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Procedia Computer Science 16 (2013) 148 – 156

Procedia
Computer Science

Conference on Systems Engineering Research (CSER'13)

Eds.: C.J.J. Paredis, C. Bishop, D. Bodner, Georgia Institute of Technology, Atlanta, GA, March 19-22, 2013.

A system dynamics perspective of patient satisfaction in healthcare

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Abstract

Healthcare systems face challenges including diminishing resources and increasing demands. The challenges need to be balanced in this complex system of systems to ensure a sustainable quality of life. Sustainability considers the needs of future generations without compromising the needs of current generations. The social component of sustainability is one of the important areas in healthcare sustainability. The social component focuses on considerations such as equity, empowerment, accessibility, participation, cultural identity, and institutional stability. Patient satisfaction is a key factor in the social element. Patient satisfaction represents patient fulfillment in regards to the cost, accessibility to services and resources, and patient wellbeing. It is analogous to 'customer satisfaction'. A systems thinking approach is applied to analyze the social aspect in healthcare systems. This paper explores important factors and factor relationships in healthcare social sustainability related to patient satisfaction using a system dynamics approach.

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Selection and/or peer-review under responsibility of Georgia Institute of Technology

Keywords: Sustainability; healthcare; patient satisfaction; systems thinking; system dynamics; causal model

1. Introduction

According to Dey et al. [1], healthcare is the fastest growing service in both developed and developing countries. The primary goal of healthcare is to offer services to people that help to improve the quality and health of their daily lives. Patients are the primary focus of healthcare systems. They can be considered as customers in this complex system of systems and have various expectations. One of the ways to determine if the services are effective is to ensure that patients are satisfied. Healthcare needs to be sustainable because it faces increasing demands and diminishing resources. The current generations need to be served and future generations need to be considered when offering services in healthcare.

Sustainability is a crucial consideration in our daily lives. Pye-Smith et al. [2] indicate that from the beginning of human history, numerous cultures have agreed that they must consider the needs of future generations once the current basic needs for resources have been met. The terms sustainability and sustainable development can be used

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interchangeably. The first attempt to define sustainability was provided by the World Conservation Union [3]: “For development to be sustainable it must take account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long-term as well as the short-term advantages and disadvantages of alternative actions”. The most quoted definition of sustainable development defines it as “...development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [4]. Three components of sustainable development according to the WCED [4] are social, economic, and environmental. The United Nations [5] recognizes these components as “three pillars” of sustainable development which are “interdependent and mutually reinforcing”. The social pillar ensures people have equal access to resources and their civil and political rights are considered. The social component focuses on aspects such as equity, empowerment, accessibility, participation, cultural identity, and institutional stability. The economic pillar attempts to ensure economic security for all. The environmental pillar considers efficient and cost effective ways to utilize and protect the current resources.

Healthcare needs to be sustainable. The Alliance for Natural Health [6], defines a sustainable healthcare system as: “A complex system of interacting approaches to the restoration, management and optimization of human health that has an ecological base, that is environmentally, economically and socially viable indefinitely, that functions harmoniously both with the human body and the non-human environment, and which does not result in unfair or disproportionate impacts on any significant contributory element of the healthcare system”.

Patient satisfaction is considered as an important factor in healthcare sustainability. Patient satisfaction relates to all three of the sustainability pillars. Understanding this factor and its relationships helps to improve sustainability considerations. The primary objective of a healthcare system is to achieve a healthier population [7]. Healthcare social sustainability ensures the current patients receive quality service and seeks to balance the resources and needs.

This paper discusses healthcare as a complex system of systems and discusses the challenges related to healthcare sustainability. The paper presents a systems thinking approach to explore the complex factors and relationships associated to the social pillar and related to patient satisfaction. A causal model illustrating factors related to patient satisfaction will be presented. Plans for the validation of the causal model and next steps are provided in the future work section.

2. Healthcare complex system of systems and sustainability challenges

Jamshidi [8] defines systems of systems as “large-scale integrated systems which are heterogeneous and independently operable on their own, but are networked together for a common goal”. Wickramasinghe et al. [9] considers healthcare as a system of systems that is a collection of independent, large-scale, intricate, and disseminated systems.

Sheard and Mostashari [10] define complex systems as systems that: 1) have many autonomous components, 2) are self-organizing, 3) display emergent macro-level behavior based on the actions and interactions of the individual agents, and 4) adapt to their environment as they evolve. Healthcare systems fit well into this definition. Many of the elements within the healthcare system can operate independently. Examples include hospitals or physician offices. The elements in healthcare do not need an authority to organize them. They can be managed and organized within their own subsystems. Desired and undesired behaviors emerge from the various interactions in the healthcare system. Healthcare systems also adapt to their environment. When new technologies or regulations are introduced, these systems must adjust with the new changes.

