Patient Use of the Electronic Communication Portal in Management of Type 2 Diabetes

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Dedication

This dissertation is dedicated to my dearest family, especially my mama Galina - my lifelong supporter and best friend, who helped me a lot with the household tasks and kids and continuously believed in me since I was born to this world, as well as my husband Gal - my mentor and great friend, loving father of my two beautiful kids Alice and Ben, who's advice is so often appreciated. This project is dedicated to all of you that waited for this degree to finally be completed. I love you so very much!

Abstract

The high incidence and prevalence of Type 2 Diabetes require urgent attention to the management of this chronic disease. Previous studies present the advantages of e-communication via the patient portal to access Electronic Medical Records (EMR) at improving clinical outcomes, establishing patient-provider relationships, and increasing patient satisfaction with healthcare services.

The theoretical framework for the study was Conversation Theory by Klemm (2002) which describes four types of conversation that have been used to classify communication in e-learning environments: These include 1) monolog, exchange of opinion and supposition; 2) dialogue, a community-building form of shared viewpoints; 3) dialectic – conversation aimed at distilling truth or correctness from logical argument; and, 4) construction ("Design"), use of conversation to create something new, often in the form of producing some kind of deliverable. The use of Conversation Theory was shown to be effective in improving student performance and facilitating conversation in e-learning environment.

The purpose of this study was to explore e-communication between patients with Type 2 Diabetes and their providers within the patient portal in one Midwest healthcare system. The aims of the study were to:

1. Describe the sample of patients with Type 2 Diabetes used to examine e-communication in terms of age, gender, ethnicity, years of education, primary language, duration of Diabetes, levels of A1C and length of use of patient portal.

2. Analyze e-communication between patients with Type 2 Diabetes and their providers within the patient portal using conventional content analysis to identify themes and sub-themes in e-message encounters.

3. Analyze themes identified in in e-encounters between patients with Type 2 Diabetes and their providers for their fit with Conversation Theory using directed content analysis.

The study employed a qualitative design, based on the use of content analysis methods. The unit of analysis was the e-message encounter. A purposive, random sample of 90 charts of patients with Type 2 Diabetes in a Midwestern health system was subjected to a retrospective review of the e-communication within the patient portal. Charts were reviewed for the sample characteristics variables. Then, conventional content analysis methods were used in order to identify themes that were common across e-message encounters. These identified themes were then analyzed using directed content analysis methods for their fit with Conversation Theory (Klemm, 2002).

The results showed that the sample of this study consisted of patients between the ages of 50 and 70, who are White, Non-Hispanic, speaking English, and a majority were married. Patients in the sample were described as receiving good Diabetes care. The mean duration of Diabetes for the sample was 8.41 years. Patients in the study sample were relatively experienced in using the patient portal, with the median duration of patient portal enrollment at slightly over a year, with most using the patient portal for between six months and over two years.

The three main themes that emerged in the e-communication via patient portal were the *Inform Theme*, the *Question Theme,* and the *Instruct/Request Theme*. Each theme also had from five to eleven sub-themes within it that captured the specific Diabetes-related topics within the theme. While the *Inform* theme was the most frequently identified theme in the e-communication, most of the e-message encounters were initiated by patients with the purpose of a request for a medication, or were initiated by staff for the purpose of delivering instruction about a necessary visit (*Instruct/Request Theme*). The *Question Theme* was the least frequently observed of the three themes in e-message encounters.

Results of further analysis of the fit between themes and structural elements with types of conversation in Conversation Theory showed that most of the staff-initiated e-message encounters fit mostly within the monolog type, while most of the patient-initiated e-message encounters fit within the dialogue type. Less often were e-message encounters of the dialectic and construction types of conversation. Limitations of the study include the bias of the researcher, no use of advanced programs for calculations and the missing data in EMR leading to an incomplete analysis on certain characteristics of the sample.

There is a need to develop standardized templates for Type 2 Diabetes e-communication via patient portal in order to increase the rates of construction type of conversation when diabetes management instruction is needed. Healthcare organization policies need to include specific guidelines on the initiation of e-communication with the

patient via patient portal as well as the frequency of the contact, specifically addressing the follow up for patients that do not meet the diabetes care targets.

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Chapter 1 - Introduction

Because Diabetes remains a growing problem in the United States, it is critical to find ways to enhance communication between the patients with Type 2 Diabetes and their providers to help with the management of the disease. Use of advanced technology in the form of electronic communication (e-communication) via the patient portal opens a new secure channel of communication, allowing patients with Type 2 Diabetes to hold "online conversations" with the healthcare staff about the various aspects of the Diabetes management. This study explored e-communication between patients with Type 2 Diabetes and their providers within the patient portal and set the stage for further investigation in this area, in order to lead to the ultimate goal of improvement in the management of the disease.

Diabetes Mellitus Type 2

"Diabetes mellitus is a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both" (World Health Organization, 2013). The prevalence of Diabetes in the United States is reaching dramatic levels. Diabetes affects 9.3% of the United States population (29.1 people), with 21 million people that are diagnosed and 8.1 million that are undiagnosed. The incidence of Diabetes in 2014 stands at 7.8 new cases per 1000, which totals 1.7 million new Diabetes cases among patients 20 years or older per year. The estimated costs related to treatment of people with Diabetes in the United States is $245 billion out of which $176 billion are

in direct costs and $69 billion are in indirect costs (Centers for Disease Control and Prevention (CDC), 2014).

The most common forms of Diabetes are: Type 1, Type 2 and Gestational. Type 1 Diabetes accounts for about 5% of all diagnosed cases of Diabetes (CDC, 2012). Type 1 is usually first diagnosed in children and young adults when their body is not able to produce any insulin - a hormone that is needed to convert sugar, starches and other food into energy needed for daily life. In order to survive, people with Type 1 Diabetes must inject insulin (CDC, 2012). Gestational Diabetes develops and is diagnosed as a result of pregnancy in 2%–10% of pregnant women. Type 2 Diabetes accounts for about 95% of diagnosed Diabetes in adults (CDC, 2012). In type 2 Diabetes, the body does not use insulin properly, which is called insulin resistance. At first, the pancreas makes extra insulin to compensate for the resistance, but with the time it will not able to make enough insulin to keep the blood glucose at normal levels (American Diabetes Association (ADA), 2015).

The rates for Type 2 Diabetes increase significantly with age for both genders and for members of all racial and ethnic groups. The prevalence of diagnosed Diabetes is about seven times as high among adults aged 65 years or older as among those aged 20–44 years. Race and ethnicity also are risk factors for Diabetes. There is a higher prevalence of Diabetes among most minority populations in the United States, including Hispanic Americans and non-Hispanic Blacks, compared to white non-Hispanic population (CDC, 2012). Appendix A contains the full list of the defined terms used in this paper.

Diabetes Education

"Diabetes education, also known as Diabetes self-management education (DSME), is defined as a collaborative process through which people with or at risk for Diabetes gain the knowledge and skills needed to modify behavior and successfully self-manage the disease and its related conditions" (American Association of Diabetes Educators (AADE), n.d.). Traditional DSME is an interactive, ongoing process involving the participation of the person with Diabetes or the caregiver or family and a Diabetes educator. Diabetes educators should adopt clear communication strategies to improve patient understanding of health information and lead to better health outcomes (AADE, 2013). DSME aims to achieve optimal health status, better quality of life and reduction of the need for costly health care (AADE, n.d.), and is considered an essential component of Diabetes care for all individuals and families with Diabetes (Miller & Fain, 2006).

Communication plays a critical role in Diabetes management. "A patient-centered communication style should be used that incorporates patient preferences, assesses literacy and numeracy, and addresses cultural barriers to care" (ADA, 2015). It is well-accepted in the medical community that the quality of communication between health practitioners and patients can make a significant difference to health outcomes (MacDonald et al., 2013; Ngo-Metzer et al., 2010). Most of the studies reviewed by Stewart (1995) have demonstrated a correlation between effective physician-patient communication and improved patient health outcomes.

Many barriers exist for the optimal care in Type 2 Diabetes, but with the advanced technologies available to the healthcare organizations today, there must be

implications for improving the management of the disease, and, consequently for improving health outcomes of patients with Diabetes. Enhanced communication between the patient and his provider, specifically the use of e-communication through personal health records in electronic health records, might be one of the possible solutions to the problems related to care and suboptimal management of Diabetes.

Electronic and Personal Health Record

An electronic health record (EHR) is the health record of a person that is being stored in and accessed via a computer, and used to provide high quality patient care. The EHR includes information that might not be listed in a paper chart, like detailed medical history, medication list, allergy list, immunization dates, and lab and test results. A personal health record (PHR) is usually organized, updated and used by the individual via a computer regardless of health insurance, health care provider type or location. According to Wilson, Murphy, & Newhouse (2012), access by the patient to his Electronic Health Record (EHR) results in improved patient information, ultimately resulting in higher levels of engagement in care, and better healthcare decisions. Implementation of Electronic Medical Record (EMR), and specifically the patient portal technology, helps the ambulatory practice to produce benefits to the patients, the staff and the practice in general (Louiselle, 2012). Examples of benefits would include improvement in clinical outcomes, as well as increase in patient satisfaction and cost-effectiveness.

Use of secure messaging in a patient portal showed positive outcomes in Type 2 Diabetes. Wade-Vuturo, Mayberry, & Osborn (2013) stated that secure messaging within

the patient portal may facilitate access to care, enhance the quality of office visits, and be associated with patient satisfaction and clinical outcomes for patients with Diabetes, although classic provider communication (face-to-face clinic visits) should still be considered as essential. Although the use of portal does not predict LDL and total cholesterol levels, it does predict HemoglobinA1c (A1C) (Shaw & Ferranti, 2011). The use of secure patient-physician email in the study by Zhou, Kanter, Wang, & Garrido (2010) was associated with a statistically significant improvement in effectiveness of care as measured by the Healthcare Effectiveness Data and Information Set (HEDIS), as well as improvement in A1C, cholesterol, and blood pressure screening and control.

Studies on communication between the Diabetes patient and his/her provider are not only important for improvement of Diabetes management, but are essential to nursing practice in general. Nursing professional practice is rapidly adapting to evidence-based practice (EBP), the use of best clinical evidence from research conducted by nurses and other health care professionals to serve as the foundation of interventions (Polit & Beck, 2008). Evidence-based practice offers solutions for improvement of health care quality in the cost-constrained environment by providing the best possible care to the most people with the most cost-effective use of resources.

Theoretical Framework in Electronic Communication

The theoretical framework for this study is based on the Conversation Theory by Klemm (2002). "Conversation is central to exchanging information, making our positions known, and persuading and motivating others" (Klemm, 2002, p.1). Research has been done introducing technology into teaching and learning experience, showing that blended

learning (face-to-face sessions complemented with communication tools) has a major impact in education (Heinze & Procter, 2012).

Conversation frameworks can be translated from the learning environment of educational setting to the learning system in the healthcare. In healthcare, the communication from provider to patient contributes to a better management of the disease by exposure of the patient to information about his disease that leads to a deeper understanding of the topic by the patient, and ultimately to better health management. Communication in the form of a conversation takes place between the patient and healthcare provider at the clinical facilities on a daily basis. The patient, as a learner, can request explanations as to "why" certain processes take place in his body, or request the provider to explain "how" to perform certain procedures related to health promotion or disease management. The healthcare provider, as a teacher, may offer explanations about certain processes occurring in the patient's body, may demonstrate certain procedures, and then may ask the patient to return the demonstration.

The written form of conversation engages the author and the reader with the content more rigorously that does speaking, as it can be easily verified, based on who said what and when. E-mail messaging (e-message) is an example of an asynchronous "conversation" over the internet. "A-synchronicity provides the crucial opportunity to reflect, to gather and organize the information, and to craft a clear and coherent message" (Klemm, 2002). The model of electronic communication in Conversation Theory is depicted in Figure 1. Klemm described four main categories of conversation as: 1) monolog, exchange of opinion and supposition; 2) dialogue, a community-building form

of shared viewpoints; 3) dialectic – conversation aimed at distilling truth or correctness from logical argument; and, 4) construction ("Design"), use of conversation to create something new, often in the form of producing some kind of deliverable".

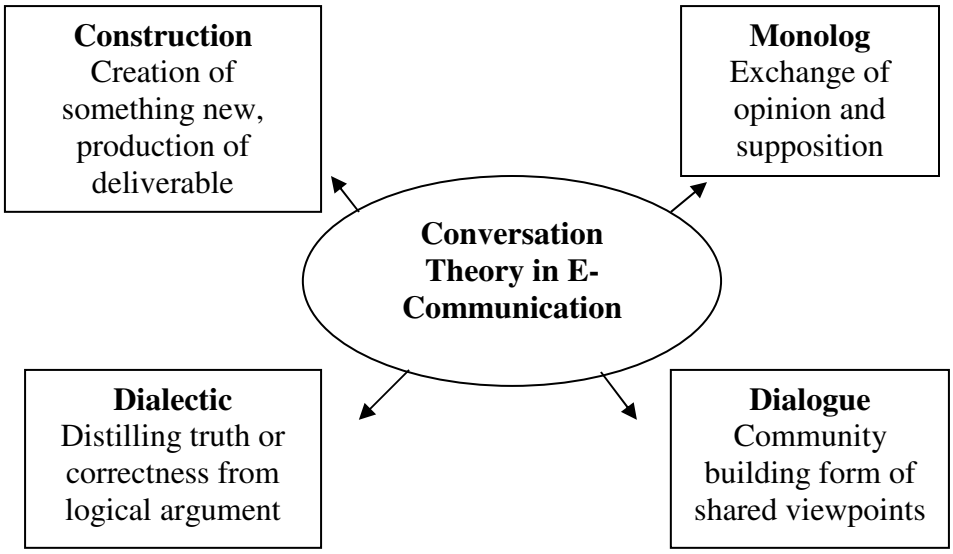

Figure 1. Conversation Theory in E-Communication (Klemm, 2002)

In the context of education, the dialectic and the construction forms should be considered the "higher" and more educationally valuable (Sherry et al., 2000, as cited in Klemm, 2002). Monolog is a self-conversation, aimed for a person to make proclamations. Dialogue is used to build consensus, presenting different views and alternatives, aiming to evaluate the pros and the cons of each alternative. The content of e-communication will be evaluated using the four conversation categories, to find out whether the information provided within the patient portal can enhance patient learning, and contribute to improved quality of Diabetes care.

A Pilot Study of Communication using Patient Portal

The author conducted a pilot study to determine the feasibility of a larger scale study. The purpose was to examine Diabetes e-communication by patients and providers

in an existing patient portal in a large Midwest clinic. The study was conducted in July of 2014 using a retrospective record review of patient portal use by patients with Diabetes. Inclusion criteria were: a) diagnosis of Type 2 Diabetes, b) at least one e-message in patient portal within the past 12 months.

The query resulted in locating a total of 3254 patients with Type 2 Diabetes that communicated at least once using patient portal within the past 12 months. The first 20 charts were selected and retrospectively reviewed from the July 2, 2011 to July 2, 2014. The content analysis method was used to extract information on e-communication content within each patient's medical record.

Findings of pilot study showed that ten patients (50% of the reviewed charts) had documented e-communication on Diabetes related topics. Out of ten charts with e-communication by patients with Diabetes Type 2, a total of six charts (30% of all the reviewed charts) included specific instructions from providers about Diabetes management or Diabetes adjustment for the patient. E-communication included the following topics: Diabetes medications (instructions on titration and adjustment), Diabetes labs, reminders on Diabetes checks and Diabetes management topics, like blood glucose testing. Initiators of the e-communications were patients, pharmacists, and primary care providers and their staff.

Findings from this pilot study were used to inform the design, analysis and the implementation of the study described in this dissertation. This preliminary study revealed that a number of e-messages contained insufficient information for proper

Diabetes management and supported the importance of further exploration of the e-communication between Type 2 Diabetes patients and their providers.

A review of the literature related to the quality of e-communication content in PHR reveals only one published study on secure patient-physician emailing by (Serrato, Retecki, & Schmidt, 2007). Content analysis of e-mail encounters was performed looking at the elements of patient messages to clinicians, and clinicians' responses to patients, addressing the types of problems for initiating the e-communication, the kinds of questions asked by the patients as well as the types of responses received by the patients from their clinicians. In a study by Shaw & Ferranti (2011), researchers found that a significant portion of patients with Type 2 Diabetes (29.7%) used the patient portal. Patients have found the PHR enhanced their communication with the provider, felt the reminder system was very helpful, and liked the remote access to lab results (Hess et al., 2007). Yet, there were no studies published to date that examined e-communication specifically among patients with Type 2 Diabetes.

In summary, Type 2 Diabetes is a chronic disease with high prevalence and incidence, affecting tens of millions of people in the United States. Communication plays an important role in management of chronic conditions like Diabetes. Electronic communication (e-communication) provides an opportunity for the healthcare organizations to enhance communication with patients in order to improve the management of Type 2 Diabetes. Despite the high prevalence of the disease, and the increasing use of e-communication among patients with Type 2 Diabetes and their providers, there have been no studies to date that have investigated the content within the

e-communication in *this population*. This study offers a unique opportunity to explore the nature of e-communication among patients with Type 2 Diabetes and their providers.

Chapter 2 – Review of Literature

The incidence and prevalence of Diabetes is a growing problem throughout the world (Martinez, 2013). Diabetes education plays an important role in the management of the disease, with communication between the patient and his provider being one of the key factors in the patient's self-management success. The use of technology, specifically the use of e-communication within systems that provide access to the Electronic Medical Record (EMR), may provide a means to improve communication, but the lack of evidence about the effectiveness of technologies like the EMR begs the need for more research. The study proposed in this paper contributes to knowledge about the content within electronic communication related to care of patients with Type 2 Diabetes.

The purpose of this chapter is to provide an overview of the relevant literature on Diabetes management, electronic communication, Electronic Medical Records (EMR) and Personal Health Records (PHR), and the use of EMR and PHR in the management of chronic disease, with a special focus on EMR and PHR in Diabetes management.

There is an urgent need to improve the management of chronic diseases such as Diabetes (Holbrook et al., 2009), because Diabetes complications are leading to disability, increase cost and might lead to death (CDC, 2012). "Diabetes mellitus increases the risk of disorders such as coronary artery disease, cerebrovascular occlusion, peripheral artery disease, renal insufficiency, peripheral neuropathy, lower-extremity infection, ulceration, and amputation, and other disorders" (Fowler, 2009, p.119). Diabetes complications among patients with poor control of the disease are noted to be more common and more severe. Early detection and management of Diabetes and its

complications, and improvements in preventive care, and treatment can prevent progression (CDC, 2012). Because the risk of cardiovascular disease is increased in Diabetes, blood pressure and lipid management, along with smoking cessation, are especially important.

Care Management of Patients with Diabetes Type 2

Khardori (2014) states that the goal in Diabetes management is to eliminate symptoms and prevent the development of complications. Patient care for Diabetes is best provided by a multidisciplinary team of healthcare professionals specializing in Diabetes, and working collaboratively with the patient and his family. Management should include a goal setting, modifications to lifestyle (e.g., diet, exercise), medication initiation or adjustment, self-monitoring of blood glucose (SMBG), monitoring for complications and laboratory assessment.

The main outcomes among adults with diagnosed Diabetes that might indicate good management of the disease include: 1) the reduction in death rates from hyperglycemic crisis (incidences in which blood glucose reaches very high levels that might lead to death); 2) decrease in rates of lower-limb amputations (of legs or feet); and, 3) decrease in rates of kidney failure (end-stage renal disease) (CDC, 2014). Since these outcomes can also be attributed to the management of blood pressure, cholesterol levels, and smoking, it is important to capture data on those factors as well.

Markers of disease progression are important to monitor, such as yearly dilated eye exams, frequent urine tests, and foot exams. A seminal marker of management of Diabetes, is the level of glycosylated hemoglobin in the patient's blood, as measured by

HemoglobinA1c (A1C). The level of glucose in the blood, or the A1C test, indicates the mean glucose concentration over the previous period (about eight to 12 weeks), and provides the best indication of long-term glycemic control (Mayo Clinic, 2013). According to the guidelines of Mayo Clinic (2013) and the American Diabetes Association (2013), the goal of the Diabetes therapy is to keep patient's A1C below 7%.

Patients with Diabetes are at increased risk of having a kidney disease. Another laboratory test used for patients with Diabetes is called Urine Microalbumin. It is used to detect microscopic levels of protein in the urine and helps diagnose early signs of kidney damage in people at risk (Mayo, 2013).

