Psychological Empowerment of Patients with Chronic Diseases: The Role of Digital Integration

Completed Research Paper

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Abstract

Information technology (IT) is enabling better healthcare delivery and care. However, the role of IT in managing chronic diseases is still unclear. Chronic diseases are a challenge today, accounting for a huge cost burden in the United States. This article is focused on addressing the research question that how digital integration can play a role in enhancing patients' psychological empowerment to manage a chronic disease. Based on existing literature, we develop a conceptual research model that provides antecedents and consequences of psychological empowerment for chronic disease treatment, and suggest a mediating role of digital integration through three tenets of digitization, mobilization and personalization. We develop a set of propositions based on the research model, and suggest a set of measurable constructs to test the propositions. A research methodology is introduced with a plan for the empirical analysis. Contributions and implications of this study are discussed.

Keywords: Digital integration in healthcare, chronic disease management, psychological empowerment, digitization, personalization, mobilization, patient-centered care, healthcare

Introduction

In the United States (US), chronic diseases have become a national health burden. A chronic disease refers to a recurring health condition affecting an individual more than three months or longer (National Health Council 2012). Chronic diseases account for 70% of all deaths, account for 81% of hospital admissions, 91% of all prescriptions filled, 76% of all physician visits, and 75% of total health spending (California Partnership for Access to Treatment 2012). Heart disease, asthma, cancer, and diabetes are the most prevalent among chronic diseases (World Health Organization). Typically, such diseases are not contagious. They are generally hereditary or a result of factors such as poor eating habits, lack of physical activities, sedentary lifestyle, tobacco use or intake of harmful substances.

All chronic conditions present a common set of challenges to patients. These challenges include dealing with symptoms, disability, emotional stress, complex medication regimens, demanding lifestyle adjustments, and obtaining helpful medical advice and care (Wagner et al. 2001). While not necessarily curable, chronic diseases are often preventable and controllable through early detection, improved diet, exercise, and treatment.

The challenges in managing a chronic disease are twofold. Firstly, the doctor-patient interaction for a chronic disease treatment is limited. Unlike other episodes of disease management, such as that of a patient suffering from Alzheimer's disease or memory loss under constant care at a nursing home, or treatment of fever, a substantial portion of the treatment process for chronic diseases takes place outside the hospital's or care provider's premises, after a guideline of disease treatment has been provided by the doctor (Kucukyazici et al. 2011; Bodenheimer et al. 2002). Second, the implications of a chronic disease are long-term, with the likelihood of the short term symptoms being ignored; unless it causes a high degree of pain or suffering. For example, one of the symptoms of diabetes is feeling tired or fatigued, and the patient may ignore them in daily life. Most chronic disease management assumes that the patient needs to play a major role in managing her own disease. Yet rarely does it consider how patients can remain motivated to tackle an ongoing disease treatment process and face this burden on their own. This pressing question is still relevant for the disease treatment process.

Recent studies in information systems research suggest that information technology (IT) can play a role in enabling a patient-centered healthcare, which is the focus of current healthcare transformation efforts in the United States (Wilson et al. 2013; Sherer 2013). Recent developments in health information technology has enabled a shift towards patient-centered care, in providing a plethora of care oriented technologies, such as telemedicine, visualization on demand, virtual doctors, smart sensors, computer visions, and robotics (Alpay et al. 2011; Gianchandani 2011). Moreover, the patient centric healthcare demands that patients need to be empowered to take control of their health management process (Wilson 2009). However, current evidence-based healthcare practice does not provide enough scope to shift the guidance for chronic diseases on to the patient as the locus of control. This gap in current practice poses a huge challenge to achieve better care.

Among recently espoused patient-centered care strategies, psychological empowerment of the patient to manage diseases is suggested as an approach to treat chronic diseases. The rationale for this strategy rests on the evidence of sustained effort required by patients to manage disease by themselves (Wilson 2004; Alpay et al. 2011; Gianchandani 2011; Ghosh et al. 2013). A patient's psychological empowerment here is defined as the patient's internal motivation derived through the cognitive assessment of disease treatment including meaningfulness, autonomy, self-efficacy, and impact. *Meaningfulness* is defined as the value of the suggested treatment option that reflects a patient's personal ideals. It reflects a fit between the values to be derived from the treatment and the ones held by the patient. *Autonomy* is defined as a patient's choice in adopting a specific treatment option or plan. This choice is made after the doctor explains activities related to diagnostics, medication, and follow up tests relevant to disease treatment. Chronic disease contexts are opposite to an episodic disease's context, where the patient has to follow whatever the doctor says, and under the supervision of the doctor. In chronic disease cases a patient's choice to adopt a treatment plan is based on his or her cognitive assessment of the pros and cons of suggested treatment options. While doctors prescribe medications, many patients do not necessarily follow the advice given, unless they are intrinsically motivated to do so. *Self-efficacy* is defined as the patient's perception of having the skills and ability to manage the treatment process. The treatment process includes taking

medication, adhering to the regime of treatment, and following activities suggested by the doctor. *Impact* is defined as the patient's perceived effect of the treatment process on clinical symptoms of her chronic disease and the long-term consequence on the patient's life. It is different from response efficacy (Witte 1994), conceptualized as an individual's belief that a prescribed behavior will prevent a threat to her health. For instance, response efficacy reflects an individual's belief that having a mammogram done will reduce the chances of dying from breast cancer, while impact encompasses the consequences of regular physical exercise on a diabetes patient's health condition and long-term well-being. Rather than an external stimuli or force, psychological empowerment is the internal willingness of an individual to perform task activities (Thomas and Velthouse 1990; Spreitzer 1995; Doll and Deng 2010; Zimmerman 1995).

The scope of IT in the management of chronic diseases remains a wide gap in existing information systems literature. A few studies focus on the concept that IT can play an integrator or enabler role towards the motivation in managing disease incidence and outcomes. In a recent study, Ghosh et al. (2013) explored how IT-enabled communication plays a significant role in shaping the patients' psychological empowerment for managing a chronic disease. The study emphasized the effects of education benefits perception (as a proxy measure for meaningfulness) and self-awareness (as an enabler of self-efficacy) on life changing interventions and patient satisfaction. Furthermore, the study hypothesized that media richness moderates relationship between self-awareness and life changing interventions; and investigated how IT helps empower patients to take charge of their own health through this moderating relationship. Using an archival data from survey of 78 patients involved in diabetes management education programs, the results of the study indicated rich media, enabled by IT, could play a significant role in patient empowerment, and influence chronic disease management outcomes. Nevertheless, except this study, to our knowledge, research on antecedents and consequences of psychological empowerment of patients with chronic disease are non-existent. In addition, little is known about what role IT plays in facilitating psychological empowerment of patients with chronic disease.

