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## Engineering a Foundation for Partnership to Improve Medication Safety during Care Transitions

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### Abstract

There are major gaps and barriers for patients and caregivers after hospital discharge to achieve safe medication use. Patients and caregivers are often not ready to take on the responsibility for medication management when transitioned from inpatient care. Current approaches tend to focus on adding isolated strategies. A system thinking can enable a fundamental transformation to redesign professionals' interactions with patients and caregivers with an explicit goal to develop patients and caregivers into true partners, with targeted roles, skills, attitude, knowledge, and tool support. We must recognize the fact that medication safety during care transition and, more so, at patient homes is the property of a "work system", in which the patient and caregivers are at the center, with collaboration with health professionals. Innovative ideas are needed to engineer work system components by systematically examining professionals' interactions with patients and caregivers, such as those during hospital stays and transitions (e.g., follow-up phone calls, community pharmacist consults, and home visits). Based on human factors principles, we describe a set of recommendations on engineering partnership with patients and their caregivers at different stages of a care episode, to enable productive interactions among work systems that are distributed and are often limited in their ability to exchange information and co-align their interests.

### Keywords

patient- and family-centered care; patient engagement; healthcare systems engineering; medication safety; care transitions

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## Introduction

Post-discharge adverse drug events (ADEs) contribute to significant patient harm, unscheduled hospital readmissions, and emergency department visits. Separate studies of consecutive discharges found that nearly 1 in 5 patients developed ADEs within 45 days of hospital discharge [1], and two-thirds of complications occurring within 3 weeks of hospital discharge were from ADEs [2]. Older adults prescribed high-risk drugs such as anticoagulants, some diabetic medications, and opioids are particularly vulnerable to ADEs during care transitions [3]. Failed systems during care transitions often contribute to increased risk of ADEs. For example, medication discrepancies were present in nearly half of patient charts on review of the medication lists after discharge [4]. Upon hospital discharge, changes to a medication regimen can add to the confusion and complicate patient and caregivers' task of adjusting to the new regimen [5]. Hospital-focused interventions are starting to address risks to medication safety as a key strategy for preventing unplanned hospital readmissions [6]. To date, most efforts to improve medication safety during transitions have primarily focused on layered and bureaucratic services offered by healthcare providers (e.g., medication reconciliation [7], medication counselling, and planning outpatient follow-up [8]). We propose redesign efforts that foster meaningful partnership between professionals with patients and their lay caregivers.

Medication management during care transitions involves multiple stakeholders, presenting numerous opportunities for miscommunication as well as recovering from errors and misunderstandings during a patient's healthcare journey. A patient likely has multiple prescribers managing multiple conditions at different organizations over time. Thus, improvement of medication safety must be made in the context of the reality of "distributed work systems": loosely coupled professional work systems (such as a combination of hospital, home health organization, community pharmacy, and outpatient clinics) and the patient's system at home, which is usually the only constant across different care episodes. We must focus on ways that help patients and their nonprofessional caregivers to become effective team members in working with different professionals, such as communicating about their medication-related information and proactively identifying gaps and discontinuities of care.

Based on the "work system" model [9] in health care system engineering, we outline a set of redesign ideas to **systematically** highlight key components that influence medication safety, with the core objective of building up abilities of patients and families so they can be true partners in achieving medication safety [3]. We believe these redesign ideas also enable tangible steps to operationalize patient-centered care, which has been accepted as a desired model of care to improve quality and safety but has remained elusive. Much like systems approach to safety in healthcare institutions, care activities at home can also benefit from a system view of considering multiple distributed work systems impacting medication safety during transitions. The partnership approach directs us away from adding new layers of only hospital-centric interventions, which may introduce potential unintended consequences such as inadequate patient engagement during discharge planning and preparation for post-discharge self-care, professional role conflict and ambiguity, and unsustainable costs [10]. The partnership approach also directs us towards those outcomes most important to patients

and families, not just clinical or operations outcomes [11] and encourages us to carefully investigate the underlying barriers and develop effective, sustainable solutions rather than adding new layers of relatively easy to implement, but ineffective or unsustainable solutions.

