

GLIF: a Language for Sharing and Executing Clinical Guidelines

Mor Peleg, Ph.D.

Post-doctoral Fellow, Stanford University, CA



InterMed

- A collaboration among researchers from medical informatics groups at **Stanford**, **Harvard**, and **Columbia**
- **11 participants**
 - S. Tu, M. Peleg, R. Greenes, A. Boxwala, Q. Zeng, O. Ogunyemi, E.H. Shortliffe, V. Patel, Dongwen Wang, J. Arocha, Timothy Branch



Goal: Development of a language and sets of tools for disseminating clinical guidelines across medical disciplines and settings

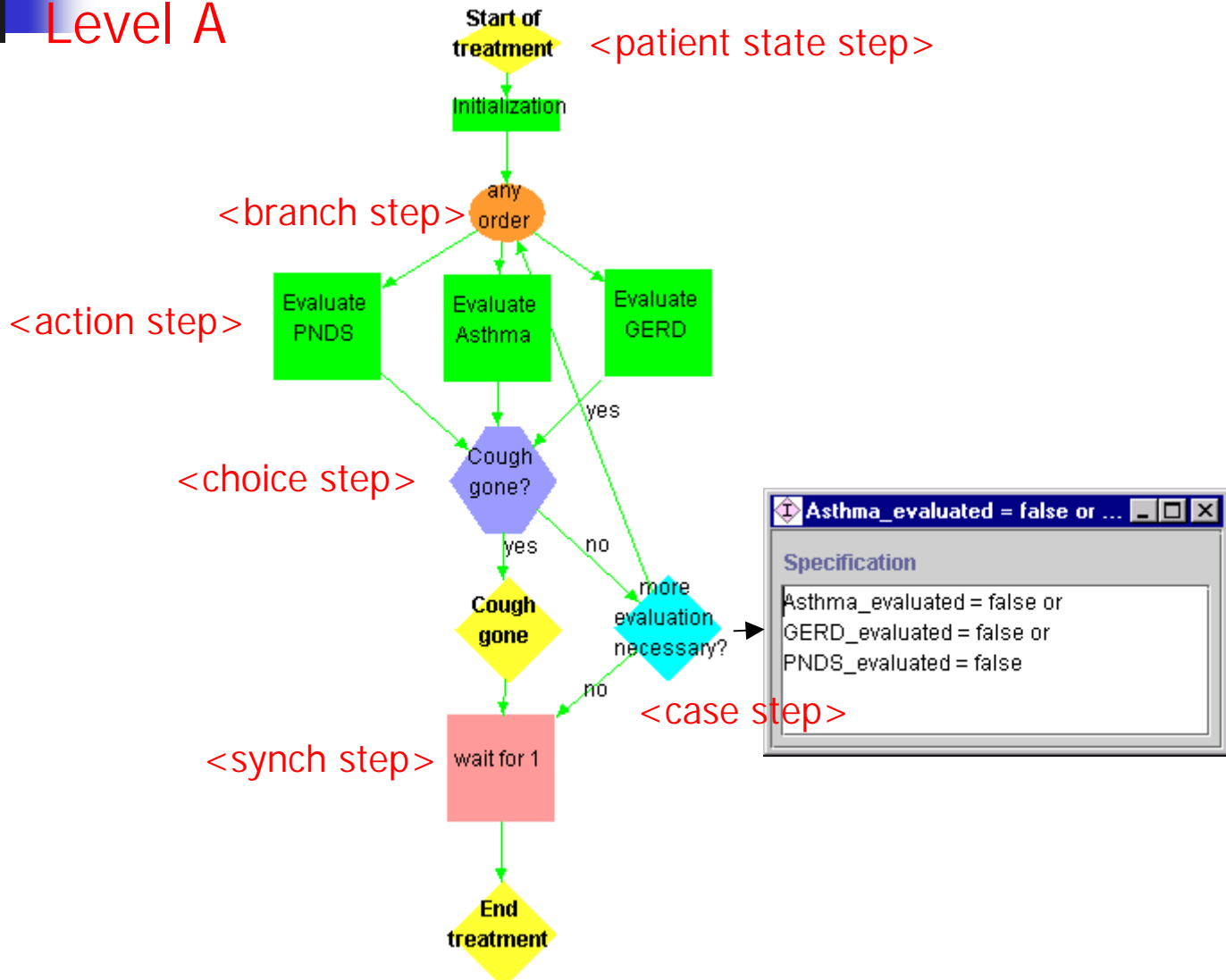


GuideLine Interchange Format (GLIF): Version 3

- Language that enables modeling and sharing of computerized guidelines
- Object-oriented model
- Guideline modelers create an **algorithm** (flowchart) of guideline steps and specify the values of the attributes of these steps
 - Action, Decision, Patient State, Branch, Synchronization
- **We developed tools for authoring guidelines in GLIF**
 - The authoring tools store the guideline models in RDF format

Example: treatment of cough

Level A