Healthcare as a complex system of systems includes elements that interact in highly intricate and variable ways [11]. There are various stakeholders in healthcare. The quantity of the stakeholders is also increasing. This drives complexity in healthcare [12]. The primary stakeholders in healthcare include patients, physicians, nurses, hospitals, healthcare organizations, pharmacies, government regulatory groups, licensing and funding agencies, and insurance companies [13]. The World Health Organization [14] emphasizes the importance of comprehending complexity in healthcare. They require that students understand why a systems approach is important and the nature of system complexity in healthcare in their curriculum on patient safety for medical schools.

Challenges healthcare systems face that affect sustainability include increasing demands, increasing cost of medical technology and medication, higher patient expectations, and limited resources [15]. Another challenge in healthcare systems is to understand the complexity [16]. The increase in the number of factors and the interconnections makes understanding and managing complex systems difficult. An appropriate level at which the

complexity is represented is also another sustainability challenge in healthcare systems [16]. The proper level depends on many factors such as the characteristics of the system, availability of data, and the information that is going to be predicted.

3. Systems thinking approach

Brailsford [17] emphasizes the need for a modeling approach capable of effectively dealing with the complexity inherent in healthcare. A systems thinking approach can be effectively applied to help in comprehending and addressing the sustainability challenges in healthcare systems.

3.1. Systems thinking

Systems thinking is a method to observe the system's role within the whole [18]. This method views the world as a complex system and supports the understanding of its interrelationships [19]. Systems thinking enables us to better understand complex systems.

Systems thinking facilitates a better understanding of complex systems such as healthcare systems by its holistic approach. In healthcare, systems thinking can consider how different factors and elements in healthcare systems interrelate. The whole system needs to be considered in a systems thinking approach. In order to comprehend and manage a complex system such as healthcare, a system's overall performance needs to be evaluated [20].

3.2. System dynamics

System dynamics helps individuals to understand the dynamic behavior of complex systems. This method was developed by Forrester [21]. Systems thinking can be promoted by understanding a system's dynamics. Causal diagrams are used in support of system dynamics as a method of graphical representation of a system's factor and relations. The major feedback mechanisms of a model are captured by causal diagrams. Elements (factors) and arrows (causal links) are included in a causal diagram. Each link is assigned a sign (either + or -) which represents an increasing or decreasing relationship between the factors. The relationship between factors may have various time delays. However, the time delay is not normally shown in a causal model. A logical next step following a causal model is to develop a simulator that represents the causal model factors and relationships. The simulator would contain a quantification of the factors and relationships.

System dynamics modeling can help individuals to better understand the healthcare system and its factors and relationships. This method can also be utilized to comprehend sustainability considerations. System dynamics can help individuals realize the effect of changes. This approach can also help individuals make better decisions related to healthcare systems and sustainability challenges. System dynamics has been applied to healthcare. Faezipour and Ferreira [13] discuss multiple examples of previous research that utilize system dynamics in healthcare.

4. Patient satisfaction and customer satisfaction

Patient satisfaction is one of the key factors in the healthcare sustainability social pillar. In this section we define patient satisfaction and related factors, methods to measure patient satisfaction, and customer satisfaction.

4.1. Patient satisfaction and related factors

Patient satisfaction is an important factor in the social pillar. Patient satisfaction represents patient fulfillment in regards to cost, accessibility to services and resources, and patient wellbeing. It is analogous to 'customer satisfaction'. Pascoe [22] defines patient satisfaction is "a health care recipient's reaction to salient aspects of the context, process, and result of their service experience". This means patient satisfaction is an evaluation of the received services and experience.

Systems thinking considers the healthcare system as a whole and takes into account the key factors and relationships. The most critical factors and relationships to patient satisfaction need to be considered. A literature search was performed to identify the effects and impacts of patient satisfaction in healthcare and also what affects

patient satisfaction. According to Naidu [23], factors affecting patient satisfaction include: access, care quality, cost, physician role and behavior, tangibles (physical facilities), and others. Lochman [24] identifies factors that have the most noticeable relationship to patient satisfaction including the accessibility of medical care, the organizational structure of clinics, treatment length, perceived competence of physicians, clarity and retention of physicians' communication to patients, physicians' affiliative behavior, physicians' control, and patients' expectations. Kessler and Mylod [25] identify a statistically significant link between patient satisfaction and patient loyalty. Bartlett et al. [26] show that the quality of interpersonal skills and the physician's communication skills influence patient satisfaction. According to Kim et al. [27], the effective use of empathic communication skills or having more empathic physicians may be one of the best ways to improve patient satisfaction. Hospitals with more empathic physicians have an advantage over other hospitals with fewer empathic physicians [27]. Finally, Shilling et al. [28] confirm long waits in the clinic decrease patient satisfaction.

