Medication Reconciliation: Solving the Problem to Improve Patient Outcomes

Peris Brodsky
Mitchell Carneol
Melody Dungee
Erin Laney
Shujen Yeh

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Introduction

Due to extraordinary pharmacologic advances, patients are prescribed a complex array of medications to prevent and treat medical conditions. Throughout the world, medication errors associated with incomplete information and inaccurate documentation have led to increased financial burden to health care systems, patient injury and even death.[1] The Institute of Medicine has estimated medication errors injure more than 1.5 million people every year and cost billions of dollars annually.[2] In 2005, the Joint Commission issued a national patient safety goal for medication reconciliation (MR) in response to medication errors in the United States.[3]

Background

Definition of Medication Reconciliation

Medication reconciliation is the process of creating an accurate and up-to-date medication list through comparing a patient's medication orders to what the patient has actually been taking. This process includes verifying a list of current medications and those to be prescribed, comparing those medications, making clinical decisions based on these lists, and communicating this information to the patient, caregivers, and providers.

The concept of the MR seems simple enough on paper, but executing the process can be daunting and labor intensive. To create this list, clinicians meet with the patient and/or surrogates to determine the dose, route and frequency of prescription medications, over-the-counter medications, vitamins, herbal supplements and recreational drugs. This reconciliation process should be performed at all transition points of care when medications are ordered or existing ones revised. Transition points of care include transfer from an emergency room to a medical floor and discharge from a hospital to an outpatient clinic.

The medication reconciliation process is done to avoid problems such as adverse drug interactions, dosing errors, duplication of orders, or omission of medications. It is critical that an accurate medication list be communicated to the next health care provider to prevent these medication errors and improve patient safety. This list should be provided to all patients at discharge from a hospital and should include a review of those prescribed prior to hospitalization.

Evidence of MR Efficacy

The Center for Medical Education & Research in Oregon reported data that showed the efficacy of using an electronic prescribing system to ensure accurate medication lists in a large multidisciplinary medical group. Since 2001, PeaceHealth Medical Group (PHMG), a multispecialty physician group, has been using an electronic prescribing system that includes medication-interaction warnings and allergy checks. In 2005, PeaceHealth established the ambulatory medication reconciliation project to develop a reliable, efficient process for maintaining accurate patient medication lists. PeaceHealth created a medication reconciliation task force. Implementation of the medication reconciliation process at the PHMG clinics resulted in a substantial increase in the number of accurate medication lists

and fewer discrepancies between what the patient was actually taking and what was recorded in the electronic medical record.[4]

In 2009, the Mayo Clinic reported findings from a prospective study about the medication reconciliation process. Electronic medical record medication documentation was analyzed in four academic, ambulatory internal medicine clinics. After this analysis, interventions were instituted to improve the MR process. These included training and performance feedback for the health care team and increasing patient awareness and participation in the MR process. These interventions proved successful. MR patient participation increased from 13.9% to 33% ($p<0.001$). Medication list correctness improved from 23.1% to 37.7% ($p = 0.087$) and completeness improved from 20.4% to 50.4% ($p<0.001$). Incomplete documentation of medication lists was due to lack of frequency (15.4%) and route (8.9%) for individual medications. Overall, accuracy of medication lists improved from 11.5% to 29% ($p=0.014$).[5]

A Case Study

The following is a case study illustrating critical barriers to successful and accurate medication reconciliation:

A 63 year-old female presented to the emergency department (ED) with complaints of nausea, vomiting and back pain. Past history included high blood pressure, seizures, herniated discs, and bipolar disorder. In her purse, she carried a non-updated medication list that included medications ordered by her PCP (primary care provider) and psychiatrist (1). This copy had fifteen different medications and did not include over-the-counter drugs or vitamin supplements. (2) This copy was not asked for or reviewed by the ED physician (3). A CT scan revealed a 9mm kidney stone. She was prescribed an oral narcotic by the ED physician, which turned out to be a duplicate prescription for her chronic back pain (4). She was discharged from the ED to follow-up with a urologist without an updated med list (5). The following evening however, she presented to another ED due to recurrence of pain, nausea and vomiting which prevented her from taking the anti-seizure medication. While in the ED, she suffered a seizure. The ED physician did not have access to an accurate medication list (6) and treated the patient with a medication known to have a severe drug-drug interaction with one of her home medications (7). She became hypotensive and was transferred to the ICU for stabilization (8). On admission the nurse completed the medication list by handwriting the medications on the paper form(9). The admitting physician misread the nurse's poor hand writing on the paper form (10) and ordered an incorrect medication that ended up causing an allergic reaction (11). The medication list was finally reconciled after several hours of nursing and physician collaboration with the patient's daughter as well as verification by calling various pharmacies. (12) Successful stone removal was performed after the ICU delay and the patient was discharged to home. She was given an updated paper medication list. Unfortunately, the hospital was unable to get a hold of the PCP and made no effort to send the list to the patient's psychiatrist. Furthermore, the nurses were too busy to teach patient about what medications to continue (13).

With an accurate medication reconciliation process, this situation could have been resolved with much less patient injury and financial cost to the health care system.

Errors in this case include:

1. The patient carried an outdated medication list.
2. Several medications for various problems make the list complicated.

