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SEIPS 3.0: Human-Centered Design of the Patient Journey for Patient Safety

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Abstract

The Systems Engineering Initiative for Patient Safety (SEIPS) and SEIPS 2.0 models provide a framework for integrating HFE in health care quality and patient safety improvement. As care becomes increasingly distributed over space and time, the “process” component of the SEIPS model needs to evolve and represent this additional complexity. In this paper, we review different ways that the process component of the SEIPS models have been described and applied. We then propose the SEIPS 3.0 model, which expands the process component, using the concept of the patient journey to describe the spatio-temporal distribution of patients’ interactions with multiple care settings over time. This new SEIPS 3.0 sociotechnical systems approach to the patient journey and patient safety poses several conceptual and methodological challenges to HFE researchers and professionals, including the need to consider multiple perspectives, issues with genuine participation, and HFE work at the boundaries.

Keywords

SEIPS; patient journey; care coordination; human-centered design; participatory ergonomics; patient safety

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Declaration of interests
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Introduction

When the initial SEIPS (Systems Engineering Initiative for Patient Safety) team put together the 2006 paper on the SEIPS model of work system and patient safety (Carayon et al., 2006), the objective was to integrate the work system model of Smith and Carayon (Carayon, 2009; Smith & Carayon-Sainfort, 1989; Smith & Carayon, 2001) with the well-established Donabedian (1988) Structure-Process-Outcome (SPO) model that describes approaches to measuring and improving health care quality. We expanded the "structure" component of the SPO model and defined it as the work system model, i.e. the elements within this system and their interactions. We expanded the "outcome" component of the SPO model by distinguishing outcomes related to patients (e.g. patient safety) and outcomes related to workers in health care organizations (e.g. quality of working life, stress and burnout). Agreeing on how to conceptualize the "process" component of the SPO model was more challenging. Bentzi Karsh and the other engineers on the SEIPS team endorsed the typical input-process-outcome engineering model, while the health scientists on the SEIPS team espoused Donabedian's view on process, i.e. "what is actually done in giving and receiving care" and its focus on measurement (Donabedian, 1988, p.1745). The "process" component of the SEIPS model has been interpreted in various ways, which are described below. In this paper, we clarify and expand the "process" component of the SEIPS model by suggesting that, in order to improve patient safety, we should focus on the journey of patients and their caregivers over space and time as they interact with different health care workers, often belonging to different organizations. The combination of space and time in conceptualizing work, work system and workflow was important to Bentzi Karsh (Karsh, 2004; Karsh, Holden, Alper, & Or, 2006; Karsh, Waterson, & Holden, 2014). We build on Dr. Karsh's contributions and propose a new focus on the patient journey as a core concept of human factors and ergonomics (HFE) and its contribution to patient safety. This leads us to propose the third generation of the SEIPS model: SEIPS 3.0. We then discuss methodological implications of the patient journey concept for human-centered design of health care sociotechnical (work) systems to improve patient safety.

The expanded focus of the SEIPS model to the patient journey is also a response to increasing challenges with care coordination, in particular for patients with chronic conditions. About 60% of the US population has one chronic condition, and 40% have multiple chronic conditions (Centers for Disease Control and Prevention, 2018). Medicare patients (i.e. American patients 65 years and older who are covered by the national health insurance program of Medicare) see seven different physicians on average and fill up to 20 prescriptions per year (Partnership for Solutions, 2004). Children also experience chronic conditions, from common respiratory diseases, like asthma, to multiple complex, chronic conditions that require care from an often fragmented array of community- and hospital-based clinicians (Kuo, McAllister, Rossignol, Turchi, & Stille, 2018). Poor care coordination for patients with chronic conditions leads to multiple bad outcomes, such as preventable hospital admissions (Frandsen, Joynt, Rebitzer, & Jha, 2015) and lack of follow-up care by primary care physicians or specialists (Doty, Fryer, & Audet, 2012). Improving care coordination requires a deep understanding of the actual work involved in coordinating care, including the various members of the distributed care team and their interdependent activities over time (Kianfar, Carayon, Hundt, & Hoonakker, 2019). Therefore, we need to go beyond the typical focus of a patient's single health care encounter, and understand a patient's journey across and between multiple health care delivery organizations and their interactions with other stakeholders (e.g. community organizations).

"Process" in the SEIPS Model

The SEIPS model originally published in 2006 (Carayon et al., 2006) was proposed as a framework to improve our understanding of the system factors that contribute to patient safety. It is a model anchored in the human factors and ergonomics (HFE) discipline as (1) the person is the center of the work system, and (2) interactions among work system elements should be designed to support performance and safety and avoid negative outcomes, such as stress and preventable patient harm. This is in line with the renewed focus of HFE on systems approaches and consideration for the dual objectives of performance and well-being advocated by HFE (Dul et al., 2012). An updated version of the SEIPS model (Carayon, Wetterneck, et al., 2014) clarifies the role of the external environment, expands on the feedback loops in the model and describes the active and adaptive role of the persons, who are at the core of the work system. The second version of the SEIPS model, i.e. SEIPS 2.0 (Holden et al., 2013), helps us understand the individual and collaborative work of clinicians, patients, and caregivers. SEIPS 2.0 further explains that the work system could be centered around the clinician, the patient (and/or caregiver), or the care team (i.e. patient with her/his clinicians and/or caregivers). Various configurations of work systems produce varying system barriers and facilitators, which in turn influence outcomes for patients (e.g. patient safety), clinicians (e.g. burnout) and health care organizations (e.g. turnover). SEIPS 2.0 calls attention to adaptation mechanisms that occur in the feedback loops between outcomes and the work systems. The original SEIPS model and SEIPS 2.0 include the work system model (Smith & Carayon-Sainfort, 1989) as their core component.

