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Exploring SEIPS 2.0 as a Model for Analyzing Care Transitions across Work Systems

Nicole E. Werner, PhD^{*1}, Rachel Rutkowski¹, Amy Graske, MS², Mary K. Finta, MD³, Craig R. Sellers, PhD, RN, FAANP⁴, Sandhya Seshadri, PhD, MS⁴, Manish N. Shah, MD, MPH⁵

¹Department of Industrial and Systems Engineering, University of Wisconsin-Madison, Madison, Wisconsin, USA

²About Health, Milwaukee, Wisconsin, USA

³University of Michigan Medical School, Ann Arbor, Michigan, USA

⁴School of Nursing, University of Rochester, Rochester, New York, USA

⁵BerbeeWalsh Department of Emergency Medicine, School of Medicine and Public Health, University of Wisconsin-Madison, Madison, Wisconsin, USA

1.0 INTRODUCTION

1.1 Older adults' care transitions often involve persistent transition-related safety risks

Care transitions also represent a persistent healthcare quality and safety challenge for older adults (Coleman, Parry et al. 2006, Jencks, Williams et al. 2009, Arbaje, Kansagara et al. 2014). A care transition is the movement of a patient from one healthcare setting to another.

^{*}Corresponding Author: Nicole E. Werner, PhD, nwerner3@wisc.edu, Phone: 608-890-2578, Website: Wernerlab.engr.wisc.edu, Twitter: [werner_ne](https://twitter.com/werner_ne).

Harvey D. Spangler Assistant Professor, Department of Industrial and Systems Engineering, College of Engineering, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI 53715

Rachel A. Rutkowski, Department of Industrial and Systems Engineering, University of Wisconsin-Madison, 1513 University Avenue Madison, WI 53715

Amy Graske About Health, (manuscript work completed while at UW-Madison Department of Industrial and Systems Engineering), 2201 East Enterprise Avenue, Suite 101, Appleton, WI 54913

Mary K. Finta, MD, University of Michigan Medical School, (manuscript work completed while at UW-Madison School of Medicine Joyce Duckles, PhD, Warner School of Education and Human Development, University of Rochester, LeChase Hall Box 270425, Rochester, NY 14627-0425

Craig R. Sellers, PhD RN, School of Nursing, University of Rochester, 255 Crittenden Blvd Box 270425, Rochester, NY 14627-0425

Sandhya Seshadri, PhD, MS, School of Nursing, 255 Crittenden Blvd, Rochester, NY 14627-0425, University of Rochester

Denise Lampo, MS, LMHC, Warner School of Education and Human Development, University of Rochester, LeChase Hall Box 270425, Rochester, NY 14627-0425

Manish N. Shah, MD, MPH, BerbeeWalsh Department of Emergency Medicine, Department of Medicine, Division of Geriatrics and Gerontology, Department of Population Health Sciences, School of Medicine and Public Health, University of Wisconsin-Madison, 800 University Bay Drive; Suite 310, MC 9123, Madison, WI 53705

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A care setting could be a hospital, ambulatory care, long-term care, home, home health, or skilled nursing facility (Coleman 2003, Centers for Medicare and Medicaid Services). Care transitions are pervasive among older adults, with 22% experiencing at least one hospital transition per year and 50% of these older adults experiencing multiple transitions annually. Further, older adults are particularly vulnerable to transition-related risks because of their complex therapeutic regimens (Arbaje, Wolff et al. 2008, Jencks, Williams et al. 2009), and vulnerability to functional decline and delirium during hospitalizations (Creditor 1993, Fernandez, Callahan et al. 2008).

1.2 Human Factors/Ergonomics work systems approaches to care transitions should take a patient journey approach

The increased understanding of the many transitions patients experience across healthcare settings has resulted in a shift in patient-engaged ergonomics approaches from conceptualizing healthcare processes as episodic and occurring in a single work system to considering care as a holistic *patient journey*, involving multiple work systems. The patient journey conceptualization suggests that many patients experience healthcare as a continuous longitudinal process (Werner, Malkana et al. 2017) that spans across time, care settings, and people (Arbaje, Kansagara et al. 2014, Werner, Malkana et al. 2017). The patient journey conceptualization also suggests that changes are needed in the analysis of the work system that produces care transitions and the work system barriers and facilitators experienced during care transitions.

