UNDERSTANDING THE SIGNIFICANCE OF PATIENT EMPOWERMENT IN HEALTH CARE SERVICES AND DELIVERY

Saad Mohammed Fahed Bani Hani

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APPROVED:

Brian Sauser, Committee Chair and Chair of the Department of Logistics and Operations Management
Suman Niranjan, Co-Chair
Arunachalam Narayanan, Committee Member
Marilyn Wiley, Dean of the G. Brint Ryan College of Business
Victor Prybutok, Dean of the Toulouse Graduate School

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To address emerging challenges in empowering patients through telehealth, this dissertation has the following objectives: (a) find the key characteristics that enable patient empowerment [PE], (b) determining when will PE work as a solution, (c) find the optimal telehealth care method that enables PE, and (d) evaluate the impact of telehealth on health care outcomes (such as, patient satisfaction, patient trust with primary care providers, etc.) that ultimately enhances PE. These objectives are addressed in three studies presented here as three essays. Collectively, these essays contribute to the knowledge on PE, patient trust, and telehealth by providing insights on leveraging PE towards better health care services and delivery systems. Essay 1 aims to systemically map the concept of PE using principles of systems thinking with the Boardman soft systems methodology that enables a graphical visualization (i.e., systemigrams). Essay 2 investigates the practical and theoretical implications of connecting patients to empowerment care plans and minimizing wait times in healthcare service delivery using electronic prescriptions (s-scripts), phone calls, and video calls. In Essay 3, the mediating role of telehealth services between patient empowerment and patient satisfaction was analyzed, along with patient trust was assessed as a moderator between telehealth usability and patient satisfaction. Two hundred sixty-two responses from patients in North America with chronic illnesses were collected through an online survey questionnaire were analyzed using partial least squares-structural equation modeling (PLS-SEM). The findings of the research show that patients with chronic illnesses in North America feel empowered by using telehealth as they can get diagnosis of the illness even in remote areas and face no obstacle.

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ABBREVIATIONS

BSSM = Boardman soft systems methodology

CPhT = Certified pharmacy technician

DES = Discrete event simulation

DOE = Design of experiment

HBM = Health belief model

NIH = National Institutes of Health

PAM = Patient activation model

PCC = Primary care clinic

PCP = Primary care provider

PE = Patient empowerment

PhT = Pharmacy technician

PLS-SEM = Partial least squares structural equation modeling

PSM = Problem structuring methods

RPh = Registered pharmacist

SDT = Self-determination theory

SSM = Soft systems methodology

TTM = Transtheoretical model

WHO = World Health Organization

OVERVIEW

In recent years, our global social and economic challenges have centered on events such as inflation in transportation, supply chain issues, human behavior economy, and health care. All of which has been the intense focus of researchers, decision-makers, and globa l citizens. Of these, health care has been a notable issue as it has become a dynamic environment and the advancement of patient access to information has brought unprecedented attention to the concept of patient empowerment (PE; Delgado et al., 2020), .

Despite PE having become a significant topic throughout the health care system, and in the literature, there are various definitions of PE that are accessible, along with models that attempt to explain how this construct is related to other constructs such as (health literacy, patent characteristics, patient self-management, etc.). however, it is uncertain whether the construct is understood similarly in all the available publications given the diversity of definitions (Acuña Mora et al., 2022) . Fundamentally, it emphasizes the importance of patients having greater control over their health care situation. One of the drivers of an increase in PE is that there is a shortage of qualified health care workers (Kumar et al., 2020). Forcing the health care system to reinvent itself and change traditional strategies for health care delivery. Over the past decade, there has been a significant increase in patients using telehealth (or) telemedicine, especially in situations where advice can be provided remotely, allowing for effective and efficient utilization of health care resources (Mahtta et al., 2021). In 2020 the growth in telehealth usage exceeds 78 times what it was before, but telehealth utilization has stabilized at a level of 38 times higher than it was before since then.   Telehealth has become the practice of remotely accessing and managing health care services via information systems, such as mobile apps and computers. (Toh et al., 2016). Telehealth is increasingly being utilized as a viable method of patient care (Fall, 2021;Mano & Morgan, 2022), and early adopters (health care providers) are trying to keep pace with the demand and expectations for providing high-quality care using telehealth. Like other innovations, a critical indicator of the success of an innovation like telehealth is to match patient expectations with patient satisfaction, which is part of PE.

To address these emerging challenges in empowering patients through telehealth, this dissertation has the following objectives: (a) find the key characteristics that enable PE, (b) when will PE work as a solution to increasing challenges in health care, (c) find the optimal telehealth care method that enables PE, and (d) the impact of telehealth on health care outcomes (such as, patient satisfaction, patient trust with primary care providers, etc.) that ultimately enhances PE.

These objectives are addressed in three studies presented here as three essays. Collectively, these essays contribute to the knowledge on PE, patient trust, and telehealth by providing insights on leveraging PE towards better health care services and delivery systems.

Essay 1: Patient Empowerment Mapping Using Systemigrams

Global crises have forced the health care sector to advance the way they practice. PE has emerged as one of the solutions to face these challenges. Nevertheless, PE is still lacking in accepted conditions, making it difficult to promote within the health care system effectively. This study aims to systemically map the concept of PE using principles of systems thinking with the Boardman soft systems methodology (BSSM) that enables a graphical visualization (i.e., systemigrams). This includes levels of PE and their relationship with other concepts such as health literacy, health providers, self-management, patient characteristics, and health care outcomes. This study contributes to the literature by (a) articulating a set of conditions to enable PE; (b) identifying the key concept that might influence the level of PE; and (c) providing guidance and propositions for future research that can promote and further study PE.

Essay 2: Reducing Patient Waiting Times in a Hub Environment

This study investigates the practical and theoretical implications of connecting patients to empowerment care plans and minimizing wait times in health care service delivery. Three distinct methods, including e-scripts, phone calls, and video calls, are explored to connect patients to empowerment care plans. Additionally, the impact of reducing waiting times on patient enrollment in empowerment care initiatives is examined. The research employs simulation, particularly discrete event simulation, to model patient flow and health care processes within a controlled environment, allowing for scenario exploration and intervention assessment. Practical implications indicate that these methods enhance patient engagement and enrollment in empowerment care plans, promoting patient-centered care and shared decision-making. Moreover, minimizing wait times improves patient satisfaction and increases the likelihood of successful enrollment. Theoretical implications highlight the significance of patient empowerment and involvement in health care decisions. The integration of simulation provides a robust approach for evaluating the implications and generating evidence-based recommendations. By implementing strategies to connect patients to empowerment care plans and minimize waiting times, health care systems can optimize service delivery and foster patient engagement for improved outcomes.

Essay 3: The Role of Patient Empowerment on Patient Satisfaction: Mediating And Moderating Role of Telehealth and Patient Trust

In the medical practice, patient empowerment is an important paradigm. The main objective of patient empowerment is to make patients' aware of their wellbeing and health. The primary goal of this research is to investigate the role of patient empowerment on patient satisfaction with telehealth in North America. The mediating role of telehealth services between patient empowerment and patient satisfaction was analyzed, along with patient trust was assessed as a moderator between telehealth usability and patient satisfaction. The research follows the comfort theory of mid-range theory to explain the level of patient satisfaction with the use of telehealth services. This paper proposes to study and emphasize the above-mentioned practices by using quantitative research methods. 262 responses were collected through an online survey questionnaire from different leading pharmaceutical companies and analyzed using partial least squares-structural equation modeling (PLS-SEM). The findings of the research show that patients with chronic illnesses in North America feel empowered by using telehealth as they can get diagnosis of the illness even in remote areas and face no obstacle. Moreover, they show trust in the service, which reveals a positive relationship with patient satisfaction.

References

Acuña Mora, M., Sparud-Lundin, C., Moons, P., & Bratt, E.-L. (2022). Definitions, instruments and correlates of patient empowerment: A descriptive review. *Patient Education and Counseling*, *105*(2), 346–355. https://doi.org/10.1016/j.pec.2021.06.014

Affinito, L., Fontanella, A., Montano, N., & Brucato, A. (2020). How physicians can empower patients with digital tools. *Journal of Public Health*, 1–13.

Delgado, G. V., Carvalho, R. B., Choo, C. W., Leite, R. S., & Castro, J. M. (2020). Patient empowerment through mobile health: Case study with a Brazilian application for pregnancy support. *Proceedings of the Association for Information Science and Technology*, *57*(1). https://doi.org/10.1002/pra2.221

Fall, S. A. W. C. (2021). Prioritizing Patient-Centeredness as a Foundation of Telehealth Solutions to Maximize User-Friendliness and Patient Empowerment in Wound Care Telehealth.

Kumar, S., Raut, R. D., & Narkhede, B. E. (2020). A proposed collaborative framework by using artificial intelligence-internet of things (AI-IoT) in COVID-19 pandemic situation for health care workers. *International Journal of Health Care Management*, *13*(4), 337–345. https://doi.org/10.1080/20479700.2020.1810453

Mahtta, D., Daher, M., Lee, M. T., Sayani, S., Shishehbor, M., & Virani, S. S. (2021). Promise and Perils of Telehealth in the Current Era. *Current Cardiology Reports*, *23*(9), 115. https://doi.org/10.1007/s11886-021-01544-w

Mano, M. S., & Morgan, G. (2022). Telehealth, Social Media, Patient Empowerment, and Physician Burnout: Seeking Middle Ground. *American Society of Clinical Oncology Educational Book*, *42*, 1–10. https://doi.org/10.1200/EDBK_100030

Sabesan, S., Allen, D., Caldwell, P., Loh, P. K., Mozer, R., Komesaroff, P. A., Talman, P., Williams, M., Shaheen, N., Grabinski, O., & The Royal Australasian College of Physicians Telehealth Working Group. (2014). Practical aspects of telehealth: Doctor–patient relationship and communication. *Internal Medicine Journal*, *44*(1), 101–103. https://doi.org/10.1111/imj.12323

Toh, N., Pawlovich, J., & Grzybowski, S. (2016). Telehealth and patient-doctor relationships in rural and remote communities. *Canadian Family Physician*, *62*(12), 961.

ESSAY 1

PATIENT EMPOWERMENT MAPPING USING SYSTEMIGRAMS

1.1 Introduction

A global health crisis can bring about substantial alterations in the practice of health care, including medical advancements, discoveries, and policy changes. This phenomenon was readily observable during the COVID-19 pandemic, which gave rise to ongoing developments that underscored the imperative to comprehend the contemporary challenges confronting the world. Beyond the tragic loss of life, the COVID-19 pandemic has exerted a profound influence on numerous sectors, encompassing industry, the economy, global markets, human behavior, and health care. It has compelled these domains to adapt to the evolving needs of the population by integrating existing systems with new ones within a dynamic environment (Kumar and Nayar 2020; Mgbako et al., 2020). Health care industries have significantly increased their focus on developing protocols and methods to address, mitigate, and control the repercussions of the pandemic. According to the World Health Organization (WHO), the COVID-19 pandemic has altered the customary behavior of individuals due to lockdowns, self-isolation, and quarantine measures, rendering face-to-face interactions challenging (World Health Organization, 2020). This situation has heightened the urgency for patients, particularly those in sensitive groups, to receive timely assistance in making informed decisions regarding the adverse effects of the disease, including its psychological impacts (Lee et al., 2002).

This dynamic environment and the increased accessibility of information to patients have garnered unprecedented attention for the concept of patient empowerment (PE) (Delgado et al., 2020). PE entails establishing effective communication with health care professionals responsible for disseminating information and resources related to the patient’s illness. This can enhance a patient's health literacy, leading to improved feelings of control, self-management, coping capabilities, and the ability to attain better health conditions. PE has emerged as a vital paradigm in health care (Bravo et al., 2015).

Despite the role of the COVID-19 pandemic in catalyzing rapid and dynamic changes in health care, PE continues to exert a long-term influence on some of the most vulnerable populations, empowering them to gain autonomous control over their daily lives. The current pandemic has witnessed an increased demand for patients to operate with a greater degree of autonomy (Small et al., 2013). While the involvement of the patient in health care decisions has gained significant importance, it has also heightened their accountability and responsibility for the outcomes of their choices (Guadagnoli and Ward, 1998) and managing their health conditions (Mgbako et al., 2020). Similarly, efforts to mitigate health care risks have had to keep pace with unprecedented speed (Fine, 1998), compelling the adoption of PE at a rate that is faster than human comprehension. While PE was first described in 1970 by Balint (1970), it was only the more recent advancements in information technology that accelerated its application. This acceleration has also led to a divergence in understanding and the implementation of PE. These emerging conditions prompt us to pose the following fundamental research questions:

1. What are the key aspects to enable PE?
2. How can PE provide solutions to health care delivery?

To explore PE and its associated relationships and to address the second research question, we applied a soft system thinking methodology to gain insights into the conditions enabling PE and providing solutions for health care delivery. A soft systems thinking methodology was selected for this problem because systems thinking is the process of understanding how things influence one another within a broader context. Soft systems encompass those that are challenging to quantify, especially those involving people with multiple and conflicting frames of reference. Additionally, soft systems offer a versatile and holistic approach to problem-solving, particularly in complex and ill-defined situations, such as patient empowerment.

To establish a contextual framework and gain multifaceted insights into various perspectives, all in pursuit of addressing the first research question., we conduct a review of literature for the constructs of empowerment, empowerment models, and PE. Building upon this knowledge base, we employ the Boardman soft systems methodology (BSSM) in combination with a supporting contextual modeling tool called systemigram s to analyze PE, health literacy, and patient self-management in health care outcomes. Our aim is to analyze their impact on patient satisfaction and health care total cost, viewing these factors as components of a holistic system (Boardman and Sauser 2008). Finally, we present the results of this effort, along with a systemigram that addresses the first research question, and a set of propositions that address the second research question for a more systemic approach to the study of PE.

1.2 A Review of Literature on Patient Empowerment

1.2.1 The Concept of Empowerment

Historically, the idea of empowerment was rooted in the social action ideology of the 1960s and 1970s with self-help perspectives, and gender and racial injustice (Gutierrez 1990; Kubiak, Siefert, and Boyd, 2004). During this period, the focus of empowerment primarily centered on the rights and capabilities of individuals rather than fostering bi-lateral communication. Empowerment has been demonstrated to have a positive correlation with both organizations and individuals (Schulz et al., 1995). Most research shows that empowered individuals outperform their non-empowered counterparts (Bryan, 2014; Mola, 2013).

Empowered individuals have the capacity to create their job and personal resources (Thun and Bakker 2018), and experience positive emotions, such as happiness, enthusiasm, and joy (Rayan 2005). They have better health (Koberg et al., 1999; Koelen and Lindström, 2005; Wallerstein, 1992) and often transfer their power to others (Pigg, 2002).

The process of empowerment is reflected in the development of self-efficacy, confidence in one's ability to perform tasks, a sense of being able to influence the job, the freedom to choose how tasks are performed, and the meaningfulness of the job (Conger and Kanungo, 1988; Spreitzer, 1995; Thomas and Velthouse, 1990). However, empowerment is not an action that can solely be initiated by one party. Moreover, it is influenced by both capabilities (at the user end) and power (at the provider end). From a theory perspective, empowerment is ambiguous because it is simultaneously interpreted both as a process and an outcome, and it can be applied to individuals, groups, and even societies (Barnett, 1981; Powers, 2003).

1.2.2 Empowerment Model

Empowerment considers two fundamental perspectives: organizational and individual. From the organizational standpoint, which emphasizes organizational behavior, empowerment involves the development of the capacity to organize and control people and resources within the organization by delegating power and influence to others. This concept is primarily derived from democratic management theory. The individual's perspective, also referred to as psychological empowerment, focuses on the cultivation of personal feelings of confidence, individual capability, effective communication skills, and the ability to influence the nature of relationships. In contrast, organizational empowerment is concerned with the organizational structure's environment and the impact of leaders on individuals. Individual empowerment represents a reciprocal process that mirrors an individual's behaviors and feelings in response to the external world (Lee and Koh, 2001). Bridges et al. (2008) introduced a community empowerment perspective in health care, which emphasizes on general policies and social rules that can support the preceding two levels.

Heron (1990) proposed a two-level model to explain individual empowerment: Controlled empowerment and assisted empowerment based on the level of empowerment. Controlled empowerment pertains to critical control factors, with leaders assuming responsibility for related tasks. This approach entails limited openness, resulting in a relatively low level of empowerment. Assisted empowerment involves sharing and transferring power while supporting other parties in taking responsibility for themselves. However, these two levels primarily address empowerment from a provider's perspective, focusing solely on the power dynamics without taking into account the capabilities of the user. Therefore, we will explore the relationship between the provider's power and the impact of the user's additional resources and capabilities.

1.2.3 Patient Empowerment

The concept of empowerment first emerged in health care through the work of Balint (1970), who introduced the patient-centered health care model that included the principals of the 6Es: empathy, expectation, enlightenment, engagement, experience, and empowerment. This model began to gain traction in the health care sector (McAllister et al., 2012) and was first associated with patients in the United States in the early 1990s (Bravo et al., 2015). PE shifts the dynamic between patients and health care providers, transferring control from health care professionals, including doctors, pharmacists, nurses, or even family members, to the patients themselves. Empowered patients can make more timely, crucial and/or sensitive decisions regarding their health (Russo et al., 2019). However, they may or may not possess the knowledge, skills, and internal awareness required to make informed decisions. Additionally, the level of empowerment is strongly associated with the quality of the information available (Anderson and Funnell, 2010).

Additional studies have advanced our comprehension of the application of PE. O'Brien (2011) investigated the relationship between empowerment, and chronic pain management and self-management among nurses working on dialysis. Smith et al. (2010) investigated the relationship between employee empowerment and organizational commitment. Reininger et al. (2012) studied the association between perceived social support and community empowerment. Yeh et al. (2018) investigated the role of PE and patient education in enhancing patient satisfaction. Pun et al., (2019) explored the effects of using patient-developed programs, which can provide knowledge and training to empower nurses in providing support to patients. Náfrádi et al. (2017) sought to address the question of whether PE can promote adherence by investigating the relationship between self-efficacy, health locus of control, and adherence medication. Altshuler et al. (2016) examined the impact of PE on health status outcomes through a case study involving participants in Italy. Werbrouck et al. (2018) studied empowerment, specifically in case of patients with chronic somatic diseases. Nonetheless, the research highlighted the importance of knowledge as a cornerstone in achieving the maximum adequate PE level. More recently, Bogaert (2021) introduced a new conceptual framework of PE. He conducted in-depth interviews with both patients and health care providers, revealing that PE is a broader concept that encompasses not only medical treatments and interactions between patients and health care providers but also life decisions. Based on their results, PE can be defined as the patient's capacity to develop and make life decisions with the support of a network within health care, which includes health care providers, as well as outside of it, involving families, friends, and the community.

In evaluating PE, Thomas and Velthouse (1990), provided four dimensions. First, the individuals' abilities to influence others and participate in decision-making at all levels. Second, their competence, which is the sense of achievement when performing the chosen tasks reasonably and efficiently. Third, meaningfulness, which reflects the significance of tasks to individuals and can indicate their level of commitment or care. Fourth, their sense of freedom to select meaningful tasks and execute them in a manner they find suitable.

While there are numerous definitions of empowerment, a unified definition of PE remains elusive (refer to Appendix 1.1 for a summary of perspectives). According to WHO, PE is a "process through which people gain greater control over decisions and actions affecting their health" (WHO, 1998). Health empowerment is defined as a construct that links individual strengths and competencies, natural helping systems, and proactive behaviors to social policy and social change (Camerini and Schulz, 2015). Previous studies have often used PE interchangeably with other terms, such as patient participation and patient-centeredness, despite differences in their meaning. Castro et al. (2016) emphasized these distinctions, defining patient participation as the opportunity and right of the patient to be involved in influencing decisions related to their lives by leveraging their expertise alongside the professional's expertise. Patient-centeredness, on the other hand, involves a shift in the behavior of both patients and professionals, building relationships based on respect, trust, empathy, and shared knowledge. PE represents a blend of both approaches, aiming to grant patients control over decisions pertaining to their health care. A major part of the literature in PE focuses on three areas: (1) health education and empowerment to enhance health communication [Koch-Weser et al., 2010; Oh and Lee 2012; Schmidt et al., 2013; Schulz 2014]; (2) self-efficacy and health literacy as essential factors of PE [Aujoulat et al., 2008; Kärner Köhler et al., 2018; Langford, 2014]; and (3) PE as a key to promote patient adherence [Chiquete and Lavalle-González, 2016; Náfrádi, Nakamoto and Schulz, 2017; Venkataraman, 1997]. However, previous studies have not adequately explored the connection between PE, health literacy, and their potential impact on the level of self-management. Our proposal aims to establish a link between patient characteristics, such as age, type of illness, culture, and beliefs, and their receptiveness to empowerment. PE can be viewed as a complex system within health care, encompassing intricate relationships among patients, physicians, pharmacies, hospitals, health care equipment companies, and interactions with government entities (Yu et al., 2016). We utilize a systems thinking technique to gain insights into the conditions that can facilitate PE and to suggest solutions for health care delivery, with the aim to address PE from a systems thinking perspective.

1.3 Methods: Boardman Soft Systems Methodology (BSSM)

We adopt systems thinking as our approach to enhance our understanding of PE. Operationally systems thinking enables us to define how a diversity of constructs can integrate into a unified construct; understand the environment in which it operates; identify synergistic and emergent properties; and describe it from multiple, relevant perspectives (Boardman and Sauser, 2008). Systems thinking has also been articulated as a theory, method, and tool for providing a holistic view to identify problems and create potential solutions. Considering that PE remains an ill-defined construct with diverse perspectives, we believe that employing a systems thinking approach is the most suitable method for developing our construct.

In practice, the use of systems thinking to define and articulate a problem has often involved the use of diagrammatic arrangements or visual mapping (Hieronymi, 2013). Visual mapping allows for “navigation, understanding, and communicating a dynamic and changing structure" (Böner, 2010, p. ix), and the integration of knowledge through the establishment of relationships amongst concepts (Hieronymi, 2013). While various manifestations of visual mapping in systems thinking principles exist, such as causal loops (Senge, 1990), problematique diagrams (Warfield and Perino, 1999), and problem structuring methods (PSM) (Mingers and Rosenhead, 2004), we opted to utilize PSM. PSM are a class of model-based problem-solving techniques that aid in structuring the problems rather than directly determining a solution to assist groups of diverse perspectives to relieve a problematic situation. Due to the diversity of perspective on PE, PSM is a well-suited for structuring the PE construct.

Within PSM is soft systems methodology (SSM), designed to transform a problem into an opportunity in terms of both problem definition and synthesizing feasible changes that address the defined problem (Checkland, 2000). Again, we seek to define unified constructs for PE that can lead to a more defined problem of interest. In addition, SSM within action research has demonstrated the ability to reveal the emergent or developing theories (Checkland and Holwell, 1998). While SSM has proven to be an effective method for proposing solutions to systematic problems, it has limitations in terms of visual representation, as it primarily employs nodes and links to express a problem. We sought to utilize a form of SSM that permits both graphics and words to convey meaning collaboratively. This enables us to understand form, function and structure based on the graphical impressions from words (Sauser and Boardman, 2014). The Boardman soft systems methodology (BSSM) extends the capabilities of SSM by introducing systemigrams (systemic diagrams) as a visual mapping method and tool (Boardman and Sauser, 2013), which includes a defined method for addressing text as a part of the diagram. Systemigrams present a graphical technique for understanding and identifying the significant elements within a system of interest and their interrelationships. They also illustrate how stakeholders (i.e., people or organizations that have a valid interest in the system) impact or are impacted by it, facilitating the synthesis of diverse perspectives into a unified understanding. This is what Chowdhury (2020) has referred to as the advantage of using system thinking. Specifically, he describes *formulative flexibility*, which refers to planning that is based on frameworks, models, and drawings; and *substantive flexibility*, which refers to the capture of new knowledge regarding the creative and flexible use of systems principles.

Systemigrams are a combination of inputs, outputs, and flow, visualized in links between the constructs using phrases or verbs. Nodes are nouns, such as people, organizations, groups, and conditions. Systemigrams have found wide use in diverse disciplines, such as industrial and systems engineering, logistics, computer science and engineering, industrial chemistry, management science, economics, education, behavioral science, and health care (see Appendix 1.2 for systemigrams use in health care).

BSSM follows seven steps that can be viewed as an iterative process:

- Step 1: *The problem situation, unstructured*. The problem situation is captured without bias and every attempt is made to refrain from extrapolating about the nature of the situation. PE is still a term which needs further understanding in its definition, thus, the problem situation in its unstructured form is, “what is PE?”

- Step 2: *The problem situation, expressed*. A description of the situation within which the problem occurs is formulated. Through a literature review, we have developed an understanding of PE and how its problems and application are being discussed.

- Step 3: *Structured text*. Conceptualize the problem situation in the structured text. The structured text identifies the key elements with attention to systemigram modeling and analysis requirements. The literature review served as the source text for defining our systemigram requirements.

- Step 4: *Systemigram design*. Creating a systemigram model as designed from the structured text. We have created a systemigram of “what is PE?” as an interpretation of the literature. Figure 1.1 provides a complete systemigram model representing PE as our system of interest.

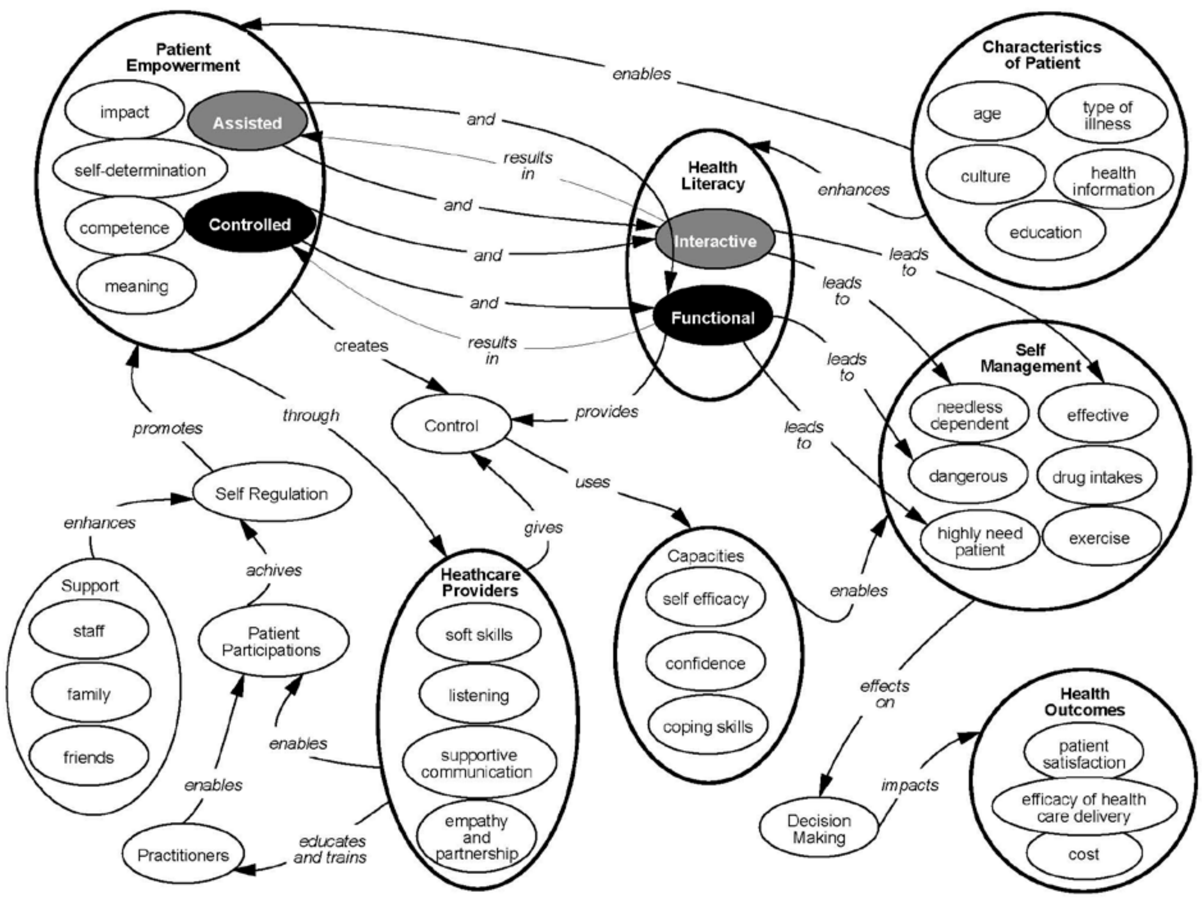


Figure 1.1: Systemigram of PE

- Steps 5: *Dramatization and dialogue*. In this step, the systemigram model is dramatized via storyboarding using scenes created from the systemigram model. This allows for a comparison and contrast between the model and reality. The differences serve as the foundation for discussion regarding how things work, might work, and the implications of these variations.

- Step 6: *Feasible, desirable changes*. The scenes were used to identify propositions by understanding the collection of perspectives and relationships between the scenes and nodes.

- Step 7: *Action to improve the problem situation*. The significance of this work lies in the creation of a systemigram that can convey a deeper meaning and relevance to our comprehension of PE. This information is instrumental in developing propositions for a systemic approach to addressing PE.

The validity of a systemigram is defined as: the people concerned, i.e., stakeholders, feel that the problem has been solved; or the problem situation has been improved; or insights have been gained. For further information on BSSM and systemigrams, please see Boardman and Sauser (2013).

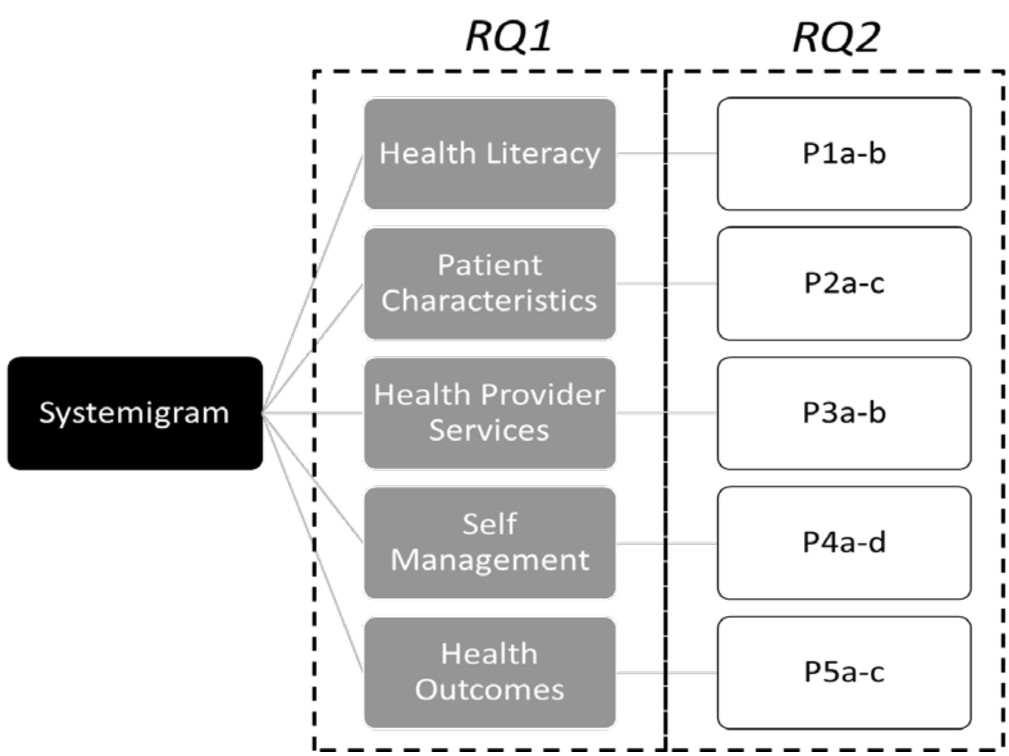


Figure 1.2: Relationship of the systemigram to research questions and propositions

As a research effort, achieving (a) was challenging, so we concentrated on a certain degree of (b) and certainly (c). This approach aligns with the principles of validation in action research, as described by Heikkinen et al. (2012). This paper, thus, represents the beginning of Steps 6 and 7 based on the development of a set of propositions resulting for each scene of the systemigram , as shown in Figure 1.2. We constructed the systemigram based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA) framework (see the protocol in Page et al., 2020), which enabled us to create a series of scenes addressing RQ1. Subsequently, these scenes served as the foundation for developing a set of propositions aimed at addressing RQ2.

1.4 Results and Proposition Development

The systemigram model in Figure 1.1 was created following the BSSM (Steps 1-4). As a result of Step 5, five scenes were created that represent key parts of PE: health literacy; characteristics of patients; health care providers; self-management; and health outcomes. The key constructs of the PE were selected through a systematic review of existing literature (Abrahams et al., 2019; Bravo et al., 2015; Chiauzzi et al., 2016).

