

# Artificial intelligence, big data, clinical decision support, and knowledge design

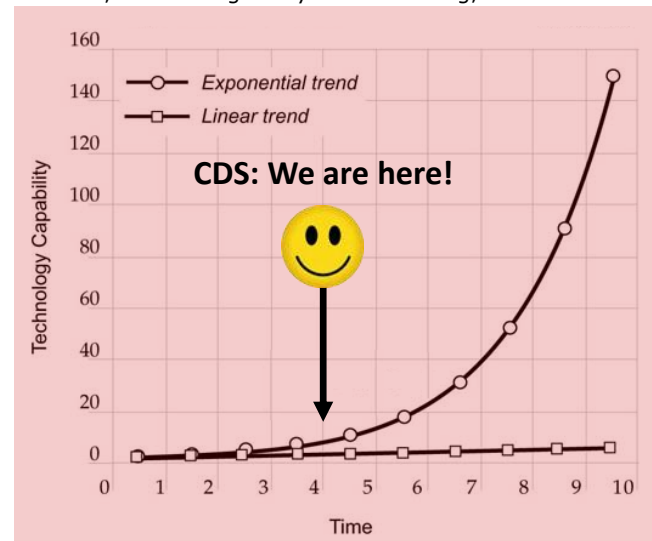
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[www.medexter.com](http://www.medexter.com)

[www.meduniwien.ac.at/kpa](http://www.meduniwien.ac.at/kpa)

Kurzweil, R. The singularity is near. Viking, 2005.

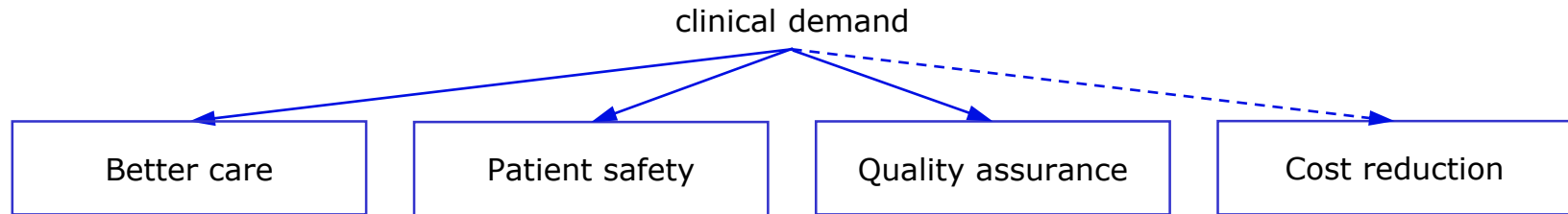


Clinical decision support in practice – HL7 standards, interoperability, and selected applications,  
Vienna, 23 May 2017

