



"A collaborative project to
develop a universal framework for
encoding and disseminating electronic clinical guidelines"

The SAGE Project

Standards-Based Sharable Active Guideline Environment



"A collaborative project to develop a universal framework for sharing health knowledge in the form of computable clinical practice guidelines"

NHII Educational Seminar Series
March 25, 2004
Washington, DC

The SAGE Project

Standards-Based Sharable Active Guideline Environment



Nick Beard, MD

Vice President, Health Informatics

IDX Systems, Seattle

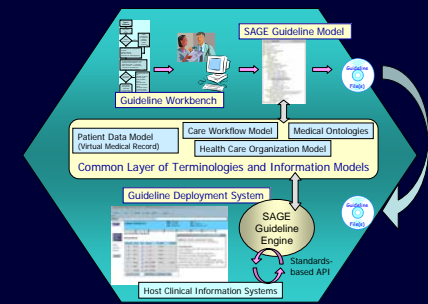
Nick_Beard@idx.com

Agenda for Today's Briefing

I. SAGE: A Partnership in Innovation

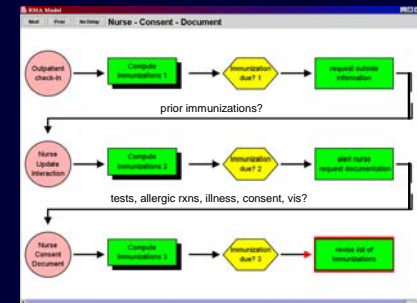
A multi-faceted overview of the vision, objectives, and collaborative approach of the SAGE project

Overview of the SAGE Infrastructure



II. SAGE Technology in Action

A walk-through illustration of working SAGE prototypes – from guideline encoding to execution of guideline content via functions of a clinical information system



III. SAGE: Looking Forward

An overview of project futures and implications for delivery of health care

The SAGE Guideline Lifecycle

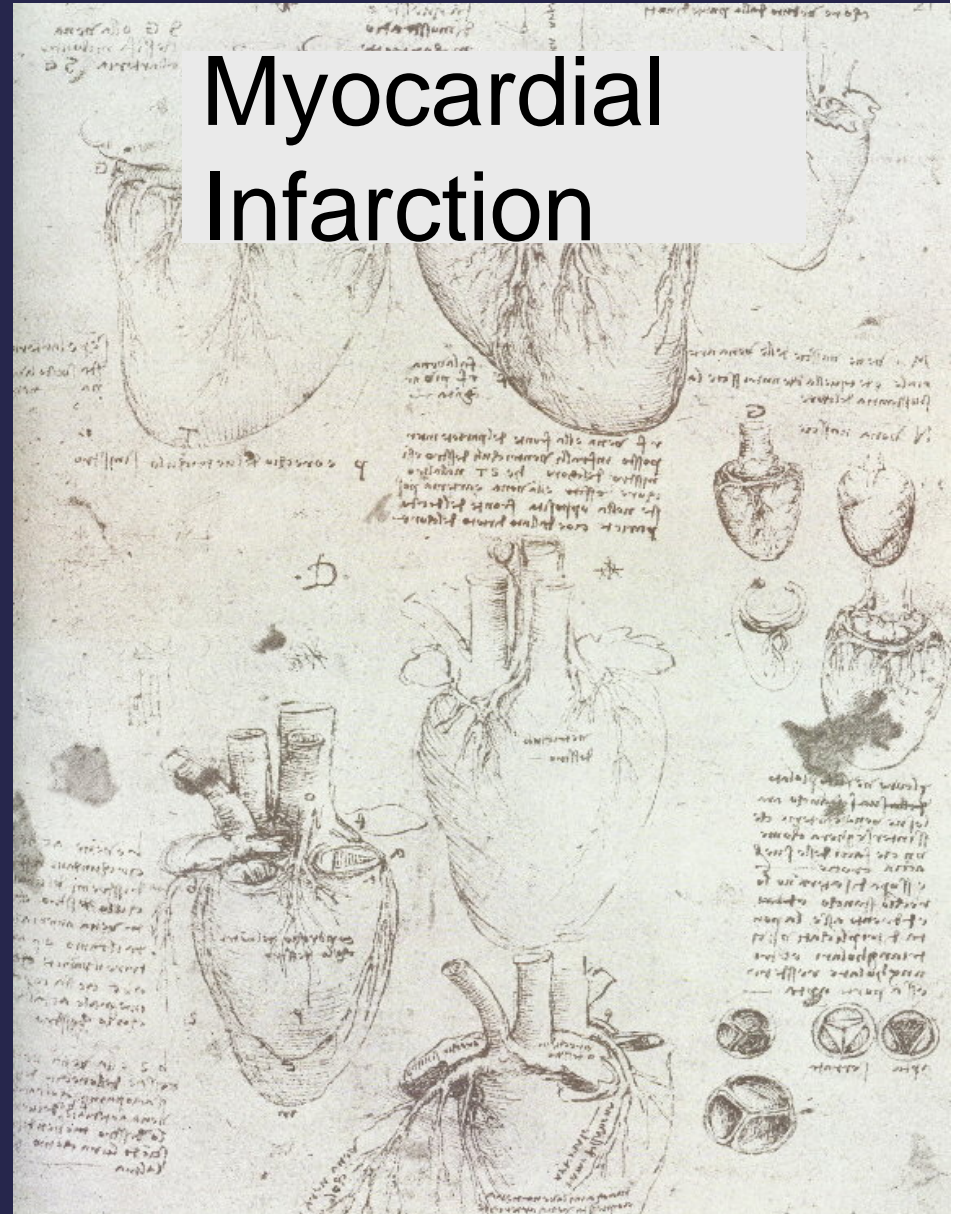


A knowledge-processing problem

“Current medical practice relies heavily on the unaided mind to **recall** a great amount of detailed knowledge – a process which, to the detriment of all stakeholders, has repeatedly been shown unreliable”

Crane and Raymond
The Permanente Journal
Winter 2003 Volume 7 No.1
Kaiser Permanente Institute for Health Policy

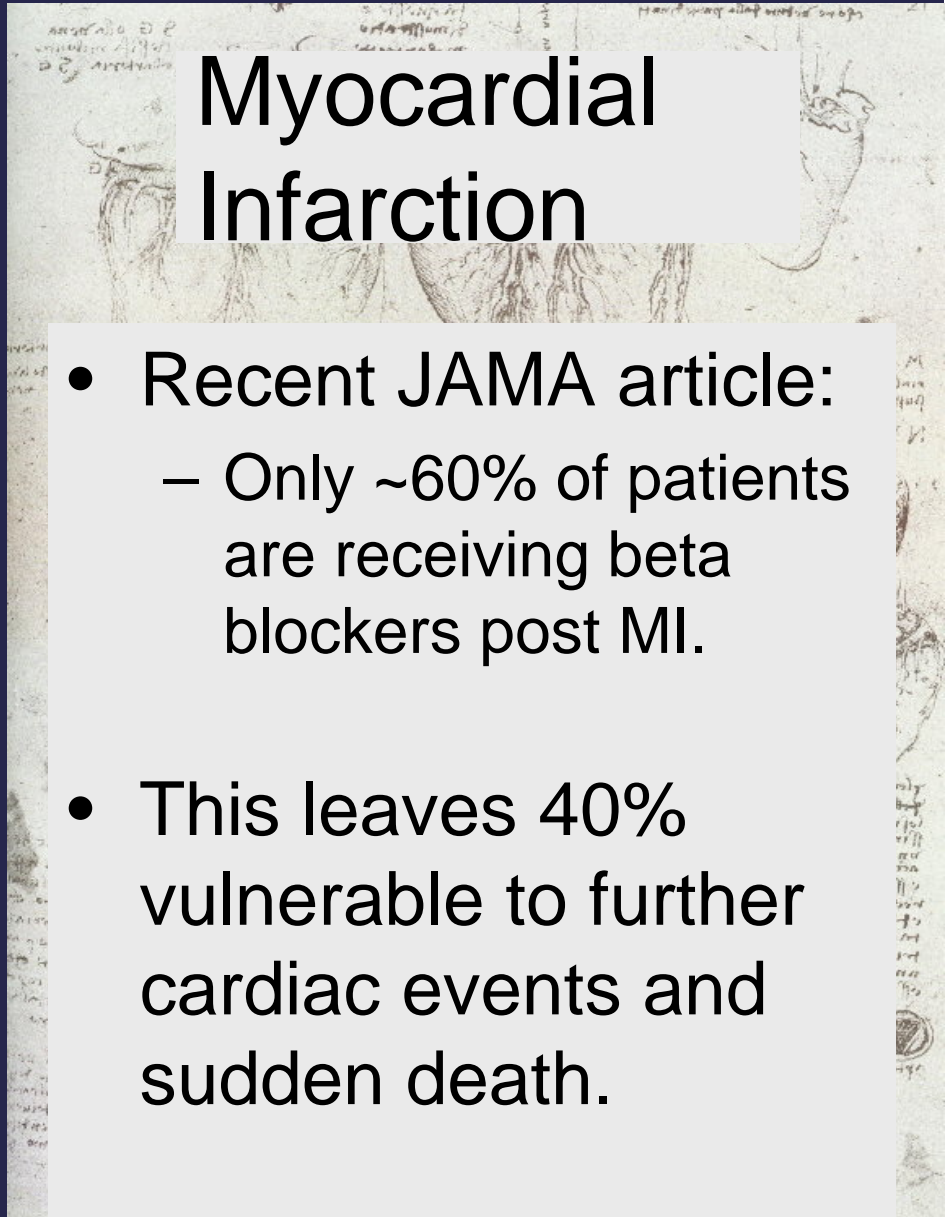
Myocardial Infarction



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Myocardial Infarction

- Recent JAMA article:
 - Only ~60% of patients are receiving beta blockers post MI.
- This leaves 40% vulnerable to further cardiac events and sudden death.

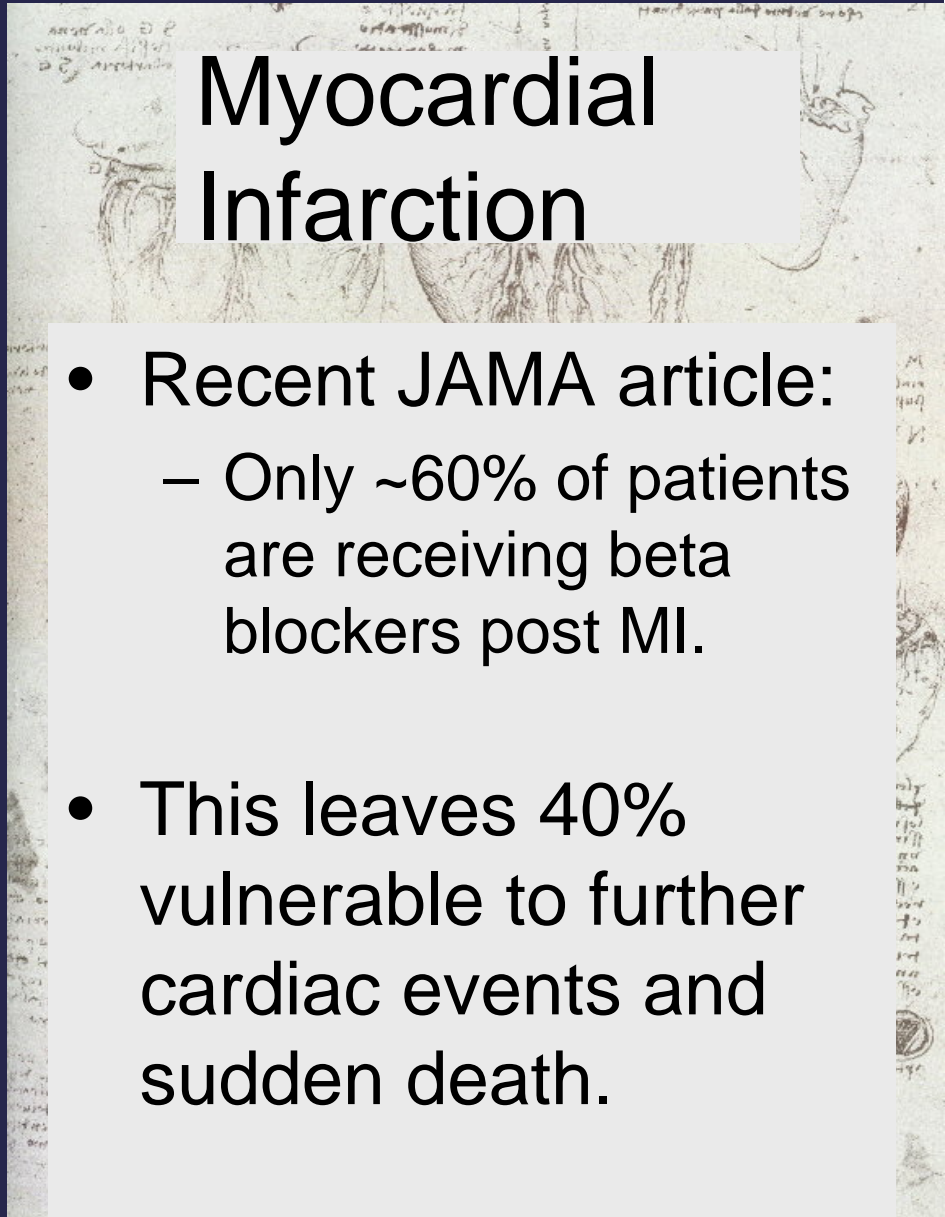
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Not just recall:

- Analysis
- Processing
- Application of knowledge to each patient



Myocardial Infarction

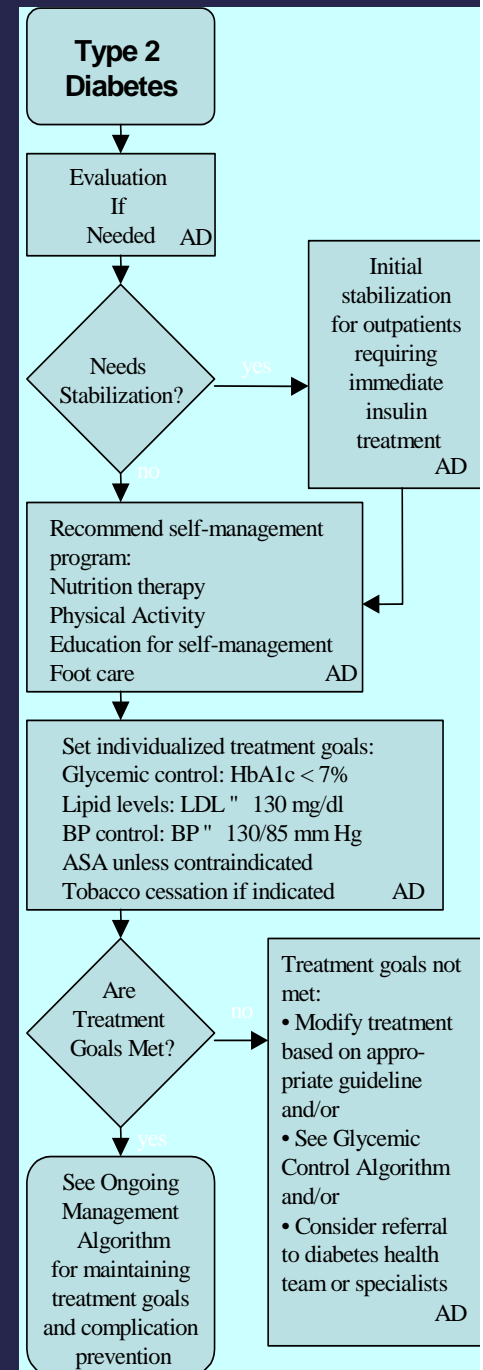
- Recent JAMA article:
 - Only ~60% of patients are receiving beta blockers post MI.
- This leaves 40% vulnerable to further cardiac events and sudden death.

What if . . . ?

Guideline content became active, offering targeted, relevant guidance at the point of care?

Patients were evaluated against proven guidelines - *automatically*?

Key data were presented at critical decision points - *automatically*?





NATIONAL HEALTH INFORMATION INFRASTRUCTURE 2003

DEVELOPING A NATIONAL ACTION AGENDA FOR NHII

JUNE 30—JULY 2, 2003 • WASHINGTON, DC

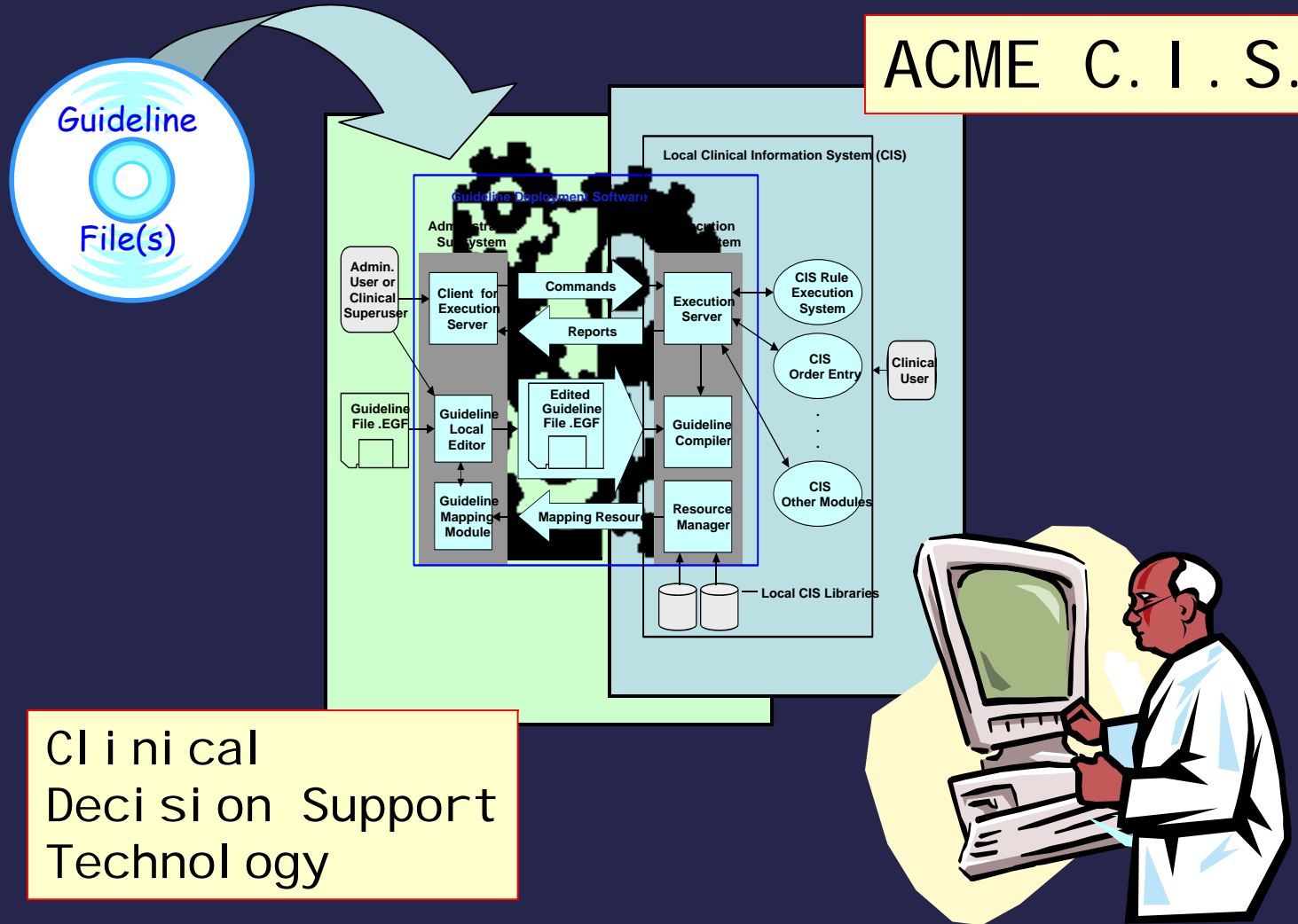
Sponsored by the Department of Health and Human Services (DHHS), the purpose of the conference was to develop a consensus for a national action agenda to guide the further development of NHII.

Safety and Quality Track Recommendation:

“Create central resources and processes that serve as a library of nationally vetted clinical guidelines and knowledge sources in standardized executable format using a standard guideline authoring tool consistent with the needs of patient safety and quality.”

