Building EMR Decision Supports for Seniors’ Medication Management

June 7, 2016

Robert Hayward MD MPH FRCPC
Chief Medical Information Officer
Alberta Health Services
To reduce inappropriate medication use in older adults, clinicians at a health sciences center partner with a physician builder and application coordinator to design and implement embedded clinical decision-supports for point-of-care guidance in outpatient clinics.

Rapid iterative user acceptance testing was paired with participatory action research. CDS were dynamically linked to evidence in service of resident training and continuing professional development.
Objectives

1. Share how Clinical Decision Supports (CDSs) were used to promote evidence-based medication guidance.
2. Reinforce appreciation of dynamic user acceptance testing.
3. Demonstrate a simple strategy for separating clinical information system rule maintenance from guidance maintenance.
‘SMART’ Criteria Working Group

Robert Hayward, physician builder… on behalf of:

- Kannayiram Alagiakrishnan, geriatrician
- Darryl Rolfson, geriatrician
- Allen Ausford, family physician
- Rob Hayward, general internist
- Jacques Romney, endocrinologist
- Cheryl Sadowski, pharmacist
- Karla Vermeer, nurse practitioner
- Kunal Mohindra, application coordinator
- Mark Ballermann, analyst
- Patricia Wilson, assistant
Outline

Context

Medication Management Intervention
Rapid Iterative User Acceptance Testing
Dynamic Evidence Linking

Learnings
- Clinical
- Technical
- Process
Alberta Health Services

- Large integrated health region (entire population of Alberta)
- Edmonton zone academic health sciences center
“eCLINICIAN”: Epicare Ambulatory Care

– Rolling go-lives starting Spring 2011
– By 2016: general and subspecialty medicine, family medicine, pediatrics, mental health, public health, women’s health, rehabilitation

Optimization challenges

– Complex ambulatory care business model
– Inconsistent EMR use
User re-centered optimization plan:

1. Organization
2. Empowerment
3. Accountability
2. User empowerment

– User groups:
  Front-line leadership

– Training for action:
  Clinician builders

– Culture shift through achievement:
  EMR Innovation Projects
EMR Innovation Projects

Criteria

- Priority
- Commitment
- Doable
  - tangible quality improvement opportunity
  - EMR-attributable meaningful use
- Supportable
  - Small & measurable
  - Within means of clinician builder to shepherd
Geriatrics EMR Innovation

Priority

– Population
  • Polypharmacy (>5 meds) affects ~25% of elderly
  • Polypharmacy associated with ~25% adverse reactions

– Organization
  • Provincial seniors drug plan drives health expenses
  • Elderly polypharmacy reduction part of provincial strategic health plan
Geriatrics EMR Innovation

Commitment

- Seniors’ clinic priorities
  - Reduce inappropriate medication use in the elderly
  - Improve high-risk medication use in the elderly

- Multi-disciplinary buy-in
  - Goals shared by specialist and family MDs
  - Hot topic in medical training and CPD programs
Geriatrics EMR Innovation

Doable

– Evidence-based, endorsed, clinical practice guidelines
  • American Geriatrics Society Beers Criteria

– Decisions occur at the point-of-care
  • Med review a key part of seniors’ clinic service

– Medication reconciliation part of established QI cycles
  • Accreditation-sensitive
Supportable

- Manageable data dependencies
  - Needed drug documentation in place
  - Needed laboratory information usually in place
- Measurable decisions and actions
- EMR Clinician Builder role
  - Paired with IT team application coordinator
Outline

Context

Medication Management Intervention

Rapid Iterative User Acceptance Testing

Dynamic Evidence Linking

Learnings

– Clinical
– Technical
– Process
BestPractice Advisories (BPA)

Passive and active clinical guidance based on:

– Clinician characteristics
  • Specialty, role, setting
– Visit characteristics
  • Type, location
– Patient characteristics
  • Demographics, vitals, problems, diagnoses, test results
– Interventions
  • Medications, procedures, patient education, etc.
Medication BPAs

