

A Human Factors Approach to Electronic Medication Reconciliation



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Background

Implementation of effective medication reconciliation processes has proven difficult due to incomplete admission medication information, lack of standardized processes, and paper-based systems which limit the ability to access, manage, and compare medication information. Some electronic health records (EHRs) provide electronic medication reconciliation functionality, but often suffer from poor design and lack of integration with the inpatient computerized physician order entry (CPOE)

BIDMC is a 631 bed academic medical center with a mature, homegrown EHR and CPOE system built using the Cache programming language with a web based interface for clinical use. We sought to design an electronic medication reconciliation (eMR) application using our existing EHR/CPOE architecture.

Methods

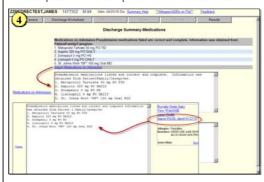
To facilitate the design and programming of the eMR application, we assembled a multidisciplinary team of doctors, nurses, pharmacists, and programmers. The design principles were that the application allow the user to import, assemble, reconcile, order, and document the PAML using a single, intuitive interface.

Description of Innovation

- On admission, the eMR application assembles the patient's medications from electronic sources (ambulatory EHR, prior discharge medication list), and by manual entry, to create an electronic preadmission medication list (PAML).
- The user then records planned actions (continue, discontinue, continue at different dose/frequency/route), and documents the accuracy of the PAML.
- The user can then edit and bring preadmission medications into the active inpatient CPOE system without manually re-entering the order.



4. The completed PAML can be imported into all clinical documentation.



5. At the time of discharge, the PAML and the existing active CPOE orders are assembled in a matrix sorted by medication. This allows for direct comparison of each medication without referring to an external data source (e.g. admission note, other applications).

Pre Admit Medication	Active POE Orders	Step	Discharge Medications	Cancel
C Aspire 325 mg PO DALY	C Agen 325 mg PONG DALY	п		
C Dorepazil 5 mg PO HS	C Dinepeci 5 mg PONG HS	г		
Liempil 5 mg PO DALY	C. Lisnopii 10 mg PONG DALY	0		
Metoproiol Tatrate (8 mg PO TID	↑ Metoprotol Tatrate 37.5 mg PO/NG BID	E		
T St. Johns Wort 16" 150 mg Oral BID		п		
	Active POE Orders	Ship		Cancel
	☐ Citaligram Hydrobromide 20 mg PO/NG DALY	п		
	☐ Lendovacie 500 mg PO/NG Q26H	п		
		-		

6. The user builds a discharge medication list by choosing from the PAML or the active POE medications, editing and adding medication as needed.



7. As each medication is reconciled, the computer identifies any that are new or discontinued, as well as any changes in the dose, route, or frequency of medications that are being continued. Each decision is automatically recorded, and the provider can edit and add additional text to these computer generated descriptions as needed. Because every medication must be reconciled, the system assures that there are no errors of omission or commission, and that every decision is clear to the patient and the next provider

Medication	Discharge Medication Other Orders	Соввен	Action Print Qu
\smile	Chalge as Hoboleswick 27 ag PO DALLY	Disaster antonia di Annonia	86
	Levelineau Nilling PO QUIII	Distriction and annual Disposement	20
CHANGED			
imaged fing PO DALLY	Leanged 10 mg PO DALLY	Day you being the well-man a love builders builders a flower states	Ref.
Boopeak Tarter N og PO TED	Minspoold Turner 17 5 og PO 800	They make being the moderation or family that they have a change in door and frequency	ANI MI
LAME			1000
legate 127 ag PO DALLY	Agen 125 mg PO DAE V	Discrete being the medianter at home and you should comment at the case that and the general	260
Avergend 7 aug PO HR	Dramprol 1 sag PO 165	The tree taking the medication of times and you should present at all the same does not be group.	100
DOPPED -			
in John Wort "NE" 150 mg Ond 2021		The medication last from respect land and retrieved with a term and devices publicational	
Portheter Stee			

8. On discharge, the patient receives a reconciled medication list; the list is stored electronically in the EHR, and sent via a Health Information Exchange to the next provider.

BETH ISRAEL DEACONESS MEDICAL CENTER DISCHARGE MEDICATION INSTRUCTIONS ZZMEDRECTEST, JAMES Use of 1477332 Allergies: Solfs						
Doctor: John Smith, 617-667-47/ Nurse: Mary Jones, 617-632-23		DAY	Terrent	BEDTIME	COMMENTS	
NEW MEDICATIONS	MORNING	DAT	EVENING	BEDTIME	COMMENTS	
CELEXA (citalopram) 20 mg by mouth daily	Ф				This is a new medication for your depression.	
LEVOQUIN (levofloxacin) 500 mg by mouth daily	0				This is a new medication for pneumonia. Take for four more days and then stop.	
CHANGED MEDICATIONS						
LISINOPRIL (lisinopril) 10 mg by mouth daily			0		You were taking the medication at home, but we have increased the dose to 10 mg.	
LOPRESSOR (metoprolol) 37.5 mg by mouth twice daily	Ф		0		You were taking the medication at home, but we have decreased the dose to 37.5, and decreased the frequency to twice daily.	
UNCHANGED MEDICATIONS			(1)		No. of the state o	
ASPIRIN (Aspirin) 325 mg by mouth daily	Ф				You were taking this medication at home and you should continue it at the same dose and frequency.	
STOP MEDICATIONS			- 3			
St. Johns Wort 150 mg by mouth twice daily					This medication has been stopped and replaced with Celexa (citalogram).	

Conclusions

The implementation of eMR is a complex process which often fails due to poor design. We have developed an easy to use eMR application which seamlessly integrates into existing workflow, and provides robust discharge reconciliation functionality which merges disparate data sources.