This article proposes a research model investigating the following: (1) how can patients be psychologically empowered to manage their own treatment processes? (2) what are the consequences of patient empowerment in chronic disease treatment programs? (3) what are the roles of digital integration in enhancing patients' psychological empowerment? Propositions are developed based on the research model, research methodology is introduced, and implications are discussed.

Prior Research

Psychological Empowerment and Patient-Centric Model for Chronic Diseases

Empowerment represents a process by which individuals, groups, or organizations can gain control over matters that are of interest to them (Zimmerman 1995). Whereas, psychological empowerment is an individual level concept (Doll and Deng 2010; Spreitzer 1995), and exemplifies a motivational facet of self-competence or self-efficacy and includes a perception of personal control (Zimmerman 1995). Psychologically empowering individuals entails creating conditions or providing opportunities so that people gain control over their actions, acquire skills to achieve their goals, and influence decisions that affect their lives.

Psychological empowerment is a multiple dimensional concept with four cognitions reflected in *meaning, autonomy, competence, and impact* (Doll and Deng 2010; Kirkman and Rosen 1999; Thomas and Velthouse 1990). In the context of individual's embeddedness in tasks, *meaning* represents the value of a goal or purpose, judged in relation to an individual's own ideals or standards; *autonomy*, or self-determination, is defined as the degree of choice an individual has in performing tasks. Further, *competence*, or self-efficacy, is defined as an individual's belief in his or her ability to perform activities. *Impact* is the degree to which an individual can influence outcomes. This multi-dimensional concept of psychological empowerment is believed to be different from or more comprehensive than the concepts of self-efficacy (Thomas and Velthouse 1990), self-management (Kirkman and Rosen 1999), job enrichment (Spreitzer 1996), or creativity (Velthouse 1990).

The concept of psychological empowerment has been viewed from both relational and motivational perspectives (Conger and Kanungo 1988). In an organizational setting, the relational view assumes that managers have more authority and resources than their subordinates and therefore have power over them. Here, empowerment means delegating authority to, or sharing resources with subordinates. Motivational perspective believes an individual's power needs are met when they perceive that they can adequately cope with events, situations, or the people they confront with some power. Therefore, this view treats empowerment as psychologically enabling, and enhancing an individual's internal efficacy. While the former view emphasizes on management practices that empower employees; the latter emphasizes the environment or practice by which employee's perceive their empowerment.

The sources of information that may build an empowering environment or a relationship vary in different contexts and at different levels. Conger and Kanungo (1988) proposed that participative management, goal setting, feedback systems, modeling, competence-based reward systems, and job enrichment as managerial techniques help to remove external conditions that create a sense of powerlessness and help to provide information to help subordinates feel empowered; and such empowerment lead to initiation of behavior to accomplish better task objectives. In a more focused task setting, Thomas and Velthouse (1990) argued that environmental events, individuals' interpretive styles, and the individuals' general assessments on meaning, autonomy, competence, and impact motivate an individual to perform the s task. Furthermore, they contended that empowerment leads to activity, concentration, initiative, resiliency, and flexibility; and in the long run helps individual-organizational reciprocity. Spreitzer (1995, 1996) suggested that individuals' *self-esteem, access to information,* an individual-performance-based *reward system, role ambiguity, locus and span of control, socio-political support,* and *participative unit climate* potentially have an influence on psychological empowerment; and such empowerment lead to innovative behavior (i.e., creation of something novel) and managerial effectiveness (i.e., the degree to which an employee fulfilled or exceeded work role expectations) in the organization. Extending early work to an engineering work setting, Doll and Deng (2010) found that software capabilities and peer support energized individual's cognitive task-technology assessment, and psychological empowerment, that in turn is highly influential with problem solving and work process innovations. At the team level within organizations, Kirkman and Rosen (1999) found external team leader behavior, service responsibilities, team-based human resources policies, and social structures associated significantly with team empowerment, to improve productivity, proactivity, customer service, job satisfaction, organizational commitment, and team commitment. In healthcare context, Koberg et al. (1999) found that tenure, leader approachability, worth of group and group effectiveness, place in the hierarchy, influences empowerment feeling of an employee; and psychological empowerment has positive outcomes on job satisfaction, productivity performance, and employee retention. Similarly, in the service industry context, Corsun and Enz (1999) found that help from peers and customer-support relationships increased the perceptions of empowerment of employees working at 21 private country clubs in the US. Overall, existing research suggests, the idea of empowerment can be applied to realize managerial and organizational effectiveness for companies in a global competitive market where employees' initiatives and innovations are required and to deal with perceived powerlessness of special groups in a social context (Conger and Kanungo 1988; Spreitzer 1995).

Psychological empowerment is relevant to US healthcare with the recent call for shift towards a patient-centric model that demands that patients need to have greater involvement and share more responsibility in their own care (Irwin et al. 2013; Wilson et al. 2013). Some argue that healthcare cannot be called patient-centered healthcare, unless the care is managed and derived from patients themselves. It demands a shift from prior focus on the "preferences, needs, and values" of healthcare providers (Strong et al. 2012; Wilson et al. 2013).

Unlike acute illnesses, chronic diseases are long-lasting conditions and cannot be cured. Chronic diseases can be controlled by seeking proper advice and regular treatment (Holman and Lorig 2004; Kucukyazici et al. 2011). Often, individuals with a chronic disease face significant changes to manage and control their condition. These changes include learning about the disease and its treatment and committing to a number of lifestyle changes or treatment-related behaviors for life.

Even with medical help, support, and encouragement from the doctor or physician, these behaviors may be difficult to adopt on a long-term basis for most people. Since they often conflict with existing behaviors, priorities, or everyday schedule (Aujoulat et al. 2008), such modified behavior requires

significant commitment and sustained effort by the patient. Self-management encompasses actions taken by a patient. It includes following the prescribed lifestyle changes (diet and exercise), adhering to medication regimes, and constantly following-up with treatment advice. Self-management is crucial to effect health behavior change in patients, and subsequently, to control chronic disease conditions (Bourbeau et al. 2003; Bodenheimer 2002).

To be capable of self-managing their chronic condition, patients need access to information regarding the disease, possess the requisite knowledge and know-how of what constitutes effective treatment of the disease and its outcomes. Patients' motivation levels help sustain efforts to improve their chronic condition, and feel in control of decisions related to their health. The cognitive dimension of psychological empowerment offers opportunities for patients to increase their autonomy and involvement in taking decisions on their healthcare. Patients feel empowered to influence health behavior changes and perceive a sense of control over management of their chronic condition (Holmstrom et al. 2010).

