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
Overview

• Systematic and replicable
• Define clinical objectives
• Markup with GEM
• XML transforms
• Action-types
• GLIA
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

## Recognize high-risk behaviors

<table>
<thead>
<tr>
<th>High Risk Behaviors</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen time (TV computers)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutritional</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lack of exercise</td>
<td></td>
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</tbody>
</table>

## Counseling (Energy balance: Nutrition-Activity)

<table>
<thead>
<tr>
<th>Counseling Activities</th>
<th>Y</th>
<th>Y</th>
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<th>Y</th>
</tr>
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<tbody>
<tr>
<td>Limit sugar sweetened beverages</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encourage fruits and vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakfast daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit fast food</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encourage family meals</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Limit portion sizes</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

5210: (fruits & vegetables, max screen time, physical activity, juice intake) | Y | Y | Y | Y
Select Relevant Guideline and Recommendations

- Manual process
- .pdf documents transformed to .html

<table>
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<tr>
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<td>5210: (fruits &amp; vegetables, max screen time, physical activity, juice intake)</td>
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Markup Guideline

• GEM Cutter II
  – Parses guideline text into components of the Guideline Elements Model
  – Create XML files
  – “GEMifying”
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
  
  \[
  <\text{inclusion.criterion}>\text{hematuria}</\text{inclusion.criterion}>
  \]
- Human-readable, yet can be processed by machine
- Markup can be performed by non-programmers
- “Hot”—considerable energies invested in X-tech
• 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) indicates relationships
GEM II-Top Level

Guideline Document

- Identity
  - Developer
- Purpose
  - Intended Audience
- Method of Development
  - Target Population
- Knowledge Components
- Revision Plan
  - Testing
  - Implementation Plan
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. Brain imaging:
   a. Computed tomography (CT)
   b. Magnetic resonance imaging (MRI);
4. Temperature control and antipyretics;
MORO

Markup Once,  Reuse Often
Perform Guideline Quality Appraisal

• Informal
• COGS (GEM-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>
</tr>
<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>
</tr>
</tbody>
</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}

IF
no clear response within 4–6 weeks
THEN
therapy should be discontinued
alternative therapies or alternative diagnoses considered

**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

- Decision variables are removed from guideline context and presented in a list.
- Opportunity to identify and judge vagueness, underspecification, and decidability.
- Provides a comprehensive list of trigger items for decision support activities.
- Measurable starting points for evaluation.
<table>
<thead>
<tr>
<th>Decision Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0–4 Years of Age</strong></td>
</tr>
<tr>
<td>Rec_1: Cond_1: DV_1</td>
</tr>
<tr>
<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>
</tr>
<tr>
<td>parental history of asthma</td>
</tr>
<tr>
<td>Rec_1: Cond_1: DV_3</td>
</tr>
<tr>
<td>a physician diagnosis of atopic dermatitis</td>
</tr>
<tr>
<td>Rec_1: Cond_1: DV_4</td>
</tr>
<tr>
<td>evidence of sensitization to aeroallergen</td>
</tr>
<tr>
<td>Rec_1: Cond_1: DV_5</td>
</tr>
<tr>
<td>evidence of sensitization to foods</td>
</tr>
<tr>
<td>Rec_1: Cond_1: DV_6</td>
</tr>
</tbody>
</table>
EXTRACTOR Transforms (2)

• Actions

  • Actions (and directives) are removed from guideline context and presented in a list
  • Opportunity to identify and 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
Actions

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>a reduction in pharmacologic therapy—a step down— can be considered</td>
</tr>
<tr>
<td>Rec_13: Cond_17: Act_24</td>
</tr>
<tr>
<td>therapy should be discontinued</td>
</tr>
<tr>
<td>Rec_14: Cond_18: Act_25</td>
</tr>
<tr>
<td>alternative therapies or alternative diagnoses considered</td>
</tr>
<tr>
<td>Rec_14: Cond_18: Act_26</td>
</tr>
<tr>
<td>a step down in therapy should be undertaken</td>
</tr>
<tr>
<td>Rec_14: Cond_19: Act_27</td>
</tr>
<tr>
<td>SABA taken as needed to treat symptoms</td>
</tr>
<tr>
<td>Rec_15: Cond_20: Act_28</td>
</tr>
</tbody>
</table>
Categorize Action-types

- Test (Inquire, Examine)
- Monitor
- Conclude
- Prescribe
- Perform Procedure

- Refer/consult
- Educate/counsel
- Document
- Dispose
- Prepare
- Advocate
Action-Types in 405 Recommendations

Essaihi A. Proc AMIA 2004

- **Action**
  - **Gather**
    - **Test**
    - **Monitor**
  - **Interpret**
    - **Conclude**
  - **Perform**
    - **Prescribe**
      - **Educate**
      - **Document**
    - **Consult**
    - **Advocate**
  - **Dispose**
    - **Procedure**
    - **Prepare**
Action Distribution

- Test: 31%
- Prescribe: 25%
- Procedure: 11%
- Educate: 10%
- Prepare Advocate
- Dispose: 4%
- Conclude: 3%
- Monitor: 3%
- Document
- Refer: 5%
- No Rec

Refer 5%
Dispose 4%
Conclude 3%
Monitor 3%
Document
Prepare Advocate
No Rec
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
# Action-Types