BPA triggered by chart review
BPA triggered by order entry
Managing BPAs
  – Suppressing a BPA
  – Acting upon a BPA
Learning from BPAs
  – Evidence and curriculum links
Reporting BPA-associated events
1910/10/2014 visit with Test Dr. D Hayward for Orders Only

**Clinical Workflow**

- **BestPractice Advisories**
  - **Triazolam warning**
    - Avoid use of benzodiazepines for insomnia, agitation or delirium. Older adults have increased sensitivity and slower metabolism of longer-acting benzodiazepines, with risk of cognitive impairment, delirium, falls, fractures, motor vehicle accidents. Use may be appropriate for seizure disorders, rapid eye movement sleep disorders, withdrawal syndromes, severe generalized anxiety disorder, perioperative anesthesia and end-of-life care.
  - **Anticholinergic warning**
    - Avoid use of drugs with strong anticholinergic properties in the elderly. See guidance link for a list of culpable medications.
  - **GFR Estimate**
    - The Cockroft-Gault method of estimating glomerular filtration rate (GFR) should be used when choosing and dosing medications in persons aged 65 and above.

**estimated creatinine clearance is 20.1 ml/min (by C-G formula based on Cr of 210).**
13/06/14 visit with Unclinician, Robert for SENIORS NEW PATIENT

Oxazepam

BestPractice Advisory - Smart, Beera Geri

Oxazepam warning
Avoid use of benzodiazepine for insomnia, agitation or delirium. Older adults have increased sensitivity and slower metabolism of longer acting benzodiazepines, with risk of cognitive impairment, delirium, falls, fractures, motor vehicle accidents. Use may be appropriate for seizure disorders, rapid eye movement sleep disorders, withdrawal syndromes, severe generalized anxiety disorder, perioperative anesthesia and end-of-life care.

Acknowledge reason:
- Safety established
- No alternatives
- Benefit outweighs risk
- Patient acknowledged risk
- Low risk

Order Entry
BPA Message Format

- Title/Type
- Alert summary
- Strength of recommendation

Key data
Manage
Actions

Guidance
Non-benzodiazepine Hypnotics

2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults - Evidence-Synthesis

Geriatrics Assessment Clinic - SMART Criteria Project
University of Alberta and Alberta Health Services

Drug Class
- Nonbenzodiazepine Hypnotics

Drugs
- Zolpidem, zaleplon, zopiclone

Recommendation
- Avoid chronic use (>90 days)

Rationale
- Benzodiazepine-receptor agonists that have adverse events similar to those of benzodiazepines in older adults (e.g., delirium, falls, fractures); minimal improvement in sleep latency and duration.

Strength of Evidence
- Moderate

Strength of Recommendation
- Strong

Comments
- [pending]

Patient Advisory

Guidance

Alert
Crystalline is used in this situation but no result appears in eCLINICIAN for over a year. Consider ordering the blood test.
Benzodiazepines

- Older adults have increased sensitivity to benzodiazepines and risk of cognitive impairment, delirium, falls, fractures, and medication errors.
- May be appropriate for seizure disorders, rapid eye movement sleep behavior disorder, anxiety disorder, peri-procedural anesthesia, end-of-life care.

Strength of Evidence

- High

Strength of Recommendation

- Strong

Comments

- [pending]

Patient Advisory

AVOID Certain Medications used for Anxiety and/or Insomnia

- Benzodiazepines, such as diazepam (Valium), alprazolam (Xanax), or chlordiazepoxide (Librium)
- Sleeping pills such as zaleplon (Sonata) and zolpidem (Ambien)

Resources

- Drugs and Drugs 2014
- AGS Beers Evidence Synopses
- AGS Beers Criteria Resources - 2012 Update
- AGS Beers Criteria - Patient Information Handout
- AGS Beers Criteria - Provider Pocket Card