Digital Integration and Chronic Disease Management

Digital integration refers to the merging or consolidation of information from disparate sources with differing conceptual, contextual and typographical representations. The consolidation and sharing of data from unstructured or semi-structured resources, enables better communication and coordination in the value chain of a product or service (Lee and Whang 2003). Further, digital integration also supports the sharing of data and processes between or within organizations or entities. A virtually implemented structure helps replicate integrated and synchronous processes (Lee et al. 2004; Vlosky and Smith 1994) and enable the exchange within and across entities. The increased adoption of health information technologies (HITs) has enhanced the quality of health management practice and the productivity of healthcare organizations (Agarwal et al. 2010; Kohli and Kettinger 2004). However for patient-centered care or management, HITs must go beyond digital transformation. Here, HITs must also enable digital integration including digitization, mobilization, and personalization.

Digitization is defined as the presentation of different types of information (medical, disease related, disease management related, and disease treatment related) in digital format (Noffsinger and Chin 2000). Scholars (for example, Khuntia and Agarwal 2009) suggest digitization in healthcare includes the 'capture' and 'storage' of personal health information of individuals in digital format. The benefits of digitizing health information includes improved patient safety and health monitoring, increased patient control over healthcare, reduced medical errors and healthcare costs (Anderson and Agarwal 2011; Glaser et al. 2008; Reiner 2011).

Recent literature suggests patients need to interact at multiple stages in the process of health management, alter their behavior, and actively participate – to be "healthicants". These *healthicants* include patients who take the assistance of technology-enabled applications to support and manage their own health and well-being, throughout their lifetime (see Sherer 2013).

Mobilization is defined as the extent to which information systems or technology can facilitate portability and transferability of disease management information (Avancha et al. 2012; Prgomet et al. 2009). Dimensions of mobilization include information mobilization from and to the patient. A patient's ability to port or transport information across time and space using IT solutions helps enable patient-doctor communication. Such communication occurs anywhere, anytime and enables doctors and patients to access information anywhere, and anytime. Mobilization may (1) enable physicians to remotely monitor their patients' health and improve the quality of healthcare, (2) reduce the cost of care by allowing patients to spend less time in the hospital and/or make fewer visits to their doctor. For example, by allowing a diabetes patient see and compare his/her glucose level history every day morning that has been collected and analyzed at the providers end (may be graphically) will help both the patient and provider to be highly effective in the treatment plan.

Personalization is defined as the degree to which online information relevant to chronic disease management has been tailored to meet the specific needs and preferences of patients (Sheng et al. 2008; Tam and Ho 2006). There are different approaches to online or web personalization, ranging from user-driven personalization to transaction- and context-driven personalization strategies. For this study, the main approach will rely on user-driven strategy (Mahoui et al. 2009). Most studies (for example, Tam and

Ho, 2006) use manipulations to understand the effect of personalization on website users, and not the positive effects.

Integration, through digitizing disease-related information, enables portability of information, facilitates the creation of a user-specific health profile, and strengthens the patient-doctor relationship. It promotes information dissemination on health issues, enables patients to monitor and receive constant feedback about their disease treatment progress and health. In addition, it enables individuals to manage the disease treatment process (Epstein et al. 2010).

HITs adoption, assimilation, implementation, and value proposition for both healthcare providers and patients have been studied extensively (see Chiasson and Davidson 2004; Romanow et al. 2012 for a detailed review). However as suggested by Ueckert et al. (2003) and Wilson (2009), IT-enabled patient empowerment is a less explored area in existing literature.

Conceptual Framework

A conceptual research framework for IT-enabled psychological empowerment of patients with chronic disease is presented in Figure 1. This framework integrates research issues at the intersection of information systems, psychological empowerment, and environmental sustainability. The focus of this research is the interaction between the treatment and the patient. A treatment is the way or method that deals with a health condition. It may lead to curing the disease, but often ameliorates the condition for a specific time period. In the context of chronic diseases, treatments normally do not cure the disease. Instead, they provide solutions to manage the disease well to lead a healthy life. For example, there is no cure for AIDS. Yet treatments are available to slow down the harm done by HIV. These treatments delay the fatality of the disease. Furthermore, as evident in the healthcare setting, often treatments do not always work. For example, chemotherapy is a method of treatment for certain types of cancer. This treatment procedure may cure cancer in some cases, but not in all cases. When nothing can be done to stop or improve a medical condition (beyond efforts to make the patient more comfortable), the condition is said to be untreatable. Some untreatable conditions naturally get treated or end on their own. Others do not.
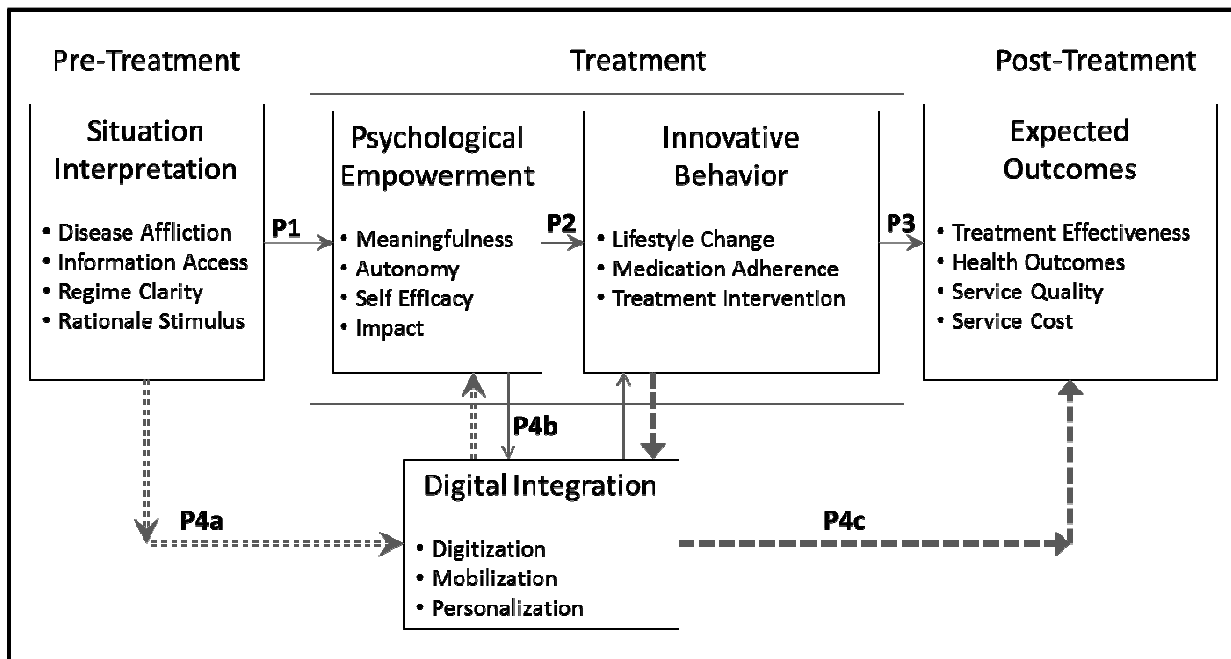

