

Medication Management in Long Term Care: the RxSafe Project

Paul Gorman, MD

Oregon Health & Science University

funded by AHRQ THQIT and AQS awards

Medications in long term care – some observations

Discharge Medication List

- ambien 5mg. take 1 tablet by mouth as needed for trouble sleeping
- calcium antacid 500mg tab chew (rp: tums) 2 tabs by mouth as needed
- ranitidine 150mg tablet (rp: zantac) 1 tab by mouth at bedtime
- atenolol 50mg tablet (rp: tenormin) 1 tab by mouth every morning
- vitamin e 400iu capsule 1 cap by mouth three times daily
- amaryl 2mg tablet 1 tab by mouth every day
- senna s tablet (rp: senokot-s) 1 tab by mouth every morning
- lovastatin 20mg tablet (rp: mevacor) 1 tab by mouth at bedtime
- singulair 10mg tablet 1 tab by mouth every day
- acetaminophen 325mg tablet (rp: tylenol) 2 tabs (650mg) by mouth every 4 hours as needed for temp > 100 not to exceed 3000mg/24hr
- metformin 1000mg tablet (rp: glucophage) 1tab by mouth twice daily
- effexor xr 75mg capsule 1 cap by mouth every morning
- metoclopramide hcl 5mg tablet (rp: reglan) 1 tab by mouth four times daily
- zyprexa 2.5mg tablet 1 tab by mouth every evening
- diltiazem er-24 180mg capsule 1 cap by mouth every morning
- milk of magnesia 400mg/5ml oral susp 30ml by mouth every day as needed
- hydrocod/acetamin 5mg/500mg tablet (rp: vicodin) 1 tab by mouth every 6 hours as needed to help control pain may cause drowsiness or dizziness
- nitroquick (25's) 0.4mg tab subl (rp: nitrostat) 1 tab sublingually every 5min. for 3 doses if as needed for chest pain if not relieved after 3 doses call 911
- ...

Medications in long term care – some observations

1. They take a lot of medications

Ms. Jones is here to see you

Lets review her meds

- Is she on digoxin?
- Any sedating meds?
- Any duplicates?
- Does she have DM?
- Is she on the right package for systolic Heart Failure?

acetaminophen (aka **TYLENOL**) tablet 325-650 mg, 325-650 mg
albuterol (aka **PROVENTIL**, **VENTOLIN**) 90 mcg/Actuation inhaler
amylase-lipase-protease (aka **ULTRASE MT20**) 65,000-20,000 units
SNACK

