

### **Beyond Alerts:** Clinical Decision Support with Evidence & Expertise

Sandy J. Falk, MD, FACOG Director, Editorial Relations Deputy Editor — Gynecology UpToDate Clinical Solutions,Wolters Kluwer Health

### About the Presenter

Sandy J. Falk, MD, FACOG Director, Editorial Relations Deputy Editor — Gynecology UpToDate



Director of Gynecology, Sexual Health Program, Adult Survivorship Program, Dana Farber Cancer Institute Clinical Instructor, Harvard Medical School



### Agenda

- Defining CDS
- Going beyond alerts
- The doctor's perspective
- A CDS Success Roadmap for CIOs/IT Management







- A 47-year old woman, previously healthy
- Delay in diagnosis, developed uterine and colon cancer
- Ultimately received treatment with multiple complications
- 30-day hospitalization with subsequent disability



# Defining Clinical Decision Support



# **Clinical Decision Support (CDS)**

CDS provides clinicians, staff, patients or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.

CDS encompasses a variety of tools to enhance decision-making in the clinical workflow.



### How Do CDS and EHRs Work Together?



### EHR adoption—but not alone

- Not associated with improvements in performance in health care quality (except surgical complications) and efficiency measures in US acute care hospitals.
  - Exception: EHR with CDS (such as clinical practice guidelines and reminders) was associated with small quality gains.



# Clinical decision support improves delivery of recommended care

Systematic review of randomized trials found that CDS was associated with use of recommended care:

- 1.4-fold increase in preventive care
- 1.7-fold increase in diagnostic studies
- 1.5-fold increase in treatment



### The Universe of Clinical Decision Support



![](_page_8_Picture_2.jpeg)

![](_page_8_Picture_3.jpeg)

### The Universe of Clinical Decision Support

![](_page_9_Figure_1.jpeg)

![](_page_9_Picture_2.jpeg)

![](_page_9_Picture_3.jpeg)

#### Alerts and reminders—*small benefits*

• Multiple studies have found that these can improve clinical decision making, although the benefits have been modest and inconsistent across studies.

![](_page_10_Picture_3.jpeg)

# McCoy et al provided a framework for evaluating CDS alerts and responses (JAMIA 2012; 19:346-352)

	Provider Response Appropriate	Provider Response Inappropriate
Alert Display Appropriate (Signal)	Successful alerts	Provider non-adherence (inappropriate overrides)
Alert Display Inappropriate (Noise)	Justifiable overrides	Unintended adverse consequences

# Overriding an alert may or may not be an appropriate provider response; cannot just look at the override rate

![](_page_11_Picture_4.jpeg)

J Am Med Inform Assoc. 2012 May-Jun;19(3):346-52. doi: 10.1136/amiajnl-2011-000185. Epub 2011 Aug 17.

### CDS + Alert Fatigue = "CDS Fatigue"

Over a recent four-year period:

### 560 alarm-related deaths

--U.S. Food and Drug Administration database

### 80 alarm-related deaths

- 13 serious alarm-related injuries
- --The Joint Commission's sentinel event database

### An Alert-Centric View Diminishes the Potential of CDS

![](_page_12_Picture_8.jpeg)

![](_page_12_Picture_10.jpeg)

# Time for CDS to go "Beyond Alerts"

![](_page_13_Picture_1.jpeg)

### **Doctors Have Clinical Questions**

Unanswered clinical questions impact patient management decisions

Approximately **2 out of 3** clinical encounters generate a question

Physicians have approximately 11 clinical questions a day

![](_page_14_Picture_4.jpeg)

Answering all clinical questions could change

5 to 8

patient management decisions each day

![](_page_14_Picture_8.jpeg)

### **Clinical Decision Support: Getting It Right**

![](_page_15_Figure_1.jpeg)

![](_page_15_Picture_2.jpeg)

### The Universe of Clinical Decision Support

![](_page_16_Figure_1.jpeg)

![](_page_16_Picture_2.jpeg)

![](_page_16_Picture_3.jpeg)

