Medication Management Process

The New England Healthcare Institute estimates that $290 billion of health care expenditures could be avoided each year if medication adherence were improved.[1] While medications are widely appreciated, commonly used, and help many people lead longer, healthier, and more productive lives, there is still great room for improvement in medication use management.

Table 1 provides an overview of the medication management process by linking areas of opportunity for medication optimization and technology-enabled innovations to process steps. The Center has focused on three medication use opportunities: Medication Adherence, Medication Reconciliation, and Medication Monitoring. Mapping these opportunities to the medication management process allows us to identify solutions that optimize outcomes.

To help pinpoint where medication use problems occur, what opportunities exist to solve these problems, and which technologies may be beneficial

in the process, it is helpful to visualize the medication-use process as a series of five phases: Assess, Prescribe, Dispense, Administer, and Monitor. [2, 3, 4] (Note that phases vary by care setting, health care professional role, and patient involvement). Medication reconciliation problems mainly present in the Assess and Prescribe phases of the medication use process, whereas medication adherence problems commonly occur in both the Dispense and Administer phases while medication monitoring problems occur in the monitor phase.

Phases can be further divided into process steps, starting from patient identification and medication history, progressing to routine dosing, tracking, and reporting of patient medication use. A number of technology-enabled innovations can mitigate medication use problems, optimize process step efficiency, and improve the health of individuals. Technology solutions range from standalone to integrated technologies and are utilized by patients, caregivers, and/or clinicians, or both.

Information and communication are the glue that holds the process together, helping to ensure successful outcomes. The process of assessing patient needs and prescribing, dispensing, administering, and monitoring medications often depends on accurate, complete and timely information. If valuable information is inaccessible or ignored by members of the medication use social system, the ability to respond accordingly and optimize the treatment regimen will be hampered.

The Center's Medication Optimization Position Paper focuses on process step outcomes and associated technology solutions, highlighted in yellow on the table, which are predominately aimed at improving the health of older adults while promoting independent living in the community-based, home, and long-term care settings. Such technologies involve principal use by patients and caregivers to improve self-management of care and enhance communication of medication information to clinicians. The example technologies are not meant as an exhaustive list of potential technology solutions, but rather are a sampling of potential innovations.

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> David Lindeman, PhD
> Director, Center for Technology and Aging

Table 1: *Medication Optimization Opportunities in Context*
Adapted from A Guide for Health Care Payers to Improve the Medication Management Process (pgs 9-11)[4]

Opportunity	Phase	Key Steps	Optimal Step Outcome	Technologies
Medication Reconciliation	Assess (physician's office, hospital)	Patient Identification	Identified patient information including name, address, birth date, gender	RFID Barcoding
		Medication History	Obtained complete list of previous and current medications used by patient	Medication list software PHR
		Diagnosis	Clinician accurately diagnoses patient problem	
	Prescribe (physician's office, hospital)	Medication Selection	Optimal medication for patient selected by clinician. Pulled from lists specific to diagnosis, commonly prescribed, etc	Clinical decision support tools EHR
		Safety Check	Patient medication selection passes safety check and does not interfere with patient allergies, other drugs or medical conditions, taking into account patient body size and pharmacokinetics for proper dose	Clinical decision support tools EHR
		Formulary and Benefits Check	Patient medication selected from pharmacy benefit list, has prior authorization, with the lowest possible co-pay	Clinical decision support tools EHR
		Medication Ordered	Electronic or hand written medication orders from clinician transmitted seamlessly to dispenser	e-prescribing CPOE
		Ordered Medication Documented	Medication order documented where patients can access the information	Medication list software PHR
Medication Adherence	Dispense (medication packing facility)	Evaluate/Approve Order	Medication order reviewed and approved to dispense	CPOE
		Medication Preparation	Medication order identified, prepared and packaged for delivery to dispensing location	RFID service robots
		Medication Distribution	Medication delivered to dispensing location	
	Dispense (pharmacy, hospital)	Patient and Medication Identification	Health care professional identifies and verifies patient and medication order	Barcoding, RFID
		Safety Check	Patient medication passes safety check and does not interfere with patient allergies, other drugs or medical conditions, taking into account patient body size and pharmacokinetics for proper dose	Clinical decision support tools
		Patient Education and Cognitive Assessment	Patient educated on medication use, dosing, side effects, and contraindications. Cognitive assessment determines patients' ability to adhere to medical regime.	TeleConsultations Online patient education Cognitive Assessment tools
		Medication Dispensed to Clinician	Medication order dispensed and picked up by clinician	Robotic dispensers and carousels
		Medication Dispensed to Patient	Medication order dispensed and picked up by patient	Pharmacy kiosk
	Administer (hospital, LTC facility, patient home)	Medication Information Identification (by clinician)	Clinician identifies and verifies correct patient and medication	Barcoding RFID
		Medication Information Identification (by patient or caregiver)	Patient identifies correct medication by reviewing drug name, dose, time of day, drug interactions	Talking pill bottles
		Dispense Individual Dose (by clinician)	Accurate individual medication dose (pill, IV bag, shot or liquid) properly dispensed to clinicians	IV Smart pumps Service robots
		Dispense Individual Dose (by patient)	Accurate individual medication dose (pill) properly dispensed to caregivers or directly to patient	Automated Dispenser Devices
		Take Dose	Patients takes proper dose at the right time	Reminder alert devices
Medication Monitoring	Monitor (LTC facility, patient home, hospital)	Routine Dosing and Tracking	Patient/caregiver routinely takes proper medication dose and records time medication is taken or not taken	Automatic dispenser devices
		Reporting and Trending	Caregiver/patient/clinician receives overview and trending of medication log and outcomes	Wireless communication devices Automatic dispenser devices PHR
		Refill prescriptions, contact clinician	Patient/caregiver refills medication or contacts clinician to adjust	Prescription reminder systems