Engineering Approach to Input-Process-Output (IPO)

From an engineering perspective, a process is the central component that transforms various inputs (e.g. supplies, materials, time, energy, skills) into outputs of importance to a customer; this is often called the IPO or Input-Process-Output approach. According to the International Organization for Standardization (ISO), a process is "a set of interrelated or interacting activities that transforms inputs into outputs" (ISO 9000:2000 clause 3.4.1). The engineering approach to IPO and its process orientation focus on ensuring adequate resources and control mechanisms are in place to achieve efficient and effective outputs. The IPO engineering approach can benefit from HFE knowledge to ensure that human considerations are being integrated in the design of work systems in which processes are embedded (Eklund & Yeow, 2015). In the SEIPS model, this is achieved by describing the process as being shaped by the work system elements and their interactions and by placing the person at the center of the work system (Carayon et al., 2006; Carayon, Wetterneck, et al., 2014; Holden et al., 2013).

In the SEIPS model, the process is bigger than the "task", one of the work system elements. A (care) process is conceptualized as a series of tasks (not necessarily organized linearly) performed by one or several persons using various technologies in a physical and organizational environment. In line with Wilson's (2000) definition of HFE with its focus on human-system interactions, it is the combination of work system interactions that produces the process, achieves the care and influences multiple outcomes, such as patient safety. Therefore, in order to understand the care process, we need to go beyond describing tasks, and assess the whole work system. Because the HFE discipline has traditionally focused on tasks (Kirwan & Ainsworth, 1992), our distinction of task and process may be confusing. Most often the focus of HFE is on individual tasks; but increasingly the HFE discipline has recognized the importance of teams and the collaborative work done by groups of individuals (Salas, Cooke, & Rosen, 2008). Our SEIPS approach is in line with the expanded focus of HFE on teams, multi-teams and systems (Dul et al., 2012; Karsh & Brown, 2010; Matthieu, Marks, & Zaccaro, 2001; Xiao, Henrickson Parker, & Manser, 2013). A process includes a set of tasks that are performed to change inputs into outputs (see above discussion on IPO); these tasks are performed individually or by multiple individuals working collaboratively with the shared goal of producing their outputs; in other words, they are a team.

Combined Work System and Process

In the different visual representations of the SEIPS model (Carayon et al., 2006; Carayon, Wetterneck, et al., 2014; Holden et al., 2013), the work system and the process are displayed separately. For instance, in the SEIPS 2.0 model (Holden et al., 2013), we distinguish between (1) the professional work process, (2) the patient work process, and (3) collaborative professional-patient work process, and we show how the work system(s) influence these three processes. However, it is important to emphasize that the work system and process are intractably related. A process can be thought of as the way "the system achieves its purpose(s)" (Siemieniuch & Sinclair, 2015, page 876). Thus, the work system and the process are two different perspectives on the same object, i.e. the "work" done by health care workers, patients and caregivers, either individually or collaboratively.

The conceptual framework of the US National Academies' report on Improving Diagnosis (Balogh, Miller, & Ball, 2015) is an example of how the work system and the diagnostic process are related to each other. As shown in Figure 1, the diagnostic process is actually *embedded* in the work system. The diagnostic process is a series of activities that begin with the patient engaging with health care, followed by a cycle of cognitive activities (i.e. information gathering, information integration and interpretation, and working diagnosis), which then lead to a diagnosis that is communicated to the patient and acted upon. The activities in the diagnostic process are influenced by multiple work system elements and their interactions. This application of the SEIPS model to diagnostic safety (Figure 1) is a useful reminder that the work system and the process are intertwined, even if they are often shown as separate entities in different visual representations of the SEIPS model.

From Care Process to Patient Journey

Walker and Carayon (2009) identified the need to shift focus from isolated tasks to care processes to improve patient safety and quality of care, specifically in the context of health information technology. While beneficial, care process analyses often focus on health care delivery and the work of physicians and nurses (Carayon & Wooldridge, 2019). However, care is “provided through a myriad of interactions between various individuals: the patients themselves, their families and friends, healthcare providers, and various other staff” (Carayon & Wood, 2009, p. 29). From the perspective of the patient, health care unfolds across multiple care settings over time (Carayon & Wood, 2009; Vincent & Amalberti, 2016), including patient encounters in a clinical setting as well as activities ‘in-between’ these encounters (e.g. health management activities performed at home) (Holden, Valdez, Schubert, Thompson, & Hundt, 2017). Therefore, we call for expanding the focus of care processes to the patient journey; this is the purpose of the SEIPS 3.0 model.