1.3 The patient journey approach requires work system analyses to consider care transitions across multiple work systems

Each healthcare setting involved in a care transition can be represented as a distinct work system—that is, each has its own physical environment, actors, tools, technology, and tasks that interact within a structure to produce processes. These individual work systems that are crossed during the patient journey often are viewed as independent from one another (Wickramasinghe, Chalasani et al. 2007). However, when work system analysis is focused on only a single work system involved in the patient journey, there is marked potential to miss critical information that may help to mitigate suboptimal outcomes. To fully understand care transitions as part of a patient journey and anticipate adverse patient outcomes in meaningful ways, work system analysis and design must include all work systems involved in the care transition process (Werner, Malkana et al. 2017, Waterson, Wooldridge et al. 2018).

Although recent research has highlighted the need for a process-level view of care transitions to sufficiently capture the transitions as they occur across system boundaries (Werner, Malkana et al. 2017), Waterson (2009) found a lack of patient safety research that crosses system boundaries or that examines cross-boundary interactions (Waterson 2009). This may be due to the methodological challenges and considerations associated with studying a process that crosses system boundaries. Currently, it is not clear how and whether existing work system models can be used to study a process that crosses system boundaries.

1.4 The Systems Engineering Initiative for Patient Safety (SEIPS) 2.0 model has the potential to facilitate work system analyses across multiple work systems

The Systems Engineering Initiative for Patient Safety model (SEIPS) (Carayon, Hundt et al. 2006) is a unique open work system model developed by combining theories from HFE (e.g., balance theory) and the field of Healthcare Quality (e.g., Donabedian's model) (Donabedian 1966, Smith and Sainfort 1989, Carayon 2009). SEIPS represents a work system structure comprised of five interacting components: (1) the person(s) at the center, (2) performing tasks, (3) using tools and technology (4) in a given environment, and (5) with a certain form of organization. Components interact to comprise processes that produce outcomes, which feed back into the structured work system.

In response to a shift in the healthcare system toward a patient-centered model of care, SEIPS was adapted by Holden and colleagues (2013) to highlight the integration of patients and their families in the work system structure to form SEIPS 2.0 (Holden, Carayon et al. 2013). SEIPS 2.0 maintains the key properties and structure of the original SEIPS model, but includes a number of clarifications and additions that distinguish it from the original model (Carayon 2006, Holden, Carayon et al. 2013). Four modifications are particularly relevant to the present research.

First, SEIPS 2.0 expanded the “person at the center” component to include patients, their family caregivers, and healthcare professionals (Holden, Carayon et al. 2013). Second, SEIPS 2.0 expanded on the concept of feedback loops through the addition of *adaptation*. Adaptation refers to the ability of the work system to change based on feedback. Third, SEIPS 2.0 introduced the concept of *engagement*. Engagement allows for the differentiation of work based on who is involved in performing work activities. This includes professional, patient and informal caregiver, and collaborative work.

Fourth, SEIPS 2.0 introduced the concept of *configuration*. Configuration suggests that “... *only a subset of all possible [element] interactions is actually relevant in a given work process or situation... Thus, for a particular process or situation, one can distinguish a configuration of a finite number of relevant elements that interact to strongly shape the performance of that process.* (p. 6)” (Holden, Carayon et al. 2013). This concept allows for a more precise definition of influential components of each process. Broadly, it can assess “*differences in systems that may account for different performance outcomes (e.g., success vs. failure)*” (Holden, Carayon et al. 2013).

Both SEIPS and SEIPS 2.0 have been used to analyze and make recommendations for improving the delivery of care in a myriad of professional healthcare settings such as the intensive care unit (Gurses and Carayon 2007, Hoonakker, Carayon et al. 2010), laboratory (Hallock, Alper et al. 2006), and operating room (Wiegmann, Eggman et al. 2010, Gurses, Kim et al. 2012). However, it is not yet clear how these models can be used to account for a patient journey that transcends system boundaries. The present research seeks to explore whether SEIPS 2.0 can be used to study a key part of the patient journey as it occurs across system boundaries – the care transitions process.

