



Clinical Decision Support: The Next Generation

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Overview

- **Embed next generation, evidence-based, contextual CDS advice into the workflow**
- **Make the advice actionable (with mappings to order catalog)**
- **Make the advice customizable**
- **How it might work**
 - Cloud
 - CDS API/App

Incorporating Research into Practice

- **“It now takes an average of 17 years for new knowledge generated by randomized controlled trials to be incorporated into practice, and even then application is highly uneven. “**
 - **Crossing the Quality Chasm, Institute of Medicine, 2001**
- **To reduce this lag time:**
 - **Peer-reviewed editorial process to identify when the evidence suggests a change to usual practice**
 - **Informatics capabilities to embed new recommendations into HIT systems**

Provider Information Needs

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
- Only 40% of questions get answered



Answering all clinical questions could

- change 5 to 8 patient management decisions each day

Covell, DG. Ann Intern Med 1985; 103:596; Green, ML. AM J Med 2002; 109:218; Osheroff, JA. Ann Intern Med 1991:575; Ely, JW. J Am Med Inform Assoc 2005; 12:217; Gorman, PN. Med Decis Making 1995; 15:113.

Incorporating New Advice into the EMR

DOE, JOHN
DOB: MAY 1, 1945 (65 YO MALE)

Cover Sheet Visit Notes Problems Medications Allergies Imaging Results Lab Results

Problems

Problem	ICD-9-CM	Resources
Hypertension	401.1	UTD
Atrial Fibrillation	427.31	UTD

Clinical Decision Support

We suggest a lenient rate control goal of <110 beats/min, compared to a stricter rate control goal of <80 beats/min, for patients in atrial fibrillation in whom a rate control strategy has been chosen (Grade 2B). (UpToDate 18.2 May 2010)
[More](#)

Medications

Medication	sig
Lisinopril Oral	20 mg daily
Diltiazem Oral	90 mg 4 times daily

Lab Results

Test	Result	Date
Sodium	140 mEq/L	6/15/2010
Potassium	3.7 mEq/L	6/15/2010
Creatinine	1.2 mg/dL	6/15/2010
Chloride	107 mmol/L	6/15/2010
BUN	10 mg/dL	6/15/2010

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Problems

Problem	ICD-9-CM	Info
Hypertension	401.1	UTD
Chronic Kidney Disease	585.4	UTD

Clinical Decision Support

We recommend sodium bicarbonate (in a daily dose of 0.5 to 1 meq/kg per day) to maintain the serum bicarbonate concentration above 23 meq/L in patients with chronic kidney disease. (UpToDate 17.3 Sep 2009) [More](#)

Medications

Medication	sig
Lisinopril Oral	40 mg daily
HCTZ Oral	50 mg daily

Lab Results

Test	Result	Date
Sodium	140 mEq/L	6/15/2010
Potassium	3.7 mEq/L	6/15/2010
Creatinine	2.1 mg/dL	6/15/2010
Chloride	104 mmol/L	6/15/2010
Bicarbonate	21 mEq/L	6/15/2010

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Cover Sheet | Visit Notes | Problems | Medications | Allergies | Imaging Results | Lab Results

Problems

Problem	ICD-9-CM	Info
Hypertension	401.1	UTD
Acute Alcoholic Hepatitis	571.1	UTD
Diabetes Mellitus Type II	250.00	UTD

Clinical Decision Support

Updated guidelines suggest pentoxifylline as an alternative to glucocorticoids in selected patients with severe alcoholic hepatitis. (UpToDate 18.1 Jan 2010) [More](#)

Medications

Medication	sig
Lisinopril Oral	40 mg daily
Glyburide Oral	1.25 mg daily

Lab Results

Test	Result	Date
AST	285 IU/L	6/15/2010
ALT	100 IU/L	6/15/2010
Bilirubin (total)	20.0 mg/dL	6/15/2010
INR	1.5	6/15/2010