3. The physician did not review the medication list even if it was outdated.
4. Duplicate prescriptions were ordered by different providers.
5. The patient was discharged from the encounter without an updated medication list.
6. The physician had no access to an accurate medication list due to the patient's altered level of consciousness.
7. An unknown drug interaction was not prevented due to the lack of an accurate medication list.
8. An adverse drug reaction occurred because the wrong drug was ordered.
9. The use of a redundant paper medication administration system.
10. Illegible handwriting led to the wrong medication being ordered.
11. Lack of electronic charting and decision support systems lead to an adverse medication reaction.
12. MR is an extremely time-consuming process.
13. Lack of communication and education occurs at discharge from the hospital.

Problem Statement: Barriers to MR

The barriers represented in this case study reflect the difficulties of achieving accurate MR. Unfortunately, health care organization administrations have traditionally been slow to adopt electronic medication records, decision support systems, computer physician order entry, and interoperability standards that allow the creation of an electronic medication list that can be communicated across all transition points of care. As more and more organizations implement an EMR, the challenge of blending the paper and electronic systems is yet to be resolved. Information in these two disparate systems remains inconsistent. Despite all of Intermountain Healthcare's recognized advances in integrated electronic medical record systems, they still use a redundant paper medication reconcilation process. (See Appendix A) Many institutions do not use standardized forms across their organization, which exacerbates the problem.

Interoperability between information systems to exchange health care data is vital because many patients see multiple providers and specialists. A patient also has the flexibility and convenience of having their medication prescriptions filled at many different local and mail order pharmacies. Many insurance companies are advocating the use of mail order pharmacies to decrease the expense of a prescription. Patients often seek medications from foreign pharmacies because they are less expensive and do not require a legal prescription.

While these pharmacy services are meant to be a convenience to the patient, it has proven to be a huge challenge for caregivers and providers in creating an up-to-date medication list. Medication that should have been discontinued by a provider may have been overlooked. A patient may have stopped taking a medication and neglected to inform the provider of this change. Ensuring that patients will adhere to medication orders is often one of the many challenges for MR. It is difficult to enforce patient compliance. Even though a patient’s medication’s list has been updated to reflect a new medication order or change, this does not mean that the patient will actually take the medication as prescribed. Educating the patient on the importance of taking their medications as prescribed improves patient safety.

Due to all of these barriers, healthcare providers often do not have an accurate list of patient medications and therefore, are vulnerable to make error prone clinical decisions at the time of a patient encounter such as outpatient visits, ED visits and hospital admissions.

Solution Statement

MIMeds

Current technologies have focused on the barriers within the hospital medication reconciliation processes. Few have provided ways that allow or encourage outpatient participation in the MR process. We propose the following solution to the medication reconciliation problem, which we've dubbed ***MIMeds***. It is a HIPAA compliant Internet application. MIMeds allows healthcare providers easy access to a patient's medication list at the point-of-care and actively engages patients through a rewards incentive program. MIMEDS will be accessible on hand held devices, such as the iPhone, Blackberry, or any Windows mobile device as well as a web browser. It is designed to allow disparate EMR systems to communicate up-to-date information through standard interfaces.

Goals

The functional scope of the MIMeds solution covers three goals:

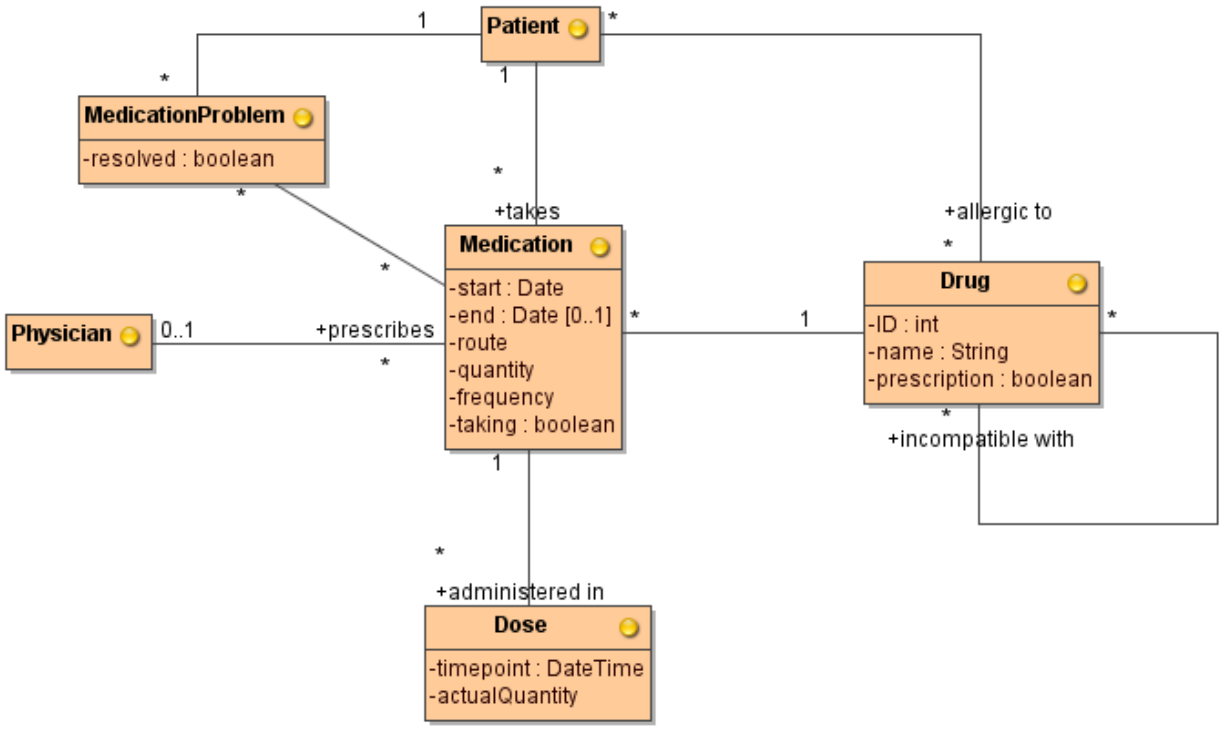
1. Retrospectively determine what medications the patient is actually taking.
2. Decide whether a patient's current list of medications, if continued, could cause a medical problem.
3. Prospectively assure that what the patient actually takes or is given adheres to the current medication list.