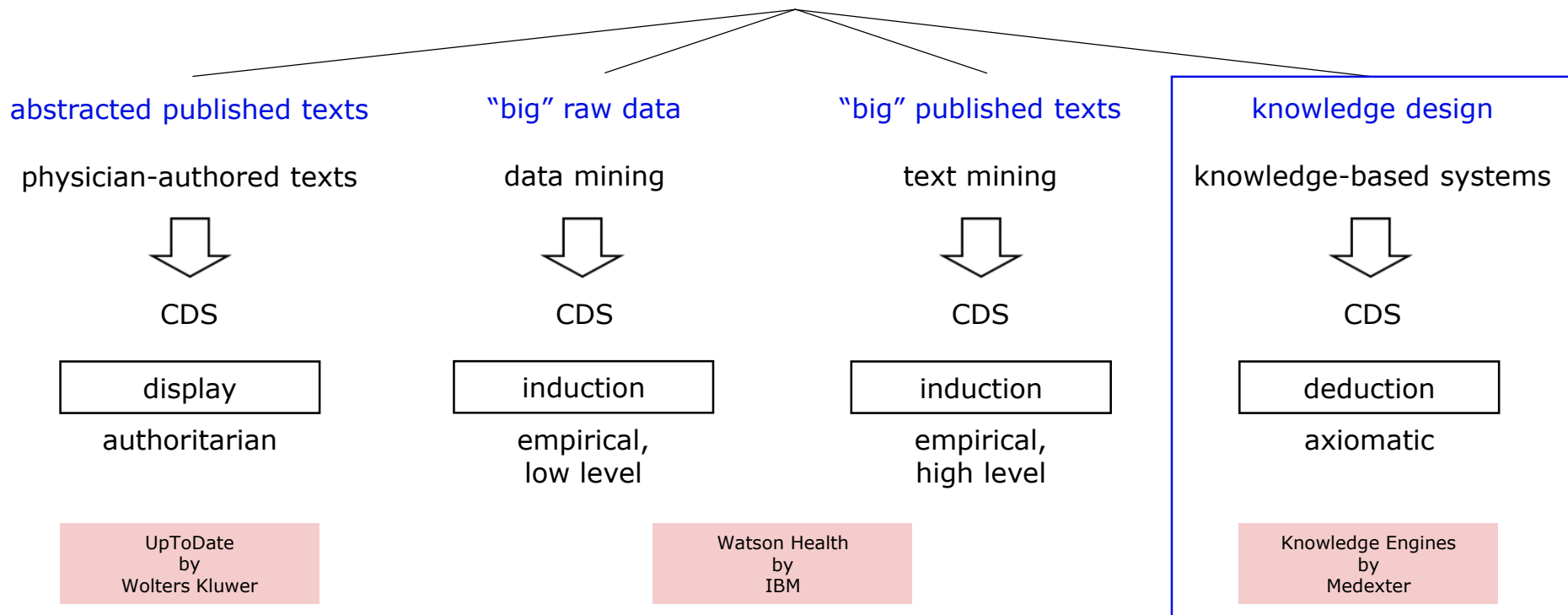
## Digitalization in clinical medicine

- Stage I: Digitizing medical patient data
  - EHRs, EMRs, Health Apps, images, bio-signals, national, ...
- Stage II: Digitizing clinical workflows
  - In-patient care, wards, departments, out-patient, home, chronic care, ...
- Stage III: Digitizing medical knowledge
  - Anatomy, physiology, pathophysiology, nosology, pharmacology, pharmacogenomics, ...

### Clinical decision support—Applying knowledge to data



## Approaches to CDS



# UpToDate by Wolters Kluwer: Abstracted published texts

Hepatitis B and pregnancy... × +

← 🔒 https://www.uptodate.com/contents/hepatitis-b-and-pregnancy?source=see\_link 🔍 uptodate ☆ ⬇ 🏠 📧 ☰

UpToDate®

Language | Hilfe

Willkommen, Wiener Krankenanstaltenverbund KAV | Anmelden

Hepatitis at Pregnancy 🔍

Inhalt | Patientenschulung | Neuigkeiten | Praxisrelevante News | Rechner | Arzneimittelwechselwirkungen

hepatitis at pregnancy Find Print Email

Topic Outline

SUMMARY & RECOMMENDATIONS

INTRODUCTION

ACUTE HEPATITIS B VIRUS INFECTION

CHRONIC HEPATITIS B VIRUS INFECTION

- Implications of infection
  - Effect on maternal disease
  - Effect on pregnancy outcomes
- Management
  - Women who are pregnant
  - Women with childbearing potential
  - Breastfeeding

MOTHER-TO-CHILD TRANSMISSION

- Risk of transmission
- Risk factors for transmission
  - HBV replicative status
  - HBV DNA level
  - Transplacental transmission
  - Amniocentesis and other procedures
  - Preterm premature rupture of membranes
  - Cesarean delivery
  - Breastfeeding and transmission
- Prevention of mother-to-child transmission
  - Maternal screening
  - Maternal antiviral therapy
  - Newborn immunization

SAFETY OF ANTIVIRAL AGENTS IN PREGNANCY

- Overview
- Risk of teratogenicity
- Other potential adverse events

## Hepatitis B and pregnancy

Authors: [Hannah Lee, MD](#), [Anna SF Lok, MD](#)  
Section Editors: [Rafael Esteban, MD](#), [Louise Wilkins-Haug, MD, PhD](#)  
Deputy Editor: [Jennifer Mitty, MD, MPH](#)

[Contributor Disclosures](#)

All topics are updated as new evidence becomes available and our [peer review process](#) is complete.  
**Literature review current through:** Feb 2017. | **This topic last updated:** Feb 04, 2017.

**INTRODUCTION** — Hepatitis B virus (HBV) infection during pregnancy presents with unique management issues for both the mother and the fetus. These include the effects of HBV on maternal and fetal health, the effects of pregnancy on the course of HBV infection, treatment of HBV during pregnancy, and prevention of mother-to-child transmission.