1.4.1 Scene 1: Health Literacy

Sørensen et al. (2012) defined health literacy as "literacy entails people's knowledge, motivation, and competence to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning health care, disease prevention, and health promotion to maintain or improve quality of life during the life course" (p. 3). It is considered an essential theoretical concept and a key to enabling empowerment actions that enhance health outcomes (Beauchamp et al., 2015). Chen et al. (2014) examined the relationship between health literacy, self-care, and patient knowledge in heart failure. They found that health literacy influences patients' knowledge or health education. However, health literacy has no direct influence on self-care. Bonaccorsi and Modesti (2017) emphasized the significance of health literacy in conjunction with health education. They noted that patients with high health literacy are more likely to enhance their quality of life and reduce the risks associated with the consequences of their illness.

Patients can be classified into two levels of health literacy, functional literacy and interactive literacy (Van der Heide et al., 2015). Functional literacy emphasizes the essential skills required to comprehend health information, such as using reading and math knowledge for understanding. Interactive literacy is the cognitive skill necessary to fully comprehend new information based on daily circumstances (Nutbeam, 2000), e.g. collecting health information from resources, such as health care providers, self-or other patients' experiences, and published articles.

Ishikawa and Yano (2008) investigated the role of health literacy in PE and demonstrated that it has a relationship with the health care process (e.g., knowledge and self-management). Finbråten et al. (2018) developed a scale to measure interactive health literacy aiming to understand health care information beyond functional ability (Finbråten et al., 2020). Although their study focused on Type II diabetes, Finbråten et al. (2018) demonstrated a connection between health literacy and PE, which they highlighted through the four cognitive dimensions of interactive health literacy: *access, understand, appraise, and apply*. However, the study did not differentiate between the influence of interactive health literacy on the level of PE, such as controlled PE, and assisted PE but focused only on PE. Controlled PE are patients who are willing to let others, or a technological system control their health. In contrast, assisted PE is the ability of a patient to gain control over their own health decisions, which is possible by interactively discussing health care decisions with health care providers or using interactive health information systems that allow for interaction with health care providers. In our study, we have differentiated between controlled and assisted PE.

In an article by the military health system (Leiba et al. 2002) (Military health system, 2020), health literacy is highlighted as a means of empowering patients to actively participate in their care.. The article categorized patients into two dyads: 1) those with high empowered meaning they have all the information and understand it correctly, and 2) those with low empowerment capacity, indicating that they have all the information but do not understand it correctly. In the former, patients still possess a certain level of empowerment, which may have a positive impact on them, while in the latter, the level of empowerment has a negative effect (Military Health System, 2020). Camerini and Schulz (2015) argued that the interaction between health literacy and PE change dynamically based on the level of each. They found no significant correlation between PE and health literacy. While they suggested treating them independently, they also recommended further research to fully understand their relationship. Figure 1.3 provides a graphic representation of the earlier-mentioned relationship between patient types and their association with empowerment. The level of PE is often determined on the patients' health literacy level. Patients with minimal functional health literacy are more likely to exhibit the lowest level of controlled PE, often necessitating assistance from professionals to make decisions on their behalf. Similarly, when patients are more inclined to seek knowledge and information related to their illness, their level of PE tends to increase to reach assisted PE, enabling them to make decisions regarding their health. Thus, we propose the following:

P1a: Patients' adoption of interactive health literacy and education results in increased assisted PE.

P1b: Patients' adoption of functional health literacy and education results in increased controlled PE.

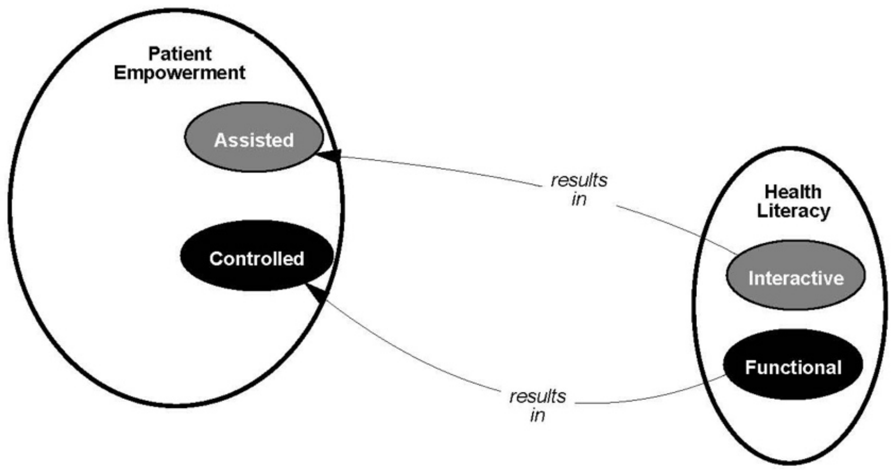


Figure 1.3: Scene 1/health literacy – Proposition 1

1.4.2 Scene 2: Characteristics of Patients

Arnold et al., (1995) expressed concern that the majority of studies on PE tend to overlook patient characteristics from multiple dimensions, including spiritual, cognitive, emotional, and social aspects. These aspects can significantly influence the level of PE, in addition to factors, such as level of patient education, patient-provider relationship, and level of patient health literacy. Patients' personal characteristics, such as culture, type of illness, and age have been correlated with their willingness to be empowered and directly linked with their level of health literacy (Shaw et al., 2009).

- *Culture*: The power of religion and faith plays an essential role in their willingness to be empowered. Patients with strong faith in God and religion may perceive doctors as holy individuals and view disease as God's will. Consequently, they may consider God ultimately responsible for caring for their bodies (Koenig, Larson, and Larson 2001). In contrast, some cultures believe that that only a physician can make decisions on their behalf. Nevertheless, culture is an important yet an understudied factor that influences the level of PE (Jiang and Street 2019; Moons et al., 2020).

- *Type of illness*: Serious illnesses, like cancer and heart failure, often lead patients to rely more on decisions made by health care practitioners rather than seeking empowerment. The type of illness and the interaction with professionals are critical to making the right decisions. On the other hand, when patients experience chronic disease, such as diabetes or hypertension, they are more willing to be empowered and participate in decision-making (Garattini and Padula 2018). However, these prior studies have focused on chronic diseases, specifically related to types of diabetes (Chen et al., 2011; Finbråten et al., 2020; Funnell et al., 2005). Very few studies have aimed to connect the impact of different types of illnesses to PE (Lin et al., 2020).

- *Age*: Faulkner (2001) found that older patients tend to have a lower willingness to engage in decision-making. Due to an increasing level of health risk associated with their age, they often exhibit less willingness to be empowered. Wai et al. (2020) demonstrated that while the combination of PE and cognitive training did not influence glycosylated patients aged over 65 years in the short term, it had a positive impact on cognitive functions from a long-term self-management perspective. However, younger patients are capable of actively communicating with health care providers through the use of smartphones (Acuna Mora et al., 2020). Markwart et al. (2020) also demonstrated that patient's age influences the level of PE through patient education programs. In contrast Abrahams et al., (2019) argued that younger adult patients are more dependent on their families, as a result they may have less ability to take control over decisions related to their illness.

Figure 1.4 represents Scene 2, which illustrates the relationship between patient characteristics and PE. Patient characteristics have a direct influence on the willingness of patient to be empowered. Thus, we propose the following:

P2a: Patient's culture impacts the level of PE.

P2b: Patient's type of illness impacts the level of PE.

P2c: Patient's age has a significant impact on the level of PE.

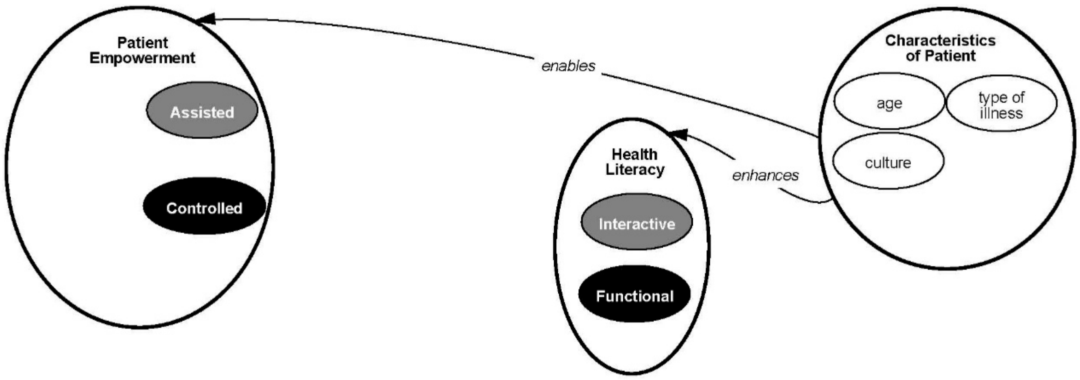


Figure 1.4: Scene 2/Characteristics of Patient - Proposition 2

1.4.3 Scene 3: Health Care Providers Services

A health care provider is a person or company that provides a health care service, which typically includes hospitals, clinics, doctors, practitioners, therapists, laboratories, and pharmacies (Sprangers and Aaronson, 1992). Patients might seek distinct services from each medical care provider to help them recover from their injury or illness. Health care providers can help increase patient participation by incorporating new technologies into their workstations and maintaining open lines of communication with them (Dexter et al., 2010; Ippolito, Smaldone, and Ruberto 2020; Maly et al., 2008). As part of this effort, a key consideration is that the information systems that effectively support the request or demands of the patient must take on more responsibility (Dexter et al., 2010). People face more complex decisions in an environment where an "overload" of information exists, only some of which may be perceived as useful, relevant, and understandable. Navigating health care is challenging even for patients with interactive health literacy. A health care system provider can be profoundly disempowering by encouraging passivity and discouraging patients' active participation. In order to facilitate the increasing level of patient participation, McCorkle et al. (2011) proposed the following actions: training practitioners to engage with patients, empowering patients to self-regulate, encouraging them to take responsibility for their decisions, and providing the necessary information to support patient self-management. Self-regulation in this context refers to a patient's awareness of threats, symptoms, management procedures, and action plans for dealing with an illness (Angwenyi et al., 2019; Ippolito et al., 2020; Leventhal et al., 2016).

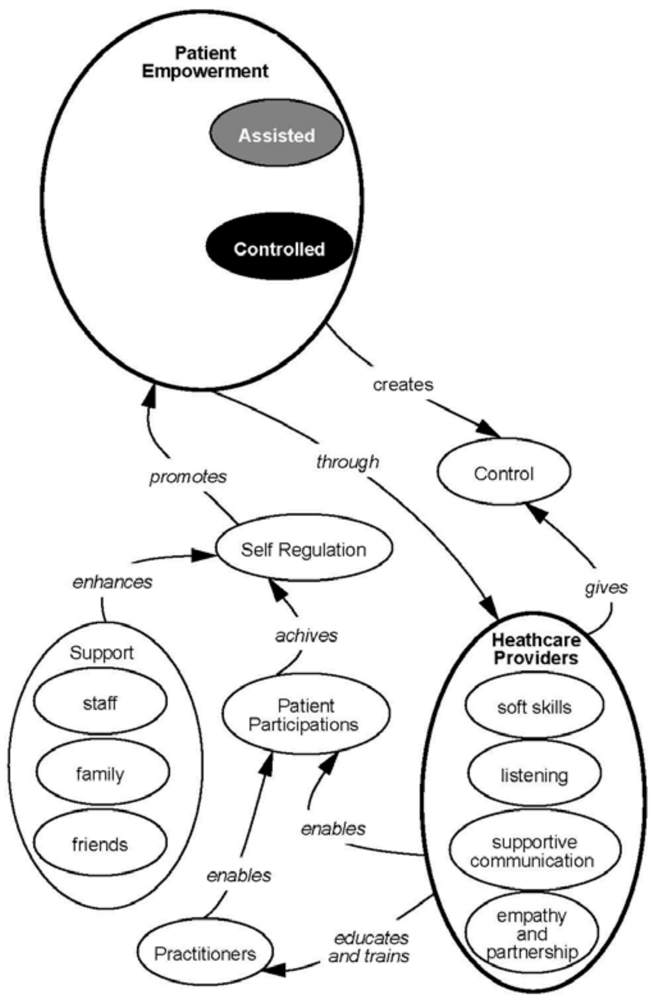


Figure 1.5: Scene 3/Health care providers - Proposition 3.

The study revealed that half of the patients exhibit a more directive/informative approach (controlled patients), relying on health care providers to make decisions regarding their illness, which results in controlled PE. Figure 1.5 illustrates the relationship between health care providers and PE levels, emphasizing that the quality and accuracy of the information shared can impact the level of PE. If health care providers i) are more willing to share patients' health information and make sure they understand it; ii) provide internet-based information and materials; and iii) maintain communication and follow-up with their patients, they are more likely to contribute to an assisted PE. Thus, we propose the following:

P3a: Higher levels of information shared by health care providers leads to more assisted PE.

P3b: Lower levels of information shared by health care providers leads to more controlled PE.

1.4.4 Scene 4: Self-Management

The goal of PE is to enable patients to gain control or self-manage themselves. Self-management is an activity undertaken by an empowered patient that results in informed decisions related to their illness and understanding their role in managing their illness (Barrie, 2011; McCorkle et al., 2011). A review by Wang et al. (2017) highlighted the positive impact of empowered patients on reducing emotional distress and improving self-management. These patients exhibited a high level of health literacy (interactive) having learned about their diseases through interviews with health care providers, consulting groups, group education, telephone coaching, computer-based training, or web-based online resources This empowered them to make more responsible and effective decisions. On the contrary, low health literacy (functional) patients were less likely to gain control of their illness, leading to a lack of control over their illness and negative emotional representation affecting their decisions.

Taggart et al., (2012) demonstrated that improved patient health literacy is associated with a reduced risk related to their illness and enhanced self-management capabilities. Eyüboğlu and Schulz (2016) found that while health literacy had no direct impact on self-management, PE did influence self-management. More recently, Angwenyi et al., (2019) argued that PE aided by effective patient-provider contact, and adequate education and health literacy, positively influences the outcomes of patient self-management. Abrahams et al. (2019) highlighted the importance of promoting PE in conjunction with supporting patient self-management to improve health care outcomes.

Clark et al. (1991) conducted a review of 70 studies and found 12 skills that could maximize patient self-management levels. They found that health literacy is a central strategy for improving patient self-management. Patients with high skills and knowledge are more likely to engage in and promote informed decision-making, as well as enhance their ability to gain control over factors that contribute to improved health outcomes. Náfrádi et al. (2018) found that self-management could be categorized into four different levels based on PE and health literacy.

As seen in our Scene 4 on self-management (Fig. 1.6), high needs patients (those with low skills, knowledge, and education) exhibit a low level of empowerment (as indicated by controlled PE). For instance, if a patient lacks knowledge of their illness, health care providers are more unwilling to share information, or they have limited access to the illness information. Thus, they are more likely in need of assistance from professionals, practitioners, health care providers for decisions related to their health status. Dangerous self-management refers to the second type of patients who possess limited health literacy (basic skills and education) and have control over making decisions that carry a higher potential for harmful health outcomes. This is because their decisions are often based on information that they do not fully comprehend.

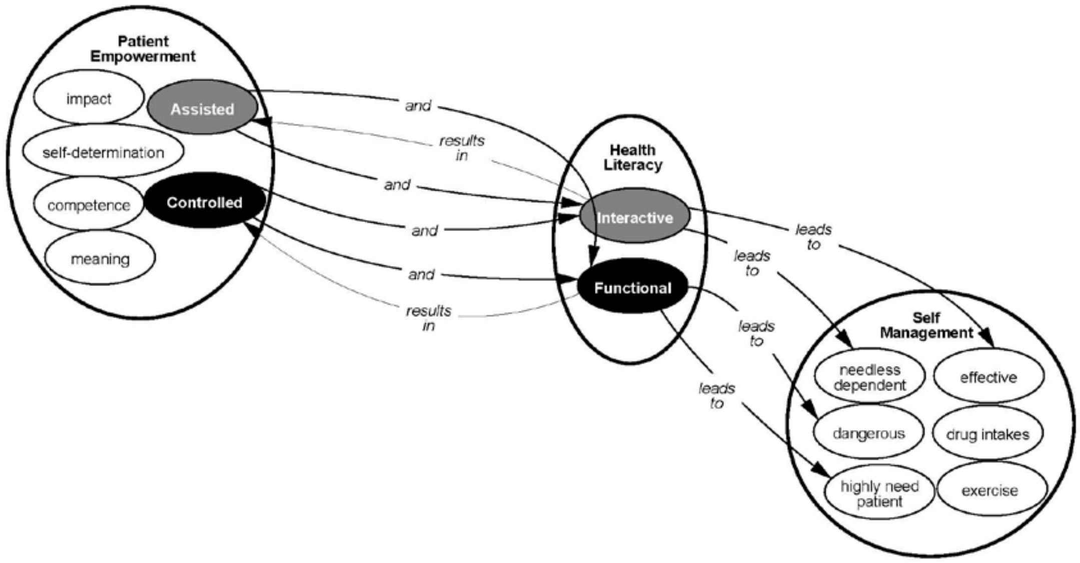


Figure 1.6: Scene 4/Self management - Proposition 4.

Needlessly self-managed refers to the third type of patients who possess skills and knowledge (health literacy). However, the health system does not provide them with the opportunity to actively engage and take control or share control over their health care decisions. These patients remain dependent on the practitioners but often express dissatisfaction with their level of involvement in their health care decisions. Finally, patients with a high level of both empowerment and health literacy are expected to achieve positive outcomes because they possess knowledge and a deep understanding of their illness. They are likely to engage in discussions about their illness with their health care providers and seek information tailored to their specific situation. Consequently, they are more likely to make informed decisions that can impact their illness recovery positively. Additionally, they are more likely to experience a higher level of satisfaction with their ability to control their illness. This type of self-management is known as *effective self- management.* Thus, we propose the following:

P4a: Interactive health literacy and assisted PE lead to effective self-management.

P4b: Interactive patient health literacy and controlled PE lead to needless dependent self-management.

P4c: Functional health literacy and assisted empowerment lead to dangerous self-management.

P4d: Functional health literacy and controlled PE lead to highly needed patient self-management.

1.4.5 Scene 5: Health Outcomes

According to Náfrádi et al. (2018), PE and health literacy predict health outcomes. Health care has several goals that include improving patient satisfaction and reducing health care costs (Stokes, 2011). Based on the evidence in previous studies, PE should lead to improved health outcomes (Náfrádi et al., 2018; Palumbo 2017; Wong et al., 2014; Adinolfi, et al., 2016). Health care has several goals which include improving patient satisfaction and reducing health care costs (Mora et al., 2018; Yeh, Wu, and Tung 2017). Based on the evidence from prior studies, PE should lead to improved health outcomes (Adinolfi, Starace, and Palumbo 2016; Lian et al., 2019; Nafradi et al., 2018; Palumbo 2017; Wong et al., 2014). However, empowerment alone is insufficient to make effective decisions if it is not linked with patients' health literacy, capabilities, ability to self-manage, support strategies from health care providers, and their willingness to be empowered. Chou (2019) found that improving self-care can improve the quality of life from a patient's perspective. Smalley et al. (2021) investigated the impact of patient-self management on their health care outcomes. The study found a non-significant relationship between self-management programs and health care outcomes. On other hand, Langford (2014) emphasized the importance of self-management in order to advance and improve health outcomes. However, previous studies have failed to distinguish between the levels of self-management that vary across patients, which could contribute to differences in perspectives on this subject. Our study proposes the inclusion of different self-management patient categories (effective, dependent, dangerous, and highly need self-management).

Additionally, we argue that these categories have a varied impact on health care outcomes. For example, effective self-management can lead to increased patient satisfaction (Carlin et al., 2012). Moreover, patient self-management can impact patient health behaviors and satisfaction levels. The effectiveness is often increased when patients have empowerment, along with high health literacy, which can impact their decision-making regarding their illness. Figure 7 represents Scene 5, which shows that the level of self-management can influence decision-making regarding health care outcomes including patient satisfaction and total cost. Thus, we propose the following:

P5a: The level of self-management can impact the decisions related to health care outcomes.

P5b: The level of self-management can impact the decisions related to patient satisfaction.

P5c: The level of self-management can impact the decisions related to total cost of health care.

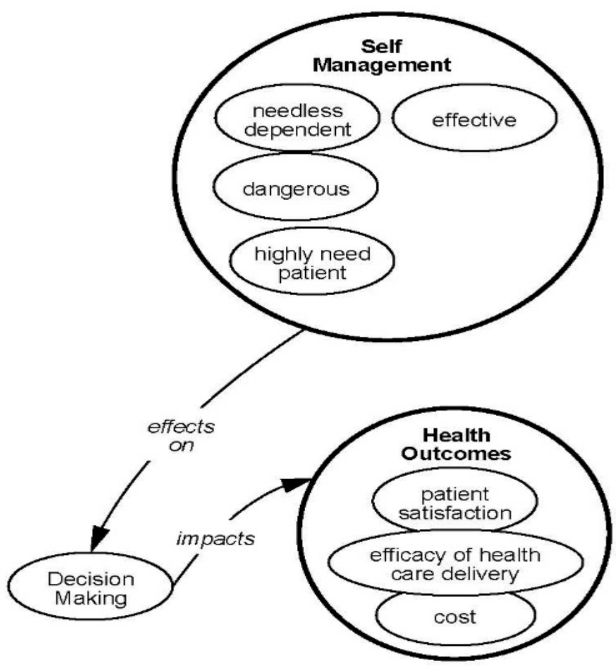


Figure 1.7: Scene 5/Health Outcomes – Proposition 5

1.5 Summary

1.5.1 Future Research

Future research should prioritize the measurement, categorization, and practical implementation of PE. Additionally, it should consider the patients' perspective, considering all factors that might influence their level of empowerment. Moreover, researchers should explore strategies for expanding patients' capacity to maximize their self-management skills, ultimately leading to improved health outcomes. While health literacy has been a common focus in extant studies, its definition and measurement remain somewhat ambiguous. Therefore, further research is essential to develop effective methods for categorizing and measuring patient health literacy. Additionally, future research should aim to identify and understand the distinctions between various levels of health literacy, as these differences can significantly impact both PE and self-management. External resources that facilitate PE play a crucial role in the ongoing evolution of health care systems. Future researchers should direct their efforts towards exploring new digital resources and innovative solutions that have the potential to add substantial value to the health care landscape.

1.5.2 Limitations

It is acknowledged that our approach may not have encompassed all possible conceptualizations of empowerment found in existing literature. However, it is also recognized that incorporating all these conceptualizations into a single study is a challenging task. Additionally, it should be noted that the findings of this study have not undergone external review, which is a standard step in action research processes

While it is acknowledged that the absence of external review is a limitation, it's important to note that the primary purpose of this study was to conduct a structured analysis of the existing body of knowledge on PE and formulate a set of propositions for further investigation. This approach is not without precedent, as described by Heikkinen et al, (2007), where good action research can incorporate elements of acknowledging past literature, reflexivity (e.g., systemigram from PRISMA), and elaboration (e.g., systemigram scenes from PRISMA), ultimately resulting in the development of practical propositions (e.g., propositions from systemigram scenes).

1.5.3 Conclusion

The health care sector is a dynamic environment, and there has been significant emphasis on improving the sector, particularly with the rapid advancements in information technology. This study delved into various aspects, including the definition and significance of PE, the factors influencing patient participation in health care decisions, and the potential benefits that can contribute to enhanced patient health outcomes. PE is indeed a complex and non-discrete system, as highlighted by Ippolito et al. (2020). In our study, we employed a systemigram to approach PE as a systemic issue with intricate and dynamic interactions. This approach enabled us to organize and elucidate the abstract constructs inherent in the PE system. Furthermore, the use of the BSSM allowed us to establish connections between theory and practical applications, and demonstrate how health care management can provide a deeper understanding of PE, facilitating more effective strategies for its dynamic role in improving patient health.

The discussions presented here are just the beginning, and further research is needed to validate the proposed PE systemigram . This can be achieved by integrating a theoretically sound and dynamic framework that shifts the traditional focus towards the co-creation of value.

Our research demonstrates that PE is not an isolated construct but rather interconnected with various resources, including patient characteristics, health literacy, patient self-management, and support from health care providers. The integration of these resources with PE can lead to the achievement of desired outcomes, benefiting both patients and the health care sector.

Our study also demonstrates how a more comprehensive understanding of PE in conjunction with other constructs can lead to the discovery of new ideas and propositions. Presently, PE is recognized as a legal right of patients and considered an international gold standard for health care systems. Patients must be empowered and actively participate in decisions related to the planning, execution, and evaluation of their health care services.

1.6 References

Abrahams, N., L. Gilson, N.S. Levitt, and J.A. Dave. 2019. "Factors That Influence Patient Empowerment in Inpatient Chronic Care: Early Thoughts on a Diabetes Care Intervention in South Africa." BMC Endocrine Disorders 19 (1). https://doi.org/10.1186/s12902-019-0465-1.

Acuna Mora, Mariela, Carina Sparud-Lundin, Ewa-Lena Bratt, and Philip Moons. 2020. "Empowering Young Persons During the Transition to Adulthood." In , 19–46. https://doi.org/10.1007/978-3-030-23384-6_2.

Adinolfi, P., F. Starace, and R. Palumbo. 2016. "Health Outcomes and Patient Empowerment: The Case of Health Budgets in Italy." Journal of Health Management 18 (1): 117–33. https://doi.org/10.1177/0972063415625524.

Allegro, Brigitte DANIEL, and Gary Robert Smith. n.d. "Mind Mapping Systems Thinker's Attitudes Facing a Sepsis Problem," 21.

Altshuler, Lisa, Joseph Plaksin, Sondra Zabar, Andrew Wallach, Chester Sawicki, Sarita Kundrod, and Adina Kalet. 2016. "Transforming the Patient Role to Achieve Better Outcomes Through a Patient Empowerment Program: A Randomized Wait-List Control Trial Protocol." JMIR Research Protocols 5 (April): e68. https://doi.org/10.2196/resprot.5376.

Anderson, Robert M., and Martha M. Funnell. 2010. "Patient Empowerment: Myths and Misconceptions." Patient Education and Counseling 79 (3): 277–82. https://doi.org/10.1016/j.pec.2009.07.025.

Angwenyi, V, C Aantjes, J Bunders-Aelen, JV Lazarus, and B Criel. 2019. "Patient-Provider Perspectives on Self-Management Support and Patient Empowerment in Chronic Care: A

Mixed-Methods Study in a Rural Sub-Saharan Setting." Journal of Advanced Nursing 75 (11): 2980–94. https://doi.org/10.1111/jan.14116.

Arnold, M.S., M.M. Funnell, P.M. Butler, R.M. Anderson, and C. Feste. 1995. "Guidelines for Facilitating a Patient Empowerment Program." The Diabetes Educator 21 (4): 308–12. https://doi.org/10.1177/014572179502100408.

Aujoulat, Isabelle, William d'Hoore, and Alain Deccache. 2007. "Patient Empowerment in Theory and Practice: Polysemy or Cacophony?" Patient Education and Counseling 66 (1): 13–20. https://doi.org/10.1016/j.pec.2006.09.008.

Aujoulat, Isabelle, Renzo Marcolongo, Leopoldo Bonadiman, and Alain Deccache. 2008. "Reconsidering Patient Empowerment in Chronic Illness: A Critique of Models of Self-Efficacy and Bodily Control." Social Science & Medicine 66 (5): 1228–39. https://doi.org/10.1016/j.socscimed.2007.11.034.

Balint, Michael. 1970. "Repeat Prescription Patients: Are They an Identifiable Group?" Psychiatry in Medicine 1 (1): 3–14. https://doi.org/10.2190/KAKM-BVK0-WGY0-D5PQ.

Barnett, Ellen Harrison. 1981. "The Development of Personal Power for Women: An Exploration of the Process of Empowerment." ProQuest Dissertations and Theses. Educat.D., Ann Arbor: Boston University School of Education. 303214658. ProQuest Dissertations & Theses Global. https://libproxy.library.unt.edu/login?url=https://www.proquest.com/dissertations-theses/development-personal-power-women-exploration/docview/303214658/se-2?accountid=7113.

Barrie, J. 2011. "Patient Empowerment and Choice in Chronic Pain Management." Nursing Standard (Royal College of Nursing (Great Britain) : 1987) 25 (31): 38–41. https://doi.org/10.7748/ns.25.31.38.s52.

Beauchamp, Alison, Rachelle Buchbinder, Sarity Dodson, Roy W. Batterham, Gerald R. Elsworth, Crystal McPhee, Louise Sparkes, Melanie Hawkins, and Richard H. Osborne. 2015. "Distribution of Health Literacy Strengths and Weaknesses across Socio-Demographic Groups: A Cross-Sectional Survey Using the Health Literacy Questionnaire (HLQ)." BMC Public Health 15 (1): 678. https://doi.org/10.1186/s12889-015-2056-z.

Boardman, J., and B. Sauser. 2008. "Systems Thinking: Coping with 21st Century Problems."

Boardman, John, and Brian Sauser. 2013. Systemic Thinking: Building Maps for Worlds of Systems. John Wiley & Sons.

Bogaert, B. 2021. "L'application Du Concept d'injustice Épistémique Dans Le Soin : Conceptualisation, Limites, et Perspectives." Éthique & Santé 18 (2): 127–33. https://doi.org/10.1016/j.etiqe.2021.03.007.

Bonaccorsi, G., and P.A. Modesti. 2017. “Health Literacy, a New Perspective for Patient Empowerment in the Public Health Approach to Hypertension.” Internal and Emergency Medicine 12 (6): 737–39. https://doi.org/10.1007/s11739-017-1657-1.

Bravo, Paulina, Adrian Edwards, Paul James Barr, Isabelle Scholl, Glyn Elwyn, Marion McAllister, and Cardiff University the Cochrane Health Care Quality Research Group. 2015. “Conceptualising Patient Empowerment: A Mixed Methods Study.” BMC Health Services Research 15 (1): 252. https://doi.org/10.1186/s12913-015-0907-z.

Bridges, John FP, Svetla Loukanova, and P. Carrera. 2008. “Patient Empowerment in Health Care.”

Bryan, Mechelle. 2014. “The Significance of Empowerment in the Field of Health and Human Services.” Journal of Human Services 34 (1): 111–16.

Camerini, Anne-Linda, and Peter J. Schulz. 2015. “Health Literacy and Patient Empowerment: Separating Con-Joined Twins in the Context of Chronic Low Back Pain.” Edited by Alessandro Antonietti. PLOS ONE 10 (2): e0118032. https://doi.org/10.1371/journal.pone.0118032.

Castro, Eva Marie, Tine Van Regenmortel, Kris Vanhaecht, Walter Sermeus, and Ann Van Hecke. 2016. “Patient Empowerment, Patient Participation and Patient-Centeredness in Hospital Care: A Concept Analysis Based on a Literature Review.” Patient Education and Counseling 99 (12): 1923–39. https://doi.org/10.1016/j.pec.2016.07.026.

Checkland, Peter. 2000. “Soft Systems Methodology: A Thirty Year Retrospective.” Syst. Res., 48.

Checkland, Peter, and Sue Holwell. 1998. “Action Research: Its Nature and Validity.” Systemic Practice and Action Research 11 (1): 9–21. https://doi.org/10.1023/A:1022908820784.

Chen, Aleda M.H., Karen S. Yehle, Nancy M. Albert, Kenneth F. Ferraro, Holly L. Mason, Matthew M. Murawski, and Kimberly S. Plake. 2014. “Relationships between Health Literacy and Heart Failure Knowledge, Self-Efficacy, and Self-Care Adherence.” Research in Social and Administrative Pharmacy 10 (2): 378–86. https://doi.org/10.1016/j.sapharm.2013.07.001.

Chen, Mei-Fang, Ruey-Hsia Wang, Chung-Ping Cheng, Chi-Chun Chin, Joel Stocker, Shan-Mei Tang, and Shu-Wen Chen. 2011. “Diabetes Empowerment Process Scale: Development and Psychometric Testing of the Chinese Version: Chinese Diabetes Empowerment Process Scale.” Journal of Advanced Nursing 67 (1): 204–14. https://doi.org/10.1111/j.1365-2648.2010.05486.x.

Chiauzzi, Emil, Pronabesh DasMahapatra, Elisenda Cochin, Mikele Bunce, Raya Khoury, and Purav Dave. 2016. “Factors in Patient Empowerment: A Survey of an Online Patient Research Network.” The Patient - Patient-Centered Outcomes Research 9 (6): 511–23. https://doi.org/10.1007/s40271-016-0171-2.