The SAGE Project

Standards-Based Sharable Active Guideline Environment



Project Overview

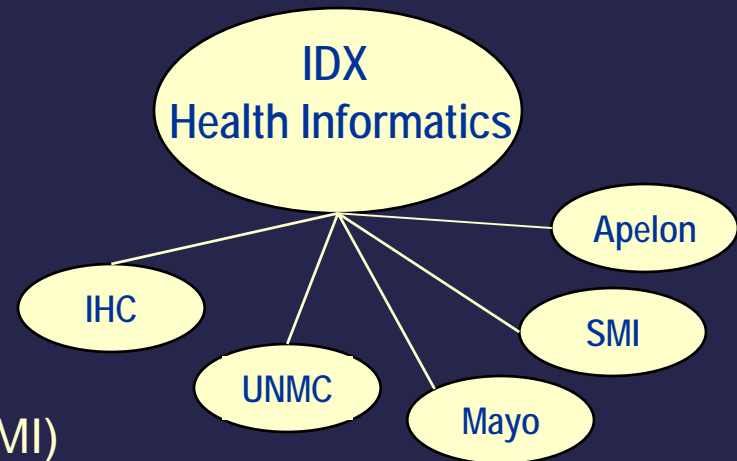
Standards-based **S**harable **A**ctive **G**uideline **E**nvironment

- An R&D consortium to develop the technology infrastructure to enable computable clinical guidelines, that will be shareable and interoperable across multiple clinical information system platforms

- Scope: 3 year, \$18 M, multi-site, collaborative project

- Partners in the project are:

- IDX Systems Inc.
- Apelon, Inc.
- Intermountain Healthcare (IHC)
- Mayo Clinic
- Stanford Medical Informatics (SMI)
- University of Nebraska Medical Center (UNMC)

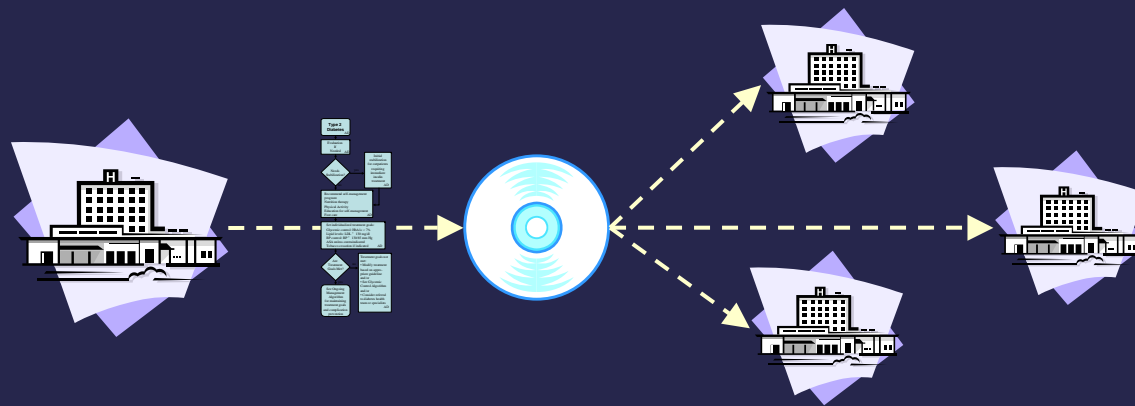


- Funded in part by: NIST Advanced Technology Program

SAGE Project Goals

The primary goal: Develop a Standards-Based Sharable Active Guideline Environment with which:

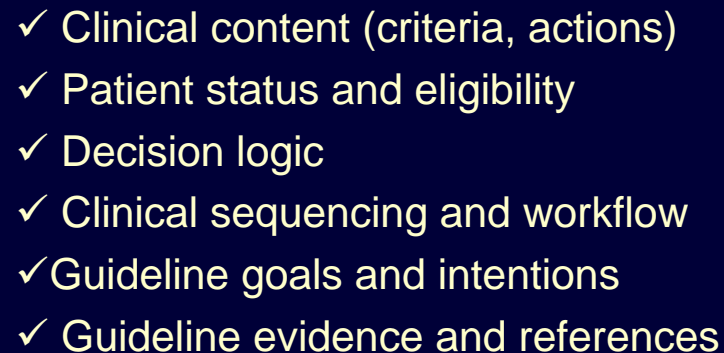
- Health experts can author and encode clinical practice guidelines in a standard computable format, and
- Health care organizations throughout the nation can deploy those guidelines easily within any standards-conforming clinical information system.



SAGE Main deliverables

- **An interoperable guideline model** – A computable knowledge representation “format” for encoding the content and logic of executable clinical practice guidelines.
- **A guideline workbench** – A software tool for authoring, encoding, and maintaining guidelines in the format of the SAGE guideline model.
- **A guideline deployment system** – Software that “decodes” the content of electronic guidelines and surfaces that content via functions of the local clinical information system.
- **Controlled resources** -- Specification of a common layer of information models and terminologies to mediate guideline content.

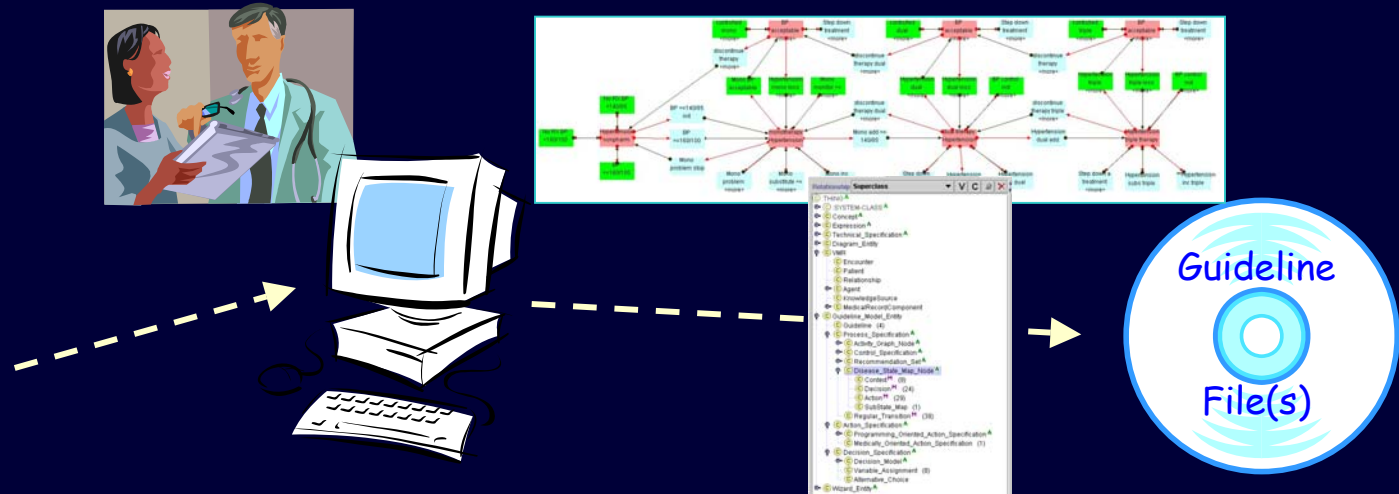
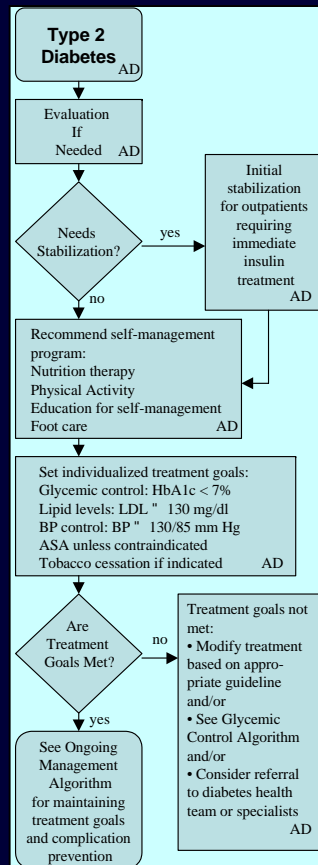
A standard computable “specification” for representing and encoding the content and logic of clinical practice guidelines



Type 2 Diabetes Guideline Flow Diagram, courtesy of
Institute for Clinical Systems Improvement (ICSI)

Interoperable Guideline Workbench

A software tool for authoring, editing, encoding, and maintaining guidelines in the format of the Guideline Model

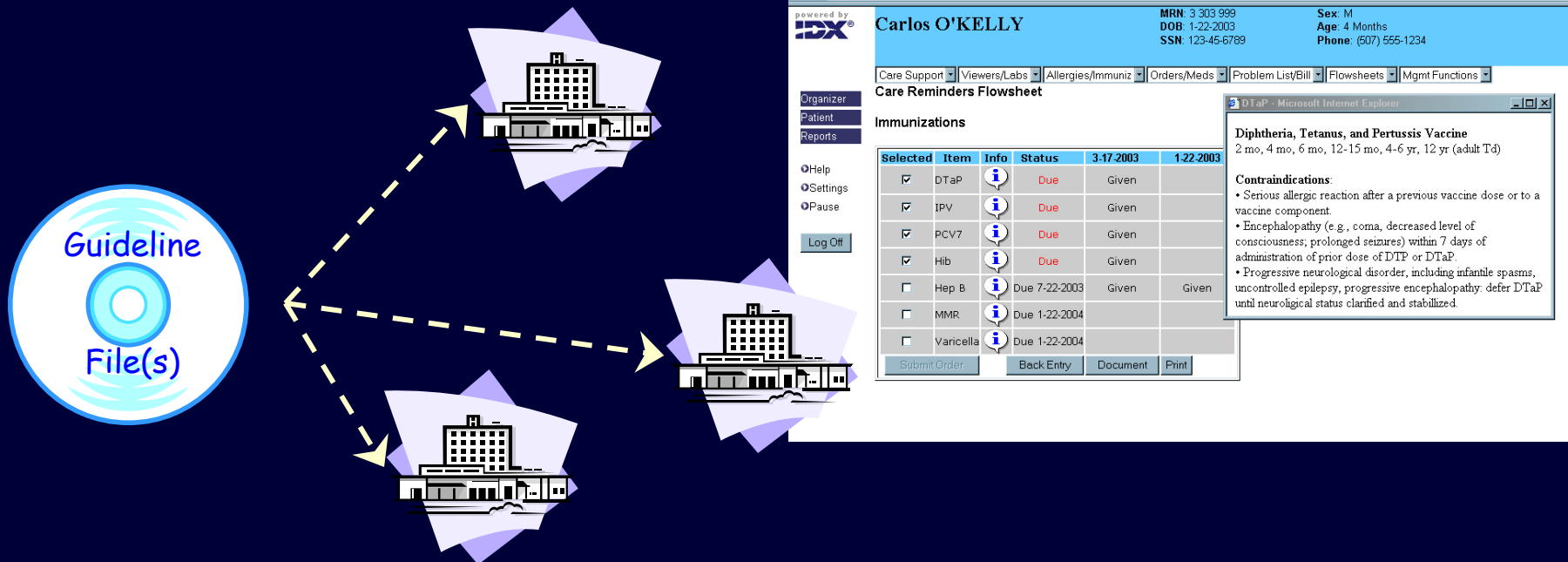


- ✓ Ensure complete **encoding** of guideline knowledge
- ✓ Support access to guideline content model
- ✓ Support access to controlled terminologies
- ✓ Support for visualization of guideline logic

Guideline Deployment System

Software that integrates electronic guidelines with the clinical information system to operationalize the guideline for clinicians

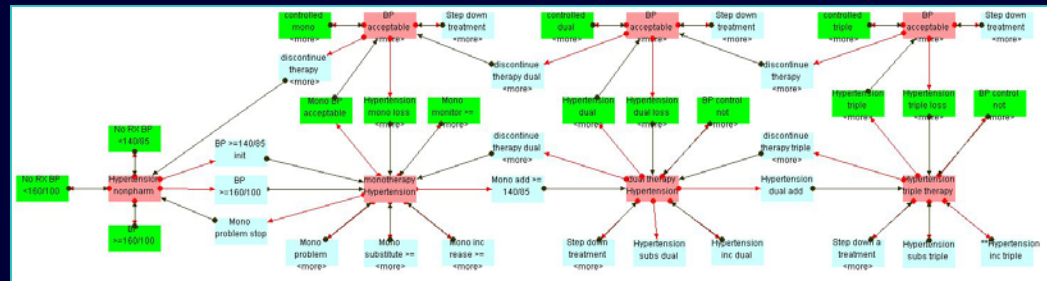
- ✓ Administer: Download, import, store
- ✓ Localize: Clinical edits, local constraints
- ✓ Set Up: Mapping to local terminologies and EMR
- ✓ Execute: Activation of guideline via CIS workflow



Specification of Standards

A common “layer” of terminology and information models that mediates guideline encoding and execution.

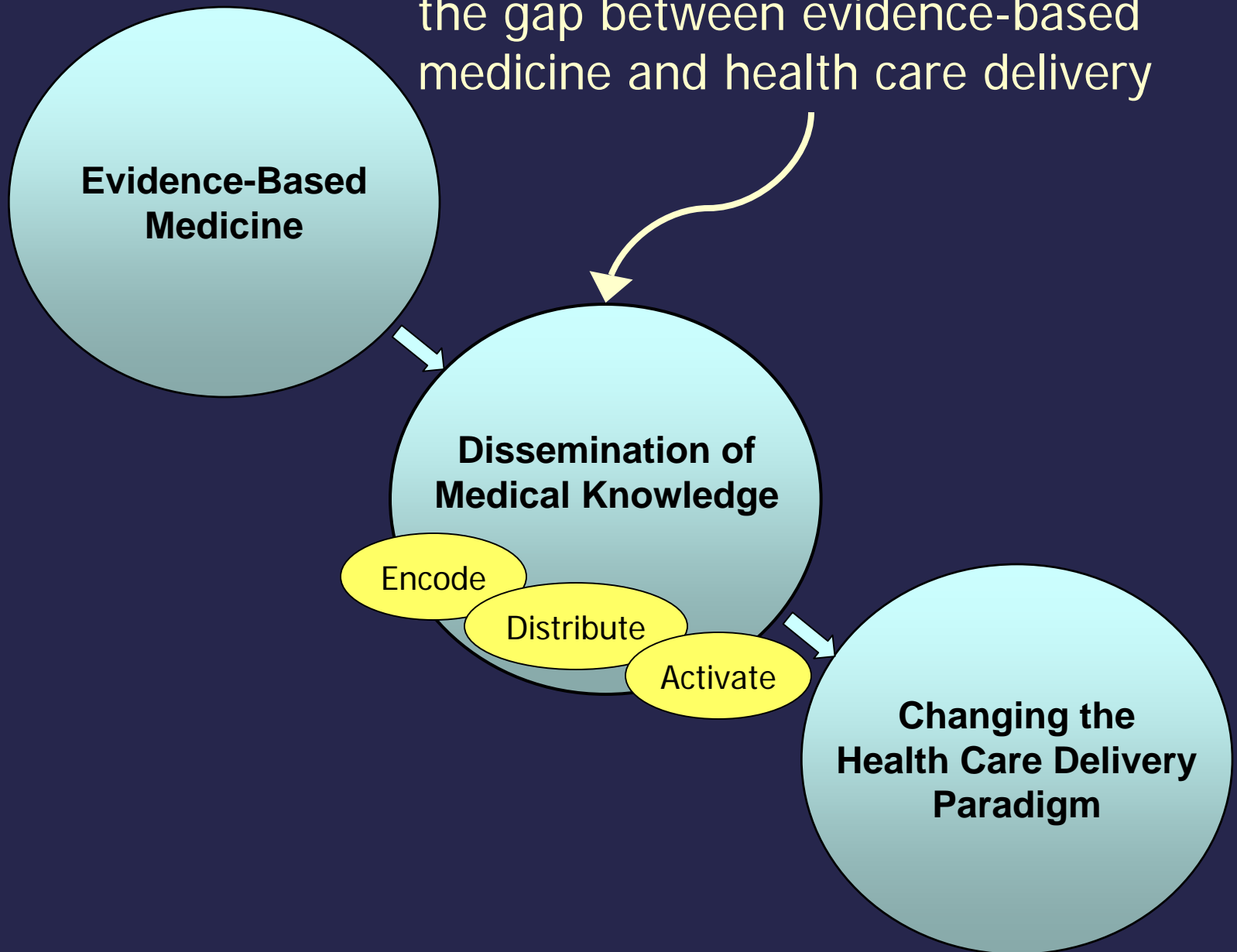
- ✓ Adoption of standard terminologies (e.g., LOINC, SNOMED CT)
- ✓ Specification of standard information models (e.g., for patient data).
- ✓ Specification of a standard for guideline knowledge representation.
- ✓ Employment of a standard expression language for guideline logic.



The SAGE Project

Standards-Based Sharable Active Guideline Environment

The SAGE Project is about bridging the gap between evidence-based medicine and health care delivery





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Key Problems to Solve:

Functionality

- Represent guideline knowledge in a manner that is both comprehensive and computable.
- Manage complexity during encoding and deployment.
- Activate guideline content via functions of clinical information systems.

Interoperability

- Deploy encoded guideline content widely.
- Semantic interoperability – sharing usable knowledge.
- Install and “map” guideline content at reasonable costs.
- Execute guideline content in multiple HIS environments.

A Key Technical Consideration:

Active Deployment of Guideline Content

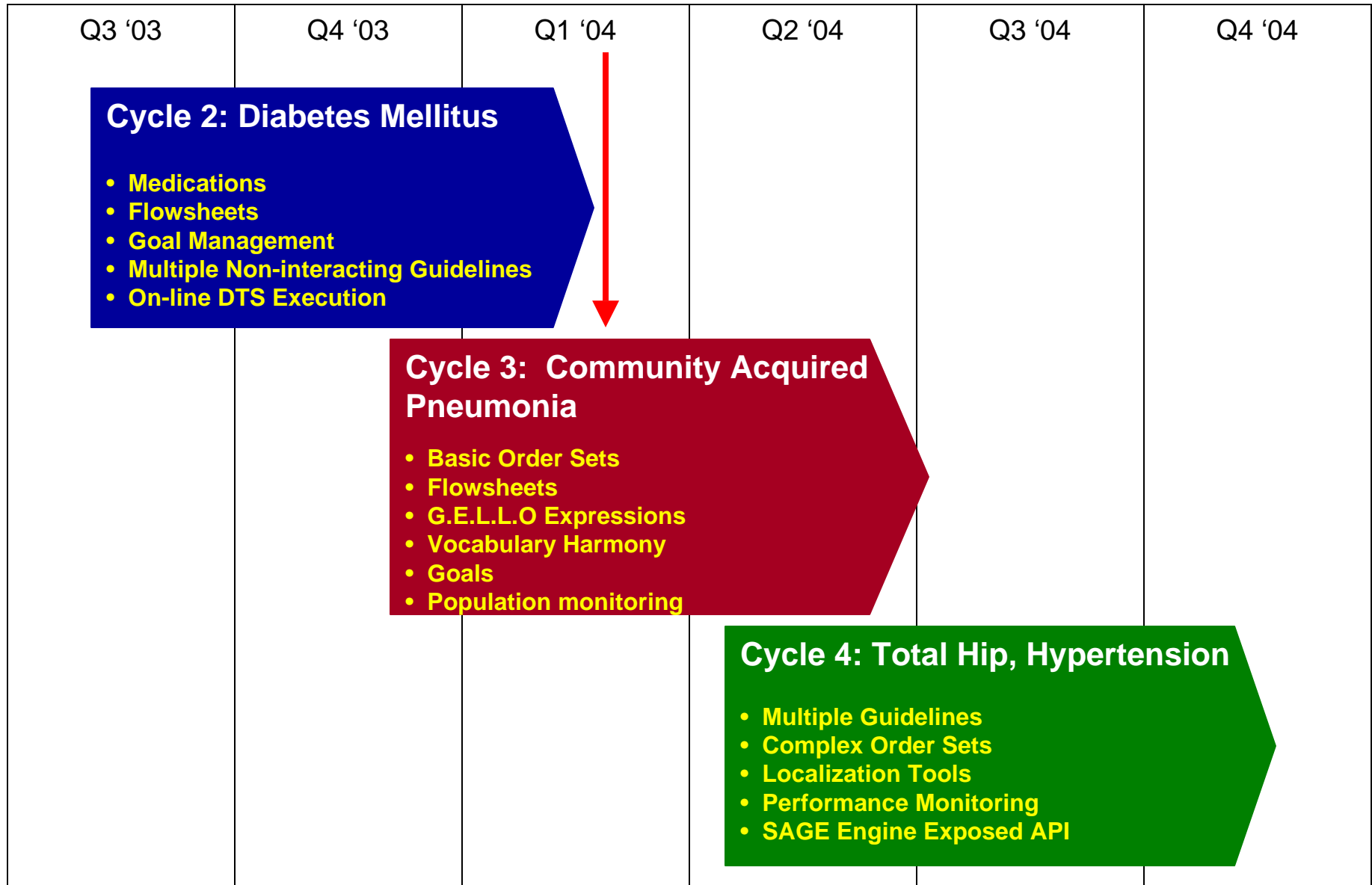
- Active use of patient EMR data by clinical decision support.
- Patient-specific recommendations.
- Integrate recommendations with care workflow.