Empirical evidence from a systematic review by Krichbaum et al. (2003) supports the involvement of people with Diabetes in their own care, with the staff guiding them in active learning about the disease, and teaching them the skills necessary to adjust their behavior to control their own health outcomes. Thus, the goal for educating people with Diabetes is to improve their individual self-efficacy and, accordingly, their self-management ability.

Issues in Management of Patients with Diabetes Type 2

According to Morrow et al. (2012), patients with Type 2 Diabetes often struggle with self-care, including adherence to complex medication regimens and management of their blood glucose levels. "Medication non-adherence in type 2 patients reflects many factors, including a gap between the demands of taking medication and the limited literacy and cognitive resources that many patients bring to this task. This gap is

exacerbated by a lack of health system support, such as inadequate patient provider collaboration" (Morrow et al., 2012, p.1023).

"In spite of the research showing the health consequences of uncontrolled Diabetes, patients very often do not get the best quality care" (Medicaid Health Plans of America (MHPA), 2013, p.10). Benhamou (2011) listed lack of patient engagement with the care plan, and *clinical inertia* (lack of treatment intensification in a patient not at evidence-based goals for care) as the main factors leading to suboptimal Diabetes care. Compliance with technology, including technological ergonomic design, along with the need to reimburse providers for their care, are listed among the other factors contributing to poor quality care in Diabetes.

According to MHPA (2013) poor quality of care might be related to different gaps in care associated with healthcare system, patient, provider and social factors. Gaps associated with the health care system factors relate to significant barriers experienced by patients with Diabetes, like the short visits, acute illness attention taking priority over routine chronic health care needs, and the system's inability to deliver culturally appropriate care. Often, poorly coordinated care is seen between the various physicians, hospitals, and other providers treating the patient.

Gaps in quality of Diabetes care can be related to provider factors: care of patients with Diabetes care is complex and requires visits to several different types of providers, which might result in issues related to continuation of care. Also, physicians or other providers may not offer the proper treatments, tests and checks to manage Diabetes, not

intensify treatment when it is needed, or may not offer the right education that patients need to "self-manage" their care simply due to lack of time (MHPA, 2013).

Gaps can also be related to patient factors, like the language barriers, low literacy, depression or other mental health problems that make it difficult to understand or carry out their treatments. Some patients may not be ready to make lifestyle changes such as healthier eating or exercising; or patients may experience health system or social barriers that affect adherence. All of these factors result in less than optimal "self-management", e.g. the eating, exercising, and health management activities needed to successfully manage Diabetes. Gaps can also be related to social factors like the insurance coverage for the health services, medications, family support or other support services needed to effectively manage Diabetes (MHPA, 2013).

Communication in the Management of Diabetes

Communication plays an important role in the management of chronic diseases, including Diabetes. There are several methods of communication described in literature, including: written communication (e.g., mail), oral communication (e.g., phone call), face-to-face communication (e.g., clinic visit), online communication (e.g., e-mail) and more (Business Case Studies (2015). Communication for management of chronic diseases like Diabetes can include all methods of communication, but mainly involves clinic visits, phone calls and/or e-messages.

There are strong positive relationships between communication skills of healthcare professionals and a patients' capacity to follow medical recommendations, ability to self-manage a chronic medical condition, and get engaged in preventive health

behaviors (Institute for Healthcare Communication, 2011). Healthcare professionals who possess better communication and interpersonal skills are more capable of early problem detection, expensive intervention and medical crises prevention, as well as being more likely to offer support to their patients, compared to healthcare professionals without the skills (Fong Ha & Longnecker, 2010). Better communication skills lead to higher-quality outcomes and better patient and healthcare staff satisfaction, lower costs of care, greater patient understanding of health issues, and better adherence to the treatment process (Street et al., 2009). In this study, researchers stated that the "seven pathways through which communication can lead to better health include increased access to care, greater patient knowledge and shared understanding, higher quality medical decisions, enhanced therapeutic alliances, increased social support, patient agency and empowerment, and better management of emotions" (p. 295).

Electronic Communication

Use of Electronic Communication in Health Care

Ergonomics (or human factors) is the scientific discipline investigating the interactions among humans and other elements of a system (International Ergonomics Association (IEA), 2006), specifically referring to mental processes, such as perception, memory, reasoning, and motor response. Among the relevant topics in cognitive ergonomics is a *human-computer interaction* (HCI) (IEA, 2006). Cognitive aspects of the interaction (e.g., design of displays, procedures, and information) are of importance, as opposed to physical aspects (e.g., design of keyboards and work stations). For example, the design and the interface of a website, like the patient portal, might play an important

role in the decision and the success of the patients using the portal. Information presented in small font, lack of sound capabilities of the written text and limited explanation on medical terms might decrease the willingness of patients to access the portal.

One of the areas of HCI that received recognition in the recent years is the use of computers for healthcare purposes. For example, patients would use computers to search for medical information, and the healthcare professionals would use computers in their clinics to enhance the quality of care provided to their patients. Special software programs were developed for healthcare clinics to contain the medical data. Electronic medical records (EMR) are the digital versions of the paper charts at the healthcare clinics (Garett, P., & Seidman, J., 2011). An EMR contains the medical and treatment history of the patients in one place, allowing the clinicians to track data over time, identify the need for preventive screenings or checkups, review on specific patient parameters, communicate with the patients via secure e-communication channels, and monitor and improve overall quality of care within the practice.

Electronic Medical Records

Similar to EMRs, electronic health records (EHR) focus on the total health of the patient, going beyond the standard clinical data collected in the provider's office and include a broader view of the total plan for the patient's care (Garett, P., & Seidman, J., 2011). EHRs are designed to reach out *beyond* the health organization that originally collects and compiles the information, to be able to share information with other health care providers, such as laboratories and specialists, so they contain information from *all the clinicians involved in the patient's care.* Woods et al. (2013) describes full EHR

sharing with patients as an opportunity to engage patients in their health and health care, as the patients would not only be able to access the information from the different clinics about their health, but share and discuss it with multiple providers, leading to deeper involvement of the patient in healthcare decisions made. For the purposes of consistency, the term EMR will be used to describe EHR term in this paper.

Meaningful use is defined as the use of certified EMR technology with the goal of improving quality, safety, efficiency, and reducing health disparities, engaging patients and family, improving care coordination, and population and public health and maintaining privacy and security of patient health information (HealthIT.gov, 2015). The ultimate final goal is that meaningful use compliance will result in improved clinical and population health outcomes, will increase transparency and efficiency, will empower individuals, and provide more robust research data on health systems. Meaningful use includes regulations that the healthcare systems and providers need to meet in order to qualify for federal stimulus funding (Wilson, et al., 2012). Stage 2 of meaningful use places a greater emphasis on patient engagement and direct patient access to personal health information. It requires the healthcare facilities to offer opportunities to electronically access personal health information for more than half of the patients within the facility (Wilson et al., 2012). Moreover, healthcare providers will need to ensure that more than 10% of their patients view, download, or transmit their information to a third party.

The actual EMR program used in healthcare facilities might have different names, depending on the vendor. One of the well-known program in the United States is the

EPICCare EMR (EPIC), an award-winning, fast, and physician-friendly software (EPIC, 2013). It uses "one patient, one record" approach that improves ambulatory care, practice management and applications for outside the practice.

Internet Access to Electronic Medical Records: The Patient Portal

A patient's personal health record (PHR) is defined as "an electronic record of an individual's health information by which the individual controls access to the information and may have the ability to manage, track, and participate in his or her own health care" (Office for Civil Rights, n.d.). The patient is able to control the health information in his PHR and can get to it anywhere at any time using an internet access. A patient portal is a secure online website that gives patients the convenient 24-hour access to PHR from anywhere with an internet connection.

For the purposes of consistency, electronic communication in this study will be described in terms of the patient's PHR accessible via the "patient portal". Both providers and patients has access to this patient portal (providers have access through EMR). In order for patients to gain access, each is required to have a personal username and a password. Louiselle (2012) specifies the following functionalities of the patient portal:

1. Appointments – schedule an appointment, cancel it or view current and historical appointments
2. Lab results – view lab results
3. Medication – review medication list and request medication refills
4. Medical records – view personal health record and visit summaries
5. Education – receive educational materials or term definitions

6. *Messages – send and receive secure e-mail message to and from clinic staff*
7. Patient intake forms – complete intake forms (medical, social and family history)
8. Reminders – receive appointment reminder and health reminders
9. Billing – view past billing statements and pay current amounts due
10. Referrals – view and request referrals.

Each of the functionalities can be activated or de-activated depending on the healthcare system or clinic (Louiselle, 2012).

Patient portals have been designed to use secure technology to protect patients' information from being seen by other people without permission. According to Varroud-Vial (2011), the objective of the patient portal is to combine all medical data to improve the management of patients and coordination of their care, with the central goal to provide patients with access to their health information to improve their interactions with healthcare professionals.

The EPIC version of the patient portal is called MyChart (EPIC, 2013) which allows patients to schedule appointments, get test results, request medication refills and access their medical problem list. EPIC also includes a freestanding personal health record which includes an interoperable health diary that can plug into MyChart – or disconnect from it, and inform care wherever the patient receives it. The personal record allows the patient to permanently organize all medical information, to request an updated copy of medical record at any time and store it, as well as to add personal information about the patient's health and share it with other organizations in which the care is

received. The EPIC program was recognized as the best by KLAS ranking in several categories, including patient engagement, for their patient portal system MyChart (EPIC, 2013). For consistency in using the terms, the "patient portal" term will be used instead of "MyChart".

E-Communication in Management of Chronic Disease

The key findings in the use of the EMR and patient portal in the management of chronic disease are that: patients had mostly positive attitudes about using the patient portal. Use of the portal improved care and clinical outcomes, and was associated with increased use of clinical services. Access to the patient portal was found helpful, enhancing patients' motivations and knowledge, and improving their self-care. Secure e-communication could increase efficiency of care (Zhou et al., 2010) and improve standards of care (Varoud-Vial, 2011), and could also predict the HgBA1C result (Shaw & Ferranti, 2011).

Attitudes of patients who used direct access to their primary care providers' electronic progress notes through the patient portal were mostly positive. Patients believed that having such access provided many benefits, including enhanced understanding, improved medication adherence, and a greater sense of control, although, privacy was their biggest concern (Goldzweig, 2012). Patients have found the patient portal enhanced their communication with the provider, felt the reminder system was very helpful, and liked the remote access to lab results (Hess et al., 2007).

In a study by Varroud-Vial (2011), researchers described observational studies that suggest improvement of recommended standards of Diabetes care and the

intermediate outcomes with the use of EMR. The multiple information technology features integrated into EMR, like the electronic reminders, e-health technology, and email messaging, also have had a demonstrated beneficial effect on Diabetes care, specifically on its quality, safety and outcomes. Researchers concluded that in order to lead to improvements in care, there is a need for widespread implementation of the EMR in primary care setting, and to allow appropriate features of EMR for the management of chronic diseases.

A study conducted by Palen et al. (2012) assessed the healthcare utilization by users and non-users of online access to health records before and after initiation of patient online access system. A retrospective cohort study was carried out and comparison between the users and the non-users of online access was performed. The results showed that there was a significant increase in the rates of office visits ($p < 0.001$), and telephone encounters ($p < 0.001$), as well as a significant increase in after-hours clinic visits ($p < 0.001$), emergency department encounters ($p=0.01$) and hospitalizations ($p < 0.001$) for users compared to non-users. Researchers concluded that online access to medical records and clinicians was associated with increased use of clinical services compared to no use of the online access.

Another study by Nazi et al. (2013) explored patients' perceptions about access to their medical records, specifically looking at the perceived value and effect on satisfaction, self-care, and communication. A web-based survey was carried out among 668 study participants. Eighty four percent of the respondents have found the information and the services were helpful. Sixty six percent agreed that the program helped improve

their care. They also considered the system to be easy to use (72%). Researchers concluded that the ability of patients to access their own personal health information from the EMR was the main motivator for the use of the program. Secure e-mail messages between patients and providers can increase efficiency of care by replacing some outpatient visits (Zhou et al., 2010). Secure patient-physician e-communication was an objective in the meaningful use of EMR.

In a study by Zhou et al. (2010), researchers explored the effectiveness of care with the use of secure patient-physician e-communication. This retrospective longitudinal observational study analyzed the effectiveness of care measures for hypertension and Diabetes using the Healthcare Effectiveness Data and Information Set (HEDIS). The researchers concluded that people with Diabetes, hypertension or both, who used secure patient-physician e-communication within a two month period, had a statistically significant improvement in effectiveness of care as measured by HEDIS. Secure e-communication was associated with improvement of 2.0-6.5 percentage points in performance on other HEDIS measures such as HgBA1C, cholesterol, and blood pressure screening and control.

A secondary analysis was performed in the cross-sectional study by Shaw & Ferranti (2011) in order to describe the types of Diabetes patients who utilize the patient-provider internet portal and to examine the preliminary differences in patient outcomes. The study results showed that about 30% of the patients with Diabetes utilized the patient portal. Although the use of patient portal was not a significant predictor of LDL and total cholesterol levels, it was a statistically significant predictor of the HgBA1C results ($p <$

0.001), meaning that patients that used the patient portal had a better HgBA1C results compared to non-users of the portal.

In a study by Wade-Vuturo et al. (2013), researchers used a mixed method approach to explore how the patients with Type 2 Diabetes use and benefit from secure e-communication within a patient portal. Total of 39 patients completed a survey and participated in a focus group, while 15 patients completed the survey only. Self-reported benefits of secure e-communication included enhanced patient satisfaction, enhanced efficiency and quality of face-to-face visits, and access to clinical care outside traditional face-to-face visits. Patients also reported barriers to secure e-communication, including preconceived beliefs or rules about secure e-communication, and prior negative experiences with secure e-communication.

A qualitative study by Woods et al. (2013) examined patients' views and experiences with reading their health records online. The sample included 30 patients enrolled in patient portal with six family members who participated in five focus group sessions. When patients had access to their records, they expressed positive communication with their providers. They also considered the access as contributing to enhanced knowledge of their health and improvement in self-care, as well as believing that it contributed to the quality of their care, meaning that the patients were better engaged in decisions regarding their healthcare.

Another qualitative study by Hassol et al. (2004) was looking at evaluating patients' values and their perceptions regarding e-communication with their primary care providers in the context of access to their EMR. The online survey of 1,421 registered

EMR users was performed showing that a majority considered the system easy to use, and that EMR information was complete, accurate and understandable. A minority of users was concerned with confidentiality of their information, or seeing abnormal test results with just an explanatory electronic message from their provider. Patients clearly preferred e-communication for certain interactions, like prescription refills, with preference to in-person communication for interactions like treatment instructions. The study concluded that overall the patients have demonstrated a positive attitude towards e-communication and online access to patient portal and EMR (Hassol et al., 2004).

Finally, a study of patient portal was carried out by Serrato and colleagues (2007) who comprehensively evaluated the personal health link secure messaging between adult patients and providers. Patients' perceptions on the use of patient portal were captured via e-mail encounter survey. Two rounds of cognitive interviews were conducted with the patients who e-mailed their provider. The results showed low level of adoption of e-communication during the first year. Yet, the study found that the patients used e-communication appropriately, seeking answers to clinically relevant questions. Nearly all patients initiated an e-message to inquire about an ongoing medical problem or care plan, or a new medical problem. Less than 5% of the e-mails contained non-medical requests or questions. The study demonstrated that patients who sent messages through the patient portal reduced their primary care visit rates and phone calls. Researchers in this study also demonstrated that the patients were highly satisfied with the e-mail exchanges, specifically with a convenient communication directly with the provider. Important factors associated with higher satisfaction were: a) that all the questions were answered;

b) that answers were complete; c) that provider responses were timely; d) that e-mail exchange achieved the results the patient wanted; e) that responses were courteous; and, f) that patients had the amount of influence they wanted and had in decisions.

Negative Aspects of E-communication in Healthcare

Patients with knowledge and understanding, who are involved in making decisions about their therapy have a better chance to achieve optimal control of their Diabetes (Liberman, Buckingham, & Phillip, 2013). The emergence of both the internet and of the EMR have brought new opportunities for a new and more active role of the patient in his care, denoted in some studies as *patient empowerment*, yet evaluation of five studies on patient portals showed only a small effect of patient portals on patient empowerment (Ammenwerth, Schnell-Inderst, & Hoerbst, 2011). Another study indicated that clinicians are less positive in their attitude towards the use of the patient portal than the patients (Hassol et al., 2004).

Shachak & Reis (2009) reviewed the literature on the effect of EMRs on patient-doctor communication to identify recurrent themes and to offer preliminary guidelines and future directions for medical education and research. A total of 14 articles, published in the past ten years that included empirical investigations, were reviewed and analyzed using a qualitative, grounded theory-like approach. The results showed that EMR use often has a positive impact on information exchange, but that it exerts a negative influence on *patient-centeredness*, a health care concept that establishes a partnership among practitioners, patients, and their families. Patient-centeredness ensures that decisions respect patients' wants, needs, and preferences, and that patients have the

education and support they need to make decisions and participate in their own care (Agency for Research Healthcare and Quality, 2011).

Sarkar et al. (2011) investigated the use of an internet-based patient portal in a population of adults with Diabetes. Researchers found social disparities in the use of patient portal, specifically that the odds among African-Americans and Latinos were higher for never logging in to the portal; this was also true for educational attainment (high school diploma to a college degree). The study concluded that those most at risk for poor Diabetes outcomes may fall further behind as the healthcare system increasingly relies on the internet as the chief means of communication, and limits other modes of access and communication.

Use of e-Communication among Patients with Diabetes

A review of current literature reveals positive as well as conflicting results with the use of EMR and the patient portal with patients, specifically in patients with Type 2 Diabetes. A study by Herrin et al. (2012) assessed the impact of EMR implementation in primary care for patients with Diabetes. The researchers completed chart audits using the AMA/Physician Consortium Adult Diabetes Measure set (set of measures for evaluating quality of care of adult patients with Diabetes). The researchers set the following primary outcomes for the measures: HbA1c $\leq$ 8%; LDL cholesterol < 100 mg/dl; blood pressure < 130/80 mmHg; not smoking. They found that the use of the EMR was associated with improvement of patients' blood pressure management, aspirin intake, and smoking cessation, yet showed no improvement in A1C and cholesterol management. Researchers

concluded that “implementation of commercially available EMRs in primary care practice may improve Diabetes care and clinical outcomes” (Herrin et al., 2012, p. 1522).

This information contradicts a later study by Lau et al. (2014) in which the researchers found that accessing an online patient portal was associated with improved glycemic control, as measured by A1C. In this study the researchers examined Diabetes outcomes as related to the use of the patient portal by patients newly referred to a diabetologist (healthcare professional that specializes in the care of Diabetes). The portal provided access to Diabetes education material, personal laboratory values, and a messaging system allowing communication with the diabetologist and staff. Patients who logged in one or more times were defined as portal users (n=50); patients who never logged in to the portal were defined as non-users (n=107). HgBA1C was measured at two time points, at baseline and at last follow-up (between six months and two years). It was concluded that, compared to non-users, a higher proportion of users achieved A1C $\leq$7% at follow up (56% vs.32%) (p=0.031).

One study showed negative results of the use of EMR on the quality of care of patients with Diabetes. Crosson et al. (2007) conducted a cross sectional analysis of 50 practices to assess the relationship between the EMR usage and care quality. Random samples in each practice were reviewed for adherence to guidelines for Diabetes processes of care, treatment and achievement for intermediate outcomes. The results demonstrated a need for Diabetes care quality improvement in all practices; practice in 37 clinics in which the EMR was not used were more likely to meet guidelines for process, treatment and intermediate outcomes, compared to 13 practices that used EMR.

A study by Cho et al. (2010) examined access of veterans with Diabetes to a web-based portal linking veterans to their care. Using a cross-sectional mailed survey, it was found that about half of all respondents to the survey had information about Diabetes online. This included some patients who did not even have home internet access. It was found that over a third of all the respondents obtained "some" or "a lot" of their health-related information online. Forty-one percent reported being "very interested" in the use of the patient portal for tracking of home blood glucose readings, yet about 33% of them did not have a home internet access. Researchers concluded that patients with Type 2 Diabetes with suboptimal control (HgbA1C > 8%) were found to have a level of familiarity with and access to the internet, showing a degree of interest in using the internet to help manage their Diabetes.

A qualitative study by Hess et al. (2007) was designed to explore personal health records that allow the patient and his physician to connect via EMR. The study used ten focus groups of 90 minutes each, and assessed reaction of patients with Diabetes to the patient portal before and after its use. Researchers found that the study participants felt that the portal would enhance communication with the office, and the reminder system would be helpful. Participants liked having remote access to lab tests, but felt frustration when the tests were not released on time, or when messages were not answered.