1.5 Domain of study

One transition that is becoming increasingly ubiquitous among older adults is to and from the Emergency Department (ED) (Ringer, Dougherty et al. 2018). Following a visit to the ED, older adults experience an increased risk of readmission to the ED, increased risk of admission to the hospital or nursing home, a decrease in quality of life, and an increased risk of death (Strange and Chen 1998, Aminzadeh and Dalziel 2002, McCusker, Roberge et al. 2008, Suffoletto, Miller et al. 2016). Notably, each of the aforementioned patient safety challenges related to older adults' ED care are incurred *after* the older adult has returned home following discharge from the ED. Thus, to understand why older adults experience suboptimal outcomes following ED discharge and how to mitigate those suboptimal outcomes and improve the transition, we must understand the transition from the ED to the home as a critical component of the patient journey. The investigation of two distinct, but intersecting work systems – the work system of the ED and the work system of the home – has the potential to provide insights about the patient journey, including ways to support care transition processes that transcend these work systems (Holden, Schubert et al. 2015).

1.6 Objectives

We used SEIPS 2.0 as a framework to explore the ED care transition as a process that occurs across work system boundaries. Specifically, we wanted to know whether the concept of configuration proposed in SEIPS 2.0 could be used to understand the care transition process as it occurs across system boundaries including: the interactions among work system elements across systems, the work system barriers and facilitators within those interactions, and the boundaries crossed by those interactions during older adults' ED-to-home transitions.

2.0 METHODS

The primary methodology involved a secondary analysis of data collected during a previous research study, which we have termed the “primary study.”

2.1 Primary study

2.1.2 Primary study participants—The primary study enrolled, consented, and interviewed (n=15) community-dwelling older adults (> 65 years; 53% female; average age=74 years; range=65-94 years), who had visited the ED to address a medical problem, had been either treated and released or observed in the ED for 5-48 hours (i.e., they did not meet criteria for hospital admission), and who were subsequently discharged to their homes. The primary study took place in an Upstate New York city with a regional population of approximately 800,000. All participants were identified and consented in the level 1 trauma center ED of an academic medical center. A level 1 trauma center is a regional resource that provides comprehensive trauma care to every aspect of a patient's injury, from injury prevention to injury rehabilitation. A level 1 trauma center has trauma surgeons, anesthesiologists, physician specialist, nurses and resuscitation equipment immediately accessible (MacKenzie, Hoyt et al. 2003). Additionally, level 1 trauma centers must meet one of the following patient volume criteria: 1200 patient admissions per year, 240 major

trauma patients per year or a mean of 35 major trauma patients per surgeon (MacKenzie, Hoyt et al. 2003).

A convenience sample of older adults was recruited between the hours of 9:00 am and 9:00 pm (i.e., participants were not recruited overnight). Data collection occurred over a one-year period from 2013-2014. Note that a study team member for the primary study was only able to visit the ED intermittently for recruitment over that one-year period. We excluded older adults who had an ED visit 30 days prior, and those who lacked decision-making capacity (e.g., those who had presented for alcohol intoxication, those who had an activated power of attorney). Table 1 summarizes the comorbidities, prescription medications, and presenting problems for each participant. Any caregivers that were present were also consented and included in the interviews.

2.1.2 Primary study design and data collection—The primary study used a grounded theory approach to qualitative analysis, which uses constant comparative methods to build a conceptual model of a social process (Maxwell 2012). The social process of focus for the primary study was of community-dwelling older adults managing and navigating their healthcare before, during, and after an ED visit. To capture older adults' experiences throughout the social process of interest, the primary study was designed such that an initial interview was conducted in the ED, followed by a second interview two weeks post ED discharge, and a third interview four weeks post ED discharge. The initial ED interview lasted up to 30 minutes. The second and third interviews were conducted in the older adults' home and each lasted up to one hour. The semi-structured interview prompts are included in the appendices.

