Reducing medication errors

The future is near field communication

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ABSTRACT

Hospital readmissions place a heavy burden on healthcare in Canada. Communication errors often occur at vulnerable time points like peridischarge, and these can lead to downstream adverse drug events necessitating rehospitalization. Existing mechanisms to address this problem still have room for improvement. Discharge summaries, for example, may be late, erroneous, or incomplete. Medication reconciliation processes directly integrated with electronic medical records have demonstrated advantages in terms of legibility and timeliness but unfortunately encourage risky behaviours like indiscriminate copy and pasting, leading to new errors of a different sort.

A single unified medication list that could be kept on a patient's person at all times can ensure that medication information is always present at medical appointments and is synchronously updated among all involved practitioners. Near-field communications (NFC) may facilitate the creation and maintenance of such a list. It is a relatively new wireless technology that has advantages over radio-frequency identification and Bluetooth. It allows information to be recorded to and read from objects as small and thin as a sticker. Technologies based on NFC may prove useful for consolidation patient health information into "one source of truth".

INTRODUCTION

Unintentional hospital readmissions present a significant challenge to the Canadian healthcare system. During an 11-month period in 2012, hospital readmissions constituted 8.5% of all acute care admissions in Canada and consumed \$1.8 billion of healthcare spending.¹ In the United States (US), the problem is no less dramatic, with a hospital readmission rate of 20%.² Importantly, approximately 23% of these readmissions were preventable.³ Across Canada, the diagnoses associated with the highest readmission rates were heart failure at 21% and chronic obstructive lung disease (COPD) at 18.8%;¹ these rates were similar in the United States.⁴

A study based in the US found that 66% of readmissions within 2 weeks of discharge were due to adverse drug events (ADE), two-thirds of which were deemed to be preventable.⁵ In addition, according to a separate American trial, 19% of patients experience ADEs postdischarge, 6% of which were considered serious.⁶

Medication errors that occur during transitions between care settings, such as in the weeks preceding and following discharge (peridischarge), are important and preventable sources of ADE.^{7,8} A review of 1245 inpatient encounters found that just over 50% of patients had one or more discrepancies between their inpatient and

home medications as determined by comprehensive chart review; importantly, the vast majority of these discrepancies had the potential to cause harm.⁹ This suggests that medication errors may be a major cause of preventable hospital readmissions and correspondingly represent a prime target for reducing patient morbidity postdischarge and for decreasing unnecessary healthcare expenditure.

MEDICATION ERRORS

Medication errors have myriad causes; polypharmacy, decreased patient cognitive ability, and certain categories of medications are specifically implicated in increasing the risk of readmissions.¹⁰ The class of medication most strongly associated with medical errors is cardiac medications, followed by COPD medications and then blood pressure medications;¹¹ these comparative risks are reflected by the readmission rates for their associated medical conditions.¹

The scope of the problem is large: one review of 22 studies found that up to 67% of patients had medication discrepancies upon admission to hospital,¹² while a separate study of 471 patients found that 59.2% had "a misunderstanding in the indication, dose, or frequency [of] a cardiac medication" after discharge.¹³

Confusion among patients and providers regarding what constitutes an accurate medication list is worsened by frequent medication changes and by having many prescribers involved in care.¹⁴ Generally, deficiencies in hospital protocols underlie most medical errors that occur during discharge, with failures in communication being the most common reason.⁶ Unsurprisingly, interprofessional communication has become a popular subject of quality improvement initiatives. Some relevant tools and strategies in widespread use today include discharge summaries, medication reconciliation, and computerized order entry and documentation.

DISCHARGE SUMMARIES

Historically, discharge summaries were necessary only as documentation since the same attending physician usually managed inpatient and outpatient care. On the other hand, modern discharge summaries are relied upon to convey pertinent details, such as primary diagnosis, physical examination, summary of investigations, discharge medications, and follow-up instructions, to community physicians assuming responsibility for care.¹⁵ Unfortunately, according to a systematic review of 73 research articles investigating discharge summaries, any of the aforementioned sections could be missing, even when explicitly required by institution guidelines. Furthermore, discharge summaries arrived after the discharged patients' first follow-up appointment (or not at all) up to 53% of the time,¹⁴ leaving patients to recall and explain the circumstances of

their inpatient stay and their new management plan.

Discharge summaries continue to be improved upon as vital tools of interprofessional communication. For example, in addition to benefits seen with standardised forms and use of electronic systems, a brief one-time educational workshop has been shown to drastically improve the quality of resident-produced discharge summaries.¹⁶ Further improvements to medication lists specifically can be achieved via medication reconciliation.

