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THE PROBLEM WITH MEDICATION RECONCILIATION

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MEDICATION RECONCILIATION: A BRIEF SUMMARY OF THE EVIDENCE, AND THE PROBLEM WITH GENERALIZING THAT EVIDENCE

Medication reconciliation ('med rec', as it is often called) refers to the "process of identifying the most accurate list of all medications a patient is taking ... and using this list to provide correct medications for patients anywhere within the health system."¹ Two recent systematic reviews summarized the evidence for med rec interventions, finding that several med rec interventions reduced medication history errors and errors in patients' admission and discharge medication regimens.^{2,3} Despite documented efficacy in reducing errors, there are caveats. An earlier literature review showed that the clinical significance of medication history errors varies substantially—between 11% and 59%.⁴ Furthermore, although errors associated with harm were prevented in those studies that examined it,² adverse drug events (ADEs) have been infrequently examined. Also, only a few studies have shown decreased healthcare utilization,^{5,6} and to our knowledge none have shown direct cost savings.

Despite imperfect evidence, The US Joint Commission and Accreditation Canada initially mandated universal med rec in 2005.^{7,8} In addition to the subset of aforementioned evidence in existence at that time, these mandates were driven by frequent anecdotes of ADEs related to med rec errors and strong face-validity of preserving and communicating medication information across patient encounters. Unfortunately, although some organizations mobilized substantial resources to comply with these mandates, other organizations

COMPETING INTERESTS

Prior to the conception of this project, Dr. Schnipper completed an investigator-initiated grant from Sanofi-Aventis to develop and evaluate a multi-faceted intervention to improve transitions of care in patients with diabetes discharged on insulin.

undoubtedly improved *documentation* of med rec (as per the mandate requirements) rather than actual medication safety.⁹ Although most studies of med rec interventions report positive results, at least one review found publication bias:² many negative experiences associated with med rec interventions were never reported.

Thus, although we acknowledge some gap between the benefits med rec interventions have been shown to provide in the medical literature and the benefit its most fervent devotees expect, we believe there is a far larger gap between the largely successful med rec efforts included in the aforementioned literature reviews and the largely unreported outcomes of med rec efforts that patients in most hospitals are likely to experience. These two concepts are related: the absence of clear cost-benefit data from the literature makes hospitals less likely to expend resources. Paradoxically, it is exactly these resources that are required for med rec interventions to succeed. This, then, is the problem with med rec interventions – benefits reaped by organizations focused on these interventions have not generalized easily to other institutions.

WHY MEDICATION RECONCILIATION INTERVENTIONS ARE PROBLEMATIC: RESOURCE INTENSITY AND COMPLEX WORKFLOWS

One difficulty in generalizing interventions from the literature to most hospitals relates to the resource intensity required to do med rec well. The potential for expending substantial resources on med rec interventions can be easily understood by considering a “best possible” medication history, for which detailed instructions have been published.¹⁰ Time and motion analysis shows that as many as 46 minutes are needed to obtain admission medication histories from medical patients,¹¹ resulting in estimated pharmacist costs of up to \$44 per patient.¹² This would translate to 11 full time personnel obtaining medication histories for a hospital with 23,500 annual admissions. Unfortunately, few organizations have the resources to obtain best possible medication histories at the start of every inpatient encounter, so they are necessarily rationed and targeted (usually to patients deemed high risk, and to provider convenience), if they are performed at all.

Obtaining a medication history is just the beginning of expending resources on med rec interventions. Much of the documented patient-centric benefits of these interventions depend on a comprehensive approach that frequently involves pharmacists and requires substantial resources: reconciling medications at discharge, patient medication education at discharge, assessing non-adherence, communicating with other providers, and post-encounter follow-up with patients. This suggests that med rec interventions may act synergistically, or that intervention breadth is needed to yield any results. Lastly, accurate measurement of benefit from these interventions (e.g. detecting discrepancies and errors in medication orders) is in itself labor intensive and thus rarely done. Thus, organizations implementing these interventions may fail to see tangible results due to deficiencies in intervention intensity, intervention breadth, and/or difficulties of measurement.

In a setting of high opportunity costs and imprecise estimates of beneficial outcomes both in the literature and at the institutional level, organizational leaders face difficult tradeoffs. This mix of factors may hinder substantial organizational commitment to med rec interventions.

Indeed, we believe one important contextual factor associated with successful implementation of med rec interventions is an organizational goal of increasing medication safety, rather than just meeting regulatory standards.

A second major difficulty with generalizing med rec interventions is that they affect complex workflows that frequently vary across, and even within, institutions. A common example of intra-institutional workflow variation is that admitting physicians sometimes place orders *after* other clinical personnel (e.g., ward nurses) have obtained or updated the medication history, and sometimes place admitting orders in the ED, *before* patients are seen by ward nurses. An intervention designed to improve the former process by having pharmacists obtain a medication history after a patient arrives in their hospital bed would not work for patients admitted with the latter process, because admission medication orders would have already been placed.

