7-8-2023

Understanding technology-enabled patient-provider working alliance in diabetes management.

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Short Paper

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Abstract

Diabetes is a prevalent global health challenge and managing it requires ongoing collaboration between patients and healthcare providers. Notably, the quality of the patient-provider relationship is a critical factor that impacts the adherence to and effectiveness of collaborative diabetes management interventions. Digital health technologies have transformed the collaborative diabetes management process, but the effectiveness of these technologies depends on their ability to foster a strong patient-provider relationship. In this ongoing interpretive and exploratory research, we investigate how the use of technology, and its features facilitates patient-provider working alliance in diabetes management considering both the personal and collaborative dimensions. We will leverage the combined conceptual lens of working alliance model from psychology and information systems affordance theory to gain insights into this important topic.

Keywords: Diabetes management, patient-provider relationship, working alliance, digital health, technology use.

Introduction

Diabetes is a significant global challenge, affecting the lives of 422 million people worldwide (WHO, 2022). In addition to the human toll, diabetes also poses a substantial global economic burden, with direct costs projected to surpass USD 1.03 trillion by 2030 (International Diabetes Federation, 2021). Type 2 diabetes, which is the most common form of diabetes is largely caused by lifestyle factors (Wu et al., 2014) and can be effectively managed through self-management. However, diabetes self-management is ongoing, complex

and dynamic, requiring increased interactions, self-management support and collaboration in decision-making between patients and providers (Glasgow et al., 2003). Notably, the quality of the patient-provider relationship is a critical factor that impacts the adherence to and effectiveness of collaborative diabetes management interventions (Ciechanowski et al., 2001; Kaplan et al., 1989; Linetzky et al., 2017; Martin et al., 2005).

Over the years, the rapid advancement, widespread adoption and use of digital health technologies have revolutionized the collaborative diabetes management process for both patients and providers (Alcantara-Aragon, 2019; Greenwood et al., 2022). These technologies provide solutions ranging from technology-mediated patient-provider remote communication and improved access to and monitoring of patients' health and behavior. The collaborative diabetes management process is being significantly enhanced and augmented by the combination of AI and analytics with the growing availability of digitized health data from diabetic patients (Contreras & Vehi, 2018). Ensuring the optimal use of collaborative technologies with their innovative features is critical to achieving their effectiveness (Alcantara-Aragon, 2019). The success of these collaborative technologies also heavily relies on the quality of the patient-provider partnership relationship it can foster (Wannheden et al., 2022). Therefore, using technology to establish and maintain an effective patient-provider relationship is crucial to fully realizing the potential benefits of these technologies in collaborative diabetes management.

The patient-provider relationship is often conceptualized using working alliance (also referred to as therapeutic alliance), which originates in the psychology literature (Bordin, 1979; Hougaard, 1994). Research indicates that working alliance is a reliable predictor of treatment outcomes (Fuertes et al., 2017). To establish a strong patient-provider working alliance, both a personal trusting relationship involving an 1) *attachment bond* and a collaborative relationship involving an 2) *agreement on treatment goals* and 3) *agreement on treatment tasks* are necessary (Hougaard, 1994; Bordin, 1979). Working alliance is a critical factor in the success of diabetes management (Heisler et al., 2003; Jones et al., 2016) and a vital component in the effectiveness of digital health interventions involving both patients and providers (Torous & Hsin, 2018). Recent studies have further shown that the quality of the technology-mediated patient-provider relationship is a significant factor in the adherence to collaborative digital health interventions and continued use of health technology (Tremain et al., 2020).

Information systems researchers have also emphasized the importance of considering this patient-provider relationship in technology-enabled diabetes management (Dadgar & Joshi, 2018). However, the effectiveness of digital health technologies in diabetes management has been mostly evaluated through their clinical impact (Chatterjee et al., 2018; Ghose et al., 2022; Kelley et al., 2011; Wannheden et al., 2022). Furthermore, the use of these digital health technologies is mostly assessed through binary variables and using existing IS theories (Dantu et al., 2019; McCreless & Eid, 2017; Petersen et al., 2019) that has so far limited the exploration of the nuances of the patient-provider relationship that is central to the effectiveness of collaborative digital health technologies. Unlike other contexts, delivery of healthcare services relies heavily on the development of these therapeutic relationships between patients and providers. Therefore, to gain a comprehensive understanding of the use of technologies by patients and providers in healthcare, particularly in the management of chronic diseases such as diabetes, it is essential to develop a new perspective that captures the dynamics of the patient-provider relationship. Against this background and in line with the calls for a shift towards more feature-based, rich and context-driven digital health technology use theorizing (Burton-Jones & Volkoff, 2017; Fallon et al., 2019), this research in progress draws on working alliance model (Bordin, 1979) and affordance theory (Gibson, 1977) to understand *how the shared use of digital health technologies may facilitate a working alliance between type 2 diabetic patients and their healthcare providers in collaborative diabetes management?*