References

- Allain 2005
- Cotroneo 2007
- Finkle 2011
- Paterini 2002

3.3 Benzodiazepines

Drug Class: anxiolytics, sedatives, and hypnotics

Drugs:

- Anti-seizure activity: olanzapine (Zyprexa), olanzapine (Zyprel), diazepam (Valium), lorazepam (Ativan)
- Anxiolytic activity: alprazolam (Xanax), lorazepam (Ativan), diazepam (Valium), lorazepam (Ativan)
- Hypnotic activity: zolpidem (Ambien) (long half-life with hangover effect) and eszopiclone (Lunesta) (long half-life with hangover effect) and eszopiclone (Lunesta)
- GABA benzodiazepines: zolpidem (Ambien), eszopiclone (Lunesta), zopiclone (Imovane)
- Others: oxazepam (Serax), chlordiazepoxide, flunitrazepam, midazolam (Hemimal)

Mechanism of Action & Indications

- Potentiate the effects of gamma-aminobutyric acid (GABA), the major inhibitory neurotransmitter in the CNS and other inhibitory transmitters by binding to specific benzodiazepine receptors. It is believed there are different types of benzodiazepine receptors in different areas of the CNS that produce the various pharmacological effects of the agents.
- May be used as anxiolytics, hypnotics, anticonvulsants, skeletal muscle relaxants, and surgical adjuvants. Also indicated for conscious sedation, induction and maintenance of anesthesia, and management of alcohol withdrawal.

Common Dosages & Prices

- Diazepam 0.25-50mg PO 1-2/12ID (0.25mg x 30 tabs = $3; 0.5mg x 30 tabs = $3)
- Diazepam 2.5mg PO Y 1ID (2.5mg x 30 tabs = $2; 5mg x 30 tabs = $3; 10mg x 30 doses = $20)
- Valium 0.5mg PO 1ID (0.5mg x 30 tabs = $12; 1mg x 30 tabs = $1)
- Lorazepam 0.5mg PO 1ID (0.5mg x 30 tabs = $1; 1mg x 30 tabs = $1)
- Midazolam 0.25-0.5mg IV at 3x dose the neurological side effect. Additional doses may be titrated over at least 2 minute increments to a maximum dose of 5mg (2mg x 1 dose = $1)
- Lorazepam 10mg PO 1ID (10mg x 30 tabs = $1; 20mg x 30 tabs = $2)

Adverse Effects & Contraindications

- Common side effects may include drowsiness, dizziness, ataxia, CNS depression, psychomotor impairment, confusion, cognitive impairment, aggression, increased risk of falls/fractures (especially in elderly) and antegrade amnesia.
3.3 Benzodiazepines

Benzodiazepines

Drug Class: Anticonvulsants, anxiolytics, sedatives and hypnotics

Uses:
- Anticonvulsant: ethosuximide, clonazepam, diazepam, oxazepam
- Anxiolytic: diazepam, oxazepam, lorazepam, alprazolam
- Sedative: clonazepam, diazepam, triazolam, temazepam
- Hypnotic: diazepam, triazolam, temazepam
- Others: bromazepam, chlorazepate, chlordiazepoxide, midazolam

Mechanism of Action & Indications
- Potentiates the effects of gamma-aminobutyric acid (GABA), the major inhibitory neurotransmitter in the CNS, and other inhibitory transmitters by binding to specific benzodiazepine receptor sites. It is believed there are different types of benzodiazepine receptors in different areas of the CNS that produce the various pharmacologic actions of the agents.
- May be used as anxiolytics, hypnotics, anticonvulsants, skeletal muscle relaxants, and surgical adjuvants such as preoperative analgesia/sedation. Also indicated for conscious sedation, induction and maintenance of anesthesia, and management of alcohol withdrawal.