azithromycin (aka **ZITHROMAX**) tablet 500 mg, 500 mg, Oral

bisacodyl (aka **DULCOLAX**) suppository 10 mg, 10 mg, Rectal

calcium-vitamin D (aka **OS-CAL 500 + D**) 500 mg(1,250mg) -

ceftAZIDime (aka **FORTAZ**) IV 2 g, 2 g, Intravenous, Q8H

codeine-guaifenesin (aka **ROBITUSSIN-AC**) 10-100 mg/5 mL

dextrose injection 25 mL, 25 mL, Intravenous, PRN

dextrose injection 25 mL, 25 mL, Intravenous, PRN

diphenhydrAMINE (aka **BENADRYL**) capsule 25 mg, 25 mg, Oral

docusate sodium (aka **COLACE**) capsule 100 mg, 100 mg, Oral

dornase alpha (aka **PULMOZYME**) nebulizer solution 2.5 mg,

fat emulsion IV infusion, , Intravenous, TPN-2100

ferrous sulfate tablet 325 mg, 325 mg, Oral, BID

fluticasone-salmeterol (aka **ADVAIR**) 500-50 mcg/Dose inha

glucagon (aka **GLUCAGEN**) injection 1 mg, 1 mg, Intramuscul

glucagon (aka **GLUCAGEN**) injection 1 mg, 1 mg, Intramuscul

glucose chewable tablet 15 g, 15 g, Oral, Q15MIN PRN

glucose chewable tablet 15 g, 15 g, Oral, Q15MIN PRN

heparin lock flush IV 50 Units, 50 Units, Intravenous, PRN

insulin aspart (aka **NOVOLOG**) injection, , Subcutaneous, TID

insulin regular (aka **HUMULIN R,NOVOLIN R**) injection, , Sub

lactulose (aka **ENULAC**) liquid 30 mL, 30 mL, Oral, ONCE

lidocaine (aka **LMX 4**) 4 % cream, , Topical, PRN

magnesium hydroxide (aka **MILK OF MAGNESIA**) suspensio

montelukast (aka **SINGULAIR**) tablet 10 mg, 10 mg, Oral, DA

morphine injection 4-6 mg, 4-6 mg, Intravenous, Q4H PRN

multivitamin-minerals-folic acid-coenzyme Q10 (aka **AQUADET**)

NaCl 0.9 % IV, , Intravenous, CONTINUOUS

norgestimate-ethinyl estradiol (aka **ORTHO TRI-CYCLEN**) .18

DAILY

ondansetron (aka **ZOFRAN**) injection 4 mg, 4 mg, Intravenous

oxycodone (immediate release) (aka **ROXICODONE**) tablet 5-

polyethylene glycol (aka **MIRALAX**) powder 17 g, 17 g, Oral,

promethazine (aka **PHENERGAN**) injection 12.5 mg, 12.5 mg,

senna-docusate (aka **SENOKOT S**) 8.6-50 mg 1 Tab, 1 Tab,

sertraline (aka **ZOLOFT**) tablet 100 mg, 100 mg, Oral, DAILY

simethicone chew (aka **MYLICON**) tablet 40 mg, 40 mg, Oral, (

sodium chloride 7 % inhalation 3 mL, 3 mL, Inhalation, BID

Medications in long term care – some observations

1. They take a lot of medications
2. Managing meds can be a real chore
 - medication lists can make it harder

Next patient Low blood sugar

- 69 year old woman
 - bright, functional
 - severe memory loss
 - moved to foster care
- Diabetes
 - complex insulin Rx
- HTN
 - betablocker
- BG 29 last night
- What are her meds?
- What are they supposed to be?

CL 6200b
Lincoln City Rehabilitation Center
For the month of: June 2005

Medication Administration Record

RECORD NURSES NOTES ON BACK

Description	Time Codes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
ASPIRIN EC 81MG 1 TAB QOD AT 06:00 DX: Start Date: 5/25/2004	INT TIME																																
LANOXIN 0.125MG 1 TAB QD DX: Start Date: 6/21/2005	1600 PULSE																																
LASIX 20MG QD ON SUN, MON, TUE, SAT DX: Start Date: 12/23/2003																																	
LASIX 20MG 2 TAB Q FRIDAY DX: Start Date: 12/23/2003																																	
AMOXICILIN 125MG/5 5ML TID X 10 DX: Start Date: 6/17/2005																																	
COUMADIN 5MG 1 TAB MON, WED, FRI DX: Start Date: 6/20/2005																																	
COUMADIN 1/2 TAB TUES, THURS, SAT DX: Start Date: 6/20/2005																																	
MULTIVITAMINS 1 QD DX, DIETARY SUPPL Start Date: 3/25/2004																																	

Drug	Dose
PATIENTS MEDS (EXTEMP MED ACCESS)	1 EA MISC
*HOLD ORDER INFORMATION (HOLD ORDER)	1 INFO *INFO
ACETAMINOPHEN (TYLENOL)	650 MG TABLET
ALUM-MAG HYDROXIDE-SIMETH (MYLANTA)	30 ML SUSP
ASPIRIN	325 MG TABLET
ATORVASTATIN (LIPITOR)	80 MG TABLET
ATROPINE	.5MG - 1MG INJECT
BISACODYL (DULCOLAX)	10 MG SUPP
CLOPIDOGREL BISULFATE (PLAVIX)	75 MG TABLET
ENOXAPARIN (LOVENOX)	60 MG INJECTION