Background

Due to the information intensive nature of diabetes management, it requires the integration of information systems, which has been recognized for years as a crucial element in the process (Norris et al., 2003; Wagner et al., 1996). According to the Chronic Care Model, the ability of information systems to support the management of chronic diseases, such as diabetes, is dependent on their capacity to facilitate productive interactions between patients and providers (Wagner et al., 1996). Wagner and colleagues (1996) noted that productive patient-provider interactions hinge on patients being informed and activated, while providers are proactive and prepared. In diabetes management, patients and providers also have their own roles and

responsibilities, with patients taking on self-management tasks such as monitoring blood glucose, adjusting nutrition and physical activity, and medication, which necessitates making numerous decisions every day(Hill-Briggs, 2003). Meanwhile, providers support patients in developing and refining personalized action plans, continually assessing patient behavior and condition, and advising and assisting in problem solving and decision making (Glasgow et al., 2003).

To support these roles and responsibilities in addition to the productive patient-provider interactions, various digital health technologies have been developed over the years (Cahn et al., 2018; Greenwood et al., 2022). Patients and providers generate a significant amount of data from sources such as electronic medical records, insulin pumps, sensors, glucometers, and wearables. Digital health platforms have been designed to assist patients in making informed decisions about their self-management behaviors. Simultaneously, the vast amount of patient-generated data is analyzed to identify trends and areas of focus for providers to make informed decisions about treatment plans (Cahn et al., 2018; Contreras & Vehi, 2018). To ensure the effectiveness of these technologies, their use must not only facilitate patients and providers in carrying out their individual roles and responsibilities but also enable them for repeated productive interactions that promote working alliance over the long term.

In diabetes management, for patient-provider working alliance, there needs to be a shared understanding and agreement on goals for controlling diabetes and the tasks associated to reaching those goals (Jones et al., 2016). Furthermore, there also needs to be trust and liking between the patient and provider, also referred to as attachment bond (Jones et al. 2016).

Researchers across different fields of literature have investigated the patient-provider working alliance, therapeutic relationship, and other related constructs in digital health interventions that employ various technologies. For example, studies in the context of mental healthcare have demonstrated that technology can be used to establish patient-provider working alliance (Richards & Viganó, 2013; Wehmann et al., 2020). Various factors influence working alliance, including increased social presence of providers (Lopez, 2014; Müssener, 2021), increased responsiveness (Glueck, 2013) and summaries and insights from patient-generated health data that allow providers to focus on actionable data to build working alliance (Wisniewski & Torous, 2020).

Based on past reviews, limited studies within the context of chronic disease management have adopted the concept of working alliance to holistically evaluate the patient-provider relationship in digital health interventions (see Table 1). Instead, researchers have assessed patient-provider collaboration, partnership, relationship, and trust as separate entities in chronic care. Studies suggest that digital health technologies can enhance the patient-provider collaborative relationship through increased transparency and shared knowledge (ElKefi & Asan, 2021). Additionally, patients' use of technology improves their access to information about their condition, encouraging their involvement in the decision-making process, and promoting collaboration (Farnood et al., 2020; Haze & Lynaugh, 2013). The utilization of digital health technologies also improves patient-provider communication (Haze and Lynaugh, 2013), increases informal interactions (Barenfeld et al., 2020), and enhances mutual understanding (Lie et al., 2019), ultimately improving the patient-provider relationship.