4.2. Patient satisfaction and measurement methods

Patient satisfaction is a key sustainability indicator in healthcare [13]. This factor has always been an important factor in healthcare and healthcare stakeholders have a special interest in obtaining the highest patient satisfaction. Gill and White [29] present a review of literature related to patient satisfaction and discuss the role of perceived service quality in patient satisfaction.

Methods have been developed to measure patient satisfaction in healthcare. The work of Hulka et al. [30] provide the initial approach to measure patient satisfaction in the healthcare area with the development of a scale to measure attitudes toward physicians and primary medical care. Ware and Snyder [31] developed the "Patient Satisfaction Questionnaire", which helps with the planning, administration and evaluation of health service delivery programs. Larsen et al. [32] developed the "Client Satisfaction Questionnaire", which is an eight-item scale for evaluating general patient satisfaction with healthcare services. The "SERVQUAL" method was developed by Parasuraman et al. [33]. Meterko et al. [34] developed the "Patient Judgment of Hospital Quality instrument". Chahal [35] developed a tri-component model that considers the loyalty of patients towards using the same provider. Brady and Cronin [36] developed a model that considers attitude, behavior, and experience (interaction quality); ambient conditions, design, and social factors (physical environment quality); waiting time, tangibles and value (outcome quality). Daoud-Marrakchi et al. [37] developed the Tunisian Measurement Scale to determine patient satisfaction based on reception, nursing care, information, comfort, food, and invoice service in the Tunisian Patient Clinic.

The Consumer Assessment of Healthcare Providers and Systems (CAHPS) is one of the tools applied for measuring patient satisfaction with quality of care. These surveys ask patients to report their experience with healthcare. The Agency for Healthcare Research and Quality (AHRQ) has been the lead developer of this program and the program has become an important national effort to measure and report the patients experience from healthcare [38]. Hu et al. [39] developed Taiwan Customer Satisfaction Index (TCSI) to measure patient satisfaction in Taiwan. TCSI is the modification of American Customer Satisfaction Index (ACSI) that is used to assess patient satisfaction in hospitals in US. ACSI produces scores on four levels: national, sector, industry, and company/agency. It consists of 10 sectors and 47 industries. One of the sectors related to healthcare social sustainability is "Health Care & Social Assistance" that includes the industries of "Ambulatory Care and Hospitals". ACSI measures customer satisfaction in each of these sectors and industries and produces scores for the causes and consequences of customer satisfaction and the relationships for each [40]. The most common methods used in hospitals for measuring patient satisfaction are the ACSI and the CAHPS methods.

4.3. Customer satisfaction

Customer satisfaction is defined as a customer's overall assessment of the performance of an offering to date [41]. Customer satisfaction has a positive effect on customer loyalty, which will increase the return on investment [42-47]. Satisfaction is a psychological concept which is defined in different ways. Sometimes satisfaction is considered as a judgment of individuals regarding any object or event after gathering some experience over time. Hunt [48] concludes that satisfaction is an evaluative reaction resulting from the interaction of the product/situation with the individual's expectations. This evaluation results from the consumption experience. Chakroborty & Majumdar [49]

introduce patient satisfaction as a subset of consumer satisfaction. The literature survey they performed suggests that patient satisfaction and perceived service quality is essential for the sustainability of healthcare. Chakroborty & Majumdar [49] discuss that according to some theorists, satisfaction is a cognitive reaction while some others consider satisfaction as emotional attachment of individuals. Patients are seen and treated as customers in healthcare systems.

5. Healthcare patient satisfaction sustainability causal model

Healthcare sustainability factor categories are identified in Faezipour and Ferreira [13]. Patient satisfaction relates to all three pillars of sustainability. This section reviews the healthcare sustainability categories and presents a patient satisfaction causal model within the context of the social pillar.