### A Closer Look at CDS "Expert Systems"

![](_page_17_Figure_1.jpeg)

![](_page_17_Picture_2.jpeg)

![](_page_17_Picture_3.jpeg)

# Features of CDS systems that correlate with improved patient care

- Integrated into the workflow
- Electronic based
- Provide decision support at the time and location of care rather than prior to or after the patient encounter
- Provides recommendations for care, not just assessments

![](_page_18_Picture_5.jpeg)

### Knowledge-based CDS Built on Evidence & Expertise

### **Evidence:**

• Review and synthesis of hundreds of research journals

many operation

olters Kluwer

20

putable

Health

ormation

able

health created

• Rigorous peer-reviewed editorial process

### **Expertise:**

- Comprehensive coverage of specialties
- Full-time MD experts
- Contributor community with global perspective
- → Graded recommendations

# Evidence-based CDS is extensively researched.

For example, over 60 studies on UpToDate alone.

![](_page_20_Picture_3.jpeg)

![](_page_20_Picture_4.jpeg)

### Researchers at Harvard University Find Clinical Decision Support Associated with Improved Outcomes

### **1** Improved Quality

Every condition on Hospital Quality Alliance Metrics

### Shorter Lengths of Stay

372 000 days over 1 year

### Lower Mortality Rates

11 500 lives over 3 years

![](_page_21_Picture_7.jpeg)

Isaac T, Zheng J, Jha A. Use of UpToDate and outcomes in US hospitals. J Hosp Med 2012; 7:85.

### **Clinical Decision Support Changes Clinical Decisions**

![](_page_22_Picture_1.jpeg)

![](_page_22_Picture_2.jpeg)

Researchers at *Singapore's National University Hospital* report that bedside use of UpToDate led to changes in patient care decisions 37% of the time

![](_page_22_Picture_4.jpeg)

Phua J, See KC, Khalizah HJ, et al. Utility of the electronic information resource UpToDate for clinical decision-making at bedside rounds. Singapore Med J 2012; 53:116.

### Improvements increased with increased use

UpToDate usage levels and impact on complications, patient safety, and length of stay

![](_page_23_Figure_2.jpeg)

Bonis PA. Association of a clinical knowledge support system with improved patient safety, reduced complications and shorter length of stay among Medicare beneficiaries in acute care hospitals in the United States. Int J Med Inform 2008; 77:745.

Wolters Kluwer

# The impact of evidence-based recommendations on treatment plans

![](_page_24_Figure_1.jpeg)

![](_page_24_Picture_2.jpeg)

### 270+ Million Topic Views in 12 months

![](_page_25_Figure_1.jpeg)

516 topic views per minute—potentially 150 changed decisions

![](_page_25_Picture_3.jpeg)

### Clinicians save time when using CDS

![](_page_26_Figure_1.jpeg)

Health

2012 UpToDate Subscribers' Survey

Based on data analysis, users are able to search, locate, and review the information they need in approximately 1 minute.

# Median mobile session **57 seconds**

Median web session 67 seconds

![](_page_27_Picture_4.jpeg)

![](_page_27_Picture_5.jpeg)

Forrester Research found Salford Royal NHS Foundation Trust (SRFT) recovered the costs of a leading Clinical Decision Support System in 90 days

### **Benefits Included:**

- Staff productivity
- Diagnostic test efficiencies
- Improvements in the quality of care

![](_page_28_Picture_6.jpeg)

![](_page_28_Picture_7.jpeg)

![](_page_28_Picture_8.jpeg)

![](_page_28_Picture_9.jpeg)

= 70

### Scalable Solutions to Increase the Impact on Care

![](_page_29_Figure_1.jpeg)

![](_page_29_Picture_2.jpeg)

### CDS is Key to Standardizing Public Healthcare

UpToDate has national contracts with the governments of *Norway*, *Spain*, *Saudi Arabia*, *Iran and Jordan* to standardize public healthcare on UpToDate

In countries such as the *Netherlands*, *Switzerland* and *Luxembourg*, UpToDate is used country-wide

In major metropolitan health systems including *New York City Health & Hospitals* and *Brasilia*, quality care is supported by UpToDate CDS

![](_page_30_Picture_4.jpeg)

# The Doctor's Perspective: A Knowledge-Based CDS Case Study

![](_page_31_Picture_1.jpeg)

![](_page_32_Picture_1.jpeg)

A 47 year old notes new bleeding between her periods. She is otherwise healthy and takes no regular medications but is allergic to penicillin.