Past research on patient-provider trust in digital health interventions highlights that patients' perceptions of how providers use technology affect their trust in both technology and the care provider (Montague & Asan, 2012). Furthermore, the use of digital health technology by the patient has an impact on trust within the patient-provider relationship, and conversely, the existence of trust in the patient-provider relationship also affects the use of digital health technology (Andreassen et al., 2006).

Within the IS literature, an interdisciplinary review of chronic disease co-management using self-monitoring technologies revealed that the exploration of patient-provider collaboration has been primarily descriptive and lacking theoretical depth (Jiang & Cameron, 2020). This highlights the need to better understand how digital health functionalities can facilitate or constrain the patient-provider co-management process in chronic care. Studies that did consider the patient-provider relationship primarily evaluated online health communities and used indirect measures to quantitatively assess the relationship quality (Liu et al., 2020; Zhang et al., 2018). Although most IS studies on digital health technologies for diabetes management have incorporated existing IS theories, this research aims to integrate domain-specific knowledge to enhance the existing IS lens for understanding technology-enabled working alliance in collaborative diabetes management by incorporating both patient and provider perspectives.

Paper	Literature	Study type	Technology and context	Key findings
ElKefi and Asan (2021)	Health informatics	Systematic Literature Review	Digital health technologies in cancer management.	When technology is used effectively, it improved patient satisfaction, ability to manage emotions and make decisions, and built a stronger therapeutic alliance based on shared knowledge and transparency between providers and patients.
Farnood et al. (2020)	Health informatics	Systematic Literature Review	Patient online self-diagnosis of chronic disease.	Patients tend to use online health information seeking to establish a partnership with healthcare providers, rather than to question their expertise, which can lead to an improvement in the patient-healthcare provider relationship.
Jiang and Cameron (2020)	Information Systems	Review	IT-enabled self-monitoring for chronic disease management.	IT-based self-monitoring can enhance patient-provider co-management by enhancing disease-related information obtained from patients and making personalized treatment plans more accessible. However, the lack of formal implementation and mistrust of system-generated information can impede co-management.

Table 1. Summary of literature reviews on patient-provider dyad in technology-enabled chronic disease management

Conceptual Framework

Based on an integration of the working alliance model (Bordin, 1979), the bi-partite perspective on working alliance (Hougaard, 1994) and affordance theory (Gibson, 1977), figure 1 presents the conceptual framework to understand how technology use by patients and providers facilitate their working alliance.

According to Bordin (1979) and Hougaard (1994), a strong patient-provider working alliance involves a personal and collaborative relationship. Hougaard's bi-partite view of working alliance posits that both patients and providers contribute to the development of the personal and collaborative relationship. The personal relationship involves an *attachment bond* that signifies the existence of trust and liking between the provider and patient. In essence, it refers to the emotional attachment that develops between a patient and their healthcare provider. Based on Hougaard's view (1994), for patient's use of technology to facilitate this personal relationship involving attachment bond, their confidence, compliance, and receptiveness need to be improved. While for healthcare providers, their authenticity, acceptance, and understanding of the patient needs to be enhanced by the use of technology.

The collaborative relationship of working alliance involves agreement on goals and tasks (Bordin, 1979). To establish a robust working alliance, patients and healthcare providers must cultivate a collaborative relationship founded on a mutual comprehension and agreement regarding diabetes management goals, as well as the necessary tasks to achieve them. Based on Hougaard's view, to facilitate the collaborative relationship involving agreement on goals and tasks through technology use, patients' working capacity, motivation, and positive expectations need to be improved. Concurrently, healthcare providers must enhance their expertise and engagement through the use of technology in order to establish this collaborative relationship with their patients.

To conceptualize the role of the technology artifact and its features in facilitating working alliance, this research employs the affordance theory (Gibson, 1977). Initially, affordance theory was developed to elucidate the interactions between animals and their surroundings (Gibson, 1977). In the context of IS, this concept is applied by perceiving affordances as possibilities for actions that facilitate the attainment of

specific, tangible objectives, resulting from the relationship between a technological artifact and the actors with goal-directed behavior (Strong et al., 2014). Based on affordance theory, the features of the technology artifact offer potential affordances for both patients and providers. However, it is important to note that these affordances must be actualized through use in order to influence outcomes relative to working alliance in diabetes management. Adopting this theoretical lens allows for an examination of how the utilization of technological features and the affordances that stem from this use impact diabetes management and the personal and collaborative relationships between patients and providers. Additionally, it allows for a better understanding of how the personal and collaborative relationships in working alliance are influenced from both patient and provider technology use experiences as two individual goal driven users. While these concepts serve as a starting point for understanding technology-enabled working alliance, the research conceptual framework will evolve as data is collected and analyzed.