SAGE Project Approach:

- Build on an invaluable foundation of previous work.
- Alignment with national health information standards.
- Organization into cross-partner work teams.
- Iterative prototyping / development cycles

SAGE Iterative Development

Cycle Scope and Objectives for Cycles 2 through 4

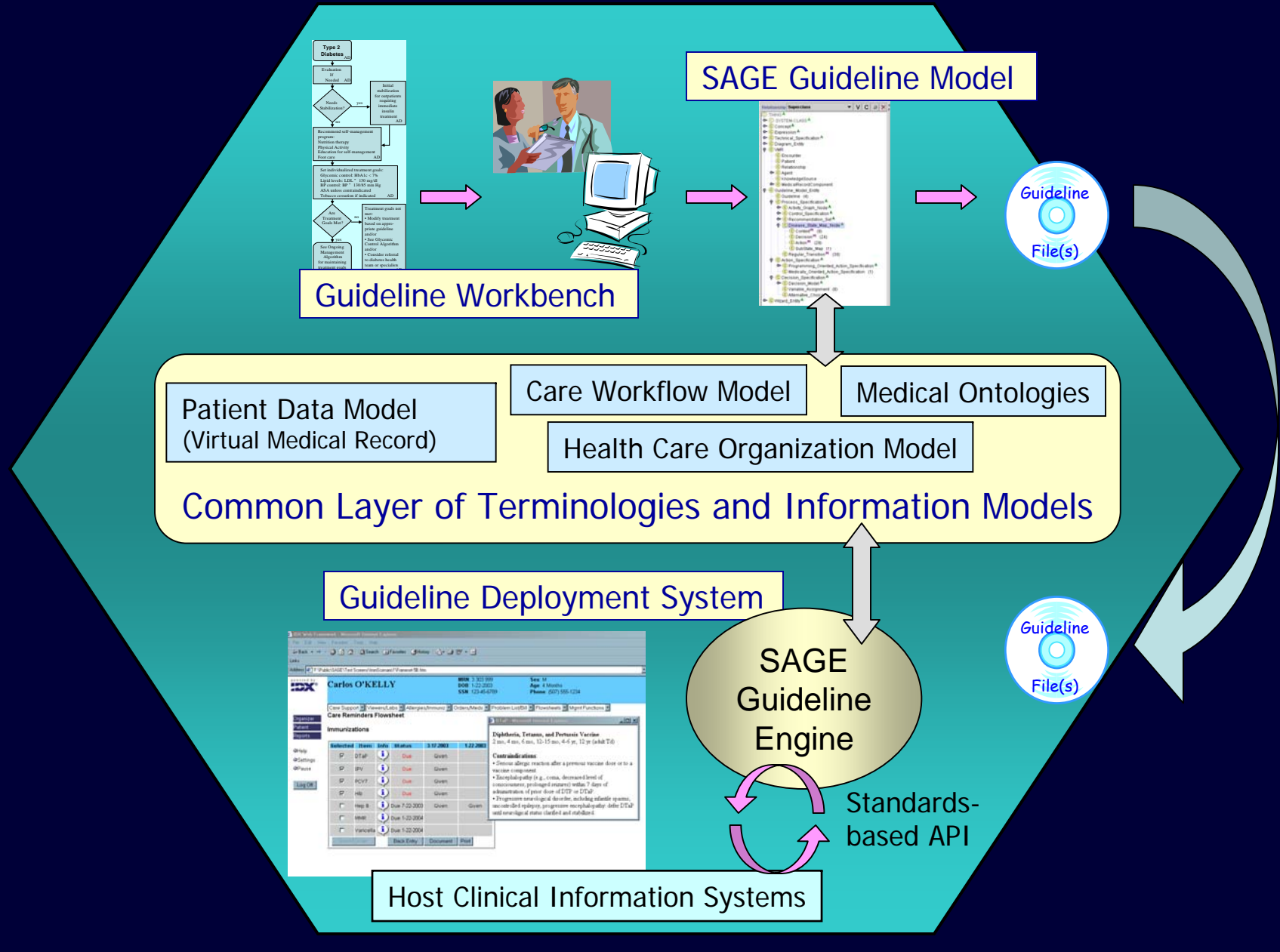


SAGE Exemplar Guidelines

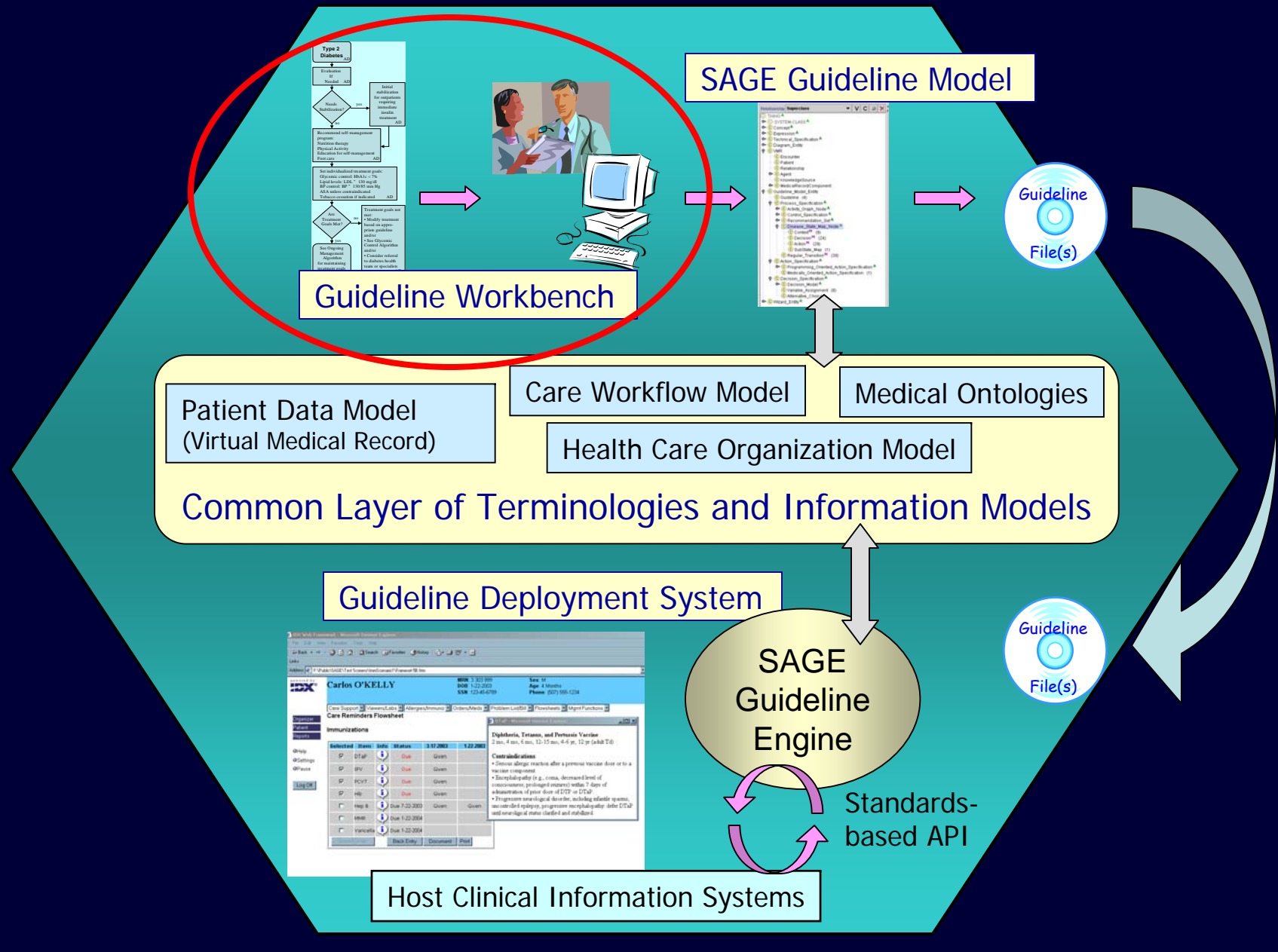
Guideline	Clinical Domain
Immunizations	Routine health maintenance, in both outpatient and inpatient settings.
Diabetes Management	Chronic disease monitoring and treatment. Acute exacerbation of chronic disease. Chronic disease as a comorbidity.
Community Acquired Pneumonia	Emergency room evaluation and diagnosis. Outpatient treatment of acute disease. Inpatient and ICU treatment of acute disease. Follow-up of acute disease.
Total Joint Replacement	Surgical guideline. Comprehensive pre-op workup, inpatient plan of care, and post-op outpatient management.



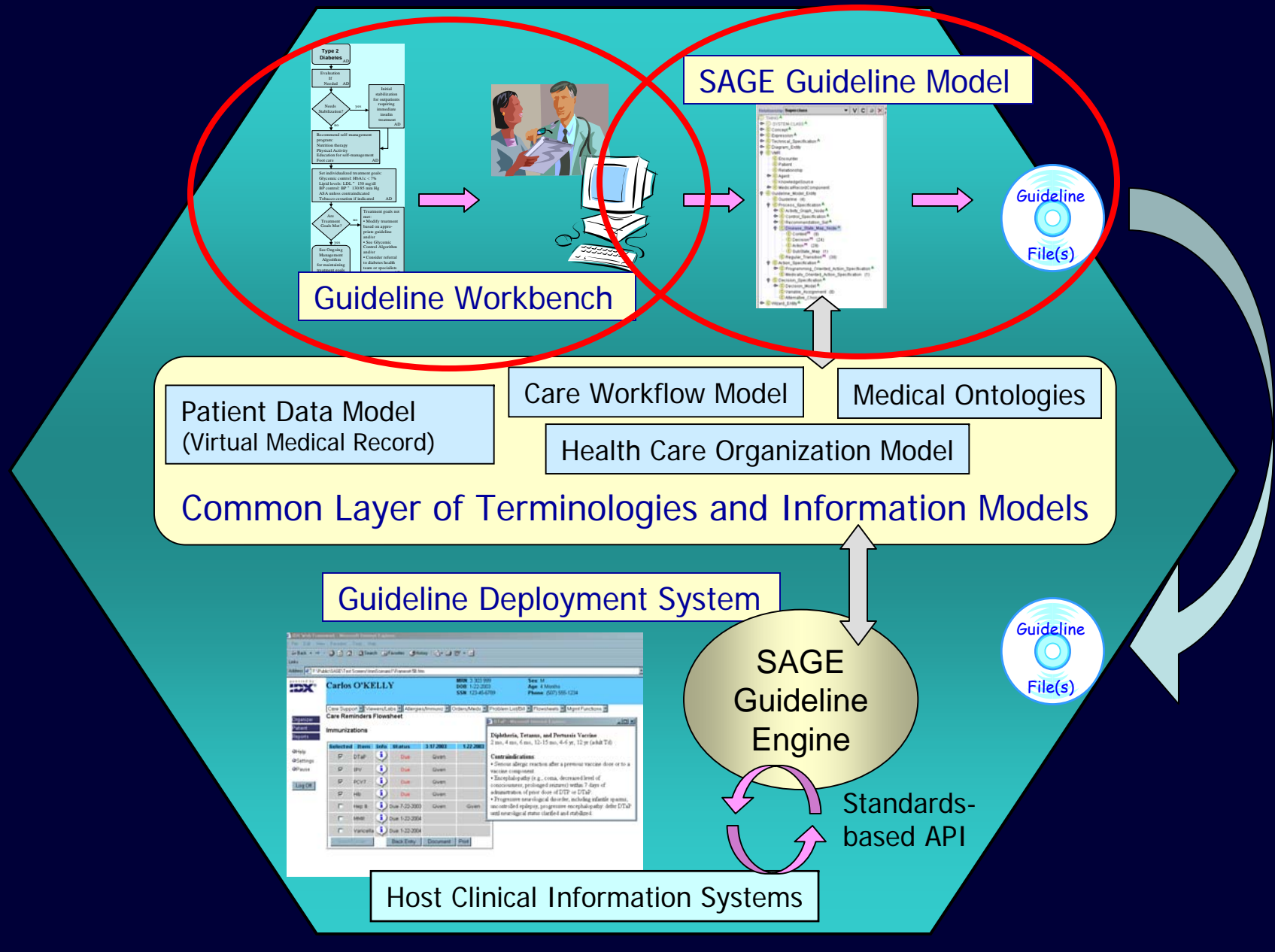
Overview of the SAGE Infrastructure



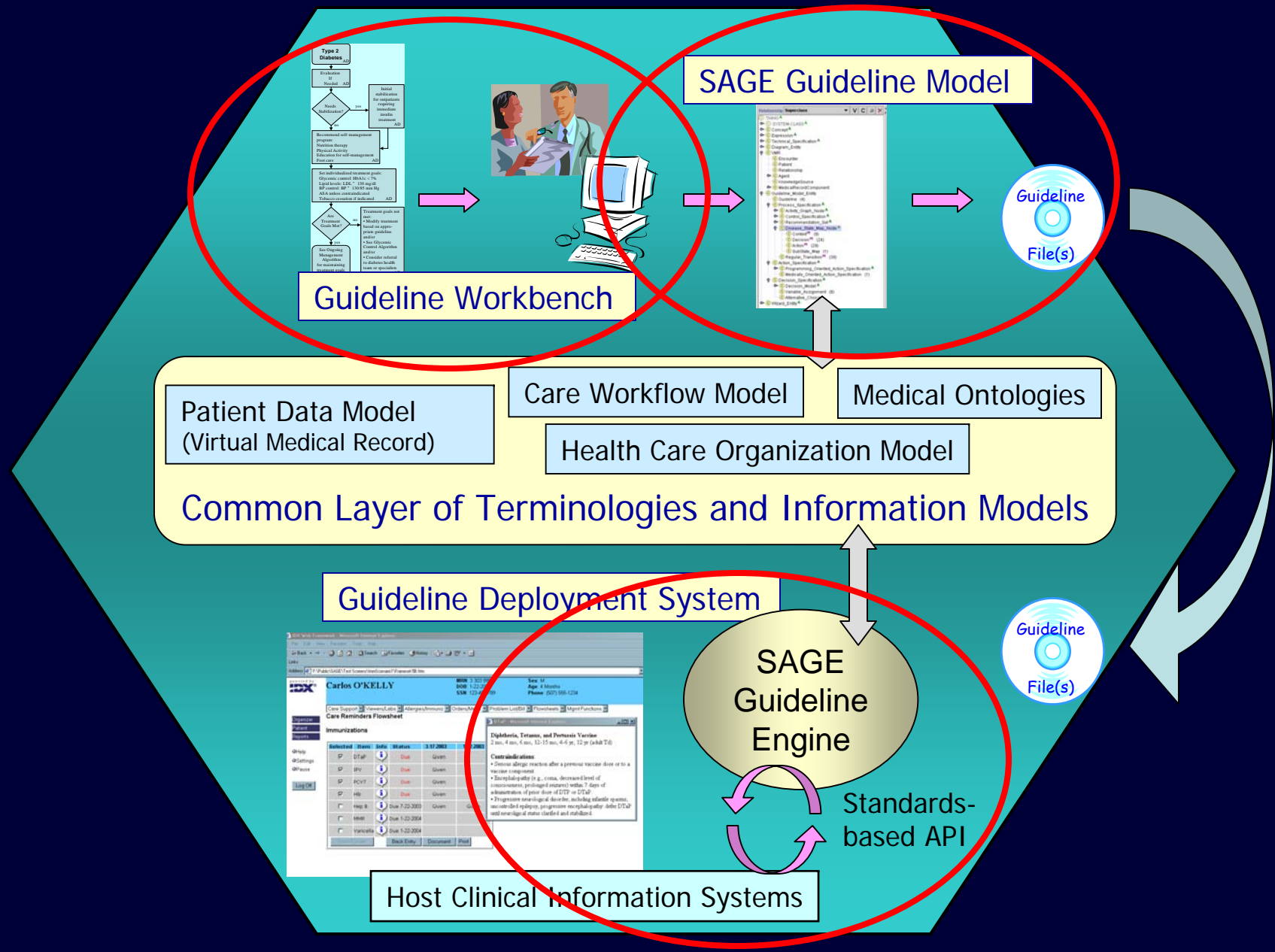
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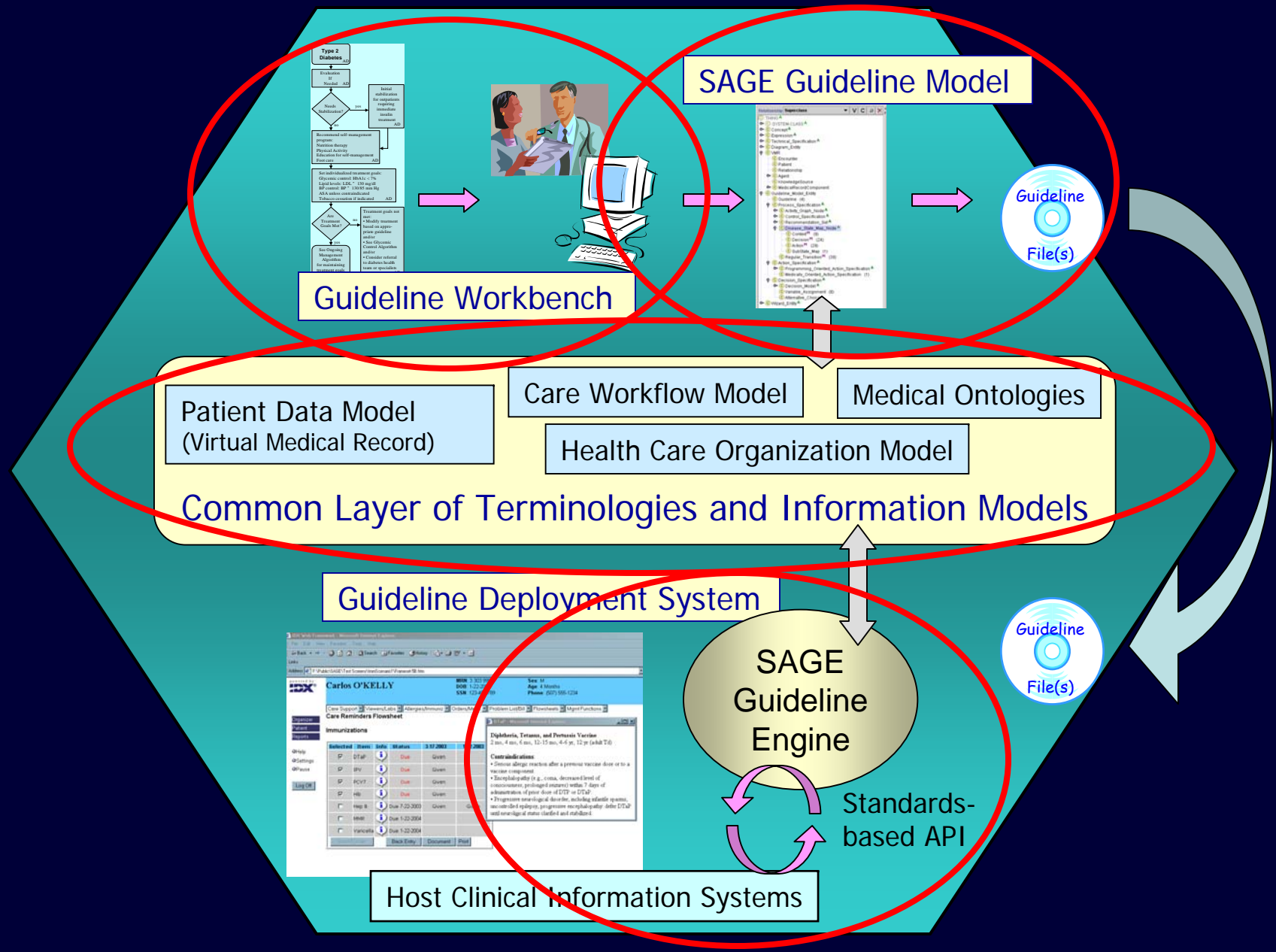
Overview of the SAGE Infrastructure



Overview of the SAGE Infrastructure



Overview of the SAGE Infrastructure



“Activating Guideline Content”

Guideline recommendations integrated into a nurse care flowsheet

- View suggested orders
- Process suggested orders

IDX Web Framework - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites History

Links

Address F:\Public\SAGE\Test Screens\ImmScenario1\Frameset-5B.htm

powered by **IDX**

Carlos O'KELLY

MRN: 3 303 999 DOB: 1-22-2003 SSN: 123-45-6789 Sex: M Age: 4 Months Phone: (507) 555-1234

Care Support Viewers/Labs Allergies/Immuniz Orders/Meds Problem List/Bill Flowsheets Mgmt Functions

Care Reminders Flowsheet

Immunizations

Selected	Item	Info	Status	3-17-2003	1-22-2003
<input checked="" type="checkbox"/>	DTaP		Due	Given	
<input checked="" type="checkbox"/>	IPV		Due	Given	
<input checked="" type="checkbox"/>	PCV7		Due	Given	
<input checked="" type="checkbox"/>	Hib		Due	Given	
<input type="checkbox"/>	Hep B		Due 7-22-2003	Given	Given
<input type="checkbox"/>	MMR		Due 1-22-2004		
<input type="checkbox"/>	Varicella		Due 1-22-2004		

Submit Order Back Entry Document Print

DTaP - Microsoft Internet Explorer

Diphtheria, Tetanus, and Pertussis Vaccine
2 mo, 4 mo, 6 mo, 12-15 mo, 4-6 yr, 12 yr (adult Td)

Contraindications:

- Serious allergic reaction after a previous vaccine dose or to a vaccine component.
- Encephalopathy (e.g., coma, decreased level of consciousness; prolonged seizures) within 7 days of administration of prior dose of DTP or DTaP.
- Progressive neurological disorder, including infantile spasms, uncontrolled epilepsy, progressive encephalopathy: defer DTaP until neurological status clarified and stabilized.

