Agency for Healthcare Research and Quality
Advancing Excellewnce in Health Care

Yale University School of Medicine

Structuring Knowledge For Clinical Decision Support

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GLIDES Project – Years 1-2
(GuideLines Into DEcision Support)

Partnership with YSM, YNHH, and Nemours

Creating and refining tools for guideline knowledge translation

Completed 2 years of contracted activities

- Applied Guideline Elements Model to extract knowledge from current guidelines
- Implemented decision support for *chronic management of asthma* and *prevention of obesity* within Centricity and EPIC EHRs
- Currently evaluating use and iteratively refining CDS

GLIDES Project – Year 3

New *Implementation* partnerships with:

- Geisinger
- Children's Hospital of Philadelphia

New *Developer* partnerships with:

- American Academy of Pediatrics
- American Academy of Otolaryngology-Head & Neck Surgery
- ECRI Institute

Human Factors Engineer and Cognitive Psychologist

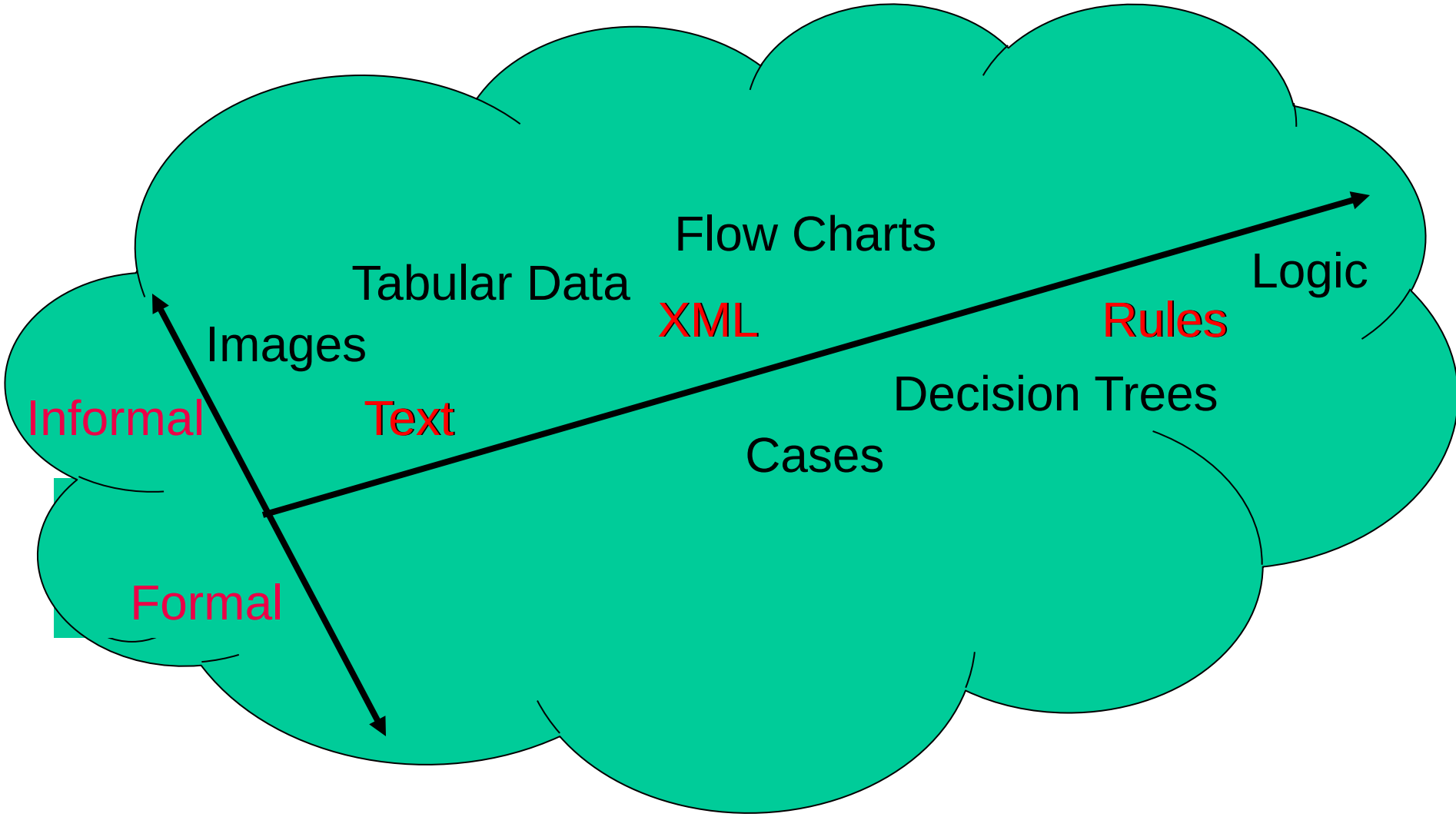
Goal: Systematic and Replicable

Fundamental problem: “Structuring Knowledge”

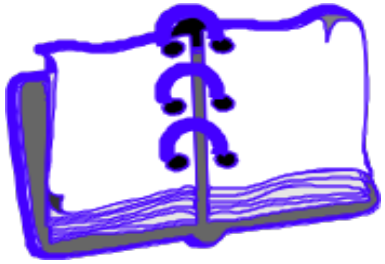
- New knowledge becomes available in original research reports, systematic reviews, meta-analyses, expert experience
- Guideline authors “digest” knowledge and make specific recommendations about how it should be applied
- Must be “formalized” to be useful to CDS implementers (to give something a proper form)