MEDICATION LIST

START DATE	MEDICATION
06/20/05	COUMADIN 5MG take one tablet MWF take 1/2 tablet TTSS
06/17/05	AMOXICILLIN 125MG/5 5ML three time
12/23/03	LASIX 20mg 1 UD take 1 once each day except frid
06/23/05	PRILOSEC 20mg 1 once each day
06/21/05	LANOXIN 0.125MG 1 Tab once each da
05/25/04	ASPIRIN EC 81MG 1 TAB QOD
03/25/04	MULTIVITAMINS 1 once each day

Medications in long term care – some observations

1. They take a lot of medications
2. Managing meds can be a real chore
 - medication lists can make it harder
3. Many people contribute to the care
 - everybody keeps their own list

Change Processes Out of Sync

Clinic	Pharmacy	Cardiologist
<p>Lisinopril 10 mg daily Coumadin 5 mg daily Atenolol 25 mg daily Alprazolam 1 mg prn Oxybutinin 5 mg at night Aspirin 1 a day</p>	<p>Lisinopril 10 mg daily Coumadin 2.5 mg daily Atenolol 25 mg twice a day Oxybutinin 5 mg at night Augmentin 250 mg tid Temazepam 15 mg hs</p>	<p>Lisinopril 20 mg daily Coumadin 2.5 mg daily Atenolol 25 mg daily Oxybutinin 5 mg at night Augmentin 250 mg tid Aspirin 100 mg daily</p>

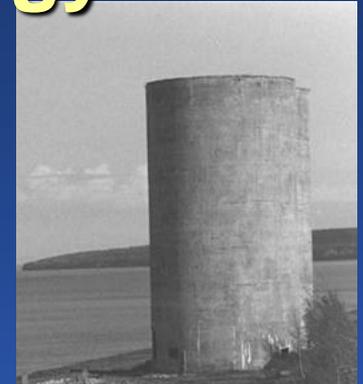
Medications in long term care – some observations

1. They take a lot of medications
2. Managing meds can be a real chore
 - medication lists can make it harder
3. Many people contribute to their meds
 - everybody keeps their own list
4. Medication lists never seem to match
 - Everyone has some information, but no one has all the information

