

## **Integrating Medication Barcodes with EMRs to Improve Medication Reconciliation**

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The Joint Commission requires that all health systems "accurately and completely reconcile medications across the continuum of care," which is a current National Patient Safety Goal. Medication reconciliation is a complex and error prone process, particularly for patients taking multiple medications, which are often prescribed by multiple providers and dispensed at different pharmacies. Medication reconciliation is typically performed by nurses and modified by physicians, often relying on patient recall and review of outdated medication lists to generate an "updated" medication list, which is manually entered into an electronic medical record (EMR). This process often leads to inaccurate information, which can be perpetuated in the EMR. Furthermore, medication lists – even if accurate – are not easily shared among EMRs, creating significant barriers to medication management. Presently there is no coordinated system to track medication changes among different systems of care or among multiple providers, which puts vulnerable patients at risk for developing adverse events. Use of barcode technology, which has improved safety of inpatient medication administration, seems a logical point for integration. Yet presently barcodes affixed to medication labels at time of dispensing include proprietary information specific to the dispensing pharmacy, a process that is not regulated by the FDA.

In response to these deficiencies we propose to develop an innovative system to improve medication reconciliation and enhance patient safety. We will develop a standardized medication barcode system that includes medication dosing information, which patients can use to create an updated "wallet reminder card" that can be scanned and read into an EMR. This approach is innovative because it will reduce time spent performing medication reconciliation, streamline nursing workflows, and transform patient care by facilitating accurate medication histories between various sites of care. Furthermore, this approach is innovative in its simplicity – using existing technologies (bar code systems, scanners, and EMRs) as a means to integrate a currently disjointed system.

The following specific aims will guide this project: A) to develop a barcode system for medication labeling at points of dispensing that is both patient-centered (labels will contain medication pictures and dosing instructions), which will be used to develop "wallet reminder cards" (or electronic medication lists – barcodes could be scanned with a smart phone using a mobile application) and provider-responsive (barcodes can be scanned at point-of-care for real-time incorporation into an EMR); B) to test a scanning system that translates barcodes containing medication data into an EMR; C) to test explicit patient medication lists to determine clinician acceptability of this approach for medication reconciliation at point-of-care; D) to describe feasibility and acceptability of this approach to integrated medication management with respect to: use of the barcode-to-EMR (patient to provider) and electronic prescribing to barcode (provider to pharmacy to patient) among patients, providers, and pharmacy systems.

A major tenant of our proposal is standardizing information contained on dispensed medication barcodes. This approach is logical, since the FDA mandated the use of standardized barcodes containing National Drug Code (NDC) information to be placed on all stock (not dispensed) medications in 2004. Furthermore, with standardization of medication information via barcodes, medication information can be transformed into a "common language," making transfer of medication histories more portable between sites of care that utilize different information systems (e.g. various EMRs) that otherwise cannot exchange information easily. Ultimately, our system focuses on a "patient centered" approach to care and encourages the patient (or proxy) to play an active role in maintaining an updated medication list with the assistance of healthcare providers and

pharmacists. When implemented, this system will improve patient safety, reduce adverse drug events, and streamline medication reconciliation.

We will achieve our aims by developing the requisite technology and integration systems and then piloting the process in a feasibility study using “dummy” patients. Specifically, we will collaborate with Sparrow Pharmacy Systems (including all Sparrow Pharmacy Plus locations) and their software vendor, SRS Pharmacy Systems, to develop a standardized label that contains the following information: drug picture and clear dosing instructions (patient-centered components), as well as a 2D barcode that specifies: drug name, dose, route, frequency, and prescribing provider (scan-able, barcode-to-EMR, integration component). These labels will be a supplement to the label affixed to the medication containers and will be provided to “dummy” subjects in our study at time of medication dispensing. Labels will be affixed to wallet reminder cards for patients to share with primary care and specialty care providers, emergency department staff, and updated at the end of each visit or inpatient admission. In addition, medication lists provided to patients at end of service (as part of an “after visit summary”) could be enhanced by including barcodes, which patients could use as their “updated medication list” pending medication changes at the pharmacy. At this time we are in negotiations with Epic IT personnel to develop requisite hardware (scanners) and software necessary to scan the medication barcodes for integration into respective fields within the EMR medication list database (outpatient, ED, and/or inpatient systems). Presently Mike Zaroukian, MD, PhD, is our liaison with Epic.

Once the technology is integrated we will test the system using “dummy” data. We will shadow “dummy” patients with “dummy” prescriptions and “dummy” medical records through a “dummy” medical journey (e.g. follow patients from ED to inpatient hospitalization to outpatient setting, whereupon patients will receive an “updated medication list” at time of discharge, which would contain 2D barcodes). Any medication changes would be transmitted to the pharmacy and new labels would be generated in order to update existing “wallet reminder cards” (or electronic medication lists). Upon previewing the system using “dummy” patients, we will consider piloting the study using highly-selected patients within a “controlled” medical system. Specifically, we have identified collaborators within Sparrow outpatient practices who use Epic outpatient EMR and who see patients enrolled by Sparrow Physicians Health Network (SPHN), which incentivizes patients to use Sparrow Pharmacies to fill their prescriptions and to use Sparrow-affiliated hospital services for emergency and/or inpatient care. Finally, we will elicit feedback regarding implementation of the barcode-to-EMR system from patients, providers, pharmacy systems, and Epic IT personnel in order to guide future direction.

The proposed timeline for our project is dependent upon further discussions with Epic IT personnel, which will elicit the level of sophistication required for developing scanners and barcode-to-EMR integration software, as well as collaboration between Epic and SRS Pharmacy Systems (labeler). The full proposal will delineate the time necessary for creating barcodes, developing the scanners and integration software, and feasibility testing. SRS Pharmacy Systems estimate costs of \$5,000 to create a modified 2D barcode with prescription fill information for Sparrow Pharmacy and \$20,000 for creation of an interface system with Epic EMR. We anticipate costs of \$10,000 for developing scanners and \$25,000 for Epic software design and integration with SRS labels. We will also request \$10,800 to fund a graduate assistant (\$25/hr, 8hrs/week, 50 weeks). Total estimated budget = \$70,800.

We anticipate that information gleaned from this project will instruct further development of integrated medication therapy management systems. It is our goal to use preliminary data from the proposed study in order to apply for additional funding from national sources such as the National Patient Safety Foundation or the Small Business Technology Transfer program.