Real time access to reference information

Guideline Modeling Overview

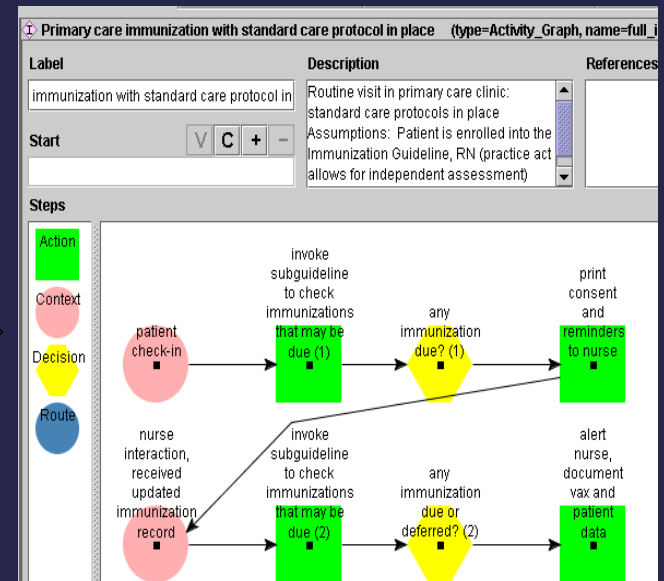
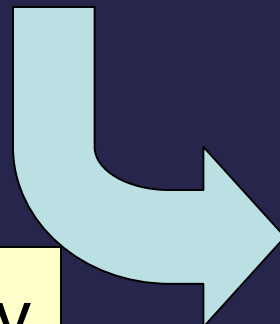
- Scenario-driven modeling
 - Clinical scenario: Patient arrives for visit with primary physician. At check-in, SAGE checks for immunizations that are due and prints consents and information sheets. Nurse then reviews any other shots received, updates the record, and records immunizations given that day in CareCast

Guideline Modeling Overview

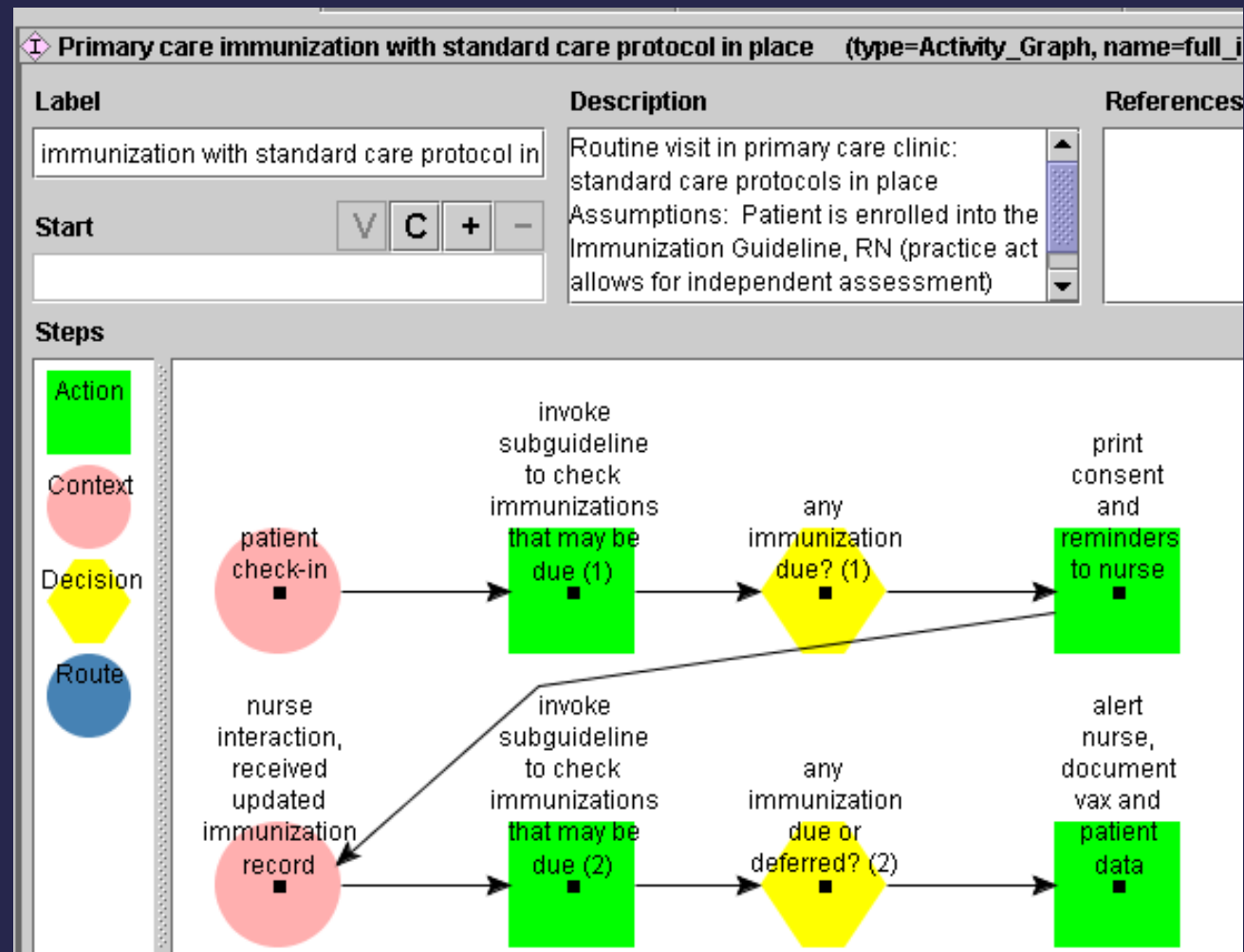
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Guideline
logic

Vocabulary
inventory



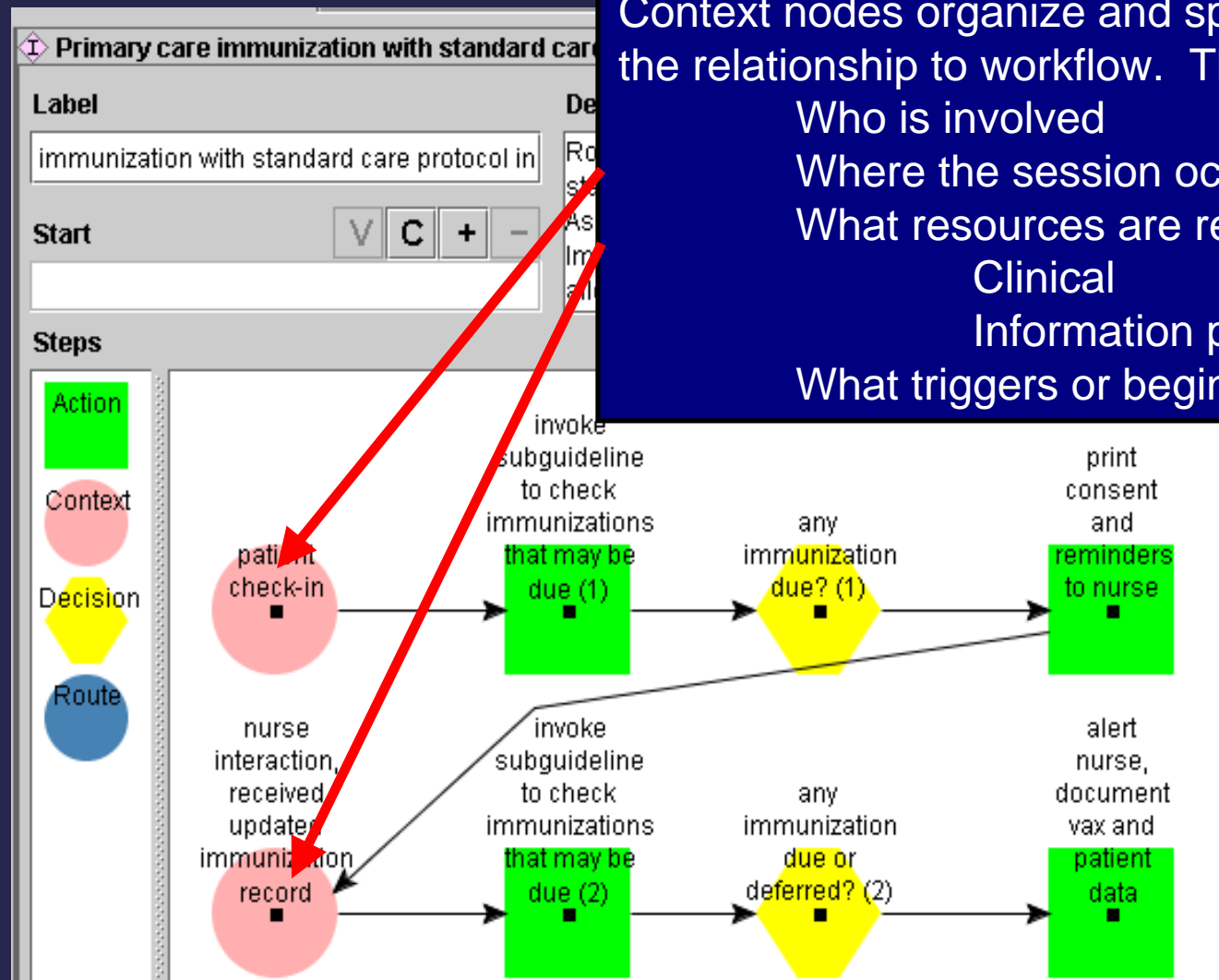
Top-Level Workflow-Aware Process



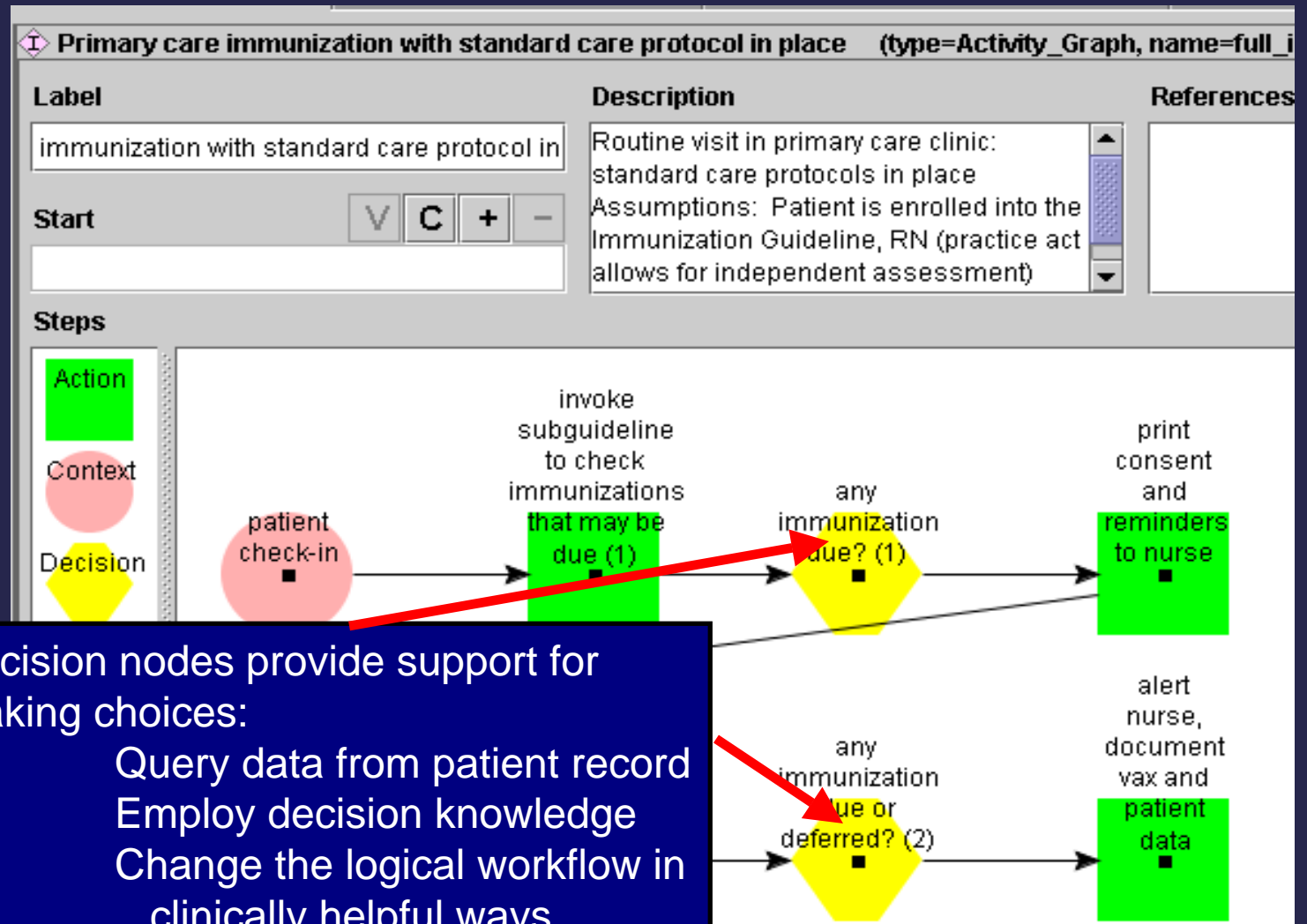
SAGE Context Model: Workflow Specification and Sharing

Context nodes organize and specify the relationship to workflow. They record:

- Who is involved
- Where the session occurs
- What resources are required
- Clinical
- Information processing
- What triggers or begins session



SAGE Decision Model: Clinical Decision Making



Decision nodes provide support for making choices:

- Query data from patient record
- Employ decision knowledge
- Change the logical workflow in clinically helpful ways

SAGE Action Model: Creating Interventions for Favorable Outcomes

Primary care immunization with standard care protocol in place (type=Activity_Graph, name=full_i

Label	Description	References
immunization with standard care protocol in	Routine visit in primary care clinic: standard care protocols in place Assumptions: Patient is enrolled into the Immunization Guideline, RN (practice act allows for independent assessment)	

Start [V] [C] [+] [-]

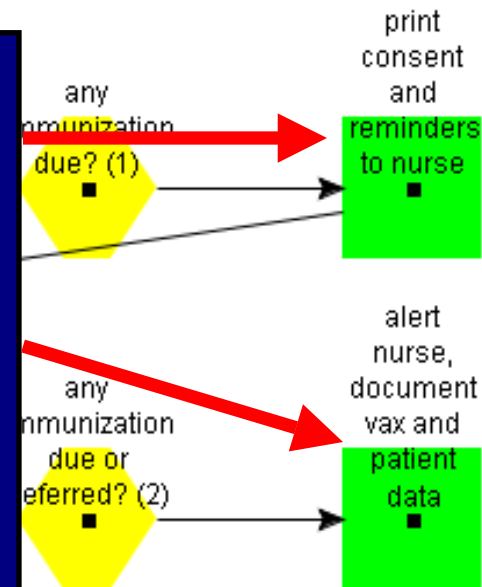
Steps

Action

invoke subguideline

Action nodes define activity to be accomplished by clinical information system:

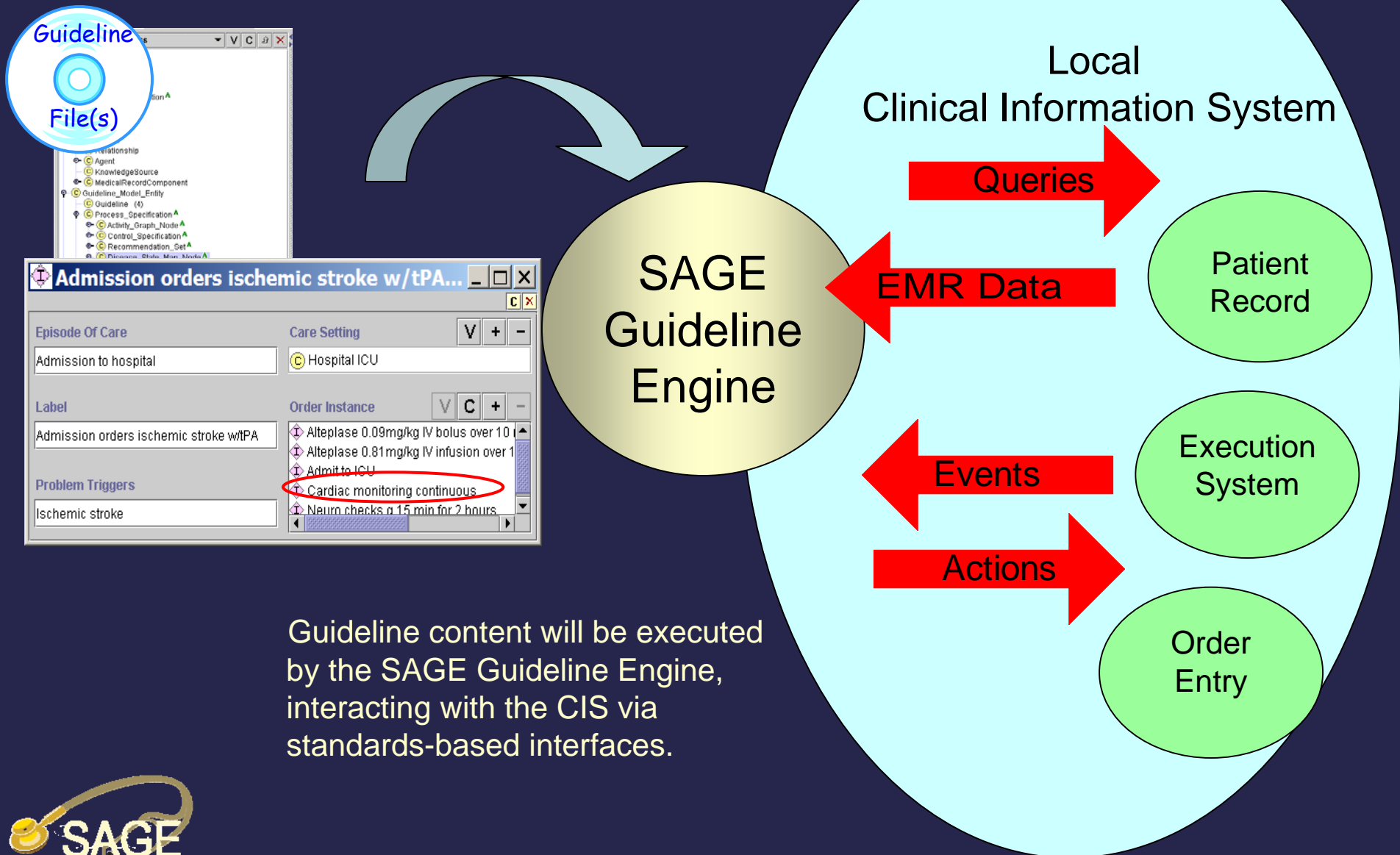
- User interaction and query
- Order sets
- Referrals
- Appointments and scheduling
- Goal setting
- Documentation and recording
- Messaging, print and paging
- Sub-guidelines



SAGE VMR

- Set of broad classes of clinical information → generic information model
 - Classes that a decision support system would need to read and write data to/from an electronic patient record
 - Model designed to be implementation independent, but with sufficient expressiveness to allow guideline execution
- Follows “vMR” initially proposed by Johnson, Tu, Musen, and Purves
 - “*A Virtual Medical Record for Guideline-Based Decision Support*” – AMIA 2001

SAGE Guideline Execution: Deployment Concepts



SAGE Deployment Components

Guideline

S
A
G
E

VMR Services	B i n d i n g
CIS Actions	
SAGE Notif- ications	

C
I
S



SAGE Deployment Components

Guideline

S
A
G
E

Authored in Protégé
Localized using Protégé
Guideline described using standard
VMR classes,
CIS Actions
Standard Terminology

VMR
Services

CIS
Actions

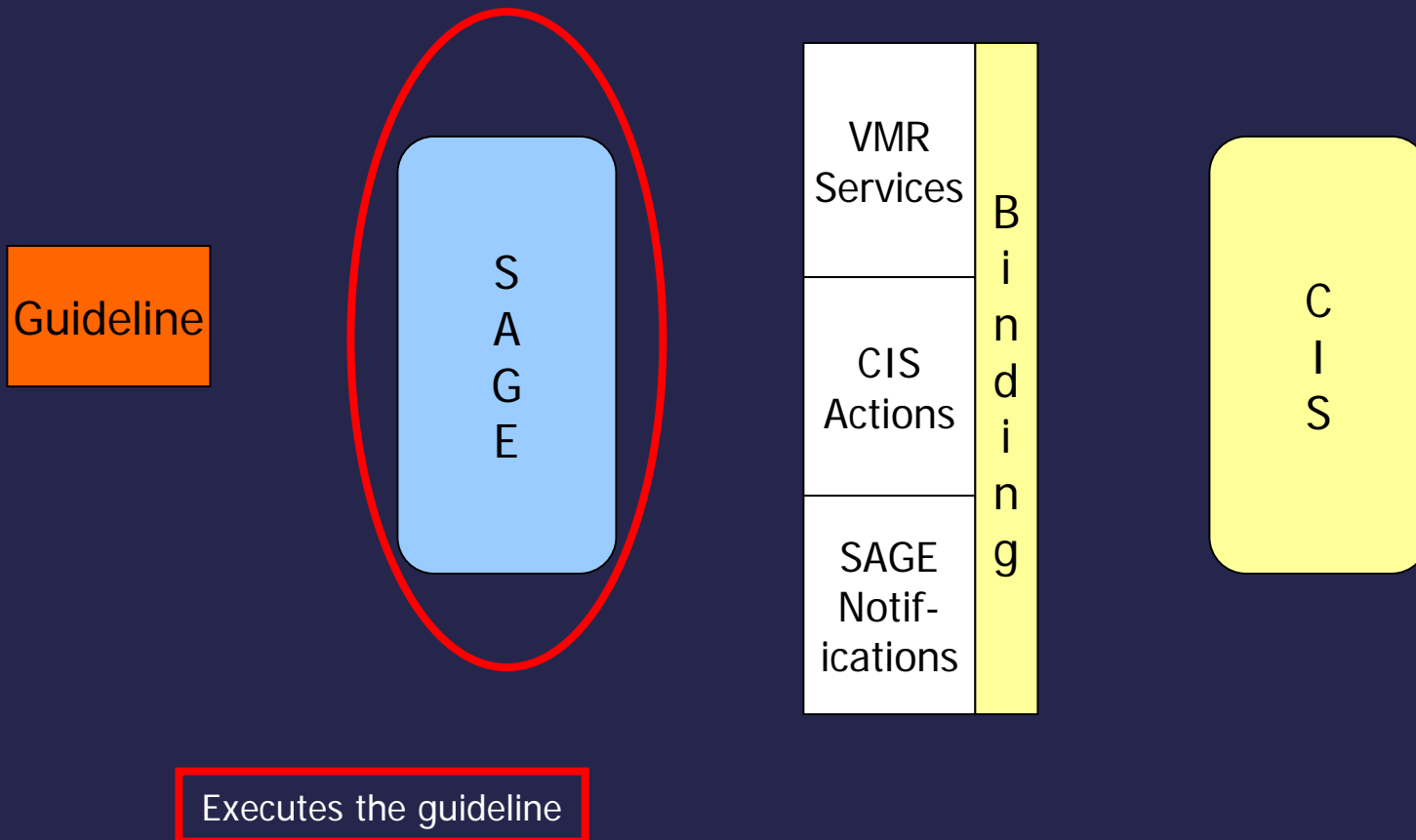
SAGE
Notif-
ications

B
i
n
d
i
n
g

C
I
S



SAGE Deployment Components



SAGE Deployment Components

Guideline

S
A
G
E

SAGE facing side stays the same
CIS facing side changes per CIS

Includes mapping methods from
standards to local CIS
functions/concepts

Includes concept mapping

Listens on events being sent by CIS

VMR
Services

CIS
Actions

SAGE
Notif-
ications

B
i
n
d
i
n
g

C
I
S





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Standards-Based Sharable Active Guideline Environment



II. SAGE Technology in Action



What's on the SAGE CD ?

Guideline Metadata	Information about the encoded guideline: Version, source, authors, dates, etc.	.doc (also included in .xml files)
Guideline Logic	The encoded clinical and operational logic of the clinical practice guideline. This includes pointers to references and source data as appropriate	SGPR.xml SGPR.xml
Clinician readable logic	The guideline logic in a narrative format that is readable Guideline logic and understandable by practicing clinicians	XML, XSLT
Test data	Specification (or set) of test data that can be used to validate guideline logic	SGTD.xml
Installation data and scripts	Specification of the “system” requirements (HIS/CIS). Specifications, resources/capabilities required to run this executable guideline	Text, programs
Support Tools	Tailoring, mapping, binding tools	Programs

Additional Information

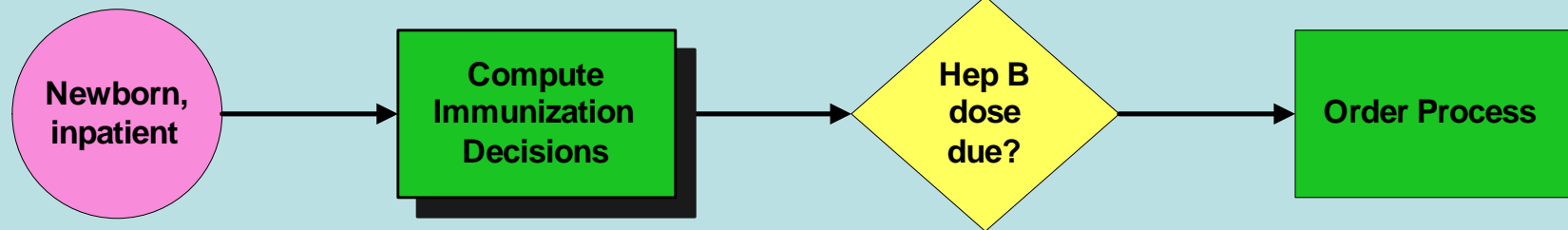
- Tailoring Tools
 - Vocabulary mapping, Binding Assistance
- Execution Semantics
 - Order of evaluation, subsumption rules, ...
- Setup and Installation
 - Discussion, examples, tools, assistance
- vMR Specification
 - Patient data information, API, actions
- CIS Conformance
 - Capabilities needed by SAGE friendly CIS

SAGE Exemplar Guidelines

Guideline	Clinical Domain
Immunizations	Routine health maintenance, in both outpatient and inpatient settings.
Diabetes Management	Chronic disease monitoring and treatment. Acute exacerbation of chronic disease. Chronic disease as a comorbidity.
Community Acquired Pneumonia	Emergency room evaluation and diagnosis. Outpatient treatment of acute disease. Inpatient and ICU treatment of acute disease. Follow-up of acute disease.
Total Joint Replacement	Surgical guideline. Comprehensive pre-op workup, inpatient plan of care, and post-op outpatient management.