The establishment of a single, authoritative version of a patient's current medication list, across the continuum of care, is the centerpiece of this or any solution. Achieving this singular list is not possible with a paper-based record-keeping process, since a single patient's medication list must shadowed across multiple provider paper record repositories. The same is true of multiple, standalone clinical information systems that store medications. Our solution intends to replace these duplicative record-keeping methods with a single digital repository of patient medication information.

Logical System View

Before starting to construct a solution, we must perform an analysis of the problem domain. This analysis process yields a **conceptual model** of the domain. A conceptual model identifies the essential entities (concepts) that are involved, and of their interrelationships. The concepts are necessarily abstracted from reality, but provide a common frame of reference, and a domain vocabulary, for all the solution stakeholders.

Conceptual models can be expressed using the graphical notation of Unified Modeling Language (www.uml.org) of the Object Management Group (www.omg.org). For the MR domain, we developed the following conceptual model, using a single UML Class Diagram:

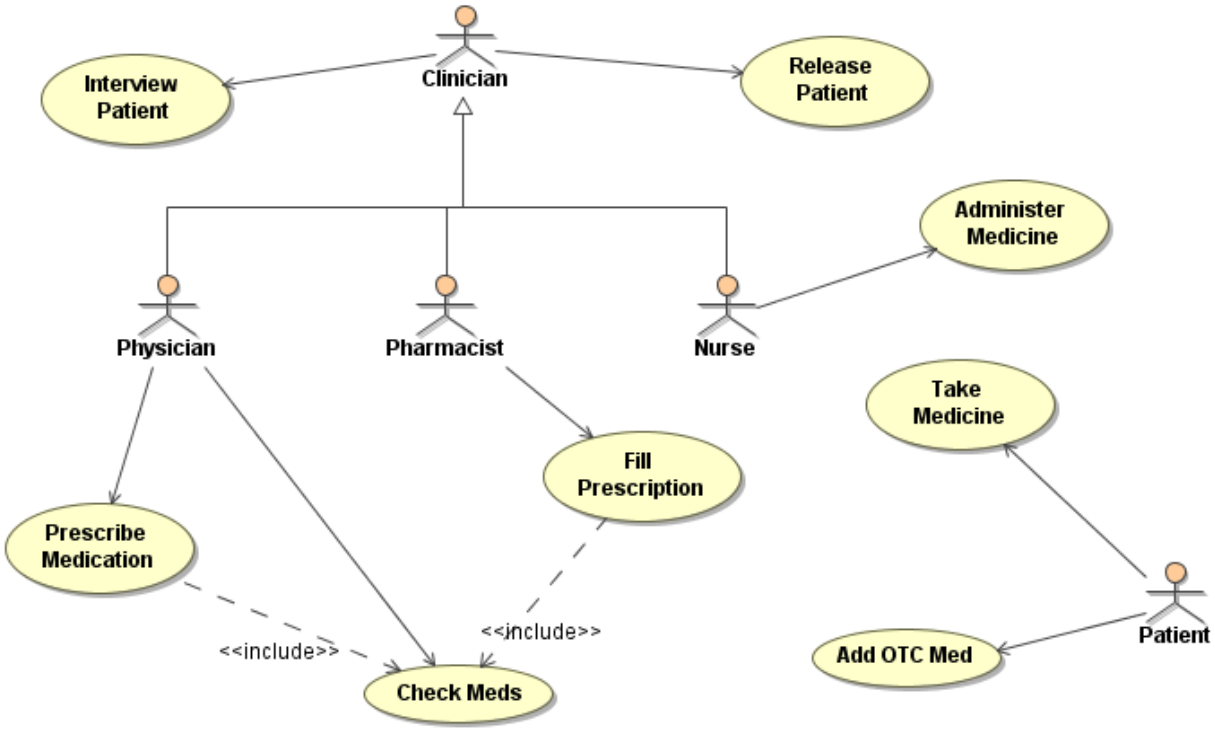


Next we begin to devise the problem solution by analyzing the user goals for the system. The solution can be viewed logically as system running within the boundary of its execution environment. This boundary and the interactions across it are represented by a **use case model**. Use case modeling is an established software analysis and design activity that is supported by the UML.

A **use case** describes a single, individually constructable portion of the system that defines the interaction between the itself and its environment. The environment consists of one or more **actors**—usually human users, but often other systems and devices. The use case model is a complete set of use cases, actors, and their relationships, for the entire system. This model helps to define the system **boundary**—the line between what it does and what it does not.

A use case describes *what* the system does, not *how* it does it, and so should be understandable to all system stakeholders. Use cases are like system requirements, except that they include an element of interaction *design*. This design can give a potential user a vision of how the system will behave, and how the user will work with it, before paying the expense of building it.