Common Dosages & Prices

Clonazepam 0.25-0.5mg PO BID-TID (0.25mg x 30 tabs = $3; 0.5mg x 30 tabs = $5)
Diazepam 2.5mg PO/IV BID-QID (2mg x 30 tabs = $2; 5mg x 30 tabs = $3; 5mg x 60 tabs = $6; 10mg x 30 tabs = $10)
Lorazepam 0.5mg PO/IV for sedation (0.5mg x 30 tabs = $1; 1mg x 30 tabs = $2)
Midazolam 0.5mg IV q30min for sedation (1mg x 200 tabs = $1)
Midazolam 0.5mg IV q30min for sedation/analgesia (1mg x 200 tabs = $1)
Zaleplon 10mg PO TID-QID (10mg x 30 tabs = $3; 20mg x 30 tabs = $6)

Side Effects & Contraindications
- Common side effects include drowsiness, dizziness, ataxia, CNS depression, psychomotor impairment, confusion, cognitive impairment, aggression, increased risk of falls/fracture (especially in elderly) and anterograde amnesia.
Avoid use of long acting benzodiazepines for insomnia, agitation or delirium. Older adults have increased sensitivity and slower metabolism of longer acting benzodiazepines, with risk of cognitive impairment, delirium, falls, fractures, motor vehicle accidents. Use may be appropriate for seizure disorders, rapid eye movement sleep disorders, withdrawal syndromes, severe generalized anxiety disorder, peri-procedural anesthesia and end-of-life care.

<table>
<thead>
<tr>
<th>Date</th>
<th>User</th>
<th>Actions Taken</th>
<th>Triggers</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/10/14</td>
<td>Testdr, Dr Hayward [TURHAYWARD]</td>
<td>Acknowledge: No Alternatives [26] Lockout: 2200 hour(s) For: Current user, all encounters</td>
<td>General BPA section • CHLORAZEPoxide HCL [7100002030]</td>
<td>1A Guidance</td>
</tr>
<tr>
<td>20/10/14</td>
<td>Testdr, Dr Hayward [TURHAYWARD]</td>
<td>Acknowledge: No Alternatives [26] Lockout: 2200 hour(s) For: Current user, all encounters</td>
<td>General BPA section • FLURAZEPAM HCL [6020101010]</td>
<td>1A Guidance</td>
</tr>
<tr>
<td>20/10/14</td>
<td>Testdr, Dr Hayward [TURHAYWARD]</td>
<td>Acknowledge: No Alternatives [26] Lockout: 2200 hour(s) For: Current user, all encounters</td>
<td>General BPA section • ALPRAZOLAM [6020101010]</td>
<td>1A Guidance</td>
</tr>
</tbody>
</table>
# Reports – BPA Exposure

## Visits with Medication BPAs

<table>
<thead>
<tr>
<th>Week beginning</th>
<th>Family Practice Clinic</th>
<th>Geriatrics Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Encounters</td>
<td>Advisory</td>
</tr>
<tr>
<td>3-Nov-2014</td>
<td>67</td>
<td>0%</td>
</tr>
<tr>
<td>10-Nov-2014</td>
<td>415</td>
<td>0%</td>
</tr>
<tr>
<td>17-Nov-2014</td>
<td>506</td>
<td>13%</td>
</tr>
<tr>
<td>24-Nov-2014</td>
<td>487</td>
<td>19%</td>
</tr>
<tr>
<td>1-Dec-2014</td>
<td>468</td>
<td>20%</td>
</tr>
<tr>
<td>8-Dec-2014</td>
<td>432</td>
<td>21%</td>
</tr>
<tr>
<td>15-Dec-2014</td>
<td>487</td>
<td>18%</td>
</tr>
<tr>
<td>22-Dec-2014</td>
<td>225</td>
<td>13%</td>
</tr>
<tr>
<td>29-Dec-2014</td>
<td>126</td>
<td>17%</td>
</tr>
<tr>
<td>5-Jan-2015</td>
<td>483</td>
<td>15%</td>
</tr>
<tr>
<td>12-Jan-2015</td>
<td>394</td>
<td>18%</td>
</tr>
<tr>
<td>19-Jan-2015</td>
<td>520</td>
<td>17%</td>
</tr>
<tr>
<td>26-Jan-2015</td>
<td>377</td>
<td>15%</td>
</tr>
<tr>
<td>2-Feb-2015</td>
<td>412</td>
<td>16%</td>
</tr>
</tbody>
</table>