Prevention of mother-to-child transmission is an important component of global efforts to reduce the burden of chronic HBV since vertical transmission is responsible for approximately one-half of chronic infections worldwide. The risk of developing chronic HBV infection is inversely proportional to the age at time of exposure. The risk is as high as 90 percent in those exposed at birth without vaccination, while the risk is much lower (about 20 to 30 percent) in those exposed during childhood. Maternal screening programs and universal vaccination of infants have significantly reduced transmission rates.

This topic will review special considerations for the management of patients with acute and chronic HBV infection during pregnancy and the post-partum period, as well as prevention of mother-to-child transmission. Additional topic reviews that address prevention and management of HBV infection in children, and liver disease in pregnancy, are found elsewhere:

- (See ["Hepatitis B virus immunization in infants, children, and adolescents"](#).)
- (See ["Hepatitis viruses and the newborn: Clinical manifestations and treatment"](#).)
- (See ["Overview of hepatitis B virus infection in children and adolescents"](#).)
- (See ["Acute fatty liver of pregnancy"](#).)
- (See ["HELLP syndrome"](#).)
- (See ["Intrahepatic cholestasis of pregnancy"](#).)
- (See ["Approach to liver disease occurring during pregnancy"](#).)
- (See ["Pregnancy in women with pre-existing chronic liver disease"](#).)

**ACUTE HEPATITIS B VIRUS INFECTION** — Acute viral hepatitis is the most common cause of jaundice in pregnancy [1]. Other causes include liver diseases associated with pregnancy, such as acute fatty liver of pregnancy, HELLP syndrome, and intrahepatic cholestasis of pregnancy. (See ["Approach to liver disease occurring during pregnancy"](#) and ["Acute fatty liver of pregnancy"](#) and ["HELLP syndrome"](#) and ["Intrahepatic cholestasis of pregnancy"](#).)

Acute hepatitis B virus (HBV) infection during pregnancy is usually mild and not associated with increased mortality or teratogenicity [1,2]. Thus, infection during gestation should not prompt consideration of termination of the pregnancy. However, there have been reports of an increased incidence of low birth weight and prematurity in infants born to mothers with acute HBV infection [2,3].

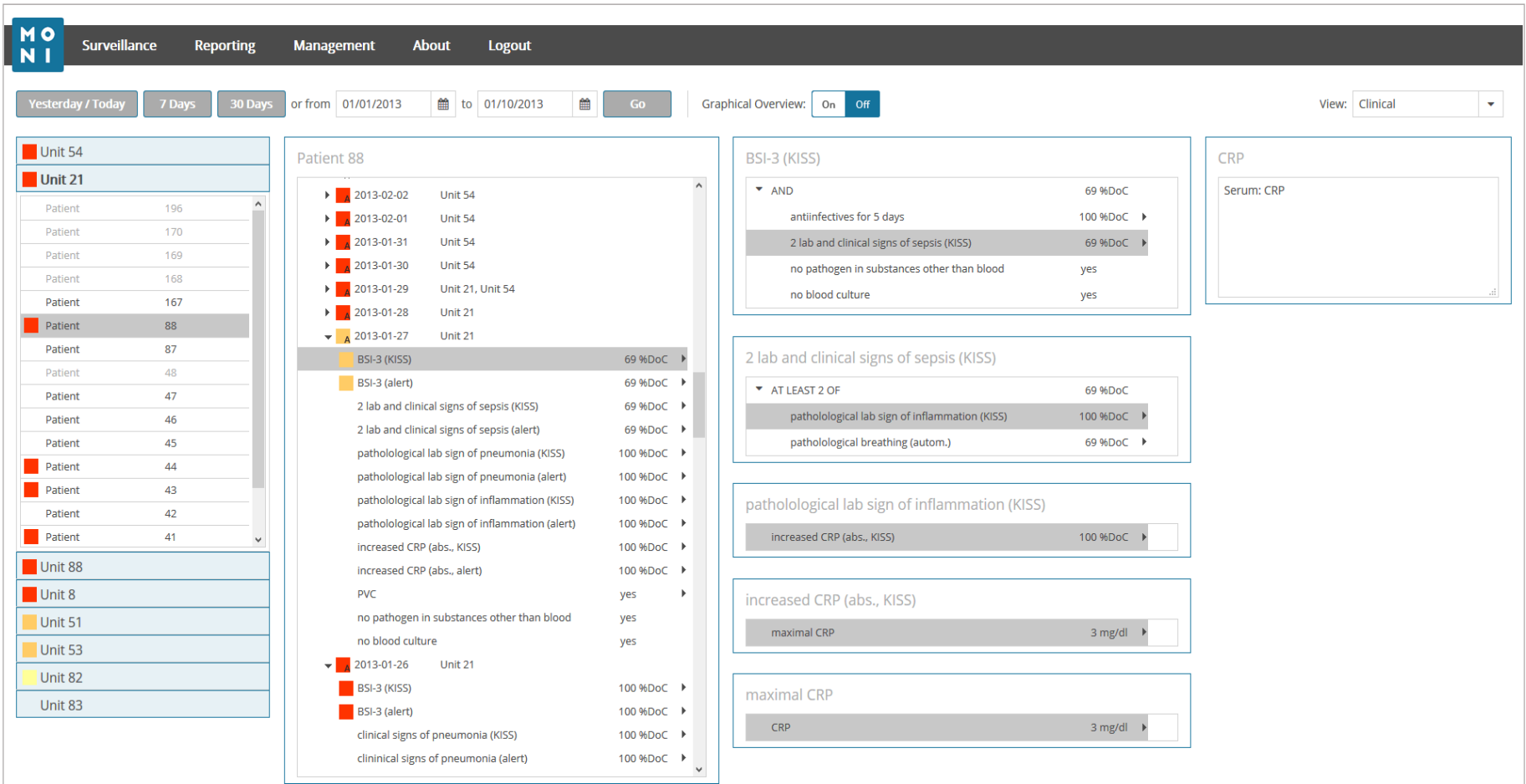
Acute HBV occurring early in the pregnancy has been associated with a 10 percent perinatal transmission rate [3]. Transmission rates significantly increase if acute infection occurs at or near the time of delivery, with rates as high as 60 percent reported [1]. Thus, serial monitoring should be performed throughout pregnancy, and if the mother remains hepatitis B surface antigen (HBsAg)-