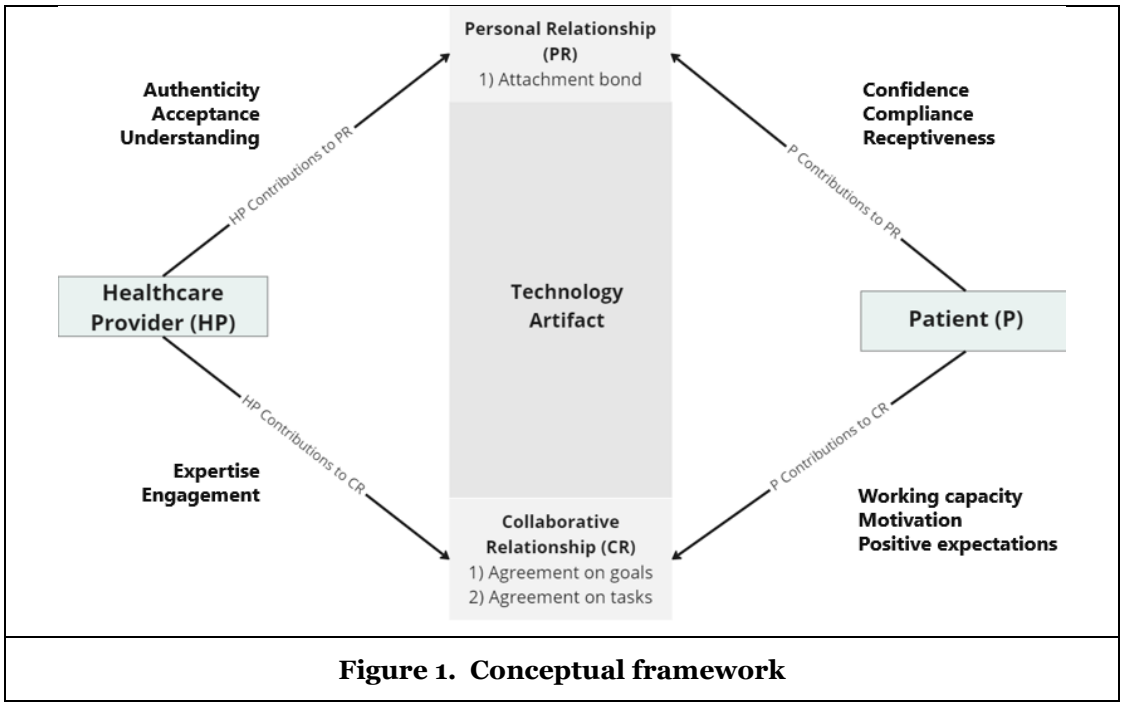

Figure 1. Conceptual framework

Methodology

This research is interpretive and exploratory (Klein & Myers, 1999) which enables uncovering of the subjective and inter-subjective meanings constructed by patients and providers in their experience of using digital health technology features that facilitate their working alliance. To achieve this, the research adopts a combined single case study approach (Benbasat et al., 1987) and constructivist grounded theory methodology (Charmaz, 2006). A single case study allows for an in-depth investigation of technology-enabled working alliance with a collection of rich descriptions (Walsham, 1995). As this research adopts an initial conceptual framework, adopting the constructivist grounded theory methodology allows for both inductive and deductive reasoning in theory building (Charmaz, 2006).

Selection of Case

To understand how the shared use of digital health technologies facilitate working alliance between patients and providers in diabetes management, this research selects Healea, a diabetes management system developed by Medi-AI for the shared use by type 2 diabetic patients and providers as the case. Healea is a comprehensive platform that allows type 2 diabetic patients and their healthcare providers to collaborate in managing all aspects related to diabetes care. The system includes a web and mobile app interface, and incorporates self-monitoring, exercise and diet tracking, collaborative medication management, smart sensor, and wearable integration. Patients can set goals with their providers, receive reminders, and

communicate with them in real-time. Providers can view their patients' data to inform individual care plans. Additionally, the system incorporates AI capabilities such as natural language processing and computer vision to provide insights from patient generated data. The innovative and comprehensive features of Healea for both patients and providers make it an interesting, unique, and revelatory case for exploring technology-enabled working alliance in diabetes management.

