



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



QuickTime™ and a
discreetizer
are needed to see this picture.

Yale School of Medicine



Overview

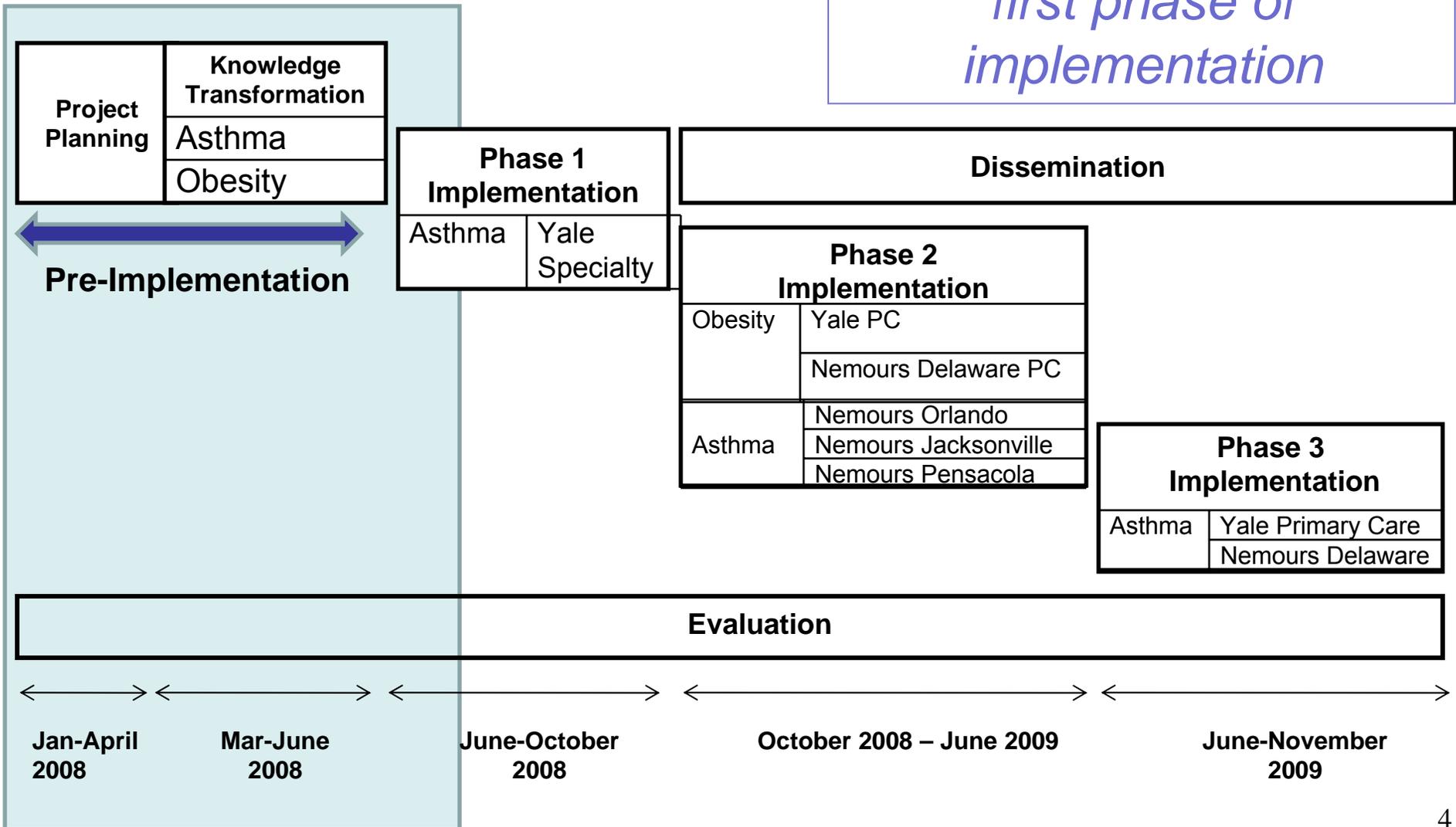
- Motto and Goals
- Knowledge transformation
 - Define clinical objectives
 - Markup with GEM
 - XML transforms
 - Action-types
 - GLIA

Goals of the GLIDES Project

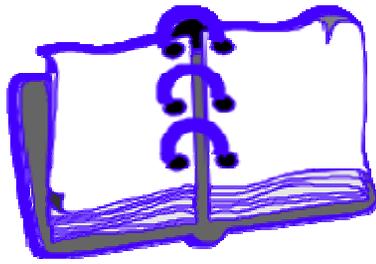
1. Implement evidence-based guideline recommendations that address prevention of **pediatric obesity** and chronic management of **asthma**.
2. Apply GEM and its associated tools **to systematically and replicably transform the knowledge** contained in these guidelines into a computable format.
3. **Deliver 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.