The case example (Box 1) based on a home observation illustrates the partnership approach: health professionals build the capacity of the family caregiver to respond to emerging risks for adverse drug events and manage information over different healthcare encounters. With this approach, care delivery process in the redesigned system will be oriented towards helping the patient and family to acquire skills, knowledge, and tools essential to function as partners, especially during care transitions.

## Building a foundation for partnership

The concept of patient “work system” [12] provides a roadmap for building a foundation for partnership. When a patient transitions to a community setting, medication safety is primarily a property of their work system at home, with other work systems (e.g., community pharmacies, outpatient clinics) supporting (or not) this home-based work system. This system view expands and complements the traditional focus on individual behaviors, such as medication counseling to improve nonadherence and medication safety [13] and exploration of motivators that drive adherence to treatment regimens [14]. A true partnership will require an assessment- and family-specific enhancement of the patient work system [12], which is conceptualized to have 5 major components: people (the patient and caregivers, usually family members at the core, and professionals such as community pharmacists, home health nurses, and primary care physicians), health care tasks (such as setting up medications and making adjustment to medication schedules), tools and technology (such as medication schedules, pillboxes, and reminders), environment (such as living arrangement, the physical environmental conditions in which medication is stored and administered), and organizational context (such as transitional care services and insurance coverage).

A system approach to build partnership means assessment of the patient’s work system and recognition of the responsibilities and workload imposed on the patient and family caregivers for safe medication management after discharge—a drastically different environment than a hospital. It also means lessening patient burdens and anticipating barriers, such as filling prescriptions and providing medications before discharge. Building a foundation for partnership will steer our attention away from one-way information delivery. Instead, professionals work collaboratively to identify safety risks and co-develop a medication management system with active participation of patient/ family during hospital stays. Hospitals should invest in the continuum of care by teaming up with the community resources that patients and family caregivers are expected to interact once they leave the hospital. Such investments may include periodic assessments on information flow to identify any gaps, developing effective communication and coordination strategies, and supporting coordination of care through effective cognitive aids, protocols, and other tools. In the case example (Box 1), the doctors and nurses worked with the caregiver during the entire hospital stay instead of waiting until discharge to cram instructions into a brief dialogue and sending them home with printed information that is hard to understand and follow. Partnership

approach should encourage discovering new tools and methods that will facilitate development of patient-specific medication use schedules that align with the routines and expectations of the family. Further, it may be helpful to assess how hospital-issued tools, such as the discharge medication list, will support or conflict with the tools and processes used by the patient and family caregiver (e.g., the medication log in the case example).

The system approach outlined here also points out the need for aligned goals for hospitals to build a foundation for partnership, most likely beyond payment models based on reduction of hospital readmissions, such as structural and process measures related to partnership building with patients and caregivers and with non-hospital-based professionals. Equally important is the need for incentives to encourage hospitals and health systems to invest in platforms that allow real time capture of patient reported outcomes instead of exclusively relying on periodic patient experience and satisfaction surveys—often beset by long latency periods and hence of limited utility in informing rapid learning and performance improvement.

### Work system elements of building partnership

Many acute care facilities have adopted strategies for medication safety during transitions of care, such as those outlined in the Ideal Transition in Care [15, 16] and safe discharge checklist [17]. These strategies include activities by inpatient care teams (e.g., medication reconciliation, teach-back) and transitional care teams (e.g., post-discharge phone calls, home visits). We suggest to systematically examine these efforts **from the lens of the patient work system** and how well they support achievement of medication safety across the continuum of care by partnering with patients.