~1/6 ~2/5

![Visits with Medication BPAs](chart.png)
Beers BPAs - Top Five (2 months)

- Modified Glomerular Filtration: 18%
- Hypnotic - Zopiclone: 18%
- Anticholinergics - high risk: 12%
- Sedatives - Lorazepam: 7%
- Systemic estrogens: 7%
- All other Beers BPAs: 37%
Beers BPA EMR Events - Top Five (2 months)

Message in view - user interaction
- Acknowledge & Override: 66%
- Link - guidance or navigation: 17%
- Accept - no action: 15%
- Cancel - no action: 2%
Guidance Links - Top Five (2 months)

- View online synopses: 33%
- Tertiary tricyclic antidepressants: 11%
- Zopiclone: 12%
- Benzodiazepines: 9%
- Anticholinergics: 5%
- Other: 30%
Outline

Context
Medication Management Intervention
Rapid Iterative User Acceptance Testing
Dynamic Evidence Linking

Learnings
  – Clinical
  – Technical
  – Process
Design

Clinical Decision Support Strategy
  – Passive >> Active >> Directive; Proximate & Specific
  – GRADE of recommendation and evidence
  – Just-in-time workflow-embedded education

Guidance Strategy
  – Multi-disciplinary clinical panel
  – Guideline adaptation
    • AGS Beers Criteria prioritized, adapted to local context
    • Guideline information analysis
Prototype Intervention

- Iteratively optimize rule performance and user interface on subset of 10 key drugs
- Develop and test in POC then TST environments

Virtual Patients

- Representative patients rendered in TST environment
- All pre-production testing done on virtual patients
Validation

Synchronous validation

- 1 hour computer lab sessions using virtual patients
- Demo → trial → focus group → online visual survey
- Repeat sessions with different groups until “saturation”

Asynchronous validation

- Changes put to clinicians through online visual surveys
- Discordant responses brought to working group
- Subsequent adjustments validated with mini-surveys
Rapid Validation Surveys

When a new drug is ordered, and it triggers a Beers Criteria, the relevant Best Practice message will show. It can be quickly bypassed either with the Cancel button, the Accept button or with one of the acknowledgement buttons.

Rate the clinical usefulness of the Beers Criteria Message appearing, as indicated, with new orders for the care of elderly patients visiting a primary care clinic for assessment (use the space below for any comments):

Very low    Low    Neutral    High    Very High
Post-Production Re-validation

Synchronous re-validation
  – Rapid diagnosis and resolution of problem reports
  – Telephone check-ins for 2 months, rotating MDs

Asynchronous re-validation
  – Simple issues communicated and voted via email with embedded visual mini-surveys
  – BPA activity and evidence reports review by working group
Re-validation Impact

Zopiclone warning: Avoid chronic use (greater than 90 days). Consider benzodiazepine-receptor antagonists associated with adverse events similar to benzodiazepines in older adults (e.g., delirium, falls, fractures) with minimal improvement in sleep latency or duration. Quality of evidence: Moderate. Strength of recommendation: Strong.

1

Medications

8

Activity - Medications
Activity - Order Entry
Navigator - Med. Document
Navigator - Meds & Orders

1B Guidance

Zopiclone warning
Avoid chronic use (greater than 90 days). Benzodiazepine-receptor antagonists are associated with adverse events similar to benzodiazepines in older adults (e.g., delirium, falls, fractures) with minimal improvement in sleep latency or duration.