Approaches to Patient Journey

Various terms have been used to describe interactions between patients and health care delivery that occur over space and time. For instance, “patient flow” is often used to identify inefficiencies in the hospital (Dixon, Punguyire, Mahabee-Gittens, Ho, & Lindsell, 2015). “Patient pathway” is used to describe steps of a care process, e.g. steps from admission to discharge (Trebble, Hansi, Hydes, Smith, & Baker, 2010). The term “patient trajectory” originated in the sociology literature in the 1980s and 1990s and initially addressed mental health problems (Corbin & Strauss, 1988). Later on, the term “patient trajectory” became widely used in socio-medical studies and, in particular, in nursing research and policy (Alexander, 2007). A trajectory in health care has been defined as “the assembling, scheduling, monitoring, and coordinating of all steps necessary to complete the work of patient care. The term trajectory refers not only to the pathophysiological process of a patient’s disease state, but also to the total organization of work done throughout all nurse and patient interactions and the impact of patient care processes on those interactions and the organization” (Alexander, 2007, page 912). A patient health care trajectory often highlights how a disease is managed (Pinaire, Azé, Bringay, & Landais, 2017).

The concept of the patient journey has been increasingly used to describe the patient’s experience, emotional and physical journey and interactions in various settings (McCarthy et al., 2016). We have defined the patient journey as “the spatio-temporal distribution of patients’ interactions with multiple care settings over time” (Carayon & Wooldridge, 2019). Figure 2 displays a model of the patient journey with multiple stages (e.g. home, hospital, clinic), which include patient interactions with a variety of work systems and their elements.

The National Academies of Sciences, Engineering and Medicine (NASEM) (2018a) defined the patient journey as follows:

> “The patient journey consists of the myriad interactions that patients have with the health care system, health care providers (formal and informal), and families and friends and among themselves. These interactions occur over time and across multiple health care settings, such as clinics and hospitals, and within communities. The spatio-temporal interactions and transitions in care experienced by a person constitute the essence of the patient journey.”
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> (page 1–10).

Figure 3 shows the NASEM model of the patient journey across the entire life course (NASEM (National Academies of Sciences, 2018a). Over their life course, people have various interactions with formal or informal health care professionals and organizations. Those interactions are influenced by individual characteristics (e.g. patient biology, patient behaviors), the socio-politico-economic environment, and socio-economic circumstances (e.g. access to community resources).

The two definitions of the patient journey by Carayon and Wooldridge (2019) and the NASEM (2018a) share several similarities, notably that the patient journey includes interactions with many formal and informal health care workers in multiple organizations. These interactions are influenced by the external environment (e.g. social, political and economic circumstances) and by patient characteristics. Further, both definitions emphasize that the patient journey includes interfaces between organizations involved in patient care, although the specific interfaces vary by patient. Those interfaces can lead to care fragmentation (NASEM (National Academies of Sciences, 2018a) and issues with care coordination (Vincent & Amalberti, 2016). Collectively, the distributed nature of the patient journey supports the argument put forward by Vincent and Amalberti (2016) that we should consider patient safety broadly, over time and across interfaces. A longitudinal analysis of the patient journey allows a better understanding of what happens to patients over time, providing a more complete picture of patient safety (Vincent & Amalberti, 2016; Vincent, Carthey, Macrae, & Amalberti, 2017).

As highlighted by NASEM (2018a), a key component of examining the patient journey is the focus on the patient experience. Therefore, safety must include the perspective of the patient and their family or caregivers (Brennan & Safran, 2004; Vincent & Amalberti, 2016). The transitions across interfaces should be designed to center on the person (or patient) while simultaneously considering needs of health care workers (NASEM (National Academies of Sciences, 2018a). Expanding the focus of care processes to the patient journey can help us to better address patient safety by designing person-centered care systems that consider the needs of all participants, including patients, caregivers and their clinicians.

The SEIPS 3.0 Model – A Sociotechnical Systems Approach to Patient Journey

As represented in Figure 4, the SEIPS 3.0 model describes the patient journey as a temporal series of work systems that interact with each other in varying degrees of coupling and involve work at the ‘sharp end’ of the care team as well as ‘blunt end’ influences of multiple socio-organizational contexts (e.g. health care organizations, home environment) (Cook & Woods, 1994; Henriksen, 2010). The sharp end and the blunt end are represented as concentric circles, in a manner similar to other multi-level HFE models (Bogner, 2007; Carayon, Hancock, et al., 2015; Moray, 1994, 2000). The inner circle (or the sharp end) represents the local context or work system where patients interact with various care team members, e.g. caregivers and clinicians. This frontline care delivery system is similar to the concept of clinical micro-system (Nelson et al., 2002) and integrates the five elements of the work system model of Smith and Carayon (Carayon, 2009; Smith & Carayon-Sainfort, 1989). The local work system is embedded in a larger socio-organizational context, which could be a formal health care organization (e.g. hospital, primary care clinic, skilled nursing facility) or an informal care setting (e.g. home). The patient journey is embedded in an external environment, which includes various actors, stakeholders and characteristics, such as regulatory entities, insurance companies, and health care workforces (Carayon, Wetterneck, et al., 2014).