Figure 1: Theoretical Model of IT-enabled Psychological Empowerment of Patients with Chronic Disease

Anchoring to the tenet of psychological empowerment (Spreitzer 1995; Spreitzer 1996; Doll and Deng 2010), the conceptual framework reflects the idea that there are certain factors that enable internalized motivations of individuals, which then lead to consequences. Although, it may appear that other theories such as the health belief model (Janz and Becker 1984), or precede-proceed model (see Glans et al. 2008 for discussions and applications of these theories in the health behavior context) could explain the antecedents and consequences of health behavior of individuals in the context of chronic disease management, these theories do not embrace the core concept of internal motivation, so essential for an individual to take charge of managing her chronic disease condition.

Underlying the conceptual framework, the major variables in this paper's conceptual framework are grouped under pre-treatment, treatment, and post-treatment. First, we follow Spreitzer's (1995) nomological network of psychological empowerment to identify a set of situational factors. These factors may influence an individual patient's readiness and interpretation of empowerment during the pre-treatment phase.

Second, the treatment phase begins with the interaction of the patient and the doctor. A patient's psychological empowerment is manifested through the patient's cognitive assessment of the disease and the treatment. The assessment is made on factors of meaningfulness, autonomy, self-efficacy, and impact. Subsequent actions and innovative behaviors include medication adherence, treatment intervention, and lifestyle change. Individual patient's psychological empowerment is derived from the assessment of the treatment. Treatment-related innovative behavior covers activities (both cognitive and physical) and/or experiences that occur in the treatment phase.

A third set of factors are included in the post-treatment phase. The framework extends Spreitzer's (1995) model to include the expected outcome variables assessed during the post-treatment phase. A treatment is viewed as sustainable only if it creates long-term positive impacts on the patient and the social environment embracing the treatment activities.

Finally, with the increasing applications of IT in health management, we also included three variables for digital integration: digitization, mobilization, and personalization. The framework helps explore the mediating role of these variables in enhancing patients' psychological empowerment and related management of chronic diseases.

Propositions

In the context of tasks in organizations, existing studies suggest that individuals assess multiple sources of information related to a situation to inform perceptions or interpretations about the situation (Thomas and Velthouse 1990; Spreitzer 1996). These interpretations affect the individuals' internal motivation to be actively involved in or experience the situation (Conger and Kanungo 1988; Thomas and Velthouse 1990). We posit that chronic disease treatment is similar to the context of tasks in an organizational setting, at least in three ways. First, individuals are the focus in the situation of chronic disease. Second, the long-term purpose involved in chronic diseases management is to determine the trusting mechanism that can foster an individual's psychological empowerment. Third, the issue of concern (chronic disease treatment) requires sustained efforts as opposed to 'one-time' effort by the patient.

However, there are also some differences of the context of chronic disease management to an organizational setting. First, there is no specific organizational boundary for treatment of patients with a chronic disease. Thus, in one sense, the focus in this study is limited to the relationship between the doctor and the patient linked through the treatment plan. Second, the conditions involved with chronic diseases are more individual specific, in contrast to the employee-organizational dyadic framework in the task-organization context of existing studies relevant to psychological empowerment. Nevertheless, this patient-centric contextual demand for chronic disease management is unique and challenging to healthcare context. Specifically, as researchers argue, individual patient's importance is very high and the focus is on the treatment process (Wilson 2009; Wilson et al. 2013). Indeed, the current US healthcare is facing a challenge to accommodate the paradigm shift from a doctor-centric to patient-centric treatment. Mapping the patient-centric view to the relational view of empowerment (Conger and Kanungo 1988), we posit that for an effective psychological empowerment of patients to manage chronic diseases, it is

imperative for doctors to develop a carefully designed treatment plan. In addition, sustained efforts are required to execute the plan, even after the doctor is out of the scope in the disease management process, and hands over the process to the patient. When the transfer of disease management takes place from the doctor to the patient, without internally energized motivations, the patients may be easily distracted from following a treatment plan by factors such as time or location constraints.

Thus, we posit that situation interpretation is a pre-cursor to the psychological empowerment plan or process. We include four tenets under situational interpretation that in a whole constitutes a state of readiness of the patient towards psychological empowerment: (1) disease affliction, (2) information access, (3) regime clarity, and (4) rationale stimulus.

The first concept of disease affliction is rooted in the health and emotions literature (Bowman et al. 2006) and prior studies (for example, Anderson and Agarwal 2011) have conceptualized health emotion as a state of mind. Disease affliction is defined as an unpleasant state-of-mind of the patient due to her health-condition which induces emotional distress as well as physical pain or distress (Bowman 2001; Bowman et al. 2006). It reflects the individual's experience with the disease. The second tenet, information access refers to the extent to which a patient can obtain information about the chronic disease and the interpretation of the information. Examples of information include disease diagnosis and its implications, disease related treatments, disease management programs, their consequences, and potential impact on a patient's health and well-being.

Third, regime clarity is defined as the reliability, credibility, or adequacy of information concerning chronic disease treatment that is shared by the doctor with the patient (Han et al. 2006). It involves the exchange of reliable information, passing of reference material, and providing suggestions regarding the disease, treatment options, and disease progression. Finally, rationale stimulus refers to a rationalization process of the treatment plan (Giufrrida and Torgerson 1997), and includes the triggering factors, such as affordability, availability, accessibility and flexibility. These factors together reflect the patient's tangible and intangible resource constraints. Purely economic factors include reducing insurance premium costs or patient co-pay. Non-economic incentives include patient readiness to go for treatment. Overall, these factors influence the patient's social environment including their family, employer, insurance, etc.

To clarify the focus of situational interpretation, envision a situation where an individual suffering from a chronic disease decides to seek medical advice and participate in treatment programs to control the symptoms of her condition. A combination of factors may prompt the individual's action. The individual may be under severe distress due to health condition; the person may have gained access to information relevant to the disease treatment programs and is encouraged by what s/he learns. A doctor or physician clearly communicates to the patient about the steps the patient must follow during treatment. This removes false perceptions about the disease and its treatment. The patient becomes aware of economic benefits, including lower insurance premium costs; and/or non-economic incentives, including options to select the treatment provider, associated with the disease treatment process.