Our analysis of the MR problem yields the following solution use case model, in the form of a single UML Use Case Diagram:



The use case model elements are described as follows:

Actors

- **Clinician**: a provider that communicates with patients.
- **Physician**: an MD, DO, PA or NP.
- **Pharmacist**: a clinical or retail pharmacist.
- **Nurse**: a nurse.
- **Patient**: an object of medical care.

Use Cases

- **Interview Patient**: reconcile a patient's stated medication list with the recorded list to determine what the patient is currently taking.
- **Prescribe Medication**: order a modification to a patient's medication regimen.
- **Administer Medicine**: give a dose of medication to an inpatient.
- **Check Meds**: record a problem with a current or planned medication list for a patient.
- **Release Patient**: hand off the home medication list to a patient.
- **Fill Prescription**: fulfill a medication order for a patient.
- **Add OTC Med**: record the addition of an OTC medication to one's regimen.
- **Take Medicine**: take a dose from one's list of medications.

For an example of a detailed rendering of a use case, please see the **Interview Patient** treatment in Appendix B.

A Patient Scenario

This solution may imply significant changes to existing clinical medication reconciliation processes. This is typical of many software system implementations, particularly when a

manual process is automated. For our MR solution, the new process can be illustrated by the following single patient scenario:

1. The patient visits clinic C_1, which is *not* using MIMeds, and is prescribed medication M_1 by physician P_1.
2. To fill the prescription for M_1, the patient visits retail pharmacy F_1, which is on MIMeds:
    1. The use case **Fill Prescription** runs, and M_1 is added to the patient's medication list, with a status of *Taking*.
    2. The system creates a MIMeds user account for the patient.
    3. The system generates credentials for accessing the medication list from home using the account.
    4. The system includes the generated credentials in the prescription information sheet, along with instructions for accessing MIMeds, and the pharmacist points this out to the patient.
    5. The patient also purchases and begins taking over-the-counter medication M_2.
3. The patient is admitted to inpatient facility H, which is using MIMeds:
    1. The **Interview Patient** use case runs:
        1. The M_1 on the list is verified.
        2. After questioning the patient, M_2 is added to the list, with status *Taking*.
    2. The **Prescribe Medication** use case runs with physician P_1:
        1. The physician orders M_3 for the patient, which is added it to the medication list.
        2. The physician also adds an order for M_4.
        3. The **Check Meds** use case runs, and the system
            1. Detects a problem regarding M_4 and M_2 for the patient,
            2. notifies the physician,
            3. records a potential problem, and
            4. adds M_4 to the list.
        4. The physician resolves the problem by removing M_4 and substituting M_5.
4. The patient is discharged from H:
    1. The **Release Patient** use case runs:
        1. Since the patient already as a MIMeds user account, the system does nothing.
        2. The user verifies that the patient knows how to access MIMeds from home.
5. The patient, now at home, runs the **Take Medicine** use case, which displays the list M_1, M_2, M_3 and M_5.
6. The patient visits retail pharmacy F_2, purchases and begins taking over-the-counter medication M_6.
7. The patient runs the **Add OTC Med** use case, and adds M_6 to the medication list with a status of *Confirmed*.
8. The patient visits clinic C_2, which is using MIMeds:
    1. The patient is identified, and the **Interview Patient** use case runs:
        1. The system displays the list M_1, M_2, M_3, M_5 and M_6.
        2. After questioning, the patient is admits to have stopped taking M_6, and M_6 is removed from the medication list.
    2. The patient is identified, and the **Prescribe Medication** use case runs with physician P_3:
        1. The physician sees the current medication list: M_1, M_2, M_4 and M_5.
        2. (and on it goes)...

Physical System View

For the physical realization of the MIMeds design, we propose a service-oriented implementation architecture[6]. Through a set of open services, the bulk of the logic and data management of MR is encapsulated and exposed through published interfaces. For the clinician-facing use cases, these service allow existing clinical information systems to seamlessly integrate MR with existing system workflows. Alternatively, standalone client access applets are provided. For the patient-facing use cases, the standalone client is the sole access method.

The service implementation, where possible, delegates to other standard services developed by the Healthcare Services Specification Project[7], in particular, the Entity Identification Service, to identify patients and providers, and the Decision Support Service, to detect medication interactions and other problems. Another implementation goals is to work with the HSSP and HL7 organizations to create a service standard for medical reconciliation.

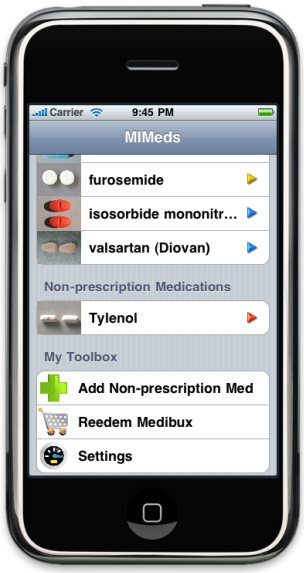
To achieve its primary goal, the MIMeds service deployment should be as singular as the medication lists it provides. There is no inherent technical reason, given the proposed design and implementation, that a single instance of the system could not be implemented at a national level. But to support an incremental adoption path, we propose a rollup implementation architecture. This would allow the service to be implemented multiple times, at any level of geographic granularity. At any point in time thereafter, when the respective administrative authorities have reached agreement, any two instances of the service can be coalesced (rolled up), without change to any client, and without any service interruption.