When a patient goes through her/his journey, s/he interacts with multiple work systems at multiple time points (see the multiple orange and blue concentric circles in Figure 4). These work systems continuously adapt or respond to changes in the external environment, such as new laws and/or regulations. The local work systems adapt to changes, for example in technologies, such as the introduction of new clinical decision support or a patient portal. They also adapt to changes in management and the way work is organized in the socio-organizational context (represented by the blue circle). Looking at only one work system at one point in time is limiting and does not consider the temporal changes and adaptations that occur, as well as the navigation of patients among and between health care organizations. A collection of snapshots of work systems over time can help to create an understanding of the patient journey, in a manner similar to pictures in a travel photo album. The combination and interactions of the work systems over time produce outcomes experienced by patients (e.g. patient safety), caregivers (e.g. caregiver burden), clinicians (e.g. burnout) and health care organizations (e.g. turnover).

Similar to the SEIPS (Carayon et al., 2006) and SEIPS 2.0 (Holden et al., 2013) models, the SEIPS 3.0 model includes feedback loops from the outcomes back to the socio-organizational contexts and the local work systems. The feedback loops represent learning, improvement and adaptation mechanisms. Data on outcomes can be used as feedback to identify improvement opportunities at various stages of the patient's journey or at specific interfaces between health care organizations. When system redesigns are implemented, their impact on outcomes can be evaluated; therefore, providing feedback into learning and continuous improvement. The outcomes relate to a range of stakeholders, including patients (e.g. patient safety), caregivers, clinicians and health care organizations; see Table 1 for a description of outcomes.

Kathy's Story and Application of the SEIPS 3.0 Model

Figure 5 describes a fictional patient, Kathy, and the steps of her journey across multiple health care organizations over time: rural ED, tertiary care hospital, skilled nursing facility (SNF) close to her daughter, and physical therapy (PT) and occupational therapy (OT) clinic. Each step includes interactions between Kathy, her family and multiple health care professionals, which occur in a larger organizational context. In addition, transition work occurs at the interface of these organizations. These transitions represent opportunities for vulnerabilities (e.g. information not transferred or not transferred correctly, completely or timely) as well as opportunities for error recovery, resilience and identification of problems (Wears, Perry, & Patterson, 2012). An in-depth analysis of the local and organizational system layers and interfaces between the systems would be necessary to assess what works and does not work in Kathy's patient journey. This would involve an assessment of system barriers and facilitators in the distributed work of Kathy's care team members and coordination at the interfaces. This in-depth analysis of Kathy's patient journey would help to understand the emergence of patient safety issues along the entire journey. In the next section, we described an example of this approach used by Werner et al. (2017) in studying medication safety in the journey of older adults who transition from hospital to skilled home health care.

HFE Challenges for Human-Centered Design of the Patient Journey

Designing and improving the patient journey poses numerous challenges to the HFE discipline and profession (Table 2). How can we design a patient journey that is centered on the patient *and* other people (e.g. caregivers, clinicians) and their needs, abilities and constraints? The answer to this question requires close attention to human-centered design, which is more than user-centered design as other stakeholders (besides the ‘patient-user’; e.g. caregivers and community) need to be considered. According to the International Organization for Standardization (2010), human-centered design (HCD) is an “approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques”. The ISO 9241–210 standard highlights key principles of HCD, including involvement of users and other stakeholders throughout design and development activities. The principle of stakeholder participation is aligned with participatory ergonomics (Haines, Wilson, Vink, & Koningsveld, 2002; Xie, Carayon, Cox, et al., 2015) and other participatory design methods such as experience-based design (Bate & Robert, 2006).

Multiple Perspectives in Human-Centered Design of Patient Journey

The application of HCD principles and methods to the design of the patient journey for improving patient safety brings up a number of issues. Improving the patient journey involves redesigning multiple work systems and their elements and interactions, and interfaces between those multiple work systems and socio-organizational contexts. This should involve multiple people who are likely to belong to different organizations and have varied backgrounds and needs. These individuals include critical stakeholders, such as patients and their caregivers, clinicians in varied settings (e.g. hospital, primary care, emergency department, community pharmacy, long-term care facility, home health agency) and community entities, and bring multiple perspectives to the design process. Addressing multiple perspectives has been identified as a major issue in participatory collaborative system design (Détienne, 2006), and can be particularly challenging in the context of the patient journey. The stakeholders have varied roles, needs and constraints that may conflict. There also may be status differentials (e.g. patient and health care professionals) that could affect the quality and amount of interactions during participatory design sessions. Because the patient journey involves multiple encounters (or events) with *multiple stakeholders* distributed across time, organizations (e.g. hospital, emergency department) and settings (e.g. home), participatory methods for redesigning work systems and their interfaces in the patient journey will be challenging. We need to create *genuine* participatory methods that balance the needs and perspectives of multiple groups. Projects to improve the patient journey also challenge HFE researchers and professionals as the improvement work often occurs at the *interface* of multiple organizations. These are major areas for HFE research.