Incorporating General Advice into CPOE



Pulmonary Embolism

IV 

- *Intravenous fluid (usually normal saline) should be administered cautiously because increased right ventricular (RV) wall stress can decrease the ratio of RV oxygen supply to demand. This may result in ischemia, deterioration of RV function, and worsening RV failure. Clinicians should be wary of administering more than 500 to 1000 mL of normal saline during the initial resuscitation period. If the patient's hypotension does not resolve with intravenous fluids, intravenous vasopressor therapy should promptly follow. (UpToDate)*

Crystalloid:

_____ [Fluid Type] _____ [KCl Amount] at _____ [IV Rate]

Lock IV:



Saline lock IV _____ [Flush Frequency]

Incorporating Smart Advice into CPOE



Allergies	
Medication	Reaction
Penicillin	Rash



Hip Replacement; Preoperative

Prophylactic Antibiotics - Beta-Lactam Allergy:  

- For patients with type I allergy to beta-lactams or high risk for MRSA give vancomycin (1 g IV). For patients who are allergic to vancomycin or cannot tolerate its infusion, give clindamycin (600 to 900 mg IV).
- Clindamycin phosphate 600 mg intravenously single dose 1 hour before surgical incision
- Vancomycin HCl 1 gram intravenously single dose 2 hours before surgical incision

Anticoagulants:  

- Dalteparin sodium 5,000 units subcutaneously single dose 12 hours before surgical incision
- Enoxaparin sodium 40 mg subcutaneously single dose 12 hours before surgical incision
- Tinzaparin sodium 4500 units subcutaneously single dose

Make it Actionable

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We recommend sodium bicarbonate (in a daily dose of 0.5 to 1 meq/kg per day) to maintain the serum bicarbonate concentration above 23 meq/L in patients with chronic kidney disease. (UpToDate 17.3 Sep 2009) [More](#)

[Order](#)

Prompt for Value

- Dose Sodium Bicarbonate Oral --
- 325 mg
- 650 mg**
- 975 mg
- 1300 mg
- 2600 mg
- 3900 mg
- 7800 mg
- 15,600 mg
- New Custom Attribute Value

Prompt for Value

- Frequency Sodium Bicarbonate Oral --
- Single Dose
- 3 Times per Day
- 4 Times per Day
- Every 4 Hours**
- New Custom Attribute Value