Acknowledgement reason:

Safety established | No alternatives | Benefit outweighs risk | Patient acknowledged risk | Low risk | See notes

Medications

9

Activity - Medications
Activity - Order Entry
Navigator - Med. Document
Navigator - Meds & Orders

1B Guidance
Outline

Context
Medication Management Intervention
Rapid Iterative User Acceptance Testing
Dynamic Evidence Linking

Learnings
  – Clinical
  – Technical
  – Process
Evidence-link Challenge

Diverse stakeholders
  – Health Authority
  – Center of Excellence (Senior’s Health)
  – University

Volatility
  – Changing evidence - work in progress
  – Evolving curricular content and resources
  – Changing evidence management systems
    ➢ Cannot afford to frequently edit >250 BPA records
Evidence Linking Strategy

BPA -> Link Manager -> Evidence Repositories
Evidence Link Manager

Add new link (*optional)

Desired host (optional ex. (host).qwogo.il/(shorturl)):
beers

Short URL*:
nsaid-non-cox

Desired Password*:

IP Restriction*:
(formats: wildcard eg: 1.2.3.4, CIDR eg: 1.2.3/24 or 1.2.3.4/255.255.255.0, Start-End IP eg: 1.2.3.0-1.2.3.255):

Expiry date* (format: 2013-12-31 18:33:34):
0000-00-00 00:00:00

Description*:
Beers guideline synopsis for non-cox NSAIDs

Cancel  Save
Alpha-1 Blockers

2012 AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults - Evidence-Synopsis

Geriatrics Assessment Clinic - SMART Criteria Project
University of Alberta and Alberta Health Services

Drug Class
- Alpha1 blockers

Drugs
- Doxazosin, Prazosin, Terazosin

Recommendation
- Avoid use as an antihypertensive

Rationale
- High risk of orthostatic hypotension.
- Not recommended for routine treatment of hypertension.
- Alternative agents have a superior risk/benefit profile.

Strength of Recommendation
- 1 - Strong

Quality of Evidence
- B - Moderate

Comments
- [pending]

Patient Advisory
- These drugs can cause a drop in blood pressure and dizziness when you stand up quickly from a lying or sitting position. If you have low blood pressure, take these medications with lower risks when treating high blood pressure.

Resources
- Drugs for Drugs 2014
- AGS Beers Evidence Synopses
- AGS Beers Criteria Resources - 2012 Update
- AGS Beers Criteria - Patient Information Handout
- AGS Beers Criteria - Provider Pocket Card
Outline

Context
Medication Management Intervention
Continuous User Acceptance Testing
Dynamic Evidence Linking

Learnings
– Clinical
– Technical
– Process
Attend to the doors that open

- Idealism
  - Clinician initiative and ownership
  - Cultural impact of clinician-driven priority-setting and consensus-building – reframe CI as Clinical Improvement

- Pragmatism
  - Start where evidence is strong but forgotten
  - Start where EMR data is reliably present
Learnings

Never underestimate challenge of moving implicit → explicit clinical reasoning

– Wide range of hidden considerations
– Expose roots of clinical practice variation
– Expose ambiguity of evidence-based guidance
– Catalytic effect of evidence-review and BPA design on clinical consensus-building
Discover >> Derive >> Design

- Clinicians find it extremely difficult to tap into their know-how until using in a clinically authentic simulation
- Especially post-production, clinician needs emerge
  - What was feared may become desired

Importance of continuing iterative validation

- Optimize a few BPAs before scaling up
- Take a chance on production; but be ready to retreat
Learnings

Post-production user interview highlights

- BPA event Frequency ≠ Importance
- Multi-dimensional CDS value proposition
  - Clinical, Quality, Education → value even if not actioned
  - Value of GFR Ht/Wt calculation assists
- Context for reluctance to ‘manage’ BPA
  - Fear of accountability
Sharing

Robert Hayward MD MPH FRCP

- robert.hayward@ahs.ca
Building EMR Decision Supports for Seniors’ Medication Management

June 7, 2016
Robert Hayward  MD  MPH  FRCPC
Chief Medical Information Officer
Alberta Health Services