She also complains of occasional chest pain occurring mostly after eating.

Her primary care provider recommends a follow-up visit in one year but no other testing.

One-year later, she is referred to a gynecologist who diagnoses endometrial cancer end recommends surgery to remove her uterus and ovaries.

![](_page_32_Picture_6.jpeg)

![](_page_33_Picture_1.jpeg)

During preoperative testing, a cardiac stress is ordered to evaluate her chest pain, the results are unclear, her primary care physician recommends that she undergo cardiac catheterization before surgery to be sure her chest pain was not caused by a heart condition.

Her catheterization is essentially normal but she has noted some mild, nagging numbness in her fingers since the procedure.

![](_page_33_Picture_4.jpeg)

![](_page_34_Picture_1.jpeg)

Surgery is performed, the patient is found to have stage I uterine cancer but also has stage III colon cancer.

12 hours after surgery, she develops a fever for which she is given Tylenol. Seven hours later, a nurse calls the covering physician because the patient looks ill. Her blood pressure is lower than normal

She is transferred to the intensive care unit with sepsis and is started on antibiotics, one of which is related to penicillin

She recovers after one month in the ICU where she suffered multiple complications including the need to amputate one of her toes

![](_page_34_Picture_6.jpeg)

Condition	Outcome	How knowledge-based CDS could have helped
Abnormal Bleeding	Delay in diagnosis	CDS would have led to earlier diagnosis
Hereditary Cancer	Patient and family may be at risk for colon and uterine cancer. A proper family history was not obtained	CDS would have provided correct guidance
Catheterization	Possibly unnecessary preoperative work-up with complication	CDS guidance might have prevented
Sepsis	Diagnosis was delayed and condition was likely not managed optimally	Guidance from CDS could have helped
Choice of Antibiotics	Penicillin given to allergic patient	Knowledge-based and drug interaction CDS provide correct choices.

![](_page_35_Picture_2.jpeg)

# A CDS Success Roadmap for CIOs/IT Management

![](_page_36_Picture_1.jpeg)

### From the Past into the Future

![](_page_37_Picture_1.jpeg)

"...many of these errors are due to man's limitations as a data processor...

Thus, I conclude that though the individual physician is not perfectable, the system of care is, and the computer will play a major part..."

![](_page_37_Picture_4.jpeg)

### **Clinicians' Most Valuable HIT Initiative for Patient Care**

Which IT initiative produces the **greatest benefit** to the quality and safety of patient care?

![](_page_38_Figure_2.jpeg)

Proportion ranking each initiative a 9 or 10 on a 10 point scale (n = 17,127)

![](_page_38_Picture_4.jpeg)

Source: UpToDate individual subscriber survey 2012

### **Checklist for Robust Clinical Decision Support**

#### ✓ Knowledge Base

- ✓ Current, comprehensive, evidence-based
- ✓ Summary & detail presentations
- Expert recommendations
- Rich & dynamic content: graphics, video, calculators

### ✓ Advanced Search

- ✓ Intuitive, auto-complete
- Filters for content type (e.g., adult vs pediatric)
- Multi-lingual search and navigation

### ✓ Context

- ✓ Patient context: integrates EHR data re: patient
- Location context: available at the point of care

![](_page_39_Figure_13.jpeg)

![](_page_39_Picture_14.jpeg)

![](_page_39_Picture_15.jpeg)

Effective decision support requires maximal integration in the clinical workflow - at the point of care.