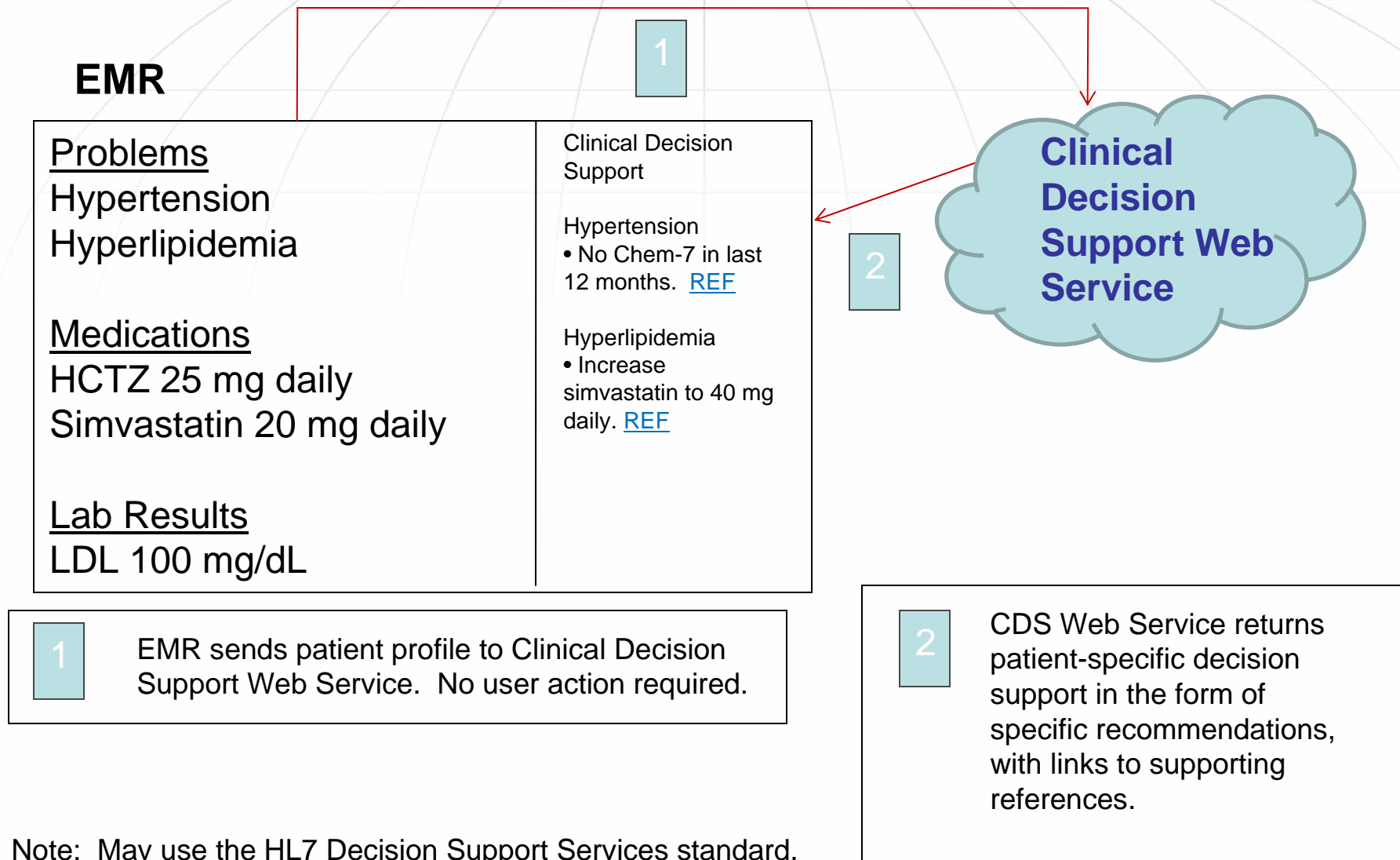
Make it Customizable

Clinical Decision Support - Management
Customer: General Hospital

Search for CDS Advice

Context Tag	Item Tag	Nugget	Status	Providers	Link
NSTEMI	Aspirin	We suggest aspirin plus clopidogrel as the preferred regimen (Grade 2B). ASA plus a GPIIb/IIIa inhibitor is a reasonable alternative and is the preferred strategy in patients known to need CABG where the surgeon will not operate with clopidogrel on board. The first aspirin tablet should contain 162 to 325 mg and should be chewed.	<input checked="" type="radio"/> Enabled <input type="radio"/> Disabled	<input checked="" type="checkbox"/> Attending <input checked="" type="checkbox"/> Resident <input checked="" type="checkbox"/> Nurse <input checked="" type="checkbox"/> Pharmacist	Reference
NSTEMI	Clopidogrel	Clopidogrel given in combination with aspirin leads to significant benefits in patients with non-ST elevation ACS. The loading dose of clopidogrel is 300 mg. However, if the patient is going to catheterization the same day, we use clopidogrel 600 mg.	<input checked="" type="radio"/> Enabled <input type="radio"/> Disabled	<input checked="" type="checkbox"/> Attending <input checked="" type="checkbox"/> Resident <input type="checkbox"/> Nurse <input type="checkbox"/> Pharmacist	Reference
NSTEMI	Enoxaparin	Loading dose of 30 mg intravenous bolus followed by 1 mg/kg subcutaneously twice daily (or once daily in patients with an estimated creatinine clearance less than 30 mL/min).	<input type="radio"/> Enabled <input checked="" type="radio"/> Disabled	<input type="checkbox"/> Attending <input type="checkbox"/> Resident <input type="checkbox"/> Nurse <input type="checkbox"/> Pharmacist	Reference