Using Participatory Design and Participatory Ergonomics to (Re)design the Patient Journey

Human-centered design of the patient journey should incorporate meaningful participation of relevant stakeholders, including patients, caregivers and health care professionals. This is in line with the definition of participatory ergonomics by Wilson (1995) as: “the involvement of people in planning and controlling a significant amount of their own work activities, with sufficient knowledge and power to influence both processes and outcomes in order to achieve desirable goals” (p. 1071). How do we implement participatory design and participatory ergonomics methods in the context of the patient journey? How can we manage participation with such a diverse group of stakeholders who may be physically distributed, have different schedules and work in various organizations or contexts? Our project on the redesign of daily bedside rounds to engage patients and families in a children’s hospital provides a useful example of the application of participatory ergonomics to improve a care process (Carayon, Li, et al., 2014; Xie, Carayon, Cartmill, et al., 2015; Xie, Carayon, Cox, et al., 2015). This redesign, described below, led to improved care team communication and associated improvements in family engagement and perceptions of safety (Cox et al., 2017). Although the patient journey in this example is limited to the hospitalization, it represents an important step in beginning to understand the temporal flow of work in the patient journey.

Patient safety is a major concern for hospitalized children who are particularly vulnerable to harm from medical errors (Kaushal et al., 2001). Engaging families in their inpatient care has been suggested as a way to improve safety (AAP, 2012). Family-centered rounds (FCR) are interdisciplinary rounds where the patient and family participate in the care management plan with the rest of the care team; this provides a venue for family engagement in patient safety efforts (Cox et al., 2017; Khan et al., 2018). However, multiple work system barriers hinder family engagement in FCR (Carayon et al., 2011; Carayon, Li, et al., 2014; Kelly et al., 2013). To address these barriers, we developed a participatory ergonomics project aimed at identifying and implementing a work system intervention to enhance family engagement in FCR (Xie, Carayon, Cox, et al., 2015). In this participatory, collaborative healthcare system redesign, we first created an intervention implementation team to facilitate the redesign process. The team consisted of researchers and FCR stakeholder representatives: parent, medical administrator, nurse manager, nurse, attending physician, and resident. Not all FCR stakeholders participated in the intervention implementation team as we balanced representation and team size (Xie, Carayon, Cartmill, et al., 2015). FCR stakeholders who did not directly participate in the team (e.g. pharmacist, social worker) were able to provide input to the redesign process through other mechanisms, including interviews, surveys and meetings. Such a multi-layer approach for genuine participation may, therefore, be necessary in projects aimed at redesigning (segments of) the patient journey; this would help to ensure input is obtained from a wide range of stakeholders, while managing active participation from a subset of representative and critical stakeholders.

HCD of the patient journey needs to incorporate ‘genuine’ participation of relevant stakeholders (Østergaard, Simonsen, & Karasti, 2018) with the goal of improving patient safety along the patient journey. Stakeholders in improvement projects, such as improving the patient journey, would typically be varied and include individuals in formal (e.g.

hospital) and informal (e.g. community organizations such as churches and patient advocacy groups) organizations. Genuine participation of these stakeholders may take different forms, as described by the broad concept of “citizen science” (NASEM (National Academies of Sciences, 2018b; Preece, 2016). A taxonomy of citizen science projects, including health-related citizen science projects, distinguishes between *contributory*, *collaborative* and *co-created* projects (NASEM (National Academies of Sciences, 2018b). In contributory projects, citizens (e.g. patients) help with data collection. For instance, patients or their caregivers could keep a diary of their experience with health care, record barriers and facilitators to coordination, and then share those data with the improvement team. In collaborative projects, patients would also help with the analysis and interpretation of their diary data. Finally, in co-created projects, patients and caregivers are involved in all phases of the project and all aspects of the work. HFE professionals and researchers should contribute to the development and testing of genuine participatory methods aimed at fully engaging patients and caregivers as well as other stakeholders in collaborative design projects for improving the patient journey.

Working at the Interface

The concept of patient journey focuses on work that occurs at organizational, geographical, cultural and temporal boundaries (Carayon, 2006). The patient ‘travels’ through multiple health care organizations, such as the ED, hospital, primary care office, specialist office and long-term care facility, which may be located in different geographical regions (see Kathy’s story in Figure 5). These multiple organizations have their own structure, processes and culture. They may be located in different regions when, for instance, the patient receives emergency care during a trip or when a patient travels from their home in a rural, remote area to a specialized treatment facility located near a major urban academic health system. In addition, care along the patient journey involves activities that are distributed over time, e.g. across day and night shifts or different time zones. In order to better understand the emergence of safety along the patient journey, we need to consider these organizational, geographical, cultural and temporal boundaries. The study by Werner et al. (2017) on transitions of older adults from the hospital to skilled home health care is an example of a (SEIPS-based) systems approach to assess work across such boundaries and associated challenges in the care journey of older adults.