A Prototype for Patients

To further illustrate MIMeds, we have developed a prototype implementation of the **Take Medicine** and **Add OTC Med** use cases, for the iPhone OS.

MIMeds can be downloaded for free from the iTunes App Store.

The main screen displays the patient's current medication list.



The patient can manage his use of non-prescription medications, and redeem Medibux credits.

In the medication detail screen can take the medication, if it is time, get help, and refill a prescription.

MIMeds advises the patient of when medication doses are due, and allows the patient to create a Medication Administration Record, by tapping the Take button.

See Appendix C for a mockup of a web interface home page for the same use cases.

Business Model

Provider Funding

The MIMeds system will need to gather information and correctly identify the patient from multiple information sources (hospitals, pharmacies, ambulatory care, etc). It will be built similar to and in collaboration with a regional health information organization (RHIO)[8] that includes hospitals, governmental agencies, health plans and payers organizations, and healthcare professional associations.[9] Through this RHIO, MIMeds will ensure interoperability, collaboration, and public access.

Private entities such as pharmaceutical companies, retail pharmacies, insurance companies, and health care providers will be incentivized to provide funding for the operation, maintenance and improvement of MIMeds. Pharmaceutical companies may utilize the

application as a channel for targeted marketing, patient education, and physician education. Clinical research recruitment is often costly and difficult. MIMeds will be a vehicle for facilitating recruitment to clinical research studies through links in the application or web browser to screening tools for these studies. MIMeds will also fulfill pharmaceutical company post market regulatory requirements by actively tracking adverse events. These companies can effectively demonstrate due diligence by offering a report channel for patients and physicians to report adverse events through the MIMeds application.

Retail pharmacies may offer rewards to encourage patient utilization of the system. One reward includes giving discounts redeemable at local pharmacies when the patient updates the medication list to include over-the-counter drugs or supplements. In the future, the application may interact with the pharmacy prescription in-take system and allow patients to fill the prescriptions online at the pharmacy of their choice. The accuracy and value of the medication list could be further improved through including not only the prescribed medication list, but also an actual filled and utilized prescription list.

Hospitals may retrieve information from the system for medication reconciliation at admission and use the system to fulfill the requirement of providing the medication list at discharge and to the next provider. Both will save them the cost of resources needed to perform MR. One study has demonstrated that a patient-centered reconciliation model reduced nurse time by 50% without loss in data accuracy.[10] Another estimated cost for MR is $50-75 per admission. Electronic MR systems such as MIMeds is estimated to reduce MR costs by more than 25%.[11] Therefore, hospitals have the incentive to sign up and share the cost of the system.

Healthcare insurers will pay into the system due to the benefit of decreased cost from the reduction of medication reconciliation errors, as well as better outcomes from patient compliance.

Patient Engagement

In an American Medical Association self study of medication reconciliation, physicians are taught to recognize that it is the most patient-centric component of medication management and that the patient is the one constant in the continuum of care. It recognizes that medication reconciliation will not be successful without patient (and family or caregiver) engagement and that the medication list is a means to enhance communication as a source of information to assist patients in self-managing their medication regimen.[12]

In order to encourage patient engagement, MIMeds offers a rewards program. Rewards programs are ubiquitous throughout the world and are often used to build customer loyalty and engagement. In the United States these programs use a discount card, club cards or rewards cards. Several major supermarket chains and at least one major pharmacy require the cards in order for customers to receive the advertised loyalty price. The practice is also common among book and music retailers, from large chains to independent retailers. Almost all of the major hotel chains have similar cards that allow guests to earn either points redeemable for discounts, future stays or other prizes or airline miles. All major US Airlines also offer rewards credit cards.[13]

Rewards programs to facilitate patient engagement in MR are another story. Med-Marketers from Marblehead Maine that has created rewards by "Engaging patients with monthly, seasonal, and ongoing contests offering great rewards as a way to create buzz for your practice….to engage your patients and keep their treatment plans fun and exciting".[14]

Another company that has created a rewards program to incentivize patient engagement is MedEncentive, an Oklahoma City-based company. "We hope to triangulate the interests of patients, the purchaser/payer and physicians. Everything revolves around these three key stakeholders." Patients are asked to read evidence-based content and answer a series of questions, testing their understanding and adherence. They score points toward a reward or rebate of their out-of-pocket medical expenses. The patient's score is forwarded to their health plan. Their responses are forwarded to their doctor to support subsequent care.[15]

The MIMeds rewards program revolves around the accrual of Medibux which can be converted into discounts for medications, insurance rate discounts or the purchase of iPhones. The initial methods to accrue Medibux include the creation of the list, regular (monthly or quarterly) updating of the list, and referring a friend. Medibux can then be redeemed at participating local pharmacies and other stores. MIMeds will also create rewards through Insurance company wellness programs that offer lower insurance rates or credits if the patient enrolls.

The rewards system is designed to minimize "cheating" such as earning Medibux through a bogus update of the list. It also incorporates an ethics board that addresses conflicts of interest issues that could arise from participating in the RHIO and offering rewards to patients.

Discussion

Regulatory Compliance

Protecting the medication list from unauthorized access is a critical security issue for the MIMeds application. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) requires that patient data be protected and secured.[16] The patient has rights regarding accessibility to that information, but HIPAA permits appropriate disclosure for patient care. The design and implementation of MIMeds must comply to HIPAA regulations.