Consistent with grounded theory methodology, data analysis occurred concurrently with data collection. This constant comparative analysis facilitated the following: First, constant comparative analysis allowed for sampling based on theoretical saturation. Based on the goal of the primary study, the study reached theoretical saturation after 11 participants. Second, constant comparative analysis allowed for a member checking process to increase qualitative rigor. Following interviews with 11 participants, the primary study team conducted an additional four interviews with four participants to member check their interpretation of and completeness of their analysis of the results (Morse 2000). Third, constant comparative analysis allowed the primary study team to determine the adequacy of the sample by ensuring that the sample was comprised of a diversity of events, experiences, artifacts, sites, interviews, and observation (Sandelowski 1995, Kearney 2007). Qualitative rigor was further addressed by multiple interactions with participants, detailed and varied data, respondent validation, theoretical sampling, triangulation across multiple data sources, and constant comparative methods (Maxwell 2012).

2.2 Secondary analysis design—We applied SEIPS 2.0 to conduct a work system analysis as a secondary analysis of the primary study. The primary grounded theory study produced rich data, making it ideal for a secondary analysis (Charmaz 1996, Aldiabat and Navenec 2018). The present study was approved by Institutional Review Boards at the University of Wisconsin-Madison and the University of Rochester.

2.3 Secondary analysis—We used a directed content analysis guided by the SEIPS 2.0 model to code elements and identify configurations, work system barriers, and boundaries (Hsieh and Shannon 2005). The SEIPS 2.0 concept of engagement was applied in the present study with the focus on older adult patients and their families as the primary agents performing patient work across the ED-to-home care transition. A coded segment was a phrase, sentence, or group of sentences in the transcript that exemplified the SEIPS 2.0 elements. The first iteration of coding focused on identifying work system elements. We then identified the barriers and facilitators of those coded elements. Next, we focused on configurations by identifying the interactions of the elements/barriers/facilitators coded. Interactions were defined as any coded segment that was coded under two or more elements. We treated each coded segment tagged with two or more elements, as a coded interaction that represented a configuration of elements during the care transition process. To determine where interactions occurred, queries were run in the NVivo 10 software to determine where a single section of the transcript was coded at two elements. To understand the interactions that occurred over the course of an entire care process or transition, interactions were combined using tables and configural diagrams.

Next, we assessed each coded segment to determine inductively what boundaries, if any, were crossed during the process, and if it acted as a barrier or facilitator in the context of its specific configuration. Barriers were defined as any circumstance or obstacle that impeded care transition activities. Facilitators were defined as any circumstance or enabler that promoted care transition processes or made them easier. Barriers and facilitators were examined to derive insights about how interactions manifest across system boundaries (Karsh, Waterson et al. 2014). Barriers, facilitators, and boundary types identified were discussed among the research team until consensus was reached. To understand how barriers and facilitators configured across boundaries, configurations were displayed using tables and diagrams. Analysis ended when the study team felt that no new information was being obtained through the analysis of additional qualitative interviews in accordance with the objectives of this study.

To ensure consistency in coding, a subset of the transcripts (i.e., full set of transcripts from 3 participants) was selected for the entire research team to independently code. Codes were compared and discussed as a group until a consensus was reached. This process was repeated with two subsequent transcripts at a later date. These team meetings were used to confirm that a clear, precise definition for all coding terms was established among team members. Two research team members (AB, MF) then coded all remaining transcripts using NVivo 10 software (QSR International); 20% of these final coded transcripts were systematically verified for consistency and accuracy by the lead researchers (NW, MS). A percent agreement function was used to crosscheck coding between researchers, and any individual codes or transcripts that did not exhibit a percent agreement of at least 80% were discussed by the research team until consensus was reached. All transcripts had an agreement of greater than 80%.