The situations described above may in parallel, or in combination, drive an individual with a chronic disease to enter a treatment program. Unlike 'acute' disease cure, chronic disease treatment requires active patient involvement, continued effort, and constant follow-up for positive results. In this context, many (for example, McAllister et al. 2012) advocate the benefits of an ideal ambience to enhance a patient's internal or intrinsic motivation to manage a chronic disease. In other words, providing facilitating conditions to psychologically empower patients could be an effective strategy to manage and treat chronic disease conditions. Removing barriers to patient empowerment may involve redefining and communicating the patient's role, enhancing their knowledge about their treatment options, health condition and personal health status. It may also involve improving patient's skills to carry out the required health-related behavior changes competently from ensuring their empowerment to increase their health literacy.

The motivating elements to accept or reject a chronic disease treatment plan may be subject to a patient's interpretation. Interpretation about the information relevant to the disease and treatment outcomes, information access, regime clarity, and rationale stimulus help patients assess the treatment objective and planned activities and form levels of psychological empowerment along meaningfulness, autonomy, self-efficacy, and impact dimensions. Therefore, we propose:

Proposition 1: Situation interpretation is positively associated with psychological empowerment.

Psychological empowerment will help energize and sustain individual's behaviors (Thomas and Velthouse 1990). In chronic diseases, key behaviors beneficial to the treatment management process include medication adherence (Viswanathan et al. 2012), treatment intervention activities (Weingarten et al. 2002), and health-related behavior adjustments or lifestyle changes (Koenigsberg et al. 2004).

Medication adherence refers to the extent to which patients follow prescriptions recommended for the treatment. This includes (1) following instructions for dosage, (2) timely intake, (3) following schedule, and (4) periodic refills and renewals for medicines and drugs. While medication adherence may seem like the patient's passive behavior, the persistency of the implementation behavior requires an internal or 'intrinsic' reminder. Viewing the taking of medicines as a fit to the individual's goal of managing or improving her health condition will serve as this internal reminder. Perceiving the impact of taking medicines on the individual's health helps reinforce supportive behavior. Taking the prescribed medicine does not require any special skills. Therefore, autonomy and self-efficacy may not create any difference to sustain this behavior.

Treatment intervention is defined as the extent to which patients follow procedure and activities associated with the disease treatment. These include (1) curative activities (2) remedial recommendations, (3) restorative advice, and (4) therapeutic instructions. Unlike medication adherence, treatment intervention involves activities that are new or challenging to the patient. If not performed well, the treatment effects may not be as expected. In an extreme case, the intervention activity may be interpreted as less effective and, thus, be abandoned.

Self-efficacy perception about performing the specified activities well and the choices of performing the activities may be the key motivating drivers of treatment intervention. Meaningfulness and impact are important but play a less distinguishing role in accentuating intervention activities.

Lifestyle change is defined as the extent to which patients alter their behavior to accommodate the treatment and disease management process. These include (1) coping with disease symptoms, (2) adjusting to disease consequences (emotional as well as physical), (3) interpreting effects of the disease and treatment (e.g. trends, pace of change, consequences), and (4) changing habitual behaviors.

It is important to note that the proposed definition of lifestyle changes incorporates the idea that they are long-term health-related change behaviors. A 'lifestyle' means behavior practiced over a long period of time to an extent that it becomes a habit. Any change to it requires persistence and sustained efforts Without meaningfulness, perceived impact, self-efficacy, and autonomy, the change will be difficult or may only take place for a short period of time.

Psychological empowerment serves as internal motivation and reminder for innovative behavior, in contrast to external stimuli. The effectiveness of any external stimuli diminishes with time as the patient gets used to it, like the Hawthorn effect in production management (Olson et al. 2004). With a chronic disease, once a patient is psychologically empowered, s/he will be more likely to engage in medication adherence, treatment intervention activities, and lifestyle change behaviors. Thus, we contend:

Proposition 2: Psychological empowerment is positively associated with innovative behavior.

Treatment effectiveness is defined as the extent to which the disease treatment can help improve patients' clinical outcome, such as, ease in disease symptoms, alleviation of pain, reduction in suffering, relief from trauma and stress (Holman and Lorig 2004) (for example, reduced hemoglobin A1C level, reduced blood glucose level, and improvement in blood pressure levels). Arguably, medicines help in getting desired outcomes in the short run, such as a painkiller to reduce pain. However, tangible long-term improvements to a patient's health come from the treatment interventions or lifestyle changes. These interventions or changes focus on rebuilding or avoiding damage to the patient's internal mechanism to manage the chronic disease.

Health outcome is defined as the medical or health condition of the patient due to treatment (Chodosh et al. 2005; Taylor et al. 2005). Examples of such conditions include the patient feeling relieved from the anxiety of the disease after joining the treatment program. Medication adherence has a less direct impact on health outcome. It is suggested that treatment intervention programs or lifestyle change activities play a more important role in improving the individual's health outcomes. The effectiveness of the treatment programs or the activities is derived from the individual's daily efforts.

Service quality is defined as the extent to which the delivery of care contributes to the improvement or maintenance of quality and/or duration of patient's life (Piligirmiene and Buciuniene 2011). Attributes of healthcare service quality may constitute multiple dimensions. These include efficiency or optimal use of available resources to yield maximum benefits or results. Medication adherence and treatment interventions are major contributors of improving service quality. Appropriate medical prescriptions and interventions that suit the individual's emotional, physical, and social situation will be effective. They also reduce wasting time and resources of both the patient and the care provider.

Service cost refers to the cost to the patient in availing the treatment and care (Taylor et al. 2005). It could include out-of-pocket expense for the treatment, indirect cost to maintain insurance, or ancillary costs associated with visits and treatment process. If an individual adheres to the prescribed medication, the effectiveness of the medicines influence the treatment process and the related symptoms will be managed.

However, when medicine intake is not in keeping with the doctor's advice, the suggested frequency, or dosage, the treatment process is jeopardized. Consequently, the treatment cycle will be repeated. More visits to the doctor's office may be needed. Even a different medicine may be prescribed when current medication is found to be less effective due to the failure of following the instructions. Such scenarios increase the service cost. Treatment intervention and lifestyle change indirect-impacts on service costs could include increased effectiveness of medicine intake.

We argue that treatment effectiveness depends on sustained efforts of the patient. The patient needs to follow the suggested medication schedule, take the doctor's advice on treatment-related activities, and sometimes change lifestyles. Following instructions and indulging in recommended activities will help demonstrate the effectiveness of the treatment.

If the treatment is effective, the health condition of the patient will improve. The doctor may also recommend minor adjustments to the treatment plan depending on patient feedback, especially when the initial suggestions prove less effective. Minor changes in the original plan could create high service quality. The collaboration of the patient and the doctor in following the recommended treatment plan and providing timely modifications could decrease service costs for the patient. These reduced costs include fewer office visits, taking the most effective medicines, participating in the appropriate treatment interventions and lifestyle changes. Once a patient is engaged in lifestyle change, medication adherence, and treatment intervention activities, the expected long-term clinical outcomes are most likely to occur, as elaborated elsewhere in this paper. Thus, we propose:

Proposition 3: Innovative behavior is positively associated with expected outcomes.