As briefly outlined earlier, the patient work system concept consists of five components for identifying key strategies for engineering partnership: people, tasks, tools, environment, and organizational context. We now provide several directions and suggestions on how to redesign these work system components to develop a partnership with patients/ families towards the goal of enhancing medication safety. First and foremost, processes may be designed to build a highly functioning team (“people” component in a work system [12]) for safe medication management after discharge, beyond the prevailing practices of providing contact information as a contingency measure as well as pushing medication-related information onto patients. This should involve assessing what a team at home looks like in relation to the patient’s need (e.g., composition, skills, availability, etc.) and activating/enabling team members through building relationships and developing a psychologically safe social environment for team members to share their perspectives, fears, and goals. This process design should also involve clarifying roles and responsibilities among patient and caregivers in the patient work system. In professional work systems, everyone has a job and job description to clarify roles and responsibilities; no such organizing systematically exists at home and such role definitions are made ad-hoc, rather than systematically, during care transitions to home. The home caregivers must be activated to use new medication knowledge and, indeed, be ready to take on the responsibilities of safe medication management at home. In the case example, the inpatient professionals treated the patient caregiver as a team member who will take over the responsibility of medication management

after discharge. Team building skills and processes are usually not part of the current patient engagement strategies, or for that matter, patient-centered care efforts, but should be part of an ideal care transition [16].

Medication management tasks are a second component of the home work system [18, 19]. Processes may be developed to identify essential skills for patients and their home caregivers who have to perform medication management tasks. Tasks at home include reconciling medications after care transitions, communicating medication history information, articulating preferences, self-knowledge, goals, and fears, working with professionals at a local pharmacy, and preventing and responding to adverse drug events. Professionals may develop processes to work with patients and caregivers to develop skills to accomplish these tasks, such as anticipating what could go wrong (e.g., by conducting “premortem” analysis before hospital discharge and/or home care discharge [20]). Learning and practicing skills at performing medication management tasks by patients and caregivers should be encouraged. Assessment of task complexity taking advantage of existing tools (e.g., Medication Regimen Complexity Index [21]) or those that may be developed in the future should be part of the routine at different health care encounters, so that task complexity may be reduced, or help is provided to manage medications.

A third component of the patient work system is tools, such as pillboxes, medication lists, and medication schedules used in medication management at home. Redesign efforts should include systematic incorporation of these types of tools to support interactions between professionals and patients and families. For example, sharing a visual representation of the medication information with patient/family can help discussions to accomplish medication scheduling tasks more reliably [22], yet this practice is not generally used in discharge medication education process. Well-designed tools should be used to support patients and families in providing medication history information, instead of relying on unaided memory recall. Current practices in patient and caregiver support are in stark contrast with various cognitive support tools and safeguards deployed in professional management of medications, such as medication administration records, reminders and medication lists. Medication related tools should also be routinely provided to patients and family members so that they can communicate effectively with different professionals, such as in jointly reviewing goals of care for each medication. For collaborative tasks at home, practices may be shared with patients and family members on the use of tools to improve situation awareness about risks and task assignment at home, and to coordinate medication management tasks.

A fourth component is the physical environment at home, which plays a critical part for medication management, such as safe storage and daily access. Patients’ lifestyles are often dramatically altered immediately after hospital discharge, such as living temporarily with relatives, in addition to expected changes in medication regimen. A redesigned partnership-based system should facilitate consistent examination of key aspects of the physical environment for medication management in patient’s home, including challenges facing the home team [23]. For example, a joint exploration of the post-discharge physical environmental factors may uncover barriers such as those in securing opioids, accessing rescue drugs, and taking medications at multiple locations. New tools and methods are needed to systematically and more comprehensively (compared to current practice) identify

characteristics of the physical environment at patient home before discharge and tailor any discharge planning and home care transition activities accordingly. In addition, professional home visits, when scheduled, should be designed to specifically look at the physical environmental factors at home for risks and practical solutions in safely managing medications, such as storage of medications and medication information related materials.