Use of Conversation Theory in Research Studies

The Conversational Framework refers to the interaction between facilitators and students (Laurillard, 2002 as cited in Heinze & Procter, 2012). It was developed from Conversation Theory and Learning Conversation both of which highlight the importance

of facilitator-learner interaction in the development of learning (Pask, 1976; Harri-Augstein and Thomas, 1991 as cited in Heinze & Procter, 2012). Pask created a model of conversation, in which the verbal exchanges and the causal connections are interconnected by the two main questions asked in the conversation: "how" and "why". The "how" level explains how to "do" a topic, while the "why" level explains or justifies what a topic means in terms of other topics. For example, the teacher can *offer* explanations about why certain processes take place or verbal accounts of how to bring about certain events, while the learner can *request* explanations of why and the accounts of how (Scott, 2001).

The Learning Conversation theory by Harri-Augstein and Thomas advances Pask's model, emphasizing the need to help students to "learn-how-to-learn". The three main components of the Learning Conversation include conversation about the how and why of a topic; conversation about the "how" of learning; and the conversation about purposes, the "why" of learning, encouraging personal autonomy and accepting responsibility for one's own learning (Scott, 2001).

The Conversation Theory was used in research studies that looked at ways to improve online learning environment and student's performance in educational facilities. The study by Strang (2011) conducted a quasi-experimental study in order to compare two instructional approaches for an online course in order to learn how the discussion questions can be more effective in online MBA courses. Among other approaches, the test group used a Conversation Theory, while the control group used the traditional peer

interaction. The researcher's finding was that the mean grade of the test group was higher compared to the control group.

Conversation Theory was also used to design the theoretical framework in a study by McKenzie, Bell-Kerr & Smith (2014) to investigate the e-tutor interaction with groups and assess the effectiveness of tutor's performance in improving learner competence in critical thinking and problem solving. The researchers have found that e-tutors employed a conversation building techniques that facilitated productive conversations.

Summary

Although the incidence and the prevalence of Type 2 Diabetes are constantly increasing and complications are debilitating and costly, the quality of care for this chronic disease remains poor. There is evidence about different factors related to the patient, provider, healthcare system, and society that contribute to the gaps in care (MHPA, 2013). Some factors that contribute to Diabetes complications include care at the clinic and gaps in communication. Electronic communication has been linked to establishing and maintaining the relationship between the healthcare provider and the patient for management of Type 2 Diabetes (Zhou et al., 2010; Wade-Vuturo et al., 2013; Hassol et al., 2004).

Intelligent records that integrate computerized decision-support systems contain data on care protocols tailored to risk levels, showing that the use of the EMR is now established as being useful for improving care for patients with Diabetes (Herrin et al., 2012; Lau et al., 2014; Shaw & Ferranti, 2011; Varroud-Vial, 2011). Use of the patient portal also promotes self-management of symptoms of the disease. Patients are provided

with access to EMRs, ability to send secure e-mail to providers, manage an online diary, and receive feedback on blood glucose readings and other risk factors. The integration of web-based patient systems into the EMR used by physicians is the next frontier (Benhamou, 2011).

Conversation Theory has been used within the theoretical framework of the research studies related to e-learning. The use of Conversation Theory was shown to be effective at increasing students' grades in the e-learning environment as well as contributing to better performance of the electronic features in the teaching environment, which facilitate conversation between teachers and learners.

The literature presents conflicting results on the use of e-communication for management of Type 2 Diabetes, yet no study published to date showed any negative impact of e-communication specifically on the quality of Diabetes care. E-communication helps improve not just the clinical outcomes, like HgBA1C, cholesterol levels, blood pressure, aspirin intake and smoking cessation (Herrin et al., 2012; Lou et al., 2014), but improves the actual established relationship between provider and the patient, and increases patient satisfaction with healthcare services (Wade-Vuturo et al., 2013). Since no study that was published to date has analyzed the actual content of e-communication between patient with Type 2 Diabetes and their providers, a pilot feasibility study of content in e-communication was performed, and showed that this particular type of e-communication requires further study. Thus, in this study, the author explored e-communication between patients with Type 2 Diabetes and their providers within the patient portal using Conversation Theory to guide the analysis.

Chapter 3 – Methods

A qualitative design was employed to examine electronic communication between patients with Type 2 Diabetes and their providers. In this chapter the author will present the methods, including the purpose, aims, design, setting, sample, study instruments, study procedures, and protection of human subjects. Finally, trustworthiness of the plan for qualitative analysis used in the study will be discussed.

Purpose of the Study

The purpose of this study was to explore e-communication between patients with Type 2 Diabetes and their providers within the patient portal.

Aims (Research Questions)

1. Describe the sample of patients with Type 2 Diabetes used to examine e-communication in terms of age, gender, ethnicity, years of education, primary language, duration of Diabetes, levels of A1C and length of use of patient portal.
2. Analyze e-communication between patients with Type 2 Diabetes and their providers within the patient portal using conventional content analysis to identify themes and sub-themes in e-message encounters.
3. Analyze themes identified in e-message encounters between patients with Type 2 Diabetes and their providers for their fit with Conversation Theory using directed content analysis.

Research Design

The qualitative design employed in the study was used to explore the content of e-communication between Type 2 Diabetes patients and providers within the patient portal.

Method

The author employed a retrospective chart review to obtain the purposive sample of patients in order to analyze the e-communication of these patients with Type 2 Diabetes using qualitative content analysis. Qualitative design allows the researcher to perform a collection of data about naturally occurring events, like e-messaging, in certain groups of people (Polit & Beck, 2010). Qualitative data are collected in order to discern the meaning of language.

Retrospective chart review is a relatively inexpensive way of collecting data; it includes several limitations, however (Gearing, Mian, Barber, & Ickowicz, 2006). Incomplete documentation, information that is unrecoverable or unrecorded, difficulty interpreting information found in the documentation (e.g., jargon, acronyms), problematic verification of information and the variance in quality of information recorded by different medical professionals might lead to credibility and confirmability issues related to the use of this method. On the other hand, it seems that retrospective chart review is the most efficient method for review and analysis of content in e-communication in this setting.

Setting

This Midwest healthcare system in which the study took place, is one of 23 organizations named a Pioneer Accountable Care Organization (ACO) by the Centers for Medicare & Medicaid Services. This system is a member of the Institute for Clinical Systems Improvement (ICSI), an independent, non-profit health care improvement organization, that unites clinicians, health plans, employers, policymakers and consumers to bring innovation and urgency to improve health, optimize the patient experience and make health care more affordable. The system employs over 8,200 people, including more than 1,000 physicians.

Care for patients with Type 1, Type 2, and Gestational Diabetes is provided at primary care clinics or in the specialty clinics like those focusing specifically on endocrinology and Diabetes. The main providers of Diabetes care are physicians, nurses, dietitians, and care coordinators. Some nurses and dietitians (diabetes specialists) and care coordinators also are certified as Diabetes educators. Care for patients with Diabetes can include initial and advanced educational sessions to learn about Diabetes and Diabetes management, as well as the routine checks for effective Diabetes management. In this study, the term *staff* included all types of providers in e-encounters described.

Sample

The target population for the proposed study is patients with Type 2 Diabetes receiving care at a nonprofit, integrated health care system located in an urban setting in the upper Midwestern U.S. According to the Information Technology (IT) department query of the electronic health records database that was conducted in September of 2014, the healthcare system had a total of 804,103 active registered patients who have used the

services of the healthcare organization at least once within the past two years; of these 171,770 were registered users of the patient portal. Over 24,700 users of the healthcare system had a diagnosis of Type 2 Diabetes; of these, 6,627 were using patient portal.

The purposive, random sample was obtained using a database query run by the IT department on all possible patients with Type 2 Diabetes who use the patient portal. In order to be included in the population, the patient must:

1. Have had a diagnosis of Type 2 Diabetes
2. Have been between the ages of 18 and 70 (inclusive)
3. Have been enrolled in the patient portal ("active" status in patient portal)
4. Have at least one e-message communicated between 09/01/2013 and 09/01/2014.

A total of 3482 patient charts was included in the initial population and were thought to have met all inclusion criteria; after a careful review by the author, it was discovered that some patients were over the age of 70 years. A manual query was then performed by the author on the list of 3482 patients to exclude patients above the age of 70. A resulting total of 3103 patients was determined to have met all inclusion criteria. The sample was selected using a randomization feature in the EXCEL program. Figure 2 summarizes the details on query results, randomization and sampling process.

Exclusion criteria were that patients had:

1. A diagnosis of Type 1 Diabetes
2. A pregnancy
3. A diagnosis of active psychiatric disorder (e.g., psychotic disorders, schizophrenia)

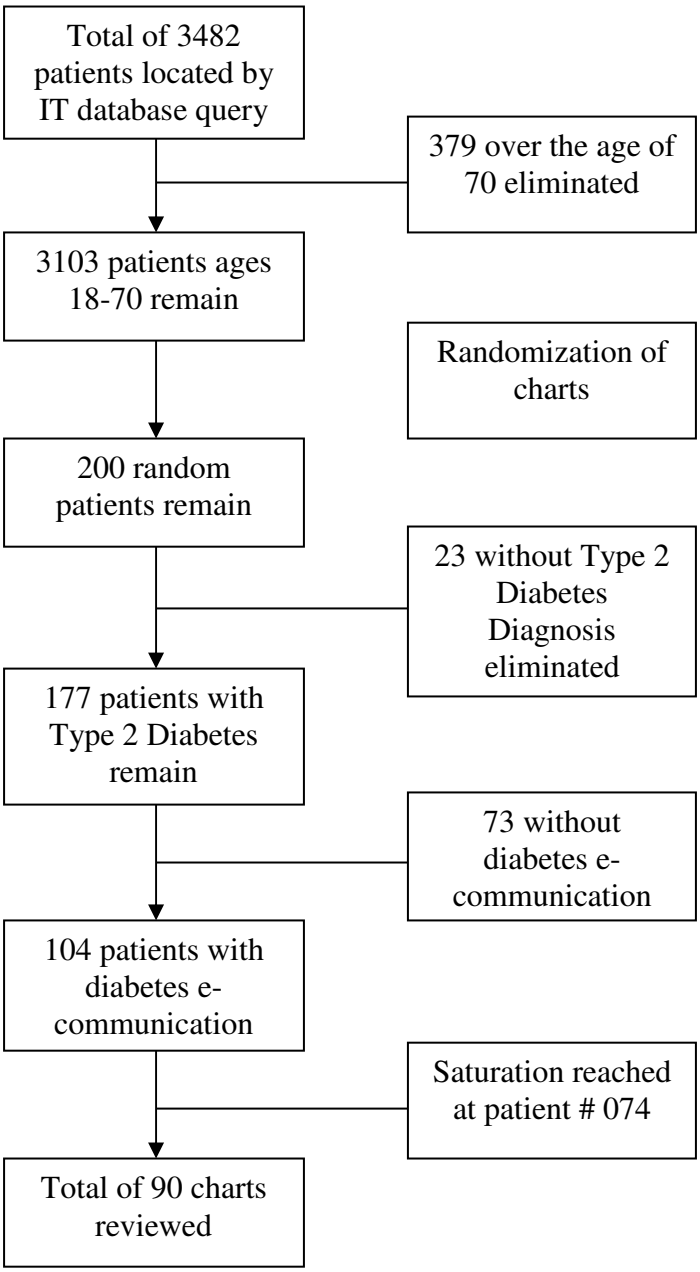

Figure 2. Randomization and Purposive Sampling of Participants in the Study.

The first 200 charts were selected for preliminary review to see if there was any e-communication in their chart related to Diabetes, and to exclude patients that met any of

the exclusion criteria. Out of the pool of 200 charts, 23 patients (11.5%) either did not have a diagnosis of Type 2 Diabetes (e.g., glucose intolerance) or had a diagnosis of Type 1 Diabetes, and, therefore, were eliminated. Seventy three patients (36.5%) had some e-communication, but it was not related to Diabetes. A total of 104 (52%) patients met all inclusion criteria and had Diabetes e-communication data in their EMR. The data collection phase began with each of the charts being reviewed, until the saturation was reached at patient # 074, meaning that no new themes have emerged for at least 15 charts. In total, 90 charts were reviewed in this study.

Protection of Human Subjects

Institutional Review Board (IRB) approvals from University of Minnesota and the healthcare system were obtained. The IRB of the healthcare system approved the conduct of this study in November, 2014, and recognized it as a quality improvement project for the organization (see Appendix C). The University of Minnesota IRB reviewed the study proposal by expedited review procedures and granted approval in December, 2014, under federal guidelines category (5) research involving materials that have been collected for non-research purposes (see Appendix D).

According to the IRB, the researcher was not required to seek patient consent for participation in the study. Patients' medical records were reviewed for study purposes only, and information obtained from the medical records was entered into database after being de-identified, with each participant receiving a unique ID number starting with 001, 002 etc.

Study Procedures

Within the last two decades, several computer programs have been developed within the framework of qualitative analysis to support steps of text interpretation (Fielding & Lee, 1998; Huber, 1992; Mayring, 1996; Weitzman & Miles, 1995 as cited in Mayring, 2000). Yet, the decision was made by the researcher not to use a program to support analysis of the e-communication content in this study, due to: a) low volume of content in e-message (half of the copied e-communication content is just a repetitive passage of who sent information to whom and when; b) no need to suspect non-reliability between the coders, as the coding was performed by one person; c) underlining and extraction of terms/phrases was already performed within the initial review of the e-communication content.

In order to carry out the study, the author used a secure log in to Electronic Medical Record (EMR) to access the charts of each study participant. The EMR is a digital version of the paper chart in the clinician's office containing the medical and treatment history of the patient to be accessed via computer. Then, all the electronic encounters (e-encounters) that existed for each patient were reviewed. An e-encounter is defined as the interaction between the patient and the health care system that creates any type of visit (e.g., clinic visit, phone visit), that generates patient health information within the EMR. Patient health information is any information related to the patient within the medical record, for example blood pressure measurement, age or medical diagnosis. Then, all the e-encounters were sorted by the type and only the *e-message encounter* type was used for analysis of e-communication within the patient portal. The e-

message encounter is defined as the interaction between the patient and health care system that creates an e-message visit, generating patient health information within the EMR.

Analysis Plan

This section describes the plan for the qualitative analysis of the data for this study. Analysis was performed from February to April of 2015; the plan for content analysis is organized according to the three study aims. The overall analysis was based on describing the sample of patients whose charts were used to access e-messaging (Aim 1), and on analysis of the e-message encounters in the EMR to identify themes that were then fit with Conversation Theory (Klemm, 2002) (Aims 2, and 3).

Aim # 1

Aim # 1: Describe the sample of patients with Type 2 Diabetes used to examine e-communication in terms of age, gender, ethnicity, years of education, primary language, duration of Diabetes, levels of A1C and length of enrollment to patient portal.

In this aim, the analysis was focused on the description of various characteristics of the sample. These are listed in Appendix A. Duration of Diabetes was defined as the difference between the date of diagnosis of Type 2 Diabetes and the date of September 1, 2014, calculated in years. Age at diagnosis was calculated as the difference between the date of birth and the date of diagnosis, calculated in years. The length of enrollment to the patient portal was defined as the difference between the date of enrollment to patient portal and the date of Sep 1, 2014, calculated in days. Data were then summarized. Due

to the limited availability of the data, only certain sample characteristics were compared to those in a national sample of the population of people with Diabetes as well as to the population of patients with Type 2 Diabetes that were enrolled in the patient portal within the healthcare system that served as the study site.

Aim # 2

Aim # 2: Analyze e-communication between patients with Type 2 Diabetes and their providers within the patient portal using conventional content analysis to identify themes and sub-themes in e-message encounters.

To address this aim, all the existing e-communication within the patient EMR was examined. The e-message encounter was the unit of analysis. The qualitative method of research is used in studies with a large volume of data; thus, organization of the data is the key to ensuring the trustworthiness of the findings. C*onventional* content analysis is defined as "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding, and identifying themes or patterns" (Hsieh & Shannon, 2005, p.1278). This qualitative method of content analysis goes beyond simple word counting, and examines the language for purposes of classification of text into a number of categories that represent similar meanings (Weber, 1990, as cited in Hsieh & Shannon, 2005). This approach is used in studies in which the existing theory or research literature on the phenomenon was limited, as was true in this study (Lauri & Kyngas, 2005 as cited in Elo & Kyngas, 2008).

Analysis involved the process of "making sense of the data", asking questions like "who is telling", "what is happening" and "why" (Elo & Kyngas, 2008), in all e-

messages within the e-message encounters. First, the total number of e-message encounters was tallied. The counts include the total number of system initiated e-message encounters and the patient-provider initiated e-message encounters. It is important to note that content analysis involved exploring only the *manifest* content as differentiated from latent content. Manifest content was described as the content that is written in the text and is available for analysis and latent content is the hidden meaning of the text. For example, it was difficult to determine if the latent content in an e-message that used capitalized text (MEDICATION) in one part the message was a sign of dissatisfaction or anger, or if it was simply an error on the patient's end because of mistakenly pressing the caps lock key on the keyboard. Thus, only the manifest content of the message itself was analyzed and any latent content was disregarded.

Once the numbers of e-message encounters were tallied, analysis proceeded to include open coding, category creation, and abstraction of themes (Elo & Kyngas, 2008). A code is the label of a unit that has meaning within the data (Graneheim & Lundman, 2004). Each e-message encounter was examined and e-messages within it were coded for the like content within the e-message encounters, and then coded according to observation of certain structural elements of text that were seen repeatedly within e-message encounters (see Appendix A for these elements).

The coding process for the e-message encounter was based on an examination of the overall initial intent or purpose of the message. From this analysis, the categories were identified (Graneheim & Lundman, 2004). Further exploration of the main intent of the e-message encounter led to the identification of a number of sub-categories that were

named using content-characteristic words related to different Diabetes management concepts, in addition to the main intent concepts. New categories, and sub-categories were identified until the saturation was reached, which meant that no new categories, or sub-categories were identified. (Graneheim & Lundman, 2004).

Then the process of abstraction, or the collapsing of smaller, similar units of meaning into broader, higher order clusters, was used to identify themes and sub-themes within e-message encounters (Burnard, 1996; Polit & Beck, 2004; Robson, 1993 as cited in Elo & Kyngas, 2008). Abstraction continued as far as was reasonable and possible and led to the identification of three major themes and several sub-themes.

Structural elements were then examined to determine their contribution to themes. Elements of the message structure were coded for common properties and included the following: 1) identifying the *initiator* - a person (patient or healthcare provider) who was the first to send the e-message within the e-encounter; 2) within the e-message encounter, there may be different *numbers of replies;* 3) the messages may or may not be *complete,* defined as messages initiated by the patient or the healthcare provider that contain all the necessary information to make informed decisions about the patient's health; 4) whether the e-message initiated by the healthcare providers were *read or not read* by the patient, by identifying a note informing the healthcare provider about the e-message being read or not read by the patient; 5) e-message encounters can consist of important exchange of information leading to a *resolution*, or the use of e-communication to either resolve the problem, or inform about resolution of the problem.

After coding, categories were created and reviewed for their fit with identified themes and subthemes.

Aim # 3

Aim # 3: Analyze themes identified in e-message encounters between patients with Type 2 Diabetes and their providers for their fit with Conversation Theory using directed content analysis.

In this aim, *directed* content analysis was used to further explore themes and sub-themes identified in Aim 2 comprising e-message encounters for their fit with Conversation Theory (Klemm, 2002). Directed content analysis is used when there is an existing theory or when there has been research already completed about the phenomenon, in this study, on e-communication between patients with Type 2 Diabetes and their providers (Hsieh & Shannon, 2005). The goal is to extend the theoretical framework using a deductive category application, in order to help determine the fit between study results and existing theory.

The guiding theory in this study was Conversation Theory by Klemm (2002). The theory describes four main categories of conversation as follows: 1) monolog, which is an exchange of opinion and supposition; 2) dialogue, a community-building form of shared viewpoints; 3) dialectic, conversation aimed at distilling truth or correctness from logical argument; and, 4) construction ("Design"), use of conversation to create something new, often in the form of producing some kind of deliverable (see Figure 1). In an education setting, the highest form of communication is construction.

The determination of fit of themes in e-message encounters in this study with the specific type of conversation identified in the theory was based on analysis of content within those themes and sub-themes and on analysis of identified structural elements within e-message encounters. Content and structure were then assessed for the match with each type of conversation theory: monolog, dialogue, dialectic, or construction.