Data collection

To recruit participants for this study, an initial purposive sampling approach will be adopted (Patton, 2015). The aim is to recruit approximately 10 to 15 type 2 diabetic patients and 5 to 10 healthcare providers. To ensure the representativeness of the participants, the study's inclusion criteria for selecting patients and healthcare providers mandates a minimum usage of the Healea platform for six months prior to commencing the first round of data collection. This is based on previous research that suggests it takes at least six months for patients and providers to explore and adopt optimal uses of technology, taking into account their individual and collaborative requirements (Gammon et al., 2017). The actual number of participants selected will be based on reaching theoretical saturation, which can be achieved with a relatively small sample size. Systematic reviews have shown that conducting 9 to 17 interviews is usually sufficient to obtain reliable results (Hennink & Kaiser, 2022). We aim to begin recruitment and data collection in the next three months. The primary data for the research will be collected through in-depth semi structure interviews (Charmaz & Belgrave, 2012) and the interview protocol has been developed with the guidance of the sensitizing concepts surrounding patient-provider working alliance from the research conceptual framework. We anticipate each interview duration to be between 45 minutes to an hour. Secondary data will also be collected for the research which includes system logs, user guides, documents, media releases and company reports to corroborate our findings through data triangulation.

Data analysis

This study will use the concurrent and iterative data collection and analysis process of constructivist grounded theory (Charmaz, 2006). The initial data collected will be first coded through line-by-line coding in the initial coding phase. The constant comparative analysis will be adopted which is unique to grounded theory methodology and allows for the comparison of codes and categories to uncover similarities and differences for further refinement of categories. The constant comparative analysis informs the theoretical sampling which helps identify and guide the gathering of further information to fill the gaps in the data. The data collected through theoretical sampling will then be focus coded where frequently used codes will be categorized. And at the final stage of theoretical sampling, connections will be established between codes and categories for theorizing and storytelling to present a coherent grounded theory of technology-enabled working alliance between patients and providers in collaborative diabetes management. To ensure rigor in practice and reliability of findings, this study will adopt the constant comparative analysis and memo writing of constructivist grounded theory methodology throughout the iterative data collection and analysis process.

Expected Contributions

The contributions to be made by this study is expected to have both theoretical and practical implications. These contributions are discussed against the generalizability of the theory produced which will be bounded by the contextual factors in which it was developed from (Seddon & Scheepers, 2015). Firstly, this research aims to produce rich insights (Walsham, 1995) and an in-depth understanding of technology-mediated working alliance and develop a type II theory for explaining (Gregor, 2006) how the collaborative use of digital health technologies (and its features) facilitate working alliance between type 2 diabetic patients and their healthcare providers. Furthermore, by incorporating working alliance model from psychology literature with affordance theory, the research will provide a new theoretical lens for IS researchers to understand technology use enabled patient-provider relationship and working alliance.

This enhanced understanding will inform the design and development of similar digital health technologies for collaborative use by patients and healthcare providers in diabetes management. Furthermore, the learnings from this research are also expected to inform the training and practice of healthcare providers

in using digital health technologies to facilitate working alliance and effective treatment compliance with their type 2 diabetic patients.

Limitations

There are several limitations that should be considered for the ongoing research. Firstly, diabetes is a disease that often involves not only patients and their healthcare providers, but also their family and peers. While the working alliance between patients and their family is crucial, the family relationship dynamic is outside the scope of this study. Additionally, the study only includes participants with type-2 diabetes, and while there are many similarities in the management of both type-1 and type-2 diabetes, there are differences that could impact how the system and its features need to be used to facilitate working alliance with patients. Lastly, the patients and healthcare providers recruited to use the Healea system may or may not have an existing relationship before beginning to use the system. While the interviews will explore this matter, future studies could involve patients and providers starting their interaction with the involvement of the system from the outset to thoroughly evaluate how the system and its features support working alliance at different stages of the relationship.

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