r=0.73$) indicating that those with a higher perception of technical and organizational support took less time to open the SMs. The construct regarding attitudes had a moderate correlation ($r=-0.3$) with volume, indicating that a more positive attitude had a slight relationship with higher volumes. Attitude had a negligible correlation ($r=0.12$) with response times. The liability construct had the only positive correlation of 0.4 , suggesting a moderate relationship between providers who perceived greater liability and SM volume. Liability and responsiveness were negligibly correlated ($r=-0.15$) suggesting that perceptions of liability may not impact response times. Finally, the task performance construct had a correlation value of -0.47 , suggesting a moderate relationship between feeling more comfortable writing messages to patients and volume. Task performance and responsiveness showed a moderate relationship ($r=0.44$), indicating that comfortability with writing to patients may positively influence the time providers take to respond.

In an analysis that separated SC providers from the overall group, the majority of correlations with constructs showed negligible to weak relationships. However, facilitating

conditions and responsiveness showed the only strong relationship ($r=0.74$), indicating that providers who perceived greater technical and organizational support had shorter response times. See Figure 12 for the scatterplot. Facilitating conditions was one of the strongest moderating factors across all providers. Though some relationships exist between the survey constructs, volume, and responsiveness, the direction of these relationships remains unknown.

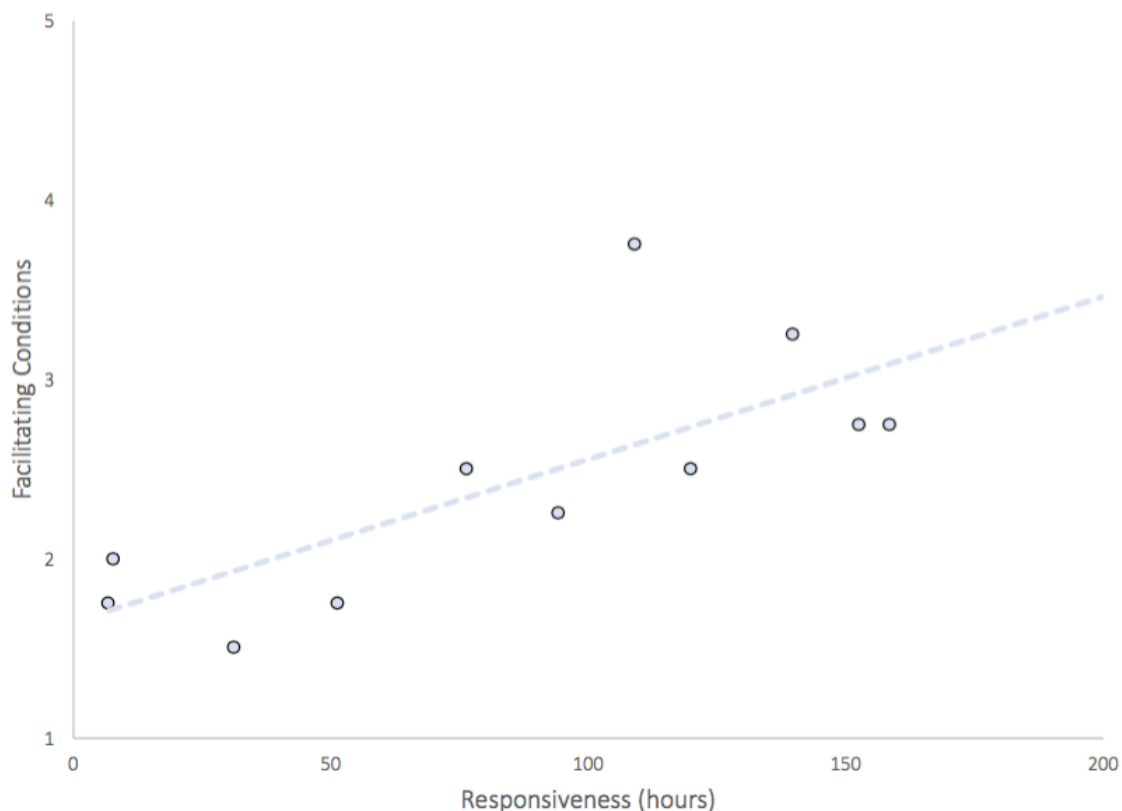


Figure 12: Scatterplot of SC Providers' Facilitating Conditions Score and Response Time in Hours

Aim 2: Modifiable factors that impact provider use

The second aim of this project was to identify modifiable factors that affected provider's satisfaction with and use of secure messaging. In total, eleven interviews were conducted from December 2016-January 2017. Interviews and observations lasted between 5 minutes and 35 minutes. The observations and interviews with the PAs and physicians followed a semi-

structured interview guide, while the interviews with the nursing and MA staff were more spontaneous and informal.

Overall, seven major themes emerged from the interviews. These include information related to task management such as individual strategies to manage messages, time, and using a team approach, as well as benefits, barriers, thoughts on patient knowledge, and technology concerns. Each theme will be explained in further detail below.

Individual strategies to manage messages

The ways in which providers review their inbox, read messages and responded to patients varied widely. Several providers tried to look at their inbox throughout the day, often to make sure nothing urgent came through. Others reviewed throughout the day, although they responded after they are done seeing their clinic patients. Three providers responded to messages as quickly as possible, while another only responded to urgent messages during the clinic workday. One provider shared that others had told her to wait to respond to message in order to prevent patients from always expecting an immediate response. Many providers tried to minimize the size of their inbox and not let messages gather. Others kept messages in their inbox to use as a reminder for tasks or communications that need additional details before responding. One provider also marked messages as unread to use as a reminder.

In order to promote efficiency, providers triaged messages, wrote concisely, and used system tools to create standardized responses to routine inquiries. Three providers prioritized messages by opening all of their messages and responding to the least time consuming first. A support staff member voiced using triage principles to prioritize messages, responding to the most urgent first. In contrast, other providers managed messages simply in the order that they appeared in the inbox, from top-down. Two providers brought up the importance of knowing the

patient as they prioritized responding to messages. Providers also tried to keep responses short since short responses helped to minimize their workload. One provider stated, “Don’t engage the long message with a long message, that only encourages long messages.” (*Specialty Clinic Provider*).