A Recommendation Set for Neonatal immunization orders...



A Recommendation Set for Neonatal immunization orders...

Newborn,
inpatient

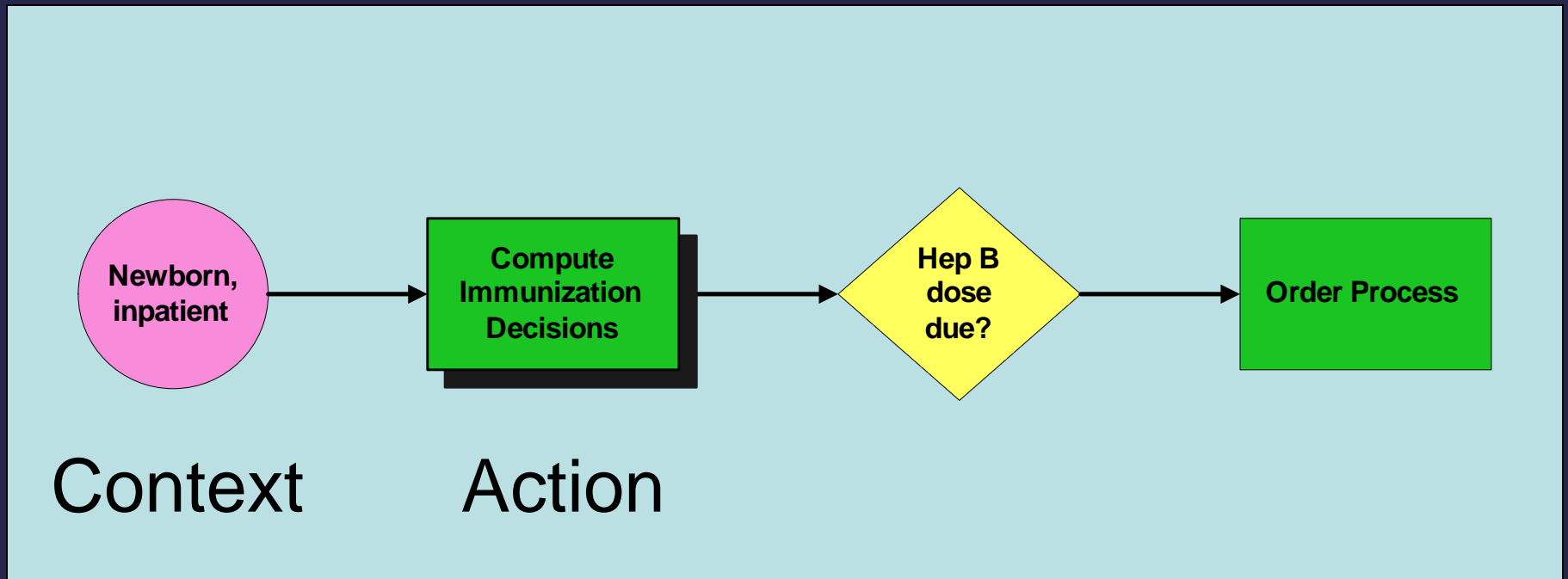
Compute
Immunization
Decisions

Hep B
dose
due?

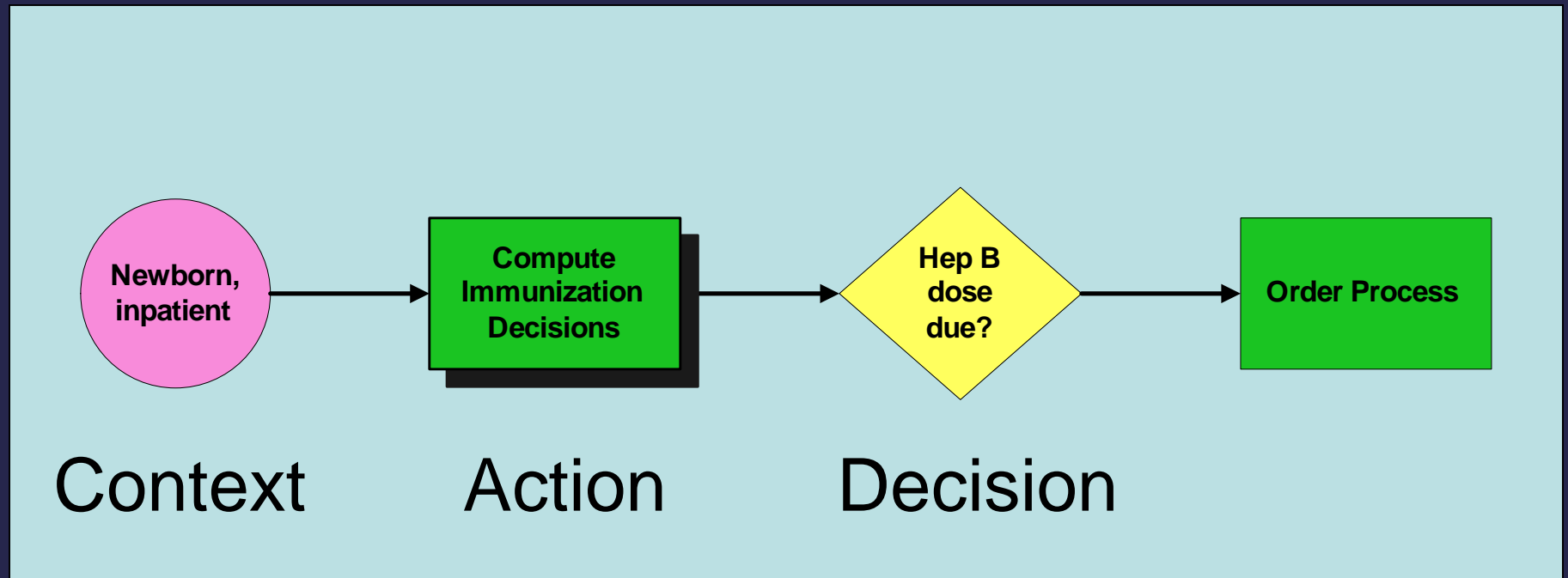
Order Process

Context

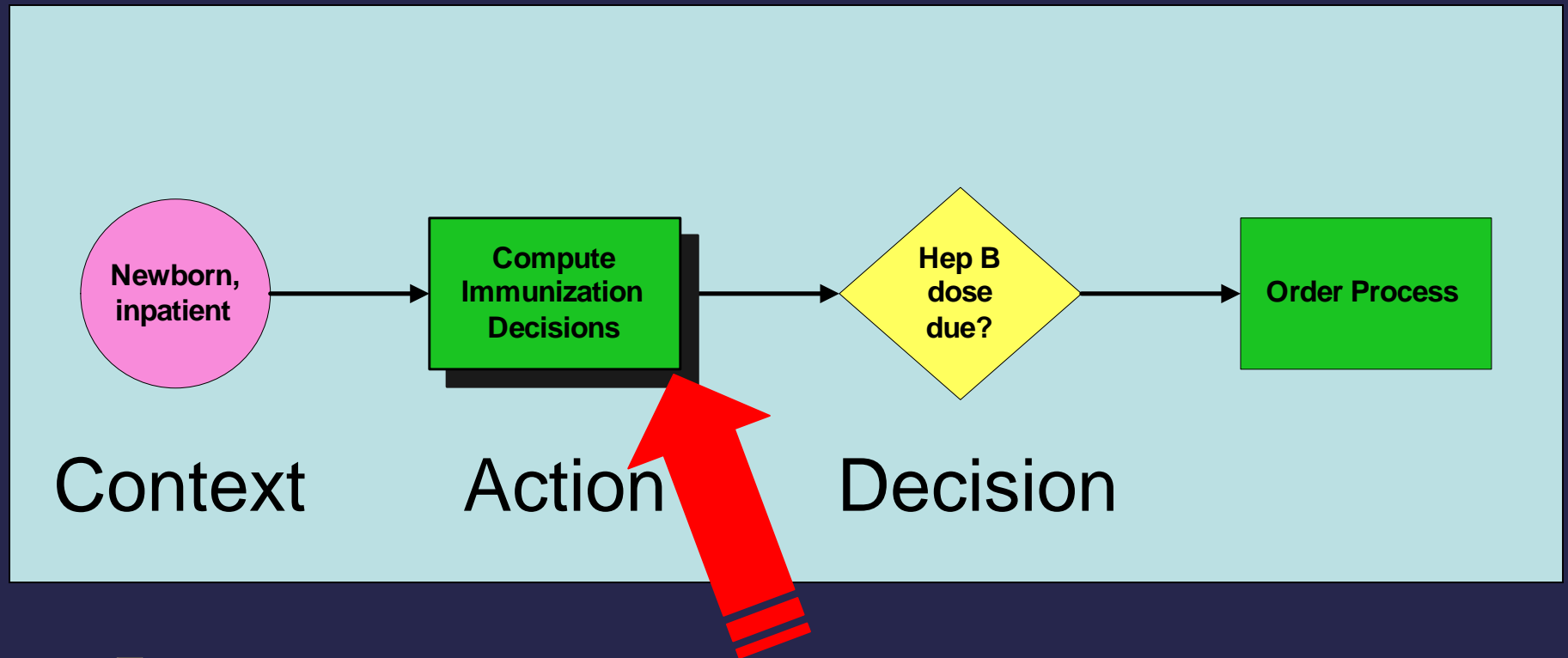
A Recommendation Set for Neonatal immunization orders...

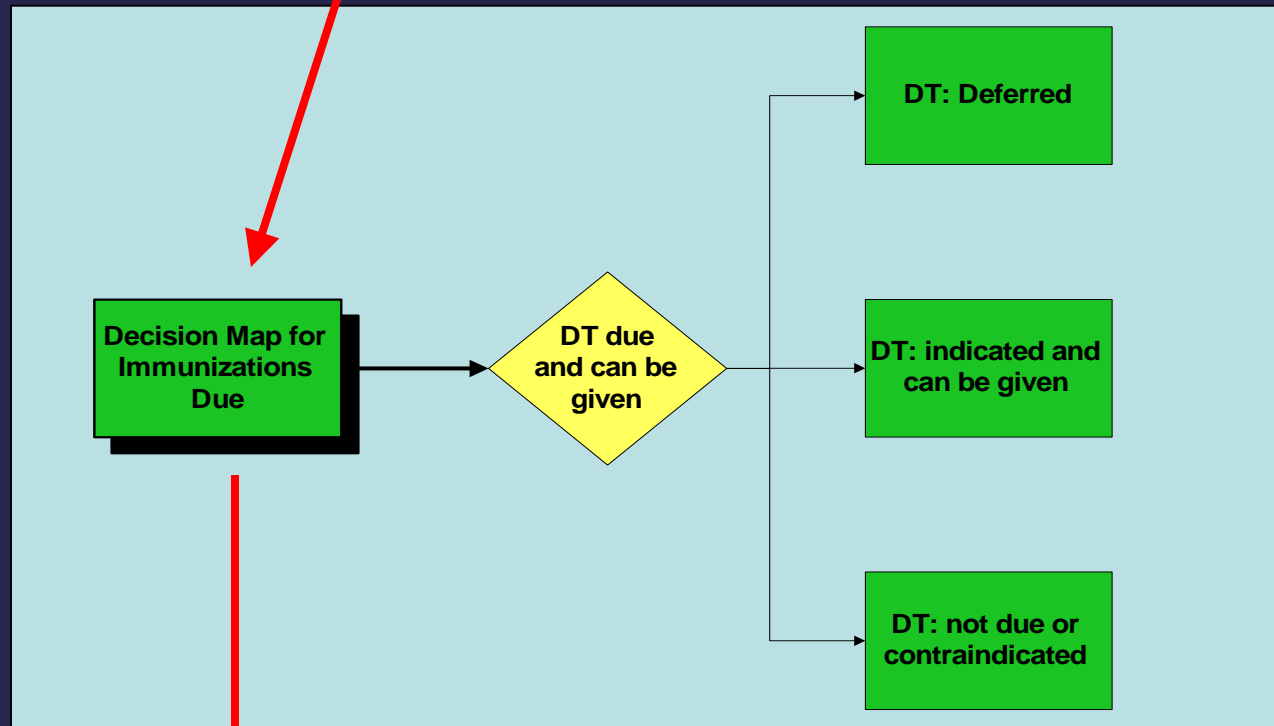
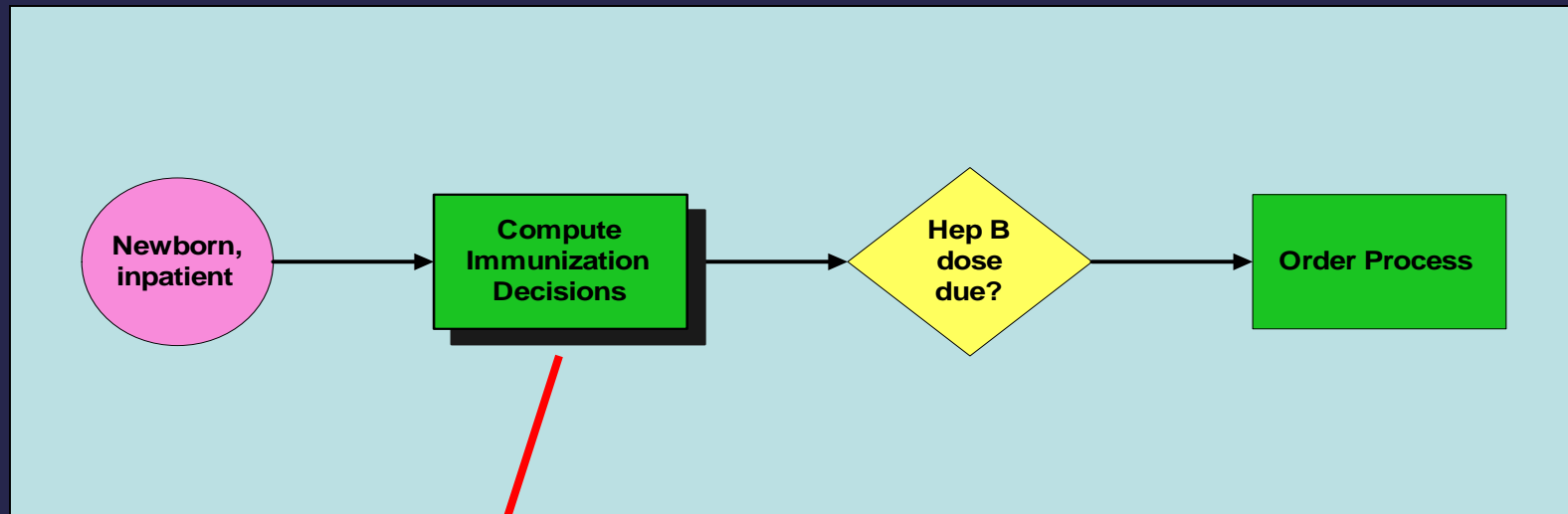


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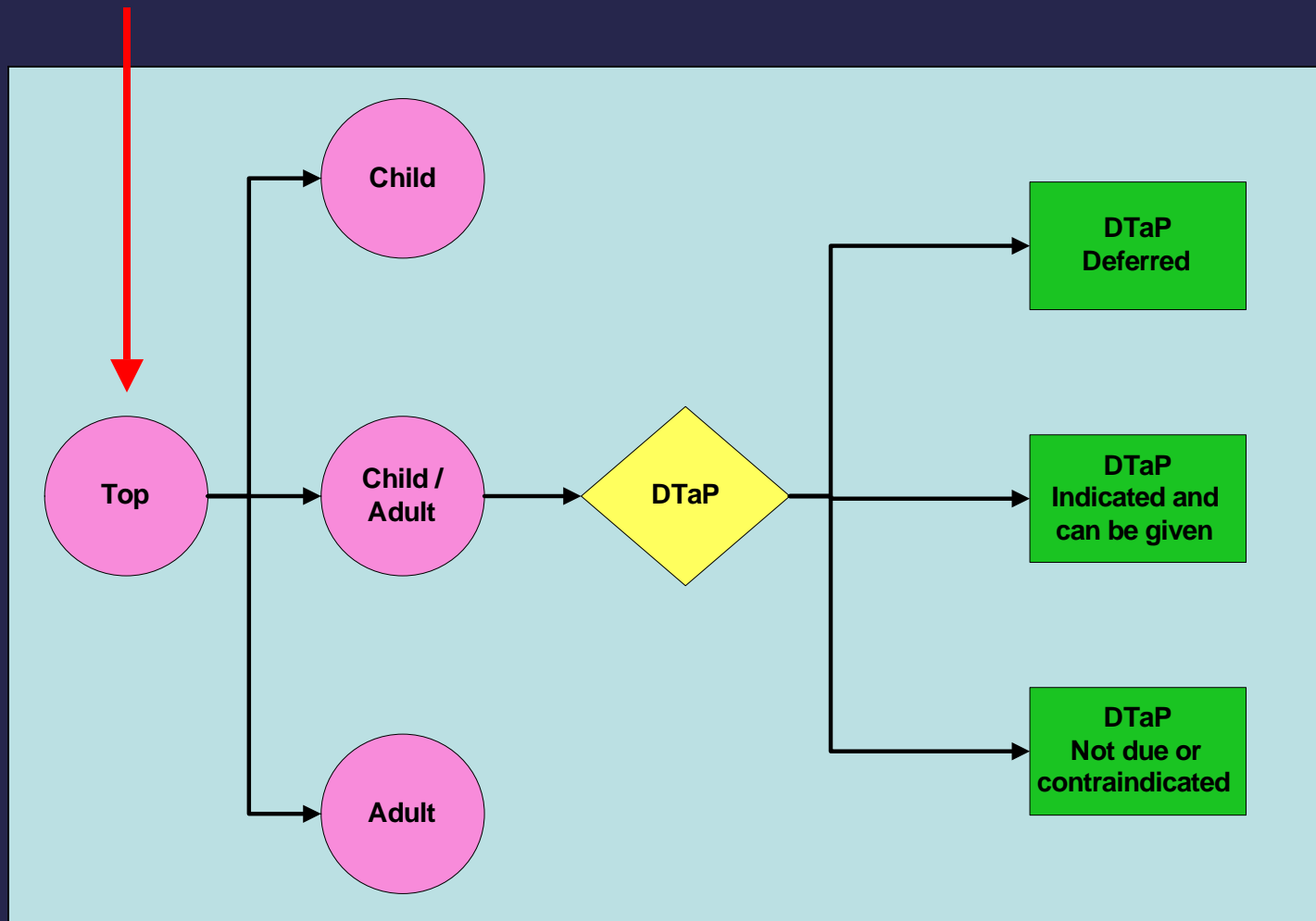


A Recommendation Set for Neonatal immunization orders...





Immunization Decisions: DTaP



Baby Boy Jones

- ✓ 2229 gram
- ✓ 34 week gestation neonate
- ✓ delivered by emergency C-section due to placental abruption
- ✓ His 20 year old mother received no prenatal care.
- ✓ Mother's urine drug screen was positive for methamphetamines.
- ✓ Mother's HBsAg serology was positive.
- ✓ Problem listed: "newborn exposure to Hepatitis B"



Baby Boy Jones

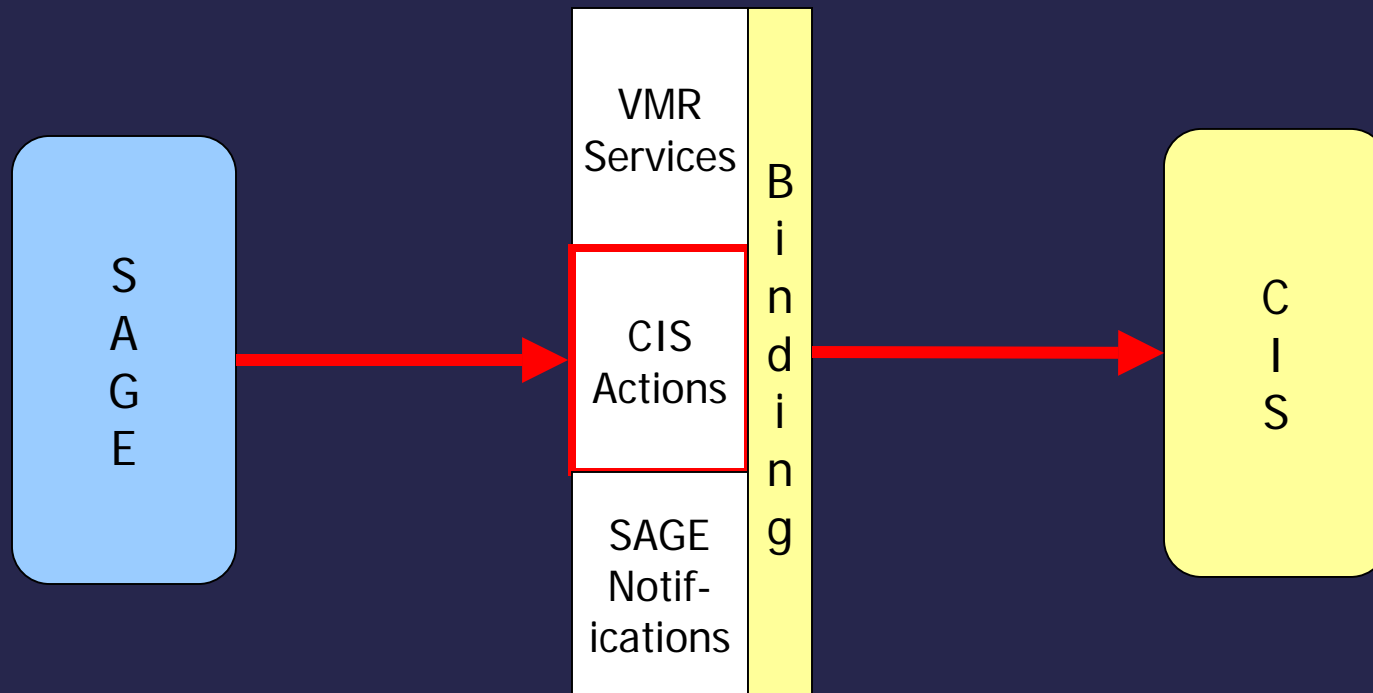
Expected SAGE Behavior (4 orders):

- **2 Substance administrations**
due immediately
 - Hepatitis B vaccine injection
 - Hepatitis B Immune Globulin (HBIG)
- **2 Serologic tests**
due 9 months in the future
 - Hepatitis B core antibody levels (anti-HBc)
 - Hepatitis B surface antigen levels (HBsAg)

Neonate w/ HepB positive mother

SAGE Actions

Pending orders created in the CIS.