Project Timeline Overview

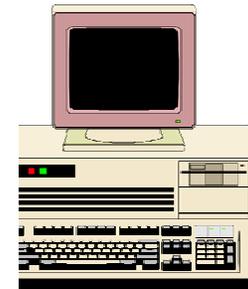
Pre-implementation work is complete, and we are now commencing our first phase of implementation



Challenge of Representing Guideline Knowledge Electronically



Published Guide



**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**

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

Addressed by GL
Facilitated by IT
Evaluable

	Addressed by GL	Facilitated by IT	Evaluable
Recognize high-risk behaviors			
Screen time (TV computers)	Y	Y	Y
Nutritional	Y	Y	Y
Lack of exercise	Y	Y	Y
Counseling (Energy balance: Nutrition-Activity)			
Limit sugar sweetened beverages	Y	Y	Y
Encourage fruits and vegetables	Y	Y	Y
Breakfast daily	Y	Y	Y
Limit fast food	Y	Y	Y
Encourage family meals	Y	Y	Y
Limit portion sizes	Y	Y	Y
5210: (fruits & vegetables, max screen time, physical activity, juice intake)	Y	Y	Y

Select Relevant Guideline and Recommendations

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

Addressed by GL
Facilitated by IT
Evaluable
Recomndn

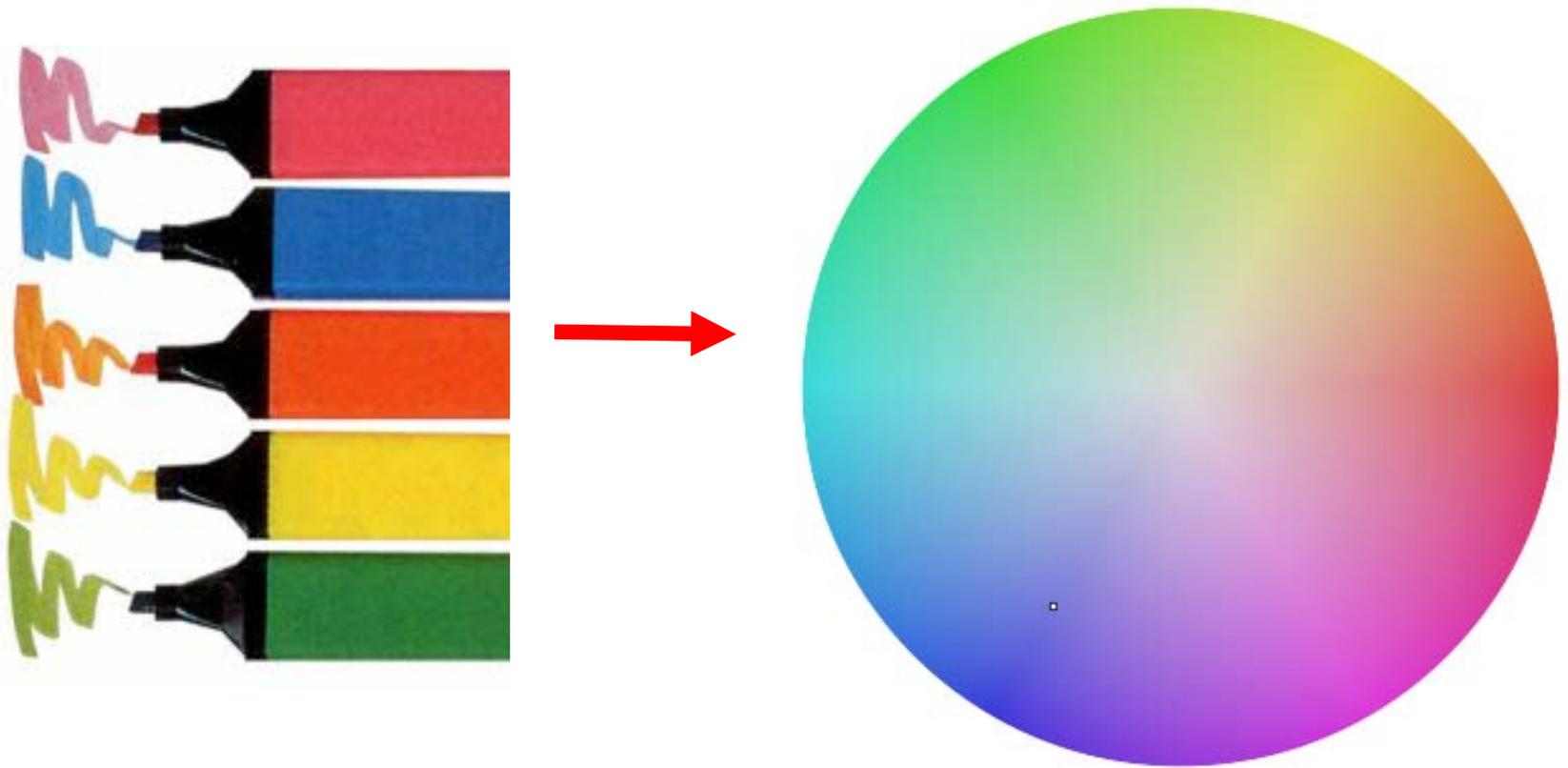
	Addressed by GL	Facilitated by IT	Evaluable	Recomndn
Recognize high-risk behaviors				
Screen time (TV computers)	Y	Y	Y	245 1c
Nutritional	Y	Y	Y	179, 186 6
Lack of exercise	Y	Y	Y	179, 186 7
Counseling (Energy balance: Nutrition-Activity)				
Limit sugar sweetened beverages	Y	Y	Y	245 1a
Encourage fruits and vegetables	Y	Y	Y	245 1b
Breakfast daily	Y	Y	Y	245 1d
Limit fast food	Y	Y	Y	245 1e
Encourage family meals	Y	Y	Y	245 1f
Limit portion sizes	Y	Y	Y	245 1g
5210: (fruits & vegetables, max screen time, physical activity, juice intake)	Y	Y	Y	245 1