A fifth component is the organizational context of medication management at home, such as reimbursement policies, transitional care services provided, caregiver commitment and availability for caregiving tasks, communication, and coordination among household members. Inevitably, patients and families interact with a number of professionals and organizations in medication management tasks. Families often do not realize the gaps in medication information among primary care physicians, specialists and hospital-based physicians. Integrated consideration of organizational context should be part of a redesigned system, such as means for families to evaluate and assess different types of supporting services, to learn how to make most of these supporting services, and to function effectively and safely as the hub of medication information across professionals and organizations. The knowledge, skills and attitude in working with different professionals and organizations are just as important as those often highlighted in health literacy about medications.

### **Implications for medication safety improvement**

Cultural changes, workflow realignment, and cognitive tools/information technology-based solutions are needed to redesign inpatient care activities in a broader context, such that patient and family roles after discharge in medication safety are articulated and supported. From the perspective of the patient, self-management of medications can pose demands that exceed patient and family member capacity [24]. The patient work system concept can guide the redesign of professionals' interactions with patients and caregivers with an explicit goal of enhancing the components of the patient work system, such as skills, attitude, knowledge, and tool support for patients and family members to function in distributed work systems. A solid foundation for partnership requires more than knowledge transfer to the patient and caregiver, and must be established to support patient capacity for self-care [25]. The patient work system concept also points out high priority gaps in medication safety during transitions. Historically, patient engagement in inpatient settings has narrowly focused on their goals of care in hospitals rather than supporting the entire patient journey; there is little perceived responsibility and specific organizational infrastructure in helping patients manage medications safely after discharge. While in the hospital, patients and caregivers are often viewed as passive recipients of care. Upon discharge, they assume complete responsibility for medication safety, but are usually inadequately engaged and activated to take such responsibility. This combination creates opportunities for unsafe management of medications at home, and in some instances adverse drug events. Hence, it is crucial to use the time in the hospital as a window of opportunity to further support patient's journey beyond the inpatient care, rather than only focusing on timely and safe discharge of patient care that seems to be interpreted only as preventing 30-day readmissions and ED visits.

Organizations should redesign how they proactively assess and productively interact with the patient work system. Such redesign will entail culture change, responsibility and

accountability structure change, feedback channels across distributed work systems to foster learning health systems, and tools. Table 1 presents examples in three work systems (inpatient, transitional, and community) for suggestions of building a foundation for partnership.

The partnership-focused approach to medication safety during transition highlighted here calls for research to develop and evaluate partnership enhancing approaches. Whereas much research on transitional care has been on professional services and on collaboration among healthcare professionals, evidential and conceptual gaps exist on how to build systems that view care transitions as handoffs of care from acute care professionals not only to ambulatory and primary care professionals, but to patients and caregivers at home who function in a patient work system.

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**Box 1:****Emma's Work System**

Emma's daughter, Becky, was managing her mom's medications and records at home. When Emma was hospitalized, Becky visited every day and communicated with the doctors and nurses about her mother's condition and medication regimen. Each day, the doctors and nurses shared their thoughts and Becky discussed the insomnia and nausea medications prescribed by different doctors, which were making her mother drowsy in the morning. These conversations enabled Becky to better manage her mother's conditions at home after discharge. Becky always used the same community pharmacy and knew the pharmacist well. She picked up all the discharge prescriptions and worked with the pharmacist to develop a new medication schedule, which included a "taper" with dose adjustment that meant a change in Emma's daily life routines. The first day, Becky woke her mother up early to take the morning medications and realized that her mother was sleepy most of the day from a new allergy medication. As a proactive caregiver, Becky held one sleeping aid until her mother's next doctor's appointment (which was only a few days later). Becky started using a large file folder provided by the doctor to organize the drug brochures and other documents (Emma had been in the hospital three times in the past year and had visited the offices of three different specialists). She also started logging her mother's medications in a notebook, a strategy she learned from one of the home health nurses.

**Table 1.**

Partnership during care transitions to home for safe medication management.