Five providers also used smart tools, or predefined text, in their messages for things such as lab results and patient education. Smart tools include smart phrases and templates for commonly used sentences or communications. Although others preferred creating individualized responses for each patient. For example, one SC provider used the term “boxed responses” when describing smart phrases, voicing that individual questions deserve individual responses. Sometimes providers received messages that were lengthy, complex or were difficult to respond to. Although one provider dealt with the most difficult patient messages solely through messaging, the majority of providers tried to set limits by minimizing the amount of time they spent writing a response. When responding in writing became too burdensome, providers would either call the patient or request that they come in for a face-to-face visit.

Providers also varied in their willingness to initiate messages to patients. Several providers initiated messages to patients in situations such as sending lab or test results, to “touch base,” or if they had forgotten to address or ask something during a face-to-face visit and then remembered later. Three providers specifically stated that they did not initiate messages, but rather preferred to call their patients. For instance, one provider verbalized, “Sometimes its difficult to really get the true sense of what somebody is trying to get at... You know, there’s intonation and there’s inference that you just don’t get via text. Sometimes its just better to call.” (*Specialty Clinic Provider*). He noted that at times it is difficult to get to the heart of a concern

via electronic means due to the absence of non-verbal communication that add depth and understanding to what a person is communicating.

Time

Providers also described the amount of time they spent responding to messages.

Providers spent a few minutes up to an hour responding to messages each day. Since responding to messages was not billable, providers felt the need to limit time spent responding to messages.

All eight providers stated that they were not given dedicated time to handle SM. Only one SC provider felt there was plenty of time to manage SM, possibly because he verbally answers SMs with his support staff, who would then send a SM response to the patient. When managing the physical task of messages, seven providers brought up closing secure message encounters.

Closing a secure message encounter is the provider's way of completing the task; it takes the message out of the providers' inbox and completes the thread so that no more messages may be sent from that encounter.

Teamwork approach to managing messages

More than half of providers participated in a team-based method to allow support staff access and permission to respond to SMs through a collective in-basket or "pod." Support staff triaged messages to determine which they could answer. One PC provider verbalized being integrated into her own pod while maintaining primary responsibility for all messages. Providers used different methods to oversee the content of responses to patients including: (1) providers typed a short, succinct message back to the nurse who would then elaborate and send the message back to the patient.; (2) providers talked through their responses with their nursing staff and then the nursing staff responded; and (3) utilized protocols for the nurses and assistants to discriminate what was important and what messages they could answer without additional input. Three providers stated that they trusted their nurses and knew that they would respond

appropriately. Trust in their support staff allowed providers to see their face-to-face patients without worrying and helped them to do their job more effectively in a way that suited them best. One provider gave the following example about delegation, "...As much as I can, within reason, and with instruction. Because I can tell them what to do, but they can actually take the time to do the clicks that I don't have the time to do." (*Primary Clinic Provider*). In several cases, support staff did background work to expedite the message response, such as searching through the patient's medical record in order to best answer the patient's question. To facilitate effectively using support staff to respond to messages, one provider recommended working with assistants to create templates, smartphrases, or protocols that help facilitate message responses. Two participants shared stories about responding to patient messages utilizing the help of other team members such as managers. However, three providers and one support staff either used a team-based approach but did not know who else was a member of their team or did not use a triage process at all. In addition, one provider used the forward function in the inbox to send relevant messages to other providers within the team and thus utilized it as a way of communicating with other providers.

Benefits

Providers from both clinics believed secure messaging improved communication with patients, increased access to care and helped avoid unnecessary use of face-to-face visits. Although providers felt the quality of the care provided was unchanged, they did perceive a benefit to increased communication with patients. One provider noted that messaging helped eliminate mistakes and things that got lost in translation because patients were able to write out everything they want and have it read directly by the healthcare team. Providers also described instances where SM helped increase their availability to patients and mitigate barriers that

patients may confront as they access care. For instance, a PC provider voiced that SM improved care by helping to “close the loop.”

“It’s actually most useful on the weekends, when patients either have to use the on call line or go to an urgent care... A lot of times its something that I’ve seen them for ahead of time... I had seen someone for a cold on a Thursday, and then on Saturday morning they wake up with a fever of 103. So their options are, ‘I can go to the ER, I can go to urgent care, but I just saw my provider for this, and she told me to watch out for a fever.’ So they’ll just send me a MyChart message and I find it really helpful, cus then I can just say, ‘Ok, well I think this has developed into a sinus infection. Let me just call you in something’.”

A SC provider voiced that SM improved care by reducing unnecessary visits and, in turn, opening more appointments for patients that needed to be seen face-to-face. Two providers found secure messaging particularly helpful for patients with chronic complaints who are seen frequently, because SM is embedded in the electronic health record and provides easy access to chart information. Several providers mentioned that their patients seemed to appreciate their use of secure messaging and often thanked them.

Barriers

Providers and staff expressed many situations that may serve as a barrier to using SM including: asynchronous nature; lack of reimbursement; potential breach of confidentiality; lengthy complex messages and the impersonal nature of SM. Several providers expressed concerns about liability in instances where messages may be misread or misinterpreted. They also worried about not knowing when a patient may read a message they send. For instance, one SC provider cautioned, “This thing, this can be dangerous,” relating an experience when she had received an SM in which the patient clearly needed to go to the Emergency Department. The provider was concerned that there was too much of a delay before the message had been opened, and that the patient may not have received the provider’s response in time to seek emergency care. Providers also raised the concern that patients may use SM as a way of getting around

paying for a visit when they really needed to be seen. In this example as well as in descriptions of time management, reimbursement remains an important issue and was seen as a burden by several providers. Confidentiality was also an ongoing concern raised by several providers. For example, teens do not have to share their medical records with parents, however, due to proxy accounts for children, where parents have electronic access to records, providers feel that some situations created ethical issues that they did not know how to address. All eight providers brought up experiences with difficult patient messages, often describing them as lengthy, full of questions, vague, or repetitive in nature. One provider called them, “long, long, stream of consciousness diatribes...” Three SC providers also highlighted improper patient expectations as another burden. For instance, they expressed concern that “instant access” was inappropriate for healthcare, stating that patients didn’t seem to understand the point of secure messaging, and were easily offended when a message was not answered immediately. One provider stated, “If I’m late or I don’t respond, it’s probably for a good reason,” noting that things such as secure messaging create an illusion that people have immediate access to their doctor. Many providers who expressed concern about time management, felt that electronic communication was impersonal in nature, and that some topics are too sensitive and inappropriate for messaging.