Desktop

Current Patient List: PERS: Sage Testing Attending, Ray

MRN	Patient Name	Other Information
01005800	ANDERSON, Paige	
01005867	CHAPMAN, Lucy	
01005776	HORNER, Jack	
01005842	JONES, Baby boy	LWGH A401 Attending, Ray
01005784	MCCRAY, Jim	
01005834	SMITH, Suzy	
01005875	STOCK, Marie	
01005883	THOMAS, John	
01005826	TUCKER, Tommy	
01005792	WHITE, Tristan	

Select Remove Add Active Find.. Temp List Print List Refresh

Command Central

 Command:
 Active MRN: Global Name Lookup

Patient List Directory

☒ Freq ☐ Folders ☐ Avail

List Name	Type	Owner
Hotlist		
CAR Service	CNSS	
Sage Testing ♥	PERS	Attending,
TemporaryList	PERS	Attending,

Select Make Default Make Freq Move/Remove

InBox Messages

☐ All Mine ☒ Patient

Notifications	Count
Unsolicited	
You have saved order sessions	4
Message from SAGE Engine	2

Create Resolve Refresh



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SAGE Engine has caused
4 pending orders to be
created in the CIS

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Command:

Active MRN:

Global Name Lookup

Patient List Directory

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Sage Testing ♥	PERS	Attending,
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Select Make Default Make Freq Move/Remove

InBox Messages

☐ All Mine ☒ Patient

Notifications	Count
Unsolicited	
You have saved order sessions	4
Message from SAGE Engine	2

Create Resolve Refresh



Desktop

Current Patient List: PERS: Sage Testing Attending, Ray

MRN	Patient Name	Other Information
01005800	ANDERSON, Paige	
01005867	CHAPMAN, Lucy	
01005776	HORNER, Jack	
01005842	JONES, Baby boy	LWGH A401 Attending, Ray
01005784	MCCRAY, Jim	
01005834	SMITH, Suzy	
01005875	STOCK, Marie	
01005883	THOMAS, John	
01005826	TUCKER, Tommy	
01005792	WHITE, Tristan	

SAGE Engine has caused
4 pending orders to be
created in the CIS

Patient List Directory

☒ Freq ☐ Folders ☐ Avail

List Name	Type	Owner
Hotlist		
CAR Service	CNSS	
Sage Testing	PERS	Attending,
TemporaryList	PERS	Attending,

InBox Messages

☐ All Mine ☒ Patient

Notifications	Count
Unsolicited	
You have saved order sessions	4
Message from SAGE Engine	2

Command Central

Command:

Active MRN:



My Saved Order Sessions

Patient	Mrn	Previous Owner	Save Date Time	Comment
JONES, Baby boy	01005842	ATTENDING, R	15Aug2003 10:41	Hep B surface antige
JONES, Baby boy	01005842	ATTENDING, R	15Aug2003 10:41	Hepatitis B core ant
JONES, Baby boy	01005842	ATTENDING, R	15Aug2003 10:41	Hepatitis B Vac Reco
JONES, Baby boy	01005842	ATTENDING, R	15Aug2003 10:41	Hepatitis B Immune G

SAGE Engine has caused
4 pending orders to be
created in the CIS

Activate

Details

Forward

Issue

Delete

Cancel



Demog

Orders

Results

Viewer

Allergies

Pathways

Pharmacy

Care Mgmt

Setup

Notes

Med Profile

Microbiology ...

Patient Problem List

☒ All ☐ Active

Add:

Status	Problem Description	Gde
A	Newborn exposure to maternal h...	

Guidelines

Update Problem

Patient Order List

Expand

Change Context

Prefs

Save Session

Current Order	ST	Sub ST	Start Date	Problem
Hepatitis B Vac Recombinant Inj inj	U	READY	15Aug2003	

Modify

D/C

Issue

Dept Buttons

Common

Order Sets

Search

Meds

Personal

Prescriptions

Common Orders

MEDICATIONS

Order Selection

- ☐ Order is Historical
☐ Order is Prescription

Select Order

Button Dept: MED

Order Text Search:



Patient Problem List

All Active

Add:

Status	Problem Description	Gde
A	Newborn exposure to maternal h...	

Guidelines

Update Problem

Patient Order List

Expand

Change Context

Prefs

Save Session

Current Order	ST	Sub ST	Start Date	Problem
Hep B surface antigen level	U	READY	10May2004	

Modify

D/C

Issue

Dept Buttons

Common

Order Sets

Search

Meds

Personal

Prescriptions

Common Orders

MEDICATIONS

Order Selection

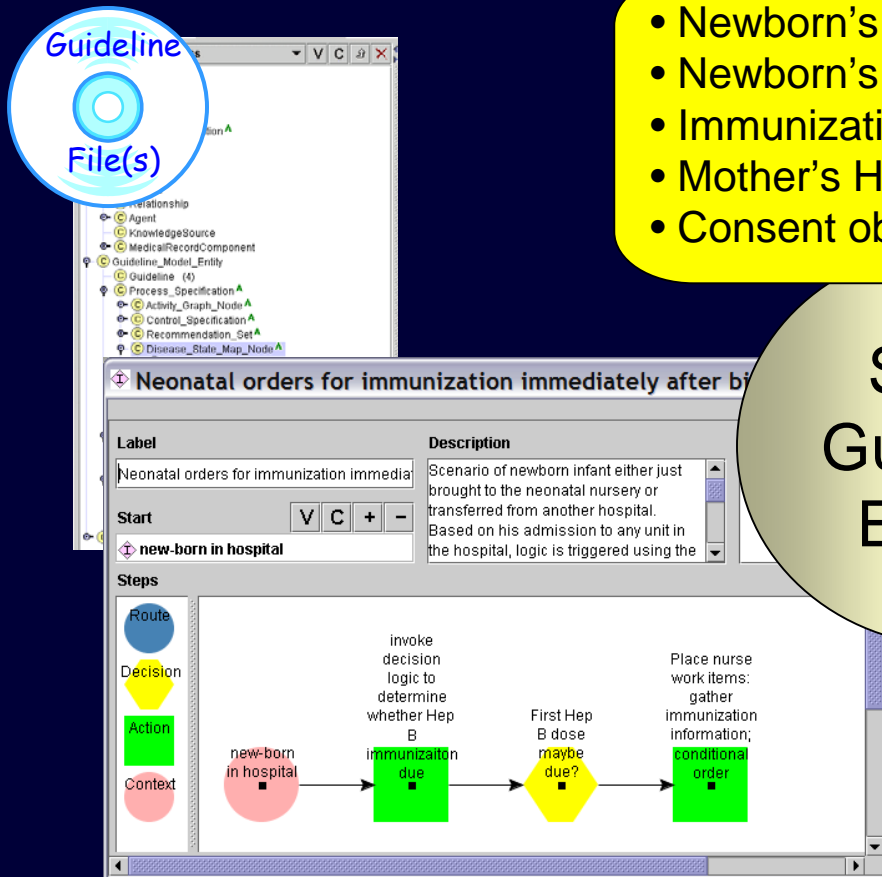
☐ Order is Historical☐ Order is Prescription

Select Order

Button Dept: MED

Order Text Search:

SAGE Guideline Execution: Neonatal Orders for Immunization



- Newborn's Age
- Newborn's Weight
- Immunization Hx
- Mother's HBsAG
- Consent obtained?

SAGE
Guideline
Engine

Local
Clinical Information System

Queries

EMR Data

Patient
Record

Events

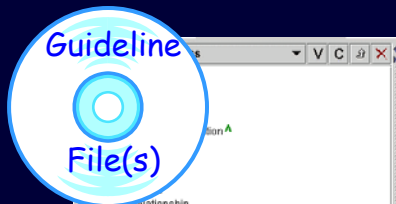
Execution
System

Actions

Order
Entry

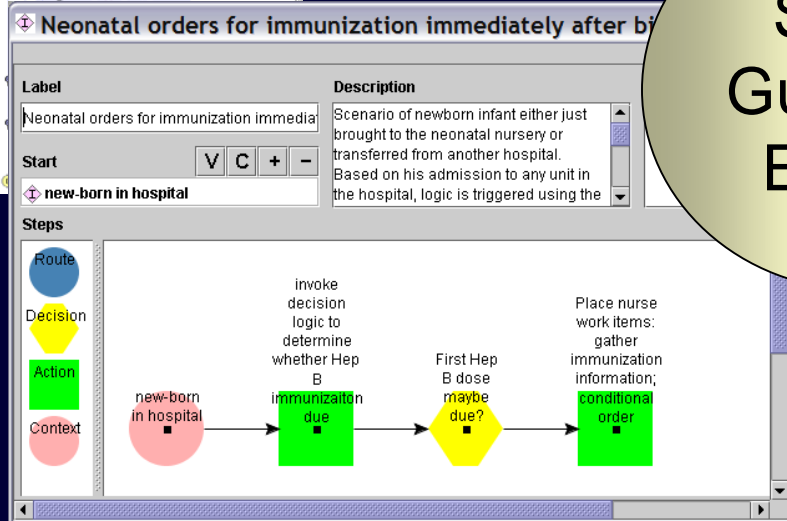
Guideline content will be executed by the SAGE Guideline Engine, interacting with the CIS via standards-based interfaces.

SAGE Guideline Execution: Neonatal Orders for Immunization



- Detect newborn admission
- Detect updates to newborn's EMR

SAGE
Guideline
Engine



Guideline content will be executed by the SAGE Guideline Engine, interacting with the CIS via standards-based interfaces.

Local
Clinical Information System

Queries

EMR Data

Patient
Record

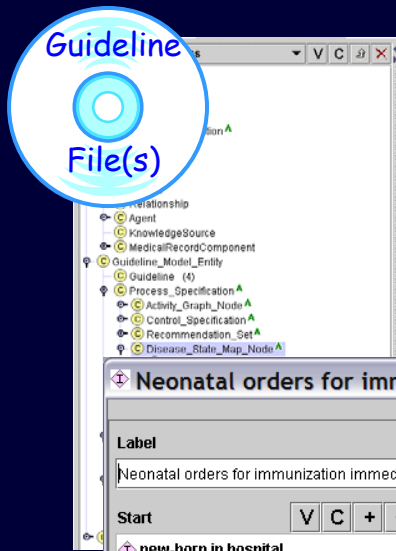
Events

Execution
System

Actions

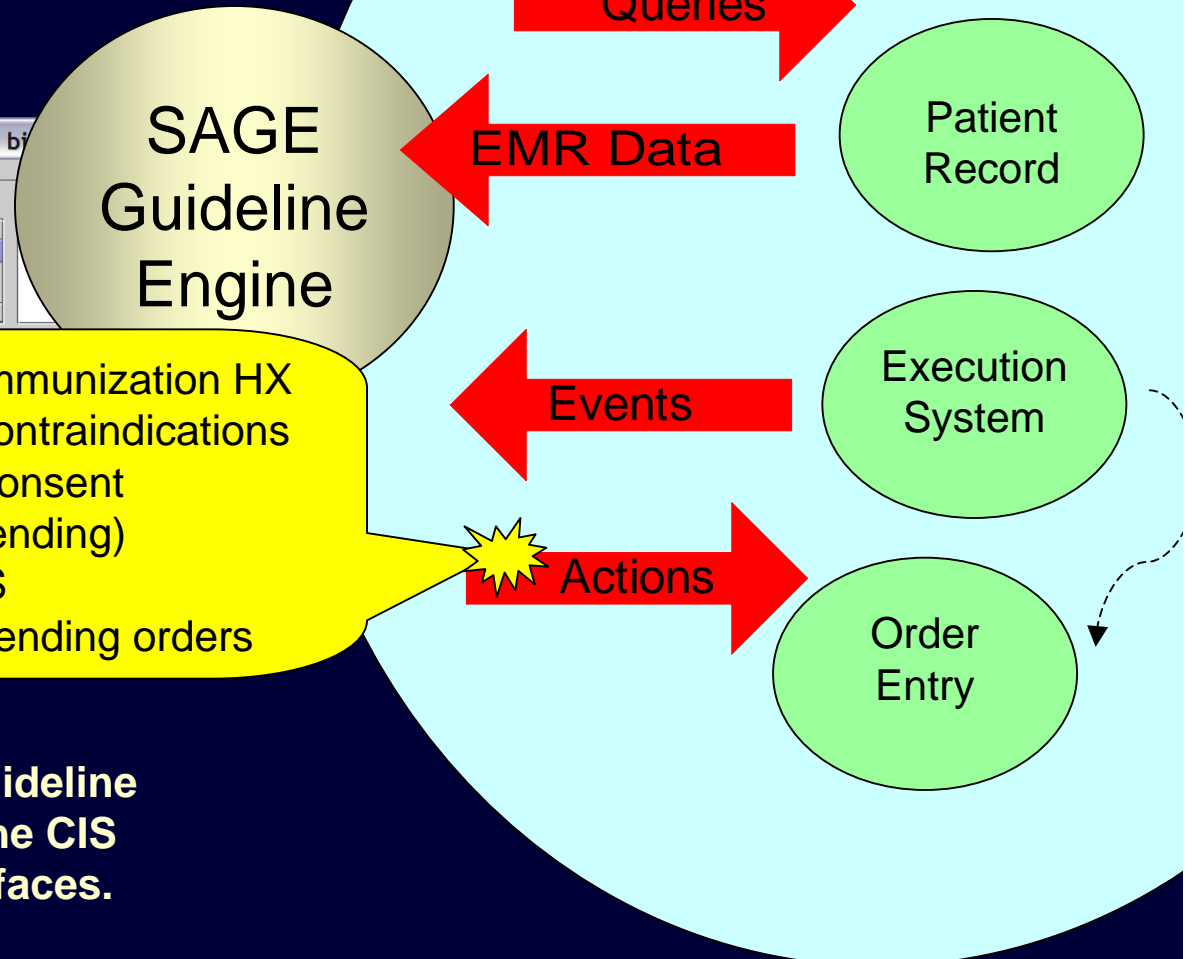
Order
Entry

SAGE Guideline Execution: Neonatal Orders for Immunization



- Remind nurse to check immunization HX
- Remind nurse to check contraindications
- Remind nurse to obtain consent
- Create recommended (pending) immunization orders in CIS
- Notify physician of new pending orders

Guideline content will be executed by the SAGE Guideline Engine, interacting with the CIS via standards-based interfaces.



SAGE Flowsheet

- A user interface for viewing CIS data supplemented by SAGE recommendations: *soft* influence
- Ability to place orders into the CIS
- Rationale provided for recommendations
- Updates allowed for input of new values
- Supports care goals



Demog

▼ Orders

▼ Results

▼ Viewer

Allergies

▼ Pathways

Pharmacy

▼ Care Mgmt

▼ Setup

Home

Care Support Flowsheet

Diabetes

Organizer

Reports

Selected	Item	Ref Value	Info	Status	Chart Now	03-16-04	11-20-03	07-20-0
		Nml <input type="radio"/> Goal <input type="radio"/>			3-18-04			
General Info								
<input type="checkbox"/>	Height (CM)	150-250				117.8	177.8	
<input type="checkbox"/>	Weight (KG)	60-90				80.7	80.7	
<input type="checkbox"/>	Systolic BP (MMHG)	90-140				160	122	
<input type="checkbox"/>	Diastolic BP (MMHG)	60-90				100	72	
<input type="checkbox"/>	HR (BEATS/MIN)	50-95				76	76	
<input type="checkbox"/>	Resp (BEATS/MIN)	15-20				20	20	
<input type="checkbox"/>	Temp (DEGREEEC)	36.1-37.8				37.0	37.0	
Information Required								
<input type="checkbox"/>	New CV signs/sx? ()							
<input type="checkbox"/>	Tobacco use status? ()							
<input type="checkbox"/>	Foot exam ()							
Diabetes Mellitus								
Assessment								
<input type="checkbox"/>	Home Glucose High (mg/dl)	100-150					120	
<input type="checkbox"/>	Home Glucose Low (mg/dl)	80-130					85	
<input type="checkbox"/>	Smoker/Tobacco use							
<input type="checkbox"/>	Foot Exam						normal	normal
<input type="checkbox"/>	Annual Retinal Exam							

- Help
- Settings
- Links
- Email
- Pause
- Exit

Demog

▼ Orders

▼ Results

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▼ Pathways

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▼ Care Mgmt

▼ Setup

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Care Support Flowsheet

Diabetes

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Selected	Item	Ref Value	Info	Status	Chart Now	03-16-04	11-20-03	07-20-03	
		Nml <input type="radio"/> Goal <input type="radio"/>			3-18-04				
General Info									
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Information Required									
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<input type="checkbox"/>	Tobacco use status? ()								
<input type="checkbox"/>	Foot exam ()								
Diabetes Mellitus									
Assessment									
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- Exit

Demog

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Care Support Flowsheet

Diabetes

Organizer

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Selected Item	Ref Value	Info	Status	Chart Now	03-16-04	11-20-03	07-20-0
				3-18-04			

General Info

<input type="checkbox"/>	Height (CM)	150-250				117.8	177.8	
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Information Required

<input type="checkbox"/>	New CV signs/sx? ()							
<input type="checkbox"/>	Tobacco use status? ()							
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Diabetes Mellitus

Assessment

<input type="checkbox"/>	Home Glucose High (mg/dl)	100-150					120	
<input type="checkbox"/>	Home Glucose Low (mg/dl)	80-130					85	
<input type="checkbox"/>	Smoker/Tobacco use							
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Selected	Item	Ref Value	Info	Status	Chart Now	03-16-04	11-20-03	07-20-0
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General Info

<input type="checkbox"/>	Height (CM)	150-250				117.8	177.8	
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Information Required

<input type="checkbox"/>	New CV signs/sx? ()							
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Diabetes Mellitus

Assessment

<input type="checkbox"/>	Home Glucose High (mg/dl)	100-150					120	
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<input type="checkbox"/>	Annual Retinal Exam							

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Diabetes

Organizer

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<input type="checkbox"/>	Foot Exam						normal	normal
<input type="checkbox"/>	Annual Retinal Exam							

- Help
- Settings
- Links
- Email
- Pause
- Exit

		Nml	Goal		3-18-04					
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General Info

<input type="checkbox"/>	Height (CM)	150-250				117.8	177.8			
<input type="checkbox"/>	Weight (KG)	60-90				80.7	80.7			
<input type="checkbox"/>	Systolic BP (MMHG)	90-140				160	122			
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Information Required

<input type="checkbox"/>	New CV signs/sx? ()									
<input type="checkbox"/>	Tobacco use status? ()									
<input type="checkbox"/>	Foot exam ()									

Diabetes Mellitus

essment

<input type="checkbox"/>	Home Glucose High (mg/dl)	100-150					120		130	
<input type="checkbox"/>	Home Glucose Low (mg/dl)	80-130					85		55	
<input type="checkbox"/>	Smoker/Tobacco use									
<input type="checkbox"/>	Foot Exam						normal	normal	normal 1 of 2	
<input type="checkbox"/>	Annual Retinal Exam								negative 1 of 2	
<input type="checkbox"/>	Cardiac Stress Test									

b Tests

<input type="checkbox"/>	HbA1c (%)	< 8	i	Due now			7.5	7.5	7.5	
<input type="checkbox"/>	Fasting BG (mg/dl)	64-110								
<input type="checkbox"/>	Total Cholestrol (MG/DL)	100-200							198	
<input type="checkbox"/>	HDL (MG/DL)	40-70	i	Due now					34	
<input type="checkbox"/>	LDL (MG/DL)	< 130	i	Due now					135 1 of 2	

		Nml	Goal		3-18-04					
--	--	-----	------	--	---------	--	--	--	--	--

General Info

<input type="checkbox"/>	Height (CM)	150-250				117.8	177.8			
<input type="checkbox"/>	Weight (KG)	60-90				80.7	80.7			
<input type="checkbox"/>	Systolic BP (MMHG)	90-140				160	122			
<input type="checkbox"/>	Diastolic BP (MMHG)	60-90				100	72			
<input type="checkbox"/>	HR (BEATS/MIN)	50-95				76	76			
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Information Required

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<input type="checkbox"/>	Foot exam ()									

Diabetes Mellitus

essment

<input type="checkbox"/>	Home Glucose High (mg/dl)	100-150				120		130		
<input type="checkbox"/>	Home Glucose Low (mg/dl)	80-130				85		55		
<input type="checkbox"/>	Smoker/Tobacco use									
<input type="checkbox"/>	Foot Exam					normal	normal	normal	1 of 2	
<input type="checkbox"/>	Annual Retinal Exam							negative	1 of 2	
<input type="checkbox"/>	Cardiac Stress Test									