Werner and colleagues (2017) focused on the distributed work of medication management when older adults transition from the hospital to skilled home health care. This is a major issue as older patients are at higher risk of harm during care transitions in their journey (Arbaje et al., 2014; Jencks, Williams, & Coleman, 2009). Using observation and interviews of health care professionals in hospitals and home health agencies and patients who experienced the transitions, the researchers mapped out the medication management process, which is distributed across the hospital work system, the home health agency work system and the patient work system. They identified interactions at the boundaries of these three work systems, and resulting system barriers and emergent properties, such as role ambiguity or confusion at all stages of medication management. Medication management involved work done by multiple individuals in loosely-coupled teams located in multiple organizations (e.g. hospital, home health agency). Researchers described the key role of hospital- and home-based boundary spanners in managing medications as they addressed and worked around barriers in communication and information management. For instance, these boundary spanners would go above and beyond their formal job and pick up medications at the pharmacies or give patients money for prescriptions they could not afford. The perspective adopted by the researchers allowed them to examine the medication-related work distributed in the older patient's journey, the system barriers that affected this work, and the propagation of barriers along the patient journey. The concept of patient journey draws attention to the spatio-temporal distribution of system barriers (and facilitators) as well as how barriers travel or propagate along the journey (Carayon, Ju, et al., 2015).

An important lesson from the study by Werner and colleagues (2017) is that, without the focus on interfaces and boundaries in the patient journey, critical system properties and barriers would not have been identified. Therefore, HFE researchers and professionals need to develop approaches and methods that can address the additional complexity of examining not just tasks, not just work systems, but a set of work systems distributed throughout the patient journey (see Figure 4). Implementing human-centered design approaches for the patient journey implies that the HFE researcher or professional works at the interface of multiple organizations and across organizational, geographical, cultural and temporal boundaries. Therefore, they must develop skills, knowledge and abilities to become "competent boundary spanners" (Williams, 2002), such as cultivating interpersonal relationships, communication skills, political skills and an ability to understand system interdependencies.

Conclusion

Challenges faced by patients, caregivers and health care organizations around the world call for a renewed focus on the patient's experience and their multiple interactions with health care across space and time. The SEIPS 3.0 sociotechnical systems approach to the patient journey describes the patient interactions that occur at the local micro work system level and are embedded in a larger socio-organizational context; the series of multi-level systems over space and time is the essence of the patient journey. Designing and improving the patient journey and patient outcomes, such as patient safety, require that HFE researchers and health care professionals develop innovative methods for engaging multiple stakeholders, managing their perspectives and working at multiple interfaces.

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Highlights

- The patient journey represents patient interactions with multiple health care organizations and contexts distributed over space and time.
- The patient journey is composed of multiple local work systems embedded in interconnected care settings.
- Designing and improving the patient journey for patient safety poses challenges to HFE, such as implementation of genuine participation of multiple stakeholders distributed over space and time.

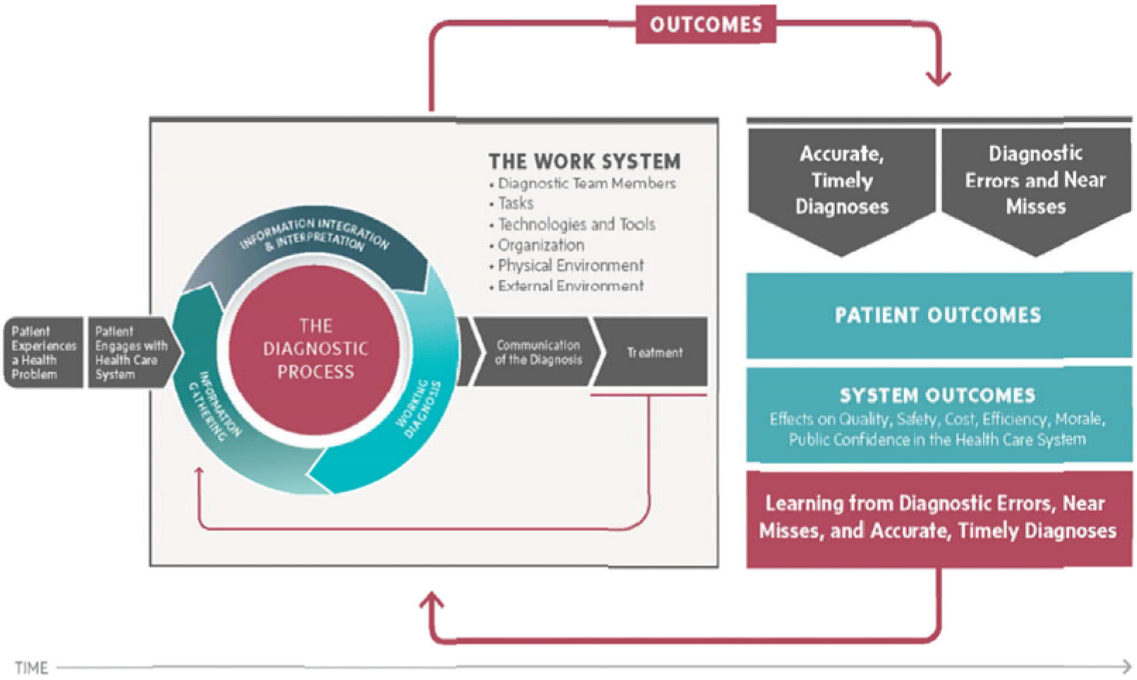

Figure 1 -

Conceptual Framework of the Diagnostic Process Embedded in the Work System (Balogh et al., 2015)