Chiquete, Erwin, and Fernando Lavalle-González. 2016. “Patients' Empowerment , Physicians' Perceptions, and Achievement of Therapeutic Goals in Patients with Type 1 and Type 2 Diabetes Mellitus in Mexico.” Patient Preference and Adherence Volume 10 (July): 1349–57. https://doi.org/10.2147/PPA.S107437.

Chou, Fang-Yu. 2019. “Cancer Illness Perception and Self-Management of Chinese Patients.” Asia-Pacific Journal of Oncology Nursing 6 (1): 57–63. https://doi.org/10.4103/apjon.apjon_56_18.

Clark, Matthew M., David B. Abrams, Raymond S. Niaura, Cheryl A. Eaton, and Joseph S. Rossi. 1991. “Self-Efficacy in Weight Management.” Journal of Consulting and Clinical Psychology 59 (5): 739–44. https://doi.org/10.1037/0022-006X.59.5.739.

Conger, Jay A., and Rabindra N. Kanungo. 1988. “The Empowerment Process: Integrating Theory and Practice.” Academy of Management Review 13 (3): 471–82. https://doi.org/10.5465/amr.1988.4306983.

Cristancho, Sayra, Susan Bidinosti, Lorelei Lingard, Richard Novick, Michael Ott, and Tom Forbes. 2015. “Seeing in Different Ways: Introducing ‘Rich Pictures’in the Study of Expert Judgment.” Qualitative Health Research 25 (5): 713–25. https://doi.org/10.1177/1049732314553594.

Delgado, Gustavo V., Rodrigo B. Carvalho, Chun W. Choo, Ramon S. Leite, and José M. Castro. 2020. “Patient Empowerment through Mobile Health: Case Study with a Brazilian Application for Pregnancy Support.” Proceedings of the Association for Information Science and Technology 57 (1). https://doi.org/10.1002/pra2.221.

Dexter, Paul R, Douglas K Miller, Daniel O Clark, Michael Weiner, Lisa E Harris, Lee Livin, Isaac Myers, et al. 2010. “Preparing for an Aging Population and Improving Chronic Disease Management.” AMIA ... Annual Symposium Proceedings. AMIA Symposium 2010 (November): 162–66.

Engelseth, Per, B. E. White, Ingunn Mundal, Trude Fløystad Eines, and Duangpun Kritchanchai. 2020. “Systems Modelling to Support the Complex Nature of Health Care Services.” Health and Technology, December. https://doi.org/10.1007/s12553-020-00504-8.

Eyüboılu, E., and P.J. Schulz. 2016. “Do Health Literacy and Patient Empowerment Affect Self-Care Behaviour? A Survey Study among Turkish Patients with Diabetes.” BMJ Open 6 (3). https://doi.org/10.1136/bmjopen-2015-010186.

Faulkner, M. 2001. “Empowerment, Disempowerment and the Care of Older People.” Nursing Older People 13 (5): 18–20. https://doi.org/10.7748/nop2001.07.13.5.18.c2183.

Feste, Catherine, and Robert M. Anderson. 1995. “Empowerment: From Philosophy to Practice.” Proceedings of the Patient Education 2000 Congress 26 (1): 139–44. https://doi.org/10.1016/0738-3991(95)00730-N.

Finbråten, Hanne Søberg, Øystein Guttersrud, Gun Nordström, Kjell Sverre Pettersen, Anne Trollvik, and Bodil Wilde-Larsson. 2020. “Explaining Variance in Health Literacy among People with Type 2 Diabetes: The Association between Health Literacy and Health Behaviour and Empowerment.” BMC Public Health 20 (1): 161. https://doi.org/10.1186/s12889-020-8274-z.

Finbråten, Hanne Søberg, Bodil Wilde-Larsson, Gun Nordström, Kjell Sverre Pettersen, Anne Trollvik, and Øystein Guttersrud. 2018. “Establishing the HLS-Q12 Short Version of the European Health Literacy Survey Questionnaire: Latent Trait Analyses Applying Rasch Modelling and Confirmatory Factor Analysis.” BMC Health Services Research 18 (1): 506. https://doi.org/10.1186/s12913-018-3275-7.

Fine, CH. 1998. Clockspeed: Winning Industry Control in the Age of Temporary Advantage. Basic Books: New York.

Funnell, Martha M., Robin Nwankwo, Mary Lou Gillard, Robert M. Anderson, and Tricia S. Tang. 2005. “Implementing an Empowerment-Based Diabetes Self-Management Education Program.” The Diabetes Educator 31 (1): 53–61. https://doi.org/10.1177/0145721704273166.

Garattini, Livio, and Anna Padula. 2018. “Patient Empowerment in Europe: Is No Further Research Needed?” The European Journal of Health Economics 19 (5): 637–40. https://doi.org/10.1007/s10198-018-0965-3.

Guadagnoli, Edward, and Patricia Ward. 1998. “Patient Participation in Decision-Making.” Social Science & Medicine 47 (3): 329–39. https://doi.org/10.1016/S0277-9536(98)00059-8.

Gutierrez, Lorraine. 1990. “Working with Women of Color: An Empowerment Perspective.” Social Work 35 (March): 149–53. https://doi.org/10.1093/sw/35.2.149.

Hannu L. T. Heikkinen , Rauno Huttunen & Leena Syrjälä (2007) “Action research as narrative: five principles for validation.” Educational Action Research 15 (1): 5-19, https://doi.org/10.1080/09650790601150709

Heide, Iris van der, Monique Heijmans, A. Jantine Schuit, Ellen Uiters, and Jany Rademakers. 2015. “Functional, Interactive and Critical Health Literacy: Varying Relationships with Control over Care and Number of GP Visits.” Patient Education and Counseling 98 (8): 998–1004. https://doi.org/10.1016/j.pec.2015.04.006.

Heikkinen, Hannu L.T., Rauno Huttunen, Leena Syrjälä, and Jyri Pesonen. 2012. “Action Research and Narrative Inquiry: Five Principles for Validation Revisited.” Educational Action Research 20 (1): 5–21. https://doi.org/10.1080/09650792.2012.647635.

Heron, J. 1990. “Helping the Client: A Creative Practical Guide.” In .

Ippolito, A., F. Smaldone, and M. Ruberto. 2020. “Exploring Patient Empowerment: The Link between Satisfying Physician Relationship and Patient Involvement.” TQM Journal 32 (1): 92–109. https://doi.org/10.1108/TQM-04-2019-0096.

Ishikawa, Hirono, and Eiji Yano. 2008. “Patient Health Literacy and Participation in the Health-Care Process.” Health Expectations 11 (2): 113–22. https://doi.org/10.1111/j.1369-7625.2008.00497.x.

Jiang, SH, and RL Street. 2019. “The Effects of Patient-Centered Communication, Social Capital, and Internet Use on Patient Empowerment: A Cross-Sectional Study in China.” GLOBAL HEALTH PROMOTION 26 (4): 33–43. https://doi.org/10.1177/1757975917749197.

Johnson, Julian, Gary Smith, Fran Beck, and Alan Harding. 2018. “A Successful Use of Systems Approaches in Cross-Disciplinary Health Care Improvement.” INCOSE International Symposium 28 (1): 881–95. https://doi.org/10.1002/j.2334-5837.2018.00522.x.

Kärner Köhler, Anita, Pia Tingström, Tiny Jaarsma, and Staffan Nilsson. 2018. “Patient Empowerment and General Self-Efficacy in Patients with Coronary Heart Disease: A Cross-Sectional Study.” BMC Family Practice 19 (1): 76. https://doi.org/10.1186/s12875-018-0749-y.

Koberg, Christine S., R. Wayne Boss, Jason C. Senjem, and Eric A. Goodman. 1999. “Antecedents and Outcomes of Empowerment: Empirical Evidence from the Health Care Industry.” Group & Organization Management 24 (1): 71–91. https://doi.org/10.1177/1059601199241005.

Koch-Weser, Susan, Rima E. Rudd, and William DeJong. 2010. “Quantifying Word Use to Study Health Literacy in Doctor–Patient Communication.” Journal of Health Communication 15 (6): 590–602. https://doi.org/10.1080/10810730.2010.499592.

Koelen, M A, and B Lindström. 2005. “Making Healthy Choices Easy Choices: The Role of Empowerment.” European Journal of Clinical Nutrition 59 (S1): S10–16. https://doi.org/10.1038/sj.ejcn.1602168.

Koenig, Harold G, David B Larson, and Susan S Larson. 2001. “Religion and Coping with Serious Medical Illness.” Annals of Pharmacotherapy 35 (3): 352–59. https://doi.org/10.1345/aph.10215.

Kubiak, Sheryl Pimlott, Kristine Siefert, and Carol J. Boyd. 2004. “Empowerment and Public Policy: An Exploration of the Implications of Section 115 of the Personal Responsibility and Work Opportunity Act.” Journal of Community Psychology 32 (2): 127–43. https://doi.org/10.1002/jcop.10088.

Kumar, Anant, and K. Rajasekharan Nayar. 2020. “COVID 19 and Its Mental Health Consequences.” Journal of Mental Health, April, 1–2. https://doi.org/10.1080/09638237.2020.1757052.

Lafontaine, Alika T., and Christopher J. Lafontaine. 2019. “A Retrospective on Reconciliation by Design.” Health Care Management Forum 32 (1): 15–19. https://doi.org/10.1177/0840470418794702.

Langford, Gemma. 2014. “Promoting Patient Empowerment and Self-Efficacy to Achieve Successful Non-Surgical Periodontal Outcomes.” Primary Dental Journal 3 (3): 34–37. https://doi.org/10.1308/205016814812736691.

Lee, Mushin, and Joon Koh. 2001. “Is Empowerment Really a New Concept?” The International Journal of Human Resource Management 12 (4): 684–95. https://doi.org/10.1080/713769649.

Lee, Stephanie J., Anthony L. Back, Susan D. Block, and Susan K. Stewart. 2002. “Enhancing Physician-Patient Communication.” Hematology 2002 (1): 464–83. https://doi.org/10.1182/asheducation-2002.1.464.

Leiba, Adi, Yuval Weiss, Judith S. Carroll, Paul Benedek, and Yaron Bar-dayan. 2002. “Waiting Time Is a Major Predictor of Patient Satisfaction in a Primary Military Clinic.” Military Medicine 167 (10): 842–45. https://doi.org/10.1093/milmed/167.10.842.

Leventhal, Howard, L. Alison Phillips, and Edith Burns. 2016. “The Common-Sense Model of Self-Regulation (CSM): A Dynamic Framework for Understanding Illness Self-Management.” Journal of Behavioral Medicine 39 (6): 935–46. https://doi.org/10.1007/s10865-016-9782-2.

Lian, J., S.M. McGhee, C. So, J. Chau, C.K.H. Wong, W.C.W. Wong, and C.L.K. Lam. 2019. “Long-Term Cost-Effectiveness of a Patient Empowerment Programme for Type 2 Diabetes Mellitus in Primary Care.” Diabetes, Obesity and Metabolism 21 (1): 73–83. https://doi.org/10.1111/dom.13485.

Lin, Chung-Ying, Mike K. T. Cheung, Anchor T. F. Hung, Peter K. K. Poon, Sam C. C. Chan, and Chetwyn C. H. Chan. 2020. “Can a Modified Theory of Planned Behavior Explain the Effects of Empowerment Education for People with Type 2 Diabetes?” Therapeutic Advances in Endocrinology and Metabolism 11 (January): 204201881989752. https://doi.org/10.1177/2042018819897522.

Maly, R.C., J.A. Stein, Y. Umezawa, B. Leake, and M.D. Anglin. 2008. “Racial/Ethnic Differences in Breast Cancer Outcomes Among Older Patients: Effects of Physician Communication and Patient Empowerment.” Health Psychology 27 (6): 728–36. https://doi.org/10.1037/0278-6133.27.6.728.

Markwart, Henriette, Franziska Bomba, Ingo Menrath, Katja Brenk-Franz, Gundula Ernst, Ute Thyen, Andrea Hildebrandt, and Silke Schmidt. 2020. “Assessing Empowerment as Multidimensional Outcome of a Patient Education Program for Adolescents with Chronic Conditions: A Latent Difference Score Model.” Edited by Rachel A. Annunziato. PLOS ONE 15 (4): e0230659. https://doi.org/10.1371/journal.pone.0230659.

McAllister, Marion, Graham Dunn, Katherine Payne, Linda Davies, and Chris Todd. 2012. “Patient Empowerment: The Need to Consider It as a Measurable Patient-Reported Outcome for Chronic Conditions.” BMC Health Services Research 12 (1): 157. https://doi.org/10.1186/1472-6963-12-157.

McCorkle, Ruth, Elizabeth Ercolano, Mark Lazenby, Dena Schulman-Green, Lynne S. Schilling, Kate Lorig, and Edward H. Wagner. 2011. “Self-Management: Enabling and Empowering Patients Living with Cancer as a Chronic Illness.” CA: A Cancer Journal for Clinicians 61 (1): 50–62. https://doi.org/10.3322/caac.20093.

McWilliam, Carol L., M. Stewart, N. Del Maestro, B. J. Pittman, J. B. Brown, S. McNair, K. Desai, and M. L. Patterson. 1997. “Creating Empowering Meaning: An Interactive Process of Promoting Health with Chronically Ill Older Canadians.” Health Promotion International 12 (2): 111–23. https://doi.org/10.1093/heapro/12.2.111.

Mgbako, Ofole, Emily H. Miller, Anthony F. Santoro, Robert H. Remien, Noga Shalev, Susan Olender, Peter Gordon, and Magda E. Sobieszczyk. 2020. “COVID-19, Telemedicine, and Patient Empowerment in HIV Care and Research.” AIDS and Behavior 24 (7): 1990–93. https://doi.org/10.1007/s10461-020-02926-x.

Mingers, John, and Jonathan Rosenhead. 2004. “Problem Structuring Methods in Action.” Applications of Soft O.R. Methods 152 (3): 530–54. https://doi.org/10.1016/S0377-2217(03)00056-0.

Mok, Esther. 2001. “Empowerment of Cancer Patients: From a Chinese Perspective.” Nursing Ethics 8 (1): 69–76. https://doi.org/10.1177/096973300100800108.

Mola, E. 2013. “Patient Empowerment, an Additional Characteristic of the European Definitions of General Practice/Family Medicine.” European Journal of General Practice 19 (2): 128–31. https://doi.org/10.3109/13814788.2012.756866.

Moons, Philip, Silke Apers, Adrienne H Kovacs, Corina Thomet, Werner Budts, Junko Enomoto, Maayke A Sluman, et al. 2020. “Sense of Coherence in Adults with Congenital Heart Disease in 15 Countries: Patient Characteristics, Cultural Dimensions and Quality of Life.” European Journal of Cardiovascular Nursing, 11.

Mora, MA, K Luyckx, C Sparud-Lundin, M Peeters, A van Staa, J Sattoe, EL Bratt, and P Moons. 2018. “Patient Empowerment in Young Persons with Chronic Conditions: Psychometric Properties of the Gothenburg Young Persons Empowerment Scale (GYPES).” PLOS ONE 13 (7). https://doi.org/10.1371/journal.pone.0201007.

Nafradi, L, K Nakamoto, M Csabai, O Papp-Zipernovszky, and PJ Schulz. 2018. “An Empirical Test of the Health Empowerment Model: Does Patient Empowerment Moderate the Effect of Health Literacy on Health Status?” PATIENT EDUCATION AND COUNSELING 101 (3): 511–17. https://doi.org/10.1016/j.pec.2017.09.004.

Náfrádi, Lilla, Kent Nakamoto, Márta Csabai, Orsolya Papp-Zipernovszky, and Peter J. Schulz. 2018. “An Empirical Test of the Health Empowerment Model: Does Patient

Empowerment Moderate the Effect of Health Literacy on Health Status?" Patient Education and Counseling 101 (3): 511–17.

Náfrádi, Lilla, Kent Nakamoto, and Peter J. Schulz. 2017. "Is Patient Empowerment the Key to Promote Adherence? A Systematic Review of the Relationship between Self-Efficacy, Health Locus of Control and Medication Adherence." Edited by Monika R. Asnani. PLOS ONE 12 (10): e0186458. https://doi.org/10.1371/journal.pone.0186458.

Norris, Susan L., Joseph Lau, S. Jay Smith, Christopher H. Schmid, and Michael M. Engelgau. 2002. "Self-Management Education for Adults With Type 2 Diabetes." Diabetes Care 25 (7): 1159. https://doi.org/10.2337/diacare.25.7.1159.

Nutbeam, Don. 2000. "Health Literacy as a Public Health Goal: A Challenge for Contemporary Health Education and Communication Strategies into the 21st Century." Health Promotion International 15 (3): 259–67. https://doi.org/10.1093/heapro/15.3.259.

O'Brien, Janice L. 2011. "Relationships Among Structural Empowerment, Psychological Empowerment, And Burnout in Registered Staff Nurses Working in Outpatient Dialysis Centers." Nephrology Nursing Journal 38 (6): 475–82.

Oh, Hyun Jung, and Byoungkwan Lee. 2012. "The Effect of Computer-Mediated Social Support in Online Communities on Patient Empowerment and Doctor–Patient Communication." Health Communication 27 (1): 30–41. https://doi.org/10.1080/10410236.2011.567449.

Palumbo, Rocco. 2017. "Examining the Impacts of Health Literacy on Health Care Costs. An Evidence Synthesis." Health Services Management Research 30 (4): 197–212. https://doi.org/10.1177/0951484817733366.

Pigg, Kenneth E. 2002. "Three Faces of Empowerment: Expanding the Theory of Empowerment in Community Development." Journal of the Community Development Society 33 (1): 107–23. https://doi.org/10.1080/15575330209490145.

Powers, Penny. 2003. "Empowerment as Treatment and the Role of Health Professionals." Advances in Nursing Science 26 (3). https://journals.lww.com/advancesinnursingscience/Fulltext/2003/07000/Empowerment_as_Treatment_and_the_Role_of_Health.7.aspx.

Prybutok, Gayle, Ahasan Harun, and V.R. Prybutok. 2017. "EHealth Marketing to Millennials: A View through a Systemigram." International Journal of Electronic Health Care 9 (January): 319. https://doi.org/10.1504/IJEH.2017.085823.

Pun, Brenda T, Michele C Balas, Mary Ann Barnes-Daly, Jennifer L Thompson, J Matthew Aldrich, Juliana Barr, Diane Byrum, et al. 2019. "Caring for Critically Ill Patients with the ABCDEF Bundle: Results of the ICU Liberation Collaborative in Over 15,000 Adults." Critical Care Medicine 47 (1): 3–14. https://doi.org/10.1097/CCM.0000000000003482.

Rayan, Deepa. 2005. Measuring Empowerment. The World Bank. https://doi.org/10.1596/0-8213-6057-4.

Reininger, Belinda M., Adriana Pérez, Maria I. Aguirre Flores, Zhongxue Chen, and Mohammad H. Rahbar. 2012. “Perceptions of Social Support, Empowerment and Youth Risk Behaviors.” The Journal of Primary Prevention 33 (1): 33–46. https://doi.org/10.1007/s10935-012-0260-5.

Russo, Giuseppe, Andrea Moretta Tartaglione, and Ylenia Cavacece. 2019. “Empowering Patients to Co-Create a Sustainable Health Care Value.” Sustainability 11 (5): 1315. https://doi.org/10.3390/su11051315.

Sauser, Brian, and John Boardman. 2014. “Systemigram Modeling for Contextualizing Complexity in System of Systems.” In Modeling and Simulation Support for System of Systems Engineering Applications, edited by Larry B. Rainey and Andreas Tolk, 1st ed., 273–302. Wiley. https://doi.org/10.1002/9781118501757.ch11.

Schmidt, Robert, Sandra Geisler, and Cord Spreckelsen. 2013. “Decision Support for Hospital Bed Management Using Adaptable Individual Length of Stay Estimations and Shared Resources.” BMC Medical Informatics and Decision Making 13 (January): 3–3. https://doi.org/10.1186/1472-6947-13-3.

Schulz, A. J., B. A. Israel, M. A. Zimmerman, and B. N. Checkoway. 1995. “Empowerment as a Multi-Level Construct: Perceived Control at the Individual, Organizational and Community Levels.” Health Education Research 10 (3): 309–27. https://doi.org/10.1093/her/10.3.309.

Schulz, Peter J. 2014. “Social Influences of Health Literacy and Patient Empowerment.” Patient Education and Counseling 94 (1): 2–3. https://doi.org/10.1016/j.pec.2013.11.002.

Senge, Peter M. 1990. “The Art and Practice of the Learning Organization.”

Shaw, Susan J., Cristina Huebner, Julie Armin, Katherine Orzech, and James Vivian. 2009. “The Role of Culture in Health Literacy and Chronic Disease Screening and Management.” Journal of Immigrant and Minority Health 11 (6): 460–67. https://doi.org/10.1007/s10903-008-9135-5.

Small, Nicola, Peter Bower, Carolyn A Chew-Graham, Diane Whalley, and Joanne Protheroe. 2013. “Patient Empowerment in Long-Term Conditions: Development and Preliminary Testing of a New Measure.” BMC Health Services Research 13 (1): 263. https://doi.org/10.1186/1472-6963-13-263.

Smalley, Katelyn R, Lisa Aufegger, Kelsey Flott, Erik K Mayer, and Ara Darzi. 2021. “Can Self-Management Programmes Change Health Care Utilisation in COPD?: A Systematic Review and Framework Analysis.” Patient Education and Counseling 104 (1): 50–63. https://doi.org/10.1016/j.pec.2020.08.015.

Smith, Lesley Marie, Mary Anne Andrusyszyn, and Heather K. Spence Laschinger. 2010. "Effects of Workplace Incivility and Empowerment on Newly-Graduated Nurses' Organizational Commitment." Journal of Nursing Management 18 (8): 1004–15. https://doi.org/10.1111/j.1365-2834.2010.01165.x.

Sommer, Kim A., and Victoria J. Mabin. 2016. "Insights into the Eldercare Conundrum through Complementary Lenses of Boardman's SSM and TOC's Evaporating Cloud." European Journal of Operational Research 248 (1): 286–300. https://doi.org/10.1016/j.ejor.2015.06.033.

Sørensen, Kristine, Stephan Van den Broucke, James Fullam, Gerardine Doyle, Jürgen Pelikan, Zofia Slonska, Helmut Brand, and (HLS-EU) Consortium Health Literacy Project European. 2012. "Health Literacy and Public Health: A Systematic Review and Integration of Definitions and Models." BMC Public Health 12 (1): 80. https://doi.org/10.1186/1471-2458-12-80.

Sprangers, Mirjam A.G., and Neil K. Aaronson. 1992. "The Role of Health Care Providers and Significant Others in Evaluating the Quality of Life of Patients with Chronic Disease: A Review." Journal of Clinical Epidemiology 45 (7): 743–60. https://doi.org/10.1016/0895-4356(92)90052-O.

Spreitzer, Gretchen M. 1995. "An Empirical Test of a Comprehensive Model of Intrapersonal Empowerment in the Workplace." American Journal of Community Psychology 23 (5): 601–29. https://doi.org/10.1007/BF02506984.

Steele, DJ, B Blackwell, MC Gutmann, and TC Jackson. 1987. "The Activated Patient: Dogma, Dream, or Desideratum?" Patient Education and Counseling 10 (1): 3–23. https://doi.org/10.1016/0738-3991(87)90059-0.

Taggart, Jane, Anna Williams, Sarah Dennis, Anthony Newall, Tim Shortus, Nicholas Zwar, Elizabeth Denney-Wilson, and Mark F Harris. 2012. "A Systematic Review of Interventions in Primary Care to Improve Health Literacy for Chronic Disease Behavioral Risk Factors." BMC Family Practice 13 (1): 49. https://doi.org/10.1186/1471-2296-13-49.

The Lancet. 2012. "Patient Empowerment—Who Empowers Whom?" The Lancet 379 (9827): 1677. https://doi.org/10.1016/S0140-6736(12)60699-0.

Thomas, Kenneth W., and Betty A. Velthouse. 1990. "Cognitive Elements of Empowerment: An 'Interpretive' Model of Intrinsic Task Motivation." Academy of Management Review 15 (4): 666–81. https://doi.org/10.5465/amr.1990.4310926.

Thun, Sylvi, and Arnold B. Bakker. 2018. "Empowering Leadership and Job Crafting: The Role of Employee Optimism." Stress and Health 34 (4): 573–81. https://doi.org/10.1002/smi.2818.

Venkataraman, Krithika S. 1997. "Role of Patient Empowerment in Enhancing Medical Care Outcomes: Development and Validation of a Framework." ProQuest Dissertations and

Theses. Ph.D., Ann Arbor: West Virginia University. 304374867. ProQuest Dissertations & Theses Global. https://libproxy.library.unt.edu/login?url=https://www.proquest.com/dissertations-theses/role-patient-empowerment-enhancing-medical-care/docview/304374867/se-2?accountid=7113.

Wai, WC, WTW O, WKW Shirley, M Ronold, H Elsie, and KCY Timothy. 2020. “Randomized Trial of a Patient Empowerment and Cognitive Training Program for Older People with Diabetes Mellitus and Cognitive Impairment.” GERIATRICS & GERONTOLOGY INTERNATIONAL 20 (12): 1164–70. https://doi.org/10.1111/ggi.14062.

Wallerstein, Nina. 1992. “Powerlessness, Empowerment, and Health: Implications for Health Promotion Programs.” American Journal of Health Promotion 6 (3): 197–205. https://doi.org/10.4278/0890-1171-6.3.197.

Wang, Tao, Jing-Yu Tan, Lily Dongxia Xiao, and Renli Deng. 2017. “Effectiveness of Disease-Specific Self-Management Education on Health Outcomes in Patients with Chronic Obstructive Pulmonary Disease: An Updated Systematic Review and Meta-Analysis.” Patient Education and Counseling 100 (8): 1432–46. https://doi.org/10.1016/j.pec.2017.02.026.

Warfield, John N., and George H. Perino. 1999. “The Problematique: Evolution of an Idea.” Systems Research and Behavioral Science 16: 221–26.

Werbrouck, Amber, Eva Swinnen, Eric Kerckhofs, Ronald Buyl, David Beckwée, and Liesbet De Wit. 2018. “How to Empower Patients? A Systematic Review and Meta-Analysis.” Translational Behavioral Medicine 8 (5): 660–74. https://doi.org/10.1093/tbm/iby064.

Wong, Carlos K. H., William C. W. Wong, Cindy L. K. Lam, Y. F. Wan, Winnie H. T. Wong, K. L. Chung, Daisy Dai, Eva L. H. Tsui, and Daniel Y. T. Fong. 2014. “Effects of Patient Empowerment Programme (PEP) on Clinical Outcomes and Health Service Utilization in Type 2 Diabetes Mellitus in Primary Care: An Observational Matched Cohort Study.” PLOS ONE 9 (5): e95328. https://doi.org/10.1371/journal.pone.0095328.

Yeh, Mei-Yu, Shu-Chen Wu, and Tao-Hsin Tung. 2017. “The Relation between Patient Education, Patient Empowerment and Patient Satisfaction: A Cross-Sectional-Comparison Study.” Applied Nursing Research 39 (October). https://doi.org/10.1016/j.apnr.2017.10.008.

———. 2018. “The Relation between Patient Education, Patient Empowerment and Patient Satisfaction: A Cross-Sectional-Comparison Study.” Applied Nursing Research 39 (February): 11–17. https://doi.org/10.1016/j.apnr.2017.10.008.

Yu, Zhongyuan, William Rouse, Nicoleta Serban, and Emre Veral. 2016. “A Data-Rich Agent-Based Decision Support Model for Hospital Consolidation.” Journal of Enterprise Transformation 6 (3–4): 136–61. https://doi.org/10.1080/19488289.2016.1248802.

Appendix 1.1: Constructs of Patient Empowerment.

Patient Empowerment Constructs	Author	Year
When an individual assumes the role of an object acted upon by the environment, rather than a subject acting in and on the environment.	Freire	1973
A process of ‘‘activating’’ patients, who because of ‘‘rejecting the passivity of sick role behavior and assuming responsibility for their care (.) are more knowledgeable about, satisfied with, and committed to their treatment regimens’’	Steele et al.,	1987
a concept to motivate self-efficacy of employees, and a model of empowerment was built by motivating individuals. They defined empowerment by identifying the conditions that negatively influence employee feelings and work on reducing them by providing formal and informal information about self-efficacy.	Conger & Kanungo	1988
a process of stimulating internal tasks, which include an individual’s behavior according to the required tasks, which may enhance satisfaction. They pointed out that empowerment is related to an individual’s beliefs, which can be influenced by the external environment	Thomas & Velthouse	1990
is a process of distributing the power and sharing responsibilities and expanding the authority of individuals by training, increasing the level of confidence and providing emotional support	Israel et al	1994
The empowerment definition should not only relate to individuals to be healthy but to bring change to the social situation and organization that influence their lives.	Feste & Anderson	1995
Empowerment is a result of both interactive and personal process	McWilliam et al.,	1997
Patient empowerment is a process of communication between patients and health care professionals and reinterpretation of illness. Empowerment provide patients with experience of feeling strong, have a cognitive choice in coping with their illness in a way they can be satisfied.	(Mok 2001)	2001
Patient empowerment in health care context means to promote patient autonomy and self-regulation by seeking information related to their illness as a first step and participating in an active way in decision-making related to their lives.	Norris et al.	2002
Patient empowerment is the capabilities that can be transferred to others by providing resource utilization to achieve an individual’s goals. When transferring power to individuals, empowerment cannot be achieved if the resources, support, access to information, and available opportunities weren’t available for individuals to learn and grow their abilities	Patrick & Laschinger	2006
Patient empowerment is a complex experience of personal change, which is guided by self-determination and may be facilitated by health care providers to adopt a patient centered approach of care.	Aujoulat et al.,	2007

(table continues)

Patient Empowerment Constructs	Author	Year
It's both personal transformation and patient provider interaction	Aujoulat et al.,	2008
Patient empowerment is a process where people get help to reach autonomous decision-making to enhance self-management of their conditions, as well as to gain control over their health.	The Lancet	2012

Appendix 1.2: Prior Studies that Used Systemigrams in Health Care

Author, Year	Summary
(Cristancho et al., 2015)	Highlighted the importance of providing visual data to support medical expert judgments. A systemigram is used to provide visual information that helps to understand the influence of the context and contextualize health care complexity. They concluded that systems engineering with systemigram s, rich pictures, causal loops diagrams, and system maps could benefit medical experts for better understanding challenging situations.
(Allegro & Smith, 2015.)	A systemigram was used to evaluate the proposed systems thinking mind map, and then was used to compare with the mental process applied in different cases which resulted in developing new treatments for sepsis. The study highlighted that a systemigram can better understand the disease by integrating it with many health care outcomes; more precisely, investigating the progression of sepsis within the health care enterprise. Many situations about how to survive from sepsis were provided.
(Johnson et al., 2018)	The authors concluded that a systemigram could be used in health care as a system thinking tool and techniques and with developing training strategies. They state it can give conceptualization and exploration for both current and future systems. They demonstrate how a systemigram can consider dynamics with the ability to support cultural and transformational changes, and most importantly, it can help to understand complex systems.
(Lafontaine and Lafontaine 2019)	A systemigram was used to engage stakeholders in a structured way to reach clarity on the defined area of impact and leverage resources by changing their way of thinking about indigenous health. The systemigram was further used to show how systems thinking can simplify system structure to provide a better understanding of the problem. By recognizing the interconnections, identifying the system and gain feedbacks helped simplify the complexity by modeling systems that allow for predicting behaviors and modifications to produce desired goals.
(Prybutok, Harun, and Prybutok 2017)	A systemigram was used to highlight the gaps in millennial electronic health marketing, provide visual information of the circumstances that practitioners and academics faced, and provide information to the system analyst regarding issues in millennial electronic health marketing.
(Engelseth et al., 2020)	A systemigram was used to illustrate the complex nature of health care services provided by information technology. Moreover, the systemigram was used to treat health care systems as a complex system with respect to the logistics services based on information technology. The systemigram helped to clear the uncertain characteristics of the appropriate information system.

(table continues)

Author, Year	Summary
(Sommer and Mabin 2016)	A systemigram was used to provide a clear image and more insight that influence the employee engagement and patient-centered health care system. Moreover, it provided a comparison between the complexity of employee engagement and patient-centered care when practiced individually or when considered together. Based on the results, the systemigram showed the redundant and duplicated services that led to one goal from human resources, patient satisfaction, and leadership perspectives. This visual view helped to provide some recommendations to improve the health care system by moving the redundant activities.