The Knowledge Formalization Continuum

Baumeister. CEUR-WS 2009

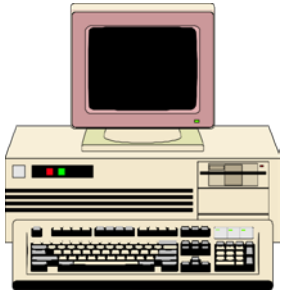


Challenge of Representing Guideline Knowledge Electronically

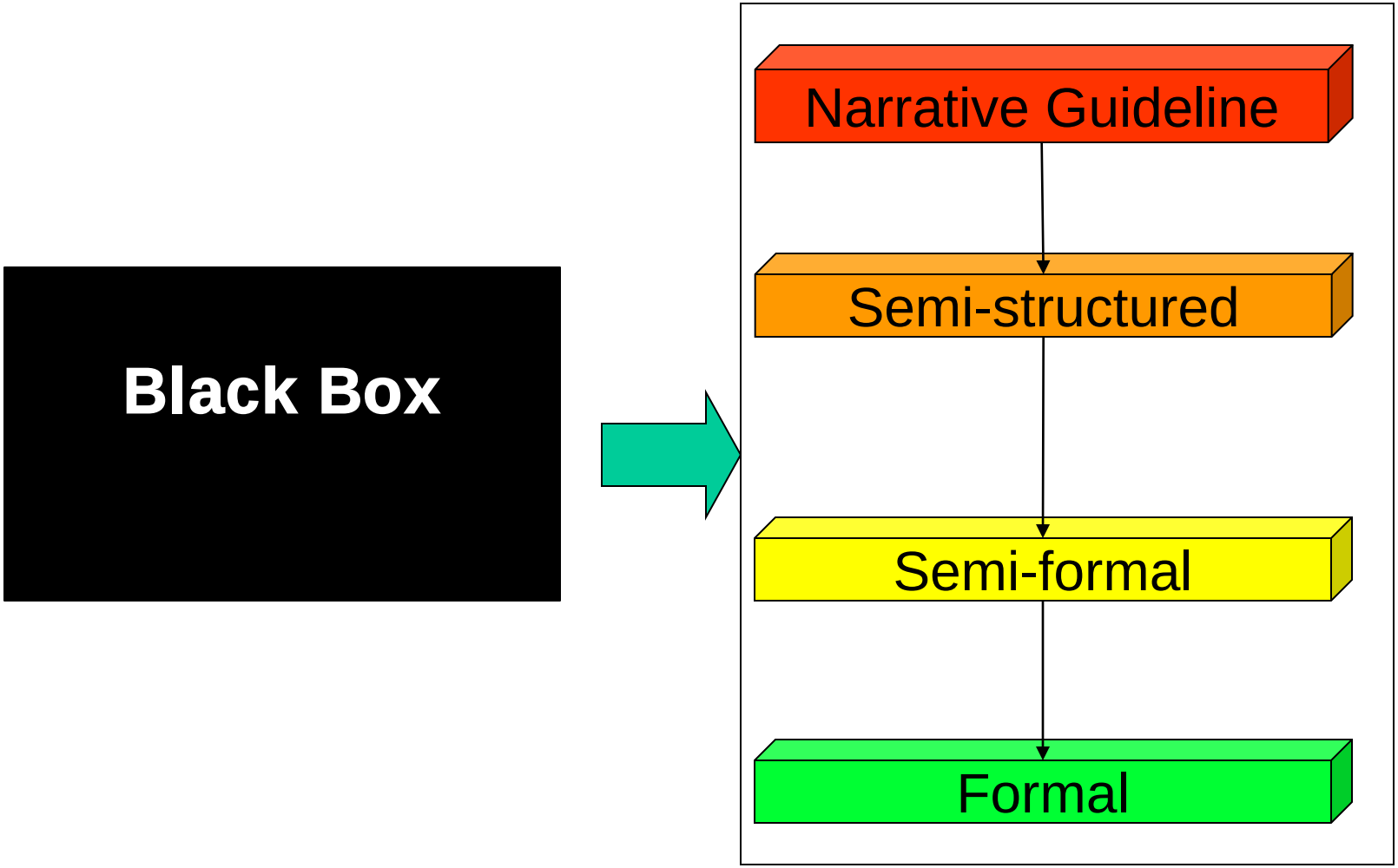


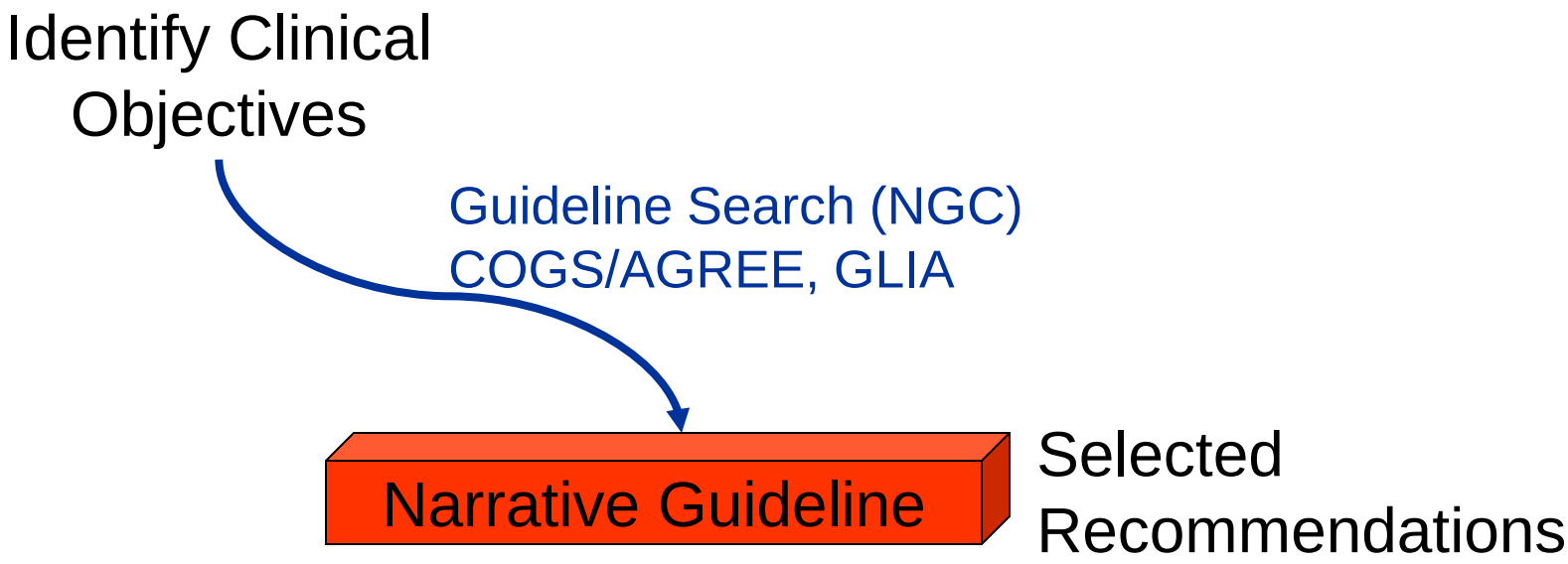
Published Guideline

Black Box

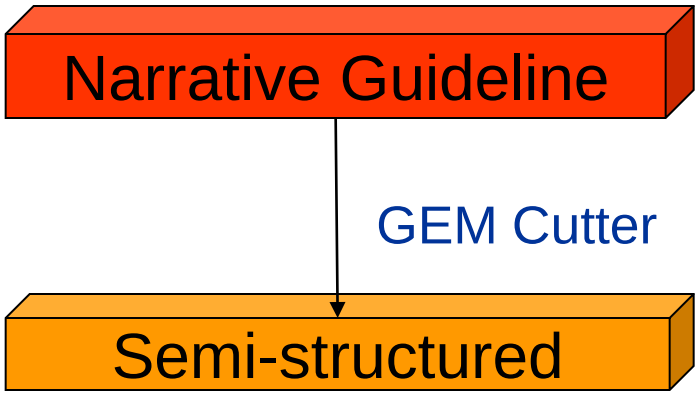


Decision Support Application


Black Box
Narrative Guideline
Semi-structured
Semi-formal
Formal


Identify Clinical Objectives
Guideline Search (NGC)
COGS/AGREE, GLIA
Narrative Guideline
Selected Recommendations