“Sometimes in basket messaging is almost a way of not communicating. It’s just kind of like, give them a quick answer and then shoo, go away... Sometimes it’s a quick way to deal with it, but sometimes it’s also an avoidance.” (*Specialty Clinic Provider*)

Patient knowledge and education

Provider opinion about the need to educate patients about appropriate and timely communication varied widely. Four providers, who did not perceive that patients sent inappropriate messages, also did not believe that their patients needed education. Others felt that

patients had an understanding of what was appropriate to send via SM. However, four providers (1 PC and 3 SCs) and one support staff verbalized that patients lacked full understanding of what constitutes an appropriate message. Two additional providers did not proactively educate their patients, but felt that they might in the future, as they had received some inappropriate messages. Taking time to provide education may have limited value for providers:

“If you coach then you spend a lot of time coaching for situations you don’t need. Right? So if I see twenty patients a day, I only get one message from them, so if I would coach twenty times that’s just twenty times of time spent that I don’t need to do.” (*Specialty Clinic Provider*)

Three providers and one support staff verbalized that they educate their patients because they recognized that patients occasionally send inappropriate messages. Two of those providers had recently begun to include information via a smartphrase in each patient’s after visit summary that educated patients on appropriate use. Although managers explained that verbally explaining use of SM to patients was the expectation, one support staff made a point to explain SM to patients when she was seeing them. Several providers educated their patients on an as needed basis, only after an inappropriate message was sent.

Technology concerns

Providers identified barriers to using the messaging technology. Although two providers did not see any problems with the SM tool, five felt the technology was burdensome. Burdens included the requirement to log in frequently because of being timed out and perceptions of the technology being in the way of patient care. Two providers felt that technology in general impeded relationships with patients.

“For me, just workload wise, I don’t like having the computer in front of me the whole time. Like you’ll hear patients all the time that talk about, ‘the doc just looked at the computer and typed in,’ or whatever, and you know, if you’re looking at other stuff then it just distracts me more in terms of who I’m talking with or seeing... People don’t feel

like they get listened to, you know, if you're just on the computer.” (*Primary Clinic Provider*)

Another reflected that technology was changing the way medicine was being practiced, with patients bringing in expectations from other aspects of social media that may not be helpful to the practice of medicine.

Providers also recommended improvements to tool design for themselves as well as for patients. From their perspective, providers desired better ways to be aware that new messages had arrived in their inbox even when they were not actively using the SM tool. They also wanted a better way to prioritize their inbox messages and pull out urgent versus non-urgent concerns. Providers also recommended that patients might benefit from the use of templates to formulate their messages, or have the patient answer a few guided questions to ensure the message was appropriate.

Providers also noted that patients faced challenges when using secure messaging, including difficulty attaching digital images and using email instead of SM to communicate. Only one provider felt that images sent through SM was beneficial clinically. Further, patients may send messages through the wrong account. For example, a patient may have proxy rights to a child accounts and send a message about their own care issue from their child's account. This error makes it difficult for providers to find the correct health information.

Aim 3: Patient satisfaction and MyChart messaging

The third and final aim of this project was to identify clinic-level differences in patient satisfaction and use of SM. Both primary care and specialty care patients rate their providers highly (9 or 10 out of 10) (87.7% vs 84.4%). Further, both primary care and specialty care patients would recommend their clinic to friends or family (98.1% vs 96%). PC patients and SC patients expressed favorable views of communication quality (98.8% vs 97.3%). Both PC and

SC patients exhibited similar use of MyChart (76.7% enrollment vs 67.3%) and communication using messaging (49.8% vs 49.7%). This suggests that patients will access and use their portals and SM independent of the providers' level of acceptance and use. See Figure 13 for the figure key and Figures 14, 15 and 16 for these reports.