3.0 RESULTS

We wanted to determine whether configuration could be used to identify the interactions among work system elements across work systems, the work system barriers and facilitators within those interactions, and the boundaries crossed by those interactions during older adults' ED-to-home transitions. The findings below describe the configurations of elements and the associated barriers and facilitators that occurred across the ED/home transition, the work system boundaries identified in the ED/home transitions, and how barriers and facilitators propagated across boundaries.

3.1 Configural diagramming

We used configural diagramming to determine the active and interacting work system elements, including engaged agents, and how the elemental barriers and facilitators manifested across system boundaries during the care transition processes. A configural diagram for the process of a patient obtaining transportation to a follow-up appointment with their primary care provider following an ED discharge is shown in Figure 1. We selected this process for the diagram because it appeared frequently throughout the interview data and demonstrated the complexity of a routine care transition process.

Figure 1 represents all of the work system elements as interacting “simultaneously”, at ‘a moment in time,’ to shape performance” of the transition according to the patient’s experience (Holden, Carayon et al. 2013). As configuration dictates, Figure 1 depicts only the elements that, from the perspective of the patient, most strongly influenced the work of the care transition process. Despite being connected and interacting, we did not specify interactions between each and every element (e.g. P1 and P2) with a line. Rather, consistent with the SEIPS 2.0 application of configuration, we grouped like elements and connected all elemental groups to represent element interactions.

We found that the most common configurations consisted of two, three, or four elements. Tables 1-3 summarize the specifics of the two, three, and four element configurations identified in this analysis respectively. The first column in each table identifies the elements within the configuration. The second column contains an example from the data presented in terms of its comprising barriers and facilitators. The examples provided from the data represent barriers and facilitators discussed in the entirety of the interview. As such we provide a summary of the results instead of providing direct quotations from the interviews.

3.2 Work system boundaries

We found that interactions among elements occurred within an individual work system as well as across multiple work systems. We identified three distinct boundary types crossed by patient work activities: organizational, temporal, and engagement. We will first describe these boundary types and then provide examples of instances where interactions crossed these boundaries.

One identified boundary type we termed organizational boundaries. These were defined as boundaries within which coordinated work occurs. We found the following six types of organizational boundaries: 1) the patient home, 2) the family, 3) the community, 4) the

primary care provider, 5) the community pharmacy, and 6) the ED. Although not every patient work process related to the ED transition crossed all of these organizational boundaries, in most transitions, two or more organizational boundaries were crossed.

Another boundary type we termed temporal boundaries.. Temporal boundaries were defined as the participants' perceived experience of length of time of events. Three key temporal boundaries were identified. One temporal boundary was the time between arrival and discharge in the ED. A second temporal boundary reflected the time the older adult was discharged home from the ED and the time he/she successfully accessed follow-up care in the community, such as visiting a primary care provider's office. The third, and somewhat broader temporal boundary, was the time between making the decision to go to the ED (including prior experiences that contributed to this decision), and the time of accessing follow-up care at home and in the community.

The third boundary type was termed engagement boundaries. Engagement boundaries were defined as those encompassing specific types of work for a specific agent. These boundaries included professional engagement boundaries and non-professional (i.e., lay person) engagement boundaries. Professional engagement boundaries included those related to healthcare providers such as the work of ED providers, community pharmacists, and primary care providers in the community. All of the ED transitions we studied crossed the professional/non-professional engagement boundary as the care transferred from the ED provider to the full responsibility of the patient and their family members.

4.0 DISCUSSION

4.1 Attributes of SEIPS 2.0 to the study of care transitions

We explored the transitions experienced by patients during the patient journey across healthcare settings surrounding an ED visit using the SEIPS 2.0 work systems model. The use of a work systems approach to analyze patient work interactions across work system boundaries allowed for the development of insights related to cross-boundary interactions and configurations.

Our results revealed the complexity of element interactions that occur during the care transition, including two-element, three- element, and four- element configurations, and suggests the need for further understanding of work system boundaries. Though it may be possible to affect system changes without understanding the full extent to which elements interact across system boundaries, our research suggests that to fully understand care transition processes, all cross-system interactions must be identified and characterized by the work systems they involve and the system boundaries they cross.