Even greater workflow variation exists across health care institutions and settings. For example, medical assistants with little pharmacology training often obtain medication histories in the outpatient setting. Because EHRs often allow for transmission of medication histories (including medication history errors) across institutions, ordering providers must recognize that workflow variation may cause substantial variation in medication history quality. Appreciating such variation is especially important in settings where ordering clinicians are accustomed to best possible medication histories that require minimal review. This is one example of how an incompletely implemented med rec intervention (best possible medication histories on some patients, with inadequate precautions on other patients) could worsen medication safety.

Another workflow challenge associated with pharmacist-based interventions involves contacting physicians to recommend medication order changes in response to medication history errors. Pharmacists often face difficulties in determining who the responsible provider is, especially for patients being seen by multiple specialists or hospitalists who work in shifts. This is one reason why it is both safer and more efficient for “best possible medication histories” to be taken *before* orders or prescriptions are placed, avoiding both erroneous orders and the communication required to fix them.

Med rec quality improvement efforts thus require a concerted inter-professional effort to understand existing workflows and to thoughtfully improve them. Without a standardized protocol designating the role of each provider in obtaining medication histories and documenting medication history quality, each provider risks committing one of two errors: 1) not obtaining a sufficiently comprehensive medication history, perhaps with the assumption that another provider has already done so or will do so, or 2) unnecessarily spending time obtaining a medication history, even though another provider has done so or will do so.¹³

Beyond the intricacies of workflows at the micro level, there are often larger system pressures at odds with med rec interventions, including pressures to expedite discharge from the emergency department and from hospital wards. To successfully improve med rec, institutional leaders must recognize and often accommodate such pressures. For example,

holding patients after discharge to allow for pharmacist-led med rec would probably not work well at an institution expediting discharges to avert a bed shortage. Instead, such an institution might focus on providing discharging clinicians with an accurate list of home and hospital medications up front, such that this provider would be well positioned to perform med rec at discharge. Even if this latter strategy were inferior to pharmacist med rec at discharge from the standpoint of med rec, it might be more sustainable, and thus more effective in the long run. In addition, in-depth discharge counseling could be deferred until after discharge (e.g., by phone), when it may be more effective than at discharge because patients and caregivers feel less rushed and are in the environment where they will be performing most of their medication-taking behaviors.

EXISTING APPROACHES TO ADDRESSING MEDICATION

RECONCILIATION: BENEFITS AND DOWNSIDES

Pharmacists

The two aforementioned systematic reviews of inpatient med rec found that successful interventions were usually pharmacist-based.^{2,3} The greatest barrier to implementing pharmacist-based interventions is their high cost, coupled with the fact that most med rec activities are not billable. Hiring additional pharmacists may be still be cost-effective under current payment models if they reduce inpatient ADEs that increase costs and length of stay. Furthermore, the ongoing shift in health care financing towards capitated payment models should motivate payor and provider organizations to underwrite this care, if it is thought to decrease post-hospital utilization. Indeed, the MARQUIS toolkit used informal calculations to estimate that hiring pharmacists to obtain medication histories and perform discharge counseling could have as much as a 3:1 return on investment from reductions in inpatient ADEs and readmissions.¹⁴ But while every step in the calculations can be justified, there is as of yet no direct evidence tying these interventions to cost savings, so many hospital leaders are reluctant to make these moves, especially in an era of cost-cutting.

In the meantime, pharmacy technicians may offer many of the benefits of pharmacist-based interventions, but at a lower cost, thus decreasing the financial risk of these types of investments. Multiple studies have shown that, at least in terms of obtaining accurate medication histories, pharmacy technicians perform on par with pharmacists.^{15–17} More advanced tasks, such as counseling high-risk patients at (or after) discharge, may always require pharmacists. Pharmacists may also be needed to supervise technicians.

Information technology solutions

The next most common type of successful interventions identified in the systematic reviews used electronic health records (EHRs).^{2,3} EHRs generally allow providers to access electronic sources of pre-admission medication information, to create an electronic medication history, and with a few subsequent clicks to order ‘home’ medications at admission and a combination of ‘home’ and ‘hospital’ medications at discharge. When used properly, such functionality saves time and reduces errors. Lamentably, because EHRs are not universally available, do not universally share information, and are not universally used as intended, these features sometimes facilitate medication history errors and concomitant

medication order and discharge prescription errors.¹⁸ Indeed, recently presented results from MARQUIS showed that vendor EHR implementation was associated with a marked increase in medication history errors,¹⁹ likely due to a combination of factors including EHR design, local implementation, and use by providers. This is in marked contrast to the seminal paper demonstrating the benefits of med rec health information technology (HIT) on outcomes, which involved proprietary HIT and a major institutional commitment to med rec during the study period.²⁰ EHRs can be used to improve medication safety, but these powerful tools require substantial institutional commitment towards optimizing how the med rec components are locally customized, integrated into workflows and used in practice. Even then, design flaws in the med rec modules of some vendor EHRs may still result in suboptimal outcomes.