Feedback zum Thema

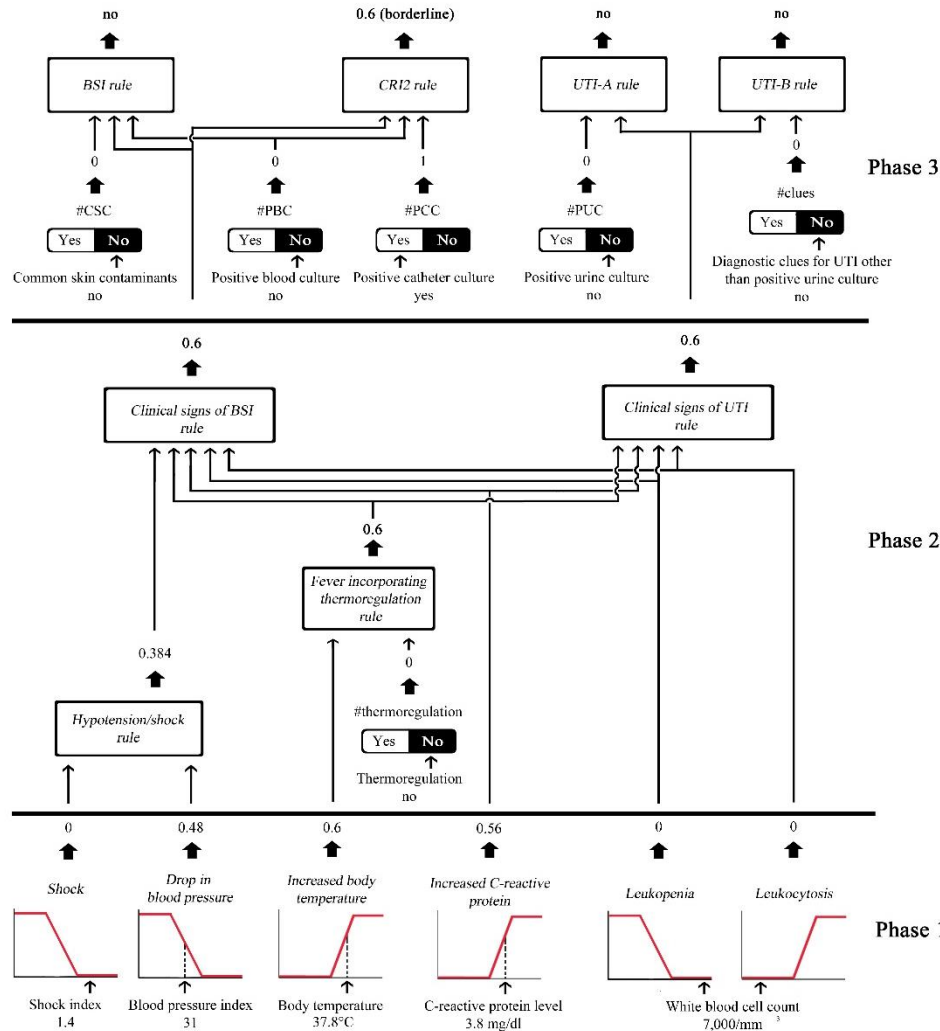
## Watson Health by IBM: “Big” raw data and “big” published texts