As suggested earlier, digital integration in healthcare implies enabling a plethora of tools and artifacts that would allow and support: (1) information storage, archiving and retrieval, (2) health monitoring, (3) health information seeking and searching, and (4) health related infrastructural tools (see Agarwal and Khuntia 2009).

The advances of computer storage hardware and database technology permit the capture and storage of health information. Internet technology and mobilization offer an easy access to the patient to comprehensive information about the disease, the doctor, the treatment plan, and the experiences of other patients with similar health conditions. This information helps patients assess the fit between the suggested medicines and activities of the disease treatment with their situations. Information enables the patient to examine if s/he will be capable of implementing the treatment plan, and understand the impact of the plan. At a later stage of the treatment, IT helps enhance the treatment intervention activities and document the immediate results of the treatment. This information aids the patient to determine whether or not to continue with the plan, and if she decides to continue, what corrective actions need to be taken. These decisions will help the patients identify and then stick to the innovative behaviors appropriate to their personal situations.

Mobilization allows the patient to access the information from anywhere, at any time. Mobile technology or some mobile applications enable the patient to maintain online contact with a doctor (Kahn et al. 2010). This online contact could be multimedia including voice, text, video, and pictures. Digitization and mobilization make telemedicine possible. Such rich, personalized information can help the doctor provide the patient relevant and/or timely advice to bring the situation (for example, physical stress experienced due to the chronic condition) under control.

Feedback from the doctor will reduce potential office visits, remove unnecessary anxiety about the situation (at an early stage of the disease), or prevent conditions from worsening. Patients will enjoy this service as well. This instant feedback about the patient's health will also enhance intrinsic motivation, making the treatment plan or intervention more meaningful to the patient. This sense of meaningfulness helps create sustained behavior to continue with the current interventions, make minor modifications to selected activities, or switch to an alternative program that fits better. In the long-run, the sense of meaningfulness derived from mobilization allows to create expected outcomes of the treatment or intervention.

Convenient communication with the doctor or receiving instant advice from the doctor through a mobile device or Internet will help enhance the patient's self-efficacy and autonomy perceptions. These enhanced perceptions motivate the patients to adhere to the medication, continue with the treatment interventions, or change her personal lifestyle.

Personalization helps create an individual profile about the patient including the customized treatment plan. Complemented by the information from the patient's own social network, the individual's health profile and the personalized treatment plan will influence the patient's perception of choice and impact during the pre-treatment stage. During the treatment stage, the personalized performance summary from the suggested activities or interventions will help the patient engage in additional activities or to make some adjustments and then re-engage in the activities. In either case, the personalized feedback or customized intervention activities during the treatment stage will help gradually modify the patient's behaviors to accommodate the treatment or intervention. The sustained behaviors enabled by personalization or customization will help generate the expected treatment outcomes for the patient over time.

Agarwal and Khuntia (2009) suggest several personalization artifacts that provide a locus of control to help patients manage their healthcare. They report that personal health information comes from multiple sources and that users need to follow different strategies to manage and organize this information. As the management of personal health information for chronic diseases is a complex process, users must rely on a variety of digital tools and artifacts to successfully integrate information. For example, a personalized health monitoring and management tool that is geared to take cholesterol levels with changing diets and informing the patient may have a substantial effect in the disease management process.

Chronic disease management involves many intervention programs (Kripalani et al. 2007). Information digitization helps monitor intervention activities and record the daily progress or performance of the activities (Halverson et al. 2012). This daily information piece could be fed to a central database. Cumulatively, the aggregated analysis of the information will provide a summary of the patient's health status at different times or situations.

In sum, we propose IT tools, applications and services influence and enable a better, more thorough-process of psychological empowerment to get desired outcomes. Internet-enabled IT systems provide timely diagnostic, clinical and drug related information to doctors and health professionals. Similarly, IT communication systems enable seamless delivery of care to the patient through multimedia or telemedicine based consultation, and diagnosis (Lin 1999).

Communication systems, such as telemedicine systems, enable remote delivery of healthcare consulting services, overcoming the limitations of the physical infrastructure (Miscione 2007;Wootton 1997). In many cases, a patient needing an intervention is able to call, e-mail, chat and videoconference a specialist on-call in a secondary care setting or at the specialist hospitals (Branger 1992;Miscione 2007). As suggested by Sherer (2013), digital integration via multiple tools and artifacts enables patient-centered care and serves as motivational, management and delivery mediums in healthcare.

Extant literature supports the argument that digital integration through digitization, personalization, and mobilization enables the psychological empowerment process for chronic disease treatment. Therefore, we propose:

Proposition 4: Digital integration will mediate the relationship between, (a) situation interpretation and psychological empowerment, (b) psychological empowerment and innovative behavior, and (c) innovative behavior and expected outcomes.

Proposed Methodology

A survey questionnaire will be developed through reviewing existing literature and developing measurement items for each construct. An initial instrument for testing the research model is included in Table 1. The table provides construct names, the definition, or description of the constructs, the measurement items, and a major reference. For example, the measurement items for disease affliction are adapted from Bowman et al.'s (2006) 24-item health-emotions scale. Items include "I have an intense loathing for my present state of health", "At present I feel extreme dread", "I feel very deep sorrow because of my health", "Health problems are tiresome to me". The measurement items for information access are adapted from Spreitzer (1996). In the questionnaire, all the items are measured on a five-point Likert scale where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree, unless specified otherwise.

These initial instrument items will be reviewed first by select scholars and patients with chronic diseases for readability and clarity. Items may be reworded to reflect the feedback from the scholars or the patients. The instruments will then be pilot tested with a small sample from the targeted population for reliability, convergent and discriminant validity, and predictability. This step will occur prior to the large-scale test. Items will be dropped or revised based on the results of the pilot test. Additional items may be added to make sure that each construct has at least three to four items.

The target population will be patients with a chronic disease. We will seek the collaborations from doctors/physicians or intervention programs. The survey will be administered on a voluntary basis and in an anonymous format. The patients' identity will not be collected for data analysis purpose.

Data will be analyzed by following Anderson and Gerbing's (1988) two-step approach. First, the measurement model will be assessed with statistics and structural equation modeling (SEM) techniques for descriptive statistics, reliability, convergent validity, and discriminant validity of the variables/factors (Nunnally 1978). Second, with the satisfactory overall results of the measurement model, hypotheses will be tested with structural equation model technique.