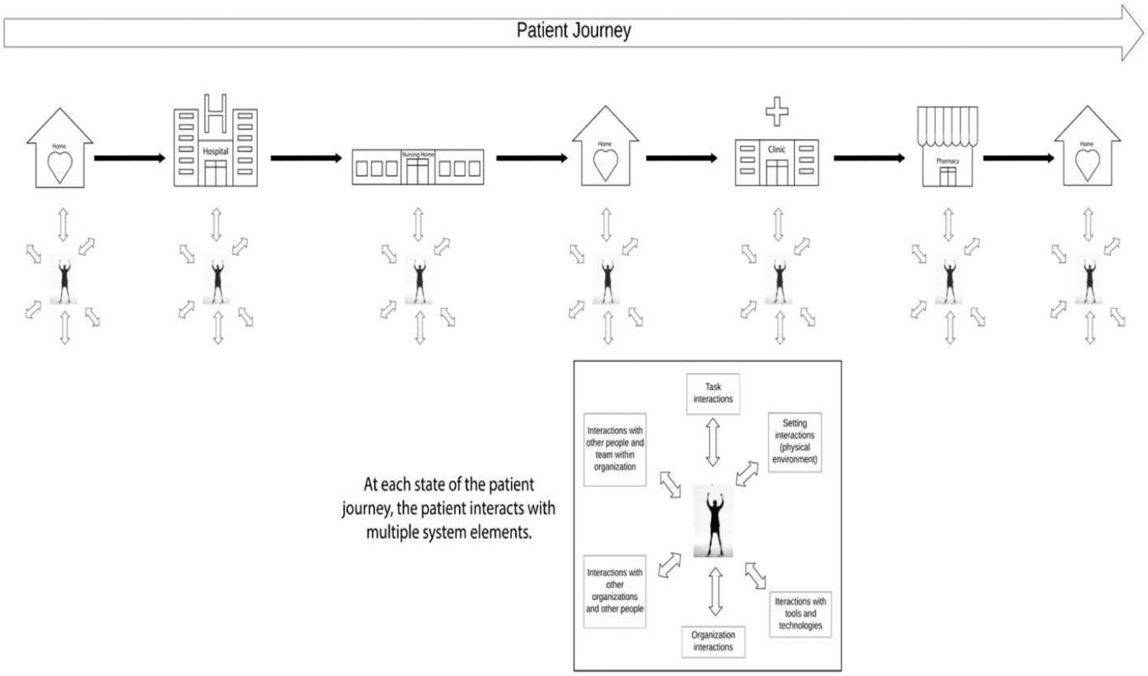

Figure 2 -

Care Transitions in the Patient Journey (Carayon & Wooldridge, 2019)

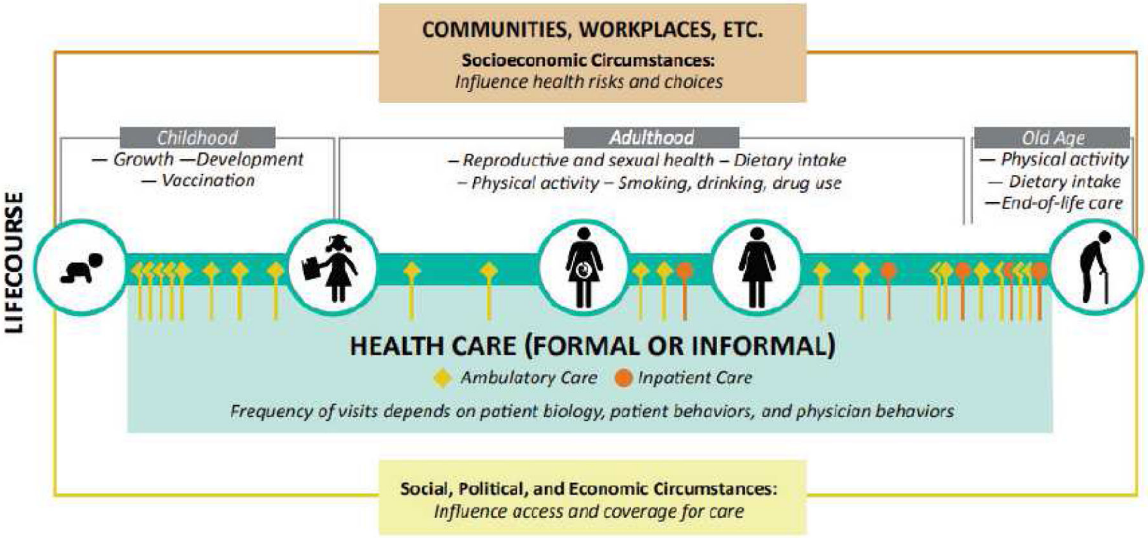

Figure 3 -

Patient Journey Across the Life Course (NASEM (National Academies of Sciences, 2018a)