We found that configuration, a work system analysis concept novel to SEIPS 2.0, permitted the identification of relevant work system elements specific to the care transition process, regardless of work system. Using configuration, we found that element interactions and the associated barriers and facilitators often extended beyond an individual work system. For example, care transitions from the ED often necessitated interaction with community (e.g. public transit) and community provider (e.g. primary care provider) work systems.

In considering the level of adaptation required to carry out care transition processes and the idiosyncrasies of each work system involved, limiting a work system analysis of care transitions to a single work system is likely to miss information critical to understanding the patient journey and potential factors that may contribute to suboptimal outcomes.

At a macro level, the prevalence of element interactions across work system boundaries suggests system misalignment across patient work and patient/provider work processes. As suggested by Carayon (2006), the identification and analysis of cross-boundary system interactions can be used as a way to align work systems (Carayon 2006). There is a need to better align the systems of professional healthcare work with those of patient work as they interact across patient care processes. Care transitions span multiple system boundaries, and understanding how barriers interact leading to patient consequences could inform the development of improved interventions for this complex and risk-prone process (Werner, Gurses et al. 2016). For example, further investigating cross-system interactions could lead to targeted support for patients' transitions, and provide the indicators for better aligning these systems for future patients.

A critical step forward to studying cross-boundary interactions, improving transitions, and better aligning the work systems involved would be to clearly define the relevant work systems involved. Only then can design for system alignment be attempted. Once system boundaries are defined, it will be critical to identify when and where boundaries are crossed, and the types of boundaries crossed. Studying the interactions that occur across boundaries and knowing which boundaries are crossed would allow researchers to better understand how barriers propagate across boundaries and anticipate how the introduction of an intervention into one work system could influence another. Pragmatically, as SEIPS 2.0 proved to provide a solid foundation for analyzing patient work processes as they involve multiple work systems, future iterations of SEIPS should include more salient mechanisms for identifying system boundaries and capturing when boundaries are crossed during care transitions.

4.2 Limitations of SEIPS 2.0 for capturing cross-boundary processes

SEIPS 2.0 had some limitations when analyzing the care transition process. First, the model offers no systematic mechanism for identifying the type of boundary crossed. We found this to be true across all three boundary types. Although SEIPS 2.0 could identify elements that either existed in, or overlapped across, multiple work systems, we were unable to comprehensively identify which agents were involved, in which distinct work system, and at what point in the process.

Second, SEIPS 2.0 had no mechanism to represent multiple boundaries. However, this was a critical process characteristic identified in our analysis. Third, currently, there is no comprehensive instructional guide on how to conduct a configuration analysis. Further, some of the proposed features of the configuration analysis outlined in SEIPS 2.0 were unclear. For instance, it was unclear why some elements were connected with lines while others physically overlapped. As such, it was challenging to replicate the configuration analysis. Additionally, it would be helpful to have guidelines or recommendations for interviewing with the intention of conducting configuration diagramming. Future work could develop a

step-by-step instructional guide or software to aid researchers in the recruitment of this novel analysis process. This type of toolkit may also address some of the issues (e.g. time and resource intensive) that exist broadly with qualitative research.

4.3 Implications for care transition quality and safety

Although not the focus of this analysis, our results have broad implications for quality and patient safety of ED care transitions. Being able to better support patients in their work during care transitions may result in decreasing suboptimal patient outcomes. Processes related to providing care over care transitions span multiple organizational boundaries, increasing the complexity of the element interactions that might occur across these boundaries (Carayon 2006). Specifically, we found that as patient work interacted with professional healthcare provider work across system boundaries, barriers and facilitators arose related to the expected feedback and adaptation of elements both within the patient and professional work systems (i.e., engagement boundaries). These cross-boundary configurations often led to minimal or no feedback across boundaries regarding issues or concerns, which increased the potential for errors or poor performance outcomes downstream. As a result, adaptation is not likely to occur, subsequently disallowing the systemic changes necessary to prevent or minimize suboptimal outcomes.