<table>
<thead>
<tr>
<th>Test</th>
<th>Obtain or collect additional data through inquiry, laboratory testing, or other investigative procedures whose intent is not curative.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescribe</td>
<td><em>Order</em> a treatment requiring medication or durable medical equipment.</td>
</tr>
<tr>
<td>Perform</td>
<td>Order activities that are therapeutic in nature.</td>
</tr>
<tr>
<td>Educate / Counsel</td>
<td>Inform the patient about means to improve/maintain health, or instruct on how to perform specific activities.</td>
</tr>
<tr>
<td>Refer / Consult</td>
<td>Direct a patient to another clinician for evaluation and/or treatment.</td>
</tr>
<tr>
<td>Conclude</td>
<td>Determine a diagnosis or clinical status.</td>
</tr>
</tbody>
</table>
## Action-Types (Cont’d)

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor</td>
<td>Make serial observations according to specific criteria and schedule.</td>
</tr>
<tr>
<td>Document</td>
<td>Record one or more facts in the patient record.</td>
</tr>
<tr>
<td>Dispose</td>
<td>Initiate an activity to direct the flow of patients, e.g., Admit, Discharge, Follow-up, Transfer, etc.</td>
</tr>
<tr>
<td>Advocate</td>
<td>Argue in support of a policy</td>
</tr>
<tr>
<td>Prepare</td>
<td>Make ready for a particular guideline-directed activity by training, equipping, or gaining new knowledge</td>
</tr>
<tr>
<td>No Rec</td>
<td>A statement that no activity is advised, usually because of insufficient scientific evidence for or against the activity</td>
</tr>
</tbody>
</table>
Map Recommendations to Controlled Vocabulary

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Language</th>
<th>Action Type</th>
<th>Concept ID</th>
<th>SNOMED ID</th>
<th>CTV3 ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring Signs and Symptoms of Asthma</td>
<td>Imperative: Consider long-term daily peak flow monitoring for: — Patients who have moderate or severe persistent asthma (Evidence B). — Patients who have a history of severe exacerbations (Evidence B).</td>
<td>Monitor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak flow monitoring</td>
<td>Peak expiratory flow rate monitoring (regime/therapy)</td>
<td>401004000</td>
<td>P0-00975</td>
<td>XaIxD</td>
<td></td>
</tr>
<tr>
<td>Moderate persistent asthma</td>
<td>Moderate persistent asthma (disorder)</td>
<td>427295004</td>
<td>F-04F3F</td>
<td>XUiW</td>
<td></td>
</tr>
<tr>
<td>Severe persistent asthma</td>
<td>Severe persistent asthma (disorder)</td>
<td>426656000</td>
<td>F-04F40</td>
<td>XUiX</td>
<td></td>
</tr>
<tr>
<td>Severe exacerbations</td>
<td>Exacerbation of asthma (disorder)</td>
<td>281239006</td>
<td>D2-00076</td>
<td>Xa1hD</td>
<td></td>
</tr>
</tbody>
</table>
Identify Obstacles to Implementation

- GuideLine Implementability Appraisal
- eGLIA
Identify Obstacles to Implementation

- To provide feedback to guideline authors to anticipate and address obstacles before a draft guideline is finalized
- To assist implementers in guideline selection and to target attention toward anticipated obstacles
- GLIA is available from http://gem.med.yale.edu/glia
GLIA Structure

• 7 global questions relate to the guideline as a whole (e.g., Target population defined? Sequence? Internal consistency?)
• 20 questions pertain to EACH recommendation
  – “No” responses indicate barriers
• 4 optional questions relate to implementability in a local computer system
• Significance of barriers is variable
Evaluate guideline as a whole with: GLOBALS

1) Do the organization(s) and author(s) who developed the guideline have credibility with the intended users of the guideline?

2) Is the patient population eligible for the guideline clearly defined?

3) Does the guideline document suggest possible strategies for dissemination and implementation?

4) Is the guideline supported with tools for application e.g., a summary document, a quick reference guide, educational tools, patients' leaflets, online resources or computer software?
5) If any guideline recommendations are considered more important than others, does their presentation or formatting reflect this?

6) Is it clear in what sequence the recommendations should be applied?

7) Is the guideline internally consistent, i.e., without contradictions between recommendations or between text recommendations and flowcharts, summaries, patient education materials, etc.?
Evaluate EACH recommendation with respect to:

- **Decidability** - precisely *under what circumstances* to do something
- **Executability** - exactly *what to do* under the circumstances defined
- **Effect on process of care** - the degree to which a recommendation impacts upon the usual workflow of a care setting
- **Presentation and formatting** - the degree to which the recommendation is easily recognizable and succinct
- **Measurable outcomes** - the degree to which the guideline identifies markers or endpoints to track the effects of implementation of this recommendation
GLIA Constructs (2)

- **Apparent validity** - the degree to which a recommendation reflects the intent of the developer and the strength of evidence
- **Novelty/innovation** - the degree to which a recommendation proposes behaviors considered unconventional by clinicians or patients
- **Flexibility** - the degree to which a recommendation permits interpretation and allows for alternatives in its execution
- **Computability** - the ease with which a recommendation can be operationalized in an electronic information system