From Guidelines To Decision Support
A Systematic and Replicable Approach To Guideline Knowledge Transformation

GLIDES PROJECT
GuideLines Into DEcision Support
sponsored by
the Agency for Healthcare Research and Quality

Yale School of Medicine  Nemours
Overview

• Motto and Goals
• Knowledge transformation
  – Define clinical objectives
  – Markup with GEM
  – XML transforms
  – Action-types
  – GLIA
Goals of the GLIDES Project

1. Implement evidence-based guideline recommendations that address prevention of pediatric obesity and chronic management of asthma.

2. Apply GEM and its associated tools to systematically and replicably transform the knowledge contained in these guidelines into a computable format.

3. Deliver the knowledge via electronic decision support at ambulatory sites that employ Centricity EMR at Yale and EpicCare at Nemours.

4. Evaluate the fulfillment of these goals and the effectiveness of the decision support tools in improving the quality of health care.
Pre-implementation work is complete, and we are now commencing our first phase of implementation.
Challenge of Representing Guideline Knowledge Electronically

Published Guideline

Computer-Based Guideline Implementation
Translation of Guideline Knowledge for Decision Support

- Collaborators at Stanford, Harvard and Columbia
- Task: Individually encode guidelines for vaccine administration and for workup of breast mass
- Test: Submit standardized patients
- Outcome: Different recommendations would be given for the same patient

Patel VL. JAMIA 1998
Define Clinical Objectives

• Teleconference involving stakeholders
• Notes distilled; circulated for approval
• Each objective scored
  – Addressed by the selected guidelines?
  – IT can facilitate attainment?
  – Evaluable?
## Goals and Specific Activities

<table>
<thead>
<tr>
<th>Recognize high-risk behaviors</th>
<th>Addressed by GL</th>
<th>Facilitated by IT</th>
<th>Evaluable</th>
</tr>
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<tbody>
<tr>
<td>Screen time (TV computers)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Nutritional</td>
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<td>Y</td>
<td>Y</td>
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<tr>
<td>Lack of exercise</td>
<td>Y</td>
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</table>

<table>
<thead>
<tr>
<th>Counseling (Energy balance: Nutrition-Activity)</th>
<th>Addressed by GL</th>
<th>Facilitated by IT</th>
<th>Evaluable</th>
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<tbody>
<tr>
<td>Limit sugar sweetened beverages</td>
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<td>Y</td>
<td>Y</td>
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<tr>
<td>Encourage fruits and vegetables</td>
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<tr>
<td>Encourage family meals</td>
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<tr>
<td>Limit portion sizes</td>
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</tr>
<tr>
<td>5210: (fruits &amp; vegetables, max screen time, physical activity, juice intake)</td>
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<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Select Relevant Guideline and Recommendations

- Manual process
- pdf documents must be transformed
- Pertinent recommendations identified

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<td></td>
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<td></td>
<td>Limit portion sizes</td>
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<td>Y</td>
<td>Y</td>
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<td>Y</td>
<td>Y</td>
<td>245 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UTI Recommendation 3

If an infant or young child 2 months to 2 years of age with unexplained fever is assessed as being sufficiently ill to warrant immediate antimicrobial therapy, a urine specimen should be obtained by SPA or bladder catheterization; the diagnosis of UTI cannot be established by a culture of urine collected in a bag. (Strength of evidence: good) Urine obtained by SPA or urethral catheterization is unlikely to be contaminated...
XML: From a small number of discrete colors to an unlimited palette
XML

• Multi-platform, Web-based, open standard
• “Tags” enclose and describe text
  `<inclusion.criterion>hematuria</inclusion.criterion>`
• Human-readable, yet can be processed by machine
• Markup can be performed by non-programmers
Markup Guideline

• GEM Cutter II
  – Parses guideline text into components of the Guideline Elements Model
  – Creates XML files
  – “GEMifying”
  – Available at http://GEM.med.yale.edu
• Knowledge model for guideline documents
• GEM adopted as a standard by ASTM in 2002; GEM II updated and re-standardized in 2006
• Models heterogeneous information contained in guidelines
  – Multi-level hierarchy (>100 elements)
GEM II-Top Level

QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.
QuickTime™ and a decompressor are needed to see this picture.
Conditional

QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.
GEM Cutter

DEFINITION OF THE PROBLEM
This practice parameter provides recommendations for the neurodiagnostic evaluation of neurologically healthy infants and children between 6 months and 5 years of age who have had their first simple febrile seizures and present within 12 hours of the event. This practice parameter is not intended for patients who have had complex febrile seizures (prolonged, focal, and/or recurrent), nor does it pertain to those children with previous neurologic insults, known central nervous system abnormalities, or histories of febrile seizures.

TARGET AUDIENCE AND PRACTICE SETTING:
This practice parameter is intended for use by pediatricians, family physicians, child neurologists, neurologists, emergency physicians, and other providers who treat children for febrile seizures.

INTERVENTIONS OF DIRECT INTEREST:
1. Lumbar puncture;
2. Electroencephalography (EEG);
3. Magnetic resonance imaging (MRI);
4. Computerized tomography (CT) scan;
5. Positron emission tomography (PET) scan;
6. Video electroencephalography (V-EEG) monitoring.

Main Focus
Primary disease/condition, health practice, service, or technology addressed in the guideline.
MORO

Markup Once, Reuse Often
Perform Guideline Quality Appraisal

- COGS (GEM-COGS)
  - http://GEM.med.yale.edu/cogs
- AGREE
<table>
<thead>
<tr>
<th>Recommendation grading criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation Grading Criteria</td>
<td>Empty</td>
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<tr>
<td>Evidence Quality Rating Scheme</td>
<td>The writing groups provided a broad rating of the evidence, so that readers can appreciate the limitations of these recommendations and watch for new studies that will refine them. The rating categories were as follows: recommends with consistent evidence (CE), that is, multiple studies generally show a consistent association between the recommended behavior and either obesity risk or energy balance; recommends with mixed evidence (ME), that is, some studies demonstrated evidence for weight or energy balance benefit but others did not show significant associations, or studies were few in number or small in sample size; suggests, that is, studies have not examined the association of the recommendation with weight or energy balance, or studies are few, small in number, and/or without clear findings; however, the expert committee thinks that these recommendations could support the achievement of healthy weight and, if future studies disprove such an effect, then these recommendations are likely to have other benefits and are unlikely to cause harm.</td>
</tr>
<tr>
<td>Recommendation Strength Rating Scheme</td>
<td>Empty</td>
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</table>
Executive Summary of actionable statements that bear on clinical objectives

**Recommendation**
5–11 Years of Age: Initiating Long-Term Control Therapy.

*Conditional*: 5–11 Years of Age: Initiating Long-Term Control Therapy.
The Expert Panel recommends daily long-term control therapy for children who have persistent asthma
Rec_5: Cond_5

**Recommendation**
Adjusting Therapy

*Conditional*: The Expert Panel recommends that, if a child is already taking long-term control medication, treatment decisions are based on the level of asthma control that has been achieved: therapy should be stepped up if necessary to achieve control
Rec_6: Cond_6
EXTRACTOR: Rules

Human-readable statement logic

Recommendation
Pharmacologic Issues for Children 0–4 Years of Age

**Conditional:** If there is no clear response within 4–6 weeks, the therapy should be discontinued and alternative therapies or alternative diagnoses considered \{Rec_14: Cond_18 \}

**Evidence Quality:** Evidence D

**Strength of Recommendation:** The Expert Panel recommends

**Reason:** treatment of young children is often in the form of a therapeutic trial

**Logic:**
EXTRACTOR: Decision Variables

- Removed from guideline context and presented in a list.
- Opportunity to judge vagueness, underspecification, and decidability
- Comprehensive list of *trigger items* for decision support activities
- Measurable starting points for evaluation
## Decision Variables