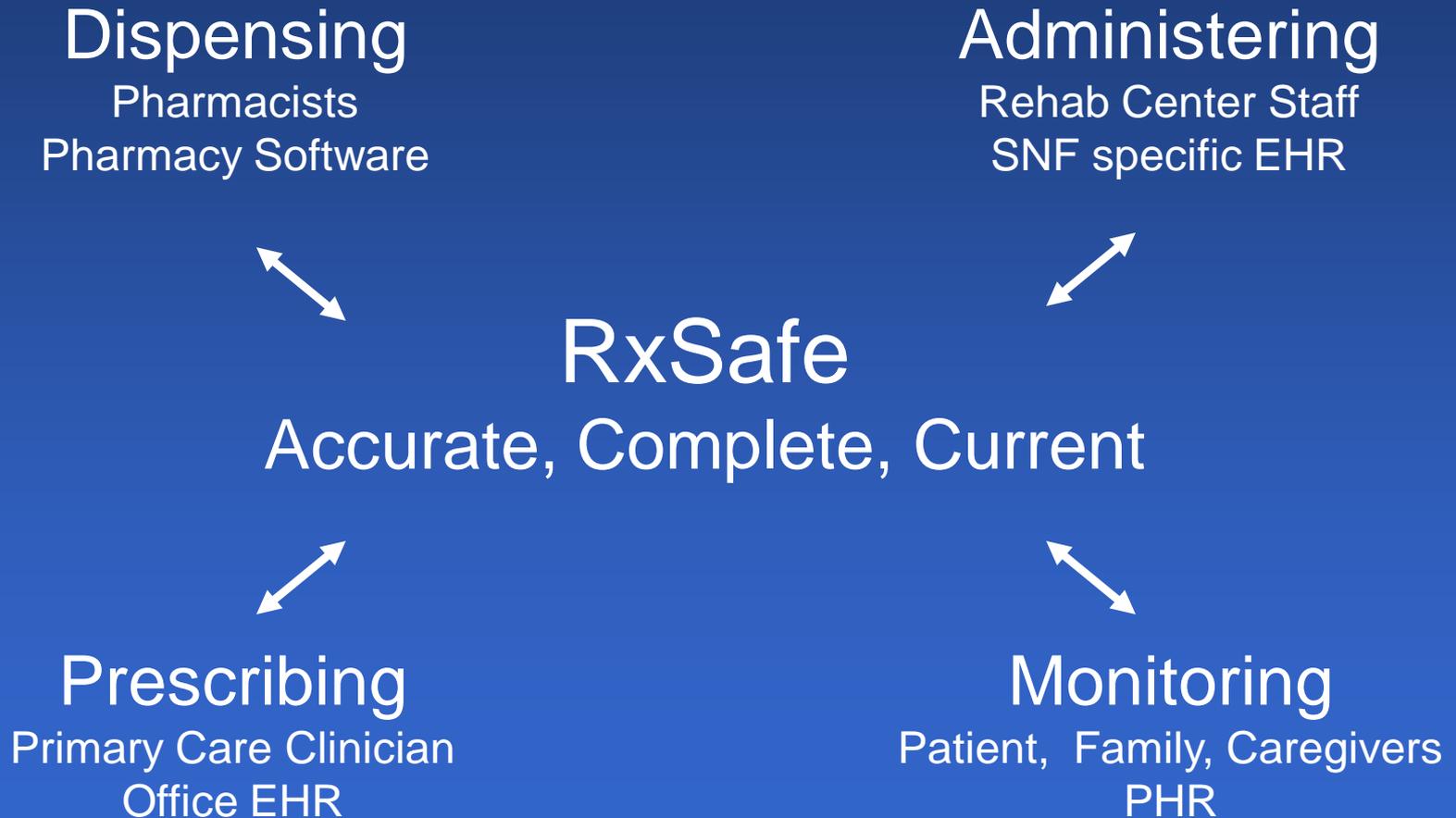
Technical Problem

Everyone has different technology

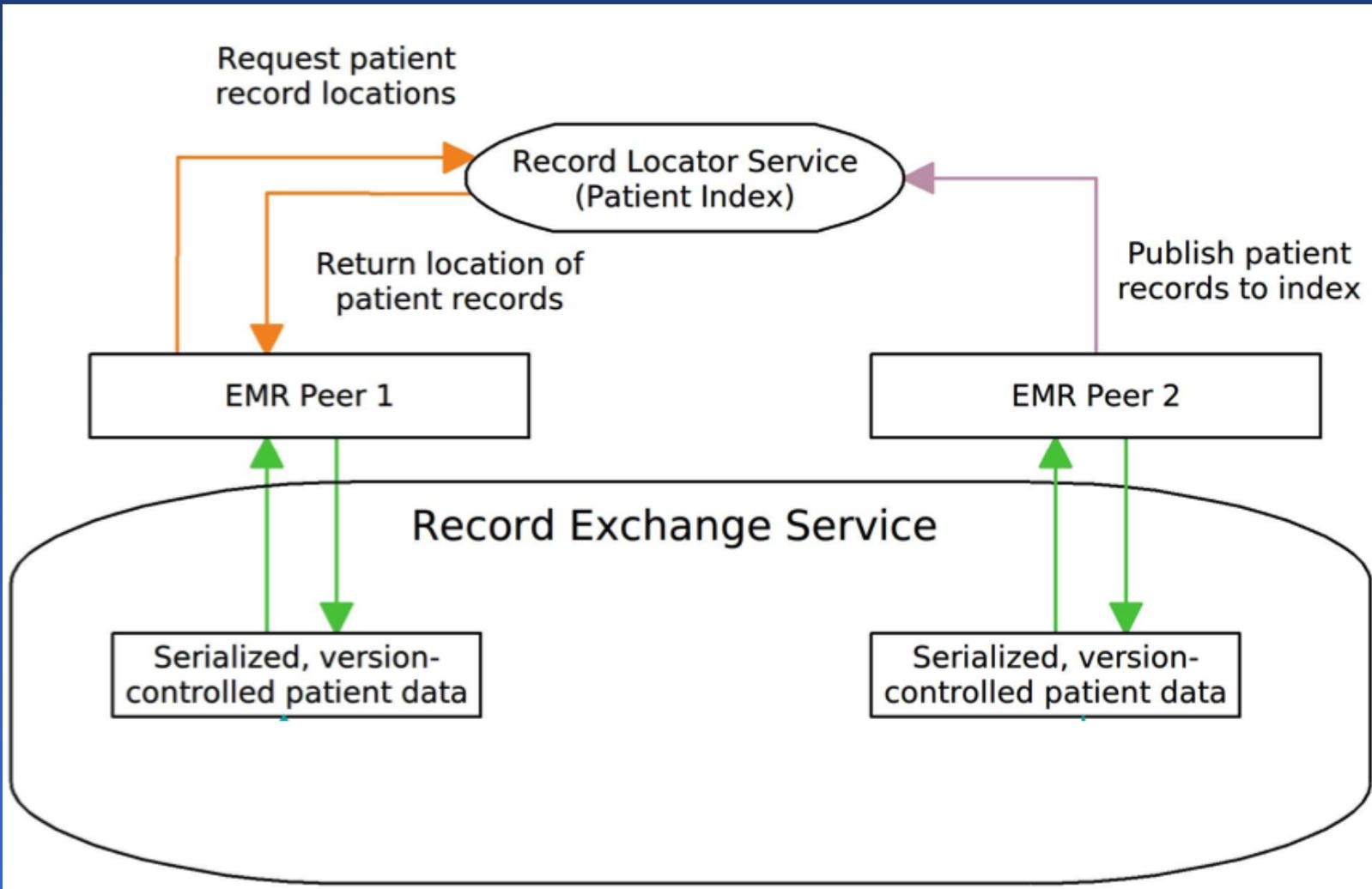
- Different types of institutions
 - Hospitals, Clinics
 - Pharmacies
 - Rehab & Assisted Living
 - Home Health
- Different tasks
 - prescribing
 - dispensing
 - administering
 - monitoring
- Lost opportunity to benefit from technology (CDS)



Goal: Everyone On the Same Page



Connecting for Health Common Framework for HIE



RxSafe: a 'window' into multiple EHRs
 Allows comparison, task integration
 No interaction – can't change underlying data

RxSafe

Compare Medication Lists by Facility

Patient Demographics

Med Verification Report

Site Med List

Med Comparison

Patient Name: MARVIN A MARTIAN Patient D.O.B: 10/15/1917 Patient Gender: M

Sort Start Date

Sort Drug Class

Sort Alpha

Group Drug Class

Lincoln City Medical

Recs: **9 Records**

Name & Dose
[DULCOLAX SUPPOSITORIES](#)

[COMBIVENT](#)

[ATENOLOL 25MG](#)

[DIGOXIN 0.125MG](#)

[SENEKOT](#)

[ACIPHEX 20 MG](#)

[FOSAMAX 70MG](#)

[LEVOXYL 100MCG](#)

Lincoln City Rehab

Recs: **23 Records**

Name & Dose
[2 CAL MED PASS SUPPL 120CC](#)

[CRANBERRY TABS](#)

[DELCOLAX SUPPOS](#)