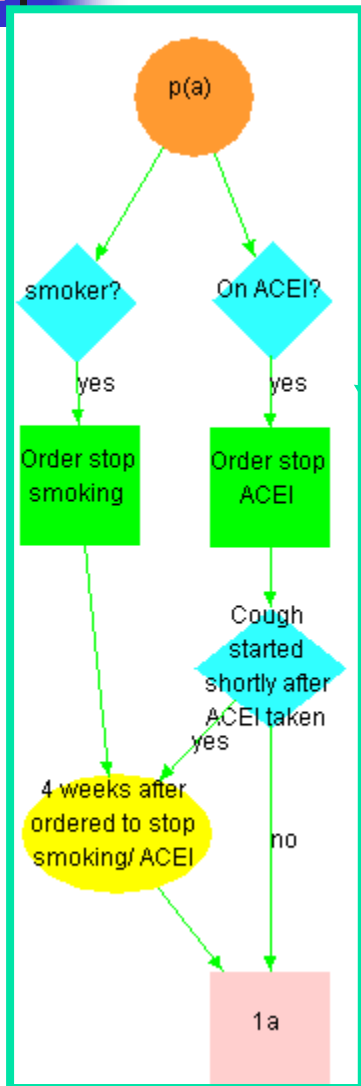


GLIF3 Process of Guideline Modeling

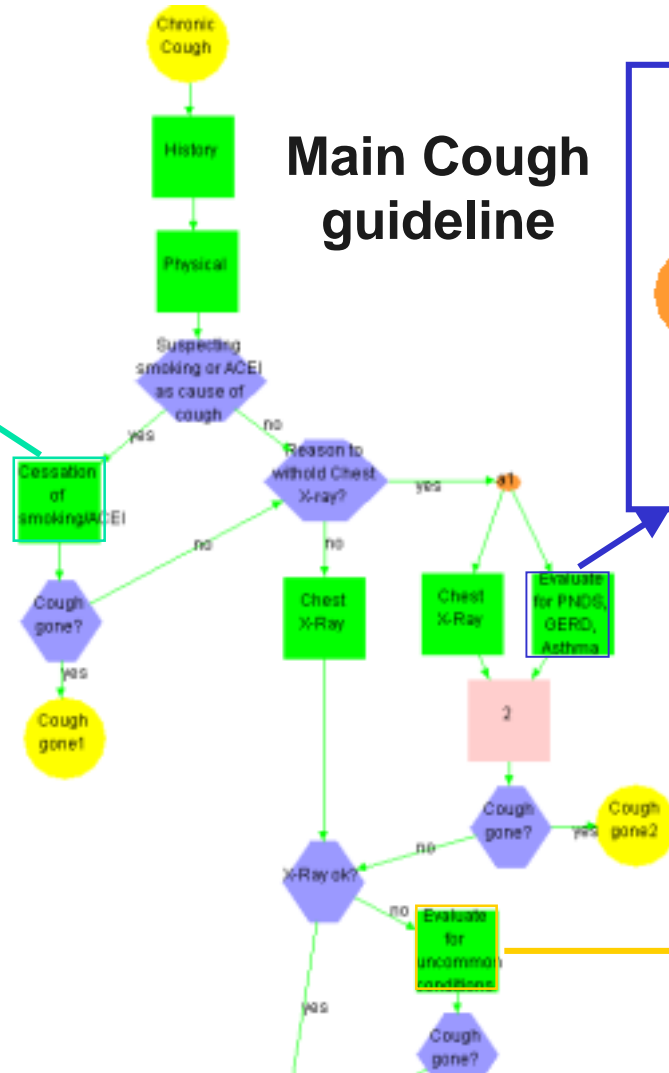
- **Level A: abstract flowchart**
 - Aids conceptualization
 - Used for navigation, browsing, documentation
- **Level B: computable representation**
 - Unambiguous syntax for logical expressions, patient data and medical concepts
 - Can be interpreted and analyzed for correctness (type, range and semantic checking)
- **Level C: Integration into application environments**
 - Mapping of data and procedures used by the GL model to EPR