The means, standard deviations, Skewness value, and Kurtosis value of each variable in the model will be assessed for the normal distribution assumption of the variable (Ghiselli et al. 1981). Construct reliabilities are assessed with Cronbach's (1951) alpha (α) with the value of 0.7 or above is considered acceptable (Nunnally 1978).

Convergent validity is an assessment of how well measurement items load on their latent variable. Item-factor loadings equal to 0.60 or greater indicate good convergent validity (Bagozzi and Yi 1988).

Average variance extracted (AVE) has been suggested as an alternative measure of convergent validity as well. An AVE value of 0.50 or higher indicates that the variance captured by the items measuring the intended construct is greater than the variance due to the measurement error, suggesting convergent validity (Fornell and Larcker 1981).

Discriminant validity is assessed by examining whether the measurement items share more variance with their intended construct than any variance that the construct shares with other constructs (Fornell and Larcker 1981). A construct has discriminant validity if the square root of its AVE value is greater than the correlations between this construct and other constructs. The values of χ^2, NNFI, CFI, and RMSEA will be used to assess the model-data fit of the measurement model and structural model (Bentler 1990; Joreskog and Sorbom 1989).

With the acceptable construct reliability, convergent validity, and discriminant validity of the measurement model, the model-data fit will then be assessed for the structural model. Research hypotheses will be evaluated by examining the structural coefficients between exogenous variables and endogenous variables or the one among the endogenous variables.

Discussion

This study proposed a research framework for exploring the role of digitization in improving the treatment outcomes through enhancing the psychological empowerment of patients with chronic diseases.

The focus was to address the questions on how patients can be psychologically empowered to manage their chronic disease, consequences of the empowerment process, and the role of digital integration in this process. Propositions are developed based on the research model, research methodology is introduced, and implications are discussed.

The conceptual model suggested in this paper establishes three groups of variables, in the pre-treatment, treatment, and post-treatment phases. It details a set of variables to explore the antecedents and consequences of psychological empowerment in the context of chronic disease management. Further, the model suggests that digital integration consists of three tenets - digitization, mobilization, and personalization. These mediate the patients' psychological empowerment for managing a chronic disease.

Three theoretical contributions can be drawn from this study. First, the scope of psychological empowerment is extended to the chronic disease management context. The concept has been used in the context of task activities in organizations (Doll and Deng 2010). Our conceptualization provides a novel approach to apply this theoretical concept to the healthcare context. Second, we suggest that digital integration plays an integrative role in the psychological empowerment avenues of disease management process. This extension contributes to the theoretical discussions in recent literature on patient-centered electronic health (PCEH), in proposing an additional avenue of research (Wilson et al. 2013). Third, we contribute to existing literature on the digital integration and enablement of healthcare (Alpay et al. 2011; Romanow et al. 2012) through information technologies by arguing that IT plays a major role in delivering efficient and high quality healthcare, as well as enabling 'cognitive and emotional' states associated with health management.

In terms of limitations, the conceptual framework needs to be validated with empirical data that remains as a future scope of this ongoing research. Further, as a limitation to the conceptual model of this study, social embedded-ness of the patient from the framework was excluded as it can be an environmental determinant. For example, a rich and positive social environment may influence the psychological empowerment better than say a war-zone environment. In this model, the patient is a reflection of the social environment. Finally, the long-term implications of the disease treatment are out of the scope of this model, although the model includes expected outcomes. Future studies may focus on exploring some of these limitations, and extending the model to other disease management and treatment contexts.

In conclusion, this study is focused on providing a conceptual model of antecedents and consequences of psychological empowerment of patients with chronic disease. We have proposed a conceptual model that builds on three key questions. These questions looked at 1) how patients can be psychologically empowered, 2) what are the consequences of psychological empowerment, and 3) what roles does digital integration play in the patients' psychological empowerment. An empirical research methodology was introduced to help test the set of propositions developed. This study is expected to contribute to the emerging literature focused on healthcare issues in the information systems literature.

Appendix

Note: The suggested constructs and items are developed keeping in view that the model is relevant to:
1. A focal chronic disease (e.g., selecting the disease among all diseases that has the greatest impact on the health of an individual).
2. In reference to a set of doctors/providers engaged with one episodic disease treatment process. Example: Patient consults a primary care physician (PCP), who in turn refers the patient to two specialists, and labs. The PCP takes decisions based on the information s/he receives, and provides medication. This is episode 1 of the disease treatment process. The patient is unhappy or did not experience improved results from episode 1. S/he switches PCP, who in turn refers to the patient to another set of specialists and/or labs to take decisions regarding the patient's chronic condition. This is episode 2 of the disease treatment process. Choose either episode 1 or 2, while answering the questions.
3. Suggested scale: a 5-point Likert scale where 1=strongly disagree and 5= strongly agree, is the preferred scale to measure the items.

Table 1. Constructs and Measurement Items for the Research Model		
Variable and Definition	Item Description	Reference
Pre-Treatment Phase: Situation Interpretation		
Disease Affliction (An unpleasant state-of-mind of the patient due to her health-condition which induces emotional distress and physical pain)	Due to the chronic disease: 1. I feel concerned about my health condition. 2. I feel sick because of my health condition. 3. I feel sad about what is happening to my health. 4. I loathe about my health condition. 5. My health condition is a real inconvenience. 6. I feel displeased about my health condition. 7. I am worried about my health condition.	Bowman et al. 2006
Information Access (The extent to which a patient can obtain information about the chronic disease).	1. I can get access to information related to my chronic disease anytime. 2. I can get access to information related to my chronic disease wherever I go. 3. I can get access to information related to my chronic disease just in time. 4. The information related to my chronic disease is always available to me at the places that I usually tend to look.	Spreitzer (1996)
Regime Clarity (The reliability, credibility, or adequacy of information concerning the treatment for the chronic disease, shared by the doctor with the patient).	1. My doctor provides reliable information on how to treat my chronic disease. 2. My doctor provides adequate material describing how to treat my chronic disease. 3. My doctor provides credible references on how to treat my chronic disease. 4. My doctor provides clear suggestions on how to treat my chronic disease. 5. Although there are different facts about treating the chronic disease I suffer from, my doctor clarifies each one of them to me.	Han et al. 2006
Rationale Stimulus (The factors that may act as a pre-curser to trigger a rationalization process of the articulated treatment plan.)	If I undergo treatment for my chronic disease: 1. My insurance premium costs could decrease. 2. My co-payments could decrease. 3. Availing the treatment will save me time and energy in the future. 4. I can afford the treatment option that will benefit me in future. 5. I will be able to take an informed decision to select my provider. 6. I will have time for the treatment. 7. Going for the treatment is convenient for me. 8. My inclination for the treatment is justified.	
Treatment Phase: Psychological Empowerment		
Meaningfulness (The value of the suggested treatment option, judged in relation to a patient's own ideals.)	1. The disease treatment process is important to me. 2. My disease treatment activities are personally meaningful to me. 3. The disease treatment process is meaningful to me. 4. I derive a sense of involvement with my disease management process. 5. My disease treatment process is relevant to my health and wellbeing.	Doll and Deng (2010)