Narrative to Semi-Structured



Selected Textual Recommendations

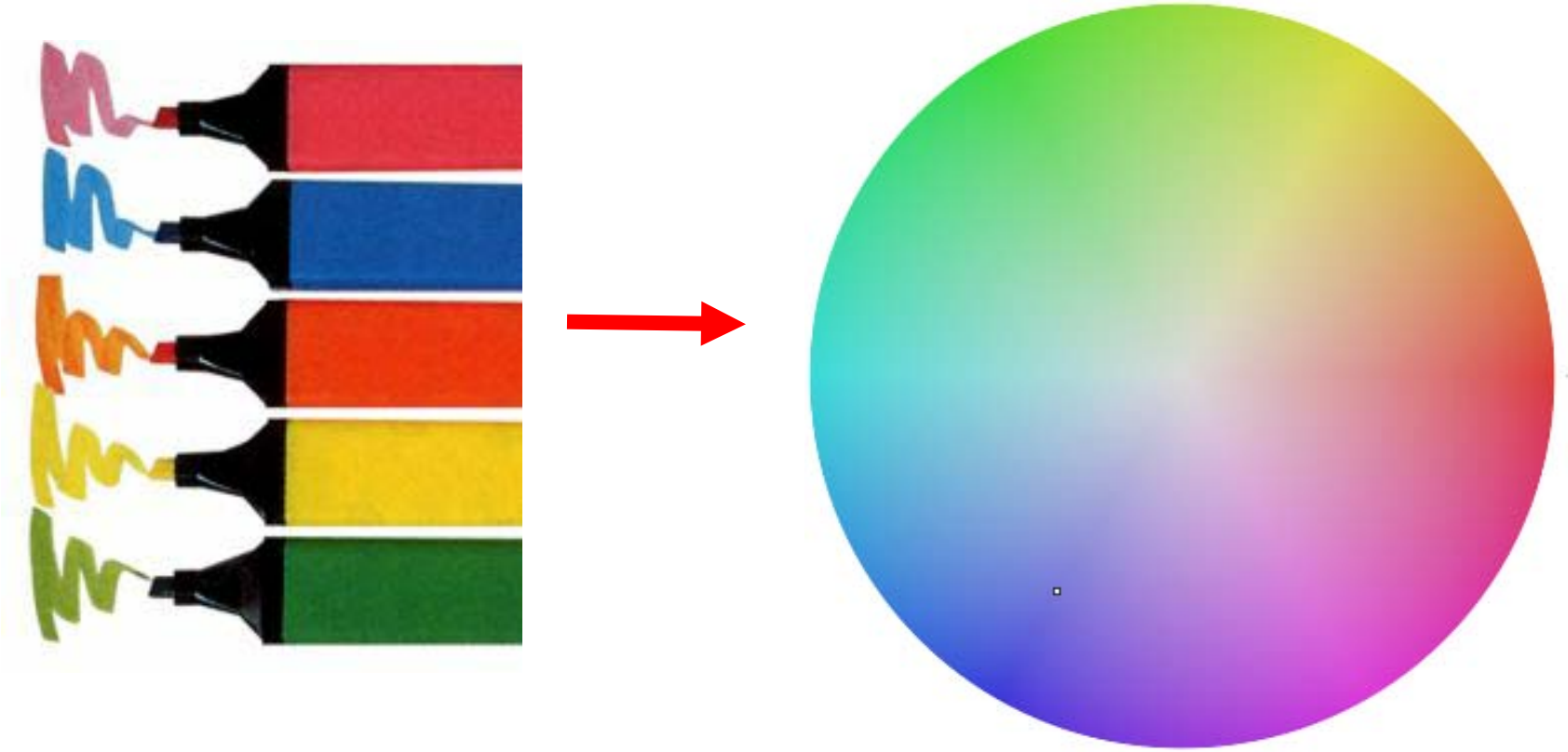
Quality and Implementability Appraisals

XML file

Logical Analysis with Highlighters

If patient adherence, inhaler technique, and environmental control measures are adequate, and asthma is not well controlled, a step-up in treatment may be needed. (Evidence quality B-extrapolated)