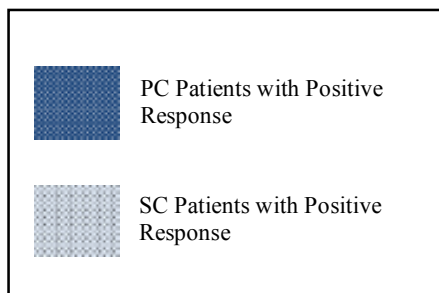


Figure 13: Figure Key

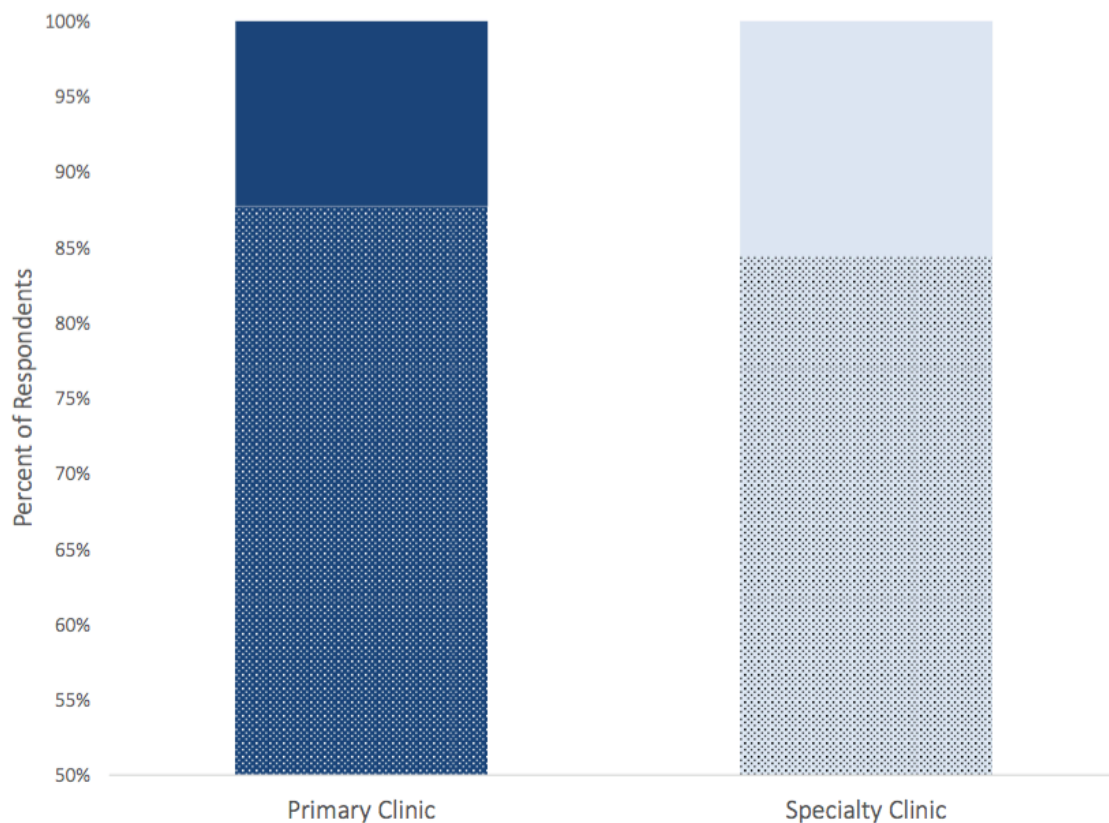


Figure 14: Percent of Patients with Positive Rating of Providers by Clinic

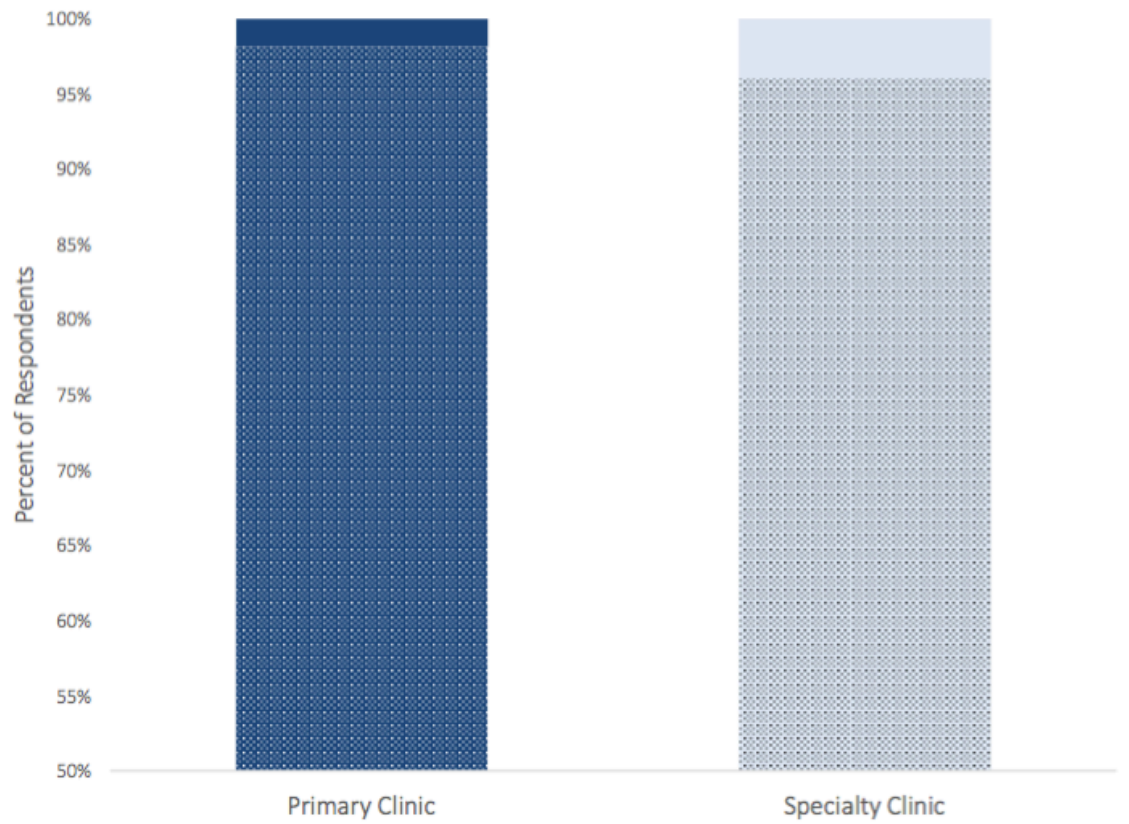


Figure 15: Percent of Patients with Positive Recommendation of Providers by Clinic