# MONI by Medexter for HAI surveillance: Knowledge design



# MONI: Healthcare-associated infection monitoring and surveillance at ICUs



# Clinical event monitoring at ICUs: Knowledge design

ICU Events

DE EN Home Print Back Redo Search Help Log Out

ent, Reinhard (4 Days)

ent, Stefan (6 Days)

**ient, Anita (3 Days)**

ent, Anita

ent, Karin

ent, Franz

ent, Mario

ent, Robert

ent, Linda

ent, Sandra

ent, Thomas

ent, Kari

ent, Martin

ent, Laura

ent, Wilhelm

ent, Johannes

ent, Simon

ent, Sonja

ent, Elisabeth

ent, Sascha

ent, Sabine

ent, Markus

ent, Jürgen

ent, Nina

Patient, Anita

Sex: Female

NINO: QR 13 62 56

Age: 51

Case Number: 468901

Date of Birth: 12/09/1965

Hospital Admission: 04/02/2016

Documents

Vital Signs & Laboratory

Diagnosis

Radiology

Images

References

	04/04 2016	04/03 2016	04/02 2016	04/01 2016	03/31 2016	03/30 2016	03/29 2016	03/28 2016	03/27 2016	03/26 2016	03/25 2016
<b>Vital Signs</b>											
Max. body temperature [°C]	38.8	38.4	37.8	-	-	-	-	-	-	-	-
Shock index	-	1.26	0.72	-	-	-	-	-	-	-	-
Blood pressure sys. [mmHG]	...	...	...	-	-	-	-	-	-	-	-
Blood pressure dia. [mmHG]	...	...	...	-	-	-	-	-	-	-	-
...											
<b>Hematological Profile</b>											
Leukocytes [/nl]	4.91	9.46	11.67	-	-	-	-	-	-	-	-
C-reactive protein [mg/l]	178.6	198.3	191.3	-	-	-	-	-	-	-	-
Ventilated	no	yes	yes	-	-	-	-	-	-	-	-
Adapted Murray score difference	0	3	3	-	-	-	-	-	-	-	-
...											
...											
...											
...											
...											
...											

04/04/20163 Events

drop in blood pressure, hypotension (borderline), inflammation symptoms in sepsis (borderline)

Max. body temperature38.8°C (04/04/2016 00:00)

CRP178.6 mg/l (04/04/2016 04:07)

Blood pressure sys. ...

Blood pressure dia. ...

04/03/20166 Events

shock, drop in blood pressure, hypotension (borderline), increase of adapted Murray score, inflammation symptoms in sepsis (borderline), clinical signs of pneumonia

Max. body temperature38.4°C (04/03/2016 04:33)

CRP198.3 mg/l (04/03/2016 04:33)

Shock index1.26 (04/03/2016)

Blood pressure sys. ...

Blood pressure dia. ...

Ventilatedyes (04/03/2016)

Adapted Murray score difference3 (04/03/2016)

04/02/20165 Events

shock, hypotension (borderline), increase of adapted Murray score, inflammation symptoms in sepsis, clinical signs of pneumonia

Max. body temperature37.8°C (04/02/2016 05:16)

CRP191.3 mg/l (04/02/2016 04:33)

Leukocytes11.67 /nl (04/02/2016 04:33)

Shock index0.72 (04/02/2016)

Blood pressure sys. ...