M. Peleg et al., GLIF3: The evolution of a guideline representation format, Proc. AMIA 2000, 645-649

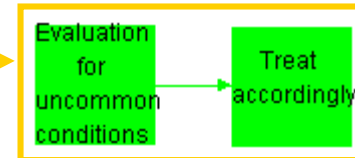
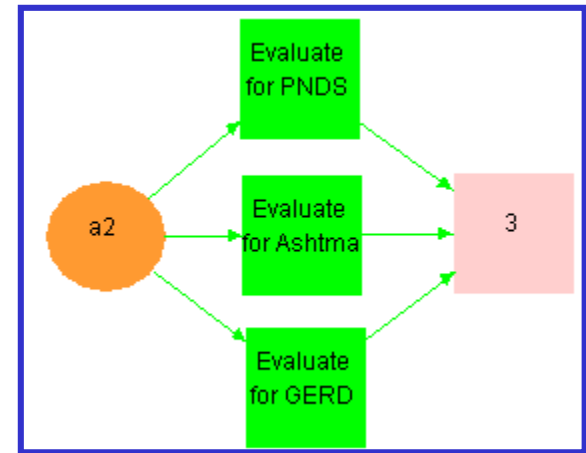
Nesting



September 2001



Main Cough guideline



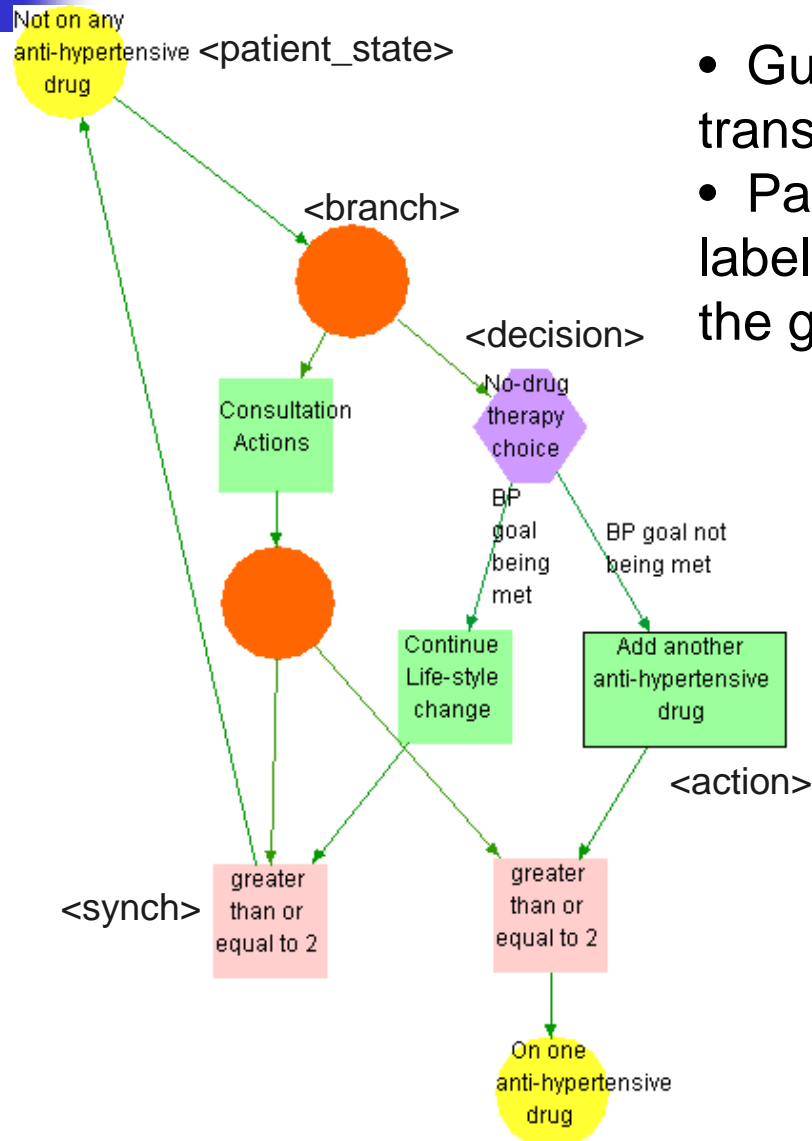
GLIF – Mor Peleg



...Complexity Management

- **Nesting** actions and decisions allows a top-down guideline representation
- Nesting also allows **reuse** of a (sub)guideline by several guidelines
- **Adaptation** of a guideline to a specific institution can be done by replacing an abstract action (goal) with a defined procedure

Patient State Steps



- Guidelines can be viewed as a state transition graph
- Patient-state steps serve both for labeling purposes and as entry points into the guideline

Choice Step

Level B

ACEI (RuleInChoice)

Name: ACEI

Strict Rule Out
proposedDrug is in contraindicatedDrugs or proposedDrug is in badDrugPartners

Strict Rule In
(not (proposedDrug is in contraindicatedDrugs)) and (proposedDrug is in compellingMe)