Considerations of Rigor in Qualitative Research

According to Polit & Beck (2010), there are four criteria for developing the trustworthiness of qualitative inquiry: credibility, dependability, confirmability and transferability. All of these criteria were considered in the plan for analysis of the data. Credibility is the confidence in the truth of data and interpretations of them. It was achieved by carrying out the study in a way that enhances believability of the findings and takes steps to demonstrate credibility to external readers. For example, only the data from medical records meeting the previously defined inclusion and exclusion criteria were collected. One of the challenges in conventional content analysis is the failure to develop a complete understanding of the context, thus failing to identify key categories (Hsieh & Shannon, 2005). Credibility within the naturalistic paradigm of trustworthiness or internal validity should also be considered within a paradigm of reliability and validity (Lincoln & Guba, 1985, as cited in Hsieh & Shannon, 2005).

Dependability ensures the stability of the data over time and over conditions. In this study, the use of a standard database query of the EMR system was intended to address this criterion. Confirmability refers to the potential for congruence between two of more independent people about data accuracy, relevance, or meaning. Transferability

refers to the extent to which qualitative findings can be transferred to other settings or groups. Reflexivity in qualitative studies refers to the critical self-reflection about the researcher's own biases, preferences and preconceptions.

In summary, the analysis plan included a summary of the characteristics of the sample using descriptive statistics and qualitative analysis of e-communication using conventional content analysis to identify themes and subthemes. Directed content analysis was used to determine the fit of identified themes and subthemes for their fit within Conversation Theory.

Chapter 4 – Results

The purpose of this study was to explore e-communication between patients with Type 2 Diabetes and their providers within the patient portal in one Midwest healthcare system. The study employed a qualitative design, based on the use of content analysis methods. The unit of analysis was the e-message encounter. A purposive, random sample of 90 charts of patients with Type 2 Diabetes was subjected to a retrospective review of the e-communication within the patient portal. While the end date was identical for all the patients, the start date for data collection for each patient could potentially range from as early as July 2, 2011 to as late as August 27, 2014. Conventional content analysis methods were used in order to identify themes that were common across e-message encounters. These identified themes were then analyzed using directed content analysis methods for their fit with Conversation Theory (Klemm, 2002). In this chapter, results of the study will be presented in relation to each of the stated aims.

Aim 1: Characteristics of the Sample

Aim 1: Describe the sample of patients with Type 2 Diabetes used to examine e-communication in terms of age, gender, ethnicity, years of education, primary language, duration of Diabetes, levels of A1C and length of use of patient portal.

The sample was described in terms of both demographic and clinical characteristics; these characteristics were analyzed using descriptive statistics (means, medians, percentages, and ranges). Certain sample characteristics were then compared to the Center for Disease Control (CDC) national data (CDC, 2014), the local (state) data on care measures (MNCM, 2012) and the local healthcare system database, that included

data on the active patients with Type 2 Diabetes that are enrolled in patient portal. The local data used for comparison included the database within the healthcare system that served as the site for the study, and the Minnesota Community Measurement website that provides clinical targets for care management of patients with Diabetes 2 Type (MNCM, 2012). The CDC data described the population of people with Diabetes *in general* (including Type 1 Diabetes), and was not specific to patients with Type 2 Diabetes. It included both the patients who were the users of the patient portal and those who were the non-users. This meant that only certain comparisons could be made between the study sample and the population of people with Type 2 Diabetes.

Demographic Characteristics

The demographic characteristics of the sample were described using descriptive statistics and are summarized in Table 1. The sample of patients in this study included 49 females (54.44%) and 41 males (45.56%). The mean age was 57.1 (SD = 9.05). The sample was further divided into four groups by age, in order to better visualize the results (Figure 3); the majority of patients in the study sample were over 50 years of age (Median=60 years).

A majority of the sample was white (80 patients, accounting for 88.9% of the sample) and non-Hispanic (87 patients which are 96.67% of the sample). There were only three Black patients, five Asian patients and one patient who refused to provide the ethnicity information. When compared to the CDC (2014) data, it shows that about 76% of the Diabetes population is White, 16.2% is Black and 4.7% is Asian; one can see that

the percentage of White people with Diabetes in the study sample is higher, and the percentage of Black people is lower.

Table 1.
Characteristics of the Sample of Patients

	n	*M (SD)*	*Mdn*	*%*	*CDC (2014)*			*Healthcare System Data*
					M	*Mdn*	*%*	*%*
Age (years)	90	57.1 (9.05)	60					
30-39 years	5			5.55				
40-49 years	14			15.56				
50-59 years	24			26.67				
60-70 years	47			52.22				
Gender	90							
Male	41			45.56			49	
Female	49			54.44			51	
Race	90							
White	80			88.89			75.9	85.46
Black	3			3.33			16.2	6.08
Asian	5			5.55			4.7	4.46
Other	2			2.22			3.1	
Ethnicity	90							
Hispanic	2			2.22			14.9	
Non-Hispanic	87			96.67			85.1	
Refused	1			1.11				
Marital Status	90							
Married	59			65.56				
Single	19			21.11				
Divorced	8			8.89				
Widowed	3			3.33				
Unknown	1			1.11				
Primary language	90							
English	89			98.89				97.8
Spanish	1			1.11				

Yet, when the study sample is compared to the healthcare system database that lists the population of Type 2 Diabetes patients enrolled in patient portal within the healthcare system, the percentages are similar, with 85% White and about 6% of Black people with Type 2 Diabetes being enrolled in the patient portal. Statistical data from the

CDC (2014) on ethnicity of the population with Diabetes shows 85% of the population is non-Hispanic and 15% is Hispanic. The study sample has a lower percentage (3.3%) of Hispanic population, compared to the CDC (2014) data.

An examination of marital status showed that the majority of the patients were married (59 patients or 65.6% of the sample), and 19 patients or 21.1% of the sample were single. Only one patient (1.1%) had Spanish listed as his primary language, with the other 89 patients (98.9%) speaking English as their primary language. The data on primary language obtained from the sample is similar to the data from the healthcare system, which showed that 97.8% of the patients with Type 2 Diabetes were enrolled in the patient portal and identified English as their primary language. Years of education was listed for three patients only, thus "years of education" parameter was not included in the analysis.

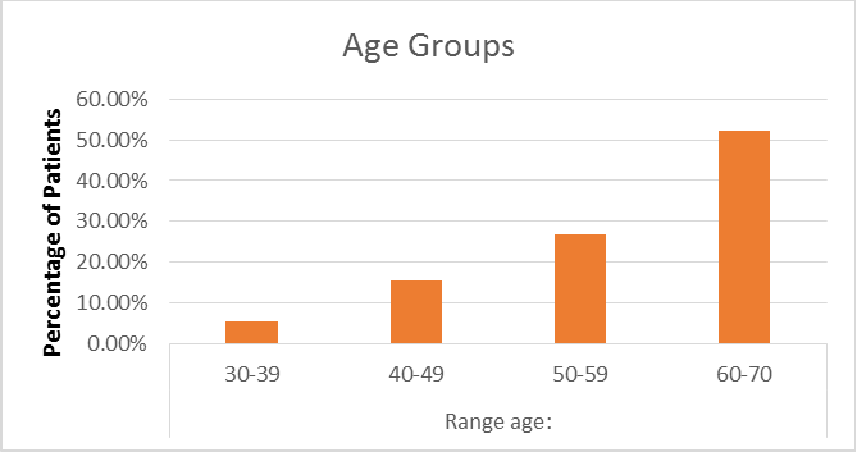

Figure 3. Age groups in study sample

Clinical Characteristics

Data related to clinical characteristics of people with Diabetes were collected from the patients' charts on measures that describe five treatment goals which, when

reached together, represent the gold standard for the effective care management of people with Diabetes (MNCM, 2015). These measures are: known as the D5 measures and include: 1) Hemoglobin A1C (A1C) laboratory test values; 2) blood pressure measurements; 3) Aspirin intake data; 4) Low-Density Lipoprotein (LDL) laboratory test values; and, 5) the smoking status parameter. In this study, only the A1C data were included as a clinical characteristic that indicated the health status of the people in the study sample. A1C laboratory test values are the best indicators of Diabetes control, providing the percentage value of the mean glucose level for the previous three months. Targets for D5 measures are established by the Minnesota Community Measurement (MNCM, 2012); for patients with Type 2 Diabetes, the target for A1C is a level of less than 8% (see Table 2). The number of patients at target was 62 (81.58%); 14 (or 18.42%) were not at target.

Table 2.
Clinical Data

Clinical Measure	*N*	*Mean*	*SD*	*Median*	*%*	*CDC (2014)*	
						M	*Mdn*
A1C Measurement	76	7.06%	1.19	6.8%			
At target	62				81.58		
Not at target	14				18.42		
Age at Diagnosis (years)	84	48.33	9.5	49.87		53.8	54.2
Duration of Type 2 Diabetes (years)	84	8.41	5.79	7.92		11.4	7.6
Less than one year	6				6.67		
1-4.99 years	23				25.56		
5-9.99 years	20				22.22		
10-15 years	25				27.78		
15-20 years	8				8.89		
More than 20 years	2				2.22		

The duration of Diabetes was another clinical variable analyzed in this study (Table 2). The duration of Diabetes is a factor used in planning care for patients. The longer the duration of Type 2 Diabetes, the higher the severity and the complexity, the risk of complications, and the cost associated with the care. Duration of Diabetes was defined as the difference between the date of diagnosis of Type 2 Diabetes and the date of September 1, 2014, calculated in years. The mean duration of Diabetes for this study sample was 8.41 years, with range of duration from 0.05 years to 28.21 years. Duration of Diabetes according to CDC (2014) was 11.4 years on average, illustrating that the average duration in the study sample is lower (Table 2).

In order to better visualize the results on duration of Diabetes, the study sample was divided into six groups, summarized in Figure 4, which shows that the majority of patients (75.56%) had Diabetes for less than 15 years. The date of diagnosis for six patients was not available; thus, the duration of diabetes for those patients was listed as unknown.

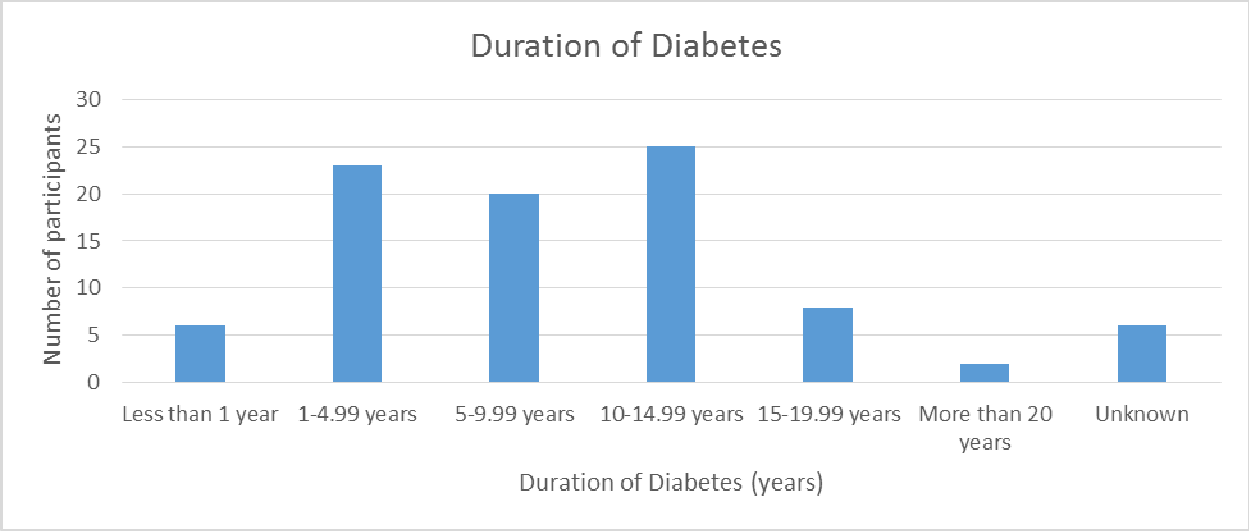

Figure 4. Duration of Type 2 Diabetes (n=90) for the study sample

The age of patients at diagnosis was calculated as the difference between the date of birth and the date of diagnosis, calculated in years (Table 2). Since the exact date of diagnosis was not available for six patients, the average age at diagnosis for a total of 84 patients was calculated at 48.3 years, with the median of 49.8 years. The CDC (2014) data showed that the age at diagnosis is 53.8 years on average and the median is 54.2 years. Similar to the analysis of the duration of Diabetes, the comparison shows that the mean age at diagnosis for the study sample is lower than the national average age at diagnosis.

Length of Use of the Patient Portal

Determining whether or not the patients were experienced in using the patient portal was assessed to distinguish beginner level users from experienced users. Beginners might not use all the features of the portal due to their lack of knowledge and the experience with the patient portal. Based on the IT query, the length of use of the portal was calculated for most users based on the difference between the date of enrollment to patient portal and the date of September 1, 2014, calculated in days. There were exceptions, however. For some patients, e-messages within their EMR were available for the dates earlier than the date of enrollment listed in IT query results, meaning that those patients were enrolled as active users, but at some point became inactive. Later, those patients were reactivated into the use of the patient portal. The query for those patients showed the actual *reactivation* date, rather than the initial enrollment date. In those instances, the date of the earliest e-message was listed as the start date for data collection.

The length of use of the patient portal for the study sample ranged from five days to 1157 days with a median of 417 days and the mean of 504 days (Median = 13.7 months; Mean = 16.6 months). Eight patients were noted as *reactivated* (the date listed in the database query as the date of reactivation as described above); the exact date of enrollment for those patients was listed as unknown. The results are presented in Table 3.

Table 3.
Length of Use of Patient Portal

	n	%
Less than 180 days	11	12.22
180-364 days	23	25.56
365-730 days	27	30.00
More than 730 days	21	23.33
Unknown	8	8.89

In order to better visualize those results, all the patients were divided into four groups by the length of use of the patient portal. The summary of the findings is presented in Figure 5 below, showing that the majority of the patients (about 79%) were enrolled to the patient portal between six months and two years. Although eight patients were listed as unknown for the length of patient portal use, the data were still collected for those patients from the date of the earliest e-message available in their EMR.

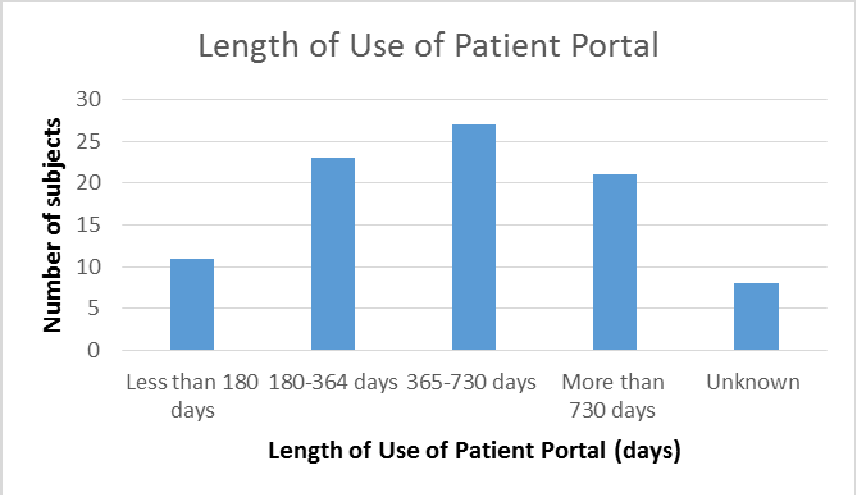

Figure 5. Length of use of patient portal in study sample

The results of characteristics analysis show that the study sample is somewhat representative of the population of patients with Type 2 Diabetes according to CDC (2012), but is representative of the people Type 2 Diabetes enrolled in patient portal.

Aim 2 - Conventional Content Analysis

Aim # 2: Analyze e-communication between patients with Type 2 Diabetes and their providers within the patient portal using conventional content analysis to identify themes and sub-themes in e-message encounters.

To address this aim, all the existing diabetes e-communication within the patient EMR was examined. All diabetes e-communication was reviewed initially and was re-read several times. Conventional content analysis was used for subjective interpretation of the text data through the systematic classification process of coding of text into a number of categories that represent similar meanings. This method was extremely useful since the existing literature on the content of e-communication in patients with Type 2 Diabetes is limited.

E-message Encounters

An e-message encounter is defined as an interaction between the patient and health care system that creates an e-message visit, generating patient health information within the EMR. All the e-encounters were sorted first by type, and only e-message encounters initiated by a person (patient or provider) were included in the content analysis. The results show a total of 344 e-message encounters that were related to Diabetes; of these,

165 (48%) were created by either the patient or the healthcare staff. Automatic e-messages from the system totaled 179 (52%).

Analysis of Content and Structure of E-message Encounters

Once the e-message encounters were tallied, analysis of person-initiated e-message encounters proceeded to include open coding of the text, creation of categories based on coding, and abstraction of themes. Analysis of the structural elements of text that were seen repeatedly within e-message encounters were also examined (see Appendix A for these elements). The categories created after this analysis were then used for developing of themes (Aim 2) and fitting of the themes to the types of conversation described within Conversation Theory (Aim 3).

Analysis of Content of E-Message Encounters Related to Intent

In order to analyze the content of e-message encounters as related to the intent, the coding, categorization and the abstraction processes were used. The content of the e-messages was coded based on the overall intent of the message, from which the main categories were created. Then sub-categories were created using content-characteristic words related to different Diabetes management concepts, and the main intent. The abstraction process was used to collapse like content identified in the categories and sub-categories into broader clusters that led to the identification of themes and sub-themes.

The coding process for the content of e-message encounter was based on an examination of the overall intent or purpose of the message. At this point, the analysis of the intent of the message included identification of the initiator of the message (patient or

staff) examined as one of the structural elements described in more detail in Aim 3. Because the types of e-message encounters and the overall intent or purpose of the initial message differed between patients and staff, coding of messages by the initiator facilitated the overall analysis of content and helped to inform the development of themes and sub-themes.

Each message within the e-message encounter was reviewed several times by searching for the phrases within the message used to create codes for the main intent of the e-message. For example, the phrases "wondering if", "wondering how", "what is", "do I", or "should I", sent by either the patient or the staff suggested that the message involved a question. The phrases "I need", "wondering if you would", or "request for", sent from the patient suggested a request. The phrases "please come", "please call", "please start with", "make the appointment", or "keep me updated" that were sent from the staff suggested instructions. Finally, the largest variety of phrases in e-communication, like "results have improved", "I have sent this", "I am a stress eater", or "I have placed orders", sent by the patients or the healthcare staff, suggested that e-messages were sent for information purposes.

Based on this list of codes, four main categories emerged that were used to describe the overall intent of e-message encounters. The categories were as follows: *Inform, Question, Request and Instruct*. The codes within the structural element "initiator" led to the identification of two categories because not all categories applied to both patients and staff. The *Request* category, for example, was initiated only by patients; the *Instruct* category was used only by staff. An example of the *Staff Instruct*

category is this directive, "*Continue current medications and continue to work on weight and diet*". Only messages from staff fit into this category, because they provided direction from staff for patients based on their expertise about care and management of Diabetes. Common categories initiated by both patients and staff were *Question* and *Inform.* An example of content in the *Patient Question* category is, "*Are the fasting labs already in the system?*" This question initiated by the patient asks the staff about labs that need to be drawn, but prior to that, the order needs to be placed within the EMR. A staff question might have asked the patient if he had his A1C lab drawn. Thus, questions could be initiated by either the patient or the staff. A total of six unique categories were identified as follows*: Patient Inform, Patient Question, Patient Request, Staff Inform, Staff Question* and *Staff Instruct.*

Based on these six categories, content was reviewed to determine broader, higher order clusters observed across all messages regardless of initiator. This abstraction led to the identification of four themes: *Inform, Question, Request, and Instruct*. Then, following further review, the *Instruct* theme and the *Request* theme were collapsed into one theme, called *Instruct/Request.* This decision was based on the observation that the e-message encounters that began with a request might be initiated by either the patient or the staff and could lead to an exchange that resulted in instruction or to a further request. It became difficult to assign the exchange to one theme or the other. The three final themes are depicted in Figure 6 (Appendix D).

Further exploration of the main intent of the e-message encounter led to the identification of a number of sub-categories that were named using content-characteristic

words related to different Diabetes management concepts, in addition to main intent concepts. These sub-categories were observed as they fit within the six categories until saturation was reached, which meant that no new sub-categories were identified. The following eleven unique sub-categories were created: Medication, Communication, Laboratory (Lab), Diabetes Mellitus (DM) Management, Visit, Appreciation, Symptom, Staff Out, Acknowledgement, Apology and Introduction. These sub-categories were then grouped according to their fit within the three themes and became the sub-themes (also listed in Figure 6 by themes).