XML: From a small number of discrete colors to an unlimited palette



XML

- Multi-platform, Web-based, open standard
- Meaningfully-named “tags” **enclose** and **describe** text

  <inclusion.criterion>hematuria</inclusion.criterion>
-

GEM

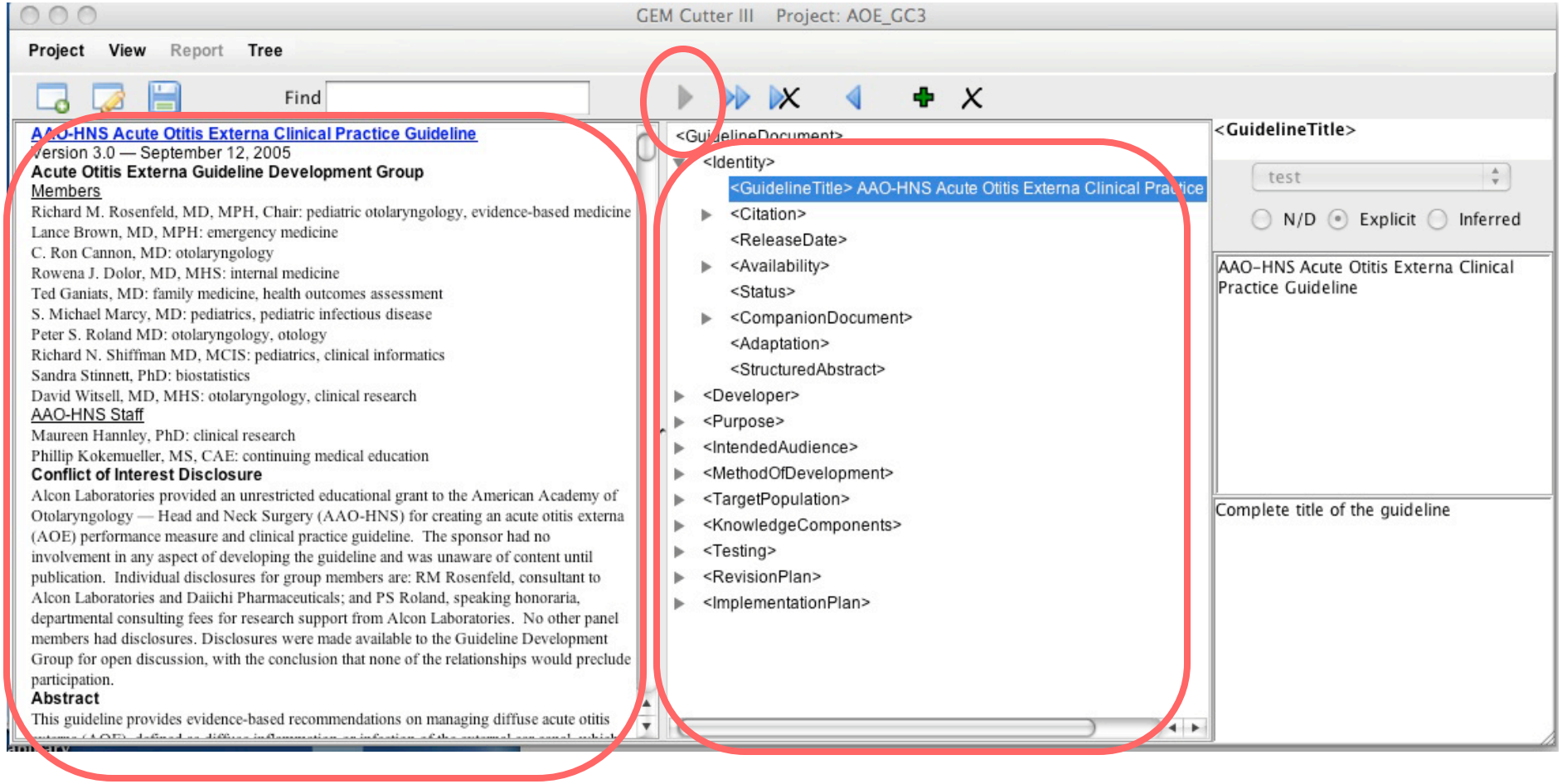
Set of >100 tags designed to represent concepts used in clinical guidelines