4.4 Limitations of the study

This study has several limitations that should be noted. The present study is limited in that it is a secondary analysis. However, future work can use our findings to focus on aspects that we were unable to address because we were unable to ask primary questions. Additionally, we do not have data on how many people were invited to participate and refused to participate in the study as this was not collected as part of the primary study. Participants were recruited in only one ED, so results may not be generalizable to other patient populations. Also, all information was self-reported by patients, and therefore may not comprehensively represent all aspects of the ED care transition. As it relates to data analysis, this limited the person element of SEIPS 2.0 to only the patient and caregivers. Further research could conduct more in-depth interviews with others involved in the transition process, such as primary care physicians, emergency department clinicians, community pharmacists, and members of the community to obtain a more robust view of the system as a whole. Recruiting additional data collection methods such as observations and integrating electronic health record data could further contextualize and characterize patient transitions. This study focused on barriers to transition processes. Future work could explore facilitators to transition processes. In addition, it should be noted that, as this was a secondary analysis, we were unable to probe for specific work system elements during our analysis and as a result, some elements may be over or under-represented.

5.0 CONCLUSION

The results of this study point to the importance of examining the patient journey as it occurs across system boundaries, as the types of interactions that occur across boundaries have critical implications for patient care processes. This study also suggests that SEIPS 2.0, specifically configuration, provides a basis to assess the patient journey across system

boundaries. However, to fully capture the complexity associated with care transitions, future iterations of SEIPS must introduce a mechanism to identify specific boundary types, so that system analysis can capture when boundaries are crossed and which boundaries are crossed. Interactions among elements and how those elements configure among work systems should be studied across system boundaries to improve healthcare delivery throughout the patient journey.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights:

- Older adults' care transitions should be conceptualized as holistic patient journey
- Patient journey crosses multiple boundaries with interacting barriers and facilitators
- Configuration has potential for work systems analysis of multi-system processes

Active Agents: Patient, Family, Primary Care Provider, ED Provider
Process performance is shaped most strongly by a combination of:
Person(s) Factors: P1: The patient's financial circumstances prevent them from being able to afford transportation to follow-up appointments P2: The patient's inability to drive

<p>P3: The patient's willingness to ask for help from family and friends</p> <p>P4: The patient's understanding of available transportation resources</p> <p>P5: The family's inability to provide support</p>
<p>Task Factors:</p> <p>Ta1: The patient seeks and coordinates transportation to follow-up appointment with primary care provider</p> <p>Ta2: The patient receives follow-up care at primary care provider at recommendation of ED provider after an ED visit</p>
<p>Organization Factors:</p> <p>O1: Time availability of patient to attend follow-up appointments</p> <p>O2: Availability of transportation in accordance with time of patient's follow-up appointment</p> <p>O3: Availability of public transportation</p> <p>O4: Coordination of multiple agencies and choices for transportation</p> <p>O5: Unreliable medical cab services</p> <p>O6: Public transportation routes and pick up times</p> <p>O7: Availability of appointments during traditional working hours</p> <p>O8: Size of patient population verses the number of primary care appointments available</p>
<p>Tools and Technology Factors:</p> <p>None identified from patient's description of their experience</p>
<p>Internal Environment Factors:</p> <p>IE1: The location of patient's rural home</p>
<p>External Environment Factors:</p> <p>EE1: Government policies and qualifications for transportation assistance</p>

Figure 1.

The active and interacting elements involved in one part of the larger transition process – obtaining transportation to a follow-up appointment with their primary care provider following an ED discharge. The spheres represent work system elements. Although it is common for the spheres to be depicted in varying sizes depending on their degree of influence, due to the nature of this analysis, we kept all circles the same size.

Abbreviations: EE=External Environment; IE=Internal Environment; O=Organization; P=Person(s); T=Tools and Technology; Ta=Task

Table 1.

Comorbidities, Prescription Medications, and Presenting Problems (n=15).