Medication Reconciliation

Medication reconciliation is the process of creating an accurate list of all medications a patient is taking and comparing that list against new physician orders. The five main steps of the process are: 1) developing a list of current medications; 2) developing a list of medications to be prescribed; 3) comparing the medications on the two lists; 4) making clinical decisions based on the comparison; and 5) communicating the new list to appropriate caregivers and to the patient.[5]

Assess Phase:

In the assess phase, clinicians identify the patient, view and reconcile medication history as well as accurately diagnose the patient's problem. Clinicians, patients, and caregivers can utilize technologies to improve outcomes within these process steps. To accurately identify the patient, technologies like RFID and barcoding can be used. These technologies may be more appropriately suited for the hospital setting. Using a variety of online medication list programs integrated with pharmacy history, PHRs, and EHRs provides clinicians with complete, up-to-date patient medication histories.

Prescribe Phase:

In the prescribe phase, clinicians utilize safety checks to find possible allergies or interactions with other medication, select medication from the pharmacy benefit list, obtain prior authorization, and select medication with the lowest possible co-pay. The order is then documented and transferred to the dispensing facility. Clinical decision support tools can assist physicians with selecting appropriate medications, searching for interactions and choosing medication from the pharmacy benefit list at the lowest cost to the patient. Technologies like CPOE and e-prescribing can minimize medication order entry error and transfer of prescription information to the dispensing facility.

Medication Adherence

The World Health Organization defines adherence as "the degree to which the person's behavior corresponds with the agreed recommendations from a health care provider."[6] Non-adherent patient behaviors occur in the Dispense and Administer phases. A significant portion (12%) of patients will not take possession of dispensed medications.[7] Of the patients that do pick up the dispensed prescription, 40% will not administer the medications correctly.[8]

Dispense Phase:

In the dispense phase, medication orders are reviewed, approved, prepared and packaged for delivery from the medication packing facility to the dispensing location (this can be the same location depending on where the medication is packaged). Proper identification of medication and patient occurs when the medication is dispensed. Cognitive assessment determines patients' ability to adhere to medical regime. The medication order is then dispensed and picked up by clinician or patient depending on the location. Next, patient education on medication use, dosing, side effects, and contraindications occurs. Dispensing technologies vary from automated robots in medication packing facilities to high tech cabinets and service robots in hospitals to dispensing kiosks in pharmacies or other convenient locations. Identification technologies for patients and medications, including RFID and barcodes, can be used in the hospital setting as well as the medication packing facilities when preparing and packaging medication. Computerized cognitive assessments can assist in determining a patient's capability for medication adherence. Patient education technologies can utilize online education programs as well as teleconsultations with pharmacists and other care providers.

Administer Phase:

In the Administer phase, clinicians and/or patients identify the correct medication and dispense the individual dose. Patients then take the dose or receive assistance with taking their medication. Identification technologies used in the hospital setting to identify patients and medication (as seen in the Assess phase) can include RFID and barcoding. Technologies can also assist patients and caregivers with obtaining proper medication information, patient education, medication organization, dispensing, dose reminders, and safeguard against an overdose. Such technologies can be classified as standalone or integrated. Standalone technologies tend to be less complicated and can be single-function, multi-function or have advanced functions. Integrated technologies are more complex and integrate medication management with other health management capabilities such as general health monitoring, sensors, or health information storage. Reminder alert devices such as watch alarms can help patients remember to take their medication.

Medication Monitoring

Medication monitoring primarily refers to the process of monitoring a patient's response to a medication. Secondarily, medication monitoring can also reveal whether a patient is taking a medication, or taking an appropriate dosage at the appropriate times. Monitoring information includes biometric data, administrative data (e.g., whether a prescription was filled), subjective reports, and health service utilization data. Medication adherence problems can also arise in the Monitor phase of the process, as patients may self-adjust their medications inappropriately, or stop altogether because of side effects.

Monitor Phase:

During the monitor phase, patients routinely take their proper medication dose while recording the time medication is taken or not taken. Tracking and trending of this information is then reported to caregivers, clinicians as well as patients. This information can be used to adjust medication dose, type, or frequency. Patients and/or caregivers must then refill medication. Point-of-care testing devices are available to monitor blood pressure, peak flow (for asthma), blood glucose (for diabetes), and a host of other health conditions. Many devices can interface with a personal computer, and increasingly with home monitoring devices. Data can also be uploaded to a clinician's portal or other remote site for review and dose adjustment. Wireless communication devices including cell phones, computers, point of care testing devices and automated dispensing devices enable continuous, real-time data collection and transmission of medication results and biometric data. Currently, mobile phone applications are available that allow users to personally manage their medications, with reporting and trending features. Point-of-care testing devices to monitor medication are becoming more prevalent and accurate, with wireless capabilities. The increased ability to store, view, and trend data by patients, caregivers, and clinicians can improve management of patients' medication programs.

End Notes:

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