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<input type="checkbox"/>	HbA1c (%)	< 8	i	Due now		7.5	7.5	7.5		
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<input type="checkbox"/>	Total Cholestrol (MG/DL)	100-200						198		
<input type="checkbox"/>	HDL (MG/DL)	40-70	i	Due now				34		
<input type="checkbox"/>	LDL (MG/DL)	< 130	i	Due now				135	1 of 2	

		Nml	Goal		3-18-04					
--	--	-----	------	--	---------	--	--	--	--	--

General Info

<input type="checkbox"/>	Height (CM)	150-250				117.8	177.8			
<input type="checkbox"/>	Weight (KG)	60-90				80.7	80.7			
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<input type="checkbox"/>	Diastolic BP (MMHG)	60-90				100	72			
<input type="checkbox"/>	HR (BEATS/MIN)	50-95				76	76			
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Information Required

<input type="checkbox"/>	New CV signs/sx? ()									
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Diabetes Mellitus

essment

<input type="checkbox"/>	Home Glucose High (mg/dl)	100-150				120		130		
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<input type="checkbox"/>	Smoker/Tobacco use									
<input type="checkbox"/>	Foot Exam					normal	normal	normal	1 of 2	
<input type="checkbox"/>	Annual Retinal Exam							negative	1 of 2	
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<input type="checkbox"/>	HbA1c (%)	< 8	i	Due now		7.5	7.5	7.5		
<input type="checkbox"/>	Fasting BG (mg/dl)	64-110								
<input type="checkbox"/>	Total Cholestrol (MG/DL)	100-200						198		
<input type="checkbox"/>	HDL (MG/DL)	40-70	i	Due now				34		
<input type="checkbox"/>	LDL (MG/DL)	< 130	i	Due now				135	1 of 2	

		Nml	●	Goal	●		3-18-04						
--	--	-----	---	------	---	--	---------	--	--	--	--	--	--

General Info

- <input type="checkbox"/>	Height (CM)					117.8	177.8			
- <input type="checkbox"/>	Weight (KG)					80.7	80.7			
- <input type="checkbox"/>	Systolic BP (MMHG)	< 130.0				160	122			
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Information Required

- <input type="checkbox"/>	New CV signs/sx? ()									
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Diabetes Mellitus

Assessment

- <input type="checkbox"/>	Home Glucose High (mg/dl)					120		130		
- <input type="checkbox"/>	Home Glucose Low (mg/dl)					85		55		
- <input type="checkbox"/>	Smoker/Tobacco use									
- <input type="checkbox"/>	Foot Exam					normal	normal	normal	1 of 2	
- <input type="checkbox"/>	Annual Retinal Exam							negative	1 of 2	
- <input type="checkbox"/>	Cardiac Stress Test									

Tests

- <input type="checkbox"/>	HbA1c (%)	< 7.0	i	Due now			7.5	7.5	7.5	
- <input type="checkbox"/>	Fasting BG (mg/dl)									
- <input type="checkbox"/>	Total Cholestrol (MG/DL)								198	
- <input type="checkbox"/>	HDL (MG/DL)	> 45.0	i	Due now					34	
- <input type="checkbox"/>	LDL (MG/DL)	< 100.0	i	Due now					135	1 of 2

		Nml	Goal		3-18-04				
General Info									
<input type="checkbox"/>	Height (CM)					117.8	177.8		
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<input type="checkbox"/>	New CV signs/sx? ()								
<input type="checkbox"/>	Tobacco use status? ()								
<input type="checkbox"/>	Foot exam ()								
Diabetes Mellitus									
Assessment									
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<input type="checkbox"/>	Home Glucose Low (mg/dl)					85		55	
<input type="checkbox"/>	Smoker/Tobacco use								
<input type="checkbox"/>	Foot Exam					normal	normal	normal 1 of 2	
<input type="checkbox"/>	Annual Retinal Exam							negative 1 of 2	
<input type="checkbox"/>	Cardiac Stress Test								
Tests									
<input type="checkbox"/>	HbA1c (%)	< 7.0	i	Due now		7.5	7.5	7.5	
<input type="checkbox"/>	Fasting BG (mg/dl)								
<input type="checkbox"/>	Total Cholesterol (MG/DL)							198	
<input type="checkbox"/>	HDL (MG/DL)	> 45.0	i	Due now				34	
<input type="checkbox"/>	LDL (MG/DL)	< 100.0	i	Due now				135 1 of 2	

		Nml	Goal		3-18-04					
--	--	-----	------	--	---------	--	--	--	--	--

General Info

- <input type="checkbox"/>	Height (CM)					117.8	177.8			
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- <input type="checkbox"/>	HR (BEATS/MIN)					76	76			
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- <input type="checkbox"/>	Temp (DEGREEC)					37.0	37.0			

Information Required





- <input type="checkbox"/>	New CV signs/sx? ()									
- <input type="checkbox"/>	Tobacco use status? ()									
- <input type="checkbox"/>	Foot exam ()									

Diabetes Mellitus

Assessment

- <input type="checkbox"/>	Home Glucose High (mg/dl)					120		130		
- <input type="checkbox"/>	Home Glucose Low (mg/dl)					85		55		
- <input type="checkbox"/>	Smoker/Tobacco use									
- <input type="checkbox"/>	Foot Exam					normal	normal	normal	1 of 2	
- <input type="checkbox"/>	Annual Retinal Exam							negative	1 of 2	
- <input type="checkbox"/>	Cardiac Stress Test									

Tests

- <input type="checkbox"/>	HbA1c (%)	< 7.0		 Due now			7.5	7.5	7.5	
- <input type="checkbox"/>	Fasting BG (mg/dl)									
- <input type="checkbox"/>	Total Cholestrol (MG/DL)								198	
- <input type="checkbox"/>	HDL (MG/DL)	> 45.0		Due now					34	
- <input type="checkbox"/>	LDL (MG/DL)	< 100.0		Due now					135	1 of 2

General Info

- ☐ Height (CM)
- ☐ Weight (KG)
- ☐ Systolic BP (MM
- ☐ Diastolic BP (M
- ☐ HR (BEATS/MIN)
- ☐ Resp (BEATS/MIN
- ☐ Temp (DEGREEC)

Information Required

- ☐ New CV signs/sx
- ☐ Tobacco use sta
- ☐ Foot exam ()

Diabetes Mellitus

Assessment

- ☐ Home Glucose Hi
- ☐ Home Glucose Lo
- ☐ Smoker/Tobacco
- ☐ Foot Exam
- ☐ Annual Retinal
- ☐ Cardiac Stress Test

Rationalé for patientId : 658 - Microsoft Internet Explorer

Conclude HbA1C due 3 months from last measurement

Criteria Evaluated:

HbA1C has not been obtained:false

HbA1C within goal:false

No existing order for HbA1C:true

Actions taken:

Check when HbA1C due and whether out of goal

Action Specs executed:

Order HbA1C 3 months from last measurement

Conclude HbA1C due 3 months from last measurement

Criteria Evaluated:

HbA1C has not been obtained:false

HbA1C within goal:false

No existing order for HbA1C:true

Recommendation Backing:

Haemoglobin A1c (HbA1c) should be measured at 2-6 monthly intervals; the interval should depend on: acceptable levels of control, D and stability of blood glucose control, D and/or change in levels of blood glucose, D and/or change in therapies. D Six-monthly measurements should be made if the blood glucose level and blood glucose therapy are stable. D Resource:ADA Diabetes Care Guideline

Tests

<input type="checkbox"/>	HbA1c (%)	< 7.0	i	Due now			7.5	7.5	7.5	
<input type="checkbox"/>	Fasting BG (mg/dl)									
<input type="checkbox"/>	Total Cholestrol (MG/DL)								198	
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The SAGE Project

Standards-Based Sharable Active Guideline Environment



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Vice President, Health Informatics

IDX Systems, Seattle

Nick_Beard@idx.com



"A collaborative project to
develop a universal framework for
encoding and disseminating electronic clinical guidelines"

The SAGE Project

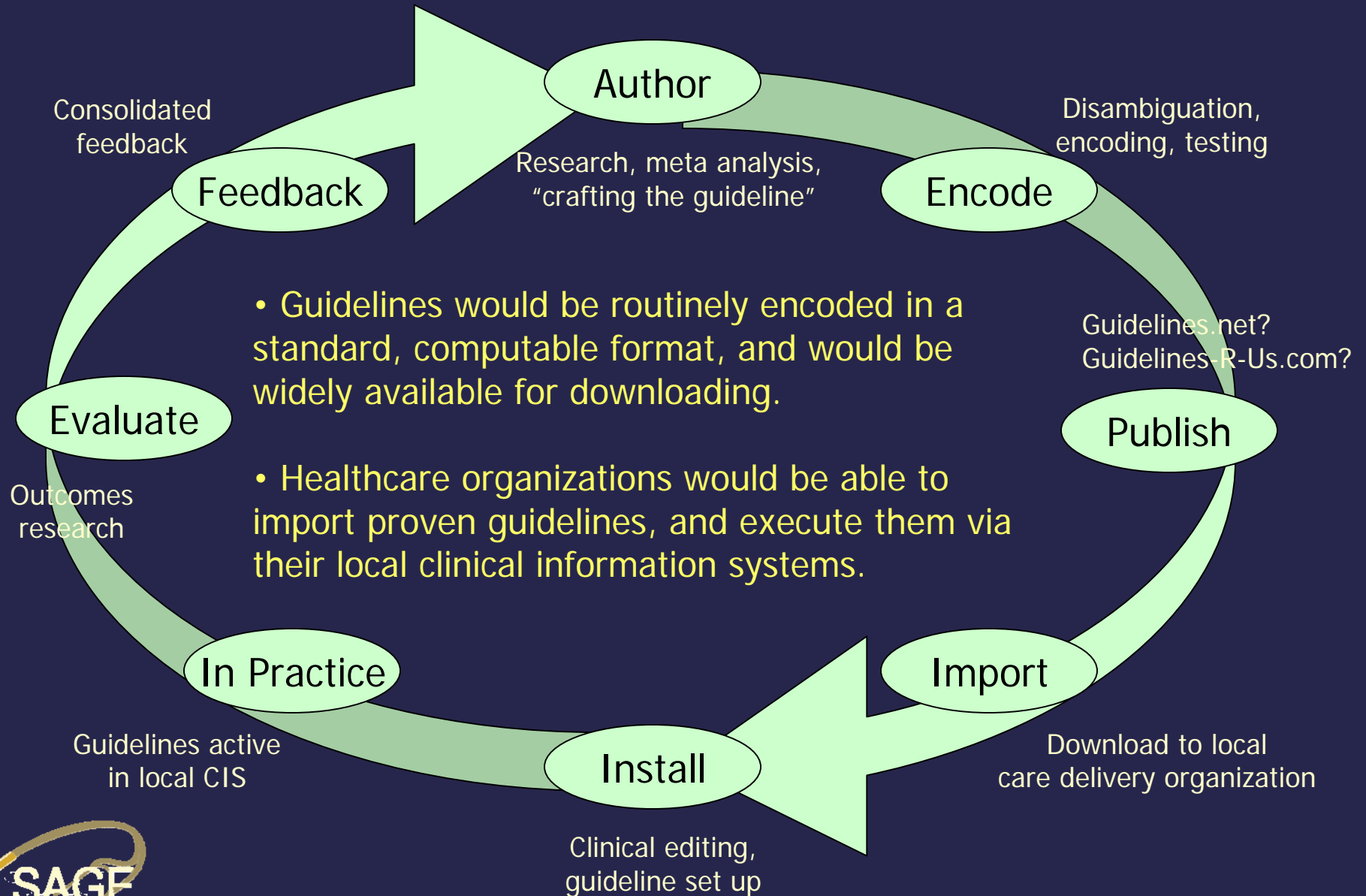
Standards-Based Sharable Active Guideline Environment