### 0–4 Years of Age

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Rec_1: Cond_1: DV_1</td>
<td>four or more episodes of wheezing in the past year that lasted more than 1 day and affected sleep</td>
</tr>
<tr>
<td>Rec_1: Cond_1: DV_2</td>
<td>parental history of asthma</td>
</tr>
<tr>
<td>Rec_1: Cond_1: DV_3</td>
<td>a physician diagnosis of atopic dermatitis</td>
</tr>
<tr>
<td>Rec_1: Cond_1: DV_4</td>
<td>evidence of sensitization to aeroallergen</td>
</tr>
<tr>
<td>Rec_1: Cond_1: DV_5</td>
<td>evidence of sensitization to foods</td>
</tr>
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</table>
EXTRACTOR Transforms (2)

• Actions
  • Removed from guideline context and presented in a list
  • Judge underspecification, vagueness, and executability
  • Comprehensive list of *activities* that will need to be addressed in the design of the decision support system
  • Listing of potentially measurable actions
a reduction in pharmacologic therapy—a step down— can be considered

therapy should be discontinued

alternative therapies or alternative diagnoses considered

a step down in therapy should be undertaken

SABA taken as needed to treat symptoms
Categorize Action-types

- Test (Inquire, Examine)
- Monitor
- Conclude
- Prescribe
- Perform Procedure
- Refer/consult
- Educate/counsel
- Document
- Dispose
- Prepare
- Advocate
Example: Application of Action-Types

• Action-type: **Prescribe**
  – Drug information
  – Safety alerts (allergy, drug-drug, drug-disease, drug-lab)
  – Formulary check
  – Dosage calculation
  – Pharmacy transmission
  – Patient education
  – Corollary orders
Map Recommendations to Controlled Vocabulary

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Language</th>
<th>Codable Components</th>
<th>Action Type</th>
<th>Concept ID</th>
<th>SNOMED ID</th>
<th>CTV3 ID</th>
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</thead>
<tbody>
<tr>
<td>Monitoring Signs and Symptoms of Asthma</td>
<td>Imperative: Consider long-term daily peak flow monitoring for: Nº Patients who have moderate or severe persistent asthma (Evidence B). Nº Patients who have a history of severe exacerbations (Evidence B).</td>
<td>Peak flow monitoring</td>
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<td>P0-00975</td>
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<td>Severe exacerbations</td>
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<td>281239006</td>
<td>Xa1hD</td>
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</table>

- Peak flow monitoring
- Moderate persistent asthma
- Severe persistent asthma
- Severe exacerbations
Identify Obstacles to Implementation

• GuideLine Implementability Appraisal
• eGLIA
Identify Obstacles to Implementation

- GuideLine Implementability Appraisal (& eGLIA)
- Provides feedback to guideline authors to anticipate and address obstacles before a draft guideline is finalized
- Assists implementers in guideline selection and targeting attention toward anticipated obstacles
- http://gem.med.yale.edu/glia
Recommendation 2: 0–4 Years of Age: The Expert Panel concludes that initiating daily long-term control therapy should be considered for reducing risk in infants and young children who have a second asthma exacerbation requiring systemic corticosteroids within 6 months (Evidence D).

8: The guideline's intended audience cannot consistently determine whether each condition in the recommendation has been satisfied.

Age 0-4?

9: Not all reasonable combinations of conditions are accounted for, i.e., the recommendation is not comprehensive.

What about exacerbations not treated with steroids? Is it only children whose second exacerbation received steroids?

11: The recommended action (what to do) is vague or ambiguous.

‘should be considered‘--what factors would indicate yes or no?

22: The recommendation may not be compatible with existing attitudes and beliefs of the guideline’s intended users.

May be some resistance to use of inhaled corticosteroids

23: The recommendation may not be consistent with patient expectations.

Some parents worry about giving a daily medication to a child--may be some resistance to use of ICS
Osheroff’s Intervention Specification Form

- Clinical objective
- Desired action
- Baseline performance
- Desired outcome
- Origin of data
- Selected DS intervention
  - Documentation templates
  - Data flowsheets
  - Present’n of data relevant for test ordering
  - Encounter-linked reminders
  - Dynamic alerts
- Approach
- Target population
- User interface
- Primary stakeholders
- Clinical champion
- Potential adverse consequences
Knowledge Pipeline