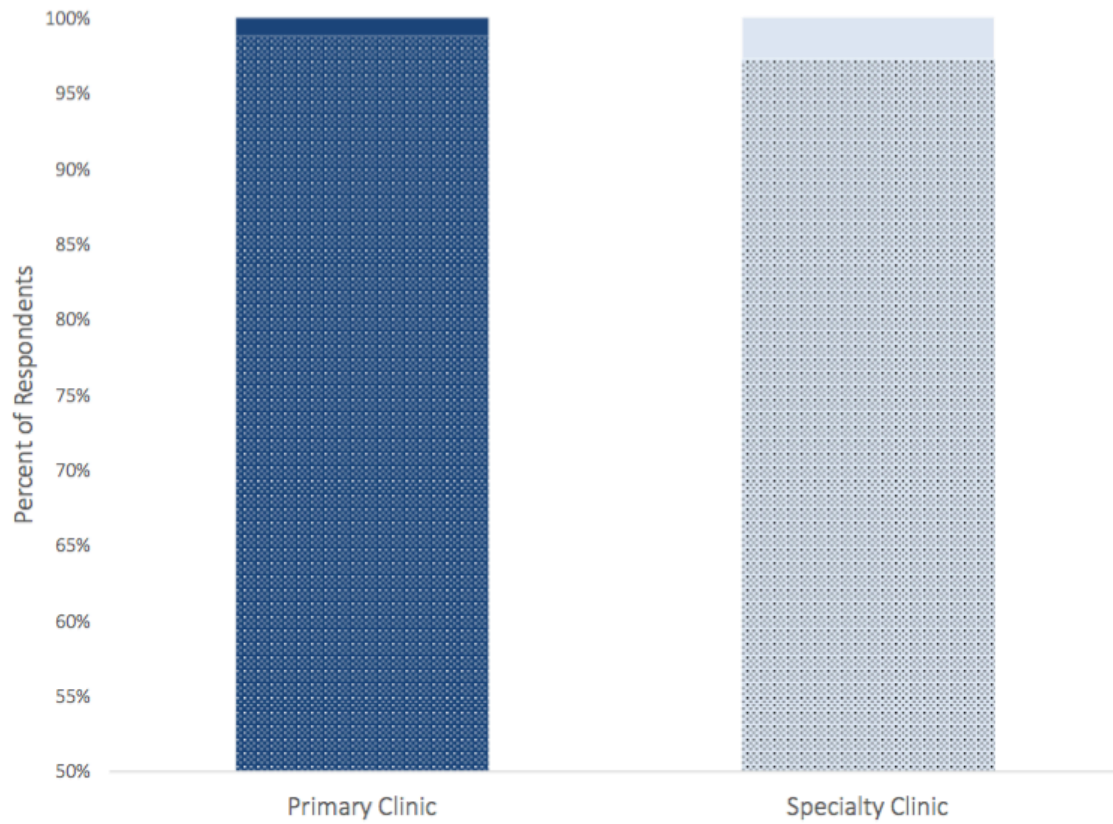


Figure 16: Percent of Patients Reporting Positive Communication Quality by Clinic

CHAPTER 5: DISCUSSION

Summary

This study sought to understand the relationships between providers' attitudes and perceptions and their use of SM in practice. Through an examination of current literature, it is apparent that patients value communication with their providers facilitated by EM and that communication via EM may help improve patient outcomes. Research findings further reveal that providers may encounter barriers as they integrate EM into their practice and that variation exists in how providers incorporate its use into their daily workflow. However, gaps exist in our understanding of how barriers and workflow variations impact providers' actual use of EM and on the subsequent effect on patient satisfaction and SM use. This program evaluation and case comparison study evaluates two clinics that use SM with their patients. Through analysis of surveys, SM usage measures, direct observations, and semi-structured interviews, this study offers unique insight into contextual factors that impact electronic communication between patients and providers.

Discussion of Findings

First, I examined contextual factors that may impact SM using a multi-method approach utilizing the framework of the UTAUT and previous work of Crotty and colleagues (2013) and Keplinger and colleagues (2013). Analysis was conducted utilizing correlations. As results are discussed, it is important to understand that correlations simply indicate a relationship exists, and does not imply the direction of the relationship. Contextual data provided by interviews and observations offer insight into some of the meaning of these quantitative relationships.

When correlated, the four constructs of facilitating conditions, performance expectancy, effort expectancy, and social influence had the greatest relationships with reported satisfaction. Moreover, facilitating conditions and performance expectancy had the greatest correlation with a value of 0.67 indicating that the infrastructure surrounding secure messaging may play a role in how providers perceive that it fits into their job. Contextually, the biggest infrastructure discrepancy between providers in this study was the degree of teamwork in place. Thus, greater levels of team work in responding to messages may influence levels of job satisfaction and performance. These relationships continue to point to the possible influence of teamwork in providers' satisfaction with SM use.

Three constructs had the highest correlation values with volume including: social influence, facilitating conditions, and task performance. Providers with greater volumes perceived a stronger social influence in using SM. This social influence may come from administration, but may also come from patients persistently requesting or using SM. Task performance of writing to patients also showed a moderate relationship with volume. This could reflect that providers with greater messaging volumes may become more comfortable writing and responding to patients due to the frequency of their experience. It may also be that they encourage their patients to use it more frequently than providers who feel less comfortable. These providers may also initiate messages to patients more frequently, further increasing the volume of messages received. The construct of facilitating conditions also had one of the strongest correlation values with volume. This construct reflects the technical and organizational structure in place to support use of secure messaging. Providers with the highest volume and best perceptions of facilitating conditions used teamwork to a greater degree as they responded to messages. It may be that overwhelming volumes force providers to develop novel methods for

coping with this demand, a concept described by Garrido and colleagues (2014). Active use of teamwork, plus customization of message flow and access, could promote positive perceptions of facilitating conditions.

Providers with higher message volumes also perceived a greater degree of liability. It may be that providers who receive and respond to higher volumes of messages, see more circumstances in which they could be liable. However, it does not seem to impede their use, since this group of providers responded to patients more quickly than those who did not express concerns about liability. Although others have identified liability concerns as a perceived barrier, this is the first study to associate liability concerns with provider usage measures of SM. It is unclear if perceived liability is associated with actionable medicolegal liability, or if the implementation of adequate policies and protocols helps mitigate this perception. Future research on the policies to protect providers may offer insight in this area.