REGULATING MEDICATION RECONCILIATION

Current regulations require documentation that med rec has been performed, without regard to the quality of the process. This is another example of a med rec intervention that can worsen medication safety, as it may pressure providers to document that substandard med rec is accurate, which has potential to inhibit fixing downstream ordering and prescribing errors. One alternative for measurement is for a random sample of patients to receive "gold standard" medication histories (e.g. by highly trained pharmacists), followed by a review of admission and discharge orders, after these patients have been subjected to the normal med rec processes of a given provider organization. This is the principle behind the med rec quality measure recently endorsed by the National Quality Forum, which quantifies the unintentional discrepancies in admission and discharge orders.²¹ This process measure may also offer organizations a practical method of monitoring, refining, and modulating their med rec efforts.

CONCLUSIONS

Med rec interventions have strong face validity and have been shown to improve processes, but are problematic in that they have been difficult to replicate outside of studied institutions. We believe much of this difficulty reflects the complexity and resource intensity required of effective med rec interventions. High opportunity costs and workflow complexity and variation within and across health systems, when interacting with other complexities of patient care and health information technology, means that there are no easy solutions to implementing med rec interventions. Instead, med rec interventions need to be carefully matched to organizational strengths, workflows, and goals based upon institutional priorities. Nonetheless, there are several broad recommendations that can be targeted to organizational leaders, clinicians, and investigators (Table).

Beyond these specific recommendations, it is important to note that effort and execution are crucial to success. It is not enough to create a new form or check a box saying that med rec has been done well. Rather, what is needed are concerted efforts with inter-professional quality improvement teams, understanding of current processes, measurement that reflects actual med rec quality, and thoughtful implementation and iterative refinement of interventions, many of which require additional resources and/or major process redesign,

and all of which require major institutional support. Further research is needed to better understand the costs and benefits of particular intervention components, alone and in combination, how best to implement them, and the patients most likely to benefit. And even more work will be required by those institutions who strive to turn the promise of med rec into reality, that is, improving medication safety during transitions of care.

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Table**Recommendations to Improve Medication Reconciliation.**

Organizational leaders should:	
1. Recognize that most evidence for improving medication safety comes from resource-intensive, pharmacist-based interventions, and that half-hearted efforts to improve med rec may just waste resources and even worsen medication safety.	
2. Ensure that designated personnel have sufficient time and training to conduct med rec. For example, hiring and training dedicated pharmacy technicians to obtain medication histories may represent a good use of resources.	
3. Recognize that in most cases, obtaining an accurate medication history early in the hospitalization (ideally while the patient is still in the emergency department) is optimal, because fixing these errors downstream (after orders have been written, or after discharge) is both unsafe and inefficient.	
4. Determine which groups of med rec interventions are most likely to serve patient and organizational goals. Institutions focused on post-discharge outcomes (e.g., readmissions) may find that med rec at discharge and post-discharge phone calls are good places to start.	
5. Prioritize which patient populations (i.e., high risk patients) would benefit the most from intensive med rec interventions to ensure responsible use of resources.	
6. Clearly delineate roles and responsibilities for those personnel involved in med rec interventions, including a designated order of intervention components, to reduce known ambiguity about which personnel are responsible for which parts of each med rec intervention and when they should occur. ²²	
7. Consider the role of information technology in med rec, including the potential for propagation of medication history errors. While major changes in the med rec modules of vendor EHRs may be out of scope for many institutions, even minor changes to user permissions (e.g. giving pharmacists or technicians the ability to edit home medication lists) or to the default appearance of certain screens could have substantial benefit.	
For organizations embarking upon these steps, existing toolkits (e.g. MARQUIS, MATCH) may be especially helpful. ^{23,24}	
Clinicians should:	
1. Ensure that organizational efforts focus on sound processes and patient outcomes, with consideration of the aforementioned NQF process measure, rather than just regulatory requirements.	
2. Disseminate and model the philosophy that ordering providers are ultimately responsible for the quality of med rec because good med rec is required for safe medication orders. This does not require providers to complete the process alone. Indeed, they should leverage work done by other providers. However, they still must verify accuracy, and must address cases with questionable accuracy (e.g. call a physician's office that was closed at the time of admission).	
Investigators should:	
1. Assess med rec interventions across the care continuum using patient-centered outcomes, with attention to interactions between interventions and the cultural context of institutions.	
2. Explicitly measure the costs and benefits of various med rec interventions (e.g. using pharmacy technicians in certain med rec roles), with attention to subgroups that might derive the most benefit.	
3. Study how large vendor EHRs can best be used to improve med rec, mindful of varying cultural contexts, implementation idiosyncrasies, and local customizations.	
4. Learn how med rec interventions can best be integrated with existing workflows and made compatible with larger system pressures. For example, unit-based pharmacists (vs centralized pharmacists) may be better positioned to provide discharge medication counseling to patients without postponing discharge.	