Figure 6 (Appendix D) provides further detail of themes, and sub-themes that were identified in relation to each theme. The *Inform Theme* was observed most often in e-communication between the patients with Type 2 Diabetes and their providers. The *Inform Theme* was identified 579 times in e-communication, as compared to *Instruction/Request Theme* that appeared 272 times, and the *Question Theme* that appeared only 92 times. The *Inform Theme* included content from eleven sub-themes, as compared to only five sub-themes in *Instruct/Request* and six sub-themes in *Question Theme*.

The *Inform Theme* contains eleven sub-themes, as follows: Appreciation (identified 111 times), Lab (identified 107 times), Medication (identified 105 times), DM Management (identified 58 times), Communication (identified 52 times),Visit (identified 27 times), Symptom (19 times), Staff Out (17 times), Acknowledgement (15 times), Apology (seven times), and Introduction (five times). The sub-themes of Medication, Lab, and Visit were identified based on content of messages from the patient or the staff

about medications (e.g., names of medication, dose of medication), about laboratory tests (e.g., A1C lab test, or Microalbumin lab test), and about scheduled or needed visits (e.g., date and time of visit, provider at the visit). The Diabetes Management (DM) sub-theme included content of messages related to diabetes management other than medication (e.g., blood glucose values, eye exam, complications). The sub-theme Communication included content about a necessary communication (e.g., fax, phone, e-mail) related to diabetes.

Appreciation was the most frequently identified sub-theme within *Inform Theme* across all e-message encounters. This sub-theme included content from the patient or staff member expressing thanks and was usually related to the care provided or to be provided. The symptom sub-theme included sentences that described or interpreted symptoms considered to be related to Diabetes (e.g., symptoms, pain or stress-eater). The Staff Out sub-theme included messages that informed the patient about staff being out of the office (e.g., phrase "*out of office*"). In the Acknowledgement sub-theme, there were phrases that informed the patient or the staff about the receipt of information (e.g., phrases like "*Sounds great!*" or "*Will do*"). The Apology sub-theme included phrases related to an apology for some inconvenience or perceived disturbance (e.g., "*sorry*") by the patients and the healthcare staff. There was also "non-Diabetes related" sub-theme used to cluster messages in the e-message encounter that were not related to Diabetes management.

The *Question Theme* had six sub-themes: Medication (identified 35 times), Lab (21 times), Visit (15 times), DM Management (14 times), Symptom (four times) and Communication (three times). The sub-themes were defined similarly to those in the

Inform Theme, with the difference being that the content in the e-messages were sent with the intent to ask a question, rather than to provide information.

The *Instruct/Request Theme* included five sub-themes: Medication (identified 89 times), Communication (65 times), Lab (55 times), Visit (50 times), and DM Management (13 times). Developed in a similar way to those in the *Inform Theme* and *Question Theme*, the sub-themes in *Instruct/Request Theme* were based on words related to diabetes concepts, in addition to the main intent concepts. The difference was that in case of *Instruct/Request Theme*, the messages were sent with the intent of instructing (initiated by staff) on a Diabetes-related topic or requesting (initiated by patient) something related to diabetes.

Detailed description of the most frequently identified themes and sub-themes, including definitions and examples of citations from e-communication, is presented in Table 4 (Appendix E). Table 4 presents a total of eleven examples of themes and sub-themes. Theme and sub-theme # 1, for example, presents *Patient Inform DM Management*, defining it as an information sent from the patient to the healthcare staff about any DM Management related topic. Example of citation includes a text copied from the EMR. The text shows part of the e-message in which the patient presents the blood glucose values including the dates and the time of day is was taken. This example shows a partially complete message, as the fasting status of the patient is not included in the text, so the provider will not have a sufficient information within the e-message sent to further instruct the patient on the management of diabetes.

Theme and sub-theme # 2 is another example, presenting *Staff Inform Medication* sub-theme, which is defined as an information sent by healthcare staff to inform the patient about diabetes medication related topic. Citation shows a single sentence in which the staff informed the patient that the prescription for the patient was sent using Express Scripts, including the date. This message shows an example of a resolution, in which the staff not only resolved the problem, but used e-communication to inform the patient about resolution.

Analysis of Structural Elements

Analyzing the structural elements within the e-message encounters provided detailed information about the messaging itself. Some messages were brief, others more extensive. Some began with a question and some were just about exchange of a reminder of an appointment. Results of this analysis appear in Aim 3 and are related to each of the structural elements: 1) the initiator of the message; 2) the number of replies; 3) whether the message was read or not; 4) whether or not the message was complete; and 5) whether or not there was enough of an exchange of information to resolve or to inform about resolution of a specific problem. Based on the coding of the structural elements, the categories were developed accordingly.

The content of each e-message encounter was reviewed; codes were assigned and categories were created by grouping the types of structure within each message using similar codes. The results on each of the five elements were presented using counts, percentages or means, as applicable and can be found under Aim 3.

Aim 3 – Directed Content Analysis

Aim 3: Analyze themes identified in e-message encounters between patients with Type 2 Diabetes and their providers for their fit with Conversation Theory using directed content analysis.

In this aim, *directed* content analysis was used to further explore themes and sub-themes identified in Aim 2 as well as the structural elements within the e-message encounters in order to assess their fit or match with types of conversation identified within Conversation Theory (Klemm, 2002). Directed content analysis is used when there is an existing theory or when there has been research already completed about the phenomenon. The goal was to extend the theoretical framework using a deductive category application, in order to help determine the fit between study results and existing theory. The guiding theory in this study was Conversation Theory by Klemm (2002).

The theory describes four main categories of conversation as follows: 1) monolog, which is an exchange of opinion and supposition; 2) dialogue, a community-building form of shared viewpoints; 3) dialectic, conversation aimed at distilling truth or correctness from logical argument; and, 4) construction ("Design"), use of conversation to create something new, often in the form of producing some kind of deliverable (see Figure 1). In an education setting, the highest form of communication is construction.

Conversation is an exchange of ideas where the message triggers a reply which might trigger another reply etc. An e-message encounter represents conversation, because it is an interaction between the patient and health care system that creates an e-message visit, generating patient health information within the EMR. In this study, themes and subthemes were identified within each e-message encounter that included a

"conversation" about Diabetes related topics between patients and providers. This e-conversation took various forms which were matched to the types of conversation identified in Conversation Theory. The structures of those messages were also analyzed because the exchange of words within a message took various forms as well.

All e-message encounters were reviewed for the content in themes and subthemes for their match with a type of conversation. In order to fit the themes and the sub-themes with the Conversation Theory, an analysis was performed to identify a pattern of emerging themes and sub-themes within the e-message encounter. For example, will the *Question Theme/ Question Medication* sub-theme in the initial message necessarily lead to *Inform Theme/ Inform Medication* sub-theme in the reply message within the same e-message encounter?

The results of this analysis show that there is no clear pattern on the themes that emerged in reply communication. The theme emerged can be summarized as follows: 1) *Request Theme* leads to no reply, or *Infrom Theme*, *Question Theme* or *Instruct Theme* to emerge; 2) *Question Theme* leads to no reply, or *Inform Theme*, *Instruct Theme* and *Question Theme* to emerge; 3) *Instruct Theme* leads to no reply, or *Inform Theme* or *Request Theme* to emerge; and 4) *Inform Theme* leads to no reply, or *Inform Theme*, *Instruct Theme*, *Question Theme* or *Request Theme* to emerge. Thee sub-themes emerged are presented in Table 5 (Appendix F).

Table 5 shows no clear pattern on certain sub-themes that emerged in response to other sub-themes. A sub-theme in the initial e-message can trigger a variety of other sub-themes in reply e-message to emerge, from no reply at all to up to ten reply messages

with a number of different sub-themes associated with each reply message. This finding suggested the need to find another way to analyze the e-communication for the fit with Conversation Theory.

Electronic communication occured only if the e-message encounter was initiated, so analysis began with identification of the *main reason* behind the initial e-message in the e-message encounter. Each initial e-message varied based on the theme; in other words, was the main reason for the message to *Inform,* to *Question*, or to *Instruct/Request?* All three themes were identified within the initial message review.

An additional analysis of the each initial message within the e-message encounter was performed to determine the main sub-theme. For example, the initial message might include several sub-themes within one theme: *Instruct Visit; Instruct Lab; Instruct Medication*, necessitating a choice about the main sub-theme. Within the three themes, seven sub-themes formed the subject of the initial message. These are listed in Table 6.

From 165 encounters identified, a total of 22 sub-themes were identified as the main sub-themes of the e-message encounter under the three major themes – *Instruct/Request* (four different sub-themes), *Question* (five different sub-themes) and *Inform* (six different sub-themes). *Instruct/Request* was identified as the main theme in 82 e-message encounters, out of which 44 were for *Instruct Theme*, and 38 – for *Request Theme*. *Question Theme* was identified in 49 e-message encounters, out of which 41 were initiates by patients and only eight – by the staff. *Inform Theme* was identified in 31 e-message encounters, out of which 14 were initiated by the patients and 17 – by the staff. There were three e-message encounters in which the main sub-theme was non-Diabetes

related. Although the main sub-theme in the initial e-message was *not related* to Diabetes, the other sub-themes in the reply e-messages included Diabetes-related content, thus this e-communication was included in the data collection and the analysis.

Table 6.
Themes and Sub-themes in the Initial e-Message of e-Message Encounter

Main Theme	Main Sub-theme	Number of Encounters
Instruct/Request		
Staff Instruct	Visit (w/w/o Lab)	34
	Lab	4
	Communication	3
	Medication	3
Patient Request	Medication/supply	25
	Communication	7
	Lab	6
Question		
	Lab	15
Patient Question	Medication	12
	Visit	8
	DM Management	4
	Communication	2
Staff Question	DM Management	7
	Medication	1
Inform		
Patient Inform	DM Management	9
	Medication	1
	Communication	1
	Symptom	1
	Appreciation	1
Staff Inform	Lab	12
	Medication	4
	Communication	2

Note. Three initial non-Diabetes messages were identified for the main purpose.

Figure 7 presents the analysis of the ten *most common* main sub-themes of the initial e-messages (additional twelve sub-themes that appeared four or less times, are not included in the figure). About 19% of the e-message encounters were initiated using *Inform Theme*, 23% used the *Request Theme*, 26.7% were initiated by the providers using

Instruction Theme and 29.7% used the *Question Theme*. E-messages sent by the patients had multiple sub-themes, yet the main sub-theme in *Request Theme* was for medication/supply for Diabetes; the most frequently identified sub-theme in *Instruct Theme* was for a visit; most of the e-message encounters involving *Question Theme* were about labs and medication, and the vast majority of *Inform Theme* sub-themes were about Diabetes management, as compared to all other possible sub-themes that emerged in the initial e-message.

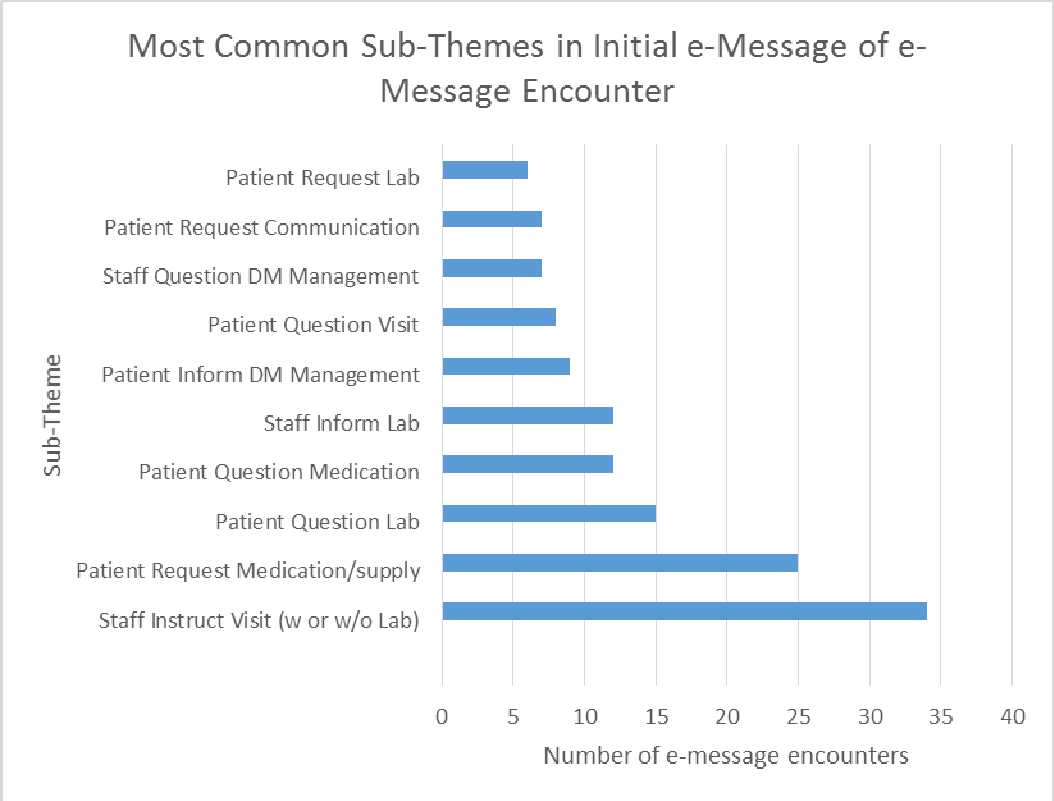

Figure 7. The most common main sub-theme in initial e-message of e-message encounter

The review of content in e-message encounters for themes and sub-themes provided some information, but was not sufficient for fitting e-message encounters into the four types of conversation. The whole e-message encounter is a complex

phenomenon that is more than just the content. The analysis proceeded to a review of the structural elements of the messages.

Results Related to Analysis of Structural Elements

Analyzing the structural elements within the e-message encounters provided detailed information about the messaging itself. Some messages were brief, others more extensive. Some began with a question and some were just about exchange of a reminder of an appointment. Results of this analysis are related to each of the structural elements: 1) the initiator of the message; 2) the number of replies; 3) whether the message was read or not; 4) whether or not the message was complete; and 5) whether or not there was enough of an exchange of information to resolve a specific problem. Results of the process of coding, categorizing and abstraction of structural elements follows

1. Initiators of e-Communication

The e-message encounter initiator is the person (patient or healthcare provider) who was the first to send the e-message within the e-encounter. The coding process began by labeling each e-message encounter as “st” for “staff” or “pt” for “patient”. The initiator of the e-message encounter was determined by reading the content of the e-message; the person sending the first e-message within the encounter was the initiator. The specific definitions of the staff members, like the care coordinators vs. Diabetes specialist or pharmacists, were determined based on the specialty section within the EMR encounter, the e-message content as well as the general knowledge of the author on the staff members working at the Diabetes clinic.

The following seven codes were created for this element: patient, primary care physician (PCP), PCP staff, care coordinator, pharmacist, Diabetes clinic staff and specialty care staff. E-message encounters initiated by either the patients or the healthcare professionals numbered 165, as summarized in Figure 8. The e-message encounter initiators were relatively equally divided between the patients (94 e-message encounters or 56.7%) and the healthcare staff (71 e-message encounters or 43.3%). Out of 71 e-message encounters initiated by the healthcare staff, 35 (49.2%) were initiated by primary care physician (PCP) staff, 22 (30.9%) by PCP, ten (14.1%) by care coordinators, two (2.8%) by pharmacists, one (1.4%) by Diabetes clinic staff and one e-message encounter (1.4%) – by the specialty care team (Figure 6). Ultimately, initiators were divided into two categories: patient or provider (staff) and used to analyze content.

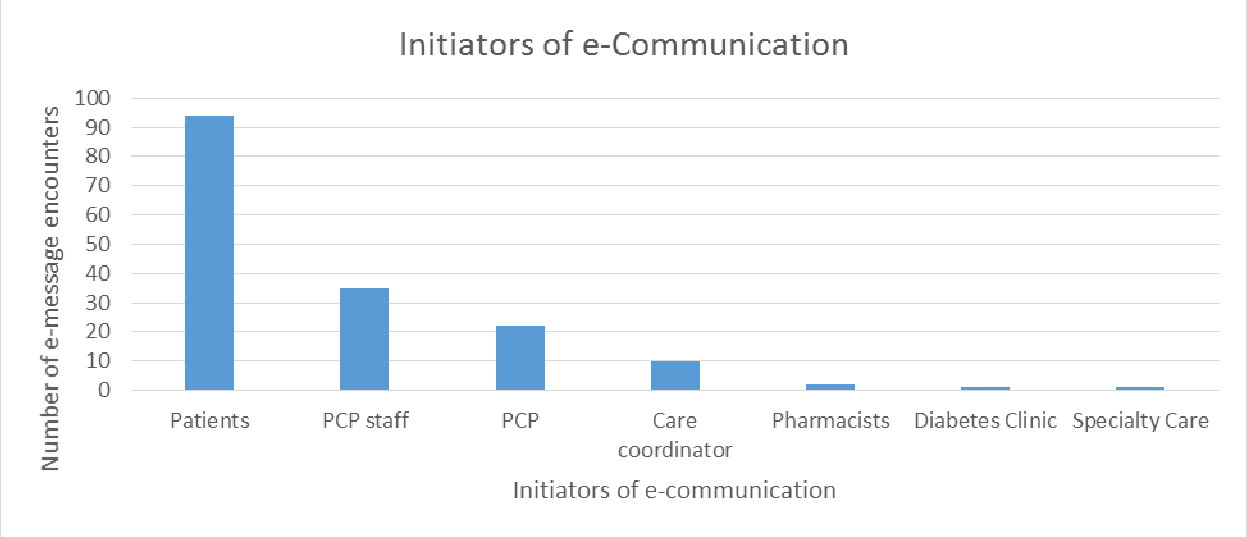

Figure 8. E-Communication Initiators

2. *Number of Replies per e-Message Encounter*

A reply within an e-message encounter is a response to any e-message within the e-message encounter. The e-message encounter can consist of one or more e-messages or replies. In order to determine if the electronic conversations between the Type 2 Diabetes patients and their providers were lengthy or not, each e-message encounter was reviewed for the number of e-messages (replies) within the e-message encounter. Each e-message encounter was coded with the number of replies. It was found that the minimum number of e-messages per encounter was one, and the maximum number – ten. The average number of e-messages per e-message encounter was 2.18.

It is important to note that some encounters were divided into two or more encounters, as judged by the author, depending on the *date* of e-messages and its *content*. Examples of encounters to be divided included: a) the encounter contained multiple messages on the same theme, but the dates would differ significantly, such as several messages occurring in one month, or several messages occurring a month later, and several more messages seen two months later; b) the encounter contained multiple messages within a tight timeframe, but the topics discussed within the encounter were different. The number of replies within an e-message encounter was used to determine the fit within the types of conversation.

3. E-Messages Read by Patients

When an e-message was initiated by the provider, there was a note generated within the e-message encounter that informed the provider about whether the initial e-message sent by the healthcare provider was read or not read by the patient. This helped the provider to determine the further steps in care planning, in case the e-messages were

not accessed by the patients. The coding for this element was performed by scanning the content of the e-message text for the note stating “not read” or “read by [patient name] on [date]” on the upper part of the e-message text. Out of 165 e-messages encounters initiated by healthcare staff and the patients, 71 were initiated by staff. Out of all e-message encounters initiated by staff, only 15 messages (21.1% of staff initiated e-message encounters) were not read. The number of messages read or not read helped informed another element to facilitate matching of e-message encounters with types of conversation as described below.

4. Completeness of E-Message

Completeness of the e-message refers to whether the messages sent by the healthcare staff contained sufficient information for the patient to make an informed decision, and the messages sent by the patients contain sufficient information for the healthcare providers to make decisions regarding patient’s care. The sufficiency of the information was determined by the author based on the Diabetes management aspects within the e-message content. For example, e-messages instructing the patient about a visit should have included information about which number to call for scheduling the visit, or directions to the patient to complete a lab test prior to visit. Coding was performed by marking each e-message encounter with either the “complete” or “partial” label. It was found that out of 165 messages sent by patients or the staff, a total of 125 (75.8%) were complete, and 40 (24.2%) were only partially complete e-messages. Analysis of this element also facilitated fitting e-message encounters into types of conversation.