Analysis between the survey's constructs and responsiveness largely reveal weak to moderate relationships, with the exception of the facilitating conditions construct. Providers who perceived greater technical and organizational support had shorter responsiveness times ($r=0.73$). This remained true when the providers at the SC were analyzed separately ($r=0.74$). Providers at the SC clinic had much longer response times than providers at the PC clinic (average of 6 hours versus 78 hours). From this we may infer that adequate technical and organizational support is important to enabling providers to respond to patients more quickly. A specific barrier to the SC not present in the PC was that some SC providers also provide inpatient or surgical care, detracting from their time in the clinic, which may impede response time. Some facilitators may include the use of teamwork and effective use of protocols. It remains important to remember that this particular measure, though called "responsiveness," simply indicates that a message has

been opened or read by a member of the health care team and does not necessarily indicate that it was answered. Intuitively, we may draw conclusions that messages opened more quickly are likely to be addressed sooner, however more accurate measures are necessary to verify this. Additionally, though these measures are assigned to a particular provider, for those utilizing a team approach to respond to SMs, it reflects the overall function of the team, rather than the practices of the provider. When addressing responsiveness, it may also be reasonable to understand the clinic's perception of benchmark goals. For instance, although the health system's benchmark for responsiveness is 72 business hours, some providers or clinics may set shorter goals that may, in turn, impact their response times. Those who plan to investigate SM or draw conclusions from reports using quantitative measures should understand how the messages are handled by the team in order to draw appropriate conclusions.

Highlighted Best Practices

Through direct observation, semi-structured interviews, and a quantitative examination of key constructs that influence technology use, I identified four practices that promoted providers' engagement with and efficient manage of SM. These practices included using a team approach, building protocols, using smart tools, and proactively engaging patients through messaging.

In interviews, providers verbalized differences in the way they manage messaging. Some providers utilize teams of nursing or medical assistants to triage and expedite SM while others did not use this technique or were not aware of a team approach to SM. Overall, the PC utilized the team method to a greater degree than SC. Additionally, providers from both clinics who utilized a team approach recommend it for others. Study participants utilizing teamwork to manage messages verbalized greater satisfaction. They perceived greater efficiency and an ability to conduct face-to-face patient visits. One of the benefits cited by providers was that a

team approach enabled them to do the job they wanted to do. Establishing trust and rapport with the staff that triaged their messages was also important. Such a relationship helped providers worry less about messages because they knew their nurses and staff would take care of messages appropriately. These findings are similar to others who identified benefits from a team approach for triaging patient messages (Eaton, 2012; Johnson, Garrido, Christensen, & Handley, 2014). Although Johnson and colleagues (2014) concluded that a team approach was simply a provider preference, I found that providers who utilize this approach had quicker response times and verbalized less dissatisfaction and disruption. This finding is in line with research by Garrido and colleagues (2014) who found that teams may increase their efficiency by improving workflow. Restructuring the work process of reviewing and responding to secure messages may help providers better manage the cultural shift in care that secure messaging represents; helping providers maintain their preference for direct patient care by shifting the burden of technology-enabled patient communication and accelerating expected benefits of SM.

Protocols were part of the foundation for enabling working relationships between providers and patient care teams. providers who utilized protocols verbalized knowledge of how they were developed. They knew what protocols were being used and how the protocols enabled teams function effectively without direct oversight. Protocols provided nurses with guidance for triaging messages and offered both parties peace of mind. This study adds to the growing evidence that protocols are an effective method for coordinating care actions when implementing new technology (Bishop, Press, Mendelsohn, & Casalino, 2013; Rodriguez, 2010).

Tools embedded with the SM application proved to be effective in aiding provider use of this communication method. Several providers stated that they used a smart phrase for patient education in order to quickly provide specific instructions for patients on when to use SM.

Providers also used smart phrases to communicate with patients about common test results.

Providers who used these features recommended that other providers work with their staff to build such tools to make working with the technology more efficient and less time consuming.

Johnson, et al. (2014) found that SM super users recommend utilizing such features as a method for increasing efficiency in responding to patients' messages. These findings suggest that developing smart tools and learning to use smart tools may be a foundational training requirement when providers are first introduced to SM.

Providers with the greatest volume of messages also actively message patients independently. Johnson and colleagues (2014) found that initiating messages to patients was a characteristic of most super-using physicians. In this study, providers reported that they messaged patients in cases where they remembered something outside of a face-to-face visit or if they had heard a patient had something going on and they wanted to check in. Providers perceived that patients appreciated receiving messages and felt that it helped build rapport and relationships. During interviews, most providers did not believe that messaging improved the quality of their care, however, providers who discussed initiating messages were more likely to indicate a positive impact on the quality of their care. The best practices highlighted here have implications for reducing barriers and improving providers' practice of SM.

Best practices are associated with decreased time until messages are viewed by providers and enhanced communication. Similarly, other studies of SM report a high degree of variation in how individual providers choose to route messages. Evidence from this study suggests that implementing triage processes and developing protocols may help reduce provider strain and improve response times to patient messages. Thus, engaging with providers and support staff to develop and implement workflows that maximize team capabilities may not only help reduce

response times but also maximize the best use of provider time. Developing protocols to enable effective triage and response to patient messages among support staff facilitates role development and it ensures that support staff meet expectations of communication.

As technology and healthcare continue to integrate, informatics holds the potential to offer new insights into effective care delivery models. It becomes increasingly important to promote valid metrics to get the fullest understanding of the impact of technology on patients and providers. In this study, quantitative data showed differences between primary and specialty clinics. The largest difference was found in the average response times. Since communication between providers and patients is associated with better self-management and improved patient outcomes as discussed in the literature, timely response to patients seems important. more accurate metrics provide members of the health care team a foundation from which to understand the impact of timeliness on patient-provider relationships. More accurate metrics may also provide insight into the burden of SM on providers' time and promote robust cost-benefit analysis. Although our survey results demonstrate a slightly positive attitude toward the ease of use of SM, during interviews, providers offered several strategies to improve human-computer interaction toward more effective use. Thus, informaticists should be prepared to work closely with practitioners toward improved fit with work process requirements.

Strengths/Limitations

This study offers a novel understanding of SM by examining provider perceptions of SM with SM volume and responsiveness measures. Although the final survey sample was too small to adequately power statistical analysis, our purposive sampling strategy allowed data collection from disparate groups of providers. Further, opportunities afforded by each clinic to interview support staff provided contextual richness and identified emerging best practices.