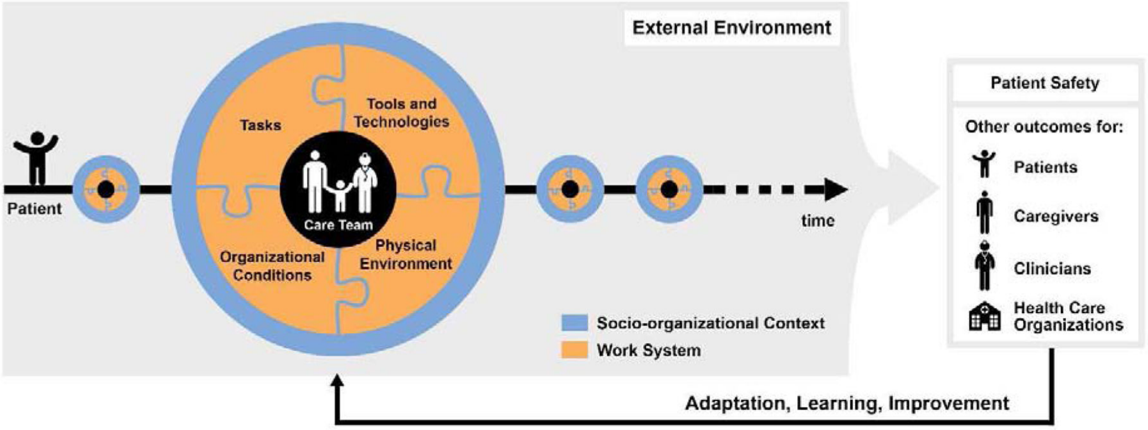

Figure 4 -

SEIPS 3.0 Model: Sociotechnical Systems Approach to Patient Journey and Patient Safety

Kathy is a 78-year-old woman who suffers from Type 1 Diabetes, congestive heart failure, and kidney disease. On a regular basis, she visits multiple specialists for her multiple chronic conditions, such as a specialist for diabetes in the endocrinology clinic. She also gets an annual physical exam from her primary care physician. Recently, she fell when she was cleaning the kitchen. She presented to a rural Emergency Department (ED) after the fall at her home. She was subsequently transferred to a tertiary care hospital for treatment of a broken hip. Upon discharge, she was moved to a skilled nursing facility (SNF) to complete her recovery. Ideally, she would have preferred to stay at a facility closer to her daughter; but this was not possible due to limitations with her insurance and coordination of her ongoing care across organizations. She then had multiple follow-up visits with physical and occupational therapists.

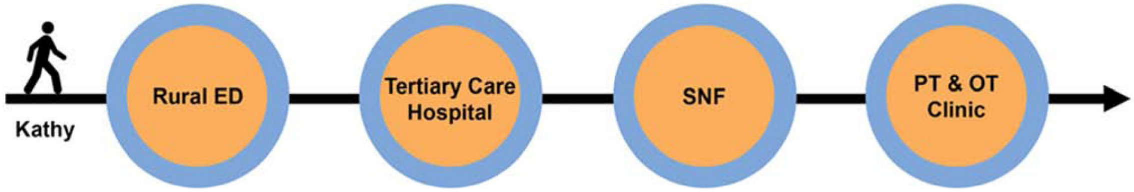

Figure 5 -
Kathy’s Story and Journey

Table 1 -

SEIPS 3.0 Model: Patient Safety and Other Outcomes for Patients, Caregivers, Clinicians and Health Care Organizations

Categories	Outcome Examples
Patient safety	• Diagnostic safety • Medication safety • Healthcare-associated infections and complications • Inadequate follow-up and monitoring of treatment
Other outcomes for patients	• Physical, mental and emotional health • Patient burden and stress • Efficiency and effectiveness of care • Patient experience and satisfaction
Other outcomes for caregivers	• Physical, mental and emotional health • Caregiver burden and stress
Other outcomes for clinicians	• Quality of working life (e.g. burnout, job satisfaction, engagement) • Occupational safety and health
Other outcomes for health care organizations	• Organizational performance • Turnover, absenteeism, presenteeism

Table 2 -

Key Challenges for Human-Centered Design of the Patient Journey for Patient Safety

Key HFE Challenges	Description
Multiple perspectives in human-centered design	Engaging with and managing the multiple perspectives of various stakeholders involved in the patient journey.
	Analysis of convergent and divergent needs and views of diverse stakeholders.
Participation in human-centered design	Genuine participation of multiple stakeholders in the (re)design process.
Working at the interface	Development of ‘boundary-spanning’ skills for HFE researchers and professionals.
Temporal analysis of patient journey	Propagation of system barriers and facilitators in the patient journey.
	Emergence of resilience over time.