### Mobile Apps:

- Cellular network
- Wi-Fi
- Download

# EHR:

- Link
- Search field
- HL7 InfoButton
- Patient-specific data

![](_page_40_Picture_11.jpeg)

# HL7 Infobutton Example

Task Edit View Patient Chat Links Navigation Help   Schedule View All Message Center Patient Links Patient Links Patient Advances Patient Education Toolkits Q CHAD Patient Education Toolkits Q LiabMan Q Patient Education Toolkits Q Liab Signes Loading Patient Education Toolkits Q Patient Education Toolkits Q Patient Education Education Patient Education	PowerChart Organizer for St	tone, David M					0 8
Schedule Viewer Metsage Center & Patient List & Ambulatory Worklist    Patient Access List & Saff Assignment & Multi-Patient Tak List    CORES    @ Explore Menu    @ Recent + Marrie    Print & 2 a minute    Patient Education Toolkis    LabMan    Patient Access List & Saff Assignment & Multi-Patient Tak List    CORES    @ Explore Menu    @ Print    2 a minute    Patient Education Toolkis    LabMan    Patient Access List & Saff Assignment    Multi-Patient Tak List    CORES    @ Explore Menu    @ Print    2 a minute    Patient Education Toolkis    LabMan    Patient Access List & Saff Assignment    Multi-Patient Tak List    CORES    @ Explore Menu    @ Print    2 a minute    Patient Education Formulary    CHLD Immunization Registry    @ Recent + Marrie    Print    2 a minute    Patient Education formulary    CHLD Immunization Registry    @ Recent + Marrie    Print    2 a minute    Patient Education formulary    CHLD Immunization Registry    @ Recent + Marrie    Print    2 a minute    Patient Education formulary    CHLD Immunization Registry    @ Recent + Marrie    Print    2 a minute    Patient Education formulary    CHLD Immunization Registry    Patient Educations Print    Patient Education formulary    CHLD Immunization Registry    Patient Educations Print    Patient Educations Print    Patient Educations Print    Patient Educations Print    Patient Educations    Patient Education    Patient Educations    Patient Education    P	Task Edit View Patier	nt Chart Links Notifications	Navigation Help				
CHILD Q Patient Education Tookkit Q LabMan Q Policies and Procedure Image: CD-9 Data Medication Formulary CHILD Immunization Registry Recent + Name   Impatient Impatient Impatient Impatient Impatient Impatient Impatient   Reason For Vist: CP Impatient Impatient Impatient Impatient   Reason For Vist: CP Impatient <th>🛄 Schedule Viewer 🗔 Mess</th> <th>iage Center 🛉 Patient List 🌃 Ambula</th> <th>tory Worklist 🔝 Patient Access List 😂 Staff Assignment 🌡</th> <th>Multi-Pat</th> <th>ient Task List 👫 CORES 🕼</th> <th>Explorer Menu</th> <th>1 N</th>	🛄 Schedule Viewer 🗔 Mess	iage Center 🛉 Patient List 🌃 Ambula	tory Worklist 🔝 Patient Access List 😂 Staff Assignment 🌡	Multi-Pat	ient Task List 👫 CORES 🕼	Explorer Menu	1 N
A      A	CHILD 🔍 Patient Educati	ion Toolkits 🔍 LabMan 🔍 Policies ar	id Procedures 📕 🥅 ICD-9 Data 🥅 Medication Formulary	CHILD	Immunization Registry 🔚	Recent + Name	-
Commonly inserted in     Selected wet     Selected w						📑 Print	2 23 minutes a
Instantion       Decand A1 Cutomes Hole®         Patient Information       Vital Signs Loading + *       Itew Order Entry + = -         Reason For Vist:       CP         Attending Physics::       CP         Targeted Dicharge Date:       No results found         Last 26 hours for the selected visit       Documents Loading +         Intake and Output Loading       Last 4 months for all visits         Vistal Signs Cooling       Last 2 days for the selected visit         Diagnoses (2)       Take and Output Loading         Selected visit       * Intex, results found         I result found       Diagnostics (0)         Selected visit       No results found         I result found       Diagnostics (0)         Selected visit       No results found         I result found       Diagnostics (0)         Selected visit       No results found         I result found       Selected visit         No results found<		100% 🔹 📀 🕲 🖾					