These are some of the ways in which MIMeds design and implementation might address HIPAA compliance:

- All service message data passing between providers and MIMeds over the public Internet will be encrypted.
- All messages over the Internet between MIMeds and the patient-facing functions will be likewise encrypted.
- EMR service clients must authenticate themselves to access MIMeds.
- To access patient functions, the patient must use credentials granted by a provider on behalf of MIMeds.

EMR Vendor Partnership

The goal of MIMeds integration with existing EMR systems is to maintain the singular list for a patient across all points of care. In order for this strategy to work, EMRs must defer to MIMeds for master storage of medication records. Decision support derived from those records can still be EMR-specific, though MIMeds will provide medication problem-detection as a standard service, since a problem ought to be visible across the care continuum.

There are major benefits for EHR vendors, particularly large vendors in the industry, to be active participants in the process of creating a solution to the MR problem. Once a provider documents that a patient has been prescribed a medication or is administered a medication in the office, this information immediately updates the patient's medication list within a practice. The next step in this process is to have this information shared with all providers involved in the care of this patient (specialists, hospital, pharmacies, etc.). This sharing is immediate and transparent with provider participation in MIMeds.

With MIMeds and its service-oriented implementation architecture, the historical, technical barriers to achieving this are minimized. The critical mass of systems needed to cover the continuum of care to the needed level is a non-technical problem, one that is in the vendors' mutual interest to solve.

Conclusion

A Cultural Shift

It is critical to create a culture of change to solve the problem of medication reconciliation. This change culture must involve health care providers at all levels and most importantly, the patient and caregiver. The MIMeds application allows for patients to become engaged in their health care by providing them a convenient and rewarding opportunity to create an accurate medication list.

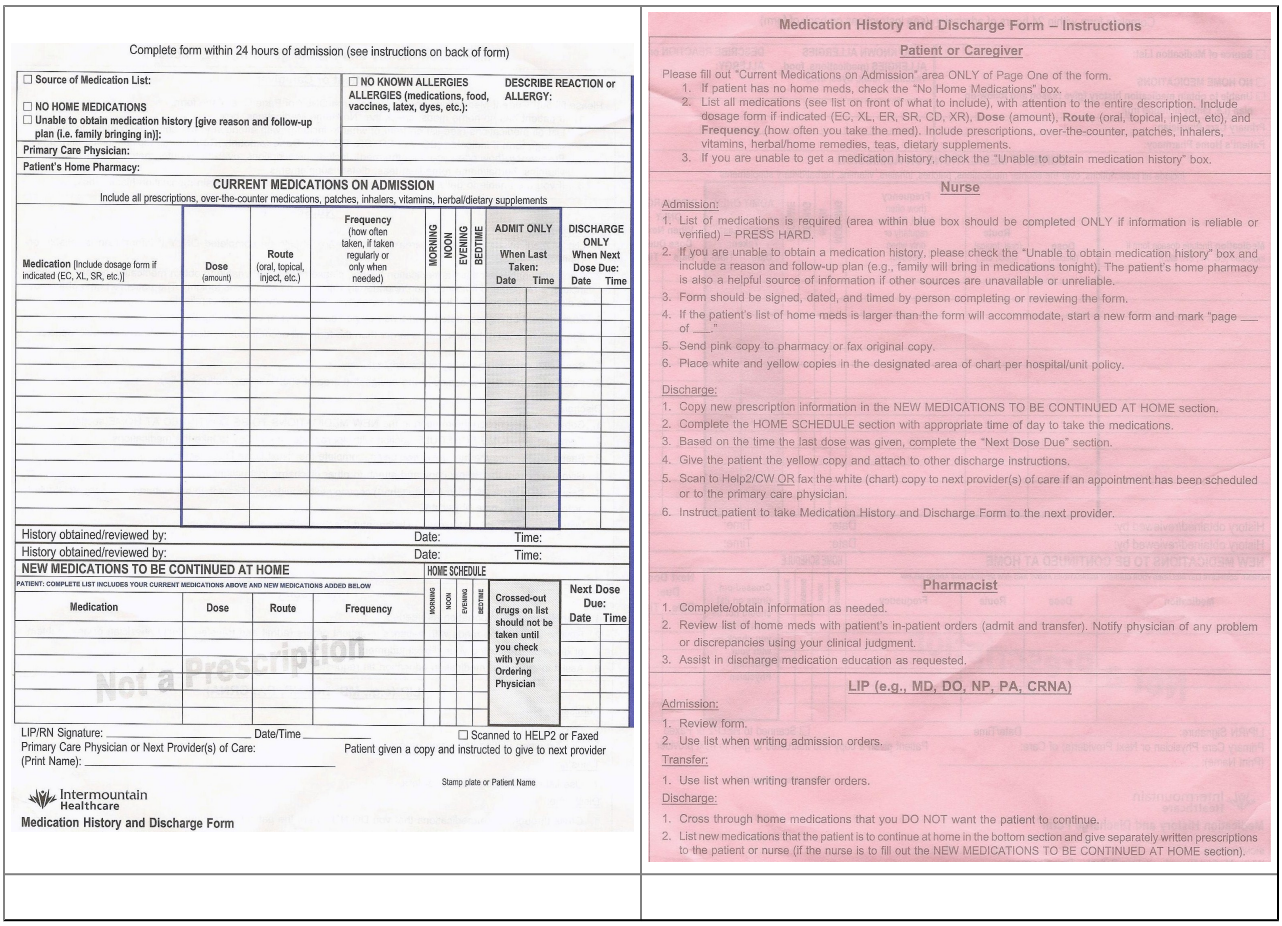
Due to the rising costs of health care, intense competition, and pressure for regulatory agencies, health care organizations cannot risk the affects of not engaging the patient in effective communication strategies. Negative communication with patients affects patient satisfaction, operational efficiency, malpractice risk, clinical outcomes, and physician loyalty.[17] Providers need to routinely ask patients for the medication lists, in order to provide the best care. Health care companies face serious challenges in facilitating effective communication with patients.