Age	Number of Comorbidities	Number of Prescription Medications	Presenting Problem
65	5	7	Knee pain secondary to MVA
76	3	15	Catheter blockage
85	2	9	Fall down embankment
72	3	0	MVA
69	2 *	15	Procedure complication
86	11	3	Constipation
70	3 *	8	Bee Sting
74	3	7	Bee Sting
70	3	0	MVA/knee fracture
68	3	7	Injury to hand
71	1	5	Arm swelling and pain
68	2	3	Arm pain
86	4	12	Gallstone
84	5	8	Syncope
73	7	9	Abdominal Pain

Note: MVA = motor vehicle accident

* Complete list of comorbidities not reported in electronic record

Table 2.

Three-Element Configurations

Configure d SEIPS 2.0 Elements	Example of Element Barriers/Facilitators as they Configured across the ED/Home Transition Summarized from Patient Interviews	Parti cipan t ID
T, O, P	Patient does not follow ED instructions because only trusts PCP (B) PCP office will not address patient concerns, refers back to ED (B)	P114
Ta, O, T	Patient's medication allergies were not updated in the EHR (B) Urgent care clinicians prescribed and ordered antibiotics (F) Prescribed antibiotic contraindicated with current medication (B) Community pharmacist worked with urgent care clinicians to antibiotic (F) Patient had allergic reaction to antibiotic and went to ED (B)	P103
Ta, P, EE	EDP prescribed new medications to pick up at community pharmacy (B) Patient is no longer able to drive (B) Patient has no access to public, community, nor insurance-provided transportation options (B)	P114
T, Ta, P	EDP identified new diagnosis (F) EDP did not communicate the new diagnosis to the patient (B) EDP suggested patient see PCP after ED visit (F) Patient did not follow-up with PCP until much later (B)	P109
T, O, IE	Patient lives in a rural area and unable to drive (B) Patient does not have easy access to a pharmacy (B) Patient has friends in the community near the pharmacy (F) Patient uses pill boxes to organize medications (F) Uses pill boxes to identify when medication supplies are almost out (F)	P101
T, Ta, EE	EDP suggested patient see PCP after ED visit (F) Patient is far from PCP (B) Medicaid's transportation process is complex (B) PCP appointment process was 12 hours due to transportation scheduling (B)	P114
T, O, EE	PCP does not have emergency appointments due to insurance coverage (B) PCP refers to urgent care (F) Patient does not have internet access to look up urgent care centers (B) Patient goes to ED (B)	P105
T, P, IE	EDP gave the patient multiple walkers because they are a fall risk (F) Patient is too weak to carry a walker up the stairs in their home (B) Patient is unable to use the walkers as the ED provider intended (B)	P114

Abbreviations: ED=Emergency Department; EDP=ED Provider; PCP=Primary Care Provider; B=Barrier; F=Facilitator; EE=External Environment; IE=Internal Environment; O=Organization; P=Person(s); T=Tools and Technology; Ta=Task

Table 3.

Four-Element Configurations

Configured SEIPS 2.0 Elements	Example of Element Barriers as they Configured across the ED/Home Transition Summarized from Patient Interviews	Participant ID
Ta, O, P, EE	EDP prescribes self-care follow-up activities (F) Patient adopts a positive outlook on self-care (F) Supported by family members to complete self-care (F) Recently moved to live with family members (F)	P114
T, Ta, O, P	EDP discontinued Coumadin but did not update discharge paperwork (B) Patient did not know that weekly bloodwork was to check Coumadin levels (B) Patient continued to incur blood draws to check for Coumadin levels for several weeks (B)	P107
T, Ta, O, EE	Patient is discharged before EDP enters orders for needed device (B) Patient returns to hospital to receive device (F) Patient requests multiple devices to accommodate living situation (F) Patient's insurance will not cover multiple devices (B)	P107
T, Ta, P, EE	EDP suggested patient see PCP after ED visit (F) Patient has no transportation (B) Medicaid transportation is complicated and demeaning to navigate (B)	P101

Abbreviations: ED=Emergency Department; EDP=ED Provider; B=Barrier; F=Facilitator; EE=External Environment; IE=Internal Environment; O=Organization; P=Person(s); T=Tools and Technology; Ta=Task