5. Use of Resolution

Resolution is the use of e-communication to either resolve the problem or inform about the resolution. Analysis of resolution facilitated understanding of the role of the patient portal for not only the resolution of the problem, but for the use of the portal as a means of communication between the patient and the provider. The achievement of the resolution was determined by the author, based on the content of the e-message encounter. For example, e-message encounters that had just one e-message were automatically categorized as having "no resolution", because after the initial e-message was sent, there was no further use of e-communication from the patient or the staff. Coding for this element involved marking of each e-message encounter with the label "yes" for using resolution, "no" for not using resolution and "partial" for those e-message encounters that needed to address more than one problem, but addressed only one of them. It was found that out of 165 e-message encounters, 81 (49.1%) had a resolution, compared to 79 (47.8%) that had no resolution, with additional five encounters (3.03%) that had only partial resolution.

To summarize the results of the analysis of the structural elements, categories were created to reflect the number of instances of each of the occurrences of those elements within the e-message encounter. The categories were analyzed in the process of developing themes used to identify the fit of e-message encounter structure with conversation types.

Based on the re-examination of content in the initial e-message and on the analysis of the structural elements within each e-message encounter, each e-message

encounter was examined for its match or fit with one the four types of conversation. Structural elements and themes/sub-themes that were used to fit the e-message encounters are summarized in Tables 7. Each of the four types of conversation is defined below and the rationale for the fit with content, using the elements from Table 7, as well as an example of the message leading to the decision, are listed.

Monolog

Monolog is an exchange of opinion and supposition (Klemm, 2002). A message was fit into this category if the initial e-message was sent by the patient or the provider, and there was either no reply, or the reply received was not relevant to the initial e-message content. The structural elements were that the message was not read, or that there was no reply, or that there was no resolution.

Example of the fitting process to monolog type: "*Overdue for diabetes visit-2nd notice. Dear [name of patient]: [name of provider] has reviewed your medical record and noticed you have not scheduled your diabetes visit. We want to make sure your diabetes treatment plan is right for you. Please call and schedule your visit at [phone number]. We look forward to hearing from you, [name of clinic] Clinic*" – this e-message does not contain a reply; the note states "Not Read" within the e-message text.

Table 7. Structural Elements Fit with Types of Conversation Theory

	Monolog	Dialogue	Dialectic	Construction
Number of replies	Zero	At least one	At least one	At least one
Use of Resolution	No	Yes/No/Partial	Yes/Partial	Yes
Completeness of e-Message	Complete or partial	Complete or partial	Partial	Complete

Specific Content of e-Message (Sub-themes)	Any	Any	DM Management Lab Medication Symptom	DM Management Lab Medication Symptom
Major Content of e-Message (Diabetes Management Education)	Any	Any except Diabetes management education	Diabetes management education	Diabetes management education

* Sub-themes might also be part of the Diabetes management depending on the major content of e-message.

Dialogue

Dialogue is a community-building form of shared viewpoints (Klemm, 2002). A message fit into this category if the initial e-message was sent by the patient or the provider, and a reply in a form of an acknowledgement, confirmation or a short chat was received. In case of a dialogue, all themes and the sub-themes could be included, like Acknowledgement, Apology, Appreciation, Communication and more. The structural elements included reply, completeness and/or resolution.

Example of the fitting process to dialogue type: Patient initial e-message *"[Name of nurse], are the fasting labs already in the system? Might be near the big lab this week-end. Thanks again!!!" with the following reply from PCP staff "Yep- A1c, liver enzymes, cholesterol panel and UMAR (urine protein). I appreciate it!!! [Name of nurse.]*" This e-message has a reply communication, resolution is used, and the e-message contains complete information. A reply to patient's request contains an answer to question and a short explanation, but no further Diabetes management education was provided.

Dialectic

Dialectic is a conversation aimed at distilling truth or correctness from logical argument (Klemm, 2002). A message fit into this category if the initial e-message was sent by the patient or the provider, and a reply in a form of an education on some aspect of Diabetes management was received (DM Management, Lab, Medication, Symptom). An analysis of the information from initial message was performed and a reply contained an explanation that could be general or personal to a particular patient, but no deliverable was created, meaning that the instructions/information provided were incomplete (partial completeness of the e-message). Structural elements included reply, completeness, and/or resolution.

Example of fitting process to dialectic type: Patient initial e-message "*I'm going to be having an injection for my back this coming Thursday. I was told it could affect my diabetes numbers. Just wondering if there is something specific I should be aware of doing or monitoring. Awaiting your reply. Thanks.....*", with the following reply from provider "*Blood sugars can be elevated for a week or two afterward. If blood sugars are running greater than 200 call the office give the information to the nurses and can decide if adjustment is needed [name of doctor]*".

This e-message encounter has a reply communication and uses resolution, Diabetes Management sub-theme is present, Diabetes management education is present within the e-message encounter (patient is educated on the effect of steroid injection on blood glucose levels), yet the e-message encounter contains an incomplete information. Diabetes education on the effect of steroids should include a more detailed explanation on at least the proper adjustment of patient's current medication or prescription of new

medication in case of blood glucose elevation of over 200 mg/dL, as well as the explanation on the importance of the dose and length of use of steroids, description of the scientific way (using simple terms) the steroids affect the blood glucose level, and the time of day the blood glucose can be elevated the most.

Construction

Construction is the use of conversation to create something new, often in the form of producing some kind of deliverable (Klemm, 2002). A message fit into this category of conversation if the initial e-message was sent by the patient or the provider, and a reply in a form of a complete explanation or some Diabetes management education on a general or personal aspect was received. The main themes most often were *Instruct/Request* or *Question.* Sub-themes can include DM Management, Lab, Medication and Symptom. E-message is considered complete.

An example of the fit with the construction type of conversation: pharmacist initiates e-message encounter with specific recommendations on insulin use, patient replies with a question "…*is there a typical range that a person's blood sugar spikes when on prednisone?*", and the pharmacist replies with the following: "*Hi [patient name], Prednisone can affect blood sugar differently. Most people have a rise in their blood sugar and it isn't uncommon to have blood sugars go above 300 when on NPH and prednisone. Your dose of prednisone is 20mg two times daily for 4 days and there is a history of your blood sugars increasing above 300 when on prednisone. So, based on your prednisone dose and history, I would adjust your NPH dose by a percentage and follow up every 2 days and make adjustments if needed. This way we taylor the insulin*

dose to meet your needs. This is also true for R insulin. Knowing your blood sugars are out of range prior to meal, we would also increase R dose by a percentage to meet your needs. Had we spoke prior to your prednisone start I would have made the following recommendations based on your current insulin dose. Day 1 and 2 of prednisone: NPH 75 units AM and 50 units PM - Use R as directed. Follow up on morning of Day 3. If blood sugars over 300 we would have made another adjustment to insulin doses: NPH 90 units AM and 60 units AM. R insulin dose would increase by 10%. Since you are day 3 of prednisone currently, the 10 unit NPH increase you made is very similar to the recommendation I would have made. If your blood sugars remain above 300 today, increase evening NPH dose to 60 units. If blood sugar over 300 in the morning on 8/9, inject 90 units of NPH. If blood sugars over 180, continue on adjusted dose of NPH 70 units AM and 50 units PM until the end of prednisone dosing. After last dose of prednisone, return to prescribed dosing of NPH: 60 units AM and 40 units PM. If readings are out of range after stopping prednisone, let me know. You may need higher doses of NPH even after the prednisone burst is over, just let us know what your blood sugars look like. Let's stick with the plan for R insulin at this time. Get comfortable with dosing 10 units per 15gm (1 carb choice) and 1 unit for each 10 points over 150. If pre meal blood sugar is 240 and you are consuming 5 carbohydrates your dose would be : [(10units x 5 carb choice)] plus [(240-150)/10)] = [50 plus 9] = 59 units of R. Again, the goal is to have an average blood sugar less than 200 for an A1C goal of less than 8. Please send a message or call me with questions/concerns. [phone number]".

This e-message encounter includes reply communication and uses resolution, the themes include *Instruct* and *Inform* and the sub-themes include Medication, DM Management and Communication. Diabetes management education exists (patient is educated on the effects of steroids on blood glucose and the ways to adjust insulin to maintain normal blood glucose levels), and the e-message encounter is complete, as it gives the patient all the necessary information he needs in order to manage the Diabetes with the instructions provided by the pharmacist. Structural elements include reply, resolution, and completeness.

Additional analysis was performed to examine the frequency of the main theme in the initial e-message of the e-message encounter in each of the four conversation types. The results of the counts and percentages of the analysis are summarized in Table 8.

Table 8.
Frequency of Conversation Types in Diabetes E-Communication

	Monolog (42.4%)	Dialogue (46.7%)	Dialectic (9.1%)	Construction (1.8%)
Question				
Patient Question	4	31	6	0
Staff Question	4	3	1	0
Instruct/Request				
Staff Instruct	37	3	2	1
Patient Request	12	24	2	0
Inform				
Patient Inform	5	8	1	0
Staff Inform	8	5	3	2
Non-DM	0	3	0	0

There were 70 monologs, 77 dialogues, 15 dialectic and only three construction type of e-message encounter identified. Out of 165 e-message encounters analyzed, the monolog accounts for 42.4% of all the e-message encounters, with most of the monolog e-message encounters (49 out of 70 e-message encounters or 70%) initiated by the

healthcare staff. Dialogues account for 46.7% of all the e-message encounters, with most of the dialogue encounters (63 out of 77 e-message encounters or 81.8%) initiated by the patients. Dialectic and construction types are the less frequently seen types of conversation in Diabetes e-communication, accounting for 9.1% and 1.8% respectively of all the e-messages encounters.

In order to better understand and visualize the results of conversation theory use in Diabetes e-communication, Figure 9 was used to show the frequencies of conversation types using themes. The figure shows that most of the *staff initiated* e-message encounters resulted in a monolog. Specifically, the *Instruct Theme* included 37 monolog e-message encounters. The majority of the *patient initiated* e-message encounters, on the other hand, resulted in a dialogue. For example, the *Patient Question Theme* has 31 dialogue e-message encounters, and *Request Theme* included 24 dialogue e-message encounters, compared to the total of 12 monolog e-message encounters in that same theme.

Dialectic and construction e-message encounters were rare in this examination of Diabetes e-communication. The dialectic type of conversation appeared in a total of nine patient initiated e-message encounters, and six of the staff initiated e-message encounters. The construction type appeared in three e-message encounters initiated by the staff. Additional analysis was performed on the initiators of the construction type of e-message encounters, and out of three encounters, two were initiated by pharmacists and one – by PCP staff.

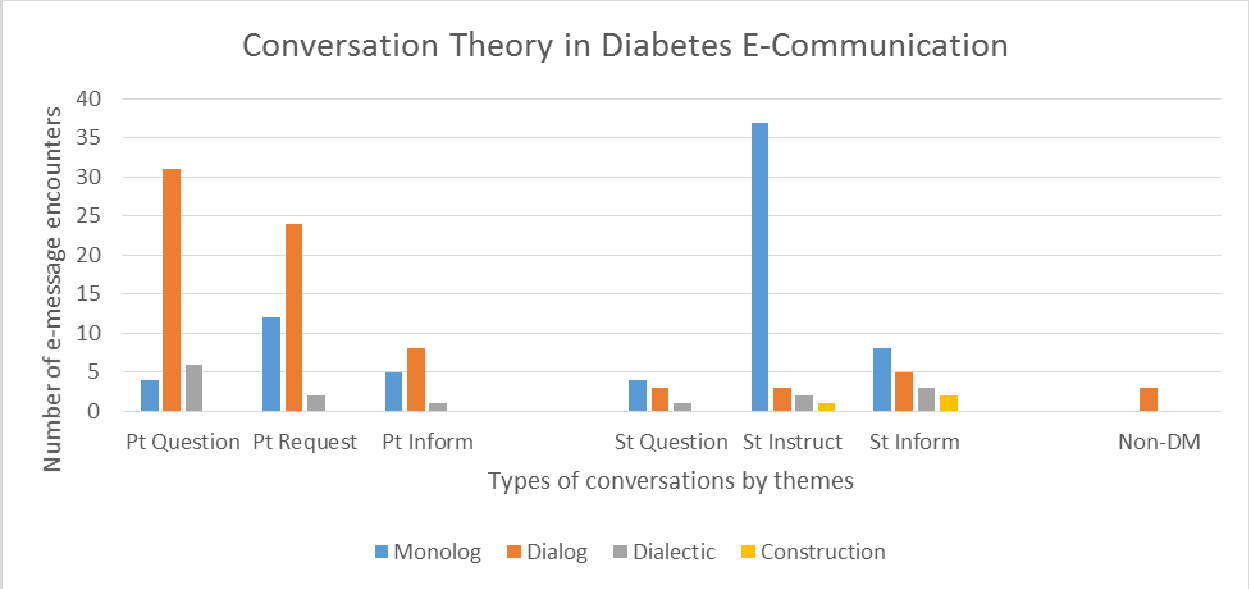

Figure 9. Frequencies of Conversation Types in Diabetes e-Communication by Themes

Figure 10 (Appendix G) presents the Model of Diabetes e-Communication using Conversation Types, which summarizes the main aspects of the four types of conversation in Diabetes e-communication described above. The four types of conversation are listed in the four corners. Each conversation type described the process of fitting the e-message encounter using the structural elements like the reply, completeness, as well as the sub-theme and the major theme – the use of Diabetes management education.

Summary

The sample of this study consisted of patients between the ages of 50 and 70, who are White, Non-Hispanic, speaking English, and a majority were married. Patients in the sample were described as receiving a good Diabetes care, with most having met their A1C measures at target, according to MN Community Measures. The mean duration of

Diabetes for the sample was 8.41 years. Patients in the study sample were relatively experienced in using the patient portal, with the median duration of patient portal enrollment at slightly over a year, with most using the patient portal between six months and over two years.

The main themes that emerged in the e-communication via patient portal were *Inform Theme*, *Question Theme* and *Instruct/Request Theme*. Each theme also had from five to eleven sub-themes. While the *Inform Theme* was the most frequently identified theme in the e-communication, most of the e-message encounters were initiated by patients with the purpose of a request for a medication, or were initiated by staff for the purpose of delivering instruction about a necessary visit (*Instruct/Request Theme*). The *Question Theme* was the least frequently observed of the three themes in e-message encounters.

Initiators of Diabetes e-communication were relatively equally divided between the patients and the healthcare staff, with primary care physicians and its staff being the most frequent initiators of e-communication among the healthcare staff. The e-message encounters were relatively short (2.18 messages per encounter on average), with about half of the e-messages not having resolution, meaning that the e-communication was not being used for resolution of the problem or information about resolution of the problem about 50% of the time. Most of the Diabetes e-messages were read, and about 76% of the e-messages were also complete, allowing the patient or the healthcare professional to make decisions based on the information sent via e-message.

Results of further analysis of the fit between themes and structural elements with types of conversation in Conversation Theory showed that most of the staff initiated e-message encounters fit within the monolog type, while most of the patient-initiated e-message encounters fit within the dialogue type. Less often were e-message encounters of the dialectic and construction types of conversation.

Chapter 5 – Discussion

The purpose of this study was to explore e-communication between patients with Type 2 Diabetes and their providers within the patient portal. The three aims for the study included description of the sample of patients with Type 2 Diabetes in terms of demographic, clinical and EMR variables; analysis of e-communication within the patient portal using conventional content analysis to identify themes and sub-themes in e-message encounters; and analysis of themes identified in e-message encounters for their fit with Conversation Theory using directed content analysis. This chapter presents a discussion of the results, addresses the limitations and considerations of rigor, conclusions, and implications of this study for clinical practice, and provides recommendations for future research in the area of e-communication between patients with Type 2 Diabetes and their providers.

Calculations comparing the population of active patients enrolled to patient portal within the healthcare organization to the population of patients with Type 2 Diabetes enrolled to patient portal show that while the general population of users of the patient portal accounts for about 21%, the percentage among the patients with Type 2 Diabetes grows to about 27%. This percentage of patient portal users is lower compared to the findings in the study by Shaw & Ferranti (2011), in which the researchers had 29.7% of the patients using the patient portal. It is important to note that in Shaw & Ferranti (2011) study, the population targeted was a general population of the healthcare system users, and not a specific diabetes population.

Discussion of Findings

Aim 1 – Demographic and Clinical Variables

Aim 1: Describe the sample of patients with Type 2 Diabetes used to examine e-communication in terms of age, gender, ethnicity, years of education, primary language, duration of Diabetes, levels of A1C and length of use of patient portal. The sample characteristics matches the description of the portal users that have diagnosis of Type 2 Diabetes. The study population confirms the good Diabetes care received within the healthcare system. Patients have a long average duration of diabetes, and are relatively experienced in the use of patient portal.

Demographic Data

The sample of patients in this study was of a high age, with median age of 60 years and mean age of 57.1 years (SD = 9.05). Once divided into four groups by age, group age 60-69 years contained over half of the sample (52.2%). The lower was the age, the less patients the group age contained. This data is similar to the CDC (2013), which states that the age at diagnosis of Type 2 Diabetes for the majority of the patients is between the ages 50 and 64. Those patients account for the total of 43.4% of the population of patients between the ages of 18 and 70 that are diagnosed with Type 2 Diabetes. In 2011, the rate of diagnosed patients with Diabetes among people aged 65–74 (21.8%) was more than 13 times that of people younger than 45 years of age (1.6%).

The mean age is similar to the findings by Crosson et al. (2007), that had a sample (n=927) mean age at 57.3 years (SD=15.1). Hess et al. (2007) had a mean age in post-implementation sample at 55 years. Nazi et al. (2013) had 86% of the patient sample

between the ages 51 to 80 years of age, with the group ages 61-70 having the most patients (45%) among all other groups. Eighty two percent of the sample in the study by Sarkar et al. (2011) were above the age of 50, with 65% of those being in 50-69 years age group. The unmatched users of patient portal in Palen et al. (2012) study average 50.5 years, with 73% of the sample above the age of 40. Serrato and colleagues (2007) has found that the older patients were, the more likely they were to register for use of the patient portal compared to other age groups.

The sample in this study was heterogeneous in terms of gender, with a slight shift in favor of females (54.44%) compared to males (45.56%). From 1980 to 2011, the age-adjusted rate of diagnosed Diabetes increased 156% (from 2.7% to 6.9%) for males and 103% (from 2.9% to 5.9%) for females (CDC, 2013). In 2011, the rate for males is higher than the females by just 1%. The gender findings were similar in the study by Crosson et al. (2007), with 53.9% of the sample being females and 46.1% being males. The unmatched sample in a study by Palen et al. (2012) had 58.9% females and 41.1% males. Herrin et al. (2012) had 50.5% of females compared to 49.5% males in the sample of patients exposed to EMR. Serrato (2007) found that women are somewhat more likely to register for the patient portal use compared to men. The only study with different findings was the post-implementation sample in Hess et al. (2007) that had 56% males and 44% females.

The sample in this study was homogenous in terms of race and ethnicity, with the vast majority of the sample being White (88.9%) and non-Hispanic (96.67%). Unfortunately this sample is not representative of the Diabetes population in United

States. From 1997 through 2011, the age-adjusted rate among blacks was higher than the rates for whites and Asians (CDC, 2013). In 2011, the age-adjusted rates by race were 9.3% for Blacks, 6.5% for Asians, and 5.9% for Whites.

Yet, these findings are consistent with the race characteristics among patient *portal users* in other studies. Sarkar et al. (2011) showed that even though African-Americans and Latinos patients requesting access to the patient portal, they have a higher chance of never logging into or actually using it. Hess et al. (2007) had 22% of the sample of a non-white race/ethnicity (n = 18), but the sample the study sample was relatively small. Palen et al. (2012) had 70% of the sample (n = 87,206) as being white, 6.7% - Hispanics, 2.4% Blacks, 2.9% other and 18% unknown.

Most of the sample participants were married (65.6%) at the time of data collection and 98.8% listed English listed as their primary language. Per healthcare system data, 97.8% of the people with Type 2 Diabetes enrolled in patient portal, have English listed as their primary language. The literature reviewed doesn't specify any information on the marital status of the patient portal users.

Years of education were entered for just three patients out of the 90, thus the "years of education" variable was not included in the analysis. In general, throughout the period of 1980-2011, the age-adjusted rate was highest among people with less than a high school education compared with those with a higher level of education (CDC, 2013). Literature has a few articles looking into the discussion of the education level role in the patient portal use (Hess et al. 2007; Nazi et al., 2013). One study showed that the higher is the education level, the better chances there are for the patients to be using the

patient portal (Sarkar et al., 2011). Due to the lack of data on the education level in this study, it was impossible to provide further insight on this variable.