Autonomy (The patient's choice in adopting a specific treatment option or plan, after the doctor explains activities related to diagnostics, medication, and follow up tests relevant to the treatment of the disease.)	1. I have the freedom to determine how I continue with my doctor's suggested plan. 2. I have considerable opportunity to adopt my doctor's treatment plan. 3. I am free to decide my treatment options explained by my doctor. 4. Following the doctor's treatment plan is up to my choice. 5. I am independent to follow the suggested treatment plan. 6. My decision to follow my doctor's treatment plan depends on my free will. 7. I have the autonomy to adopt my doctor's treatment plan.	Doll and Deng (2010)
Self-Efficacy (The patient's perception that he/she has mastered the skills and abilities required to manage the treatment process such as taking medication, adhering to the regime of treatment, and following the activities suggested by the doctor.)	1. I am confident about my ability to manage disease treatment. 2. I am self-assured about my capabilities to perform my disease treatment activities. 3. I have a fair idea about the necessary steps in my disease treatment. 4. I have the ability to manage a complicated medication schedule. 5. I am able to acquire skills to adapt to exercises or dietary requirements relevant to the disease treatment process. 6. I feel I have mastered the skills needed to management my treatment process. 7. I have the ability when it comes to manage the nitty-gritties of the treatment process.	Doll & Deng (2010)
Impact (The perceived influences of the treatment process on clinical symptoms for the disease and the long-term consequence on the life of the patient.)	1. The treatment will help reduce my immediate symptoms. 2. The treatment process will help alleviate my pain. 3. My treatment will have influences over the disease's indicators. 4. The treatment will lead me to a better condition. 5. My treatment will help me to control the signs for the disease. 6. The signs of the disease will be managed by the treatment process. 7. The treatment will be helpful to me to lead a painless life now.	Doll & Deng (2010)
Treatment Phase: Innovative Behavior		
Medication Adherence (The extent to which patients follow prescriptions for the treatment.)	1. I follow prescription instructions related to my treatment. 2. I take all my medications related to my treatment on time. 3. I follow my medication dosage related to my treatment. 4. I make sure to refill my medication on time. 5. I make sure to refill my medication on schedule. 6. I keep my tests on schedule. 7. When required, I make sure to renew my medications. (Anchors- never = 1, rarely = 2, sometimes = 3, almost always = 4, always = 5)	Morisky et al. 1986
Treatment Intervention (The extent to which patients follow procedural treatments and activities associated with the disease treatment.)	1. I practice suggested corrective activities helpful towards my disease. 2. I perform the suggested procedures that reduce pain and aid to heal. 3. I stick to the therapy (or, similar activity) schedule suggested by my doctor. 4. I do the suggested treatment activities that help sooth my health condition. 5. I keep up with the doctor's suggestions to settle the restoration devices (or, similar). 6. I adhere to the rectifications suggested by my doctor. 7. I look to follow the curative process suggested by my doctor.	Weingarten et al. 2002
Lifestyle Change (The extent that patients alter their behaviors to accommodate the treatment.)	1. I have changed the way of my life to support the treatment of my disease. 2. I engage in more activities that positively impact the treatment of my disease. 3. I refrain from activities that negatively impact the treatment of my disease. 4. I indulge in healthy behaviors that positively impact the treatment of my disease 5. I reduce unhealthy behaviors that negatively impact the treatment of my disease. 6. I have adopted health habits that positively impact the treatment of my disease 7. I control health habits that negatively impact the treatment of my disease.	Ghosh et al. 2013

	(Anchors- to least extent = 1; to great extent = 5)	
Post-Treatment Phase: Expected Outcomes		
Service Cost (The cost to the patient in availing the treatment and care.)	Comparing to that of other treatment plans, 1. The cost of the service is less than what had originally expected. 2. The frequency of office visit has been reduced. 3. Out-of-pocket expense is less. 4. Cost of interventions is within the budget. 5. Insurance cost has no change.	Taylor et al. 2005
Treatment Effectiveness (The extent to which the treatment can help improve patients' clinical outcomes, such as ease in symptoms, alleviation of pain, reduction in suffering, relief from trauma and stress.)	1. The treatment of my chronic disease has reduced my suffering. 2. The treatment of my chronic disease has provided me with relief. 3. The treatment of my chronic disease has reduced my stress. 4. The treatment of my chronic has alleviated my agony. 5. The treatment of my chronic disease has enabled me to recover from trauma.	Holman and Lorig 2004
Health Outcomes (The medical or health condition of the patient due to treatment.)	1. In general, my health has improved as a result of my disease treatment. 2. My disease symptoms have reduced significantly as a result of my disease treatment. 3. My physical condition has improved as a result of my disease treatment.	Chodosh et al. 2005
Service Quality (The extent to which the delivery of care contributes to the improvement or maintenance of quality and/or duration of patient's life.)	1. The doctor is responsive to my inquiries. 2. The delivery of care is timely. 3. The delivered care is of quality. 4. Nurses provide good care for me.	Kenagy et al. 1999
Digital Integration		
Digitization (Presentation of different types of information (medical, disease related, disease management related, and disease treatment related) in digital format.)	1. My treatment information is electronically captured. 2. My treatment and condition information is stored in digital format 3. My treatment information is regularly saved. 4. My health information can be accessed in digital format. 5. My treatment information is electronically available for health decision making.	Agarwal and Khuntia 2009
Mobilization (The extent to which information systems or technology can facilitate portability and transferability of disease management information.)	1. During treatment process, my treatment information can be ported to an accessible digital medium 2. My treatment information can be viewed from anywhere outside of my providers' premises. 3. My condition can be remotely monitored by my provider at the time of need 4. My stored treatment information can be accessed to enable me to manage the disease. 5. My provider's specific suggestions/recommendations is available at my end, digitally, anytime, from anywhere.	Prgomet et al. 2009
Personalization (The extent that the online information related to chronic disease management has been tailored to meet the specific needs and preferences of patients.)	1. My health information can be availed and compared for disease specific treatments. 2. I obtain specific personalized recommendation related my treatment, from my provider using digital medium 3. I receive specific online guidelines related to my treatment, suggested by my provider. 4. I obtain a customized treatment plan from my provider using digital modes. 5. My treatment information is preferentially designed to suit to my needs.	Tam and Ho 2006

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