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Toward a process-level view of distributed healthcare tasks: Medication management as a case study

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ABSTRACT

We aim to highlight the importance of using a process-level view in analyzing distributed healthcare tasks through a case study analysis of medication management (MM). MM during older adults' hospital-to-skilled-home-healthcare (SHHC) transitions is a healthcare process with tasks distributed across people, organizations, and time. MM has typically been studied at the task level, but a process-level is needed to fully understand and improve MM during transitions. A process-level view allows for a broader investigation of how tasks are distributed throughout the work system through an investigation of interactions and the resultant emergent properties. We studied MM during older adults' hospital-to-SHHC transitions through interviews and observations with 60 older adults, their 33 caregivers, and 79 SHHC providers at 5 sites associated with 3 SHHC agencies. Study findings identified key cross-system characteristics not observable at the task-level: (1) identification of emergent properties (e.g., role ambiguity, loosely-coupled teams performing MM) and associated barriers; and (2) examination of barrier propagation across system boundaries. Findings highlight the importance of a process-level view of healthcare delivery occurring across system boundaries.

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1. Introduction

Recent years have seen a substantial increase in research focused on improving the safety of transitions of care, particularly for older adults. Despite these efforts, transitions remain a high-risk healthcare process. In particular, unsuccessful medication management (MM) is a persistent contributing factor to suboptimal outcomes for older adults receiving skilled home healthcare (SHHC) services (e.g., nursing, physical therapy) after hospital discharge (Coleman et al., 2005; Schoenborn et al., 2013). MM refers to the ability to successfully obtain, administer, and take medications according to a prescribed regimen. Historically, medication management has been studied at the task level. However, for older adults transitioning to SHHC services after hospital discharge, MM tasks are distributed across people, organizations, and time. **To improve MM for these vulnerable older adults, a process-level view of MM is needed.**

Carayon (2006) described a process as "a series of tasks performed by individuals using various tools and technologies in a specific environment" (p.17) (Carayon, 2006). Expanding that view

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to encompass processes within the distributed context of healthcare delivery, Walker and Carayon (2009) underscored the distinction between tasks and processes in the following way:

> *"Task-focused care is centered on the provider or facility rather than on the patient. The focus on tasks (and payment for isolated tasks) is a fundamental cause of the fragmentation, low quality, and high cost of U.S. health care. On the other hand, process-focused care is centered on the patient. It coordinates the work of many care team members (including patients, physicians, nurses, midlevel providers, lay caregivers, clinical educators, pharmacists, case managers, and call-center personnel) to provide each patient with high-quality, efficient care across time and across all venues of care"* (p. 468). (Walker and Carayon, 2009)

This is not to say that we espouse a process-level view to the exclusion of analyzing task interactions. Multiple levels of analysis are critical to understanding the work that occurs within a complex sociotechnical system (Hendrick and Kleiner, 2002; Karsh and Brown, 2010; Kleiner, 2006). Rather, we aim to highlight the importance of using a process-level view in analyzing the distributed tasks associated with healthcare delivery through a case study analysis of a healthcare delivery activity (i.e., MM) typically studied at the task level. In particular, we aim to emphasize the importance of accounting for the distributed nature of healthcare delivery activities in human factors and ergonomics analysis (Walker and Carayon, 2009). The analysis should capture the distribution of tasks as they occur across traditionally-defined system boundaries (i.e., temporal, organizational, person/team. (Carayon, 2006).

The level of interaction within a system often guides how boundaries are defined (Wilson, 2000, 2014; Karsh et al., 2014). Levels of interaction encompass both micro-level interactions (between humans and machines, i.e., cognitive and physical ergonomics), and macro-level interactions (between humans and organizations, e.g., macroergonomics). Carayon (2006) highlighted how the study of interactions across "*organizational, geographical, cultural and temporal boundaries increas[es] the number and type of interactions between systems, and therefore amplify[ies] the complexity of work systems*" (p. 526) (Carayon, 2006). As work spans system boundaries, the increasing complexity of interactions poses a challenge to identifying and defining the boundaries of the system under investigation. Taking a process-level view may serve to bound the system analysis as complexity increases across system boundaries.