<b>Inpatient Care</b>	
<p><b>Partnership Approach</b></p> <p>Medication reconciliation (to gather medication-related information): Collaborative workflows, such as (a) at multiple time points convenient for family care givers, (b) with cognitive support (e.g., list of medications maintained at home; technology showing generic and brand names, indications and pictures). Current practices tend to be provider centric (once at admission under stressful conditions, relying on error-prone memory recall or retrieval of outdated records).                      Discharge (to prepare and transition care to another setting): Collaboration on skills and knowledge development, such as (a) anticipating medication related tasks post discharge (e.g., insurance approval, formulary changes, initiation of high risk medications, number of medication changes, patient's previous adherence history), (b) setting explicit and clear expectations of patient and family for post-discharge roles and responsibilities before discharge, (c) safety briefings with patients and family members to identify patient-specific concerns and risks due to handoffs (e.g., with primary care providers, home health professionals), (d) practicing self-management activities in inpatient workflow (e.g., medication planning, symptoms monitoring). Current practices tend to treat patients and family caregivers not as partners but as passive recipient of delivered services and tend to view patient education as a one-way information delivery.</p>	<p><b>Enablers</b></p> <ul style="list-style-type: none"> <li>- Policy contexts (e.g., regulations and legislation that rewards system redesign for stronger partnership with patients and family members), alignment of incentives across distributed work systems (e.g., inpatient, home care, and primary care providers working together towards a goal of safe care transition), and accountable care across care episodes</li> <li>-Organizational leadership and strong community involvement in care redesign, education and training programs on teamwork across distributed work systems and with patients and family members, and cultural changes to re-orient inpatient professionals to partner with patient/family in medication safety</li> <li>-Information technology enabling and supporting collaborative work with the home team [26]</li> </ul>
<b>Interactions with Home Care/ Transitional Care Services</b>	
<p><b>Partnership Approach</b></p> <p>Teamwork across settings (e.g., home health nurses, transitional care staff, and community health workers): setting common goals of engaging patients and home caregivers over time, such as (a) systematic process for learning about downstream and upstream workflows and roles to organize partnering approaches, (b) routine feedback and problem-solving mechanisms on patient and family engagement and care handoffs, (c) investment in technology to support situation awareness across settings on patient and family engagement goals. Current practices tend to focus on "orders" of services to be delivered to patients and families and not focusing on building home team capacities, and no systematic feedback to inpatient teams from downstream professionals on care transition for organizational learning; time pressure and variations in clinicians' personal approaches tend to encourage 'heroism' of home care coordinators to arrange for home care service last minute to be able to discharge patient.</p>	<p><b>Enablers</b></p> <ul style="list-style-type: none"> <li>- Culture change to appreciate challenges facing patients and families, and to view part of the same support "team" for patient and family work system</li> <li>-Health information technology that supports family engagement across time and organizational boundaries; coordination on availability of key clinical documents)</li> <li>-Alignment of incentives across different team members working in distributed work systems, collaboration and communication infrastructure across organizations (inpatient, home care, community pharmacies)</li> <li>-Research and quality improvement approaches to improve across professional/cultural boundaries</li> </ul>
<b>Interactions in Community Settings</b>	
<p><b>Partnership Approach</b></p> <p>Teamwork with professionals (e.g., pharmacies, community health centers, home health providers, outpatient providers), developing a system to support collaborative work, such as: (a) tools and skills for inpatient teams to proactively identify risks and develop ways with patients and family caregivers to use community resources for medication management, (b)</p>	<p><b>Enablers</b></p> <ul style="list-style-type: none"> <li>- Support structures (e.g., information technology) that promote collaboration and feedback across organizational, professional and cultural boundaries</li> <li>-Infrastructure that allows crowdsourcing of community-based challenges and fresh ideas that can</li> </ul>

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support organizational learning and continuous improvement	systematic process for learning about community resources and roles and for feedback on improvement for partnering with patients and families (e.g., more effective use of community health services). Current practices do not adequately consider skills, knowledge and attitude needed to work with professionals such as community pharmacists in supporting care transitions, and no systematic feedback on ways to improve patient home team's abilities to manage medication safety.
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