ESSAY 2

REDUCING PATIENT WAITING TIMES IN A HUB ENVIRONMENT

2.1 Introduction

In a health care hub environment, the focus is on connecting patients with care plans using telecommunication as the primary interaction method, such as electronic prescriptions (e-scripts), phone calls, and video calls. Connecting patients to empowerment care plans is a crucial aspect of health care delivery, as it enhances patient engagement and promotes better health outcomes. Additionally, minimizing waiting time for patients is essential in providing timely and efficient health care services. This introduction explores the different ways of connecting patients to empowerment care plans and the importance of minimizing waiting time, supported by relevant references from health care literature.

To connect patients to empowerment care plans, e-scripts have gained prominence as a convenient and efficient method. e-Scripts enable health care providers to send prescriptions directly to pharmacies electronically, eliminating the need for handwritten or printed prescriptions. This method not only improves medication adherence but also facilitates the enrollment of patients in empowerment care plans by streamlining the prescription and medication management process (Nafradi et al., 2017).

In addition to e-scripts, phone calls have been utilized to connect patients with empowerment care plans. Personalized phone calls from health care providers or care coordinators allow for direct communication with patients, providing an opportunity to discuss care plans, address concerns, and ensure patient understanding and engagement. Research has shown that regular phone calls to patients can enhance the satisfaction of patients, medication adherence and overall outcomes related to health (Hong et al., 2017; McGillicuddy et al., 2013).

Moreover, the advancements in telehealth technology have facilitated the use of video calls for connecting patients to empowerment care plans. Video calls provide a more personalized and interactive experience, allowing health care providers to visually assess patients, discuss treatment options, and provide education and guidance remotely. Studies have demonstrated the effectiveness of video calls in enhancing patient engagement, reducing travel burden, and improving access to health care services, especially for patients in remote or underserved areas (Biagio et al., 2013; Wade et al., 2019).

Furthermore, minimizing waiting time is crucial for patient satisfaction and efficient health care delivery. Prolonged waiting times can lead to displeasure of patient, adhesion to care plan decreases, and delayed access to necessary treatments. Implementing strategies to minimize waiting time, such as optimizing appointment scheduling, improving workflow processes, and leveraging technology for efficient patient management, can significantly enhance the overall patient experience and health care system efficiency (Fung et al., 2018; Sun et al., 2014).

In conclusion, connecting patients to empowerment care plans through methods like e-scripts, phone calls, and video calls plays a vital role in engaging patients and improving health care outcomes. Additionally, minimizing wait time is crucial for patient satisfaction and efficient health care delivery. By adopting these approaches, health care providers can enhance patient engagement, improve access to care, and optimize health care service delivery.

Minimizing wait time is not only crucial for improving patient satisfaction and optimizing health care service delivery but also plays a significant role in increasing the number of patients who enroll in empowerment care plans. Lengthy wait times can discourage patients from seeking care or following through with recommended treatment plans, leading to missed opportunities for enrolling them in empowerment care initiatives. By minimizing wait times in a hub environment, health care providers create a positive patient experience, which fosters trust, engagement, and willingness to participate in care plans. Studies have shown that reducing wait times can enhance patient satisfaction, increase patient compliance, and ultimately improve the overall enrollment rates in empowerment care plans (Lacy et al., 2004; Eze at al., 2020). Therefore, prioritizing efficient processes and implementing strategies to minimize wait times in a hub environment can have a profound impact on patient engagement and the successful enrollment of patients in empowerment care plans.

Empowered patients are more likely to actively participate in their own care, resulting in improved health outcomes. In fact, a recent study demonstrated that care quality was ranked 3.75 out of 5 and relational support in the care context was ranked 3.91 out of 5, while the perception of direct control was ranked 2.87 out of 5 (Bailo et al., 2019). Hospitals with better work environments were associated with improved care quality and patient satisfaction. These results were consistent across countries, with nurses with better work environments half as likely to report poor or fair care quality, and patients in these hospitals more likely to rate their hospital highly and recommend their hospitals. Additionally, each additional patient per nurse increased the odds of nurses reporting poor or fair quality care and poor or failing safety grades, while patients with higher ratios of patients to nurses were less likely to rate them highly or recommend them (Aiken et al., 2012). This indicates that patient empowerment plays a crucial role in enhancing patient experience and overall satisfaction. Research conducted by the National Institutes of Health (NIH) suggests that patient empowerment can lead to better medication adherence. The study found that empowered patients were 30% more likely to adhere to their prescribed medication regimen, resulting in improved treatment outcomes and reduced health care costs (Nafradi et al., 2017).

According to Jotterand et al. (2016), the empowerment model is founded on the principle that the power to influence behavior lies within the person making the decision. Therefore, the potential for external manipulation is greatly reduced as the patient is the one initiating any behavioral changes. Furthermore, patient education should strive to empower the patient to change their own behavior, rather than imposing any values. Self-determination theory (SDT) is a theory of motivation which states that humans have three innate psychological needs: autonomy, competence, and relatedness. These needs must be satisfied in order for individuals to experience intrinsic motivation and achieve psychological health (Ryan & Deci, 2017). The empowerment model proposed by Jotterand et al. (2016) is deeply rooted in SDT, as it seeks to foster autonomy and self-efficacy in the patient by providing them with the tools to make their own decisions and take control of their behavior.

The health belief model (HBM) is a theoretical framework that can be applied to understand patient empowerment. It suggests that patients are more likely to be empowered when they perceive a personal threat to their health and believe that taking action will result in positive outcomes. This model highlights the importance of providing patients with relevant information and resources to enable them to make informed decisions (Bishop et al., 2014). The transtheoretical model (TTM) is another theoretical framework that can be used to explain patient empowerment. This model proposes that individuals go through different stages of change when it comes to their health behaviors. Patient empowerment is achieved by supporting patients in progressing through these stages and helping them build self-efficacy and confidence in managing their health (Hashemzadeh et al., 2019). The patient activation model (PAM) is a theoretical framework that focuses on measuring and enhancing patients' knowledge, skills, and confidence in managing their health. It suggests that empowered patients are more likely to engage in proactive health behaviors and take an active role in their care (Hibbard et al., 2004).

The objective of this research is to utilize discrete event simulation (DES) to evaluate the impact of minimizing wait time on patient enrollment in empowerment care plans in a hub environment. A hub environment is one in which the focus is on connecting patients with care plans and the primary interaction method is telecommunication. By developing a simulation model that replicates the patient flow and processes within a health care system, the aim of present research is to analyze the effects of reducing wait times on patient satisfaction, patient, engagement, and the successful enrollment rates in empowerment care plans. Results of present research will help to understand the potential benefits of minimizing patient wait time and inform strategies to optimize health care service delivery for increasing patient participation in empowerment care initiatives. The following research questions were addressed:

1. What are the implications of reducing patient wait times on the successful integration of patients into empowerment care plans?
2. What strategies can be employed in services provided by health care system to heighten the involvement of patients in empowerment care initiatives?

First, I began by reviewing the literature on service delivery management and patient empowerment. Then I examined three different models for patient enablement process, utilized by a North American integrated health care solutions company. DESs were used to find an optimal number of staff and services to maximize efficiency and minimize costs for each process model and an integrated model. AnyLogic software is used to compare the costs of the three models in different scenarios in a hub environment, where the focus is on connecting patients with care plans and the primary interaction method is telecommunication. This investigation supplements the existing body of evidence by pinpointing the component needed for patient empowerment. Additionally, it formulates solutions that are designed to increase efficiency, both in terms of cost and benefit. The remainder of this essay is arranged as following. The next section is dedicated to a literature review. The third section presents a case study to build the model. The fourth section provides an overview of the simulation model and optimization results, along with a discussion of the findings. The fifth and final section summarizes the conclusions and suggests potential future work.

2.2 Literature Review and Related Work

Historically, the notion of empowerment can be traced back to the 1960s, when it was first used in the context of politics to tackle issues such as gender and racial discrimination. Since then the idea has been adopted by advocates of social action to promote equality and justice (Mclean, 1995). During this period, primarily concern of empowerment was on rights and capabilities of individuals, rather than on engagement and communication of people. During 1980s the concept of empowerment was adopted widely, with the idea of improving outcomes was developed. This idea was focused on the results and cost of health care for patients .This was shift away from the traditional view of health care (Pluut, 2016). Further in late 1980s the health sector started to focus on enabling people to gain control over their own health (Wittink & Oosterhaven, 2018). In the early 1990s, it was first associated with patients in health care in the United States. Empowerment of patients has been a source of debate in the literature (O'Keefe et al., 2015) because the concept is often interpreted differently depending on the context and field of study.

In addition the dynamic nature of the definition varies from person to person (Ferline & Shortell, 2001). Definition of patient empowerment is multifaceted. It includes the capacity of patients to assume responsibility for their lives; second, having requisite knowledge and skills to make informed decisions; and third, it comprises the experiences to evaluate the efficacy of their choices. Numerous studies have explored the objectives and significance of empowerment of patient, particularly in terms of attaining management of self and self-beliefs and satisfaction of patient (Andreassen & Trondsen, 2010; Pekonen et al., 2020). Research is ongoing to discover ways to help patients make informed decisions about their health, consequently improving their overall wellbeing while reducing health care services demand, as well as using less health care resources to improve cost effectiveness (Agner & Braun, 2018). Nevertheless, focusing on benefitting patient and optimizing service time to make decisions remains a skepticism for other parties (Zhai et al., 2023).

Health care providers face difficulties in getting patients to take part in making decision related to their health due to differences between patients and doctor (Castro et al., 2016). In recent years, health care has progressed to the point where patients are better informed about managing their diseases and are actively involved in their own health care (Pomey et al., 2015). Educating patients about their diseases has become an essential part of providing quality health care (Hibbard et al., 2004).

Because of the complex nature of patients self-determination most studies aiming to enable patient self-determination through education are limited (Olesen & Jorgensen, 2022). Recent studies have shed light on number of issues concerning health care, i.e., the treatment duration, the length of service delivery, the medical equipment used, and the physical environment. All of these components create a level of unpredictability and diversity within the health care field (Wan et al., 2020). These complexities in health care has led to much research focusing on simulation modeling (Marshall et al., 2015). Publications related to the current study can be divided into three groups: patient referral processes, simulation optimization, and resource distribution. Table 2.1 provides a summary of papers where simulation models have been used.

Table 2.1: Related Work of Simulation Papers in Health Care

	Study	Objective of the Study	KPIs	Data Gathering	Software	Country
1.	(Setijono Djoko et al., 2010)	For decreasing average non-value-added time, finding the right amount of medical specialists and physicians	Non-value- added time, average total time spent in the system,	Triage database and personal observation	Arena	Swedan
2.	(Mould et al., 2013)	Analyzing the impact of redesign services in ED on patients’ overall time spent	Average process time	Null	null	UK
3.	(La & Jewkes, 2013)	Investigated the operational level and optimal performance of emergency departments through fast track	Queuing length	Null	null	Canada
4.	(Bair et al., 2010)	Patient flow in ED modelled to assess the impact of boarding on the efficiency of the ED	The length of queue	Null	null	USA
5.	(Kang et al., 2014)	Examine the impact on patient flow by patient admitted in emergency department	Process interval time, queuing length	Hospital database, expert opinions	Simio	USA
6.	(Sinreich & Marmor, 2005)	Assessing the effectiveness of operational procedures in emergency department.	Main resources time in patient flow	Interviews, work study, observation	Arena	Israel
7.	(Ahmed & Alkhamis, 2009)	Research used simulation optimization to identify the most efficient deployment of resources in order to maximize patient flow and minimize patient wait times within budgetary constraints.	Number of arrival patients and, average wait time	Survey, and interviews.	Simiscript	Kuwait
8.	(Lin et al., 2015)	Assessing the effectiveness of various ambulance diversion strategies	The associated average wait time for patients to get service	Simulation tool obtained by MATLAB	null	Taiwan

This research approach is focused on tackling a specific problem. By concentrating on reducing the average wait time of referred patients, I examine the various pathways that patients take through the system. Models are often inadequate if they are created with the sole intention of exploring the system in general, rather than addressing a specific problem. The researcher must look at the system holistically in order to gain an understanding of the issue and find a resolution. The system could benefit from a dynamic model, but this would only be feasible if there is a large patient population, and the amount of time they take to make a decision is insignificant in terms of the system's performance. Despite the impact of random effects of the time taken for the patient to make his decision, discrete event simulation (DES) modeling is chosen to analyze the results. This is due to the varying impacts these random effects may have on the results (Tako & Robinson, 2018)

Numerous studies have been conducted to explore various aspects of patient referrals, specifically those related to emergency medical services. This includes research conducted in control centers, emergency pharmacies, ambulances and inter-hospital collaborations (Essoussi et al., 2023). When an emergency call is received at the control center, the ambulance is dispatched to the patient's location with an allotted time to arrive. The ambulance then transports the patient to the closest hospital for initial treatment. To reduce the wait time for treatment, physicians can collaborate to transfer the patient from a hospital with a high patient population to one with fewer patients.

Jacob et al. (1984) investigated 19 general practitioners through simulations, to review the quality of written reports created from patient-physician encounters. The focus of the examination was on the amount of medications prescribed and the referrals to specialists. The goal of the research was to identify the correlation between the risk of potentially dangerous drug usage, depending on whether the prescription was written by a practitioner or a physician. Results of the study showed that practitioners were more likely to prescribe medicines not deemed necessary for the patient. Biya et al. (2017) conducted an analysis of the patient referral process between three hospitals that have a collaborative relationship. The simulation was designed to minimize the amount of time patients had to wait, with the decision variable of the number of patients transferred daily in a range of 0 to 10. Software OptQuest for Arena was used to resolve the issue and the outcomes demonstrated that teamwork between the three hospitals was effective in decreasing patient wait times. Yao et al. (2020) conducted study to understand the effects of collaborative arrangements between two hospitals where the number of daily referrals is predetermined and not a fixed number; an integer decision variable was used in the model. This variable ranged from 0 to the maximum amount of patients that could be referred in a month. The results indicated that having patient referrals not fixed was preferable to fixed number of daily patient referrals for achieving the shortest wait time. Chen and Lin (2017) conducted an investigation utilizing the Fledermaus algorithm to uncover daily unfixed referred patients. This research extended upon their previous work, exploring the capabilities of the algorithm to identify such patients in a more efficient and accurate manner.

Allocation of resources for referral problems is a matter of discussion across industries that share similar features. Yu et al. (2011) provided an analysis of the workflow allocation problem using a combination of simulation optimization and tabu search with heuristics. They applied DES to a range of workflow models to compute the mean time for every task. The outcome of the analysis allowed them to define the necessary number of resources for any given task.

2.3 Hypotheses

2.3.1 Hypothesis 1 (H1)

The choice of method used to connect patients (e-scripts, phone calls, video calls) significantly influences patient waiting time for a call in a hub setting.

In a hub setting, the focus is on connecting patients with care plans and the primary interaction method is telecommunication. In recent years, technology-mediated patient engagement methods have received increased attention due to their potential to transform health care delivery. These technologies, which include e-scripts, phone calls, and video calls, have been recognized for their role in minimizing the patient wait times (Kooij et al., 2018).

E-scripts are touted as efficient and reliable tools for connecting patients to health care providers. They not only improve medication adherence but also streamline the prescription and medication management process, potentially decreasing wait times (Porterfield, 2014). Telephone consultations have been a long-standing method for patient interaction and have proven essential in reducing patient wait times. Direct phone call interactions allow for personalized communication, immediate clarification of patient queries, and real-time scheduling, thereby improving the overall efficiency of the system (Rho et al., 2014). More recently, video consultations have become a crucial aspect of telemedicine. Research has shown that video consultations, while providing a higher level of interaction similar to face-to- face encounters, can significantly decrease patient wait times, especially in remote or underserved areas (Polinski et al., 2016).

However, there is a substantial gap in the literature regarding the comparison of these methods in the specific context of patient wait time in a hub setting. While numerous studies discuss these methods in general health care scenarios, the nuanced differences in a hub setting and how they affect waiting times have not been sufficiently explored. A comprehensive investigation of these methods in a hub environment will provide valuable insights to guide system improvements and enhance patient care.

2.3.2 Hypothesis 2 (H2)

The number of CPhTs, RPhs, and referral patients significantly influences patient wait time for contact in a hub setting.

- Certified pharmacy technicians (CPhTs)

CPhTs have been widely recognized for their role in streamlining the workflow in a pharmacy setting. They assist pharmacists in many aspects, ranging from filling prescriptions to answering patient queries, thereby enhancing overall service quality and efficiency (Sparkmon et al., 2021). However, the specific relationship between the number of CPhTs and patient wait time for contact in a health care hub setting has not been comprehensively studied.

Several studies have indicated the potential impact of increasing the number of CPhTs on the workflow and operational efficiency in a pharmacy setting (Chui et al., 2012). These studies have demonstrated that the presence of CPhTs can potentially reduce errors and enhance patient satisfaction by improving service efficiency. However, these studies did not directly evaluate the effect on patient wait time for contact in a hub setting, leaving a gap in the literature.

Our hypothesis posits a direct relationship between the number of CPhTs and patient wait time for contact in a hub environment. While the literature suggests potential for improved efficiency with an increased number of CPhTs, it lacks explicit investigation into patient wait time, a critical measure of service quality and efficiency in a hub setting.

This research aims to directly address this gap by studying the effect of varying the number of CPhTs on patient wait time for contact. By focusing on this specific aspect of health care service delivery, we aim to generate insights that can be used to optimize resource allocation and enhance service efficiency in a hub setting. The results of this research would contribute to the existing body of knowledge by offering a more nuanced understanding of the role of CPhTs in health care service delivery and its implications for patient wait times.

- Registered pharmacists (RPhs)

The role of RPhs in health care delivery has been the focus of many studies. Their roles are widely recognized in medication management, patient counseling, and improving the overall quality of patient care (Rajiah et al., 2021). Yet, their specific influence on patient wait times for contact in a hub setting is not as thoroughly researched.

Most literature underscores the general importance of having adequate staff numbers for efficient health care delivery. For instance, Bates et al. (2017) suggest that an increase in staffing levels can help reduce wait times in health care settings. This understanding can be extrapolated to imply that an increase in the number of RPhs might likely improve patient wait times in a video call hub. In a study examining the impact of pharmacist involvement in patient consultations, it was noted that a marked improvement in patient outcomes. Although their work did not focus on wait times, it hinted at potential efficiency gains that could be achieved by involving more pharmacists (Rajiah et al., 2021).

Despite these pieces of evidence, a clear gap exists in the current body of literature. The exact effect of the number of RPhs on patient wait times in a video call hub is still not well-explored. Most studies have focused on the more general role of pharmacists in patient care, rather than their direct impact on patient wait times in specific settings such as a video call hub. Moreover, the increasing role of telehealth services, particularly video calls, in patient care delivery calls for more focused studies. In light of this, our study aims to explore this gap and provide more insights into the influence of RPh numbers on patient wait times in a video call hub.

The effect of patient volume, particularly the number of patient referrals, on the efficiency of health care delivery is a widely discussed topic in health care literature. However, specific studies focusing on how the number of referrals affects patient wait time in a hub setting are limited, thus warranting further exploration. Patient volume has been linked to wait times in various health care settings. Nyce et al. (2021) analyzed the impact of patient volume on emergency department wait times and found a significant correlation. Their study suggested that as patient volume increased, so did wait times. This finding, though not specific to a hub setting or patient referrals, provides a basis for understanding how higher patient volume could lead to longer wait times.

Moreover, patients who are referred often require more complex care or specialist attention (Rosenthal et al., 2013). This increased complexity can lead to longer processing times and potentially extend the wait time for all patients. However, this theory needs to be further tested in a hub setting, where the focus is on connecting patients with care plans and the primary interaction method is telecommunication.

The effect of patient referrals on wait times can also be influenced by other factors, such as staffing and resource allocation. For instance, Aboueljinane et al. (2014) suggested that the level of staffing could mitigate the impact of increased patient volume on wait times. However, this was not specifically tested with referral patients or in a hub setting.

The above literature suggests a potential correlation between the number of patient referrals and patient wait time in a hub environment. However, the unique dynamics of a hub setting and the specific implications of dealing with referral patients in such a context have not been thoroughly examined. Therefore, a significant gap exists in understanding how the volume of referral patients directly influences the wait times in a hub. This gap necessitates further research to provide more definitive and context-specific insights.

2.3.3 Hypothesis 3 (H3)

The priority given to the method used to connect to patients significantly influences the patient wait time in a hub setting.

Health care providers have traditionally used multiple methods to connect with their patients. These methods range from in-person appointments, telephone calls, emails, text messages, to recent advancements like telemedicine (Wade et al., 2012). The efficacy of these methods varies depending on multiple factors such as the complexity of the patient's health condition, accessibility, technology use, and patient preferences (Hofstetter et al., 2020). Some studies suggest that in-person consultations tend to have the longest wait times due to factors such as travel, clinic workflows, and physician availability (Fung et al., 2018).

Meanwhile, alternative methods like telephone calls, emails, and telemedicine can significantly reduce wait times as they do not involve travel and allow for greater flexibility (Sun et al., 2014). However, not all these methods are suitable for all types of consultations. For instance, while telemedicine has been found to be effective for routine follow-ups, it may not be suitable for initial assessments or complex conditions (Wade et al., 2012). Thus, the priority assigned to each method can potentially impact wait times.

Despite these insights, the existing literature has not explicitly explored how the prioritization of different patient contact methods impacts wait times. This gap in the literature could be addressed through empirical research that measures the impact of method prioritization on wait times. This research could consider variables such as the type of health condition, patient population characteristics, health care provider resources, and technological capabilities

2.4 Methodology

Simulation plays a crucial role in enhancing health care service delivery by enabling the evaluation and optimization of complex supply chain processes. By employing simulation models, health care organizations can analyze various factors such as patient flow, resource allocation, and inventory management, leading to improved operational efficiency and quality of care. According to a recent study by Günal et al. (2021), simulation-based optimization techniques in health care supply chain management have shown significant potential in reducing costs, minimizing waiting times, and enhancing patient satisfaction. These findings emphasize the value of simulation as a valuable tool for health care practitioners and decision-makers to make informed operational and strategic decisions.

The dynamic and uncertain nature of health care supply chains necessitates the use of simulation to effectively manage and mitigate risks. With the increasing complexity of health care systems, the ability to simulate different scenarios and evaluate their impact becomes essential. Research by Dehghanian et al. (2020) emphasizes the importance of simulation in health care supply chain risk management. By employing simulation models, health care organizations can identify vulnerabilities, test mitigation strategies, and optimize their response to various disruptions. This proactive approach enables health care providers to enhance supply chain resilience and ensure the continuous delivery of critical services, especially during times of crises or unexpected events.

Simulation-based optimization also supports strategic decision-making in health care supply chain design and improvement. By simulating and analyzing different configurations and process changes, health care organizations can identify bottlenecks, optimize resource allocation, and improve overall system performance. A recent article by Saleh et al. (2021) highlights the significance of simulation in health care supply chain redesign. The study demonstrates how simulation models can guide decision-makers in designing more efficient and cost-effective supply chain networks, ultimately leading to enhanced patient outcomes and reduced health care costs. These findings emphasize the value of simulation as a decision support tool for health care supply chain managers seeking to optimize system performance and achieve strategic objectives.

In a hub setting, the focus is on connecting with patients to enroll them in empowerment care plans, using telecommunication as the primary interaction method is telecommunication including e-scripts, phone call outreach, and video calls. e-Scripts enable health care providers to electronically send prescriptions directly to pharmacies, streamlining the medication ordering process and ensuring patients have access to the necessary medications (Lau et al., 2023). Phone calls allow health care professionals to directly communicate with patients, discussing care plans, answering questions, and providing guidance (Bell et al., 2012). Video calls offer the advantage of face-to-face interaction, allowing health care providers to visually assess patients, provide personalized education, and strengthen the patient-provider relationship (Andino et al., 2021). These different connecting methods facilitate the enrollment of patients in empowerment care plans, enhancing patient engagement, adherence to treatment, and overall health care outcomes.

2.4.1 Parameter Settings

The pharmaceutical company targeted for this study is one of the leading pharmaceutical companies in a North American integrated health care solutions company. The leading pharmaceutical company provides practice services, network services, pharmacy services, analytics and reporting, business planning, chief financial officer (CFO) services and accounting, accountable care organizations (ACOs), independent physician, payer, employer, population health, referral management, medication management, and revenue cycle management.

In 2016, the organization launched an initiative to enhance and refine the relationship between physicians and patients, with primary care at its core. Through this program, physicians are offered a technology platform that operates with data-driven insights and a team-based care methodology that directs patients to the right care setting depending on their feedback. The goal of this venture is to empower patients by engaging them in a thorough discussion about their adherence to medication. It further seeks to identify any educational or financial challenges that may impede the patient's journey to optimal therapy and collaborate with health care providers to facilitate the process. Medications are sent regularly each month and the patient is contacted virtually on a monthly basis to review their feedback on the progress of their treatment and to assess their condition. A team known as the empowerment team was created to meet the objectives set by management. This team has set the goal of increasing the number of patients served each day while minimizing the average service time and reducing acquisition expenses. In the present study, we are testing three models with three different methods of service delivery: (i) 3-calls outreach model, (ii) electronic presecription [e-script] model, and (iii) RxHUB model.

2.4.1.1 3-Calls Outreach Model

Utilizing phone calls to reach patients and convince them to enroll in an empowerment health care plan offers a valuable opportunity for personalized communication and persuasion. Through these phone calls, the empowerment team can engage in empathetic conversations, understanding patients' concerns, and addressing their individual needs. By highlighting the benefits, advantages, and potential positive outcomes of the empowerment health care plan, providers can effectively convey the value and significance of enrolling in such a program. The phone calls allow for a direct and interactive dialogue, enabling providers to answer questions, provide clarifications, and alleviate any doubts or hesitations that patients may have. Through persuasive communication, active listening, and tailored explanations, empowerment team can foster patient trust, motivation, and ultimately convince them to enroll in the empowerment health care plan.

In certain circumstances, patients may not answer phone calls, which can pose challenges in reaching them to discuss enrollment in an empowerment health care plan. Research has identified various factors that contribute to missed or unanswered calls, including caller ID unfamiliarity, concerns about privacy and confidentiality, phone-related issues, and competing priorities or distractions (Bradley et al., 2017; Jenkinson et al., 2015). Additionally, individuals with limited access to reliable phone services or those facing socioeconomic barriers may be more likely to miss phone calls. Understanding these circumstances and barriers can inform strategies to mitigate missed calls, such as using familiar caller IDs, ensuring privacy and confidentiality measures, offering alternative communication channels, or providing flexible call scheduling options. By addressing these challenges, empowerment teams can enhance the effectiveness of their outreach efforts and increase the chances of connecting with patients to discuss enrollment in empowerment health care plans.

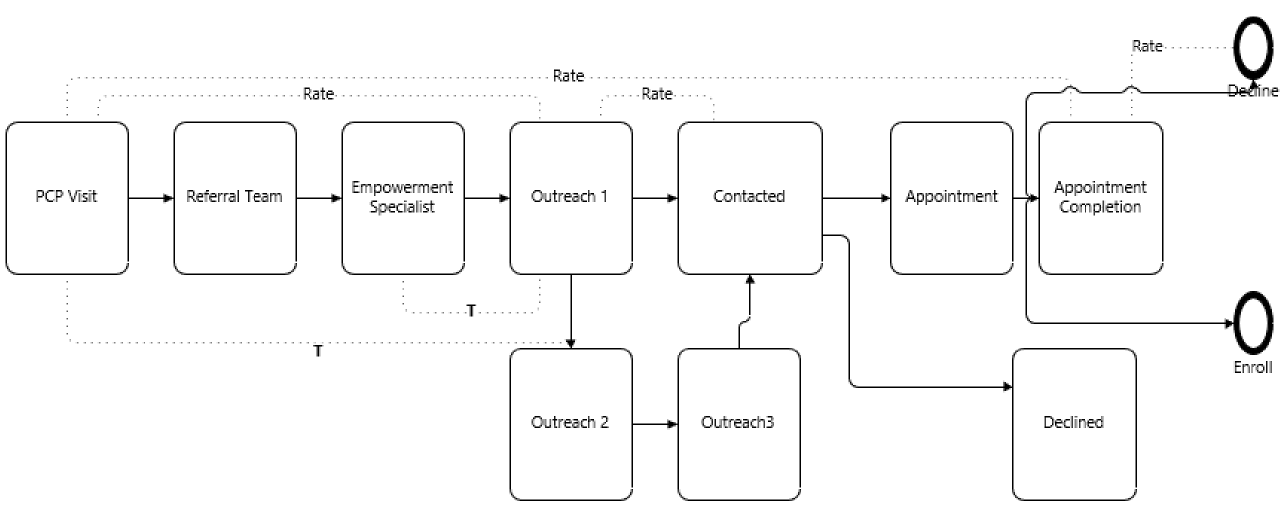


Figure 2.1*:* 3-calls outreach model.

The process of this model starts with patient referrals by primary care providers (PCPs) connected to the enterprise network. Then, the empowerment specialist (CPhT and/or RPh) must convince the patient of the importance of the empowerment program. Figure 2.1 shows the model, while Figure 2.2 shows the data flow of the model in detail.

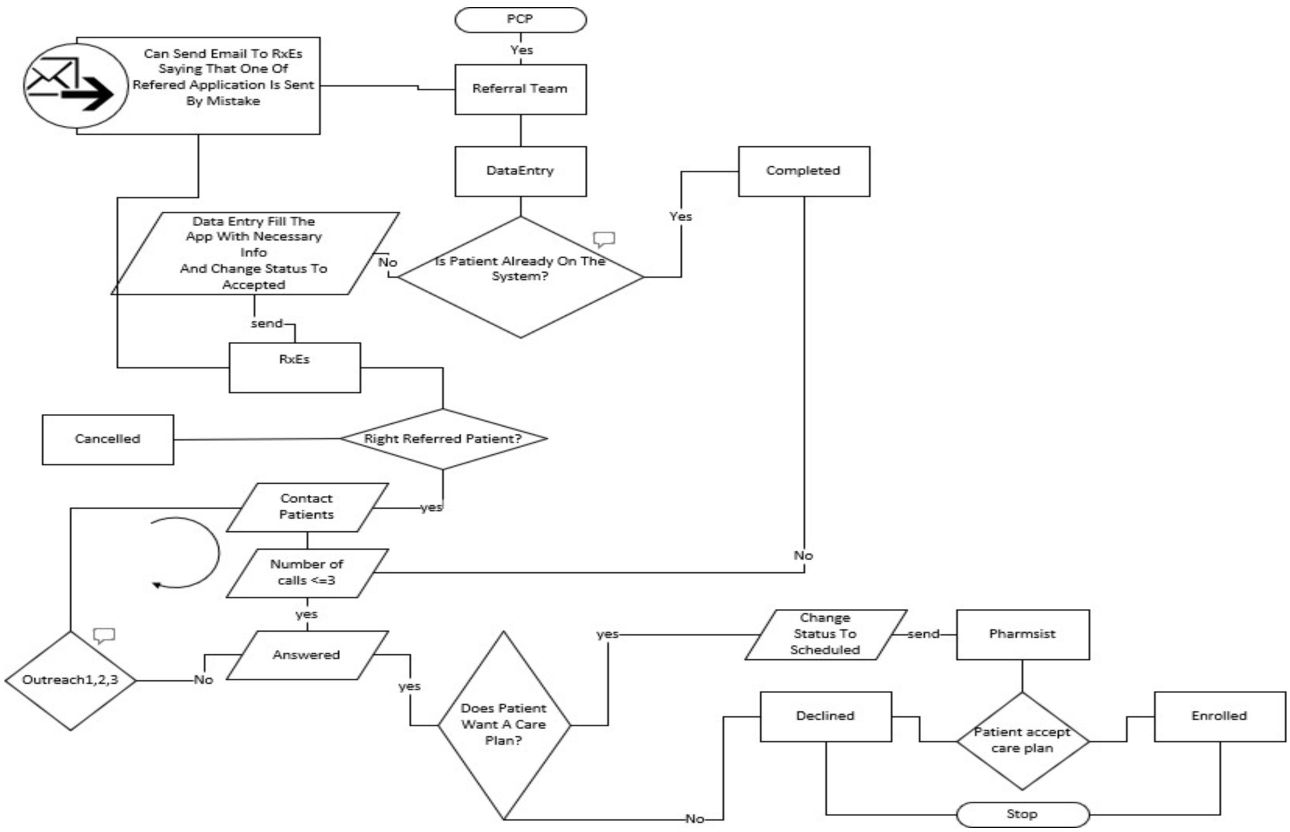


Figure 2.2: 3-calls outreach data flow process.

2.4.1.2 e-Script Model

e-Script referrals have emerged as a valuable tool for connecting patients to appropriate health care services. This method allows health care providers to electronically refer patients to specialists, diagnostic tests, or other services, enhancing the efficiency and coordination of care (Bates et al., 2015). e-Script referrals streamline the referral process, reducing the need for manual paperwork and facilitating timely access to specialized care (Busse et al., 2002).