he page & not a complete source of visit information  Patient Information  Reason For Visit:  Attending Physican:  Targeted Dacharge Date: No results found Last Vait:  No results found Code Statue:  No results found Emergency Contact (0)  Problems (1)  At Veat  Problems (1)  At Veat  Informatic cressets()  Informatic found Lines, Tubes, and Drains Loading  Selected visit Diagnoses, (2) Selected visit Diagnoses (2) Selected visit UpToDate  Commonly inserted in Diagnoses, Problem Lis Medication List, or Ord Lines, Strubes, and Drains Loading  Restma ad subjest 10 mg tables 25 mg1 tables, Oral, Dayr 30  Code Status:  Restma ad subjest 10 mg tables 10 mg1 tables, Oral, Dayr 30  Code Status:  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Code Status:  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Code Status:  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Code Status:  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Code Status:  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Code Status:  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Code Status:  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad tables 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad subjest 10 mg1 tables, Oral, Dayr 30  Restma ad su	inpatient Summary					Expand All Custom	ice Heb 🖗
Patient Information       Vital Signs Loading + *         Reason For Vist:       C         Attending Physican:       Last 26 hours for the selected visit         Targeted Discharge Date:       No results found         Last Vist:       No results found         Last Vist:       No results found         Last 2 days for the selected visit       UpToDate Search (Enk Van Eston, MD)         Diagnosees (2)       Intake and Output Loading         Selected visit       Diagnosets (0)         Problems (1)       Selected visit         M Visit       Selected visit         Integration (2)       Selected visit         Problems (2)       Selected visit         Integration (2)       Selected visit         Moreal       Energency Common(2)         Integration (2)       Selected visit         Moreal       Diagnosets (2)         Selected visit       No results found         Integration (2)       Selected visit         Moreal       Selected visit         Moreal       Energy without a full 24 hour meanument poind         Diagnoses (2)       Selected visit         Moreal       Selected visit         Moreal       Selected visit         Moreal       Energy without a fu	his page is not a complete source of	f visit information.					
Reason For Visit: CP Attending Physican: Targeted Discharge Date: No results found Last Visit: No results found Code Status: No results found Diagnosess (2) Selected visit Problems (1) at Visits I hores/ Reminders (1) Last 3 days for the selected visit Diagnosess (2) Selected visit Problems (1) at Visits I hores/ Reminders (1) Last 3 days for the selected visit Diagnosess (2) Selected visit Diagnosess (2) Selected visit I hores/ Reminders (1) Last 3 days for the selected visit Diagnosess (2) Selected visit I hores/ Reminders (1) Last 3 days for the selected visit Diagnosess (2) Selected visit I hores/ Reminders (1) Last 3 days for the selected visit Diagnosess (2) Selected visit I hores/ Reminders (1) Last 3 days for the selected visit Diagnosess (2) Selected visit I hores/ Reminders (1) Last 3 days for the selected visit Diagnosess (2) Selected visit I hores/ Reminders (1) Last 3 days for the selected visit Diagnoses, Problem Liss Medication List, or Ord Entry	Patient Information	•	Vital Signs Loading 💠 🎽	0	New Order Entry 🕂		≡• •