Markup can be performed by non-programmers

Human-readable, yet can be processed by machine

GEM DTD adopted as ANSI standard (ASTM E2210-02)
GEM II Schema adopted as ANSI standard (E2210-06)

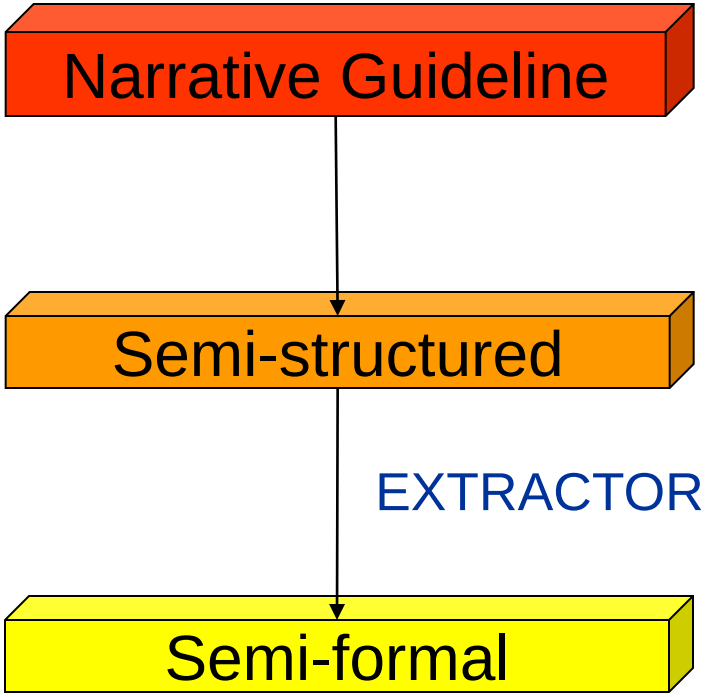
GEM Cutter


GEM Cutter III Project: AOE_GC3
Project View Report Tree
Find
AAO-HNS Acute Otitis Externa Clinical Practice Guideline
Version 3.0 — September 12, 2005
Acute Otitis Externa Guideline Development Group
Members
Richard M. Rosenfeld, MD, MPH, Chair: pediatric otolaryngology, evidence-based medicine
Lance Brown, MD, MPH: emergency medicine
C. Ron Cannon, MD: otolaryngology
Rowena J. Dolor, MD, MHS: internal medicine
Ted Ganiats, MD: family medicine, health outcomes assessment
S. Michael Marcy, MD: pediatrics, pediatric infectious disease
Peter S. Roland MD: otolaryngology, otology
Richard N. Shiffman MD, MCIS: pediatrics, clinical informatics
Sandra Stinnett, PhD: biostatistics
David Witsell, MD, MHS: otolaryngology, clinical research
AAO-HNS Staff
Maureen Hannley, PhD: clinical research
Phillip Kokemueller, MS, CAE: continuing medical education
Conflict of Interest Disclosure
Alcon Laboratories provided an unrestricted educational grant to the American Academy of Otolaryngology — Head and Neck Surgery (AAO-HNS) for creating an acute otitis externa (AOE) performance measure and clinical practice guideline. The sponsor had no involvement in any aspect of developing the guideline and was unaware of content until publication. Individual disclosures for group members are: RM Rosenfeld, consultant to Alcon Laboratories and Daiichi Pharmaceuticals; and PS Roland, speaking honoraria, departmental consulting fees for research support from Alcon Laboratories. No other panel members had disclosures. Disclosures were made available to the Guideline Development Group for open discussion, with the conclusion that none of the relationships would preclude participation.