Rule In
proposedDrug is in relativeIndicatedDrugs

Rule Out
proposedDrug is in relatively ContraindicatedDrugs

Level A





Level B: Expression Language

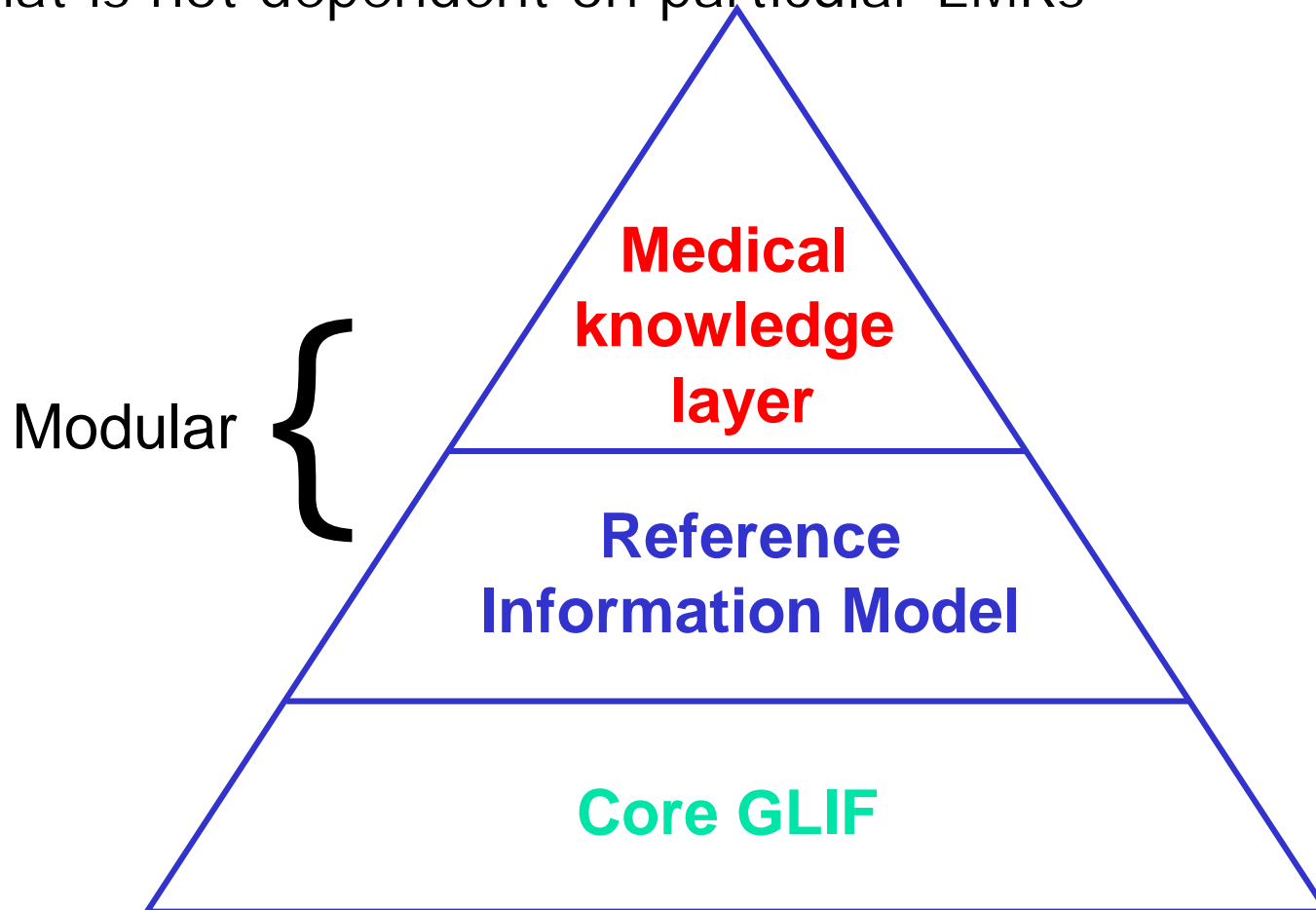
- **GLIF uses a formal expression language, based on Arden syntax logic grammar to represent decision criteria**
- **Arden syntax**
 - A language for creating and sharing E-C-A rules that represent single medical decisions (alerts, reminders)
 - A standard of ASTM and of HL7

“young non-smoker or pregnant woman”

**((Age > 18 year) and smokingEndTime < now)) or
(pregnancyDueDate > now)**

Level B: Data Model for Medical Data

Idea: representing medical data abstractly, in a way that is not dependent on particular EMRs





- **Core GLIF defines:**

- GL modelers can define data items, concepts and concept-R
 - Based on standard medical vocabularies and data models
 - Define novel concepts and data classes

Chest X-Ray (Literal_Data_It...