[FESO4 5 GR](#)

[FLEETS ENEMA](#)

[MOM 30CC](#)

[OYSTER SHELL CALCIUM 500MG](#)

[ROXINAL 20MG/ML](#)

Bi-Rite Pharmacy

Recs: **5 Records**

Name & Dose
[PHENOBARBITAL 60MG TABLET](#)

[SENNA 8.6MG TABLET](#)

[GUIATUSS 100MG 5ML SYRUP](#)

[NORCO 5/325MG](#)

[LEVOTHYROXINE 0.025MG TABLET](#)

Senior Pharmacy

Recs: **25 Records**

Name & Dose
[BISAC-EVAC SUPP 10MG](#)

[CALCIUM ANTACID 500MG TAB](#)

[CALCIUM ANTACID ASSTD 500MG TABLET](#)

[CITALOPRAM 20MG TABLET](#)

[CRANBERRY 425MG CAPSULE](#)

[DEPAKOTE SPRINKLE 125MG CAPSULE](#)

[DEPOKOTE SPRINKLE 125MG CAPSULE](#)

[DOCUSATE SODIUM 100MG CAPSULE](#)

RxSafe Observations & Issues

- Users liked RxSafe
 - spontaneous spread beyond ED
 - task integration, critical mass of data
- Medication lists are a mess
 - content ('mom to give meds'), format
- Reconciliation is hard
 - would help to sort, highlight duplicates, highlight by indication
- Effort is wasted
 - dyssynchronous processes, non-interoperable systems

RxSafe Same Page View

Better, but still not helpful enough

Need to be computable to help more

- Lists as text
 - need parsing
- Align meds
 - need to identify
- Sort meds
 - need class info
- Side effects, etc
 - needs enhancement

RxSafe

Compare Medication Lists by Facility

Patient Name: MARVIN A MARTIAN Patient D.O.B: 10/15/1917 Patient Gender: M

Lincoln City Medical	Lincoln City Rehab	Bi-Rite Pharmacy	Senior Pharmacy
# Recs: 9 Records	# Recs: 23 Records	# Recs: 5 Records	# Recs: 25 Records
Name & Dose DULCOLAX SUPPOSITORIES	Name & Dose 2 CAL MED PASS SUPPL 120CC	Name & Dose PHENOBARBITAL 60MG TABLET	Name & Dose BISAC-EVAC SUPP 10MG
COMBIVENT	CRANBERRY TABS	SENNA 8.6MG TABLET	CALCIUM ANTACID 500MG TAB
ATENOLOL 25MG	DELCOLAX SUPPOS	GUAJUSS 100MG 5ML SYRUP	CALCIUM ANTACID ASSTD 500MG TABLET
DIGOXIN 0.125MG	FESO4 5 GR	NORCO 5/325MG	CITALOPRAM 20MG TABLET
SENEKOT	FLEETS ENEMA	LEVOTHYROXINE 0.025MG TABLET	CRANBERRY 425MG CAPSULE
ACIPHEX 20 MG	MOM 30CC		DEPAKOTE SPRINKLE 125MG CAPSULE
FOSAMAX 70MG	OYSTER SHELL CALCIUM 500MG		DEPOKOTE SPRINKLE 125MG CAPSULE
LEVOXYL 100MCG	ROXINAL 20MG/ML		DOCUSATE SODIUM 100MG CAPSULE

Done

Web Based CDS: Goals

- Harness publicly available sources
- Assist medication management tasks
 - parse, identify, classify
- Enhance with additional information
 - FDA SPLs, MEDLINE Plus, etc.
 - access to knowledge sources
 - process med list information