Abstract
This guideline provides evidence-based recommendations on managing diffuse acute otitis
<GuidelineDocument>
<Identity>
<GuidelineTitle> AAO-HNS Acute Otitis Externa Clinical Practice
<Citation>
<ReleaseDate>
<Availability>
<Status>
<CompanionDocument>
<Adaptation>
<StructuredAbstract>
<Developer>
<Purpose>
<IntendedAudience>
<MethodOfDevelopment>
<TargetPopulation>
<KnowledgeComponents>
<Testing>
<RevisionPlan>
<ImplementationPlan>
<GuidelineTitle>
test
N/D Explicit Inferred
AAO-HNS Acute Otitis Externa Clinical Practice Guideline
Complete title of the guideline

XML-Tagged Recommendation

<decision_variable> patient adherence
<value> adequate </value> </decision variable>
<decision_variable> inhaler technique
<value> adequate </value> </decision variable>
<decision_variable> environmental control measures
<value> adequate </value> </decision variable>
<decision_variable> asthma control
<value> not well-controlled </value> </decision variable>
<action> a step up in treatment may be needed </action>
<evidence_quality> B–extrapolated </evidence_quality>

Semi-Structured to Semi-Formal



XML file

EXTRACTOR Transforms

Statement logic
Coded decision variable & action concepts

EXTRACTOR Transform to Statement Logic

Recommendation: 7

Conditional: {Statement from guideline}

IF

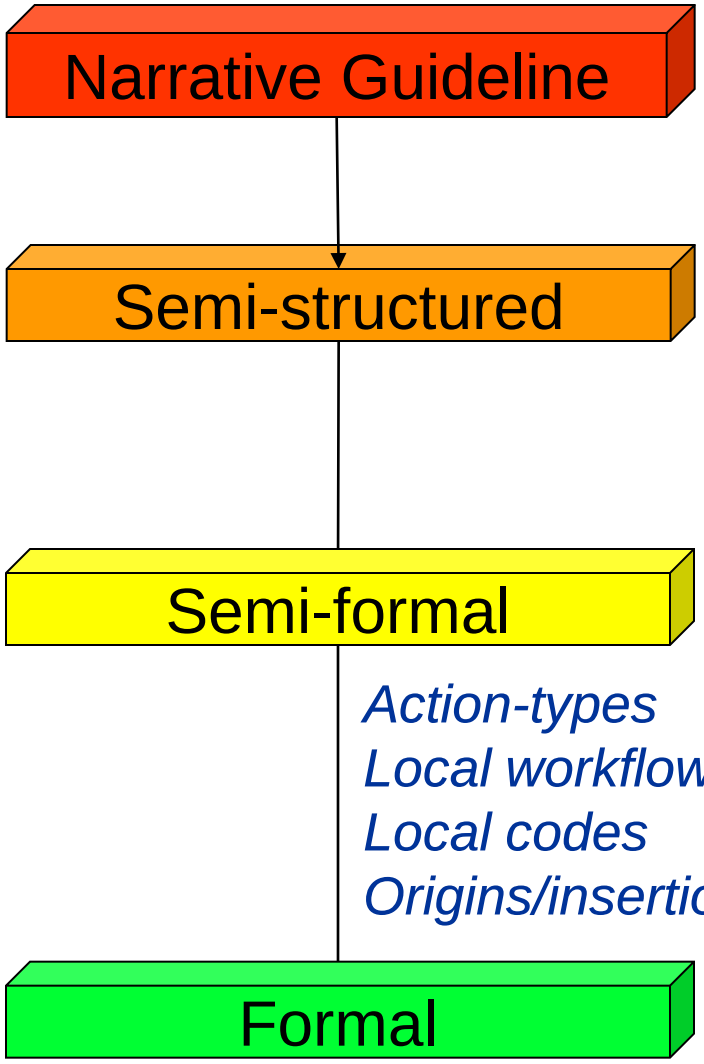
patient adherence **is** adequate AND
inhaler technique **is** adequate AND
environmental control measures **is** adequate AND
asthma control **is** not well controlled