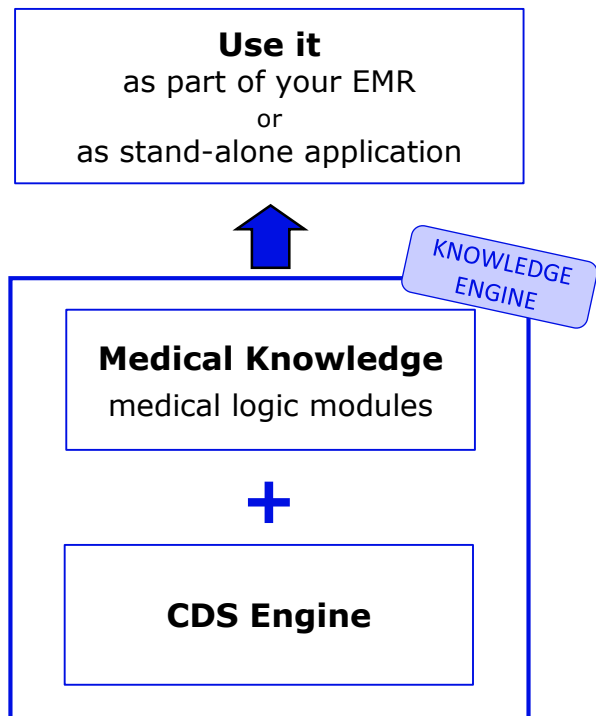
Blood pressure dia. ...

Ventilatedyes (04/02/2016)

Adapted Murray score difference3 (04/02/2016)



## Medical Knowledge CDS Engines



### The prediction:

In the future, any clinical activity will be either supported or substituted by Medical Knowledge Engines.

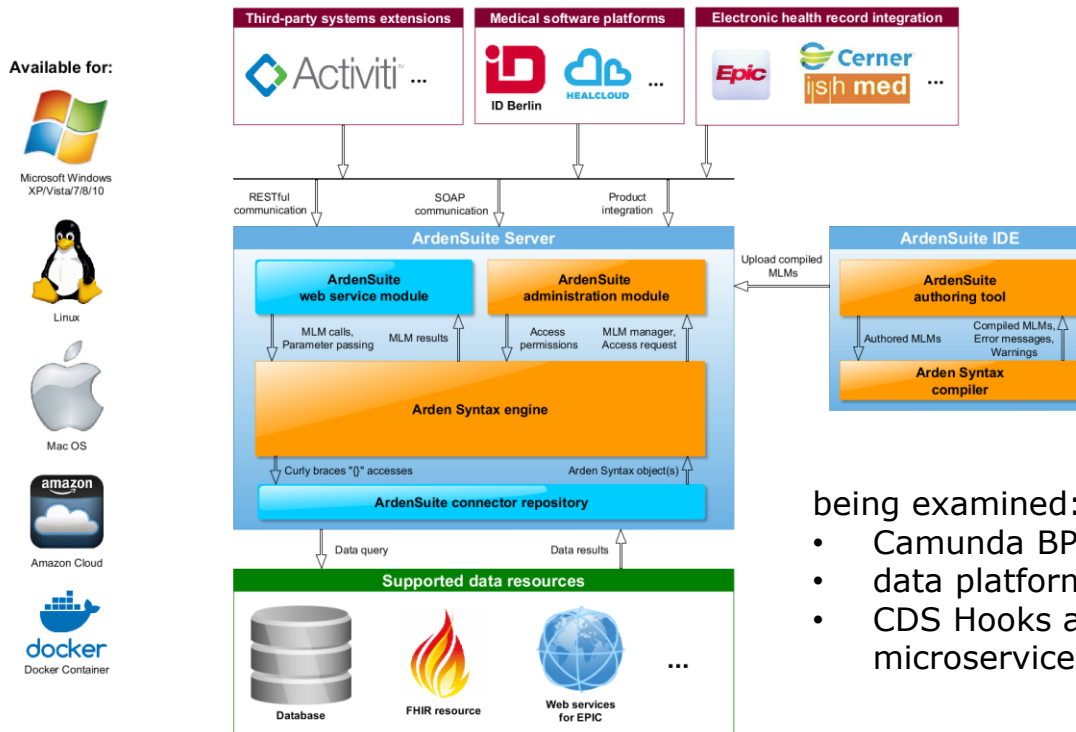
### The medical knowledge

- clinically proven knowledge: rules, tables, decision trees, guidelines, scores, algorithms, ...
- evidence-based, application-ready knowledge packages
- **knowledge design** or **knowledge through machine learning**

### The CDS engine

- HL7's Arden Syntax medical knowledge representation and processing, with fuzzy methodologies
- scalable from cloud-based services to mobile apps

# Arden-Syntax-based CDS authoring tool and engine



being examined:

- Camunda BPMN
- data platforms and warehouses
- CDS Hooks and clinical microservices