5.1. Healthcare sustainability factor categories

According to the definition of ANH [6], the three pillars of sustainability need to be addressed in a sustainable healthcare system. Factors are identified as a result of breaking down the main categories contributing to sustainability. Faezipour and Ferreira [13] performed a rigorous review of literature, analyzed and studied the previous work, and determined the top-level factor categories that contribute to healthcare sustainability. These factor categories include patient, provider, resource, quality, financial, and environmental/energy. These factor categories are interconnected and align with the three sustainability pillars and other major categories in healthcare. Faezipour and Ferreira [13] provide a detailed description of each of the factor categories and relationships. A set of causal models illustrating healthcare sustainability and environmental sustainability related to these categories are presented [13, 50]. However, these works did not focus on an analysis of patient satisfaction.

5.2. Causal model

Patient satisfaction is affected by many factors within the context of the social pillar in healthcare sustainability. Section 4.1 of the paper reviews some of the previous work related to patient satisfaction factors. Presenting all the factors is not possible within the limits of this paper. Therefore, a subset of factors and their relationships related to patient satisfaction are presented. A causal model illustrating patient satisfaction in healthcare is shown in Figure 1. Other factors in the causal model not shown include factors related to the top-level healthcare sustainability categories defined in 5.1. These factors can be grouped into staff-quality related factors such as staff efficiency and staff experience level that are related to the provider, quality, and resource healthcare sustainability categories. Preventive program related factors such as number of patients using wellness programs and cost of insurance can be another group of factors that are related to the patient, provider, and financial healthcare sustainability categories. Another group of factors can be ecological related factors such as energy cost in healthcare and greenhouse gas emission amount in healthcare that are related to the environmental/energy and financial healthcare sustainability categories. Each arrow has a positive or negative sign that indicates the nature of the relationship between the factors. Some of the factors are related to both the social and economic pillar.

The level of patient satisfaction is one of the most important factors in the model. The level of patient satisfaction expresses patient contentment in regards to the cost, accessibility to services and resources, and patient wellbeing. Patient satisfaction is analogous to ‘customer satisfaction’. The level of patient satisfaction defines the level of proper health, security, safety, and happiness of the patient. The amount of resources reflects the amount of available resources including medication, healthcare facilities, and equipment. The level of demand for services and resources indicates the level of need for resources including medication, healthcare facilities, and equipment. Cost of services and resources covers the costs including trained staff, medication, healthcare facilities, and equipment that are offered to the patients. Level of accessibility to services is the availability of the services and resources for each patient. This factor ensures all patients have equal access to the services and resources and also seeks to reduce patient’s waiting time. The overall population defines the amount of living population. The number of patients shows the total number of patients entering the healthcare system. The effectiveness of services refers to the services offered and their outcome. The number of trained staff defines the total number of the trained staff that can include the doctors, nurses, and the physicians. Trained staff are typically more empathic and caring and have better

communication skills. The level of patient complaint indicates the level at which the patient is not satisfied and criticizes the system. Patient loyalty shows the patient’s faithfulness to the existing providers, resources, and services.

As shown in the causal model, as the overall population increases, the quantity of patients increases. As the quantity of patients increases, this is expected to increase the level of demand for healthcare services and resources. As the quantity of trained staff increases, the effectiveness of services they provide to patients are expected to increase which will increase the level of patient wellbeing. As a result, the level of patient satisfaction increases. Carlson & Gabriel [51] identify that improving effectiveness of services offered to patients, improves patient wellbeing. When the level of patient wellbeing increases, patients are expected to become healthier therefore the quantity of patients decreases. As the level of demand for services and resources increases, the resources and services become less available. When more resources are available, the level of accessibility to services and resources is expected to increase. An increase in the amount of resources can increase the number trained staffs. As the number of trained staff increases, the cost of services and resources increases. Increase in the cost of services will result in a decrease of the level of patient satisfaction. According to Bacon & Mark [52], as accessibility to services and resources increases, patient satisfaction is expected to increase. Patient satisfaction improvement improves patient loyalty [25]. An increase in the level of patient loyalty is expected to increase the level of demand for services and resources because patients are more apt to return or recommend healthcare services to others. An increase in patient satisfaction can also decrease the level of patient complaints. As patient complaints increase, the level of demand for services and resources would decrease.