Successful medication reconciliation can improve patient outcomes. An Internet based system which allows easy provider access to a patient's accurate medication list will overcome the barrier of disparate paper and electronic systems and streamline the process. Active engagement of patients in this process will help to facilitate its success.

The Net Effect

Appendices

Appendix A



Complete form within 24 hours of admission (see instructions on back of form)

☐ Source of Medication List:

☐ NO HOME MEDICATIONS
☐ Unable to obtain medication history [give reason and follow-up plan (i.e. family bringing in)]:

Primary Care Physician:

Patient's Home Pharmacy:

☐ NO KNOWN ALLERGIES
ALLERGIES (medications, food, vaccines, latex, dyes, etc.):

DESCRIBE REACTION or ALLERGY:

CURRENT MEDICATIONS ON ADMISSION

Include all prescriptions, over-the-counter medications, patches, inhalers, vitamins, herbal/dietary supplements

Medication [Include dosage form if indicated (EC, XL, SR, etc.)]	Dose (amount)	Route (oral, topical, inject, etc.)	Frequency (how often taken, if taken regularly or only when needed)	MORNING	NOON	EVENING	BEDTIME	ADMIT ONLY When Last Taken: Date	Time	DISCHARGE ONLY When Next Dose Due: Date	Time

History obtained/reviewed by: Date: Time:

History obtained/reviewed by: Date: Time:

NEW MEDICATIONS TO BE CONTINUED AT HOME

PATIENT: COMPLETE LIST INCLUDES YOUR CURRENT MEDICATIONS ABOVE AND NEW MEDICATIONS ADDED BELOW

HOME SCHEDULE

Medication	Dose	Route	Frequency	MORNING	NOON	EVENING	BEDTIME	Crossed-out drugs on list should not be taken until you check with your Ordering Physician	Next Dose Due: Date	Time

Not a Prescription

LIP/RN Signature: _____ Date/Time _____

☐ Scanned to HELP2 or Faxed

Primary Care Physician or Next Provider(s) of Care:

Patient given a copy and instructed to give to next provider

(Print Name): _____

Stamp plate or Patient Name

Intermountain Healthcare

Medication History and Discharge Form

Medication History and Discharge Form – Instructions

Patient or Caregiver

Please fill out "Current Medications on Admission" area ONLY of Page One of the form.

1. If patient has no home meds, check the "No Home Medications" box.
2. List all medications (see list on front of what to include), with attention to the entire description. Include dosage form if indicated (EC, XL, ER, SR, CD, XR), **Dose** (amount), **Route** (oral, topical, inject, etc), and **Frequency** (how often you take the med). Include prescriptions, over-the-counter, patches, inhalers, vitamins, herbal/home remedies, teas, dietary supplements.
3. If you are unable to get a medication history, check the "Unable to obtain medication history" box.

Nurse

Admission:

1. List of medications is required (area within blue box should be completed ONLY if information is reliable or verified) – PRESS HARD.
2. If you are unable to obtain a medication history, please check the "Unable to obtain medication history" box and include a reason and follow-up plan (e.g., family will bring in medications tonight). The patient's home pharmacy is also a helpful source of information if other sources are unavailable or unreliable.
3. Form should be signed, dated, and timed by person completing or reviewing the form.
4. If the patient's list of home meds is larger than the form will accommodate, start a new form and mark "page ___ of ___"
5. Send pink copy to pharmacy or fax original copy.
6. Place white and yellow copies in the designated area of chart per hospital/unit policy.

Discharge:

1. Copy new prescription information in the NEW MEDICATIONS TO BE CONTINUED AT HOME section.
2. Complete the HOME SCHEDULE section with appropriate time of day to take the medications.
3. Based on the time the last dose was given, complete the "Next Dose Due" section.
4. Give the patient the yellow copy and attach to other discharge instructions.
5. Scan to Help2/CW OR fax the white (chart) copy to next provider(s) of care if an appointment has been scheduled or to the primary care physician.
6. Instruct patient to take Medication History and Discharge Form to the next provider.

Pharmacist

1. Complete/obtain information as needed.
2. Review list of home meds with patient's in-patient orders (admit and transfer). Notify physician of any problem or discrepancies using your clinical judgment.
3. Assist in discharge medication education as requested.

LIP (e.g., MD, DO, NP, PA, CRNA)

Admission:

1. Review form.
2. Use list when writing admission orders.

Transfer:

1. Use list when writing transfer orders.

Discharge:

1. Cross through home medications that you DO NOT want the patient to continue.
2. List new medications that the patient is to continue at home in the bottom section and give separately written prescriptions to the patient or nurse (if the nurse is to fill out the NEW MEDICATIONS TO BE CONTINUED AT HOME section).

Appendix B

Interview Patient

Summary

This case performs a clinician-managed reconciliation of a current medication list using information provided by the patient, or a proxy of the patient.

Preconditions

A patient has been identified.

Postconditions

A record of an interview is created containing interview events, and the patient medication list is modified.