Clinical Data

The target used for the D5 measure was evaluated against the Minnesota Community Measurement (MNCM, 2012) that had specified the treatment goal for A1C of less than 8% for patients with Diabetes. The overall analysis has shown that the majority of the patients (82%) had their A1C values at target, with average A1C of 7.06% (n=76). This data is consistent with the information located on MNCM (2015) that rated the healthcare organization, the database of which was used for data collection and analysis of this study, at the top for Diabetes care, meaning that the medical group is among the top 15 clinics (as long as their rate is above average) for the best outcomes in adult Diabetes management in the state. The study by Herrin et al. (2012) used similar Adult Diabetes Measure set guidelines to D5 Measures used in the study, with HgBA1C set at $\leq$ 8 %, showing that the group of patients (n = 6,376) exposed to EMR had an average A1C result of 7.2%. They also found that 78.9% of the patients exposed to EMR (n = 10,017) had A1C $\leq$ 8%.

The vast majority of the patients in the sample had a duration of Diabetes between one and 15 years, with the mean duration for the sample standing at 8.41 years (median of 7.92 years). According to CDC (2013), for the ages 18 to 79, the duration of the Diabetes for about 79% of the diagnosed population is from 0 to 15 years, with the most number of patients (23.1%) having duration of Diabetes between six and ten years. The mean duration of Type 2 Diabetes in 2011 was 11.4 years, and the median was at 7.6

years. Similar results were found in Hess et al. (2007) study post-implementation group (n = 18) with the average duration of diabetes standing at 10.8 years.

Length of Use of Patient Portal

The median length of enrollment to patient portal was 417 days, with mean duration of 495 days, showing most of the patients in the sample enrolled between six months and over two years. The post-implementation group (n = 18) in the study by Hess et al. (2007) had a mean duration of patient portal use of only 8.1 months. It suggests that the patients in this sample are relatively experienced in using the patient portal, and the reason for non-initiation of the e-messages cannot be explained by the lack of experience or knowledge on the patient portal functionality.

In summary, the sample characteristics match the samples of other studies that investigated the use of patient portal within the EMR. Patients are of older age, relatively equally distributed in terms of gender, and are mostly White and non-Hispanic. The sample is different from the CDC (2014) data of patients with Type 2 Diabetes, because CDC data does not differentiate between the users and non-users of the patient portal. The study sample confirms the data from MNCM (2012) on the good diabetes care provided within the healthcare system.

Aim 2 – Conventional Content Analysis

Aim 2: Analyze e-communication between patients with Type 2 Diabetes and their providers within the patient portal using conventional content analysis to identify themes and sub-themes in e-message encounters. The initiators of Diabetes e-communication were relatively equally shared between the patients and the healthcare

providers, with primary care clinic staff being the most frequent initiators of the e-communication for Diabetes among the other healthcare staff. This contradicts the whole concept of using the care coordinators and diabetes specialists within the healthcare system who are working on providing Diabetes education to the patients with Diabetes. The conversations within the patient portal were short, and often had no reply and no resolution to issues raised. The patient portal was used as a last resort to get ahold of the patients for attending a clinic visit or for a Diabetes check-up. Partially completed e-messages and no use of resolution requires an attention from the healthcare system overall to address the lack of e-communication initiation and the use. Diabetes e-communication via patient portal is rarely used for Diabetes management education. There is no literature published on the use of Diabetes management education via patient portal of EMR.

E-Message Encounters

About half the e-message encounters are created automatically by the system for medication refill purposes. The use of electronic refill system within the patient portal is convenient and popular among the patients with Type 2 Diabetes.

Content Related to Intent

Three themes were identified within e-message encounters. The three themes, *Inform*, *Question* and *Instruct/Request,* represented commonalities in messages that appeared across all encounters. The *Inform Theme,* was used by patients or staff to inform about any topics related to Diabetes. The *Question Theme* was used by patients or staff to ask a question about a variety of topics related to Diabetes. The *Instruct/Request Theme*

was used by the staff to provide patients with directions about care related to their Diabetes, or by patients, in order to ask for something related to Diabetes.

The process of coding, categorization and abstraction of the content within e-message encounters revealed that the *Inform* Theme was the most frequently observed theme. This finding is explained by the fact that any most communications included information that explained, informed or simply answered the questions sent in the initial e-message. For example, after the patient or staff member expressed appreciation, they exchanged information about medication intake or dose approval (the second most frequently seen sub-theme in the *Inform Theme*), or about laboratory results, tests, or orders (the third most frequently seen *Inform* sub-theme). These results suggest that the aspects of *Diabetes care* are the most frequently discussed topics within the e-communication.

The *Instruct/Request theme* was the second most observed theme in Diabetes e-communication, with the most frequently seen sub-theme being Medication *Instruction*. *Instruction* on Labs was second, Instruction on Visits was third, and Communication was fourth. The *Instruction Theme* suggests again that the most important topics in e-communication are related to the Diabetes care of the patient: medications, labs, visits and communication. With the *Question Theme* being the least observed among all the themes in Diabetes e-communication, similar sub-themes, related to Diabetes care, were frequently seen in this theme as well: questions about Diabetes management, medication, labs and visits.

Patients within the study sample initiate e-communication mainly for requesting (41.3%) and questioning (44.5%) purposes, with just 14.5% of the e-messages initiated for the information purposes. This data corresponds with the findings in a study by Serrato et al. (2007) that had 45% of the encounters initiated by patients beginning with a clear request, while 34% of the encounters that had diffuse open ended or complex questions. The staff, on the contrary, has 61.7% of e-messages initiated for instruction purposes, 25.2% for information purpose and only 11.2% of the messages – for questioning related to Diabetes.

The messages sent by the healthcare staff were mainly sent with the purpose of instructing on a clinic visit (with or without any instructions on laboratory tests), questioning Diabetes management and informing about laboratory tests. Analysis shows that while the main sub-theme in the initial e-messages are more or less equally divided among the *Information*, *Question*, *Instruct/Request Themes*, a majority of the e-messages sent required an actual action by the patient or the provider; the messages in the *Instruction/Request Theme* accounted for a total of 51.3% of all the e-messages. Yet, the setting of the patient portal to accommodate these kinds of requests from the patients remains questionable. The option of providing Diabetes instruction by the healthcare staff in a fast and easy way via the portal is unknown.

The findings are similar to those of Serrato et al. (2007) who only assessed the messages initiated by patients. In this study, all the e-messages were divided into two categories: messages as related to an *ongoing* medical problems or care plans (75), and messages related to a *new* medical event, condition or problem (25%). The five leading

primary reasons for an email initiated by the patient were: report a change in condition (16%), discuss lab results (14%), discuss a new condition (12%), discuss changes in prescription dose (11%) and discuss the need for a new prescription (10%).

Structural Elements

Initiators of the e-message encounters in this study were relatively equally divided between the patients (56.7%) and the healthcare providers (43.3%). From the healthcare staff, primary care staff and primary care physicians (34.5% of all initiated e-messages, or 80.2% of staff initiated e-messages) were the most frequent initiators of the Diabetes e-communication, as compared to the care coordinators, pharmacists, Diabetes clinic staff and specialty clinics. This result shows the higher involvement of the primary care clinics in Diabetes management, and raises the question on the extent of involvement of the care coordinators and Diabetes clinic employees in the management of Type 2 Diabetes. Care coordinators are often involved by the primary care clinics in the management of Diabetes, blood pressure, depression, heart failure and other chronic conditions, yet the initiation of the e-messaging for Diabetes among this group of healthcare staff is very low. The role of Diabetes clinic employees, nurses or dietitians, who often acquire certification for Diabetes education, is to provide Diabetes education and management to Diabetes population of the healthcare organization, yet the initiation of the e-messaging on their end remains very low as well.

Number of messages per encounter was only slightly over 2 messages per encounter on average, showing that the e-messaging communication is not involving a long e-messaging communication, and is relatively short. Serrato et al. (2007) has found

that 68% of the e-message encounters had one patient message and one provider reply. Twenty percent of the e-messages had two patient emails and two provider replies, and only less than 10% of the e-message encounters had more than three messages from patients and providers.

Out of 165 messages sent by healthcare staff and the patients, 90.9% of the e-messages were read, compared to 9.1% that were not read. This accounts for 21.1% of the provider initiated e-message encounters. This result shows the importance of raising awareness of the patients to e-communication as an important means for information exchange as well as education provision. Since the majority of the unread e-messages (66.7%) were sent with the purpose of instructing patient about the visit, it is suggested that the e-communication is often used as a secondary means of locating the patient, when the phone communication, for example, has failed.

Completeness of the e-message refers to the way the message was written, specifically looking at whether the messages sent by the healthcare staff had a sufficient information for the patient to make an informed decision, and the messages sent by the patients contained sufficient information for the healthcare providers to make decisions regarding patient's care. It was found that most of the e-messages sent (80.6%) were completed, and only 19.4% were partially completed. Completeness of the e-messages is an important component in e-communication. In order to have an empowered patient who is able to make decisions, the information provided to the patient should be complete. Serrato et al. (2007) has assessed patient satisfaction with the use of patient portal, and has found that 85% of the patients were extremely satisfied with the email exchanges in

patient portal. It was found that satisfaction was positively associated with the *completeness* of the answers provided by the providers, along with several other variables, like 'all the questions being answered', timelines of the responses and more.

Resolution is the use of e-communication to bring to either the resolution of the problem using patient portal or to the use e-communication to inform about the resolution. It was found that slightly below half of the encounters (49.1%) had a resolution, compared to about 47.8% that didn't have resolution. This result might suggest that the use of patient portal is not a common method of resolution by the healthcare staff or the patient, who would prefer to conduct a phone call or attend the clinic/ask the patient to attend the clinic for resolution.

Structural Elements Related to Themes

The most popular reason for initiating Diabetes e-communication was either a request from the patient or an instruction provided by the healthcare staff. Diabetes e-communication in the patient portal was mostly used to ask for something. Yet, the settings within the patient portal did not provide easy options for requests, except for medication refills.

About 2/3 of the unread e-messages were sent by the staff with the purpose of instructing a patient on a visit. Unfortunately, additional analysis of the content of those messages shows that the staff used the patient portal as the last resort to reach the patient to bring him in for the Diabetes well check-up.

Aim 3 – Directed Content Analysis

Aim 3: Analyze themes identified in e-message encounters between patients with Type 2 Diabetes and their providers for their fit with Conversation Theory using directed content analysis. The four types of conversation included the monolog, dialogue, dialectic and the construction. The study results showed that most of the staff initiated e-communication results in a monolog, and most of the patient initiated communication results in a dialogue. The model of conversation theory in Diabetes e-communication is presented in Figure 12 (Appendix J).

It is important to note the difference between the goals of e-communication used in educational facilities and the goals used in Diabetes e-communication. While the ultimate goal in the educational e-learning environment is to achieve the construction type of conversation, the situation in the Diabetes e-learning environment can be different. As previously shown in Aim # 2, the e-communication in Diabetes consists of three main themes: *Inform, Question* and *Instruct/ Request*. Despite the fact that the goal of the Diabetes education is to get the patient with Diabetes to gain the knowledge and the skills to self-manage the disease, Diabetes e-communication might only consist of the e-messages with the goal of obtaining a short acknowledgement of the information received, or a short answer to the question. Examples of the communication that do not require a detailed Diabetes education can include: "*What pharmacy would you like that sent to*?", or "*E [nurse name], are the fasting labs already in the system?*"

Analysis of the initial e-message themes and sub-themes allowed for further insight into the nature of the interactions within e-message encounters. The initial message often led to a complex exchange of information that included many replies.

When the structure of those exchanges and replies was examined for the fit with types of conversation, results showed that most staff initiated e-messages result in monologs, while most of the patient-initiated e-messages resulted in a dialogue. This can be explained by the fact that patient- initiated e-messages required a response by the healthcare staff within 24 to 48 hours, depending on the department, while the patients did not have any obligation to respond to staff initiated e-messages. It might suggest that the patients simply do not get to read the e-messages (21.1% of the staff initiated e-messages were not read) due to lack of awareness about the e-message, or that they considered it of low importance to their care.

The monolog is the only type of conversation that should not be promoted in Diabetes e-communication, because it leads to no resolution. While in online education, the construction type of conversation is the only type to be encouraged, dialogues along with dialectic and construction can be sufficient in Diabetes e-communication. Dialogues can serve as good examples of conversations to be used to provide short replies to patients with any questions requiring confirmations or acknowledgements. For example, reply for a question on whether the orders were placed or not, can be a simple acknowledgement, creating a short dialogue type of conversation. Dialectic and construction can be used for Diabetes management education, with the ultimate goal of having a construction type of conversation. In order to promote dialectic and construction types of conversation, the patient portal should be built to accommodate the educational aspects of Diabetes management within the program. That way, the information on side effects of medications, adjustment of medication or any other aspects of Diabetes

management will be just a click away from incorporating that information within the e-message to be sent to the patients.

Limitations and Considerations of Rigor

There are several limitation to this study. First, a bias of the researcher was developed due to the pilot study being conducted several months prior to this dissertation study. Certain expectations were developed for the themes to emerge. Also, the development of certain themes and the analysis overall was based solely on this researcher's decision. Second, all the analysis was completed by the researcher manually. Percentages and randomization were calculated in EXCEL, but no other programs were used. Third, lack of certain data in the database (e.g., years of education) led to incomplete analysis of the demographic variables for this study. This is related to the choice of retrospective chart review method in the study.

Credibility in this study was achieved by randomly choosing the participants meeting the inclusion exclusion criteria from a pool of 200 charts; there was a wide range of ages and representativeness of both genders; their e-communication in patient portal was not influenced by the study in any way, because the patients were not aware of the data to be analyzed for the purposes of this study later on. The meaning unit chosen for the study was the e-message encounter initiated by person, which contained sufficient information for analysis, yet was not too broad to contain various meanings. The categories were developed using phrases from quotations from the actual transcribed text.

Dependability was achieved in this study, as a standard query of the database can theoretically be run again for the same timeframe to achieve the same results based on

patients active in patient portal who communicated at least once in the past 12 months. Also, because the data were collected through a retrospective chart review, there was no risk for data change over time, or that it could be affected by the researcher's decisions during the analysis, since the analysis was performed by a single person.

Confirmability in this study was achieved by the data and analyses being verified by the advisor for accuracy. Transferability can be achieved by the standard query of the database to theoretically be repeated at any other institution where the EPIC program is being used. However, there are needed considerations of the match between EPIC applications from one system to another that might affect the query results.

Reflexivity in this study was addressed as well, since the pilot feasibility study on e-communication in the patient portal was completed personally by the researcher, so the expectations existed for certain outcomes, which led to a certain degree of bias. It was expected that certain themes would develop from e-communication analysis, like medication adjustment, lab result discussion, symptoms discussion, etc. Yet, no personal preferences of the researcher existed about the development of any themes to emerge in this study, so that the results and the conclusions were developed based on the data collected and analyzed.

Conclusions

The relatively high number of monolog types of conversation, and the low number of dialectic and construction types of conversation in e-communication within the patient portal led to a conclusion that the e-communication examined between patients with Type 2 Diabetes and their providers was not frequently used for Diabetes

management education. The high number of partially completed messages and frequent lack of resolution suggest that the healthcare system must address those gaps by revising the guidelines for initiation and construction of the e-messages using the patient portal.

Implications for Practice

Information gathered from a comprehensive study evaluating e-communication might allow improvement in communication and the management of Type 2 Diabetes in several areas. Recommendations are as follows:

1. Develop templates for e-communication in patient portal in order to ensure a complete capturing of the data necessary for proper Diabetes management from the patients. Templates sent by healthcare professionals will specify all the areas needed for capturing information on Diabetes management. Templates developed can also capture the main aspects of general Diabetes management education (e.g., side effects of medications, insulin titration guidelines), and those can lead to development of construction type of conversation in Diabetes e-communication.
2. Develop automatic messages for follow up in a certain timeframe, relating to specific patient populations or specific types of clinic visits for Diabetes management. Examples will include visits at which the HgBA1C was determined as higher than the goal set by the healthcare organization, so the healthcare staff will follow up with the patient via patient portal in one week to determine if any changes and further adjustment is necessary.

3. Ensure proper completion of the data in demographics section of EMR by the front line staff. The training of the staff should be completed on the healthcare organization level to ensure understanding of the importance of completing all demographics sections of EMR.
4. Raise awareness of importance of e-communication in patients with Type 2 Diabetes and other chronic conditions. Possibility of linking the patient portal account notification to personal email should be employed automatically in every patient.
5. Develop guidelines for e-communication initiation among care coordinators and Diabetes clinic staff, in order to increase the low rates of e-communication initiation among these staff.
6. Improve the quality of the IT query results by correctly adjusting the parameters of the query in the database. This needs to be implemented due to the results of the query being incorrect, and including the patients without Type 2 Diabetes, patients over the age of 70, or having an incorrect date of enrollment to patient portal listed.

Recommendations for Future Research

There are several recommendations for future research in the area of patient portal use for Type 2 Diabetes management. First, correlational analysis can be performed evaluating the impact of the demographic variables on e-communication. Second, there should be an investigation of the impact of the D5 measures on e-communication. Third, the relationship should be examined between e-communication in Diabetes and e-

communication not about Diabetes. This work might provide an important data on e-communication in general to explain the patterns of e-communication in Diabetes patients and help with the management of other chronic conditions, besides Diabetes.

In addition, comparing users to the non-users of the patient portal would add to the knowledge about how to improve the portal. It will also be important to collect data on the chronic conditions of the patients and perform a correlational analysis of the e-communication frequency between patients with various chronic conditions and frequency of use of e-communication. Finally, a larger scale qualitative study needs to be performed to also assess the perceptions of patient portal users on the portal use, assessing the reasons for using the portal, the benefits they see in the use of portal and improvements they would like to see with the program. Such a study can also assess perceptions of not only the Diabetes patients, but the healthcare providers as well.

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Appendix A

Operational Definitions of Terms

Terms Related to Electronic Communication:

Electronic Communication (e-communication) – a communication using electronic media. For the purposes of this paper, e-communication refers to the secure e-messaging that occurs via the patient portal of EMR

Electronic Encounter – interaction between the patient and the health care system that creates any type of visit, generating patient health information within the EMR. Examples of electronic encounters include, but are not limited to: clinic visit encounter, phone encounter, e-message encounter, and more.

Electronic Medical Record (EMR) - a digital version of the paper chart in the clinician's office containing the medical and treatment history of the patient to be accessed via computer (HealthIT.Gov, 2015).

Electronic Message Encounter (e-message encounter) – interaction between the patient and health care system that creates an e-message visit, generating patient health information within the EMR. It can consist of one or more e-messages, and be initiated by either the system or the person (patient or healthcare provider).

Electronic Messaging (e-messaging) – any type of electronic communication between provider and the patient via patient portal.

E-message visit – visit within the healthcare system that results in an electronic communication data structure.

Patient Health Information – any information related to the health of the patient within the medical record.

Patient Portal - a secure online website that provides patients with convenient, 24-hour access to their personal health information from anywhere with an Internet connection to view, update and use their personal health record (PHR) (HealthIT.Gov, 2015).

Personal Health Record (PHR) - an electronic record of an individual's health information housed in the patient portal that allows an individual patient to control access to the information and have the ability to manage, track, and participate in his or her own health care (Office of Civil Rights, n.d.).

Reactivation – a process of renewal of the enrollment to patient portal for a patient that was enrolled in the patient portal, but became inactive, and his enrollment needed to be renewed at a later time in order to continue using the portal.

Structural Elements within E-Message Encounter:

Complete e-message encounter – an e-message sent by either the patient or the provider includes all the necessary information for the receiver to make an informed decision about health related to Diabetes (e.g., complete clinic visit, perform laboratory test, increase the dose of insulin, or determine relationship of the symptom to diabetes).

E-message encounter initiator - a person (patient or healthcare provider) or a system (automatic messaging) that was the first to send the e-message within the e-encounter.

E-message read – the note within the e-message encounter that informs the healthcare provider about whether the initial e-message sent by the healthcare provider was read or not read by the patient.

Latent Content - the hidden meaning of the text (use of capitalized text, symbols etc.)

Manifest Content— the content that is written in the text and is available for analysis (actual written sentences or phrases).

Reply within an e-message encounter – a response to any e-message within the e-message encounter. Multiple replies may appear within any e-message encounter

Resolution in e-message encounter – the use of e-communication to either resolve the problem or inform about the resolution.

Medical Terms:

Active Patient – for the purposes of this paper, it is a patient who has at least one e-encounter within the EMR within the past two years.

D5 Measures - set of five treatment goals that, when reached together, represent the gold standard for managing diabetes (MNCM, 2012).

Diabetes Education or Diabetes Self-Management Education (DSME) - a collaborative process through which people with or at risk for diabetes gain the knowledge and skills needed to modify behavior and successfully self-manage the disease and its related conditions (AADE, n.d.).

