Medication Management in Long Term Care: the RxSafe Project

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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 inhal
amylase-lipase-protease (aka ULTRASE MT20) 65,000-20,000 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
diphendramINE (aka BENADRYL) capsule 25 mg, 25 mg, Q8H
docusate sodium (aka COLACE) capsule 100 mg, 100 mg, Q8H
dornase alpha (aka PULMOZYME) nebulizer solution 2.5 mg, fat emulsion IV infusion, , Intravenous, TPN-2100
gerrous sulfate tablet 325 mg, 325 mg, Oral, BID
fluticasone-salmeterol (aka ADVAIR) 500-50 mcg/Dose inhal
glucagon (aka GLUCAGEN) injection 1 mg, 1 mg, Intramuscular
glucagon (aka GLUCAGEN) injection 1 mg, 1 mg, Intramuscular
glucose chewable tablet 15 g, 15 g, Oral, Q15MIN PRN
glucose chewable tablet 15 g, 15 g, Oral, Q15MIN PRN
ehparin lock flush IV 50 Units, 50 Units, Intravenous, PRN
insulin aspart (aka NOVOLOG) injection, , Subcutaneous, TID
insulin regular (aka HUMULIN R, NOVOLIN R) injection, , Subcutaneous, TID
lactulose (aka ENULAC) liquid 30 mL, 30 mL, Oral, ONCE
lidocaine (aka LMX 4) 4 % cream, , Topical, PRN
magnesium hydroxide (aka MILK OF MagnesIA) suspension
montelukast (aka SINGULAIR) tablet 10 mg, 10 mg, Oral, DAILY
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, DAILY
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?
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
<table>
<thead>
<tr>
<th>Clinic</th>
<th>Pharmacy</th>
<th>Cardiologist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lisinopril 10 mg daily</td>
<td>Lisinopril 10 mg daily</td>
<td>Lisinopril 20 mg daily</td>
</tr>
<tr>
<td>Coumadin 5 mg daily</td>
<td>Coumadin 2.5 mg daily</td>
<td>Coumadin 2.5 mg daily</td>
</tr>
<tr>
<td>Atenolol 25 mg daily</td>
<td>Atenolol 25 mg twice a day</td>
<td>Atenolol 25 mg daily</td>
</tr>
<tr>
<td>Alprazolam 1 mg prn</td>
<td>Oxybutinin 5 mg at night</td>
<td>Oxybutinin 5 mg at night</td>
</tr>
<tr>
<td>Oxybutinin 5 mg at night</td>
<td>Augmentin 250 mg tid</td>
<td>Augmentin 250 mg tid</td>
</tr>
<tr>
<td>Aspirin 1 a day</td>
<td>Temazepam 15 mg hs</td>
<td>Aspirin 100 mg daily</td>
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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

Dispensing
- Pharmacists
- Pharmacy Software

Administering
- Rehab Center Staff
- SNF specific EHR

Prescribing
- Primary Care Clinician
- Office EHR

Monitoring
- Patient, Family, Caregivers
- PHR

RxSafe
- Accurate, Complete, Current
Connecting for Health
Common Framework for HIE

Request patient record locations

Record Locator Service (Patient Index)

Return location of patient records

Publish patient records to index

EMR Peer 1

Record Exchange Service

EMR Peer 2

Serialized, version-controlled patient data
RxSafe: a ‘window’ into multiple EHRs
Allows comparison, task integration
No interaction – can’t change underlying data

RxSafe

Compare Medication Lists by Facility

<table>
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<tr>
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<tbody>
<tr>
<td>Lincoln City Medical</td>
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<tr>
<td>Lincoln City Rehab</td>
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<tr>
<td>Bi-Rite Pharmacy</td>
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<table>
<thead>
<tr>
<th>Name &amp; Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dulcolax Suppositories</td>
</tr>
<tr>
<td>Combivent</td>
</tr>
<tr>
<td>Atenolol 25mg</td>
</tr>
<tr>
<td>Digoxin 0.125mg</td>
</tr>
<tr>
<td>Senekeot</td>
</tr>
<tr>
<td>Aciphex 20 mg</td>
</tr>
<tr>
<td>PosaMax 70mg</td>
</tr>
<tr>
<td>Levoxyl 100mcg</td>
</tr>
<tr>
<td>Mom 30cc</td>
</tr>
<tr>
<td>Oyster Shell Calcium 500mg</td>
</tr>
<tr>
<td>Roxinal 20mg/ml</td>
</tr>
<tr>
<td>Phenobarbital 60mg Tablet</td>
</tr>
<tr>
<td>Senna 8.6mg Tablet</td>
</tr>
<tr>
<td>Guiauss 100mg 5ml Syrup</td>
</tr>
<tr>
<td>Norco 5/325mg</td>
</tr>
<tr>
<td>Levothyroxine 0.025mg Tablet</td>
</tr>
<tr>
<td>Bisac-Evac Supp 10mg</td>
</tr>
<tr>
<td>Calcium Antacid 500mg Tablet</td>
</tr>
<tr>
<td>Calcium Antacid Asstd 500mg Tablet</td>
</tr>
<tr>
<td>Citalopram 20mg Tablet</td>
</tr>
<tr>
<td>Cranberry 425mg Capsule</td>
</tr>
<tr>
<td>Depakote Sprinkle 125mg Capsule</td>
</tr>
<tr>
<td>Depokote Sprinkle 125mg Capsule</td>
</tr>
<tr>
<td>Docusate Sodium 100mg Capsule</td>
</tr>
</tbody>
</table>
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
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

Platform as a Service
E.g. Integrating with Salesforce.com's CRM

Composition

RxSafe Services

Medication Data, Knowledge

Recurring ongoing cost

Maintenance in cloud
Sample Output: combination
SyncRx Goal

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

Internet

glipizide 5 mg
lisinopril 10 mg
Model for a Record Synchronization Service

Request patient record locations

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Publish patient records to index

EMR Peer 1

EMR Peer 2

Record Exchange Service

Serialized, version-controlled patient data

Serialized, version-controlled patient data

Pull changes through the Version Control System
Questions

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Aim 1 Meaningful presentation

- Field observation:
  - users sort info
- Card sort result:
  - task dependent piles
- Recall experiment
  - order helps novices
  - experts reorganize list
- Conclusions
  - semantics matter
  - drug classes matter
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