Moreover, they can improve communication between referring and receiving providers, ensuring the continuity of care and reducing the likelihood of errors or delays (Keely et al., 2013). Studies have shown that e-script referrals lead to increased referral completion rates, reduced patient wait times, and improved patient satisfaction with the referral process (Westaby et al., 2017; Keely et al., 2013). The adoption of e-script referrals in health care settings has the potential to optimize patient outcomes, enhance care coordination, and streamline the referral process. The company has integrated e-scripts into a new model where the PCP submits the prescriptions and information of the patients most likely to fit into the empowerment care plan (Fig. 2.3). The empowerment team then contacts the patient to schedule a consultation to explain the empowerment care plan, and the patient has the right to either accept or decline the empowerment care plan. Figure 2.4 shows the flow of this model.

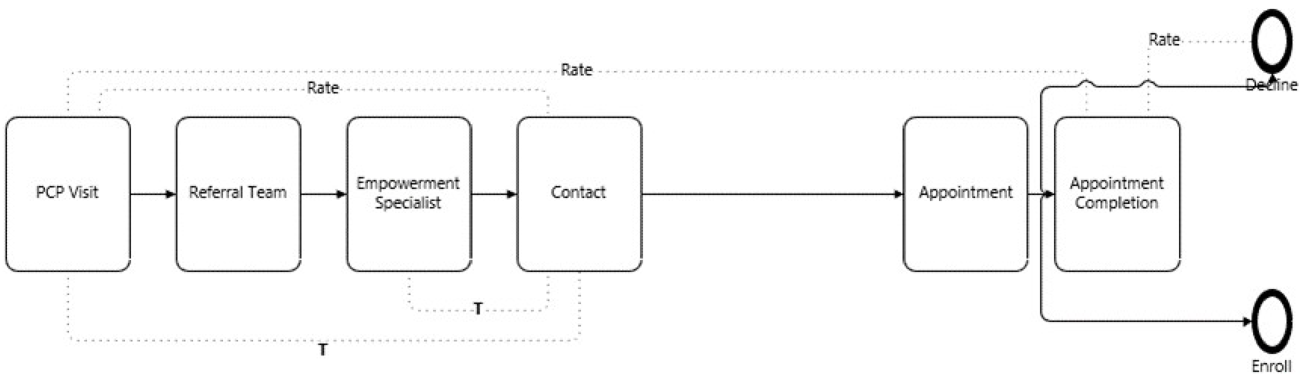


Figure 2.3: e-Script model.

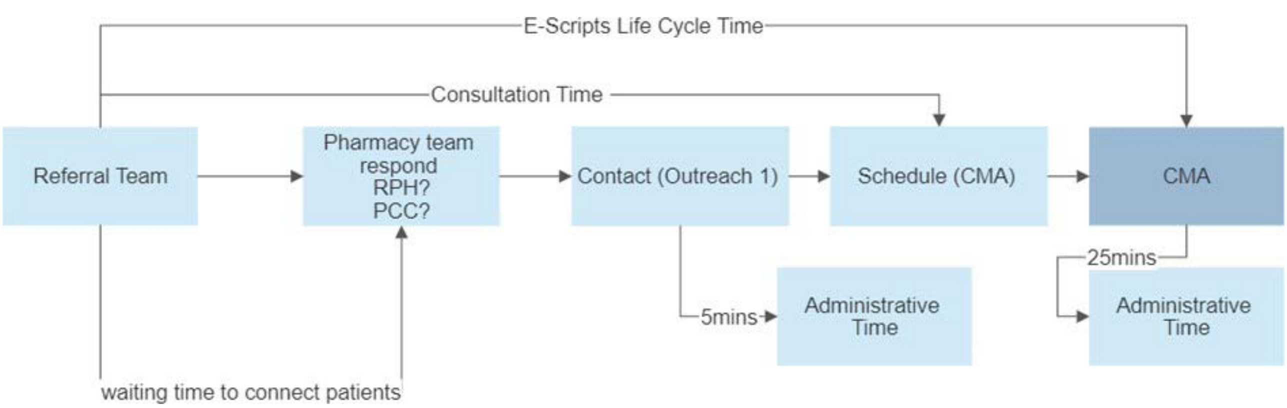


Figure 2.4: e-Script data flow process.

2.4.1.3 RxHub Model

Video calls have become an effective means of connecting patients with empowerment care plans, enabling remote communication and engagement in health care services. Through video calls, health care providers can establish visual and auditory connections with patients, creating a more personal and interactive experience (Lewis, 2002). This medium allows for face-to-face interactions, facilitating a sense of trust, empathy, and understanding between providers and patients (Perle et al., 2013). Video calls provide an opportunity for comprehensive assessments, where providers can observe non-verbal cues, conduct visual examinations, and address patients' concerns in real-time (Totten et al., 2016). Moreover, video calls eliminate geographical barriers and can be particularly beneficial for patients in remote or underserved areas, ensuring access to specialized care and support (Lewis 2002). By utilizing video calls as a referral method, health care providers can effectively connect patients with empowerment care plans, fostering collaboration, empowerment, and improved patient outcomes.

The pharmaceutical company continues to build relationships through partnerships with PCPs and engage them more, such as through a new integration hub that facilitates connecting patients with PCPs. The model begins in primary care clinics (PCCs), where patients complete their treatments. Then the PCP presents the empowerment care plan that the company offers, and if the patient is interested, the PCP connect the patient to the company's pharmaceutical team through the Catalyst One app by sending a message to the pharmaceutical team. Once the pharmaceutical team receives the message, they will initiate a video call with the patient and schedule an appointment for a full care plan. If the patient then agrees to the recording, they will be prompted to download the app. Figure 2.5 shows the model; while Figure 2.6 shows the data flow of the model.

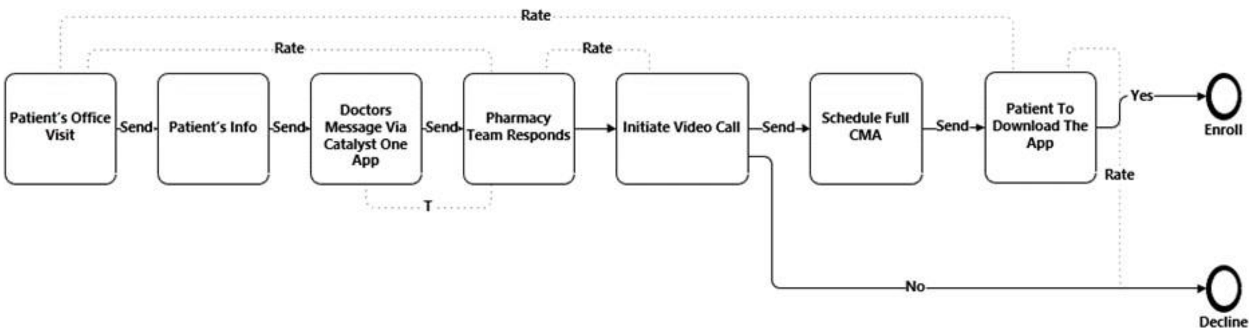


Figure 2.5: RxHub model

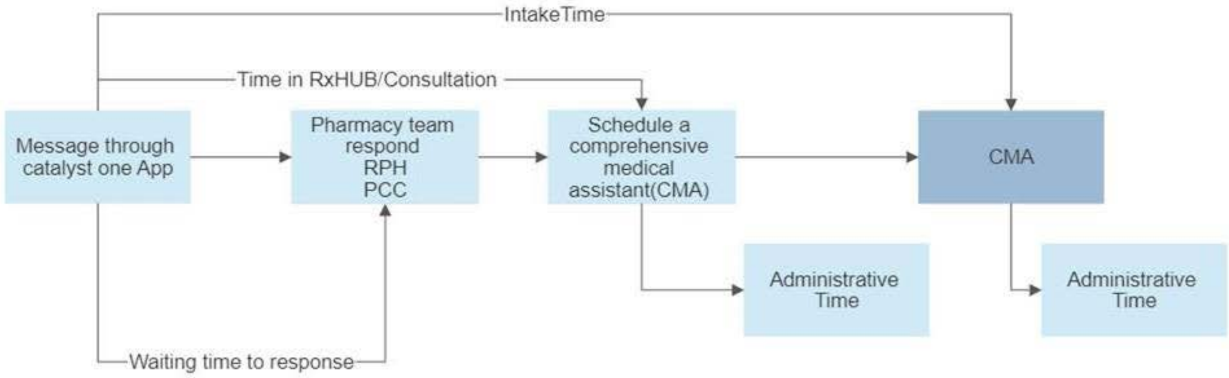


Figure 2.6: RxHub model data flow process.

2.4.2 Model Logic and Parameters

AnyLogic University 8.8 was utilized to construct three models in this study: the 3-calls outreach model, the e-script model, and the RxHub model. These models were developed to analyze and optimize different aspects of the health care system. The choice of AnyLogic was also driven by its visual interface, which enabled effective communication of the model findings to stakeholders in the health care system (Possik et al., 2022). The development of the model logic involved iterative consultations with health care staff and stakeholders. To ensure accuracy and realism, a combination of expert opinion and company data was incorporated into the model logic and parameterization. The model parameters were derived by utilizing data collected from the system during the period between July 2019 and July 2022.

The model focuses on patients who are referred to orthopedic services, serving as the entities within the simulation. To simplify the model and align with its objectives, the assumption is made that patients do not possess attributes such as age or priority grouping that would impact their progression through the system. This assumption is deemed appropriate as these attributes are not relevant to the specific modeling objectives, allowing for a reduction in model complexity. The routing logic for patients in the simulation model is presented in Table 2.2. This logic is established by utilizing a percentage profile derived from company data to determine the patient routing pathways for all models.

In the 3-calls outreach model, the rate of individual patient contact is set at 20 per week. The resources involved in the model include a CPhT responsible for data entry and three outreach tasks. The time for each task follows a triangular distribution with ranges between 20 and 30 minutes. The decline rate for patients unable to connect is sourced from company data, with specific rates for various reasons such as financial reasons, network restrictions, and lack of interest in the care plan.

For the e-script and RxHub models, the average rate of individual patient contact is set at 14.5 per week. In the e-script model, a CPhT is involved in call-related tasks (delay or already in a call) with associated triangular time distributions. The probability of patient engagement with an RPh is estimated at 0.74 based on expert opinion. The decline rates for patient non-empowered are provided for different reasons such as being unable to connect, financial reasons, network restrictions, not being an optimal candidate, and lack of interest in the care plan.

In the RxHub model, patient engagement probabilities for CPhT and PhT are specified at 0.05 and 0.57, respectively. The probability of patients being engaged with both CPhT and PhT is set at 0.25. The decline rate for non-answering calls and other reasons follows a triangular distribution sourced from company data. The in-call and consultation times for the RPh are also represented by triangular distributions.

Table 2.2: Simulation Parameters

Resource	Task or Reason	Time (min) or Rate (%)
3-Calls Outreach Model: Patient Referral Rate = 20/week)		
CPhT	Data entry	Triangular (10, 18, 12)
	1st outreach	Triangular (20, 30, 25)
	2nd outreach	Triangular (20, 30, 25)
	3rd outreach	Triangular (20, 30, 25)
RPh	RPh appointment	Triangular (60, 120, 75)
Reason Given to Decline	Unable to connect	0.48
	Financial reasons	0.016
	Network restrictions	0.1145
	Not optimal candidate	0.043
	Not interested in care plan	0.48
e-Script Model: Patient Referral Rate= 14.5 per week		
CPhT	Delay	Triangular (2, 60, 10)
	In call	Triangular (7, 15, 10)
Probability of patient to engage with RPh*		0.74
Reason Given to Decline	Unable to connect	0.26
	Financial reasons	0.07
	Network restrictions	0.09
	Not optimal candidate	0.09
	Not interested in care plan	0.47
RxHub Model: Patient Referral Rate = 14.5 per week		
CPhT	Delay	Triangular (1, 3, 2)
	In call	Triangular (1, 10, 7)
RPh	In call	Triangular (7, 15, 10)
	Consultation	Triangular (25, 45, 30)
Probability of patient to…	Engage with CPhT	0.05
	Engage with PhT	0.57
	Engage with both	0.25
	No engagement**	0.13
Reason Given to Decline	Unable to connect	0.244
	Financial reasons	0.115
	Network restrictions	0.173
	Not optimal candidate	0.181
	Not interested in care plan	0.47

*Based on expert opinion. **No engagement = Patient declines call or does not answer.

2.5 Design of Experiment

The study employed the design of experiments (DOE) methodology to optimize patient waiting time in the hub model. DOE allowed for a systematic exploration of various factors and their interactions to identify influential variables and determine optimal settings (Atalan & Donmez, 2020). Through carefully designed experiments, researchers assessed the impact of parameters such as resource capacities, appointment scheduling strategies (priorities to assign resources), and patient flow management techniques on waiting time (Ordu et al., 2021). The objective was to enhance the overall efficiency and effectiveness of health care delivery by reducing patient wait time in the RxHub model.

Table 2.3: Experimental Design

Factor	Referral Rate	Treatment Label	Level
Number of Certified Pharmacy Technicians		A	5
Number of Registered Pharmacists		B	3
Arrival Rate		C	
RxHub Priority		D	5
e-Script Priority			5
3-Calls Outreach Priority			5
RxHUB & e-Script	14.5		3
Total Number of Experiments			5625

By utilizing DOE, the study captured the intricate relationships and interactions among factors in the RxHub model, providing data-driven insights for evidence-based decision-making (Box et al., 2005). The structured nature of DOE facilitated the identification of significant factors and their optimal levels, enabling the design and implementation of interventions to effectively minimize patient wait time (Atalan & Donmez, 2020). Statistical techniques such as ANOVA and regression analysis were employed to analyze experimental data and develop predictive models to guide decision- making processes (Box et al., 2005). These approaches allowed researchers to identify the most influential factors impacting patient wait time and develop strategies for its reduction in the RxHub model. The levels of the experimental factors employed in the DOE are summarized in Table 2.3. These levels represent different settings and combinations of parameters such as resource capacities, appointment scheduling strategies, and patient flow management techniques, which were systematically varied to assess their impact on patient wait time in the hub model.

2.6 Model Verification and Validation

The primary output of interest in the simulation model was the average wait time for a patient to get contacted through RxHUB model. Four years of simulated time was examined. Model verification was conducted to ensure the accurate translation of the conceptual model into the AnyLogic software (Banks et al., 2000). This verification process involved several steps: (i) maintaining updated documentation throughout the model construction, (ii) examining the model output with variations in input parameter distributions to validate expected behavior, and (iii) utilizing the visual interface of AnyLogic to visually inspect the model logic in collaboration with the company staff and stakeholders.

In addition, it is worth mentioning that the DOE involved 30 replications for each factor in order to ensure statistical robustness and reliability of the findings (Atalan & Donmez, 2020). This replication process allowed researchers to observe the effects of the experimental factors on patient waiting time across multiple iterations, thereby enhancing the validity of the results, and providing more accurate insights into the optimization of the RxHub model.

2.7 Results

Table 2.4 presents a four-way ANOVA analysis, detailing the effects of variables Treat A (nCPhTs), Treat B (nRPhs), Treat C (arrival rate), and Treat D (RxHub-P) as well as their interactions on the dependent variable, patient wait time. Each variable and interaction are analyzed for their sum of squares, degrees of freedom, mean square, F-value, and significance (Sig.). The main effects of the four variables are all highly significant, with p-values less than 0.001. Treat A has a significant effect ($F = 895.687$, $p < .001$) on the dependent variable. Treat B also significantly influence the dependent variable ($F = 664.871$, $p < .001$). Treat C presents a very strong effect ($F = 13651.72$, $p < .001$), as does Treat D ($F = 5136.938$, $p < .001$). The two-way interactions between the variables also reveal significant effects. Notably, the interaction between Treat C and Treat D presents a strong effect ($F = 1306.091$, $p < .001$). The three-way and four-way interactions among these variables, while having smaller F-values, are still significant ($p < .001$). This suggests that these combinations of variables interact to significantly impact the dependent variable, albeit less so compared to the two-way interactions and the individual variables. The sum of squares for the corrected model and the error, along with the total, are also presented, providing a basis for the computation of the various effects and interactions. This information is critical in understanding the variance explained by each factor and their interactions, and how they contribute to the dependent variable.

A comprehensive overview of mean patient wait time, decision variables, nCPhT, nRPh, RxHub-P, and arrival rate across different treatment levels is found in Appendix 2.1. To simplify the referencing of different combinations of treatment levels and their interactions, a shorthand notation is used. Levels are denoted by a numeric designation following the relevant treatment. For example, A1B1C2 represents Treat A Level 1, Treat B Level 1, and Treat C Level 2. If no numeric designation follows a treatment, it indicates that all levels of that treatment are considered. Hence, A2BC2 refers to Treat A Level 2 and Treat C Level 2, while considering all levels of Treat B. AB1C refers to Treat B Level 1, considering all levels of Treats A and C. With this notation established, the analysis proceeds by first focusing on the discussion of main effects, followed by the exploration of interaction effects.

Table 2.4: ANOVA Results: Dependent Variable = Mean Patient Wait Time

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	363626812.466[a]	224	1623334.0	312.834	<.001
Intercept	2.79E+08	1	2.79E+08	53769.4	<.001
Treat A (nCPhT)	18591294.0	4	4647824.0	895.687	<.001
Treat B (nRPh)	6900189.0	2	3450095.0	664.871	<.001
Treat C (arrival rate)	1.42E+08	2	70840366.0	13651.72	<.001
Treat D (RxHub-P)	1.07E+08	4	26656180.0	5136.938	<.001
Two way interaction					
Treat A * Treat B	574978.3	8	71872.29	13.851	<.001
Treat A * Treat C	11105230.0	8	1388154.0	267.512	<.001
Treat A * Treat D	8997277.0	16	562329.8	108.367	<.001
Treat B * Treat C	4932273.0	4	1233068.0	237.626	<.001
Treat B * Treat D	1060428.0	8	132553.6	25.545	<.001
Treat C * Treat D	54219686.0	8	6777461.0	1306.091	<.001
Three way interaction					
Treat A * Treat B * Treat C	479666.0	16	29979.12	5.777	<.001
Treat A * Treat B * Treat D	578523.1	32	18078.85	3.484	<.001
Treat A * Treat C * Treat D	5590633.0	32	174707.3	33.668	<.001
Treat B * Treat C * Treat D	794820.6	16	49676.29	9.573	<.001
Four way interaction					
Treat A * Treat B * Treat C * Treat D	561555.3	64	8774.302	1.691	<.001
Error	3.44E+08	66301	5189.118		
Total	9.86E+08	66526			
Corrected Total	7.08E+08	66525			

Treat A = number of CPhTs; Treat B = number of RPhs; Treat C = arrival rate; Treat D = RxHub Priority. a. R Squared = .514 (Adjusted R Squared = .512)

2.7.1 Treatment A: Number of CPhTs

Figure 2.7 showcases the primary effect estimates for Treat A on the dependent variable mean patient wait time. It is observed that the mean wait time undergoes a decrease with an increase in the number of CPhTs. More specifically, each additional CPhT contributes to a diminished mean wait time. When there is only one CPhT present, the mean wait time is at 97.329 minutes (95% CI: 95.773 - 98.885), while the presence of 5 CPhTs reduces it to 54.493 minutes (95% CI: 52.914 - 56.072). These observations imply that a rise in the number of CPhTs can substantially lower the mean waiting time within the RxHub system. This is in line with the scenario represented by AB0C0D1.

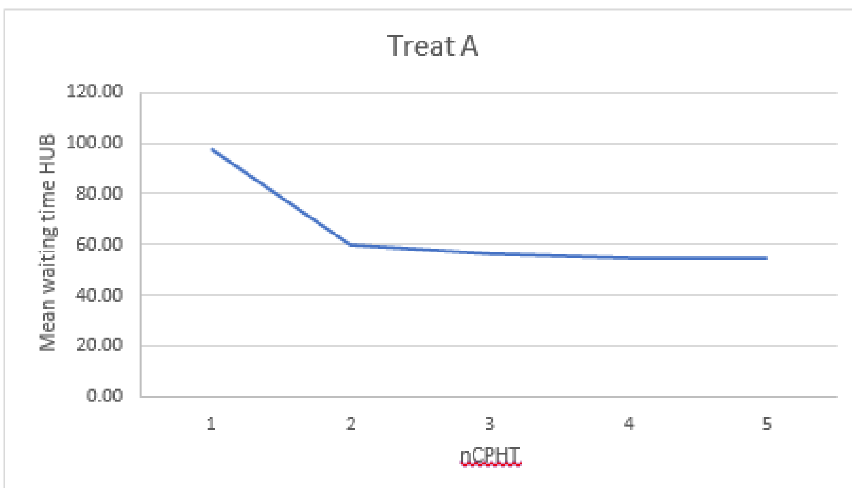


Figure 2.7: Mean patient wait time vs Treat A.

Figure 2.8 presents the interactive effect estimates of variables Treat A and Treat B on the dependent variable mean patient wait time. The combined effects of Treat A and Treat B significantly impact the mean wait time. The data indicates that an increase in the number of both CPhTs (Treat A) and RPhs (Treat B) leads to a decrease in the mean wait time. For instance, under conditions A1B1C0D1, the mean wait time clocks in at 119.894 minutes (95% CI: 117.197 - 122.591). However, when conditions shift to A2B2C0D1, the mean wait time significantly reduces to 47.555 minutes (95% CI: 44.792 - 50.318). These observations emphasize the interactive influences of Treat A and Treat B on decreasing the mean patient wait time within the system.

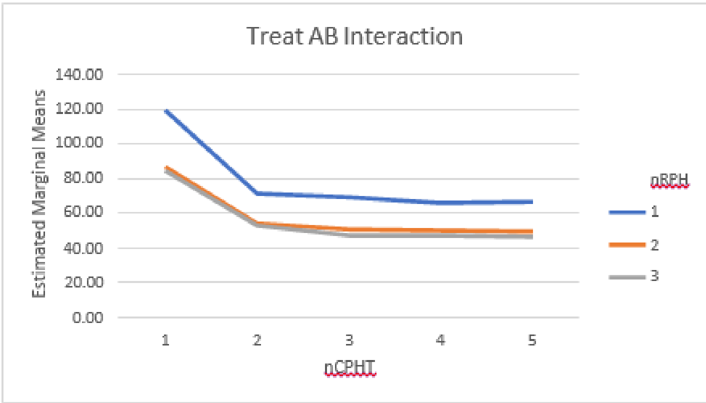


Figure 2.8: Treat A and Treat B interaction.

The interplay between variables Treat A and Treat C and its impact on the dependent variable, mean patient wait time, is graphically represented in Figure 2.9. The interaction of Treat A and Treat C significantly affects the average wait time in the system. Taking A1B0C0D1 as an example, the mean wait time stands at 160.065 minutes (95% CI:157.343 - 162.788). However, when transitioning to A1B0C1D1, the average wait time drops to 154.258 minutes (95% CI: 151.545 - 156.971). This declining trend persists with subsequent reductions in the mean wait time under AB0C2D1, AB0C3D1, and AB0C4D1 conditions.

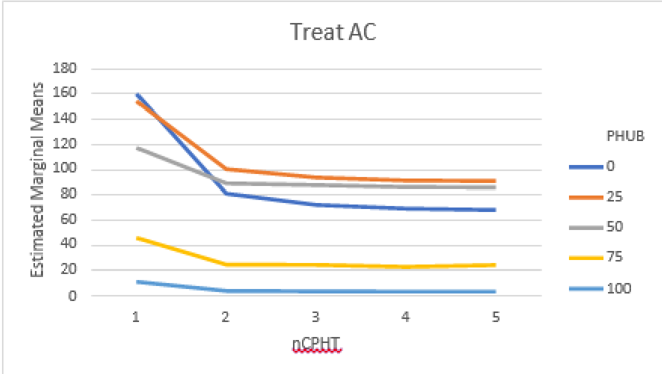


Figure 2.9: Treat A and Treat C interaction.

In the case of having 2, 3, 4, or 5 CPhTs, the interactive influences between Treat A and Treat C exhibit a consistent pattern. An increase in RxHub utilization corresponds with a decrease in the mean wait time. These results emphasize the necessity of taking into account the interaction between Treat A and Treat C to effectively reduce the mean patient wait time in the system.

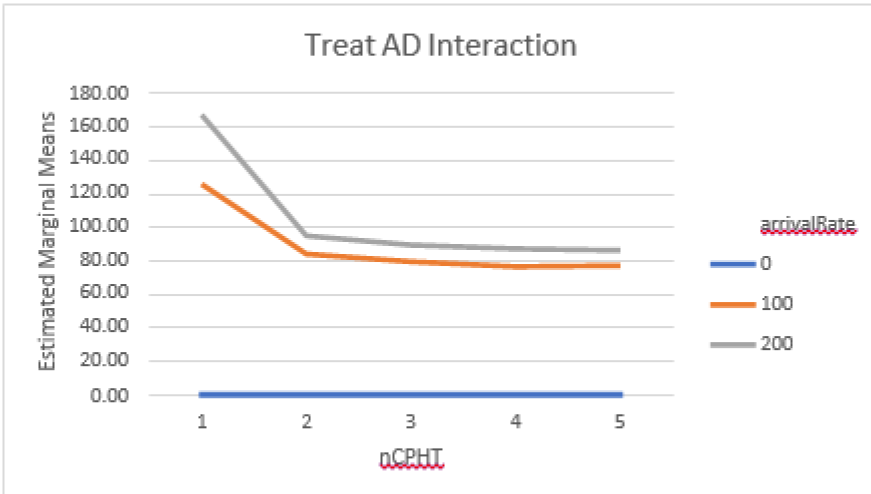


Figure 2.10: Treatment A and D interaction.

Lastly, the interactive impacts of variables Treat A and Treat D on the dependent variable "meanWaitingToCallTime hub" are illustrated in Figure 2.10. For example, under AB0C0D1, the mean waiting time is 0.0 minutes (95% CI: -1.796 - 2.393), indicating no effect as there were no arriving patients. However, as Treat C increases, for example under A1B0C0D1, the mean waiting time elevates to 126.001 minutes (95% CI: 123.889 - 128.113). This upward trend persists with further increments in Treat C. A1B0C0D2, resulting in a mean waiting time of 167.344 (95% CI: 165.235 - 169.453).

2.7.2 Treatment B: Number of RPhs

Figure 2.11 showcases the main effect estimates of Treat B on the dependent variable, mean patient wait time. As the number of RPhs rises, there's a noticeable reduction in mean wait time. For instance AB1CD, the mean wait time is observed at 78.889 minutes (95% CI: 77.684 - 80.095). However, at AB2CD, the mean wait time falls to 55.993 minutes (95% CI: 54.760 - 57.226). This data infers that amplifying the number of RPhs can notably aid in diminishing the mean wait time in the RxHub system, a finding that aligns with the A0BC0D1 model.

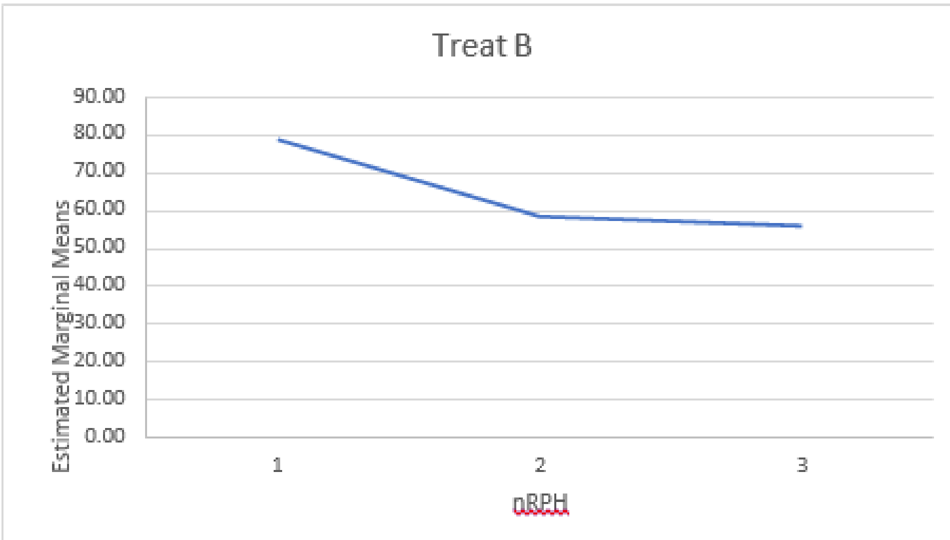


Figure 2.11: Mean patient wait time vs Treatment B.

Figure 2.12 displays the estimates for the main effect of variables Treat B and Treat C on the dependent variable, mean patient wait time. These estimates represent the mean wait time corresponding to various combinations of RPh quantity within different priority levels of the RxHub model. Take, for instance, AB1C0D1, where the mean waiting time records at 111.399 minutes (95% CI: 109.288 - 113.510). As Treat C level shifts from 0 to 4 (as seen in AB1C1D1, AB1C2D1, AB1C3D1, and AB1C4D1), the mean wait time spans from 124.698 to 10.201 minutes, respectively. Likewise, for configurations with 2 and 3 RPhs, the main effects of Treat A and Treat C follow a similar trend. The mean patient wait time for phone calls fluctuates based on the levels of Treat B and Treat C.

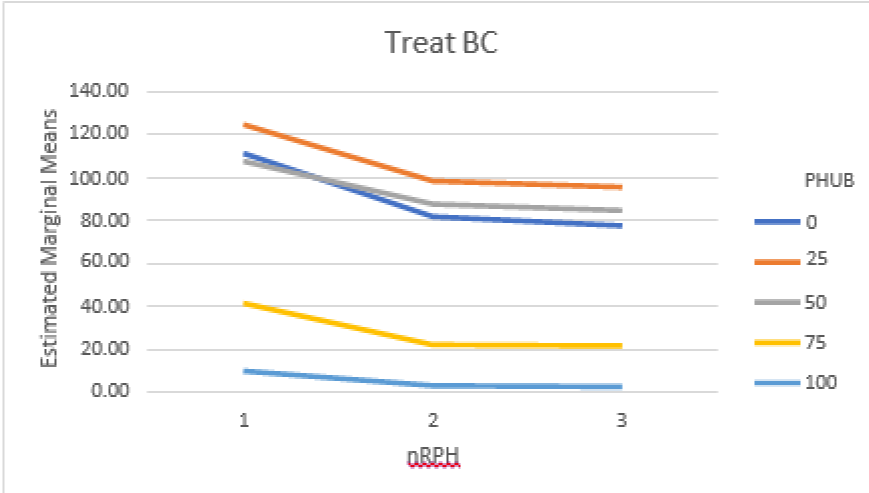


Figure 2.12: Treat B and Treat C interaction.

Finally, the interaction effect between Treat C and Treat D on the dependent variable is displayed in Figure 2.13. Results indicate that increasing number of patient arrivals corresponds to increasing mean patient wait time. For instance, AB1CD1 the mean waiting time is 101.911 (95% CI: 100.276 - 103.545). This trend continues with further increases in ABCD2, resulting in a mean wait time of 134.967 (95% CI: 133.335 - 136.600).

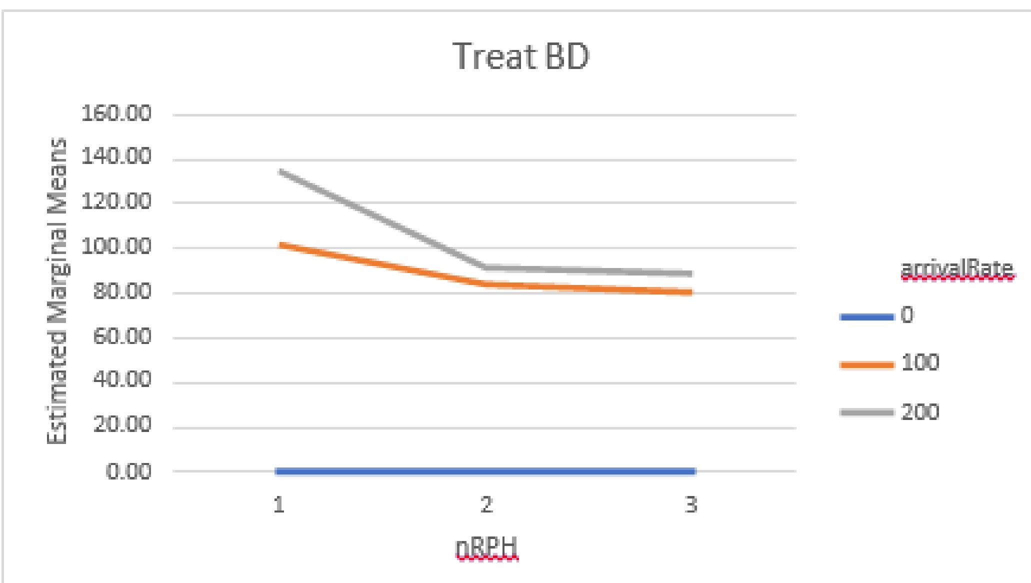


Figure 2.13: Treat B and Treat D interaction.