Attending Physican: Targeted Discharge Date: No results found Last Vat: No results found Last Second Wat: Emergency Contact (0) Diagnosets (2) Selected Vat: HYPERTENSION Attending Physican: Last Second Vat: Problems (1) Attending Physican: Last Second Vat: Problems (2) Selected Vat: HYPERTENSION Attending Physican: The selected Vat: Hotes/Reminders: (1) Last 3 days for the selected vat: Totake and Output Loading Last 3 days for the selected vat: Totake and Output Loading Last 3 days for the selected vat: Totake and Output Loading Last 3 days for the selected vat: Totake and Output Loading Last 3 days for the selected vat: Totake and Output Loading Selected Vat: HYPERTENSION Attending Physican: Totake and Output Loading Last 3 days for the selected vat: Hypertension Medications (2) Tecorr totake and Drains Loading Selected Vat: Totake and Drains Loading Selected Vat: Hore subts found The coars 25 mg oral tablet 25 mg table(5), Oral, Daly 30 Disc(5) 0 refls Totake 10 mg oral tablet 10 mg oral tablet 10 mg oral tablet 10 mg table(5), Oral, Daly 30 Disc (5) 0 refls	Reason For Visit:	œ	Last 36 hours for the selected visit		Documents Insting		-
Targeted Discharge Date:       No results found         Last Vist:       No results found         No results found       Intake and Output Loading         Emergency Contact (0)       Intake and Output Loading         Diagnosete (2)       Intake and Output Loading         Selected visit       * Emergency Contact (0)         Exercise a day without a full 24 hour measurement period       UpToDate*         Problems (1)       Intex, Tubes, and Drains Loading         Al Visits       Exected visit         Insommal (personation)       Exected visit         Intex, Tubes, and Drains Loading       Selected visit         Intex, Tubes, and Drains Loading       Selected visit         Intex, Tubes, and Drains Loading       Selected visit         Intex, Tubes, Tubes, and Drains Loading       Selected visit         Intex, Tubes, Tubes, and Drains Loading       Selected visit         Intex, Tubes, Tubes, Tubes, and Drains Loading       Selected visit         Intex, Tubes,	Attending Physician:				Last & ments for al write		-
Last Vat: Code Status: No results found Emergency Contact (0) Diagnoses; (2) Selected Vat HyperTENSION mergen Problems (1) Al Veats Insomnia (personation) Medications (2) Medications (2) Medication List, or Ord Entry	Targeted Discharge Date:	No results found	Notes/Reminders (1)		Last 6 months for all visits		
Code Status:       No results found         Emergency Contact (0)       Last 3 days for the selected visit         Diagnoses (2)       * Enderse a day without 6 4/d 24 hour measurement period         Diagnostics (0)       Selected visit         Problems (1)       Selected visit         HYPERTENSION (wr.m)       Energy Contact (0)         Insomma: (25:004000)       Energy Contact (0)         Insomma: (25:0040000)       Energy Contact (0)         Insomma: (25:00400000)       Energy Contact (0)         Insomma: (25:0040000000000000000000000000000000000	Last Visit:	No results found	Intellig and Dataset London		Herebala Canada II-da	Ine Taken APR	
Lest 3 days for the selected vart UpToDate <sup>a</sup>	Code Status:	No results found	Incake and Output Loading	0	oprobate Search (Enk	Van Eaton, MD)	0
Biagnoses (2)       * Indexte a day without a full 24 hour measurement period       OprioDate       Indexte a day without a full 24 hour measurement period         Biagnostics (2)       Biagnostics (0)       Selected visit       Selected visit         Problemas (1)       Biagnostics (0)       Selected visit       Selected visit         Al Visits       Selected visit       Selected visit       Selected visit         Insommia (personation)       Selected visit       Selected visit       Selected visit       Selected visit         Insommia (personation)       Selected visit       Selected visit       Selected visit       Selected visit         I	<ul> <li>Emergency Contact (0)</li> </ul>		Last 3 days for the selected visit		LInToDato*		
Selected viat Selected viat HYPERTENSION (m2.1) Al Viata Medications (2)  Selected viat Hormulta found Lines, Tubes, and Drains Loading Selected viat Selected v	Diagnoses (2)	~	* Indicates a day without a full 24 hour measurement period				-