THEN

a step up in treatment may be needed

Evidence Quality: B–extrapolated

Semi-Formal to Formal



Statement logic
Coded decision variable & action concepts

Action-types
Local workflow & barrier analysis
Local codes
Origins/insertions

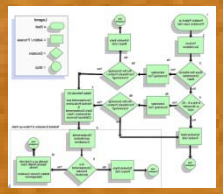
Code in local EHR “language”
CDS user interface choices

Palette of CDS Interventions

Documentation template

Alert

Reminder

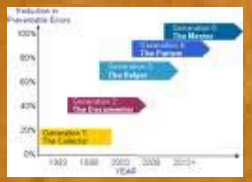


Algorithm

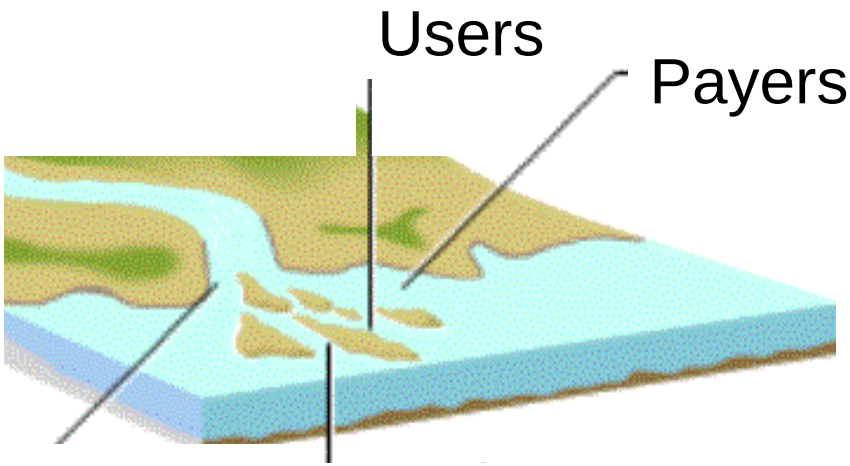
Order Facilitator

Infobutton

Calculator



Flowsheet


Users
Payers
IMPLEMENTERS
Performance
Measurers

BRIDGE-Wiz

Building Recommendations in a Developer's Guideline Editor

- Formalizes a process for writing implementable recommendations
- Incorporates prompts to improve guideline quality
- Controlled natural language
  - Offers verb choices based on action-type
  - Traps and disallows use of "consider"
  - Discourages "statement of fact"
- Requires systematic appraisal of evidence quality and benefit-harms
  - Suggests appropriate obligation term (deontic modal)
- Output includes a high-level "rule" and an evidence profile

Summary

Systematic and replicable process for formalization of guideline knowledge

- Markup guideline document into (ANSI standard) GEM
- Manipulate and display components with XSLT transforms
- (Does not require knowledge engineers at each step)

Upstream: facilitate development of “actionable” recommendations

http://GEM.med.yale.edu

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