Service Oriented Architecture for Medication Management

Service-Oriented Architecture

A completely service-oriented model

Clinical Systems and Users

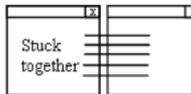


Services can be used and accessed through any device that hooks up to the web

Recurring ongoing cost

Platform as a Service

E.g. Integrating with Salesforce.com's CRM



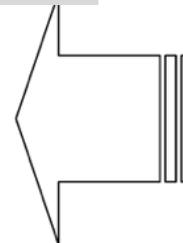
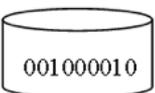
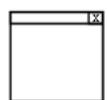
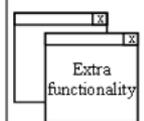
Composition

RxSafe Services

Medication Data, Knowledge

Maintained in cloud

001000010



Sample Output: combination

Medication Decision Support Pipeline [WSDL](#)

```

    graph LR
      A[Original Order] --> B[Fall-Through Parser]
      B --> C[RxNorm Concept Identifier]
      C --> D[NDF-RT Classifier]
  
```

Original Order

Order	
Original Script	bactrim 50 mg solution
Medication Name	
Medication Name CUI	
DrugComponents	
Route	
Form	
Frequency	
Positions	
UnrecognizedData	
Identified Drug	
Ingredients	
Identified SCDx	
Identified RxNormSCDx	
History	

Fall-Through Parser

Order	
Original Script	bactrim 50 mg solution
Medication Name	bactrim
Medication Name CUI	C0591139
DrugComponents	1: bactrim: 50: mg;
Route	
Form	SOLUTION
Frequency	
Positions	MedicationNameTokenPc0
UnrecognizedData	; ;
Identified Drug	
Ingredients	
Identified SCDx	
Identified RxNormSCDx	
History	

RxNorm Concept Identifier

Order	
Original Script	bactrim 50 mg solution
Medication Name	bactrim
Medication Name CUI	C0591139
DrugComponents	1: bactrim: 50: mg;
Route	
Form	SOLUTION
Frequency	
Positions	MedicationNameTokenPc0
UnrecognizedData	; ;
Identified Drug	Trimethoprim: 10829: C0041041;
Ingredients	Sulfamethoxazole: 1018 C0038689;
Identified SCDx	Sulfamethoxazole / Trimethoprim Injectable Solution: 377117: C1251329: SCDF
Identified RxNormSCDx	
History	0: 5/28/2010: Input processed: Medication name + dosage + dose form: Success: ID2: 1.0

NDF-RT Classifier

Order		Trimethoprim	Sulfamethoxazole
Actions			
Folic Acid Antagonists			
Effects			
Increased Cellular Death			
Treats			
AIDS-Related Opportunistic Infections			
Bronchitis			
Escherichia coli Infections			
Eye Infections, Bacterial			
Pneumonia, Pneumocystis			
Proteus Infections			
Staphylococcal Infections			
Toxoplasmosis			
Urinary Tract Infections			

Medication Order:

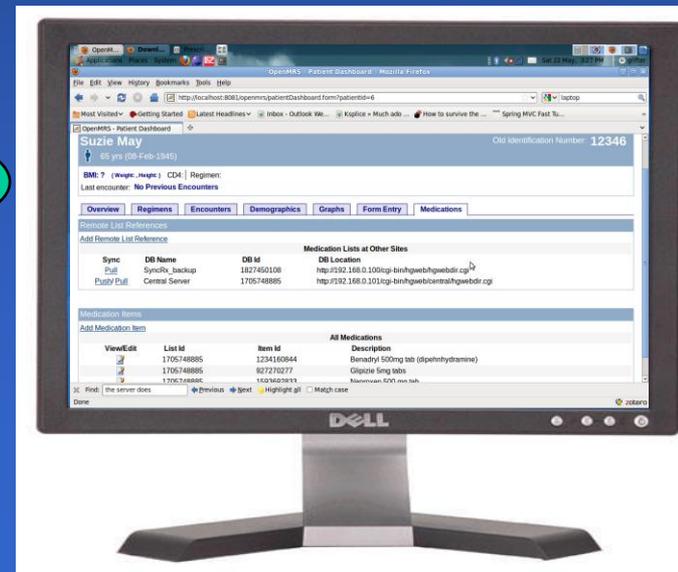
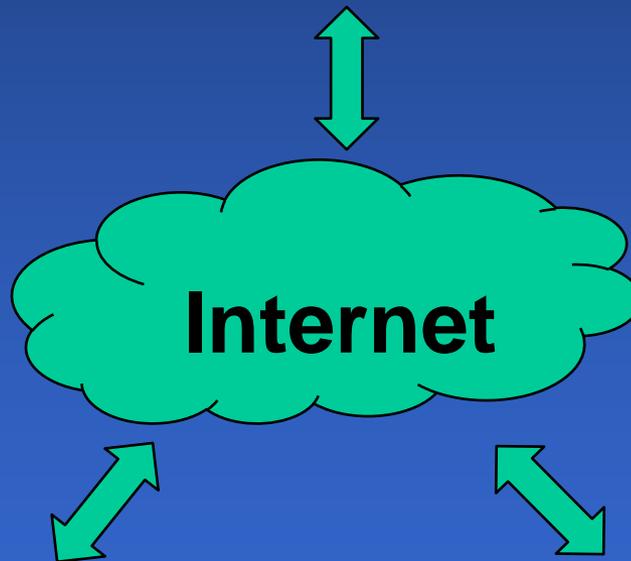
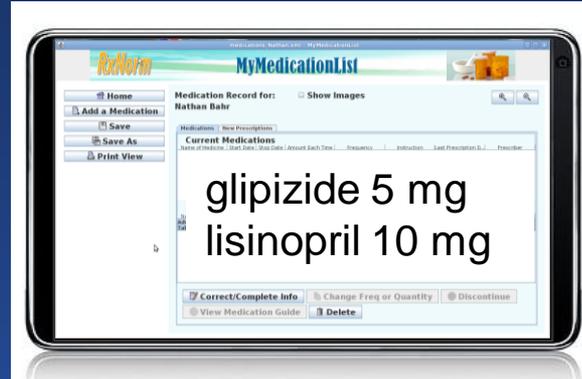
Service Name End point

- ... Fall-Through Parser http://localhost/Parsev1_2/RxSafeCDSPipelineComponentService.asmx +
- ... RxNorm Concept Identifier <http://localhost/ID2WebService1/RxSafeCDSPipelineComponentService.asmx> +
- ... NDF-RT Classifier <http://localhost:8080/RxSafeClassifier/services/RxSafeCDSPipelineComponentService.asmx> +

SyncRx Goal

- Support collaborative medication management by enabling interaction among systems and users so that medication lists are always in synchrony.

Vision



Questions

gormanp @ohsu.edu

Aim 2 Assisted Reconciliation

- Field Observations
 1. Residential Care Manager
 - monthly “recap” of meds, problems, issues
 2. Pharmacy Tech
 - “doing the yellows” monthly for nursing homes
 3. Visiting pharmacist
 - medication review diagnoses match problems
- Not “med rec” – not list processing
 - more inclusive medications management
 - more integrated – other resources needed
 - cognitive assist – indications, side effects, class

Assumptions

1. Multiple users: physicians, consultants, pharmacists, nurses, patient, caregiver
2. Multiple independent organizations or health systems
3. Multiple information systems designed for different tasks
 - a) e-prescribing system in doctor's office
 - b) dispensing software in retail pharmacy
 - c) medication record system(s) in hospital or nursing home
 - d) patient health record on internet or home PC
4. Asynchronous unpredictable processes for changing and checking medications

Requirements

1. Transfer data securely
2. Identify and track discrepancies between copies of data
 - What data was changed?
 - Who changed the data?
 - When was the data changed?
3. Enable resolution of discrepancies between different copies of the same item
 - human assisted
 - ? automated
4. Maintain audit trail, such that errors can be identified and reconciled.
5. Integrate with existing and future systems.
6. Graceful failure