While purposeful, our choice to examine one specialty practice and one primary care practice limits generalizability to other types of care settings. Further, our ability to use secure messaging metrics to accurately capture message flow in the system is dependent upon the types of data an organization collects. In this study, data captured when a message was received from a patient and when a message was opened. However, these data did not allow us to determine how long providers took to respond to patients, nor were we able to identify the rate at which providers initiated messages to patients. To make significant progress in understanding uptake of secure message among providers, the development of more accurate measures of engagement is essential.

Lessons Learned

The American Association of Colleges of Nursing (2017) highlights 8 essentials of education for DNP candidates. In light of the essential element of science that underscores practice, this study incorporates scientific methods to gain a greater understanding of electronic communication between providers and patients. This study acts as a starting point to translate evidence into practice. a number of aspects of this study offer points of learning and could be refined for improved understanding

First, the Likert scale codes in the survey administered used a 1 to 5 scale with 1 reflecting the most positive score and 5 the least positive. However, Likert scales usually use 1 as the least positive and 5 as the most positive. This resulted in the correlations with volume being negative rather than positive, and may cause confusion when trying to understand the results of this study.

Second, this study did not incorporate hypotheses prior to the study onset. Rather, this study identified aims of the research. However, hypotheses may have helped better guide a

mixed methods analysis of the qualitative and quantitative data to provide a fuller understanding of the relationships between providers' practices and perceptions on their use of SM.

Additionally, lessons were also learned as an outside researcher trying to gather data from a technology team. DHTS obtained data on secure messaging volume and responsiveness by clinic and provider. The primary clinic's report listed each provider. However, the first report for the specialty clinic listed only 7 out of 28 providers in the clinic. After multiple attempts to obtain a report with all 28 providers, a ticket was put in to check the database and attempt to find the missing data. After about one month, the missing data was retrieved and a report was generated that included messaging volumes for all of specialty clinic's providers. This story shows the complexity of trying to understand and retrieve data to understand a practice phenomenon.

Another area of learning was interacting with the providers to understand their practice and use of SM. Information was largely derived from the qualitative analysis of the interviews and observations with the providers. The original goal of the observations was to utilize a "think aloud" method in which providers were instructed to verbalize their actions as they used secure messaging in their inbox. However, many had difficulty separating their role as a care provider from being a simple technology user. Often, they would begin to tell stories about their interactions with patients through secure messaging rather than verbalizing the physical and technological aspects of their work. As a researcher, had I been an expert in the think aloud method, I may have been able to redirect providers. However, as a novice researcher this proved difficult. Thus, the degree of quality of data derived from the observations was not as high as it might have been if I had more experience.

Actionable Strategies & Dissemination Plan

This project was completed in collaboration with two outpatient clinics and health care system's informatics team. For local dissemination and to fulfill the goals of this study, this information will be taken back to both practices and informaticists. I propose to do the following:

- In collaboration with informatics staff, plan to debrief them on the lessons learned, results, and implications of this study.
- Organize an exit interview with both clinic managers and staff that want to participate to relay the study results and implications.

For national dissemination, the PI plan to pursue publication and poster presentations that relate to this topic.

Conclusion

Effective communication between patients and providers remains essential to patient care. teamwork and interdisciplinary practice are becoming increasingly essential to successful practice. this study, sought to understand the relationships between provider satisfaction and perceptions with usage of SM. The methods were designed to achieve an overall understanding of perceptions and daily interactions with SM. Findings suggest that adequate organizational and technical support has an important relationship with provider satisfaction, perceptions, and use of SM. Given the small sample size of this study, global conclusions cannot be drawn from this research. However, the relationships and practices highlighted suggest that certain practices may promote greater success with SM. This study identified relationships between teamwork, use of protocols, volume, and responsiveness, as well as provider satisfaction and job performance. Identified facilitators that are implemented in a systematic way may impact providers'

satisfaction and engagement with patient communication via electronic means. More research should be conducted to identify the direction of relationships between provider's practice with SM and patient satisfaction. Further, research should be conducted to identify best practices and how implementation of best practices may transform and improve SM.

APPENDIX 1: Survey

Provider Evaluation of Secure Messaging

Q41 Please enter your name (this will be used to invite you to an interview- your name will never be used to identify your answers)

Q1 Please select your gender:

- ☐ Male (1)
- ☐ Female (2)
- ☐ Prefer not to answer (3)

Q2 Please select your ethnicity

- ☐ African-American/Black (1)
- ☐ Hispanic (2)
- ☐ Asian (3)
- ☐ Caucasian (4)
- ☐ Prefer not to answer (5)

Q3 Please identify your role in the clinic:

- ☐ Clinician (MD, PA, NP) (1)
- ☐ Nurse/MA (2)
- ☐ Other Clinical (Please enter text) (3) _____
- ☐ Administrative (4)

Q4 How long have you worked within this clinic?

- ☐ 0-2 years (1)
- ☐ 3-5 years (2)
- ☐ 6-10 years (3)
- ☐ >10 years (4)

Q5 How many years of experience do you have in your role?

- ☐ 0-2 years (1)
- ☐ 3-5 years (2)
- ☐ 6-10 years (3)
- ☐ >10 years (4)

Q6 How long have you used electronic messaging to communicate with your patients?

- ☐ I avoid/don't use it (1)
- ☐ 0-2 years (2)
- ☐ 3-5 years (3)
- ☐ 6-10 years (4)
- ☐ >10 years (5)

Q7 How long have you used electronic messaging to communicate with other healthcare providers?

- ☐ I avoid/don't use it (1)
- ☐ 0-2 years (2)
- ☐ 3-5 years (3)
- ☐ 6-10 years (4)
- ☐ >10 years (5)

Q8 How frequently do you use personal email or social media to communicate outside of your practice?

- ☐ Never (1)
- ☐ Sometimes (2)
- ☐ Often (3)
- ☐ Always (4)

Q9 What is your educational level?

- ☐ Diploma (1)
- ☐ Bachelors (2)
- ☐ Masters (3)
- ☐ Doctorate/PhD (4)

Q10 How many hours do you work per week?