2.7.3 Treatment C: Patient Arrival Rate

The main effect of the variable Treat C on the dependent variable, mean patient wait time, is illustrated in Figure 2.14. Treat C notably influences the mean wait time.

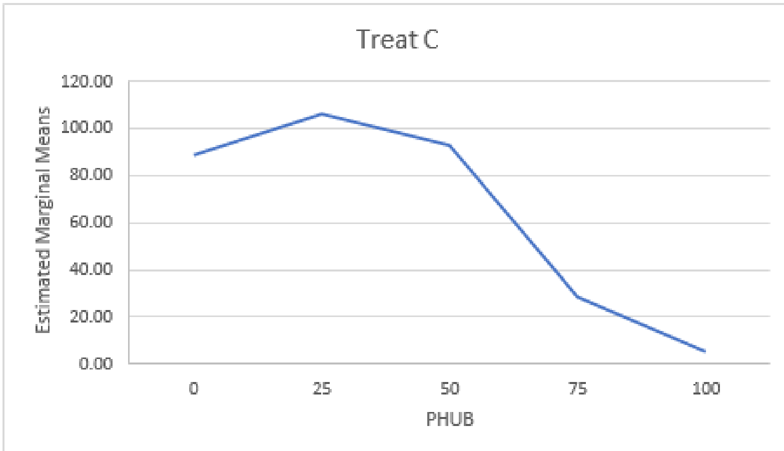


Figure 2.14: Treat C main effect.

When applied to ABC0D1, the mean wait time registers at 90.356 minutes (95% CI: 89.131 - 91.582). However, under ABC1D1 conditions, the wait time elevates to 106.249 minutes (95% CI: 105.027 - 107.471). On the other hand, with ABC2D1, there’s a significant dip in the mean wait time to 28.641 minutes (95% CI: 27.418 - 29.865). Even greater reductions are observed under ABC3D1, where mean wait time becomes 5.436 minutes (95% CI: 4.211 - 6.661). These observations imply that implementing RxHub priority could significantly decrease the mean patient wait time in the system.

The interactive effects of variables Treat C and Treat D on the dependent variable, mean patient wait time, are exhibited in Figure 2.15. This interaction is impactful to the mean patient wait time in the system. For instance, with ABC0D0, the mean wait time records at 1.740 minutes (95% CI: -0.345 - 3.825), indicating a modest effect, likely due to resources being engaged with patients in the 3-calls outreach model. Yet, under ABC1D1, wait time expands to 118.436 minutes (95% CI: 116.289 - 120.582). This upward trend persists with further increments in ABC0D2, yielding a mean waiting time of 150.894 minutes (95% CI: 148.757 - 153.031).

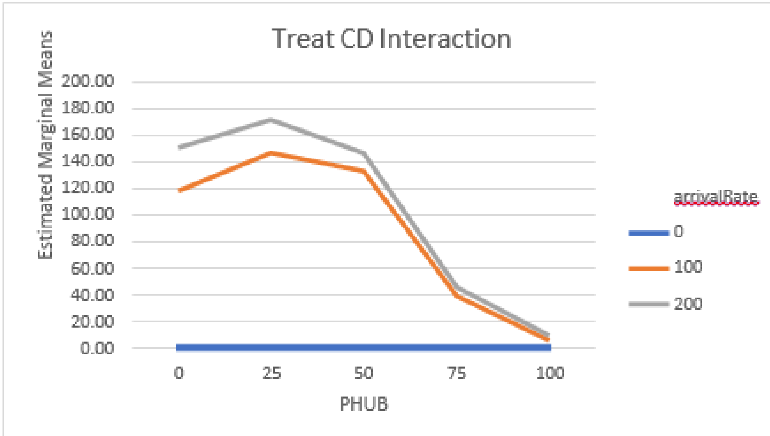
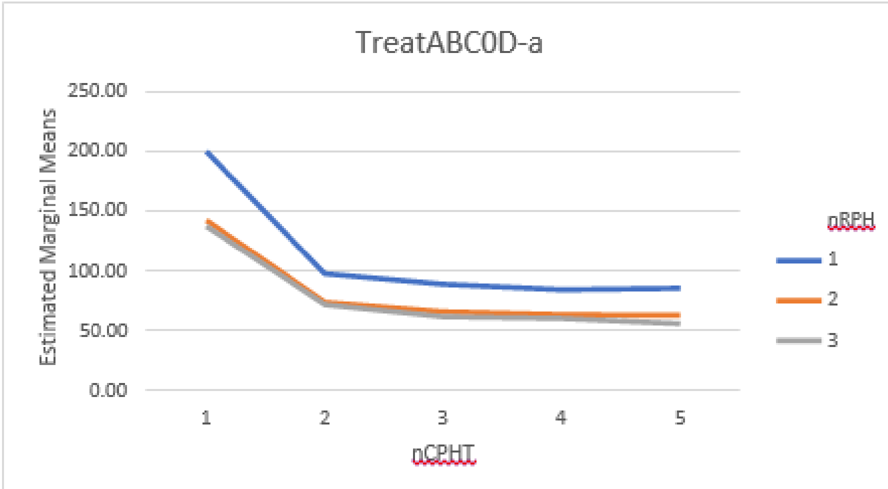


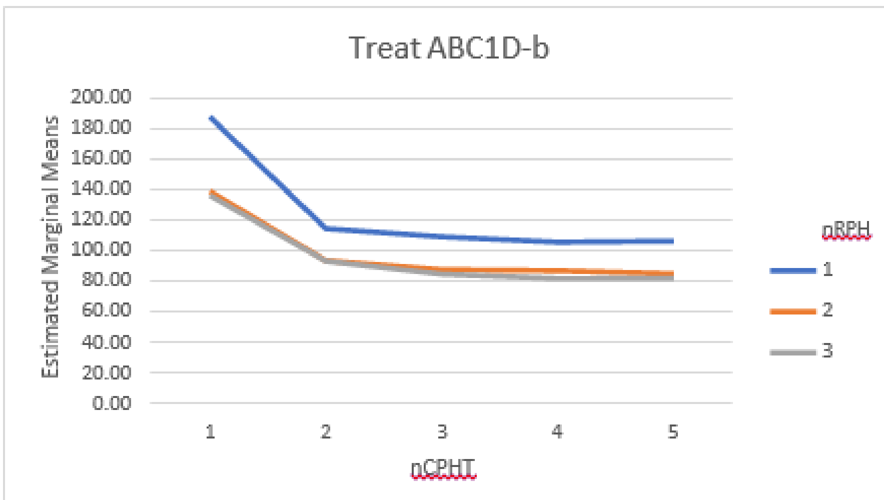
Figure 2.15: Treat C and Treat D interaction.

The interactive impacts between Treat C and Treat D under ABC1D, ABC2D, ABC3D, and ABC4D demonstrate various patterns. The mean patient wait time fluctuates based on RxHub priority and patient arrival rate. These findings underscore the importance of considering the interaction between Treat C and Treat D for effective management of the mean patient wait time in the system.

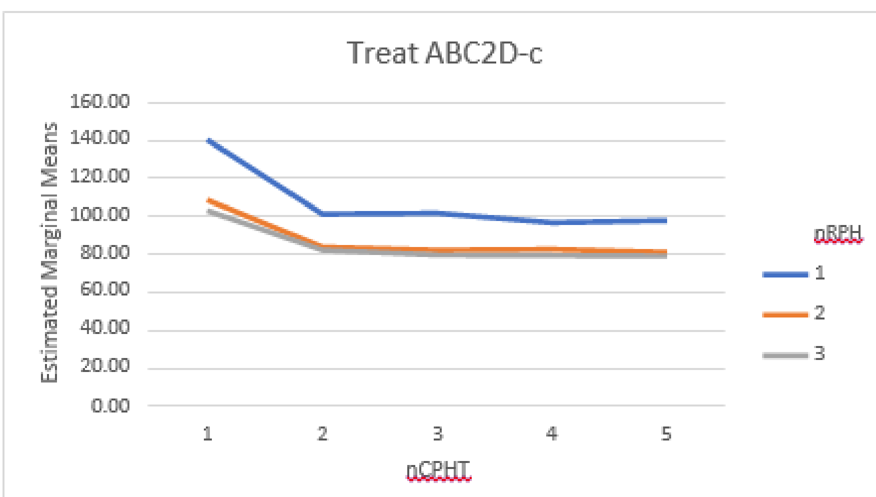
The interactive effects of Treats A, B, and C on the dependent variable, mean patient wait time, are demonstrated in Figure 2.16 (a-e). The interplay among these variables provides insights into how their collective impact influences the system's mean wait time. For instance, when the conditions are A1B0C0D1, the system's mean wait time stands at 200.135 (with a 95% confidence interval of 195.443 - 204.828). However, under the conditions A2B0C1D1, the mean wait time notably decreases to 38.862 (95% CI: 34.158 - 43.567). The interaction of variables like quantity of CPhTs and RPhs, and RxHub priority also result in a range of mean wait times, demonstrating how the combined effects of these variables critically shape the management of the system's mean patient wait time.


TreatABC0D-a
Estimated Marginal Means
250.00
200.00
150.00
100.00
50.00
0.00
1
2
3
4
5
nCPHT
nRPH
1
2
3

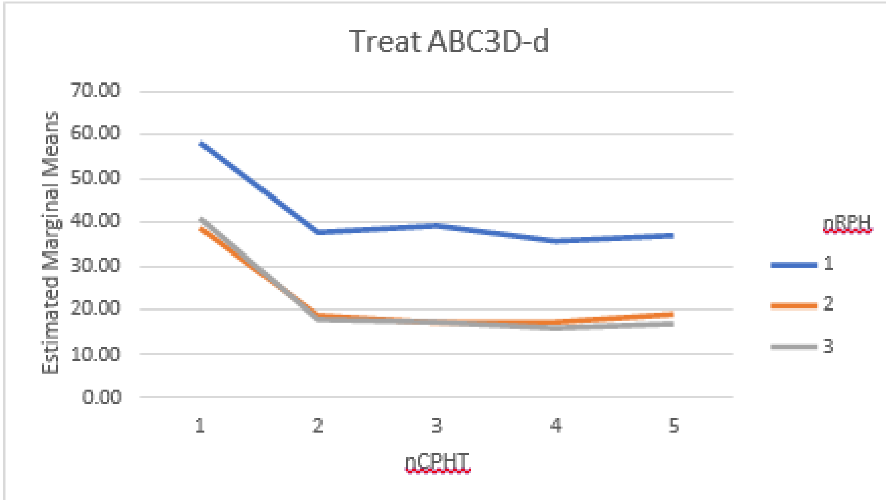
(a)


Treat ABC1D-b
Estimated Marginal Means
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1
2
3
4
5
nCPHT
nRPH
1
2
3

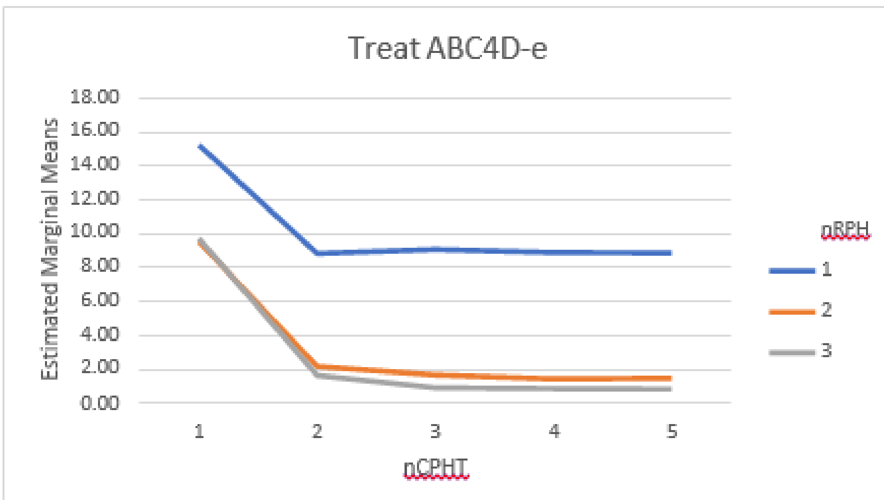
(b)


Treat ABC2D-c
Estimated Marginal Means
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1
2
3
4
5
nCPHT
nRPH
1
2
3

(c)



(d)



(e)

Figure 2.16: Treat A and Treat B and Treat C interaction.

2.8 Conclusions, Managerial Implications, and Future Research

In conclusion, the objective of this study was to evaluate the impact of minimizing waiting time on patient enrollment in empowerment care plans by utilizing discrete event simulation and developing a simulation model to replicate the patient flow and processes within a health care system. The study used simulation models to evaluate different configurations and process changes in health care supply chain design to optimize system performance and achieve strategic objectives. Additionally, various methods such as e-scripts, phone calls, and video calls were employed to connect patients to enroll them in empowerment care plans. Effectively connecting patients to empowerment care plans through means such as e-scripts, phone calls, and video calls is crucial for increasing patient engagement and fostering better health outcomes (Hong et al., 2014; McGillicuddy et al., 2013; Wade et al., 2012). Alongside these, the minimization of patient waiting time proves indispensable for elevating patient satisfaction and the efficiency of health care delivery, with extended waiting periods potentially leading to decreased adherence to care plans and delayed treatments (Fung et al., 2008; Sun et al., 2014). These results should serve as a guide for health care providers seeking to enhance patient engagement, improve access to care, and optimize health care service delivery.

Future research should continue to investigate and evaluate the impact of wait times on patient enrollment in empowerment care plans. Techniques like DES could provide valuable insights into the effects of reducing wait times on patient satisfaction, engagement, and successful enrollment rates. Additionally, such research could further explore the use of video calls and other telehealth technologies, and their implications for patient access and engagement, particularly in underserved and remote areas. Furthermore, investigating the role of personalized approaches in patient care, such as individualized phone calls, could yield fruitful insights into enhancing patient-provider relationships and health outcomes.

2.8.1 Practical Implications

- *Connecting patients to empowerment care plans*: The practical implications of connecting patients to empowerment care plans through e-scripts, phone calls, and video calls are significant. These methods provide health care providers with efficient channels for engaging and enrolling patients in care plans. e-Scripts streamline the prescription process, enhancing medication adherence and facilitating enrollment in empowerment care initiatives (Nafradi et al., 2017). Personalized phone calls and video calls allow for direct communication, enabling health care providers to address patient concerns, educate patients about their conditions, and promote active participation in care plans (Hong et al., 2014; Wade et al., 2012). These practical implications highlight the importance of leveraging technology and personalized communication to enhance patient engagement and enrollment in empowerment care plans.

- M*inimizing wait time to increase enrollment:* Minimizing wait time in health care settings has several practical implications for increasing patient enrollment in empowerment care plans. By reducing waiting times, health care providers can improve the patient experience, enhance patient satisfaction, and foster patient engagement (Lacy et al., 2004; Song et al., 2013). A positive patient experience and increased satisfaction contribute to higher patient compliance and willingness to participate in care plans (Siamisang et al., 2020; Li et al., 2021).

These practical implications emphasize the significance of efficient processes, optimized workflows, and strategies to minimize wait times to encourage patient enrollment and engagement in empowerment care initiatives.

2.8.2 Theoretical Implications

- *Connecting patients to empowerment care plans*: From a theoretical perspective, connecting patients to empowerment care plans advances the concept of patient- centered care and shared decision-making. e-Scripts, phone calls, and video calls empower patients by providing them with access to information, resources, and support necessary for active participation in their health care decisions (Hong et al., 2014; Wade et al., 2012). Theoretical frameworks that emphasize patient autonomy, involvement, and empowerment are reinforced through these methods, contributing to the ongoing evolution of patient-centered care models.

- *Minimizing wait time to increase enrollment*: Theoretical implications of minimizing wait time to increase enrollment in empowerment care plans revolve around enhancing health care service quality and patient-centeredness. By prioritizing efficiency and minimizing waiting times, health care providers align with theories of value-based care and patient satisfaction (Lacy et al., 2004; Song et al., 2013). The reduction of waiting times contributes to improved patient experiences, enhanced patient satisfaction, and increased patient engagement. These theoretical implications highlight the importance of incorporating patient perspectives and preferences into health care delivery systems.
- *Integration of simulation and discrete event simulation:* The integration of simulation and discrete event simulation in evaluating the practical and theoretical implications of connecting patients to empowerment care plans and minimizing wait times offers valuable insights.

Simulation provides a controlled environment for studying complex health care systems, allowing researchers to explore different scenarios and assess the impact of interventions (Rejeb et al., 2018). Discrete event simulation, in particular, enables the modeling of patient flow, process optimization, and resource allocation, providing a holistic view of the health care system (Banks et al., 2021). By utilizing this methodology, researchers can generate evidence-based recommendations to enhance patient enrollment in empowerment care plans and optimize health care service delivery.

2.9 References

Aboueljinane, L., Sahin, E., & Jemai, Z. (2013). A review on simulation models applied to emergency medical service operations. *Computers & Industrial Engineering*, *66*(4), 734-750. https://doi.org/10.1016/j.cie.2013.09.017

Agner, J., & Braun, K. L. (2018). Patient empowerment: A critique of individualism and systematic review of patient perspectives. *Patient Education and Counseling*, *101*(12), 2054-2064. https://doi.org/10.1016/j.pec.2018.07.026

Ahmed, M. A., & Alkhamis, T. M. (2009). Simulation optimization for an emergency department health care unit in Kuwait. *European journal of operational research*, *198*(3), 936-942. https://doi.org/10.1016/j.ejor.2008.10.025

Aiken, L. H., Sermeus, W., Van Den Heede, K., Sloane, D. M., Busse, R., McKee, M., Bruyneel, L., Rafferty, A. M., Griffiths, P., Moreno-Casbas, T., Tishelman, C., Pearce, S., Brzostek, T., Kinnunen, J., Schwendimann, R., Heinen, M., Zikos, D., Sjetne, I. S., Smith, H. L., & Kutney-Lee, A. (2012). Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States. *BMJ*, *344*(mar20 2), e1717. https://doi.org/10.1136/bmj.e1717

Andino, J. J., Castaneda, P., Shah, P., & Ellimoottil, C. (2021). The impact of video visits on measures of clinical efficiency and reimbursement. *Urology Practice*, *8*(1), 53–57. https://doi.org/10.1097/upj.0000000000000149

Andreassen, H.K. and Trondsen, M. (2010) The empowered patient and the sociologist, Social Theory & Health, 8, 3, 280– 7.

Atalan, A., & Dönmez, C. Ç. (2020). OPTIMIZING EXPERIMENTAL SIMULATION DESIGN FOR THE EMERGENCY DEPARTMENTS. *Brazilian Journal of Operations & Production Management*, *17*(4), 1–13. https://doi.org/10.14488/bjopm.2020.026

Bailo, L., Guiddi, P., Vergani, L., Marton, G., & Pravettoni, G. (2019). The patient perspective: investigating patient empowerment enablers and barriers within the oncological care process. *Ecancermedicalscience*, *13*. https://doi.org/10.3332/ecancer.2019.912

Bair, A. E., Song, W. T., Chen, Y. C., & Morris, B. A. (2010). The impact of inpatient boarding on ED efficiency: a discrete-event simulation study. *Journal of medical systems*, *34*, 919-929.

Banks, J., Carson, J. S., & Nelson, B. L. (2000). DM Nicol. *Discrete-Event System Simulation*.

Bates, D. W., Saria, S., Ohno-Machado, L., Shah, A., & Escobar, G. (2014). Big data in health care: using analytics to identify and manage high-risk and high-cost patients. *Health affairs*, *33*(7), 1123-1131. https://doi.org/10.1377/hlthaff.2014.0041

Bell, A. M., Fonda, S. J., Walker, M., Schmidt, V., & Vigersky, R. A. (2012). Mobile Phone-Based Video Messages for Diabetes Self-Care support. *Journal of Diabetes Science and Technology*, *6*(2), 310–319. https://doi.org/10.1177/193229681200600214

Biagio, L., Swanepoel, D. W., Adeyemo, A. A., Hall, J. W., & Vinck, B. (2013). Asynchronous Video-Otoscopy with a Telehealth Facilitator. *Telemedicine Journal and E-health*, *19*(4), 252–258. https://doi.org/10.1089/tmj.2012.0161

Bishop, A., Baker, G. R., Boyle, T. A., & MacKinnon, N. J. (2014). Using the health belief model to explain patient involvement in patient safety. *Health Expectations*, *18*(6), 3019–3033. https://doi.org/10.1111/hex.12286

Biya, M., Gezahagn, M., Birhanu, B., Yitbarek, K., Getachew, N., & Salgedo, W. B. (2022). Waiting time and its associated factors in patients presenting to outpatient departments at Public Hospitals of Jimma Zone, Southwest Ethiopia. *BMC Health Services Research*, *22*(1). https://doi.org/10.1186/s12913-022-07502-8

Box, G. E., Hunter, W. G., Hunter, J. S., & Hunter, W. G. (2005). Statistics for Experimenters: Design, Innovation, and Discovery, (Wiley). *New Jersey*.

Bradley, E. H., Curry, L. A., & Devers, K. J. (2007). Qualitative data analysis for health services research: developing taxonomy, themes, and theory. *Health services research*, *42*(4), 1758-1772. https://doi.org/10.1111/j.1475-6773.2006.00684.x

Busse, R. D., Healy, A., Krasnik, J., León, A., Paris, S., Polton, V., & Signild Vrangbaek, K. (2002). Health care systems in eight countries: trends and challenges.

Castro, E. M., Van Regenmortel, T., Vanhaecht, K., Sermeus, W., & Van Hecke, A. (2016). Patient empowerment, patient participation and patient-centeredness in hospital care: A concept analysis based on a literature review. *Patient education and counseling*, *99*(12), 1923-1939. https://doi.org/10.1016/j.pec.2016.07.026

Chen, P. S., & Lin, M. H. (2017). Development of simulation optimization methods for solving patient referral problems in the hospital-collaboration environment. *Journal of biomedical informatics*, *73*, 148-158. https://doi.org/10.1016/j.jbi.2017.08.004

Chui, M. A., Mott, D. A., & Maxwell, L. (2012). A qualitative assessment of a community pharmacy cognitive pharmaceutical services program, using a work system approach. *Research in Social and Administrative Pharmacy*, *8*(3), 206-216. https://doi.org/10.1016/j.sapharm.2011.06.001

Dehghanian, F., Mansouri, S. A., & Hassini, E. (2020). Supply chain risk management in health care: A review. Computers & Industrial Engineering, 144, 106451.

Essoussi, I. E., Masmoudi, M., & Babai, M. Z. (2023). Multi-criteria decision-making for collaborative COVID-19 surge management and inter-hospital patients' transfer optimisation. *International Journal of Production Research*, 1-30. https://doi.org/10.1080/00207543.2022.2162619

Eze, N. D., Mateus, C., & Cravo Oliveira Hashiguchi, T. (2020). Telemedicine in the OECD: an umbrella review of clinical and cost-effectiveness, patient experience and implementation. *PloS one*, *15*(8), e0237585. https://doi.org/10.1371/journal.pone.0237585

Ferlie, E. B., & Shortell, S. M. (2001). Improving the quality of health care in the United Kingdom and the United States: a framework for change. *The Milbank Quarterly*, *79*(2), 281-315. https://doi.org/10.1111/1468-0009.00206

Fung, C. H., Lim, Y. W., Mattke, S., Damberg, C., & Shekelle, P. G. (2008). Systematic review: the evidence that publishing patient care performance data improves quality of care. *Annals of internal medicine*, *148*(2), 111-123. https://doi.org/10.7326/0003-4819-148-2-200801150-00006

Günal, M. M., Pohl, E. A., Jain, R., & Lin, L. (2021). Modeling, simulation, and optimization in health care supply chains: A review. European Journal of Operational Research, 295(3), 797-819.

Hashemzadeh, M., Rahimi, A., Zare-Farashbandi, F., Alavi-Naeini, A. M., & Daei, A. (2019). Transtheoretical model of health behavioral change: A systematic review. *Iranian Journal of Nursing and Midwifery Research*, *24*(2), 83. https://doi.org/10.4103/ijnmr.ijnmr_94_17

Hibbard, J. H., Stockard, J., Mahoney, E. R., & Tusler, M. (2004). Development of the Patient Activation Measure (PAM): conceptualizing and measuring activation in patients and consumers. *Health Services Research*, *39*(4p1), 1005–1026. https://doi.org/10.1111/j.1475-6773.2004.00269.x

Hong, Y., Goldberg, D., Dahlke, D. V., Ory, M. G., Cargill, J. S., Coughlin, R., ... & Peres, S. C. (2014). Testing usability and acceptability of a web application to promote physical activity (iCanFit) among older adults. *JMIR human factors*, *1*(1), e3787.https://doi.org/10.2196/humanfactors.3787

Jacobs, H. M., Kuyvenhoven, M., Touw-Otten, F. W. M. M., & Es, J. (1984). Written Simulation of Patient-Doctor encounters. 2. Assessment of the performance of general practitioners. *Family Practice*. https://doi.org/10.1093/fampra/1.1.20

Jenkinson, C. E., Dickens, A. P., Jones, K., Thompson-Coon, J., Taylor, R. S., Rogers, M., ... & Richards, S. H. (2013). Is volunteering a public health intervention? A systematic review and meta-analysis of the health and survival of volunteers. *BMC public health*, *13*(1), 1-10. https://doi.org/10.1186/1471-2458-13-773

Jotterand, F., Amodio, A., & Elger, B. S. (2016). Patient education as empowerment and self-rebiasing. *Medicine, Health Care and Philosophy*, *19*, 553-561.

Kang, H., Nembhard, H. B., Rafferty, C., & DeFlitch, C. J. (2014). Patient flow in the emergency department: a classification and analysis of admission process policies. *Annals of emergency medicine*, *64*(4), 335-342.https://doi.org/10.1016/j.annemergmed.2014.04.011

Keely, E., Liddy, C., & Afkham, A. (2013). Utilization, benefits, and impact of an e-consultation service across diverse specialties and primary care providers. *Telemedicine and e-Health*, *19*(10), 733-738. https://doi.org/10.1089/tmj.2013.0007

Kooij, L., Groen, W. G., & van Harten, W. H. (2018). Barriers and facilitators affecting patient portal implementation from an organizational perspective: qualitative study. *Journal of medical Internet research*, *20*(5), e183. https://doi.org/10.2196/jmir.8989

La, J., & Jewkes, E. M. (2013). Defining an optimal ED fast track strategy using simulation. *Journal of Enterprise Information Management*, *26*(1/2), 109-118.

Lacy, N. L., Paulman, A., Reuter, M. D., & Lovejoy, B. (2004). Why we don't come: patient perceptions on no-shows. *The Annals of Family Medicine*, *2*(6), 541-545. Lau, F. (2019). Patient empowerment: the role of technology. Improving Usability, Safety and Patient Outcomes with Health Information Technology: From Research to Practice, 257, 70. DOI: https://doi.org/10.1370/afm.123

Lau, P., Tran, M. T., Kim, R. Y., Alrefae, A. H., Ryu, S., & Teh, J. C. (2023). e-Prescription: views and acceptance of general practitioners and pharmacists in Greater Sydney. *Australian Journal of Primary Health*. https://doi.org/10.1071/PY22240

Lewis, A. (2002). Health informatics: information and communication. *Advances in Psychiatric Treatment*, *8*(3), 165–171. https://doi.org/10.1192/apt.8.3.165

Li, J., Zhu, G., Luo, L., & Shen, W. (2021). Big data-enabled analysis of factors affecting patient waiting time in the nephrology department of a large tertiary hospital. *Journal of Health Care Engineering*, *2021*. https://doi.org/10.1155/2021/5555029

Marshall, D. A., Burgos-Liz, L., IJzerman, M. J., Osgood, N. D., Padula, W. V., Higashi, M. K., & Crown, W. (2015). Applying dynamic simulation modeling methods in health care delivery research—the SIMULATE checklist: report of the ISPOR simulation modeling emerging good practices task force. *Value in health*, *18*(1), 5-16. https://doi.org/10.1016/j.jval.2014.12.001

McGillicuddy, J. W., Gregoski, M. J., Weiland, A. K., Rock, R. A., Brunner-Jackson, B. M., Patel, S. K., ... & Treiber, F. A. (2013). Mobile health medication adherence and blood pressure control in renal transplant recipients: a proof-of-concept randomized controlled trial. *JMIR research protocols*, *2*(2), e2633. https://doi.org/10.2196/resprot.2633

McLean, A. (1995). Empowerment and the psychiatric consumer/ex-patient movement in the United States: Contradictions, crisis and change. *Social science & medicine*, *40*(8), 1053-1071. https://doi.org/10.1016/0277-9536(94)00179-W

Mould, G., Bowers, J., Dewar, C., & McGugan, E. (2013). Assessing the impact of systems modeling in the redesign of an Emergency Department. *Health Systems*, *2*(1), 3–10. https://doi.org/10.1057/hs.2012.15

Náfrádi, L., Nakamoto, K., & Schulz, P. (2017). Is patient empowerment the key to promote adherence? A systematic review of the relationship between self-efficacy, health locus of control and medication adherence. *PLOS ONE*, *12*(10), e0186458. https://doi.org/10.1371/journal.pone.0186458

Nyce, A., Gandhi, S., Freeze, B., Bosire, J., Ricca, T., Kupersmith, E., Mazzarelli, A., & Rachoin, J. (2021). Association of emergency department waiting times with patient experience in admitted and discharged patients. *Journal of Patient Experience*, *8*, 237437352110114. https://doi.org/10.1177/23743735211011404

O'Keefe, E. B., Meltzer, J. P., & Bethea, T. N. (2015). Health disparities and cancer: racial disparities in cancer mortality in the United States, 2000–2010. *Frontiers in public health*, *3*, 51. https://doi.org/10.3389/fpubh.2015.00051

Olesen, M. R., & Jørgensen, R. (2022). Impact of the person-centred intervention guided self-determination across health care settings—An integrated review. *Scandinavian Journal of Caring Sciences*, *37*(1), 37–59. https://doi.org/10.1111/scs.13138

Ordu, M., Demir, E., Tofallis, C., & Gunal, M. M. (2021). A novel health care resource allocation decision support tool: A forecasting-simulation-optimization approach. *Journal of the operational research society*, *72*(3), 485-500. https://doi.org/10.1080/01605682.2019.1700186

Pekonen, A., Eloranta, S., Stolt, M., Virolainen, P., & Leino-Kilpi, H. (2020). Measuring patient empowerment–A systematic review. *Patient education and counseling*, *103*(4), 777-787. https://doi.org/10.1016/j.pec.2019.10.019

Perle, J. G., Langsam, L. C., & Nierenberg, B. (2011). Controversy clarified: An updated review of clinical psychology and tele-health. *Clinical psychology review*, *31*(8), 1247-1258. https://doi.org/10.1016/j.cpr.2011.08.003

Pluut, B. (2016). Differences that matter: developing critical insights into discourses of patient-centeredness. *Medicine Health Care and Philosophy*, 19(4), 501–515. https://doi.org/10.1007/s11019-016-9712-7

Polinski, J. M., Barker, T., Gagliano, N., Sussman, A., Brennan, T. A., & Shrank, W. H. (2016). Patients' satisfaction with and preference for telehealth visits. *Journal of general internal medicine*, *31*, 269-275. https://doi.org/10.1007/s11606-015-3489-x

Pomey, M. P., Ghadiri, D. P., Karazivan, P., Fernandez, N., & Clavel, N. (2015). Patients as partners: a qualitative study of patients' engagement in their health care. *PloS one*, *10*(4), e0122499. https://doi.org/10.1371/journal.pone.0122499

Porterfield, A. (2014). *Electronic prescribing: Improving the efficiency and accuracy of prescribing in the ambulatory care setting*. PubMed Central (PMC). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3995494/

Possik, J., Asgary, A., Solis, A. O., Zacharewicz, G., Shafiee, M. A., Najafabadi, M. M., & Wu, J. (2022). An agent-based modeling and virtual reality application using distributed simulation: Case of a COVID-19 intensive care unit. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/TEM.2022.3195813

Rajiah, K., Sivarasa, S. a. P., & Maharajan, M. K. (2021). Impact of Pharmacists' Interventions and Patients' Decision on Health Outcomes in Terms of Medication Adherence and Quality Use of Medicines among Patients Attending Community Pharmacies: A Systematic Review. *International Journal of Environmental Research and Public Health, 18*(9), 4392. https://doi.org/10.3390/ijerph18094392

Rejeb, O., Pilet, C., Hamana, S., Xie, X., Durand, T., Aloui, S., & Augusto, V. (2018). Performance and cost evaluation of health information systems using micro-costing and discrete-event simulation. *Health care management science*, *21*, 204-223. https://doi.org/10.1007/s10729-017-9402-x

Rho, M. J., Choi, I. Y., & Lee, J. (2014). Predictive factors of telemedicine service acceptance and behavioral intention of physicians. *International Journal of Medical Informatics, 83*(8), 559–571. https://doi.org/10.1016/j.ijmedinf.2014.05.005

Rosenthal, M. B., Friedberg, M. W., Singer, S. J., Eastman, D., Li, Z., & Schneider, E. C. (2013). Effect of a multipayer patient-centered medical home on health care utilization and quality: the Rhode Island chronic care sustainability initiative pilot program. *JAMA internal medicine*, *173*(20), 1907-1913. doi:10.1001/jamainternmed.2013.10063

Ryan, R. M., & Deci, E. L. (2017). Self-determination theory. *Basic psychological needs in motivation, development, and wellness*.