Fever Juscession         HYPERTENSION (m2 st)         Al Vests         Insommia (sensore(1))         Medications (2) (main tablet 25 mg1 tablet), Oral, Daly 30         Into (s) O refils	Selected visit		Diagnostics (0)	8			
HYPERTENSION       Moresulta found         Problems (1)       Insert tubes, and Drains Loading         Al Vests       Selected wat         Insomnia (carsonic)       Selected wat         Medications (2)       Image: Tubes, and Drains Loading         Al Vests       Selected wat         Medications (2)       Image: Tubes, and Drains Loading         Al Vests       Selected wat         Medications (2)       Image: Tubes, and Drains Loading         Medication List, or Ord       Entry         Medication List(s), Oral, Daly (3)       Image: Tubes, and Tubes, Oral, Daly (3)         Medication List(s), Oral, Daly (3)       Image: Tubes, and Tubes, Oral, Daly (3)         Medication List(s), Oral, Daly (3)       Image: Tubes, Oral, Daly (3)	Fever /unmonord		Selected visit				
Problems (1) Al Vests Medications (2) + = = • • • Al Vests Medications (2) + = • • • Al Vests Medications (2) + = • • • • Al Vests Medications (2) + = • • • • Al Vests Medications (2) + = • • • • • • • • • • • • • • • • • •	HYPERTENSION (997.30)		No results found				
Al Vests Insomnia (257504665) Medications (2) + = = = = = Al Vests Medications (2) + = = = = Al Vests Medications (2) + = = = = Al Vests Al Vests Medications (2) + = = = = = Al Vests Medication List, or Ord Entry	Problems (1)		Lines, Tubes, and Drains Loading				
Insomnia (28190441) Medications (2) + = • • • • • • • • • • • • • • • • • •	All Visits		Selected visit		Commor	lv insert	ed in
Medications (2)  Medications (2)  Medications (2)  Medication List, or Ord Medication List, or Ord Entry Medication List, or Ord Entry	Insomnia company						
Al Visits Al Visits Di Hoc Cozaar 25 mg oral tablet 25 mg1 tabl(s), Oral, Daly 30 Entry Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tabl(s), Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tablet 10 mg1 tables, Oral, Di Hoc sinvastatin 10 mg oral tables, Oral, Di Hoc sinvast					Diagnoses	i, Probler	n List
Al Visita Hoc Cozaar 25 mg oral tablet 25 mg1 tables), Oral, Daly 30 Hoc Simvastatin 10 mg oral tablet 10 mg1 tables), Oral, Hoc Simvastatin 10 mg oral tablet 10 mg1 tables), Oral, Bedtame 30 tables) 0 refils	Medications (2) 💠	≡• ⊗			Modicatio	n list or	Ordo
Hoc: Cozaar 25 mg oral tablet 25 mg1 tab(s), Oral, Daily 30     Tab(s) 0 refils     Hoc: smvastatin 10 mg oral tablet 10 mg1 tab(s), Oral, Bedtame 30 tab(s) 0 refils	Al Vota				medicatio	II LISL, OI	Ulde
He: sinvastatin 10 mg oral tablet 10 mg1 tab(s), Oral, Bedtane 30 tab(s) 0 refils	Hec Cozaar 25 mg oral ta tab(s) 0 refils	ablet 25 mg1 tab(s), Oral, Daily 30				Entry	
	Hx: sinvastatin 10 mg of Bedtime 30 tab(s) 0 refils	ral tablet 10 mg1 tab(s), Oral,					
BUILD DSTONE 18 July 2012						BUILD DSTONE 1	8 July 2012 1

![](_page_41_Picture_2.jpeg)

### **HL7 Search Results**

![](_page_42_Figure_1.jpeg)

![](_page_42_Picture_2.jpeg)

### Where is CDS Headed?

#### The evolution of Clinical Decision Support capabilties

Passive			
Highlighting	Active		
relevant	Clinical guidelines	Interactive	
patient info	Clinical pathways	"Intelligent" data	
Dashboard	Therapy protocols	acquisition and	
	Knowledge systems	interaction	
	functionality	Decision	
		monitoring	

![](_page_43_Picture_3.jpeg)

### A CIO's Roadmap for CDS Success

- ✓ Evaluate CDS in a partnership between HIT and clinical leaders
- ✓ Ensure that CDS is an integral part of the **clinical workflow**
- ✓ Think holistically about EHR in terms of user needs
- ✓ **mHealth** is here to stay position CDS in your mHealth strategy

![](_page_44_Figure_5.jpeg)

![](_page_44_Picture_6.jpeg)

# **Thank You**

### **Questions and Answers**

![](_page_45_Picture_2.jpeg)