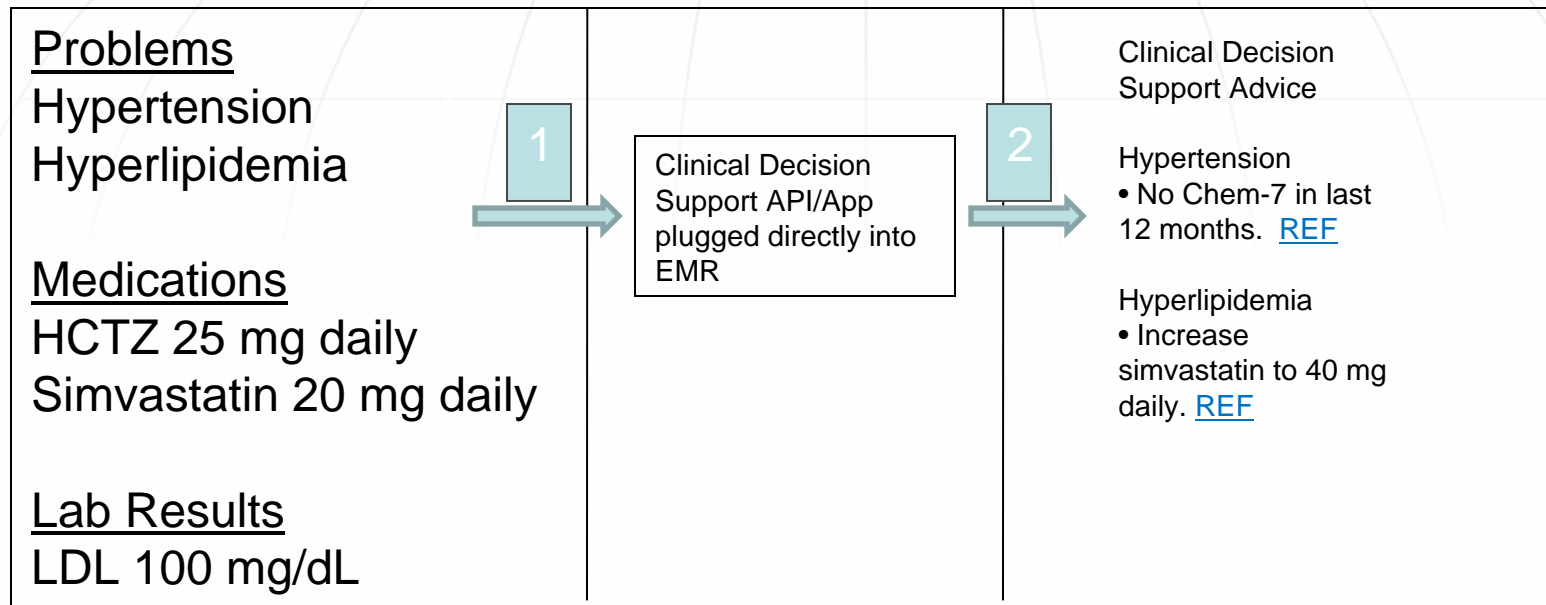
How would it work? (A) Cloud



Note: May use the HL7 Decision Support Services standard.

How would it work? (B) API/App

EMR



1

EMR sends patient profile to Clinical Decision Support API/App. No user action required.

2

CDS API/App returns patient-specific decision support in the form of specific recommendations, with links to supporting references.

Summary

- **Peer-reviewed editorial process identifies when the evidence suggests a change to usual practice**
 - Information comes from a trusted source
- **New recommendations are embedded into the workflow of HIT systems**
- **Advice is actionable**
- **Advice is customizable**
- **CDS can come from the cloud or from embedded EMR applications**



Questions

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