Saleh, Y. A., Pereira, A. F., Oliveira, A. J., Leal, R. P., & Zarpelão, B. B. (2021). Simulation-based optimization for redesigning health care supply chains: A case study. Computers & Industrial Engineering, 156, 107238.

Setijono, D., Mohajeri Naraghi, A., & Pavan Ravipati, U. (2010). Decision support system and the adoption of lean in a swedish emergency ward: balancing supply and demand towards improved value stream. *International Journal of lean six sigma*, *1*(3), 234-248.

Siamisang, K., Tlhakanelo, J. T., & Mhaladi, B. B. (2020). Emergency department waiting times and determinants of prolonged length of stay in a Botswana referral hospital. *Open Journal of Emergency Medicine, 08*(03), 59–70. https://doi.org/10.4236/ojem.2020.83007

Sinreich, D., & Marmor, Y. N. (2005). Emergency department operations: The basis for developing a simulation tool. *Iie Transactions*, *37*(3), 233–245. https://doi.org/10.1080/07408170590899625

Song, Z., Hill, C., Bennet, J., Vavasis, A., & Oriol, N. E. (2013). Mobile clinic in Massachusetts associated with cost savings from lowering blood pressure and emergency department use. *Health affairs*, *32*(1), 36-44. https://doi.org/10.1377/hlthaff.2011.1392

Sparkmon, W., Barnard, M., Rosenthal, M., Desselle, S. P., & Holmes, E. R. (2021). Community pharmacist perceptions of increased technician responsibility. *Journal of the American Pharmacists Association*, *61*(4), 382-389.e4. https://doi.org/10.1016/j.japh.2021.03.011

Sun, M., Burke, L. E., Mao, Z. H., Chen, Y., Chen, H. C., Bai, Y. ... & Jia, W. (2014). eButton: a wearable computer for health monitoring and personal assistance. In *Proceedings of the 51st annual design automation conference* (pp. 1-6). https://doi.org/10.1145/2593069.2596678

Tako, A. A., & Robinson, S. (2018). Comparing discrete-event simulation and system dynamics: Users' perceptions. *System dynamics: Soft and hard operational research*, 261-299.

Totten, A. M., Womack, D. M., Eden, K. B., McDonagh, M. S., Griffin, J. C., Grusing, S., & Hersh, W. R. (2016). Telehealth: mapping the evidence for patient outcomes from systematic reviews. PMID: 27536752

Wade, V. A., Karnon, J., Eliott, J. A., & Hiller, J. E. (2012). Home videophones improve direct observation in tuberculosis treatment: a mixed methods evaluation. *PLoS one*, *7*(11), e50155. https://doi.org/10.1371/journal.pone.0050155

Wan, S., Gu, Z., & Ni, Q. (2020). Cognitive computing and wireless communications on the edge for health care service robots. *Computer Communications*, *149*, 99-106. https://doi.org/10.1016/j.comcom.2019.10.012

Westaby, S., Archer, N., Manning, N., Adwani, S., Grebenik, C., Ormerod, O., & Wilson, N. (2007). Comparison of hospital episode statistics and central cardiac audit database in public reporting of congenital heart surgery mortality. *BMJ*, *335*(7623), 759. https://doi.org/10.1136/bmj.39318.644549.AE

Wittink, H., & Oosterhaven, J. (2018). Patient education and health literacy. *Musculoskeletal Science and Practice*, *38*, 120-127.

Yao, H., Chen, P., Kuo, Y., Shih, C., Wang, X., & Chen, P. (2020). Solving patient referral problems by using bat algorithm. *Technology and Health Care*, *28*, 433–442. https://doi.org/10.3233/thc-209044

Yu, Y., Pan, M., Li, X., & Jiang, H. (2011). Tabu search heuristics for workflow resource allocation simulation optimization. *Concurrency and Computation: Practice and Experience*, *23*(16), 2020–2033. https://doi.org/10.1002/cpe.1736

Zhai, K., Yousef, M. S., Mohammed, S., Al-Dewik, N. I., & Qoronfleh, M. W. (2023). Optimizing clinical workflow using precision medicine and advanced data analytics. *Processes*, *11*(3), 939. https://www.mdpi.com/2227-9717/11/3/939#

Appendix 2.1: Mean Patient Wait Time Across All Treatment Levels

- Treat A = Number of CPhTs
- Treat B = Number of RPhs
- Treat C = Arrival rate

- Treat D = RxHub priority

Treatment				Mean	Std. Error	95% Confidence Interval	
A	B	C	D			Lower Bound	Upper Bound
0	0	0	0	0.00	4.072	-7.630	8.332
0	0	0	1	0.00	4.166	-8.165	8.165
0	0	0	2	0.00	4.194	-8.220	8.220
0	0	0	3	0.00	4.201	-8.234	8.234
0	0	0	4	0.00	4.091	-8.019	8.019
0	0	1	0	230.03	4.216	221.764	238.289
0	0	1	1	235.67	4.194	227.446	243.887
0	0	1	2	179.26	4.173	171.078	187.436
0	0	1	3	69.58	4.098	61.545	77.609
0	0	1	4	17.32	4.201	9.089	25.558
0	0	2	0	370.03	4.152	361.891	378.167
0	0	2	1	327.17	4.145	319.048	335.297
0	0	2	2	242.05	4.166	233.882	250.213
0	0	2	3	105.61	4.245	97.292	113.932
0	0	2	4	28.42	4.132	20.322	36.518
0	1	0	0	0.00	4.072	-4.408	11.553
0	1	0	1	0.00	4.138	-8.111	8.111
0	1	0	2	0.00	4.223	-8.277	8.277
0	1	0	3	0.00	4.132	-8.098	8.098
0	1	0	4	0.00	4.065	-7.968	7.968
0	1	1	0	182.31	4.245	173.990	190.629
0	1	1	1	188.63	4.187	180.419	196.832
0	1	1	2	153.04	4.132	144.946	161.142
0	1	1	3	51.98	4.208	43.730	60.227
0	1	1	4	11.69	4.138	3.577	19.799
0	1	2	0	241.49	4.173	233.313	249.671
0	1	2	1	228.19	4.138	220.079	236.301
0	1	2	2	173.24	4.194	165.022	181.463
0	1	2	3	64.61	4.132	56.511	72.707
0	1	2	4	16.99	4.180	8.794	25.179
0	2	0	0	0.00	4.118	-7.522	8.621
0	2	0	1	0.00	4.132	-8.098	8.098
0	2	0	2	0.00	4.138	-8.111	8.111
0	2	0	3	0.00	4.125	-8.084	8.084
0	2	0	4	0.00	4.216	-8.262	8.262

(table continues)

Treatment				Mean	Std. Error	95% Confidence Interval	
A	B	C	D			Lower Bound	Upper Bound
0	2	1	0	168.44	4.245	160.116	176.755
0	2	1	1	186.97	4.125	178.887	195.056
0	2	1	2	152.64	4.180	144.443	160.829
0	2	1	3	50.81	4.132	42.712	58.908
0	2	1	4	11.66	4.125	3.574	19.743
0	2	2	0	243.82	4.208	235.575	252.071
0	2	2	1	221.70	4.145	213.571	229.820
0	2	2	2	156.77	4.216	148.512	165.037
0	2	2	3	72.54	4.166	64.372	80.702
0	2	2	4	17.53	4.125	9.447	25.616
1	0	0	0	0.00	4.173	-3.787	12.571
1	0	0	1	0.00	4.105	-8.045	8.045
1	0	0	2	0.00	4.145	-8.125	8.125
1	0	0	3	0.00	4.091	-8.019	8.019
1	0	0	4	0.00	4.216	-8.262	8.262
1	0	1	0	123.02	4.138	114.904	131.126
1	0	1	1	151.07	4.216	142.807	159.332
1	0	1	2	141.58	4.216	133.317	149.842
1	0	1	3	48.06	4.072	40.084	56.045
1	0	1	4	10.22	4.173	2.041	18.399
1	0	2	0	166.21	4.216	157.948	174.473
1	0	2	1	192.97	4.105	184.922	201.012
1	0	2	2	162.48	4.208	154.232	170.729
1	0	2	3	65.46	4.138	57.351	73.573
1	0	2	4	16.34	4.125	8.251	24.420
1	1	0	0	0.00	4.118	-5.214	10.929
1	1	0	1	0.00	4.152	-8.138	8.138
1	1	0	2	0.00	4.145	-8.125	8.125
1	1	0	3	0.00	4.173	-8.179	8.179
1	1	0	4	0.00	4.111	-8.058	8.058
1	1	1	0	106.69	4.282	98.302	115.087
1	1	1	1	138.61	4.105	130.561	146.651
1	1	1	2	125.22	4.159	117.072	133.375
1	1	1	3	29.27	4.098	21.241	37.305
1	1	1	4	2.89	4.267	-5.477	11.250
1	1	2	0	112.69	4.145	104.566	120.816
1	1	2	1	142.51	4.180	134.321	150.706

(table continues)

Treatment				Mean	Std. Error	95% Confidence Interval	
A	B	C	D			Lower Bound	Upper Bound
1	1	2	2	126.50	4.152	118.363	134.639
1	1	2	3	27.26	4.125	19.174	35.343
1	1	2	4	3.70	4.152	-4.439	11.837
1	2	0	0	0.00	4.132	-5.586	10.610
1	2	0	1	0.00	4.152	-8.138	8.138
1	2	0	2	0.00	4.085	-8.006	8.006
1	2	0	3	0.00	4.216	-8.262	8.262
1	2	0	4	0.00	4.138	-8.111	8.111
1	2	1	0	101.89	4.245	93.567	110.206
1	2	1	1	134.00	4.125	125.917	142.086
1	2	1	2	121.64	4.173	113.463	129.821
1	2	1	3	29.18	4.180	20.988	37.374
1	2	1	4	2.12	4.145	-6.001	10.248
1	2	2	0	112.04	4.194	103.820	120.261
1	2	2	1	145.84	4.145	137.712	153.962
1	2	2	2	125.63	4.173	117.450	133.808
1	2	2	3	24.87	4.091	16.848	32.886
1	2	2	4	2.88	4.187	-5.328	11.085
2	0	0	0	0.00	4.152	-5.562	10.714
2	0	0	1	0.00	4.138	-8.111	8.111
2	0	0	2	0.00	4.159	-8.152	8.152
2	0	0	3	0.00	4.223	-8.277	8.277
2	0	0	4	0.00	4.152	-8.138	8.138
2	0	1	0	112.41	4.125	104.322	120.491
2	0	1	1	147.75	4.201	139.517	155.985
2	0	1	2	141.68	4.208	133.431	149.927
2	0	1	3	52.49	4.173	44.315	60.672
2	0	1	4	10.96	4.118	2.885	19.028
2	0	2	0	151.75	4.223	143.469	160.023
2	0	2	1	179.86	4.065	171.893	187.829
2	0	2	2	163.67	4.194	155.452	171.893
2	0	2	3	65.63	4.125	57.545	73.714
2	0	2	4	16.33	4.166	8.167	24.498
2	1	0	0	0.00	4.159	-7.467	8.836
2	1	0	1	0.00	4.111	-8.058	8.058
2	1	0	2	0.00	4.223	-8.277	8.277
2	1	0	3	0.00	4.159	-8.152	8.152

(table continues)

Treatment				Mean	Std. Error	95% Confidence Interval	
A	B	C	D			Lower Bound	Upper Bound
2	1	0	4	0.00	4.145	-8.125	8.125
2	1	1	0	94.32	4.166	86.152	102.482
2	1	1	1	127.30	4.132	119.198	135.394
2	1	1	2	118.23	4.187	110.028	126.441
2	1	1	3	27.92	4.216	19.655	36.180
2	1	1	4	1.83	4.125	-6.259	9.910
2	1	2	0	103.67	4.173	95.490	111.848
2	1	2	1	136.06	4.132	127.965	144.160
2	1	2	2	128.31	4.138	120.200	136.422
2	1	2	3	23.87	4.173	15.691	32.049
2	1	2	4	3.28	4.159	-4.868	11.436
2	2	0	0	0.00	4.059	-7.345	8.565
2	2	0	1	0.00	4.201	-8.234	8.234
2	2	0	2	0.00	4.152	-8.138	8.138
2	2	0	3	0.00	4.187	-8.206	8.206
2	2	0	4	0.00	4.152	-8.138	8.138
2	2	1	0	88.66	4.180	80.467	96.852
2	2	1	1	123.91	4.336	115.415	132.412
2	2	1	2	117.34	4.352	108.808	125.867
2	2	1	3	30.23	4.290	21.822	38.637
2	2	1	4	1.31	4.305	-7.123	9.753
2	2	2	0	97.05	4.417	88.394	105.708
2	2	2	1	129.94	4.336	121.444	138.441
2	2	2	2	121.88	4.320	113.411	130.347
2	2	2	3	21.88	4.400	13.258	30.507
2	2	2	4	1.53	4.328	-6.949	10.018
3	0	0	0	0.00	4.159	-5.046	11.257
3	0	0	1	0.00	4.173	-8.179	8.179
3	0	0	2	0.00	4.159	-8.152	8.152
3	0	0	3	0.00	4.173	-8.179	8.179
3	0	0	4	0.00	4.118	-8.071	8.071
3	0	1	0	106.14	4.223	97.865	114.419
3	0	1	1	141.08	4.152	132.940	149.217
3	0	1	2	131.48	4.132	123.384	139.579
3	0	1	3	41.89	4.138	33.780	50.002
3	0	1	4	9.63	4.166	1.466	17.796
3	0	2	0	143.79	4.201	135.551	152.020

(table continues)

Treatment				Mean	Std. Error	95% Confidence Interval	
A	B	C	D			Lower Bound	Upper Bound
3	0	2	1	175.81	4.159	167.661	183.964
3	0	2	2	159.12	4.118	151.051	167.193
3	0	2	3	65.59	4.223	57.309	73.862
3	0	2	4	17.11	4.166	8.947	25.277
3	1	0	0	0.00	4.046	-7.373	8.487
3	1	0	1	0.00	4.237	-8.305	8.305
3	1	0	2	0.00	4.159	-8.152	8.152
3	1	0	3	0.00	4.065	-7.968	7.968
3	1	0	4	0.00	4.297	-8.423	8.423
3	1	1	0	91.89	4.208	83.640	100.137
3	1	1	1	127.52	4.072	119.539	135.500
3	1	1	2	124.93	4.201	116.696	133.165
3	1	1	3	27.96	4.187	19.749	36.162
3	1	1	4	1.59	4.201	-6.645	9.823
3	1	2	0	98.46	4.105	90.413	106.503
3	1	2	1	133.27	4.145	125.150	141.399
3	1	2	2	123.07	4.173	114.893	131.251
3	1	2	3	24.31	4.132	16.209	32.405
3	1	2	4	2.81	4.252	-5.526	11.142
3	2	0	0	0.00	4.230	-7.836	8.746
3	2	0	1	0.00	4.368	-8.561	8.561
3	2	0	2	0.00	4.392	-8.608	8.608
3	2	0	3	0.00	4.282	-8.393	8.393
3	2	0	4	0.00	4.328	-8.483	8.483
3	2	1	0	86.72	4.450	77.993	95.439
3	2	1	1	116.40	4.305	107.958	124.834
3	2	1	2	115.69	4.368	107.129	124.250
3	2	1	3	27.99	4.344	19.472	36.500
3	2	1	4	1.24	4.313	-7.215	9.691
3	2	2	0	94.75	4.442	86.045	103.458
3	2	2	1	129.01	4.313	120.553	137.458
3	2	2	2	122.56	4.352	114.030	131.089
3	2	2	3	20.09	4.320	11.624	28.560
3	2	2	4	1.44	4.360	-7.104	9.987
4	0	0	0	0.00	4.085	-5.121	10.892
4	0	0	1	0.00	4.145	-8.125	8.125
4	0	0	2	0.00	4.145	-8.125	8.125

(table continues)

Treatment				Mean	Std. Error	95% Confidence Interval	
A	B	C	D			Lower Bound	Upper Bound
4	0	0	3	0.00	4.252	-8.334	8.334
4	0	0	4	0.00	4.027	-7.893	7.893
4	0	1	0	112.29	4.275	103.910	120.666
4	0	1	1	143.57	4.118	135.498	151.640
4	0	1	2	137.78	4.173	129.601	145.959
4	0	1	3	43.61	4.187	35.400	51.812
4	0	1	4	9.21	4.173	1.033	17.391
4	0	2	0	142.02	4.152	133.886	150.162
4	0	2	1	175.52	4.152	167.383	183.659
4	0	2	2	156.13	4.173	147.955	164.313
4	0	2	3	67.64	4.125	59.551	75.720
4	0	2	4	17.48	4.245	9.156	25.795
4	1	0	0	0.00	3.977	-7.208	8.384
4	1	0	1	0.00	4.201	-8.234	8.234
4	1	0	2	0.00	4.245	-8.320	8.320
4	1	0	3	0.00	4.125	-8.084	8.084
4	1	0	4	0.00	4.138	-8.111	8.111
4	1	1	0	90.93	4.208	82.678	99.174
4	1	1	1	124.24	4.194	116.024	132.465
4	1	1	2	121.52	4.216	113.260	129.785
4	1	1	3	32.21	4.085	24.205	40.217
4	1	1	4	1.62	4.125	-6.467	9.702
4	1	2	0	98.13	4.208	89.877	106.374
4	1	2	1	130.56	4.145	122.439	138.688
4	1	2	2	121.75	4.173	113.572	129.930
4	1	2	3	25.29	4.118	17.222	33.364
4	1	2	4	2.91	4.208	-5.334	11.163
4	2	0	0	0.00	4.245	-7.916	8.724
4	2	0	1	0.00	4.352	-8.530	8.530
4	2	0	2	0.00	4.305	-8.438	8.438
4	2	0	3	0.00	4.409	-8.641	8.641
4	2	0	4	0.00	4.352	-8.530	8.530
4	2	1	0	80.82	4.409	72.182	89.464
4	2	1	1	118.28	4.313	109.826	126.731
4	2	1	2	115.42	4.384	106.824	124.009
4	2	1	3	29.26	4.344	20.741	37.769
4	2	1	4	1.21	4.384	-7.378	9.807

(table continues)

Treatment				Mean	Std. Error	95% Confidence Interval	
A	B	C	D			Lower Bound	Upper Bound
4	2	2	0	87.51	4.313	79.058	95.964
4	2	2	1	127.79	4.305	119.352	136.228
4	2	2	2	121.94	4.384	113.351	130.536
4	2	2	3	21.80	4.344	13.283	30.311
4	2	2	4	1.36	4.320	-7.107	9.829

ESSAY 3

THE ROLE OF PATIENT EMPOWERMENT ON PATIENT SATISFACTION: MEDIATING AND MODERATING ROLE OF TELEHEALTH AND PATIENT TRUST

3.1 Abstract

The primary goal of this research is to investigate the role of patient empowerment in the modern era on patient satisfaction with telehealth in North America. The mediating role of telehealth services between patient empowerment and patient satisfaction was analyzed, along with patient trust was assessed as a moderator between telehealth usability and patient satisfaction. The research follows the comfort theory of mid-range theory to explain the level of patient satisfaction with the use of telehealth services. This paper proposes to study and emphasize the above-mentioned practices by using quantitative research methods. Two hundred sixty-two responses were collected through an online survey questionnaire from different leading pharmaceutical companies and analyzed by partial least squares structural equation modeling (PLS-SEM). The findings of the research show that patients with chronic illnesses feel empowered by using telehealth and have trust in the service, which reveals a positive relationship with patient satisfaction.

Keywords: *Patient empowerment; mid-range theory; patient satisfaction; telehealth; trust; comfort theory; chronic diseases*

3.2 Introduction

In the health care sector, patient empowerment has emerged as an important tool to advocate for patients' health care processes and promote health-related knowledge (WHO, 1986). It is a new model of health care excellence (Bravo et al., 2015). Several strategies are applied globally to empower patients and are based on the health care system of a particular country (Wakefield et al., 2018). Patients who are diagnosed with chronic diseases use empowerment to take autonomous health care decisions to improve their health (Aujoulat et al., 2007; Anderson and Funnell, 2010). Lone et al. (2014) proposed that these chronic patients have to visit hospitals frequently, even in emergencies, and they need support, guidance, and extra care to tackle the disease, so they need to be empowered. Due to empowerment, patients advance their mental and physical skills to self-manage the disease and its cure (Aujoulat et al., 2007; Fisher & Owen, 2008).

Telehealth refers to the use of digital technology to provide rapid, remote access to data for medical professionals. Asynchronous and synchronous modes are the two primary ways in which telehealth may be put into action (Suter et al., 2011). Audio conferencing systems are widely used in real-time telemedicine sessions, which are live connections. Asynchronous telehealth allows users to access their information at their convenience, since it consists of already acquired data such as digital films, images, and reports. It is possible, for instance, to learn more about one's own health status by consulting independent expert videos and reading articles written by professionals (Hollander et al., 2018). Many websites provide advice on how to address common health issues that may be found on many different websites. As medical science and technology advance together, patients are finding that they can treat themselves in certain circumstances (Rathert et al., 2013). Services, patients, doctors, practices, and locations are only a few of the many dimensions that make up telehealth (Suter et al., 2011).

After this initial telehealth session, patients may turn to telemedicine, in which they pay doctors for advice over the phone (Clark and Goodwin, 2010). If the patients are content with consultation via telehealth and telemedicine, there is a good chance they may go for medical tourism if they feel their condition is dire or, more importantly, if they are from another country. Patients dealing with mental health problems can use telemedicine to receive treatment (Wilson and Maeder, 2015).

Great-quality medical care is in high demand; therefore, hospitals are always looking for ways to better meet patients' expectations and meet their requirements (Bashshur et al., 2014). Patients' experiences might be influenced by their preconceived notions about the quality of the treatment they would get. Therefore, this evaluation highlights the discrepancy between actual and desired consequences, which might lead to enhanced service quality.

Among the several metrics by which emergency care facilities are judged, patient satisfaction ranks high. Although patient happiness has been seen as a proxy for health care quality, the exact nature of that link remains unclear. Patient trust is strongly affected by patients' levels of satisfaction and care, which are in turn heavily influenced by patients' impressions of the quality of their medical treatment. Trust is seen as a crucial outcome because of its links to health outcomes and patient satisfaction. Trust is not the same as contentment; the former is focused on the past, while the latter is forward-looking and heavily influenced by feelings. Thus, contentment is more important than faith.

Patient empowerment can play an important role in patient satisfaction. However, research has shown that patients may distrust telehealth services if they do not have trust in the health care system (Donahue et al., 2008). This study seeks to investigate how patient empowerment and trust interact to moderate the relationship between telehealth service use and patient satisfaction. This study seeks to elucidate how and whether patients' levels of empowerment impact their satisfaction with telehealth services, which are used as a mediator between them. Patients with empowerment to use telehealth can perceive treatment efficacy in a constructive way, which eventually builds trust and satisfaction with using telehealth.

The main purpose of this research is to investigate the role of patient empowerment in patients' satisfaction with using telehealth, along with patient trust. Though, the following research questions are needed to be investigated:

1. What role does telehealth usability play in mediating the relationship between patient empowerment and patient satisfaction?
2. What is the role of patient trust in moderating the relationship between telehealth service use and patient satisfaction?

By identifying the above-mentioned objectives, this research aims to achieve in-depth knowledge about the impact of patient empowerment on patient satisfaction when using telehealth, which would be interesting for professionals employed in the health care sector and researchers as well. The statistics obtained through quantitative survey-based research would be beneficial for understanding the proper usage of telehealth, how much patients trust it, and the level of patient satisfaction acquired through empowerment.

3.3 Literature Review

3.3.1 Patient Empowerment

Pickstone (1993) proposed that the idea of patient empowerment has historical importance. In the 18th and 19th centuries, Americans stressed the importance of freedom and social rights for people, as at that time people were cautious about using medicines, doctors were not trusted and respected, and patients were treated by female family members or faith healers (Starr, 1982). In the late 19th century, this concept of unprofessional therapists slowly vanished due to technological advancements in the medical field (Roberts, 1999). Also during the 1990s, the involvement of patients in treating themselves at home without the help of any physician (for minor illnesses) increased, and books related to home remedies were published in this regard (Fries and Vickery, 1990). This has led to an 'era of patient empowerment," in which patients now want empowerment in health-related information (Roberts, 1999).

In the literature, as stated by multiple researchers, four aspects of empowerment have been found (Hogg, 1999; Wilkinson and Miers, 1999; Kemshall and Littlechild, 2000), which consist of patients' reliance to gain power and authority; the willingness of health practitioners to empower patients; patients' anticipation about change in power in terms of care for themselves; and lastly, they demand no discrimination and equal opportunities. According to Byrt and Dooher (2002), without fulfilling these four dimensions, empowerment is incomplete.

According to Funnell et al. (1991), patients feel empowered by acquiring information, skills, and awareness, which helps to improve their health-related issues. As stated by Cerezo et al. (2016), patient empowerment is related to mutual understanding and relationships with health care providers. So, they may also feel empowered when the doctors interact with them and help them solve issues related to their health (McKay, 1990). Hence, this concept leads to better health and quality of life along with efficient health-related services (Bravo et al., 2015; Wallerstein, 2006).

3.3.2 Telehealth Usability

Suter et al. (2011) proposed that for the goal of bettering patients' health, telemedicine is described by the American Telemedicine Organization as the electronic transmission of medical information from one location to another (Suter et al., 2011). The phrase "telehealth," which is closely related to the term "telemedicine," is often used to refer to a wider concept of virtual health care that might or might not include clinical services (Suter et al., 2011). Many home health care providers now use telehealth to remotely monitor their patients' vital signs from the comfort of their own homes (Li et al., 2021).

According to Hall et al. (2014), ninety percent of home health services in a recent nationwide telehealth survey performed by Fazzi Associates claimed that they were able to deliver higher-quality care to their patients as a result of using telehealth. About 75% of organizations reported decreases in both unplanned hospitalizations and emergency department visits as a result of their efforts to reduce health care usage (Suter et al., 2011). More than 40 percent of organizations also found that adopting telehealth practices lowered their operational expenses, most likely because they were able to cut down on unnecessary home visits after a patient's condition had stabilized (Or & Karsh, 2009).

According to Suter et al. (2011), home health care organizations often utilize telehealth monitors, which consist of a screen and several pieces of equipment for collecting data regarding the patient's health, such as a blood pressure cuff, cardiac oximeter, blood glucose meter, and a weight scale. Using landlines or cellular networks, monitors may gather data on a patient's vital signs, store that data, and then upload it to a secure website. In most cases, a medical practitioner is the one to access and examine these records, interpret the information, and decide what course of action is necessary (Suter et al., 2011). No matter how remote a patient's location is, telehealth may play a part in increasing their access to treatment by offering care monitoring and health behavior counseling from the comfort of their own home (Teresa et al., 2014). Improved access to medical specialists who give monitoring and advice from a distance may be especially beneficial for populations like the elderly, who might have restricted mobility, chronically ill patients with reduced functional capacity, and the underserved (Xiaofei et al., 2021).

3.3.3 Patient Trust

Velsen et al. (2017) suggested that during the treatment, patients build trust in telemedicine as they show dependence on the service, and in return, they expect time savings and quality health care. There are many dimensions of trust, some with high impact and others with low impact that patients consider before trusting telemedicine. For instance, the level of trust in telehealth is proportional to the relationship of the patient with the physician or the interface of the application they use to access the service (Velsen et al., 2017).

The authors, Bradford et al. (2015), highlight a few explanations for the concerns doctors examined, including issues in communication and relationships, negative physician attitudes, medical misconduct, a disjointed treatment plan, and unreasonable patient expectations. There may be unintended repercussions from high levels of mistrust in different parts of medical treatment. Patients with a low level of confidence are more likely to disregard their doctors' orders and refuse treatment (Vassilev et al., 2015). A lower estimation of one's own health was likewise linked to a lack of trust. Inadequate health care, which in turn might cause delays in seeking medical care, can serve as a key moderating link in this connection. Trust in the health care provider's methods and practices may extend to the care team as a whole (Yang et al., 2019).

As it is already known that telemedicine is a part of medical treatment and collects and processes personal data of patients, patients give high levels of value to this service (Velsen et al., 2017). Consequently, patients develop trust in using telemedicine and are satisfied (Bansal et al., 2016). Developing patient trust in telemedicine by various means is a key factor that allows standardizing multiple telemedicine services to satisfy a patient (Velsen et al., 2017).

3.3.4 Patient Satisfaction

In the health sector, patient satisfaction has high value, and success is based on it (Pakdil and Harwood, 2005). According to Zeithaml and Bitner (2000), patient satisfaction is considered a broader aspect, while the quality of service has a smaller aspect, even though both have certain similarities. Linder-Pelz (1982) defines patient satisfaction as an assessment of multiple aspects of health care. So, for structuring processes in health care, patient satisfaction should be considered an important tool to check the quality of care provided (Turner and Pol, 1995; Naidu, A., 2009).

In today's world where customers have high value and in the health care sector patients are considered customers, keeping them satisfied has become an important tool to assess the quality of health care services (Ng and Luk, 2019). Abrams and Geier (2006) conducted research that reveals that patients using telehealth services are highly satisfied. Another study reveals that almost eighty percent of patients are satisfied with telemedicine (López et al., 2011). According to research in emergency and uncertain situations, telehealth services play an important role by delivering on-time services, and hence patients seem positively satisfied with the use of telehealth (Orrange et al., 2021).

3.4 Hypothesis Development

3.4.1 Impact of Patient Empowerment

The result evaluated from several research studies is that patient empowerment has a powerful impact on many health consequences, such as medication compliance and patient satisfaction (Roberts, 1999). Moreover, findings show that when patients' satisfaction is high and they have trust in treatment procedures, they tend to visit physicians and interact with them actively (Ley, 1998; Hall et al., 1998). The levels of self-efficacy and self-esteem rise when people feel empowered and lead their lives towards healthier options (Falk-Rafael, 2001). In the light of the above-discussed perspectives, the first hypothesis has been proposed:

H1: Patient empowerment can positively influence patient satisfaction.

3.4.2 Impact of Telehealth Usability as a Mediator

According to a review of the literature undertaken by the New England Health Care Institute, remote patient monitoring reduces hospital readmissions by 60% when compared to normal treatment (Christina et al., 2014). Rehospitalization rates for heart failure patients were lowered by 72% when home monitoring was combined with post-hospitalization health coaching (Lu et al., 2021). All home health care agencies that accept Medicare patients are required to provide quality of care metrics to CMS. Re-hospitalization rates, which are disclosed publicly on the government website "Home Health Compare," would likely be used as a baseline for pay-for-performance payment procedures in a revamped health care system (Suter et al., 2011). If the rising tide of favorable evidence from the most recent literature continues to lift all boats, telehealth services are likely to keep growing (Roncoroni et al., 2014). Nowadays, telehealth usability depends on the level of patient satisfaction because their reviews about the treatment are important and can be reported (Cleary, 2003). To investigate further, three hypotheses have been proposed to investigate the direct relationship of telehealth usability with patient empowerment and patient satisfaction and the role of telehealth usability as a mediator between patient empowerment and patient satisfaction:

H2: Telehealth usability can positively influence patient satisfaction.

H3: Patient empowerment can positively influence telehealth usability.

H4: Telehealth usability acts as a mediator between patient empowerment and patient satisfaction.