- ☐ 20-30 (1)
- ☐ 30-40 (2)
- ☐ >40 (3)

Q11 Do patients email you directly on your personal email rather than use the 'Medical Advice' function in MyChart?

- ☐ Yes (1)
- ☐ No (2)
- ☐ Yes, but then I refer them to MyChart (3)

Q12 When during the day do you check your EPIC inbox for messages from patients? (Select all that apply)

- ☐ Morning (1)
- ☐ Mid-day (2)
- ☐ Evening (3)
- ☐ At home (4)
- ☐ Not unless someone tells me to (5)
- ☐ I consistently check throughout the day (6)

Q13 For the following questions in this block, please select answers for this statement: Increased electronic communication with my patients...

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
Increases my workload (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decreases the number of phone calls (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decreases patient satisfaction (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Decreases the frequency of patient visits (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improves the quality of care (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Negatively impacts my income (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increases my professional satisfaction (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improves patients' ability to comply with treatment (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q14 Given the choice, you would endorse electronic communication between patients and providers

- ☐ Strongly agree (1)
- ☐ Agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Disagree (4)
- ☐ Strongly disagree (5)

Q15 Using secure messaging improves my practice performance

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q16 Using secure messaging enhances my effectiveness in the practice

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q17 Using secure messaging makes it easier to practice

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q18 I find secure messaging useful in my practice

- ☐ Extremely useful (1)
- ☐ Moderately useful (2)
- ☐ Slightly useful (3)
- ☐ Neither useful nor useless (4)
- ☐ Slightly useless (5)
- ☐ Moderately useless (6)
- ☐ Extremely useless (7)

Q19 Using secure messaging enhances my productivity

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q20 If I use secure messaging...

	Agree (1)	Neither agree nor disagree (2)	Disagree (3)
My coworkers perceive me as competent (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will increase my chances of increasing my income (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q21 Using secure messaging takes too much time from my normal duties

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q22 Working with secure messaging is so complicated, it is difficult to understand what is going on

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q24 Overall, I believe that secure messaging is easy to use

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q25 People who influence my behavior think that I should use secure messaging

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q26 People who are important to me think that I should use secure messaging

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q27 In general, the organization has supported the use of secure messaging

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q28 I have the resources necessary to use secure messaging

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q29 I have the knowledge necessary to use secure messaging

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q30 Specialized instruction concerning secure messaging was available to me

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q31 A specific person (or group) is available for assistance with secure messaging difficulties

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q32 I think that using secure messaging fits well with the way I like to work

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q34 Using secure messaging is a (fill in the blank) idea

- ☐ Bad (1)
- ☐ Good (2)

Q35 I (fill in the blank) the idea of using secure messaging

- ☐ Dislike (1)
- ☐ Like (2)

Q36 Using secure messaging is (fill in the blank).

- ☐ Unpleasant (1)
- ☐ Pleasant (2)

Q37 Secure messaging is ok for some practices, but not the kind I want to work in

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q38 I look forward to those aspects of my job that require me to use secure messaging

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q39 Using secure messaging is frustrating for me

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q40 I hesitate to use secure messaging for fear of making a mistake I cannot correct

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q42 Using secure messaging makes receiving care easier for my patients

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q43 Using secure messaging empowers patients to improve their own care

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q44 I am concerned that I may miss a message because I cannot check my inbox regularly

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q45 I am concerned that I may be held liable for patients sending emergent concerns through secure messaging

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q46 I am concerned that I may be held liable for not checking my inbox enough

- ☐ Strongly agree (1)
- ☐ Somewhat agree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat disagree (4)
- ☐ Strongly disagree (5)

Q47 I am comfortable writing responses or initiating messages to patients

- ☐ Extremely comfortable (1)
- ☐ Somewhat comfortable (2)
- ☐ Neither comfortable nor uncomfortable (3)
- ☐ Somewhat uncomfortable (4)
- ☐ Extremely uncomfortable (5)

Q48 I am comfortable addressing and managing patient concerns outside of a face-to-face visit

- ☐ Extremely comfortable (1)
- ☐ Somewhat comfortable (2)
- ☐ Neither comfortable nor uncomfortable (3)
- ☐ Somewhat uncomfortable (4)
- ☐ Extremely uncomfortable (5)

APPENDIX 2: Semi-Structured Interview Guide

Workflow management and scheduling

1. What is the workflow for patient secure messages?
2. Do patient messages come into a common inbasket shared with others or do they go directly to you? If they go to a common inbasket, how is the workflow structured? Who shares the inbasket and what are their roles?
3. How many secure messages from patients do you receive each day?
4. About how long does it take for you to respond to them?
5. When do you respond to e-mail from patients?
6. Do you have a set time within which you try to respond to messages, or do you respond as soon as or shortly after you see the message, or both?
7. Are you given a dedicated time to handle messages?

Email management strategies

8. What types of patient messages are difficult to deal with?
9. What do you do to address these messages?
10. What do you need from the patient to handle these messages more efficiently?
11. Do you try to coach, establish ground rules for, or otherwise guide your patients use of secure messaging?
12. Is there a way the Duke MyChart patient portal secure messaging feature could be structured to help patients send clearer or more appropriate messages?
13. Do you close secure messaging encounters?
14. Have patients ever sent you digital images? If yes, were they clinically useful?
15. What messaging functions (smart phrases, smart texts, etc) do you use regularly?
16. What new strategies have you or other providers developed, tried, or envisioned, to make patient messaging communication more effective and efficient?
17. How could the patient portal be structured to support those strategies?
18. In what ways do you see your colleagues struggling with secure e-mail with patients? What sorts of suggestions do you most often offer them?
19. Do you initiate messages with patients? In what context?

Patient-provider communication

20. How has the use of secure messaging affected your relationship with your patients, it at all?
21. Has the use of secure messaging affected the quality of care? If so, how?

Future concerns and recommendations

22. What concerns you the most about the use of secure messaging with patients?
23. What additional features would make secure messaging with patients more useful for you?
24. How do you prioritize responding to patient messages? Any suggestions for managing this part of your practice you can offer to others?
25. What is your most amazing patient story that resulted from secure messaging?

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