Name
Chest X-Ray

Concept
Chest X-Ray

Data Model Class Id
Procedure

Data Model Source Id
HL7-RIM

Data Value
Chest X-Ray

Chest X-Ray (Concept)

Concept Name
Chest X-Ray

Concept Id
C0202783

Concept Source
UMLS



Concepts and Relationships

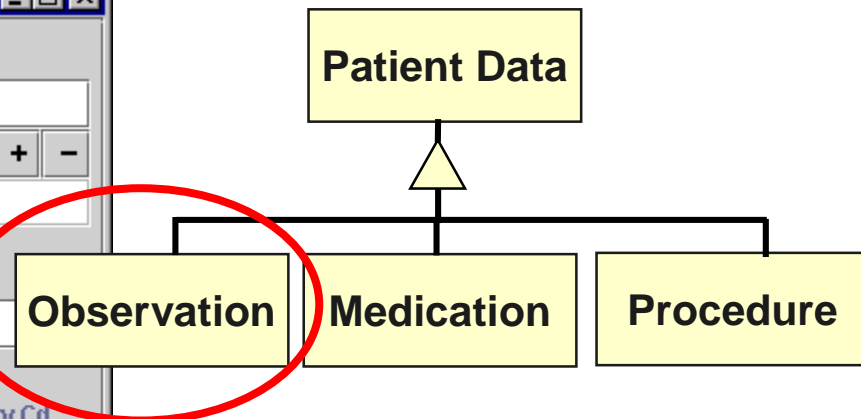
Concept
concept_name: ACEI Concept_code: 0013764 Vocabulary_code: UMLs

Concept_Relationship
concept_from: ACEI-concept relationship_type: is-contraindicated-by concept_to: Pregnancy-concept

Reference Information Model

KB_9090_00002 (instance of Observation)

Service Cd	V C + -	Id	
LDL Cholesterol			
Mood Cd		Method Cd	V C + -
event		12 h, fast	
Critical Time	V C + -	Severity	Certainty
(06-06-2000, 06-06-2000)			
Activity Time	V C + -	Status Cd	Confidentiality Cd
		completed	
Recording Time	V C + -	Body Site Cd	V C + -
06-06-2000:21:00			
Critical Duration	V C + -	Interpretation Cd	V C -
		normal	
Value	V C + -		
80 mg/dL			
Normal Range	V C + -		
< 130 mg/dL			
Derivation Expression			



- High-level classification of medical concepts
- Attributes



Medical Knowledge Layer



- **Still under development**
- **Will contain interfaces to:**
 - Controlled vocabularies
 - Medical knowledge bases
 - EMR systems
- **Will be specified in terms of the methods for interfacing with these knowledge sources**



Criteria Reference Patient Data

**current_pH_monitoring := SelectAttribute("value",
latest pH_Monitoring where time of it >= now);**

**pH_Monitoring_Time := SelectAttribute("recording_time",
current_pH_Monitoring);**

pH_Monitoring_Time < (now – 4 weeks)



More GLIF3 Features

- **A hierarchy of action specifications (tasks done within an action step)**
 - Medically related tasks (e.g., lab test order) that refer to concepts from the domain ontology
 - Implementation related tasks (e.g., message sending, assigning values to variables)
- **Formally specifying iterations**
- **Specifying events that can trigger action and decision steps, and exceptions that pass the control flow to exception handling guideline step**
 - e.g., if the patient is experiencing an allergic reaction or toxicity, then the current treatment plan is dropped



Summary

- **GLIF3 is a language designed to allow modeling and sharing of clinical guidelines among institutions and computer-based applications**
- **GLIF3 enables encoding of the logic of guidelines in a way that is computable**
 - Highly structured specification
 - Formal expression syntax
 - Data model for medical data and concepts
- **GLIF3 supports local adaptation of guidelines from shared resources**
- **We encoded 11 guidelines in GLIF3**



Future Research

- **Execution engine**
 - How to deal with missing and uncertain data?
- **Validation tools**
 - ✓ Compiler for expression language
 - Constraint satisfaction
- **Integration of a guideline into a hospital Info System**
- **Guideline Server**



Links and Contact Info

Mor Peleg

Stanford Medical Informatics

Stanford University

peleg@smi.stanford.edu

GLIF page:

<http://www.GLIF.org>

Stanford InterMed Page:

<http://smi.stanford.edu/projects/intermed-web/>