MEDICATION RECONCILIATION

As the number of professionals involved in the care of one patient increases, medication information becomes increasingly fragmented among multiple informal, paper, and electronic sources.¹⁷ Medication reconciliation refers to the comparison of lists of active medications drawn up at different points in a patient's care for the purpose of detecting and correcting discrepancies.¹⁴ Sources of information include patient interview, collateral history from family members, handwritten or pharmacist-generated lists, previous lists documented in a patient's medical record, and a patient's physical medications brought to the point of care. Though known to greatly decrease medication inconsistencies and omissions,¹⁸ medication reconciliation is a laborious and technically challenging task.

Physician education has been shown to improve the quality of medication reconciliation, as have targeted patient education and empowerment; however, asking patients to bring their medications to medication review sessions (so-called brown bagging) has not worked as well.¹⁹ Fortunately, some computerised solutions have emerged to improve and streamline the process.

COMPUTERIZATION AND TECHNOLOGY

In recent years, the introduction of medication reconciliation through electronic medical records (EMRs) has given health care providers an opportunity to decrease peridischarge medication errors. In addition to compelling physicians to scrutinize admission medication lists when formulating discharge plans, electronic systems have many theoretical benefits, including guaranteed legibility,¹⁷ standardized documentation production, automatic flagging of discrepancies, and higher-fidelity communication.²⁰ Accordingly, a randomized controlled trial involving 322 internal medicine inpatients found that an integrated electronic medication reconciliation and order entry application reduced the number of potentially harmful medication discrepancies compared to using traditional methods.²⁰ Computerization also improves the overall quality of discharge summaries by standardizing their format and content. Electronic discharge summaries have been shown to be more understandable and lucid than their dictated counterparts.²¹ Email can be as effective as fax and more effective than standard mail or hand delivery in ensuring that primary care physicians received discharge summaries in a timely manner.¹⁷

Unfortunately, while existing forms of electronic systems tend to integrate well with medical products included in formulary medications that have been specifically programmed into them, other products, including herbals and supplements, are handled less ef-

fectively.¹⁷ Electronic systems can also be technically difficult to implement and use²⁰ or simply less preferred than existing methods,¹⁷ thus decreasing physician and institution buy-in and compliance. Even with full implementation, certain types of errors still occur. For example, while computerized medication reconciliation significantly decreases erroneous inclusions of medications and unintended changes to dose, mistakes such as errors of omission are more difficult to avoid.²² Use of electronic medical records also risks encouraging counterproductive behaviours such as copying and pasting information or attaching test results indiscriminately.²³

EMERGING TECHNOLOGY: NEAR-FIELD COMMUNICATION

Near-field communication (NFC) utilises short-wave radio to transfer information between devices within 10 cm of each other. Advantages of NFC over contemporary technologies like radio-frequency identification (RFID) or Bluetooth include its short range (and associated privacy) and negligible need for setup.²⁴

Medical information can be stored on a small passive NFC-compatible object, then read by a powered terminal. Like a barcode, the storage device does not need to be powered, increasing portability and decreasing cost. Indeed, NFC devices shaped like small stickers or credit cards are currently available for around \$1 apiece²⁵ and the expectation is that future products will be even more compact and affordable. Stored information can be accessed or edited with a tap on a machine, similar to how instant payment systems currently function.

Imagine a patient arriving for a postdischarge primary care appointment with a medication list stored on an NFC-enabled sticker attached to the health card. The physician taps the card on a terminal and uses the stored information to update the patient's medical record. The EMR system draws attention to the medications that have been modified, which the physician and patient discuss. At the end of the appointment, the physician makes several medication changes. The EMR software prints prescriptions and updates the patient record. With another tap, the physician updates the medication list on the NFC sticker. This up-to-date list is returned to the patient and will be available at the next healthcare encounter, whether it be in the same office, an emergency department, an inpatient ward, or elsewhere.

This approach consolidates information into a single source that is kept with the patient and guarantees timely delivery of health information between practitioners. It also avoids the characteristic problems of having multiple medication lists that are stored in separate places and asynchronously maintained and updated. Widespread implementation will take time and resources, but the benefits described above strongly suggest it is worth the effort.

CONCLUSION

Medication errors are a major preventable cause of hospital readmissions. Medication reconciliation and computerized order entry and documentation have already decreased medication error rates. Current best practices in medication reconciliation involve pooling information from a variety of sources, but this painstaking

process can seldom be fully accomplished, especially given the resource constraints of modern healthcare. The advent of NFC applications in health informatics may bring us closer to the elusive “one source of truth”: a single accurate medication list that can be communicated efficiently and accurately between physicians.

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