3.4.3 Impact of Patient Trust as a Moderator

Velsen et al. (2017) proposed that, according to research, patients trust telemedicine services, doctors, and the treatment they get through this service. Another study reveals that there should be mutual trust and understanding between the physician and patient so that a person can make use of telehealth services (Donaghy et al., 2019). Patients who are satisfied with using telemedicine and want to continue using this service have trust in their doctor and believe that he or she is treating them in the right way (Orrange et al., 2021). Hence, it can be concluded that patients who trust telehealth services perceive high levels of satisfaction. Considering the above-discussed perspectives, a fifth hypothesis has been proposed to investigate the role of patient trust as a moderator between telehealth usability and patient satisfaction.

> *H5: Patient trust acts as a moderator between telehealth usability and patient satisfaction.*

3.5 Theoretical Approach

According to Bu and Jezewski (2007), middle-range theory is the set of laws that are both derived from grand theory and linked to observation through bridge laws. Theories in the medium range are less theoretical extensions of fundamental notions. In the middle is Watson's hypothesis of human compassion. Theories that fall somewhere in the center of the predictive power spectrum do more than just explain things; they also make predictions, such as regarding the relationships between ideas or the results of a certain action. The focus is on the comfort theory of current middle-range theory to explain how patient empowerment affects patient satisfaction (Kolcaba, 2001).

According to comfort theory, patients and their families tend to engage in health-seeking activities when they feel comfortable, and this behavior creates patient satisfaction, financial stability, and benefits for the health-care institutions as well (Kolcaba, 2001).

Three forms of comfort are important for patients: ease, relief, and transcendence. Patients feel at ease when they are content; they experience a sense of relief when their needs and desires are fulfilled; and finally, transcendence is achieved when patients overcome their challenges (Kolcaba, 2001).

To experience comfort, four contexts need to be assessed: physical, psychospiritual, environmental, and sociocultural. Physiological and homeostatic mechanisms are related to physical comfort; psychospiritual concerns with self-internal awareness, such as esteem, meaning of life, and identity; the external environment and conditions are related to environmental comfort; and sociocultural concerns pertain to family, societal, and interpersonal associations (Kolcaba & Fisher, 1996).

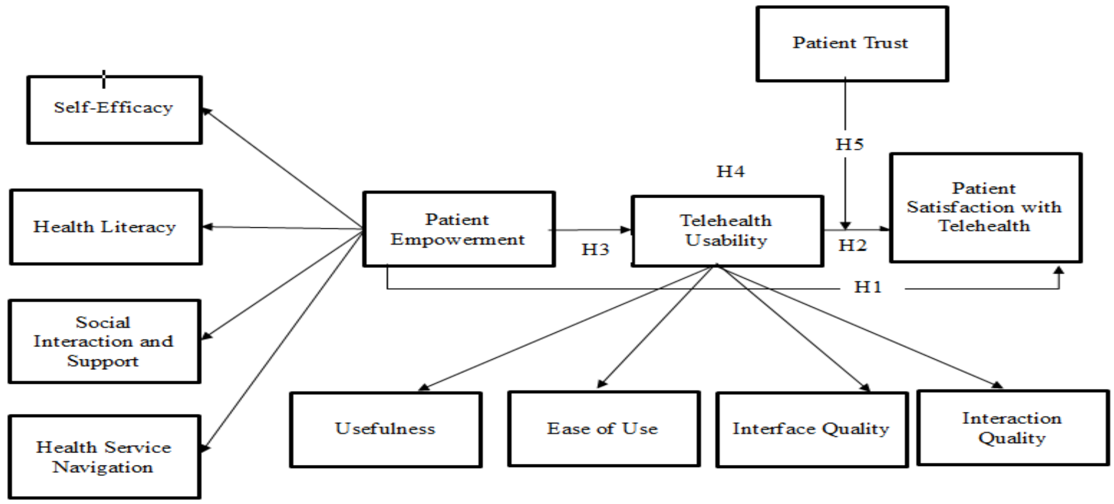


Figure 3.1: Conceptual model.

3.6 Research Methodology

3.6.1 Research Model

The main purpose of this research is to assess the role of patient empowerment in patient satisfaction. Furthermore, it aims to explore the role of telehealth usability as a mediator between patient empowerment and patient satisfaction, as well as patient trust as a moderator between telehealth and patient satisfaction.

3.6.2 Data Collection

To conduct this research, an instrument questionnaire was designed in which participants were requested to record their responses to the questions on a 5-point Likert scale, which is used to measure the constructs mentioned in the model, starting with 1 = strongly disagree, 2 = somewhat disagree, 3 = neither agree nor disagree, 4 = somewhat agree, and 5 = strongly agree.

As listed in Table 3.1, the three questions related to self-efficacy, three questions regarding health literacy, three questions related to social interaction and support, and the four questions linked with health service navigation to evaluate patient empowerment were taken from Osborne et al. (2007). The three questions to evaluate patient satisfaction with telehealth were taken from Thayaparan & Mahdi (2013). To assess the role of telehealth usability as a mediator, the three questions regarding telehealth usefulness, three questions for telehealth ease of use, four questions related to telehealth interface quality, and four questions for telehealth interaction quality were taken from Parmanto et al. (2016). Moreover, to evaluate the role of patient trust as a moderator, three questions were taken from Thom et al. (2002).

Table 3.1: Questionnaire Design

Variable Name	Variable Type	Measurements	References
Patient Empowerment	*Independent*	13 questions related to: • Self-efficacy • Health literacy • Social interaction and support • Health service navigation	Osborne et al., 2007
Telehealth Usability	*Mediator*	14 questions related to • Telehealth usefulness • Telehealth ease of use • Telehealth interface quality • Telehealth interaction quality	Parmanto et al., 2016
Patient Trust	*Moderator*	3 questions related to patient trust	Thom et al., 2002
Patient Satisfaction	*Dependent*	3 questions related to patient satisfaction.	Thayaparan and Mahdi, 2013

The questionnaire was designed in English, and to collect the responses for quantitative analysis, it was distributed through online platforms using Centiment, a respected service provider for survey deployment and data gathering (Tambling et al., 2021). The sample conducted in North America, and the convenience sampling method was used. This study's data was collected in February 2023. The response rate was 87.3%, as out of 300 respondents from leading pharmaceutical companies, 262 participated diligently. A sample size of 50 is considered poor, while the criteria for good is 300 (Raza and Hanif, 2013; Comrey and Lee, 2013).

As listed in Table 3.2, 122 male responded to the survey (46.57%) and rest of the 140 were female respondents (53.43%). People having age between 35-54 years (39.70%), white people (67.56%), according to income level $25,00 - $49,999 (27.48%), full-time employed (34.73%), people who are married or in any domestic relationship (48.09%) and patients having chronic diseases (63.36%) shown interest to participate in the survey.

Table 3.2: Participant Demographics (*N* = 262)

Characteristic		*n*	%
Gender	Male	122	46.57
	Female	140	53.43
Age	18-25	16	6.11
	26-34	35	13.36
	35-54	104	39.7
	55-64	50	19.08
	65 or over	57	21.75
Ethnicity	White	177	67.56
	Hispanic or Latino	20	7.63
	Black or African American	43	16.41
	Native American or American Indian	4	1.53
	Asian or Pacific Islander	14	5.34
	Other	4	1.53
Disease	Chronic	166	63.36
	Both chronic and acute	96	36.64
Employment Status	Unemployed	33	12.6
	Full time	91	34.73
	Part time	30	11.45
	Retired	77	29.39
	Other	31	11.83

3.7 Results and Discussion

3.7.1 Data Analysis

The quantitative method is used to interpret the results of the collected data, which is primary in nature and totally comprises facts and figures, by collecting data, sampling, observing, and measuring, then analyzing and interpreting accordingly. To examine the hypothetical model, SmartPLS 4 software is used. Data is analyzed using the SEM (Structural Equation Modeling) technique as it helps to evaluate the validity of the collected facts and figures (Ringle et al., 2005), and this is considered an accurate technique that gives precise results.

3.7.2 Measurement Model

For the evaluation of the model the following tests were assessed.

Cronbach's alpha and composite reliability values are required to be assessed to evaluate the internal consistency and are attained when the values of reliability are greater than 0.7, which is the cut-off value (Field, 2009; Hair Jr et al., 2016). Results in Table 3.3 clearly show that all the variables have a relationship with the questions, as all the scores exhibit values exceeding 0.7, hence meeting the criteria.

Table 3.3: Tests Used to Evaluate Model

Items	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
PE	0.827	0.862	0.533
PS	0.752	0.858	0.670
PT	0.736	0.805	0.580
TU	0.906	0.921	0.559

Convergent validity shows the correlation of the indicators of the same variables with each other (Hair Jr et al., 2016). It is achieved when the value of average variance extracted

(AVE) within the variables is equal to or greater than 0.5, which is the threshold value (Hair Jr et al., 2016; Fornell and Larcker, 1981). The results show that AVE values for all variables in the model exceed 0.5, hence meeting the criteria, as shown in Table 3.3.

Chin (1998) proposed that indicators having more than 0.5 outer loading are considered acceptable to increase composite reliability. The outer model testing (Table 3.4) shows that all the variables have values greater than 0.5, which is considered acceptable as reliability criteria except for a few that need to be removed to increase reliability.

Table 3.4: Outer Loadings

	PE	PS	PT	TU	PT x TU
PE1	0.557				
PE2	0.500				
PE3	0.590				
PE4	0.702				
PE5	0.665				
PE6	0.615				
PE7	0.595				
PE8	0.530				
PE9	0.552				
PE10	0.530				
PE11	0.259				
PE12	0.624				
PE13	0.654				
PS1		0.837			
PS2		0.765			
PS3		0.850			
PT1			0.784		
PT2			0.810		
PT3			0.685		
TU1				0.663	
TU2				0.584	

(table continues)

	PE	PS	PT	TU	PT x TU
TU3				0.483	
TU4				0.721	
TU5				0.749	
TU6				0.623	
TU7				0.774	
TU8				0.727	
TU9				0.731	
TU10				0.663	
TU11				0.753	
TU12				0.744	
TU13				0.710	
TU14				0.464	
PT x TU					1.000

Discriminant validity evaluates the levels of distinction of indicators of one variable from the other (Hair Jr et al., 2016). It is clearly shown in Table 3.5; the diagonal values of each variable are higher than the other values of the variables. It means that all the constructs in this model representing the square roots of AVE achieve the criteria, as none of the off-diagonal values exceeds the respective ones.

Table 3.5: Discriminant Validity (Fornell– Larcker Criterion)

	PE	PS	PT	TU
PE	0.777			
PS	0.608	0.818		
PT	0.595	0.523	0.761	
TU	0.670	0.754	0.555	0.677

In Table 3.6, discriminant validity based on the criteria of HTMT assesses that all the variables have a value less than 0.85, which is the threshold given by Henseler et al. (2015), hence verifying the validity of the constructs. Though, after evaluating all the analysis, the measurement model can be used as it verifies the convergent and discriminant validity.

Table 3.6: Discriminant Validity (Heterotrait–Monotrait Ratio-HTMT)

	PE	PS	PT	TU	PT x TU
PE					
PS	0.763				
PT	0.816	0.751			
TU	0.761	0.814	0.740		
PT x TU	0.101	0.221	0.104	0.178	

3.7.3 Structural Model

The structural model has been evaluated by assessing the path analysis. Each path related to the hypothesis developed in the research has been tested.

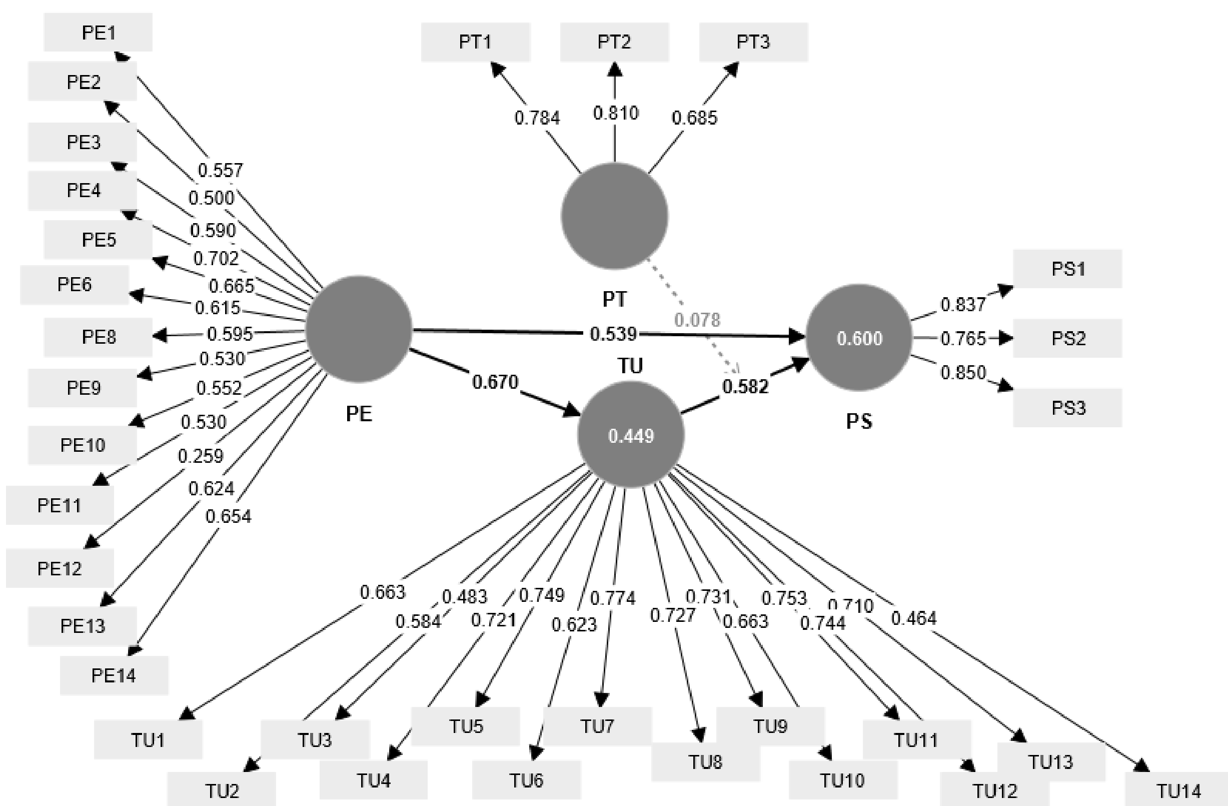


Figure 3.2: Model correlations.

A standard multiple linear regression is used to evaluate the strength of the relationship between the independent variables and dependent variables. R-squared is the percentage of the variance in the response variable that can be analyzed by the predictor variables. According to Chin (1998), an R^2 value exceeding 0.2 is acceptable, and model is considered moderately fit.

Table 3.7 shows that R^2 is 60%, which indicates that the variation in the dependent variable, i.e., patient satisfaction, explained by independent, mediator, and moderator variables is 60% and the model is strongly fit (Figure 3.2). The adjusted R^2 value is less than R^2 which is 59.4%, so this value of patient satisfaction is explained by all independent, mediator, and moderator variables.

Table 3.7: Regression Analysis

R-square	R-square adjusted
0.600	0.594

The values in Table 3.8 show the results of the path analysis. All the 3 hypotheses are direct and show positive and significant relationship and hence are accepted. H1 (Patient Empowerment -> Patient Satisfaction) shows that PE has a major significant effect on patient satisfaction and hence affects it positively (beta = 0.539, p-value = 0.000). H2 (Telehealth Usability -> Patient Satisfaction) shows that TU has a major significant effect on patient satisfaction and hence affects it positively (beta = 0.582, p-value = 0.000). H3 (Patient Empowerment -> Telehealth Usability) shows that PE has a major significant effect on TU and hence affects it positively (beta = 0.670, p-value = 0.000).

Table 3.8: Results of Path Analysis

Hypotheses	Direct Relationships	Beta	T-value	P-value	Remarks
1	PE -> PS	0.539	10.680	0.000	*Accepted*
2	TU -> PS	0.582	9.197	0.000	*Accepted*
3	PE -> TU	0.670	18.535	0.000	*Accepted*

In Table 3.9, mediation analysis has been shown in which only 1 hypothesis is listed which shows positive and significant relationship which is partial mediation and hence is accepted. In H4 (PE -> TU -> PS) shows that telehealth usability has a significant effect between patient empowerment and patient satisfaction and acts as a bridge (beta = 0.39, p-value = 0.000), hence it positively mediates the relationship.

Table 3.9: Mediation Analysis: Hypothesis 4

Path	Effect Type	Beta	T-value	P-value	Remarks
PE -> TU -> PS	Indirect Effect	0.390	8.002	0.000	Accepted

In Table 3.10, moderation analysis has been shown in which only one hypothesis has shown which depicts positive and significant relationship and hence is accepted. In H5 (PT x TU -> PS) shows that patient trust has significant effect between telehealth usability and patient satisfaction (beta = 0.078, sig value = 0.035), hence it positively moderates the relationship.

Table 3.10: Moderator Analysis: Hypothesis 5

Path	Beta	T-value	P-value	Remarks
PT x TU -> PS	0.078	2.107	0.035	*Accepted*

3.8 Conclusion

The current research is conducted to determine the role of patient empowerment on patient satisfaction through the usage of telehealth services, which acts as a mediator, while patient trust plays the role of a moderator between telehealth and patient satisfaction. A survey questionnaire was designed, and 262 responses were collected online from respondents from leading pharmaceutical companies. To analyze the data, the SEM technique has been used with the help of SmartPLS 4 software. There are a total of 5 hypotheses, of which 3 are direct and show a positive and significant relationship and are hence accepted, while the 4th hypothesis analyzes the mediation relationship of telehealth usability between patient empowerment and patient satisfaction, which also shows a highly positive and significant impact. Moreover, to investigate the moderation effect of patient trust on telehealth usability and patient satisfaction, a fifth hypothesis has been analyzed, which also shows positive and significant moderation relationships. The findings showed the importance of telehealth services to build trust in health care sector and empower patients, especially those fighting chronic illnesses, so that they can be satisfied with these technologies even in uncertain situations and situations of emergency. The findings reveal that for chronic patients, using telehealth services not only reduces the cost of visiting hospitals again and again, but also saves time because they do not have to take time off from work in order to visit a doctor for treatment. Moreover, patients in remote areas can easily access this service and treat themselves without any hurdles. It is highly recommended from the research conducted that the concerned department should empower patients by providing knowledge and awareness about the usage of telehealth, its constituents, benefits, disadvantages, and how it can be used. Telemedicine utilization empowers patients, builds high levels of trust in their physicians, and hence builds patient satisfaction with using telehealth.

3.8.1 Managerial Implications

The findings of this research give an understanding of the mediating effects of telehealth usability in the relationship between patient empowerment and patient satisfaction. Health care providers can utilize the results of current research to develop strategies to enhance the use of telemedicine, which will result in patient empowerment and satisfaction. Moreover, the role of patient trust also strengthens the relationship between telehealth usability and patient satisfaction, as trust plays an important role in utilizing the offered services. So, the practitioners should focus on building trust and mutual relationships with the patients so that they can feel satisfied by using telemedicine. Hospitals should conduct a survey to identify the patients' perceptions of the services delivered, especially telehealth, and whether they are satisfied or not. This needs attention so that they can improve their quality; otherwise, due to the high competition in contemporary society, they can lose potential patients by keeping them unsatisfied.

3.8.2 Theoretical Implications

By following the comfort theory of mid-range theory in the conceptual framework of the current research, the findings have revealed that patients may feel satisfied by using telehealth services. They may feel content and relaxed when receiving treatment through the new technology, i.e., telehealth, and trust their physician in this regard; hence, they experience a sense of empowerment to easily access telemedicine whenever in need or in any case of emergency without any hurdle.

3.8.3 Limitations and Future Recommendations

It is necessary to mention the limitations of this research so the gap can be filled by future researchers. This research has been conducted in North America, which shows that future researchers are invited to conduct this research in other cities or countries. A huge sample size can be used to further evaluate the big picture. Furthermore, it is recommended to evaluate a comparison of pre and post-telehealth usage to check the levels of patient satisfaction, trust, and empowerment, as this will reveal the true benefits of the advanced technology. Moreover, a panel study should also be conducted to examine the role of this technological advancement in different time intervals and zones. Lastly, to further expand the research, the researchers should use the current framework and conduct a study on patients fighting with acute diseases and have a comparison with this current study focused on chronic illnesses to investigate the role of telehealth services in empowering patients and to determine the difference in levels of patient satisfaction. It is also recommended to conduct qualitative research on this quantitative study to investigate in detail the perceptions and feelings of patients towards the use of telehealth.

3.9 References

Abrams DJ, Geier MR. (2006). A comparison of patient satisfaction with telehealth and on-site consultations: a pilot study for prenatal genetic counseling. *J Genet Couns. , 15*, 199–205.

Anderson RM, Funnell MM. . (2010). Patient empowerment: myths and misconceptions. *Patient Educ Counc , 79*(3), 277–82.

Aujoulat I, d. W. (2007). Patient empowerment in theory and practice: polysemy or cacophony? . *Patient Educ Counc, 66*(1), 13–20.

Bansal,G., F.M. Zahedi, D. Gefen, . (2016). Do context and personality matter? Trust and privacy concerns in disclosing private information online. *Inform. Manag., 53*, 1–21.

Bashshur, R. L., Shannon, G. W., Smith, B. R., Alverson, D. C., Antoniotti, N., Barsan, W. G., Bashshur, N., Brown, E. M., Coye, M. J., & Doarn, C. R. (2014). The empirical foundations of telemedicine interventions for chronic disease management. *Telemedicine and e-Health, 20*(9), 769-800.

Bradford, N. K. (2015). Awareness, experiences and perceptions of telehealth in a rural Queensland community. *15*(1), 1-10.

Bravo, P. E. (2015). Conceptualising patient empowerment: a mixed methods study. *BMC Health Serv Res , 15*, 252. Retrieved from https://doi.org/10.1186/s12913-015-0907-z

Bu, X., & Jezewski, M. A. . (2007). Developing a mid-range theory of patient advocacy through concept analysis. *Journal of advanced nursing, 57*(1), 101-110.

Byrt R, Dooher J. (2002). *Empowerment and participation: defifinitions, meanings and models. In: Dooher J, Byrt R, editors. Empowerment and participation: power, inflfluence and control in contemporary health care* (Vol. 1). Trowbridge, Mark Allen: Quay Books.

Cerezo PG, Juvé-Udina ME, Delgado-Hito P. . (2016). Concepts and measures of patient empowerment: a comprehensive review. *Rev Esc Enferm USP, 50*(4), 667–74.

Chin, W.W. . (1998). “The partial least squares approach for structural equation modeling”, in Marcoulides, G.A. (Ed.). *Methodology for Business and Management. Modern Methods for Business Research*, 295-336.

Christina, E; Mortensen, E L; Rydahl-Hansen, S; Østergaard, B; Jakobsen, A S; Schou, L; Phanareth, K;. (2014). The impact of virtual admission on self-efficacy in patients with chronic obstructive pulmonary disease - a randomised clinical trial. *Journal of Clinical Nursing*.

Clark, M., & Goodwin, N. (2010). *Sustaining innovation in telehealth and telecare: WSD Action Network.* King's Fund London.

Comrey, A.L. and Lee, H.B. (2013). A First Course in Factor Analysis.

Donaghy E, Atherton H, Hammersley V, McNeilly H, Bikker A, Robbins L, Campbell J, McKinstry B. (2019). Acceptability, benefits, and challenges of video consulting: a qualitative study in primary care. *Br J Gen Pract. , 69*(686), e586–e594. doi:10.3399/bjgp19X704141.

Donahue, M. O., Piazza, I. M., Griffin, M. Q., Dykes, P. C., & Fitzpatrick, J. J. (. (2008). The relationship between nurses' perceptions of empowerment and patient satisfaction. *Applied Nursing Research, 21*(1), 2-7.

Falk-Rafael AR. . (2001). Empowerment as a process of evolving consciousness: a model of empowered caring. *Adv Nurs Sci , 24*(1), 1-16.

Field, A. (2009). *Discovering statistics using SPSS:(and sex and drugs and rock 'n'roll)", Introducing Statistical Methods.*

Fisher, P., & Owen, J. . (2008). Empowering interventions in health and social care: Recognition through ecologies of practice. *Social Science and Medicine, 67*(12), 2063-2071.

Fornell, C., & Larcker, D. . (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50.

Fries JF, Vickery DM. (1990). *Take Care of Yourself: the Healthtrac Guide To Medical Care. Reading (MA).* Addison-Wesley Publishing Company, Inc.

Funnell MM, Anderson RM, Arnold MS, et al. (1991). Empowerment: an idea whose time has come in diabetes education. *The Diabetes Educator, 17,* 37-41.

Hair, J., F, J., Hult, G., Ringle, C., & Sarstedt, M. . (2016). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM).* Thousand Oaks, CA: Sage Publications.

Hall , A K; Virginia, D; Amy, H; Kara, M; Clifford, D; Colton, L M;. (2014). Heart Failure Patients' Perceptions and Use of Technology to Manage Disease Symptoms. *Telemedicine and e-Health, 20*(4), 324-331.

Hall JA, Roter DL, Katz NR. . (1988). Meta-Analysis of correlates of provider behavior in medical encounters. *Medical Care, 26*, 657-675.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115–135.

Hogg C. . (1999). *Patients, power and politics. From patients to citizens.* London: Sage Publications.

Hollander, J. E. (2018). Recommendations from the first national academic consortium of telehealth. *Population health management, 21*(4), 271-277.

Kemshall H, Littlechild R. (2000). User involvement and participation in social care. *Research informing practice.* London: Jessica Kingsley.

Kolcaba, K. (2001). Evolution of the mid range theory of comfort for outcomes research. *Nursing outlook, 49*(2), 86-92.

Kolcaba, K. and Fisher, E.M. (1996). A holistic perspective on comfort care as an advance directive. *Crit Care Nurs Q, 18*(4), 66-76.

L.S. Wilson, A.J. Maeder. (2015). Recent directions in telemedicine: review of trends in research and practice. *Health care informatics research , 21*(4), 213.

Ley P. (1988). *Communicating with Patients: Improving Communication, Satisfaction, and Compliance.* London: Croom Helm.

Li, J. V. (2021). Home telemonitoring for chronic disease management: Perceptions of users and factors influencing adoption. *Health informatics journal, 27*(1). doi:1460458221997893.

Linder-Pelz, S.U. . (1982). Toward a Theory of Patient Satisfaction. *Social Science & Medicine, 16,* 577-582.

Lone, S., Birte, Ø., Rasmussen, L. S., Susan, R. H., Svarre, J. A., Christina, E., & Klaus, P. (2014). Telemedicine-Based Treatment Versus Hospitalization in Patients with Severe Chronic Obstructive Pulmonary Disease and Exacerbation: Effect on Cognitive Function. A Randomized Clinical Trial. *Telemedicine and e-Health, 20*(7), 640-646.

López C, Valenzuela JI, Calderón JE, Velasco AF, Fajardo R. (2011). A telephone survey of patient satisfaction with realtime telemedicine in a rural community in Colombia. *J Telemed Telecare, 17,* 83–87.

Lu, X. Z. (2021). Impact of patient information behaviours in online health communities on patient compliance and the mediating role of patients' perceived empathy. *104*(1), 186-193.

McKay B, Forbes JA, Bourner K. . (1990). Empowerment in general practice: the trilogies of caring. *Australian Family Physician, 19,* 513-520.

N., W. (2006). *What is the evidence on effectiveness of empowerment to improve health?* WHO Regional Office for Europe, Copenhagen, Denmark.

Ng JH, Luk BH. . (2019). Patient satisfaction: Concept analysis in the health care context. *Patient Educ Couns, 102,* 790–796.

Naidu, A. (2009). Factors affecting patient satisfaction and health care Quality. *International Journal of Health Care Quality Assurance, 22*(4), 366-381.

Or, C. K., & Karsh, B.-T. J. J. o. t. A. M. I. A. . (2009). A systematic review of patient acceptance of consumer health information technology. *16*(4), 550-560.

Organization, W. H. (1986). *Ottawa charter for health promotion.*

Orrange, S; Patel, A; Mack, W J; Cassetta, J;. (2021). Patient Satisfaction and Trust in Telemedicine During the COVID-19 Pandemic:Retrospective Observational Study. *JMIR Hum Factors, 8*(2). doi:10.2196/28589

Osborne, R. H., Elsworth, G. R., & Whitfield, K. (2007). The Health Education Impact Questionnaire (heiQ): An outcomes and evaluation measure for patient education and self-management interventions for people with chronic conditions. *Patient Education and Counseling, 66*, 192–201. doi:10.1016/j.pec.2006.12.002

P., S. (1982). *The Social Transforma tion of American Medicine.* New York: Basic Books.

Pakdil, F., & Harwood, T. . (2005). Patient Satisfaction in a Preoperative Assessment Clinic: An Analysis Using SERVQUAL Dimensions. *Total Quality Management, 16*(1), 15–30.

Parmanto, B; Lewis, A N; Graham, K M; Bertolet, M H;. (2016). Development of the Telehealth Usability Questionnaire (TUQ). *International Journal of Telerehabilitation, 8*(1), 3-10.

PD., C. (2003). A hospitalization from hell: a patient’s perspective on quality. *Ann Intern Med, 138*, 33–9.

Pickstone NV. . (1993). Ways of knowing: toward a sociology of Science, technology, and medicine. *British Journal for the History of Science, 26*, 433-458.

Rathert, C., Wyrwich, M. D., Boren, S. A. J. M. C. R., . (2013). Patient-centered care and outcomes: a systematic review of the literature. *70*(4), 351-379.

Raza , S A; Hanif, N;. . (2013). Factors affecting internet banking adoption among internal and external customers: a case of Pakistan. *International Journal of Electronic Finance, 7*(1), 82-96.

Ringle, C. M., Wende, S., & Will, A. (2005). *SmartPLS 2.0 M3 Beta.* Heidelberg, Berlin: Springer.

Roberts, B; Kathleen , J;. (1999). Patient empowerment in the United States: a critical commentary. *Health Expectations, 2*, 82-92.

Roncoroni, J., Tucker, C. M., Wall, W., Nghiem, K., Wheatley, R. S., & Wu, W. J. A. J. o. L. M. . (2014). Patient perceived cultural sensitivity of clinic environment and its association with patient satisfaction with care and treatment adherence. *8*(6), 421-429.

Suter, P., Suter, W., & Johnston, D. . (2011). Theory-based telehealth and patient empowerment. *Population health management*, *14*(2), 87-92.

Tambling RR, D’Aniello C, Russell BS. Health insurance literacy among caregivers of substance using young adults. Alcohol Treat Q 2021 May 25;39(4):505-516.

Teresa, J; Weiss, M; Yakusheva, O;. (2014). Patient perceptions of patient- empowering nurse behaviours, patient activation and functional health status in postsurgical patients with life-threatening long-term illnesses. *Journal of Advanced Nursing, 70*(6), 1310-1322. doi:10.1111/jan.2014.70

Thayaparan, A J; Mahdi, E;. (2013). The Patient Satisfaction Questionnaire Short Form (PSQ-18) as an adaptable, reliable, and validated tool for use in various settings. *Med Educ Online, 18*, 21747. Retrieved from http://dx.doi.org/10.3402/meo.v18i0.21747

Thom, D H; Kravitza, R L; Bell, R A; Krupat, E; Azari, R;. (2002). Patient trust in the physician: relationship to patient requests. *Family Practice, 19*(5), 476-483.

Turner, P. a. (1995). “Beyond patient satisfaction”. *Journal of Health Care Marketing, 15*.

Vassilev, I. R. (2015). Assessing the implementability of telehealth interventions for self-management support: a realist review. *Implementation Science, 10*, 1-25.

Velsen LV, Tabak M, Hermens H. . (2017). Measuring patient trust in telemedicine services: Development of a survey instrument and its validation for an anticoagulation web service. *Int J Med Inform, 97*, 52-58. doi:10.1016/j.ijmedinf.2016.09.009.

Wakefield D, Bayly J, Selman LE, Firth AM, Higginson IJ, Murtagh FE. . (2018). Patient empowerment, what does it mean for adults in the advanced stages of a life limiting illness: a systematic review using critical interpretive synthesis. *Palliat Med, 32*(8), 128.

Wilkinson G, M. M. (1999). *Power and nursing practice.* Basingstoke: Macmillan.

Xiaofei, Z. G.-h. (2021). Effects of emotional attachment on mobile health-monitoring service usage: An affect transfer perspective. *58*(2), 103-312.

Yang, Y., Zhang, X., & Lee, P. K. J. I. J. o. P. E. (2019). Improving the effectiveness of online health care platforms: An empirical study with multi-period patient-doctor consultation data. *207*, 70-80.

Zeithaml, V. A., & Bitner, M. J. . (2008). *Services marketing.* . New York: McGraw-Hill.