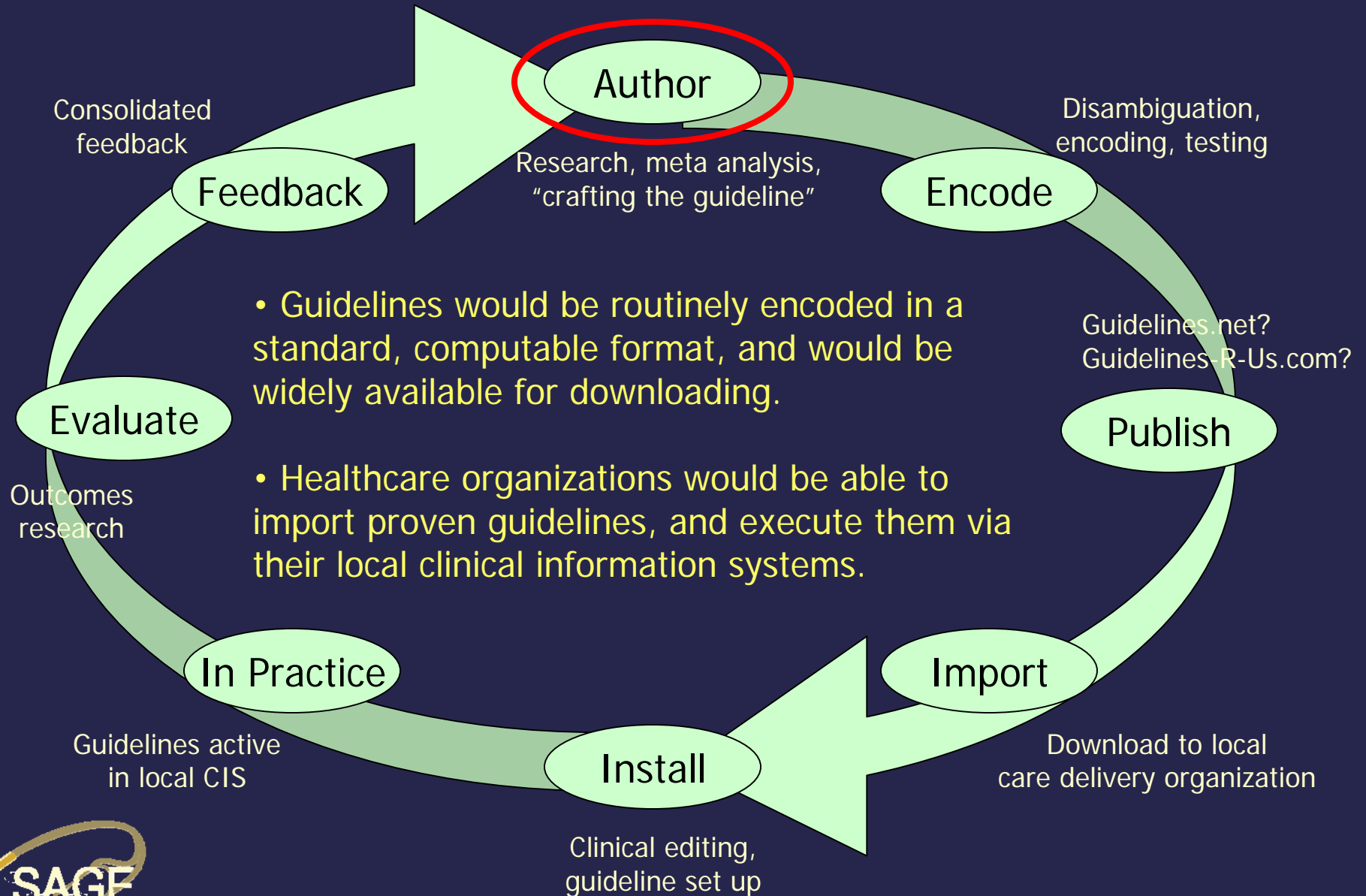
III. SAGE: Looking Forward

- Implications
- Next Steps

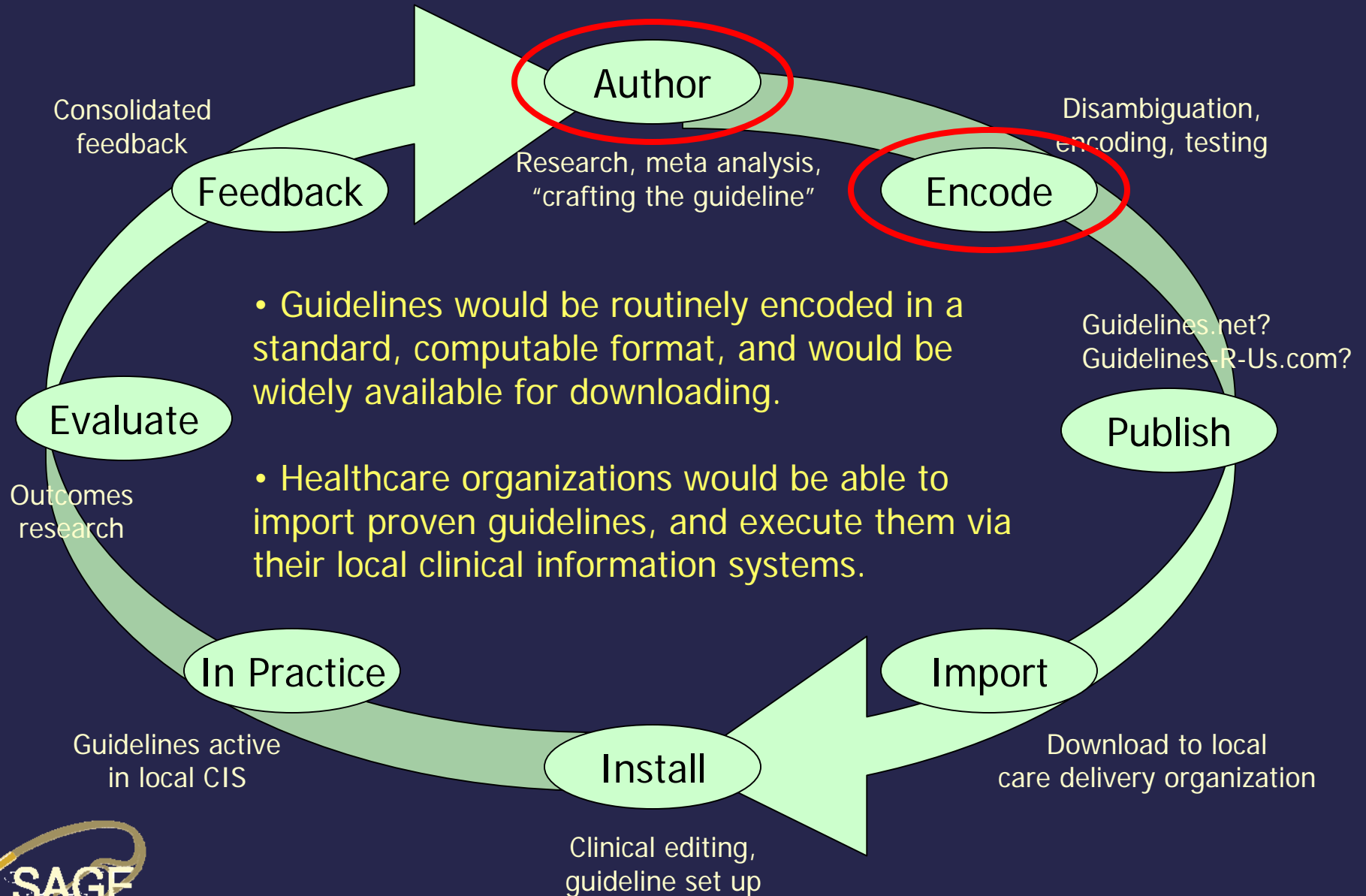
The SAGE Guideline Lifecycle



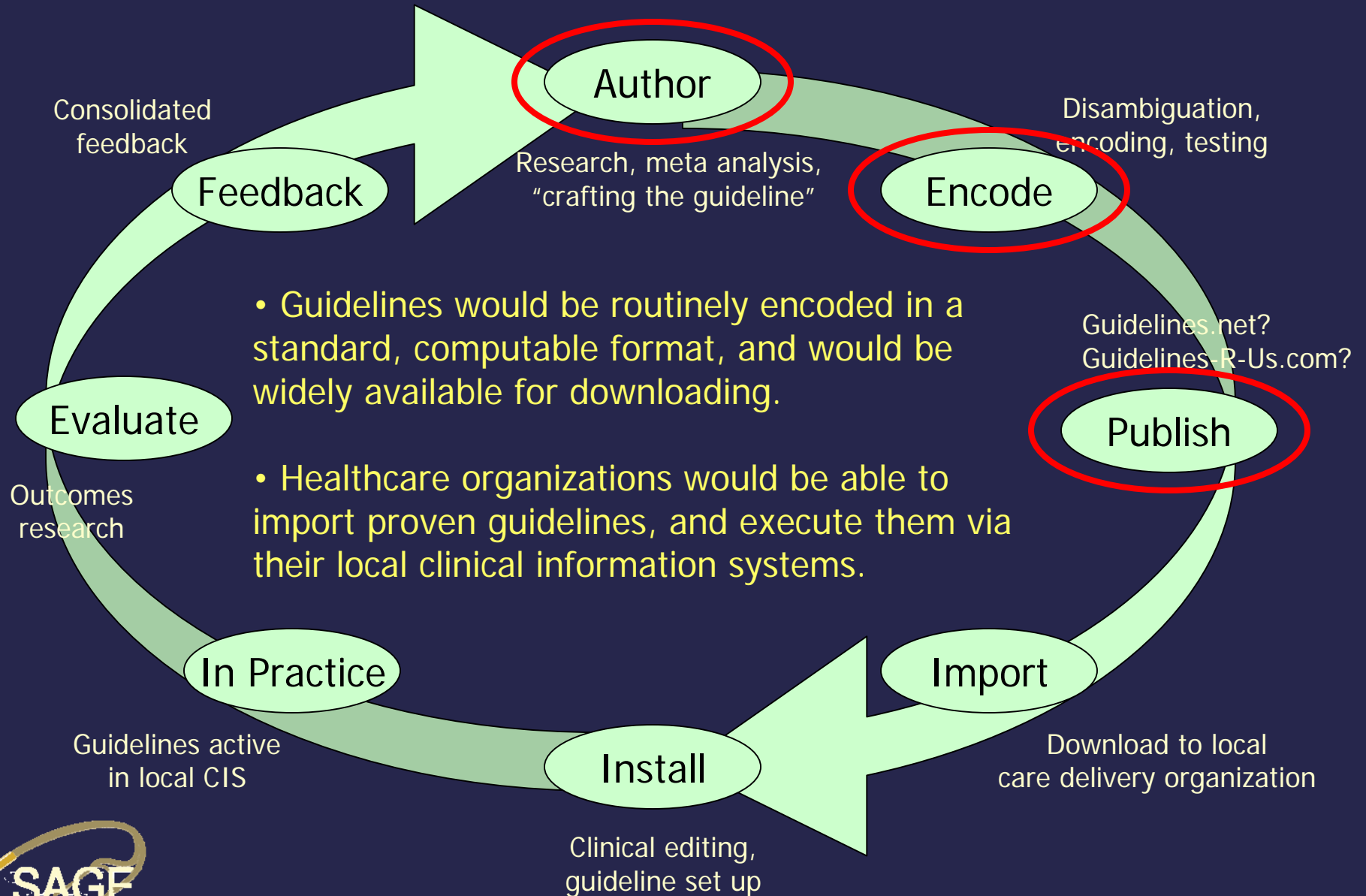
The SAGE Guideline Lifecycle



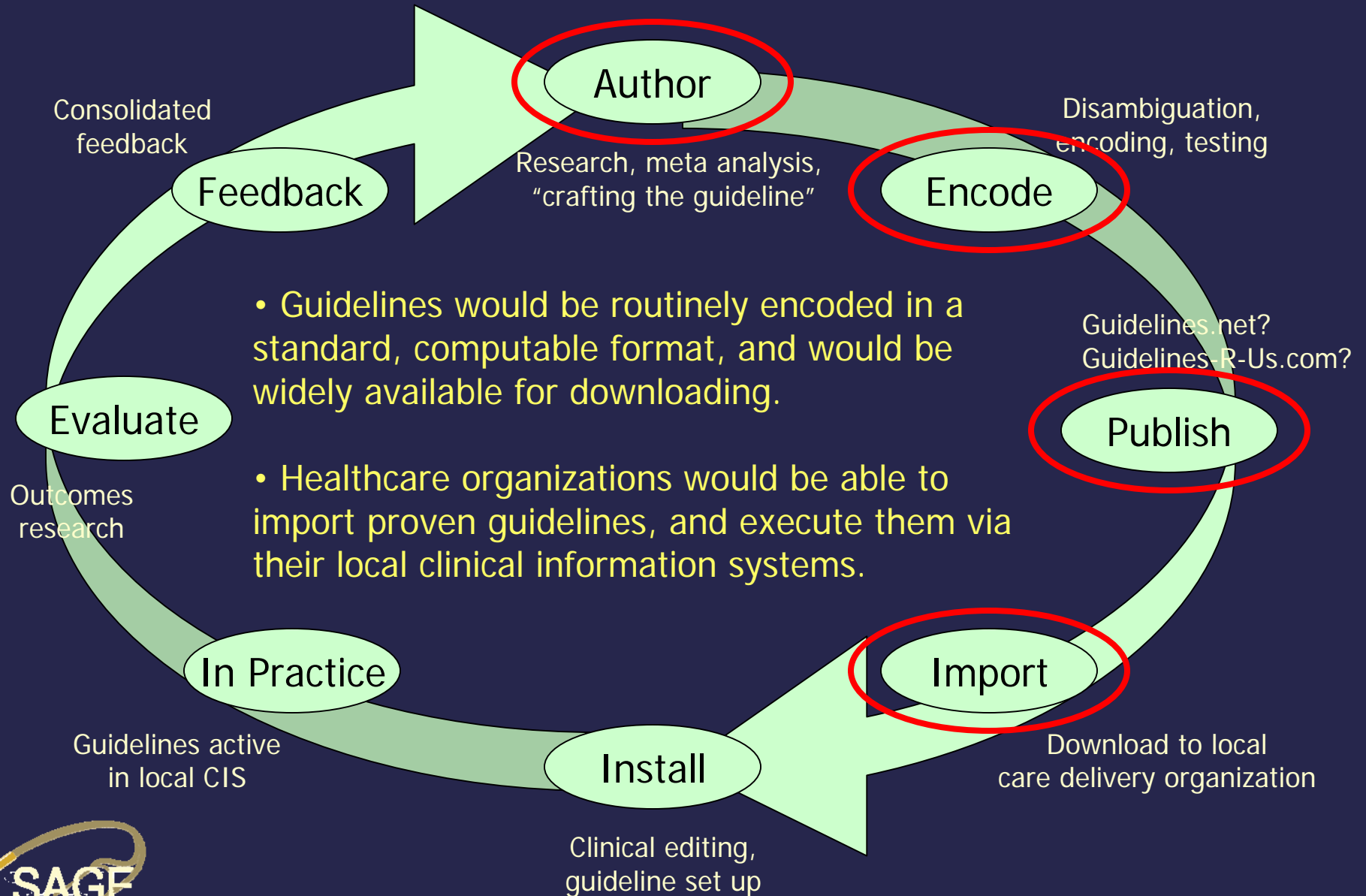
The SAGE Guideline Lifecycle



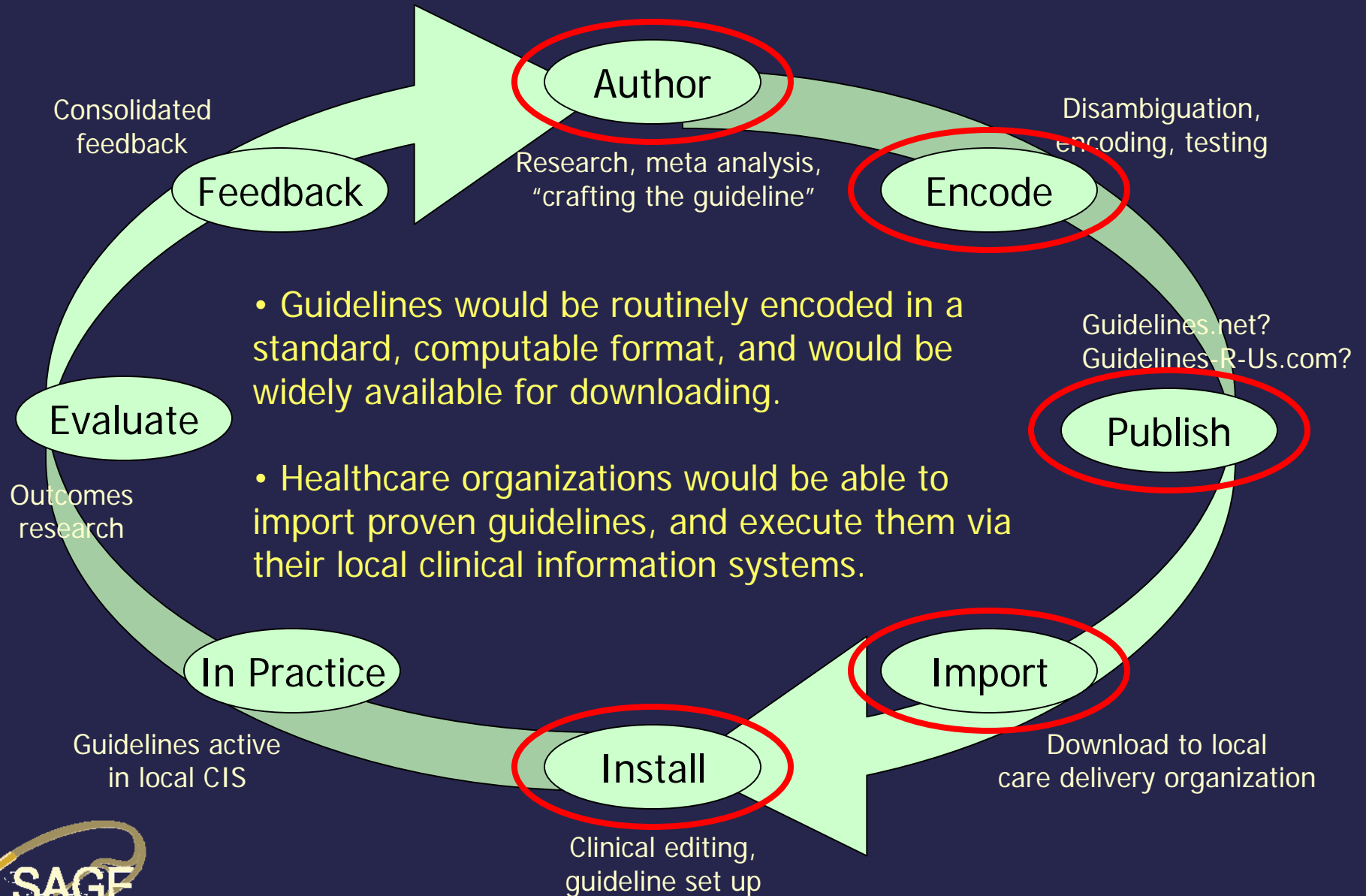
The SAGE Guideline Lifecycle



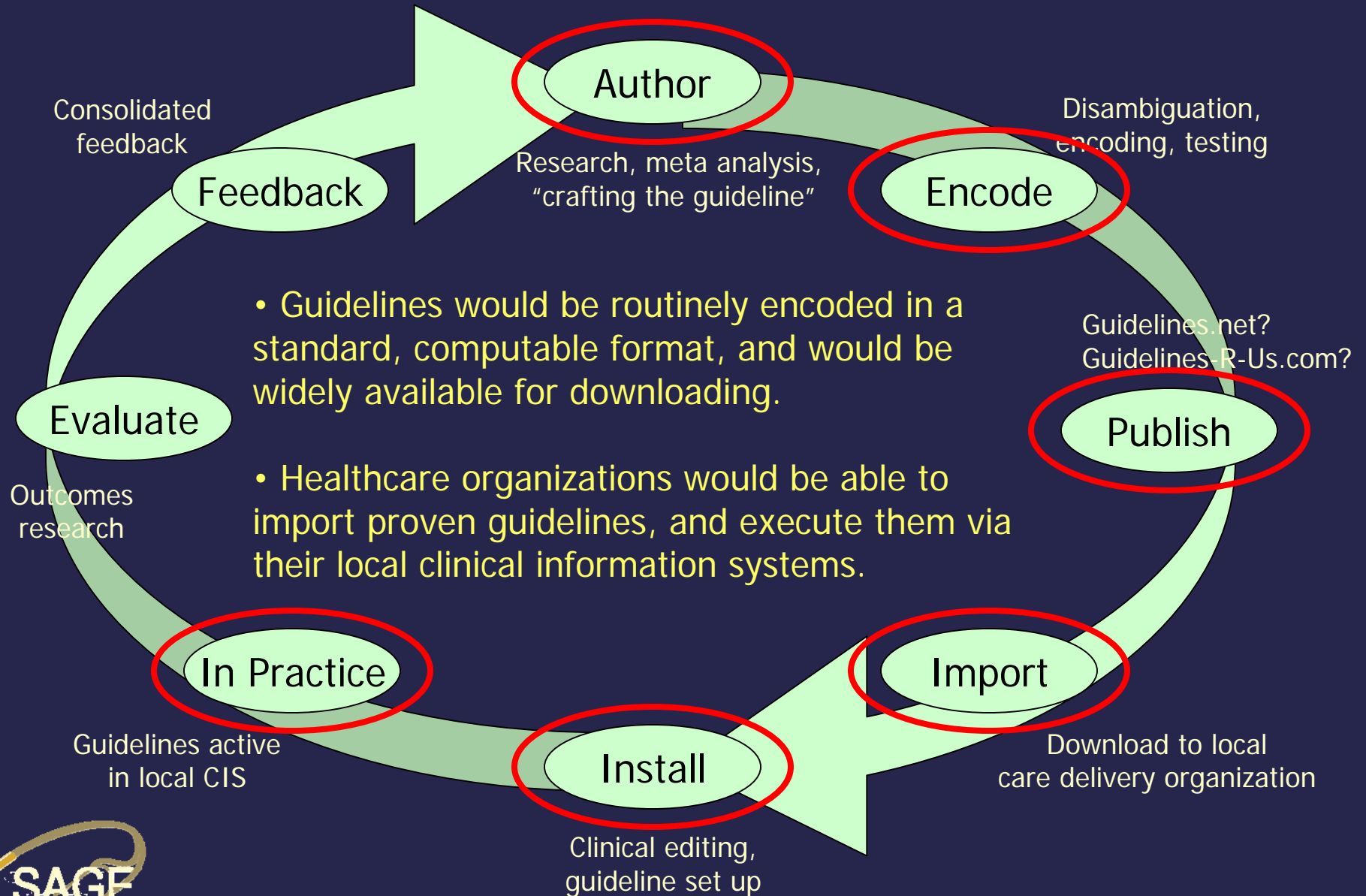
The SAGE Guideline Lifecycle



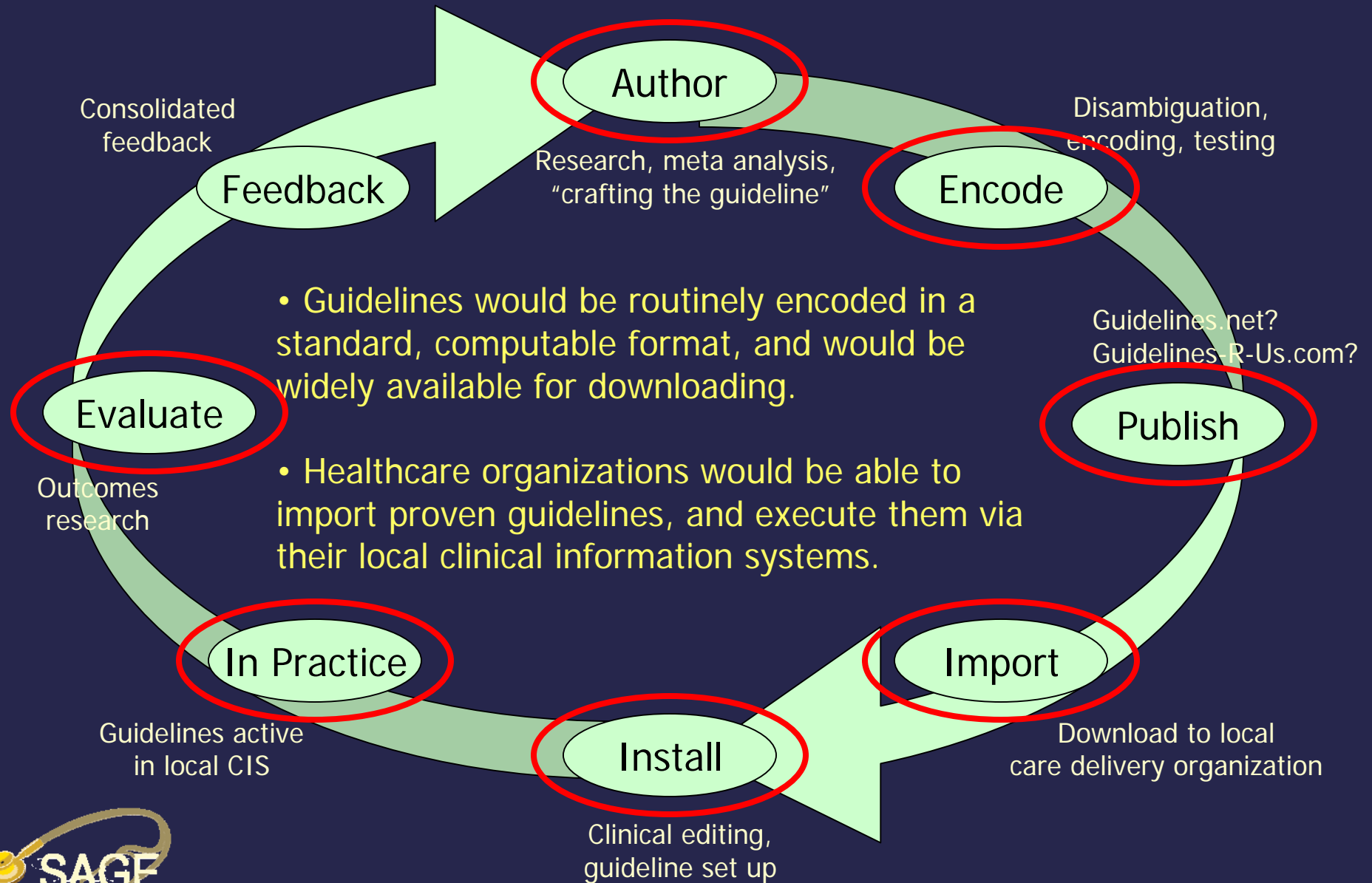
The SAGE Guideline Lifecycle



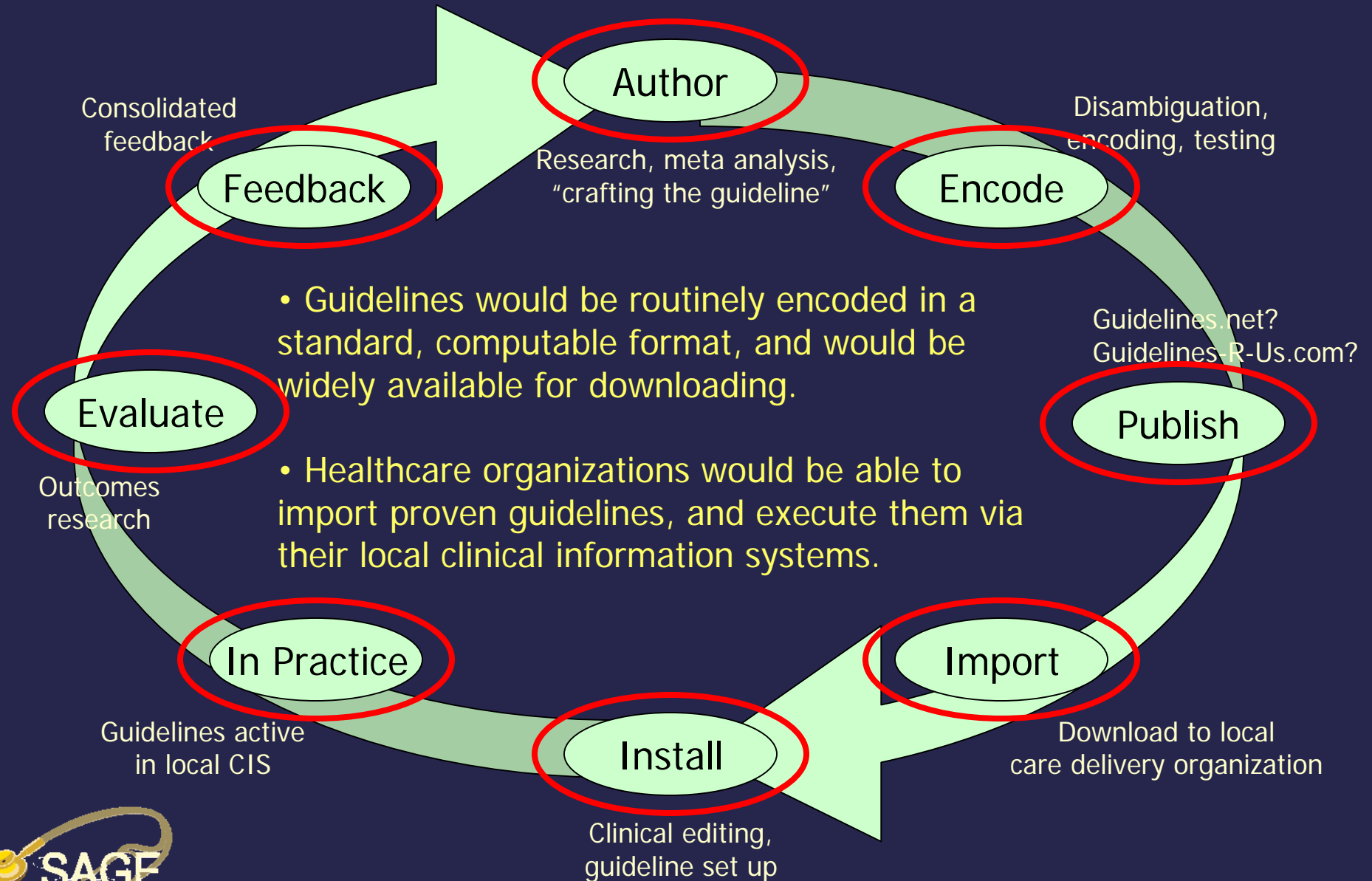
The SAGE Guideline Lifecycle



The SAGE Guideline Lifecycle



The SAGE Guideline Lifecycle



SAGE: Feasibility Now Demonstrated

We have:

- Shown that clinical guidelines can be encoded in a standards-based, sharable, computable format.
- Demonstrated the capability to represent complex guideline content and logic for both acute and chronic care domains.
- Used standard information models and terminologies to support interoperable transfer of medical knowledge.
- Developed and tested an interoperable approach to deploying guideline-based decision support that:
 - Activates guideline logic in response to clinical events.
 - Retrieves patient data from the EMR.
 - Makes patient-specific recommendations based on guideline logic.
 - Integrates those care recommendations into the care workflow.

SAGE: The Next Steps

- Continued development and promotion of foundation informatics standards (VMR, Guideline Model, Terminologies)
 - With standards initiatives and organizations (e.g., NHI, HL7)
 - With HIS vendors and medical content developers
- Seeking AHRQ funding for research on impact of SAGE guideline technology on clinician behavior and clinical outcomes.
- Plan to obtain early, widespread benefits via incremental roll out of SAGE technology

SAGE: Potential for Immediate Impact

We believe:

- Early implementations of “simple” SAGE technology can have a wide impact.
- Encoding of basic primary care reminders:
 - Easiest to encode; lowest cost to develop.
 - Easier to disseminate on wide basis.
 - Largest impact on health care improvement.
- Implementation lower cost of “SAGE Lite” technology to “basic” hospital information systems.
 - Develop streamline SAGE technology for early, wide adoption.
 - Target implementation to “community” health care where advanced clinical information systems are not yet available, yet where much of today’s basic health care is provided.

SAGE: Summary of Future Potential

- SAGE as a clinical trials automation technology?
- SAGE as a knowledge discovery platform?
- Future SAGE-related research
- Development, promotion of SAGE-related informatics standards
- Alignment with Federal informatics standard initiatives

The SAGE Project

Standards-Based Sharable Active Guideline Environment

Thank You!



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