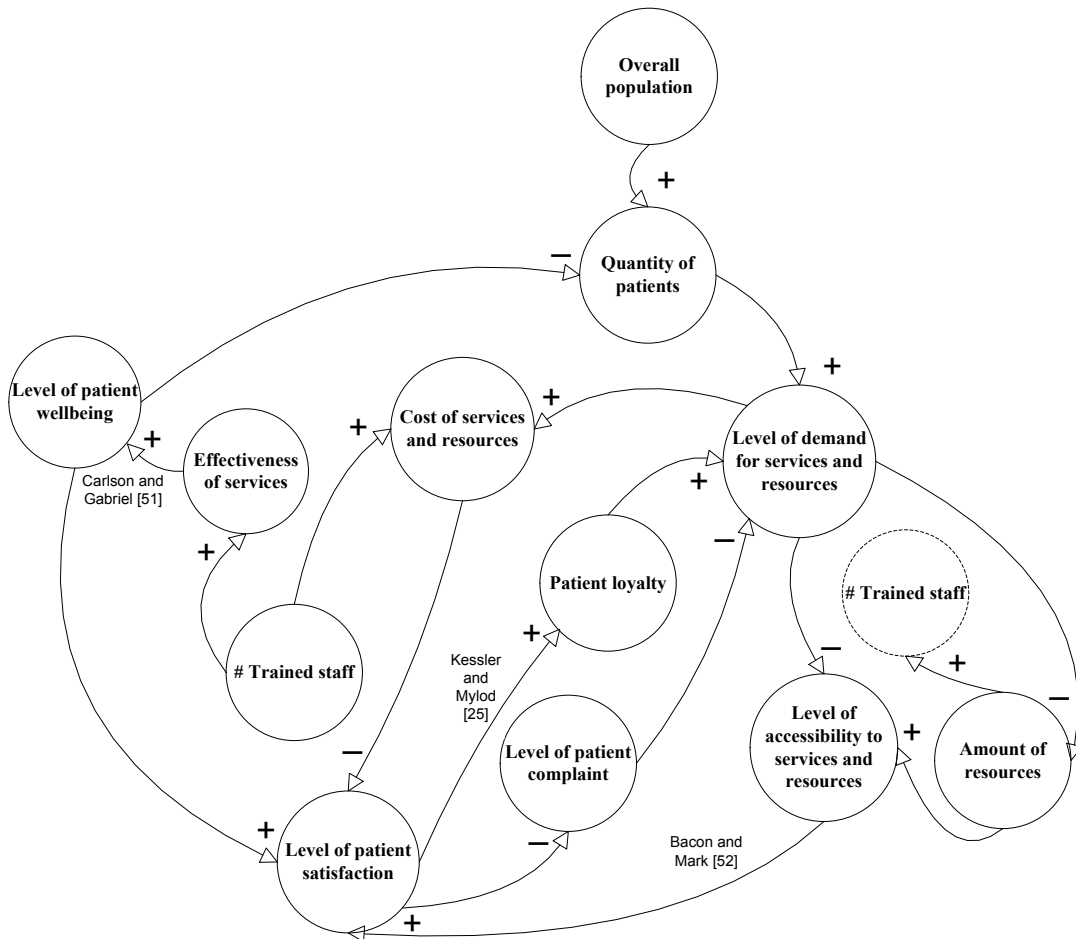


Fig.1 Patient Satisfaction Sustainability Causal Model

6. Future Work

The causal model validation is currently underway with a set of hospitals in the Dallas-Fort Worth Metroplex. The purpose of the causal model validation is to ensure all the factors and the factor relationships are valid and reasonable. A validation package has been provided to the hospitals that includes the causal model and a set of questions related to the factors and the factor relationships. The causal model will be updated and modified based on recommendations and feedback received from the validators. A simulator will be developed from the causal model.

The simulator will help decision makers understand the impacts and relationships of key factors in healthcare associated to patient satisfaction.

7. Conclusions

This paper discusses the importance and definition of sustainability in healthcare systems. Healthcare needs to be sustainable since the demands are increasing and the resources are limited. A balanced approach is required to ensure the needs of current generations are met as well as considering the needs of future generations. All three pillars of sustainability need to be addressed in a sustainable healthcare system. The demands of society, economic and environmental needs should be appropriately balanced with the available resources to ensure a sustainable quality of life. The focus of this paper is on patient satisfaction in the context of the social pillar. Patients are the main focus in healthcare. Patient satisfaction is defined and is considered as one of the key sustainability factors in healthcare.

Systems thinking offers a holistic view of a system and facilitates the understanding of complex systems. This method is used to address sustainability challenges in healthcare. System dynamics helps to explore the complex relationships between the various factors in a system. A causal model is presented that provides a graphical illustration of the factor relationships associated with patient satisfaction in the social pillar. Next steps include the validation of the causal model that ensures that the factors and factor relationships are correct and the development of a simulator.

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