Logical Analysis with Highlighters

- 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>

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

GEM

- 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
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GEM Cutter

The screenshot displays the GEM Cutter software interface, which is used for processing and structuring guideline documents. The interface is divided into several panes:

- Left Pane:** Displays the text of a practice parameter document titled "Practice Parameter: The Neurodiagnostic Evaluation of the Child With a First Simple Febrile Seizure". The text includes sections for "DEFINITION OF THE PROBLEM", "TARGET AUDIENCE AND PRACTICE SETTING", and "INTERVENTIONS OF DIRECT INTEREST".
- Center Pane:** Shows a tree view of the document's metadata, including fields like <Identity>, <Title>, <Citation>, <Release_Date>, <Availability>, <Status>, <Companion_Document>, <Adaptation>, <Developer>, and <Purpose>. The <Main_Focus> field is currently selected, showing the text: "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."
- Right Pane:** Contains a "Source" section with radio buttons for "N/D", "Inferred", and "Explicit" (which is selected). Below this is a scrollable text area containing the same text as the <Main_Focus> field.
- Bottom Pane:** Titled "GEM Structure", it shows a hierarchical diagram of the document's structure. The root level includes boxes for "Title", "Citation", "Release Date", "Availability", "Status", "Companion Document", and "Adaptation". "Citation" is linked to "Length". "Availability" is linked to "Electronic", "Print", and "Contact". "Companion Document" is linked to "Patient Resources".

MORO

Markup Once,



Reuse Often



Perform Guideline Quality Appraisal

- **COGS (GEM-COGS)**
 - <http://GEM.med.yale.edu/cogs>
- **AGREE**

GEM-COGS

<p>(9) Recommendation grading criteria</p>	<p><i>Describe the criteria used to rate the quality of evidence that supports the recommendations and the system for describing the strength of the recommendations. Recommendation strength communicates the importance of adherence to a recommendation and is based on both the quality of the evidence and the magnitude of anticipated benefits or harms.</i></p>
<p><i>Recommendation Grading Criteria</i></p>	<p>Empty</p>
<p><i>Evidence Quality Rating Scheme</i></p>	<p>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.</p>
<p><i>Recommendation Strength Rating Scheme</i></p>	<p>Empty</p>

Extractor: Recommendations

- 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

Decidable	Vocab
Executable	Vocab

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

Rec_1: Cond_1: DV_1

four or more episodes of wheezing in the past year that lasted more than 1 day and affected sleep

Rec_1: Cond_1: DV_2

parental history of asthma

Rec_1: Cond_1: DV_3

a physician diagnosis of atopic dermatitis

Rec_1: Cond_1: DV_4

evidence of sensitization to aeroallergen

Rec_1: Cond_1: DV_5

evidence of sensitization to foods

Rec_1: Cond_1: DV_6

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

Actions

a reduction in pharmacologic therapy—a step down— can be considered

Rec_13: Cond_17: Act_24

therapy should be discontinued

Rec_14: Cond_18: Act_25

alternative therapies or alternative diagnoses considered

Rec_14: Cond_18: Act_26

a step down in therapy should be undertaken

Rec_14: Cond_19: Act_27

SABA taken as needed to treat symptoms

Rec_15: Cond_20: Act_28

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

Recommendation	Language			Action Type	
Monitoring Signs and Symptoms of Asthma	Imperative: Consider long-term daily peak flow monitoring for: N Patients who have moderate or severe persistent asthma (Evidence B). N Patients who have a history of severe exacerbations (Evidence B).			Monitor	
Codable Components	Fully-Specified Concept Name	Concept ID	SNOMED ID	CTV3 ID	
Peak flow monitoring	Peak expiratory flow rate monitoring (regime/therapy)	401004000	P0-00975	XaIxD	
Moderate persistent asthma	Moderate persistent asthma (disorder)	427295004	F-04F3F	XUfiW	
Severe persistent asthma	Severe persistent asthma (disorder)	426656000	F-04F40	XUfiX	
Severe exacerbations	Exacerbation of asthma (disorder)	281239006	D2-00076	Xa1hD	

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