Diabetes Management - a specific instruction provided to patient regarding his personal diabetes management. Examples of instructions might include specific insulin adjustment recommendations for the patient, instructions on starting oral diabetes medication with specific dose and titration recommendation.

Diabetes Mellitus - a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both (WHO, 2013).

Hemoglobin A1C (A1C) - a test that indicates the mean glucose concentration over the previous period (approximately 8-12 weeks, depending on the individual) providing the best indication of long-term glycemic control (Mayo clinic, 2013).

Insulin - a hormone that is needed to convert sugar, starches and other food into energy needed for daily life (ADA, 2015).

Type 2 Diabetes - a metabolic disorder characterized by increased blood glucose due to insulin resistance and insufficient insulin production (ADA. 2015).

Provider - healthcare professional (physician, nurse, dietitian or other staff) who is involved in patient's care. For the study purposes, the terms provider and staff will be used interchangeably.

Variables Examined to Describe the Sample:

A1C - the lab result showing the level of diabetes control for the past three months, and will be recorded in % units as the latest available A1C result from the lab section of patient EMR within five weeks from September 1, 2014, including the date of lab results.

Age at Diagnosis - the age at which the patient was diagnosed with diabetes. In the study, it is calculated as the difference between the Sep 1, 2014 and the date of Type 2 Diabetes diagnosis.

Age of the Patient - the number of years of age (18 to 70), as listed in the title bar of EMR.

Date of Birth of the Patient - the date the patient was born on, as listed in the title bar of EMR.

Date of Type 2 Diabetes Diagnosis - the date patient was initially diagnosed with Type 2 Diabetes, as listed in patient's problem list or in progress notes (in case the diagnosis was prior to July of 2011). For patients diagnosed before 2003, 15/JUN/YEAR format is reported, if only the year is known.

Duration of diabetes - the length of time from the date of diagnosis of diabetes to a certain date. In this study, it is calculated as the difference between the date of Type 2 Diabetes diagnosis and the date of Sep 1, 2015 and is recorded in years.

Ethnicity - the ethnic group that the patient considers himself to belong to, as listed in the demographics contact information section of patient's EMR.

Gender - the gender (male or female) that the patient identifies himself/herself with, as listed in the title bar of EMR.

Marital Status - the marital status as listed in demographic section contact information tab of patient's EMR.

Primary Language - the main language that patient uses as listed in clinical information section of patient's EMR.

Race - the race group that the patient considers himself to belong to, as listed in the demographics clinical information section of patient's EMR.

Start Date for Data Collection - a date that is determined by two factors: 1) date of Type 2 Diabetes diagnosis; 2) date of enrollment to patient portal. Data is collected since the

enrollment patient portal, unless the diagnosis of diabetes came after the date of enrollment, in which case the date of diagnosis is listed.

Study ID # - identification number from 001 to 090 that was assigned to each patient which met the inclusion and exclusion criteria and his chart was chosen for retrospective review.

Years of Education - the number of years that the patient had studied, as listed in history section under socioeconomic section of patient's EMR.

Appendix B

IRB Approval from Healthcare System

November 18, 2014

To: Diana Peremislov, MSN, RN, CDE
Kathleen Krichbaum

Re: QI Project Submission – "Patient Use of the Electronic Communication Portal in Relation to Managing Their Diabetes"

Dear Ms. Peremislov and Ms. Krichbaum:

It is understood that Diana Peremislov is seeking to submit her dissertation for review at the University of Minnesota and that the above project has been submitted to the [redacted] Institutional Review Board (IRB) administrative office for review. This letter clarifies institutional policy with respect to IRB review and oversight of quality improvement projects.

This project is a retrospective chart review designed to describe [redacted] experience and outcomes of T2DM patients and their utilization of EPIC MyChart program in comparison with their age, socioeconomic fields, gender and other factors. Based on review of the project by this office, this project constitutes quality improvement only and does not meet the definition of research under the applicable human subjects' protections regulations (45 CFR 46.102(d)).

Institutional policy only requires IRB review of non-research activities which 1) directly involve a particularly vulnerable population, or 2) pose greater than minimal risk as defined at 45 CFR 46.102(i). As neither criterion apply to this project, IRB review and oversight are not required.

The Institutional Review Board Office reminds all those participating that no patient identifiers or [redacted] may be removed from [redacted] facilities or be viewed by anyone other than [redacted] Employees.

While the IRB is responsible for ensuring that the rights, safety and welfare of human subjects are protected, the committee also takes seriously its responsibility to support our physicians, staff and residents in their role as researchers or – as here – when engaged in quality improvement activities to improve the lives of our patients.

If you have any concerns about this project in relation to institutional research, QI or IRB policy, please don't hesitate to contact me directly at [redacted]

Sincerely,

[redacted]

Appendix C

IRB Approval from University of Minnesota

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Human Research Protection Program
Office of the Vice President for Research

D326 Mayo Memorial Building
420 Delaware Street S.E.
MMC 820
Minneapolis, MN 55455

Office: 612-626-5654
Fax: 612-626-6063
E-mail: irb@umn.edu or ihr@umn.edu
Website: http://irbresearch.umn.edu/subjects/

December 19, 2014

Diana Perennislov

RE: "Patient Use of the Electronic Communication Portal in Relation to Managing Their Diabetes"
IRB Code Number: **1411M56062**

Dear Dr. Perennislov,

Medical Record Chart Review; Expedited Review Approval

Message: The Institutional Review Board (IRB) reviewed the referenced study by expedited review procedures and has granted approval under federal guidelines 45 CFR Part 46.110 category (5) Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for non-research purposes (such as medical treatment or diagnosis).

The code number above is assigned to your research. That number and the title of your study must be used in all communication with the IRB office.

This e-mail confirmation is your official University of Minnesota RSPP notification of approval. You will not receive a hard copy or letter. This secure electronic notification between password protected authentications has been deemed by the University of Minnesota to constitute a legal signature.

This approval has been granted with the understanding that Kathleen Krichbaum will be completing her CITI training the beginning of January 2015. Please provide a response by email to the IRB with the completed date of the refresher course at that time.

The date of approval is December 5, 2014. Your study will expire one year from this approval date. A report form will be sent out two months before the expiration date.

You are approved to access 100 records from Park Nicollet Healthcare Services. Please note that you may be required to present this letter when requesting access to records.

If you requested a waiver of HIPAA Authorization and received this e-mail, the waiver was granted. Please note that under a waiver of the HIPAA Authorization, the HIPAA regulation [164.528] states that the subject has the right to request and receive an accounting of Disclosures of PHI made by the covered entity in the six years prior to the date on which the accounting is requested.

If you are accessing a limited Data Set and received this email, receipt of the Data Use Agreement is acknowledged.

Driven to Discover℠

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Human Research Protection Program
Office of the Vice President for Research

D528 Mayo Memorial Building
420 Delaware Street S.E.
MMC 820
Minneapolis, MN 55455

Office: 612-626-5654
Fax: 612-626-6061
E-mail: irb@umn.edu or ihc@umn.edu
Website: http://eresearch.umn.edu/subjects/

As the Principal Investigator of this project, you are required by federal regulations to inform the IRB of any proposed changes in your research that will affect human subjects. Changes should not be initiated until IRB approval is received. Unanticipated problems and adverse events should be reported to the IRB as they occur. Research projects are subject to continuing review and renewal. Once data analysis is complete, you must notify the IRB to inactivate your research project. If you have any questions, call the IRB office at 612-626-5654.

Upon receipt of this email, you may begin your research. If you have questions, please call the IRB office at 612-626-5654.

You may go to the View Completed section of eResearch Central at http://eresearch.umn.edu/ to view further details on your study.

The IRB wishes you success with this research.

Sincerely,

Melissa Nowicki

Melissa Nowicki, CCRP
Research Compliance Supervisor

CC: Kathleen Krichbaum

Appendix D

Themes and Sub-Themes in Diabetes e-Communication

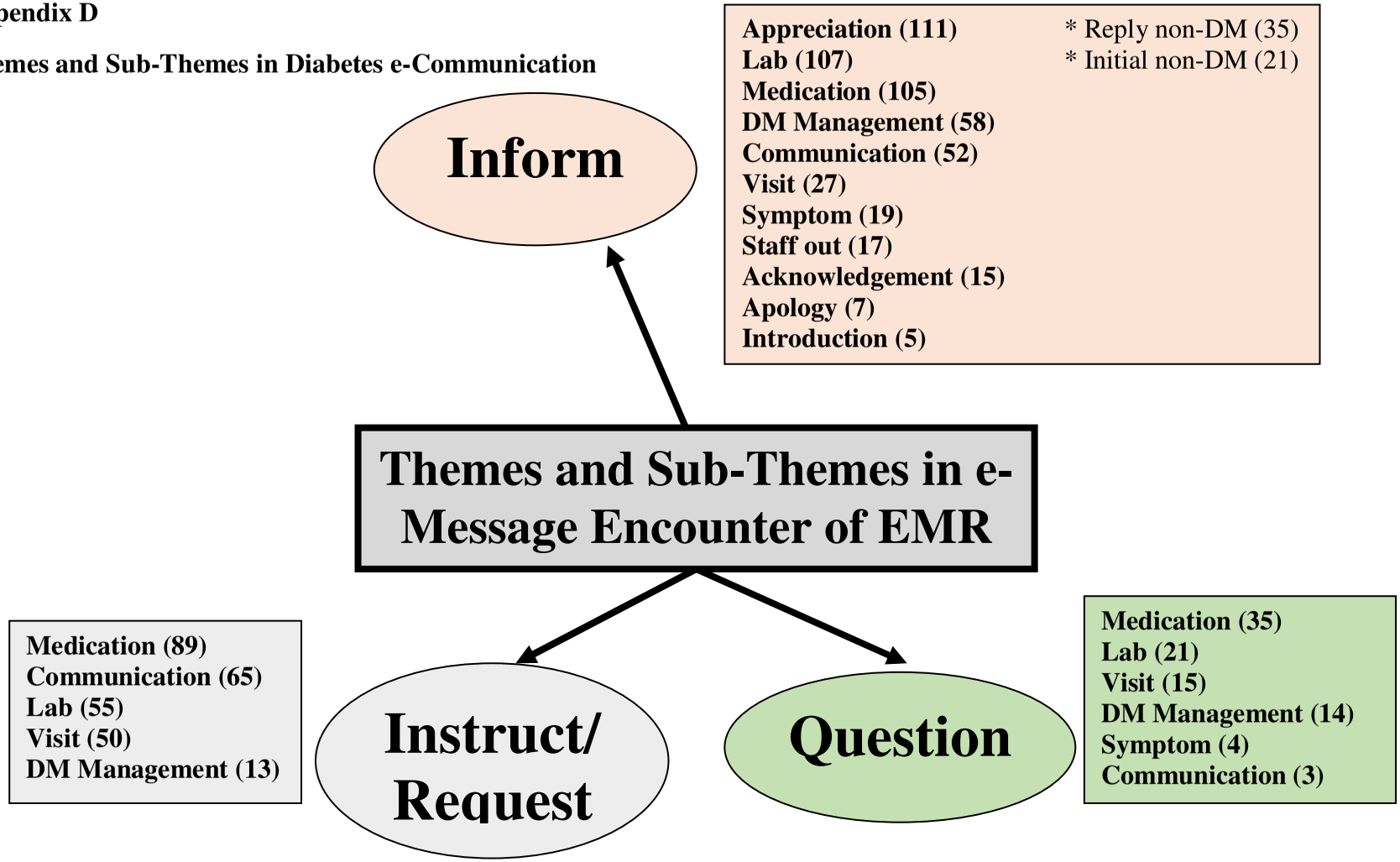

Figure 6. Themes and Sub-Themes in e-Communication via Patient Portal in Type 2 Diabetes

Appendix E

Examples of Themes, Sub-themes, Definitions and Citations

Table 4. Examples of the Most Frequently Identified Themes and Sub-themes with Definition and Citations

Number	Theme and Sub-theme	Definition	Example of Citation
1	Patient Inform DM Management	Inform the healthcare staff about any DM Management topic	"*12-16-13 midnight 216, 12-17-13 noon 165, 12-18-13 noon 164 midnight 172, 12-19-13 noon 93 midnight 124, 12-20-13 noon 115 midnight 340…"*
2	Staff Inform Medication	Inform the patient about diabetes medication related topic	"*It looks like the Rx was sent to Express scripts 4/14/14*"
3	Staff Inform Lab	Inform the patient about the different topics related to laboratory processes for diabetes management	"*The A1c is moving in the right direction*" and "*…my last test results indicated that my AC1 [A1C] was now 8.1*"
4	Patient Question DM Management	Question the healthcare staff about	"*Blood sugars are 200-400. Not sure how to get them*

		diabetes management	*down... What can I do?*" and "*I wanted to check in to see how things are going for you?*"
5	Staff Question Medication	Question the patient about any aspect of diabetes medication	*"Did you make any changes to your insulin?"*
6	Patient Question Medication	Question the healthcare staff about any aspect of diabetes medication	*"W [pharmacy] has my Insulin (Glarine ®) as 45 units once a day. I thought it was supposed be 45 units twice a day. Can you clarify this for me and W [pharmacy]?"*
7	Patient Question Lab	Question the healthcare staff about topics related to the laboratory processes for diabetes	"*A1C - verifying that this was an improvement*"
8	Instruct Medication	Instruction from healthcare staff about the different aspects of	*"Please continue to take your medications as prescribed"*

		diabetes medication	
9	Request Medication	Request from patient regarding diabetes medication	"*I need to get some additional test strips*"
10	Instruct Visit	Instruction from healthcare staff on diabetes visits	"*Please call and schedule your visit at X [phone number]*"
11	Request Communication	Request from patient on communication related to diabetes management	"*Please review my blood glucose readings from above for the last three weeks and call me if you have any questions*"

Appendix F
Reply Communication Themes and Sub-Themes

Table 5.
Initial and Reply Communication Sub-Themes

Initial Message Theme and Sub-Theme	Reply Message Sub-Theme
Request Medication	No reply
	Inform Medication
	Question Medication
	Question Visit
	Instruct Communication
	Instruct Medication
Request Laboratory	No reply
	Inform Laboratory
	Inform Medication
	Instruct Visit
	Instruct Medication
	Instruct DM Management
	Instruct Communication
	Instruct Laboratory
Request Communication	No reply
	Inform Communication
	Inform Medication
	Inform DM Management
	Inform Visit
	Instruct Communication
	Question Medication
	Inform Acknowledgement
Question Visit	Inform visit
	Inform Communication
	Inform Medication
	Inform Laboratory
	Instruct Visit
	Instruct Communication
	Instruct Medication
	Question Visit
	Question Laboratory
	Inform Acknowledgement
	Inform Introduction
	Inform Staff Out
Question Laboratory	No reply
	Inform Laboratory

	Inform Communication
	Inform Visit
	Instruct Medication
	Instruct DM Management
	Instruct Visit
	Instruct Laboratory
	Introduction
	Inform Apology
	Inform Staff Out
Question DM Management	No reply
	Reply non-DM
	Inform Medication
	Inform Symptom
	Inform DM Management
	Inform Communication
	Inform Visit
	Question Medication
	Instruct Medication
	Instruct Communication
	Instruct Visit
	Inform Staff Out
Question Medication	No reply
	Inform Medication
	Inform Communication
	Inform Laboratory
	Instruct Laboratory
	Instruct DM Management
	Instruct Visit
	Instruct Medication
	Instruct Communication
	Inform Staff Out
	Inform Apology
Question Communication	No reply
	Inform Communication
	Inform Apology
Instruct Lab	No reply
Instruct Visit	No reply
	Inform Symptom
	Inform Visit
	Inform DM Management
	Inform Medication
	Request Lab
Instruct Medication	No reply
Instruct Communication	Inform Medication

	Inform Communication
	Inform DM Management
	Inform Medication
	Request Medication
Inform DM Management	No reply
	Inform Communication
	Inform Laboratory
	Instruct Communication
	Instruct Medication
	Instruct Medication
	Acknowledgement
	Staff Out
Inform Medication	No reply
	Inform Medication
	Inform DM Management
	Question DM Management
	Question Medication
	Request Communication
	Instruct Medication
	Instruct Visit
Inform Laboratory	No reply
	Reply non-DM
	Inform DM Management
	Inform Laboratory
	Inform Symptom
	Instruct Laboratory
	Question Medication
Inform Communication	No reply
	Inform DM Management
	Inform Communication
	Question Symptom
Inform Appreciation	Question Lab
Inform Symptom	Inform Symptom
	Instruct Visit
	Instruct Laboratory
	Instruct Communication
Initial non-DM	Inform DM Management
	Request Medication
	Instruct Visit
	Instruct Communication

Appendix G

Model of Diabetes e-Communication using Conversation Types

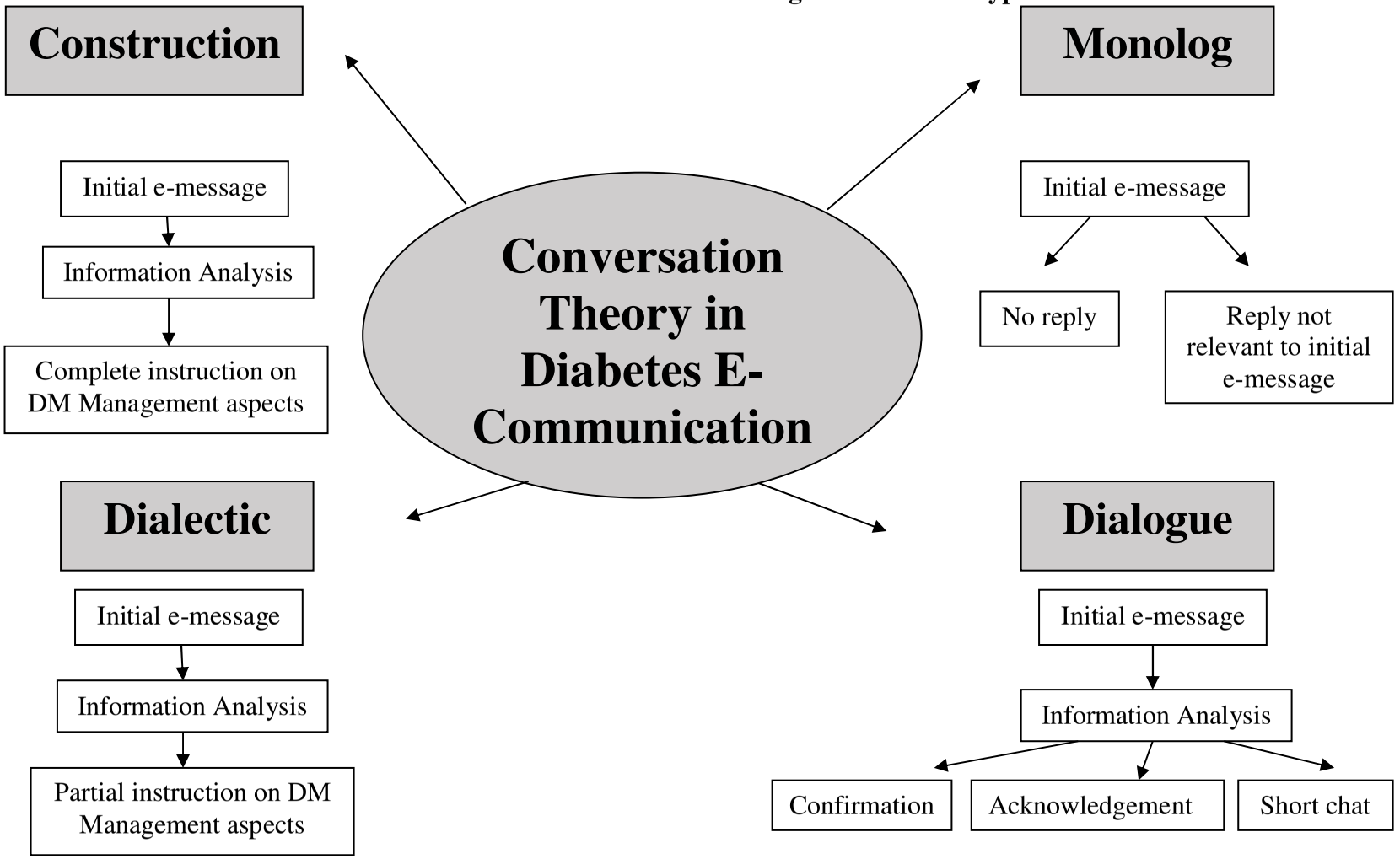

Figure 10. Model of Diabetes e-Communication using Conversation Types