1.1. The importance of accounting for the distributed nature of medication management from the hospital to skilled home healthcare

Previous research has used a task-level view to evaluate MM in single healthcare settings (Meredith et al., 2001; Faye et al., 2010; Caroff et al., 2015; Carayon et al., 2015). However, from a patient-centered perspective, MM activities are distributed and include interactions with various healthcare providers, organizations, and tasks over time. Communication is integral to successful MM and is a process-level activity distributed across people, time, and tasks. Carayon and Wood (2009) referred to this patient-centered view of healthcare delivery as a "patient journey" in which patient care "*interactions occur over time, and therefore produce transitions of care that influence each other and accumulate over the journey of the patient care process.* (p.29) (Carayon and Wood, 2009)." The hospital-to-SHHC transition highlights the distributed nature of MM tasks. MM occurs across system boundaries over several days and involves multiple organizations (e.g., the hospital, the older adult's home, the community pharmacy), and occurs over multiple days.

Work often occurs across predefined system boundaries (Carayon, 2006; Olson and Olson, 2000). These boundaries include temporal, geographical, organizational, and cultural boundaries. Boundary-spanning work can have a significant effect on both the work performed and the individuals performing the work (Carayon, 2006; Karsh et al., 2014). Choosing how to define system boundaries is a challenge that has the potential to either facilitate or hinder the design of the boundary-spanning work being studied (Rivera-Rodriguez et al., 2013).

We propose that studying MM at the process level as it occurs across system boundaries will produce insights into optimizing work system design that would be indiscernible with a task-level approach. When we refer to a process-level view, we conceptualize a distributed process that has the following characteristics: 1) unfolds over time; 2) involves the dynamic interaction of multiple system elements (e.g., individuals, tasks, organizational structure, technologies, etc.) (Wilson, 2014; Carayon et al., 2006); 3) has both loosely- and tightly-coupled (Weick, 1976) non-linear subprocesses; and 4) occurs across multiple system boundaries (Carayon, 2006). Key tenets of sociotechnical system design such as the emergent properties of systems, identification of variances [i.e., divergences from a standard/normal process or procedure] or barriers [conditions or properties within the system that make work performance challenging, distressing, or unfeasible] (Holden et al., 2013a) distributed interactions, and propagation of variances are not necessarily detectible at the task level of analysis (Hendrick and Kleiner, 2002; Cherns, 1976; Herbst, 1974). Thus, we use MM as a case study to highlight the critical significance of analyzing the distributed tasks of healthcare from a process-level view.

1.2. Case study domain

Skilled home health care (SHHC) is one of the most commonly utilized and poorly understood healthcare delivery models (Carayon, 2012). SHHC is a formal, regulated program of care providing a range of healthcare services to patients (e.g., nursing, physical therapy) in the home, such as wound care, physical therapy after a hip replacement, or medication management (MM) for patients with complex medication regimens (Centers Medicare Medicaid Serv., 2014).

Older adults transitioning to SHHC following hospital discharge are among those at highest risk for experiencing adverse outcomes in the post-discharge period (Murtaugh and Litke, 2002). Unsuccessful MM is a persistent contributing factor to suboptimal outcomes (Coleman et al., 2005; Rosati and Huang, 2007; Bruning and Selder, 2011; Dierich et al., 2011) and is associated with readmission within the first 60 days of receiving SHHC (Rosati and Huang, 2007). Older adults are particularly susceptible to problems with MM. They typically follow complex medical regimens and are hospitalized at a higher rate than the general population, leading to further changes in medication regimens (Coleman et al., 2005; Dierich et al., 2011).

It is not yet clear how a process may change as it occurs across predefined system boundaries. The process of MM during older adults' hospital-to-SHHC transitions from the hospital to SH involves multiple organizations (e.g., hospital, SHHC agency, older adult's home) and often occurs across over several days. We do not yet know how crossing these temporal and organizational boundaries may affect the fundamental attributes of the process, or how cross-system barriers will affect the process of MM. For example, there is the potential for barrier propagation at an earlier stage of the process to propagate through the later stages of the process across system boundaries. Propagation refers to the proliferation of variances or barriers from one stage of a process to stages

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