Main Flow

The system logs an interview record, and links it to the patient.

For each current active medication on the list for the patient, the system displays the following, sorted by drug class and name:

- drug class
- name
- activation date
- deactivation date, if inactive
- prescribing physician, if a prescribed medication
- notes by prescribing physician, if any
- pharmacy, date and quantity of most recent prescription fill, if a prescribed medication
- date of last reconciliation, if any
- status (COMPLIANT, NONCOMPLIANT or UNKNOWN)
- date and time of last dose taken, if any
- nurse that administered last dose, unless self-administered

The system also displays the inactive history of patient medications.

For every active medication, the subflow *Verify Active Medication* begins.

For every inactive medication discontinued within the last year, the subflow *Verify Recent Medication* begins.

The subflow *Elicit Other Medications* begins.

Subflows

Verify Active Medication

The system displays the medication, and verifies with the user that the medication is truly active for the patient [**E1**]. The user agrees, and the system updates the date of last reconciliation for the medication to the current date.

Verify Recent Medication

The system displays the medication, and verifies with the user that the medication is no longer taken by the patient [**E2**]. The user agrees, and the subflow ends.

Verify Recent Medication

[et cetera]

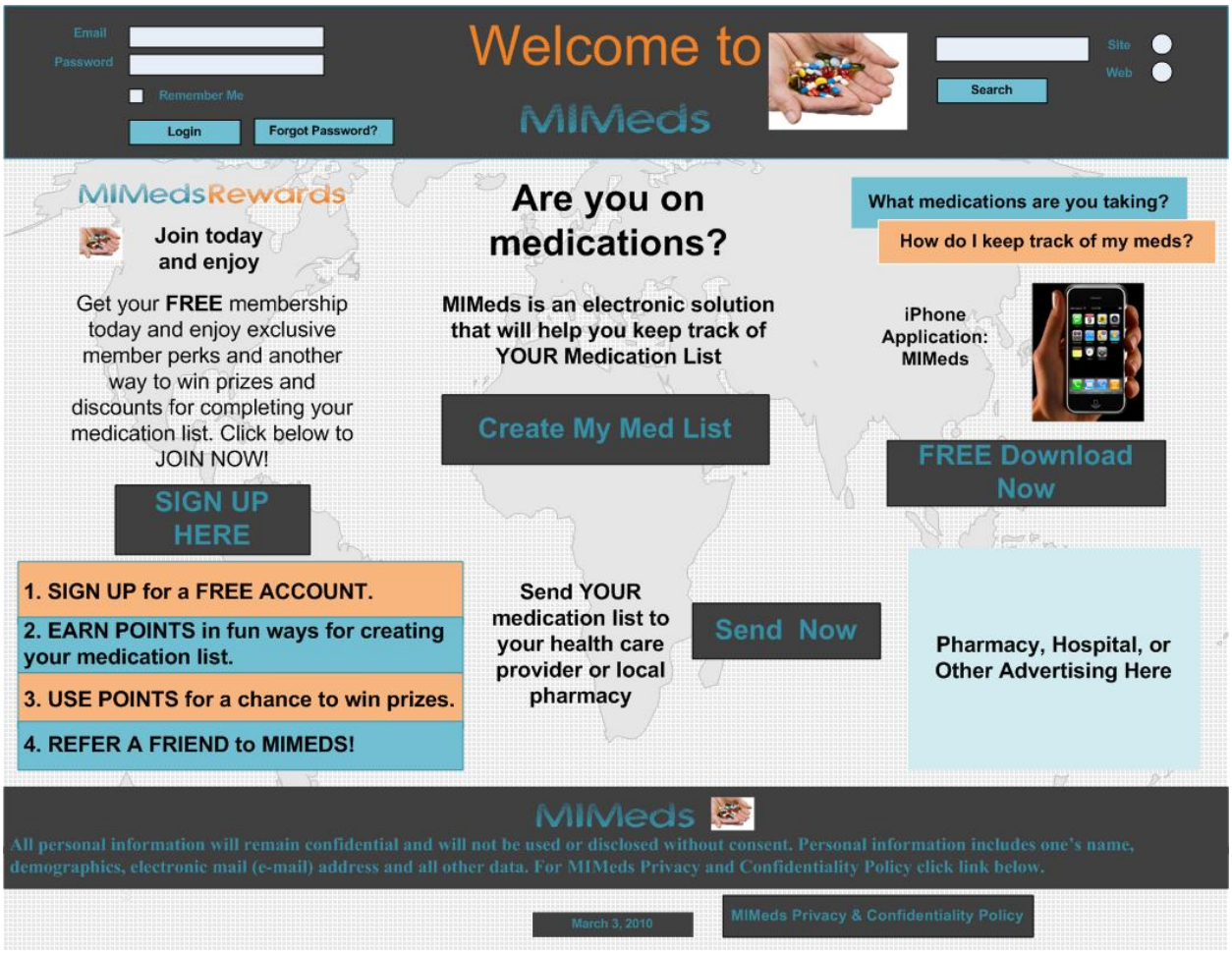
Exceptional Flows

E1: The patient has stopped taking the medication. The system prompts for a reason for stopping, and the user enters it; the system updates the medication record status to NONCOMPLIANT, records the reason, and the subflow ends.

E2: The patient has started taking the medication again. The system prompts for a reason for starting, and the user enters it; the system updates the medication record status to NONCOMPLIANT, records the reason, and the subflow

ends.

Appendix C



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