

Arden Syntax training course

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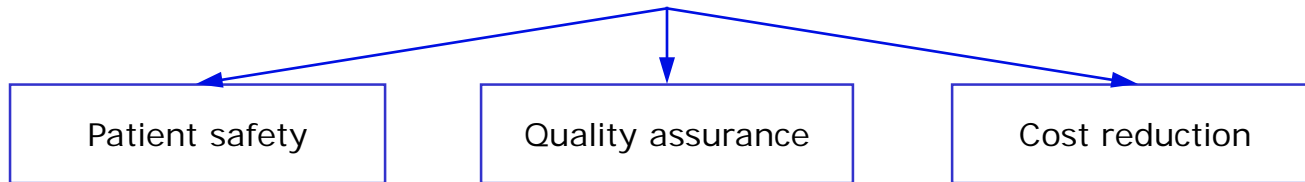
```
logic:  
  let hmi be weight / (size ** 2); // BMI  
  age := currenttime - birth; // AGE  
  if the age is less than 19 years then  
    classification := null;  
  elseif the hmi is less than 18.5 then  
    classification := localized 'under';  
  elseif the hmi is less than 25 then  
    classification := null; // BMI normal range  
  else  
    let the classification be localized 'over';  
  endif;
```

Arden Syntax training course, Vienna, 23 May 2016

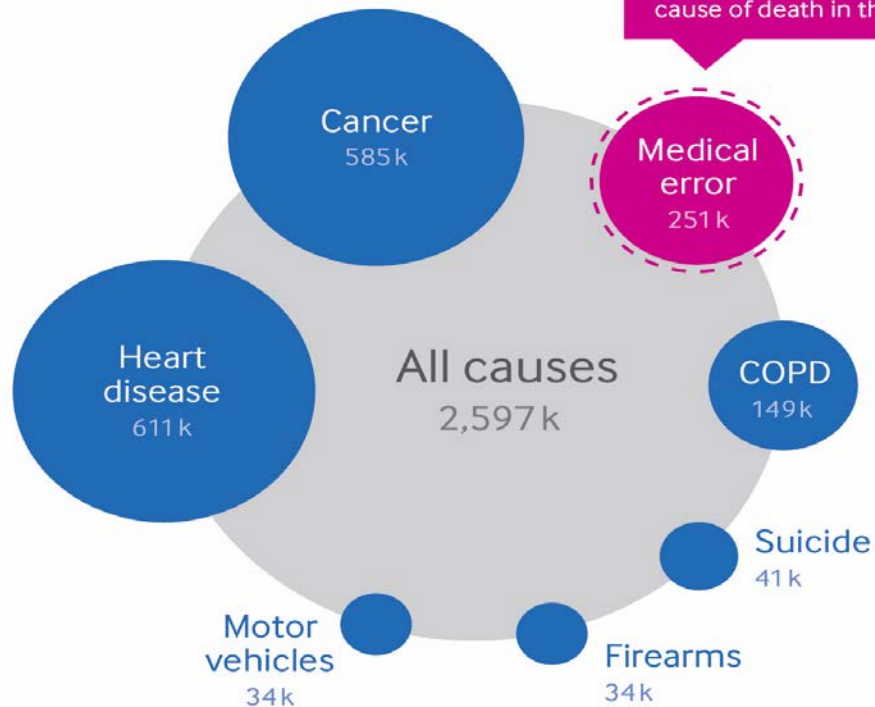
Digitalization of clinical medicine

- Stage I: Digitizing medical patient data
 - EHRs, EMRs, Health Apps, ...
- Stage II: Digitizing clinical workflows
 - In-patient, out-patient, home
- Stage III: Digitizing medical knowledge
 - Big data vs. knowledge design

Clinical decision support—Applying knowledge to data



Causes of death, US, 2013



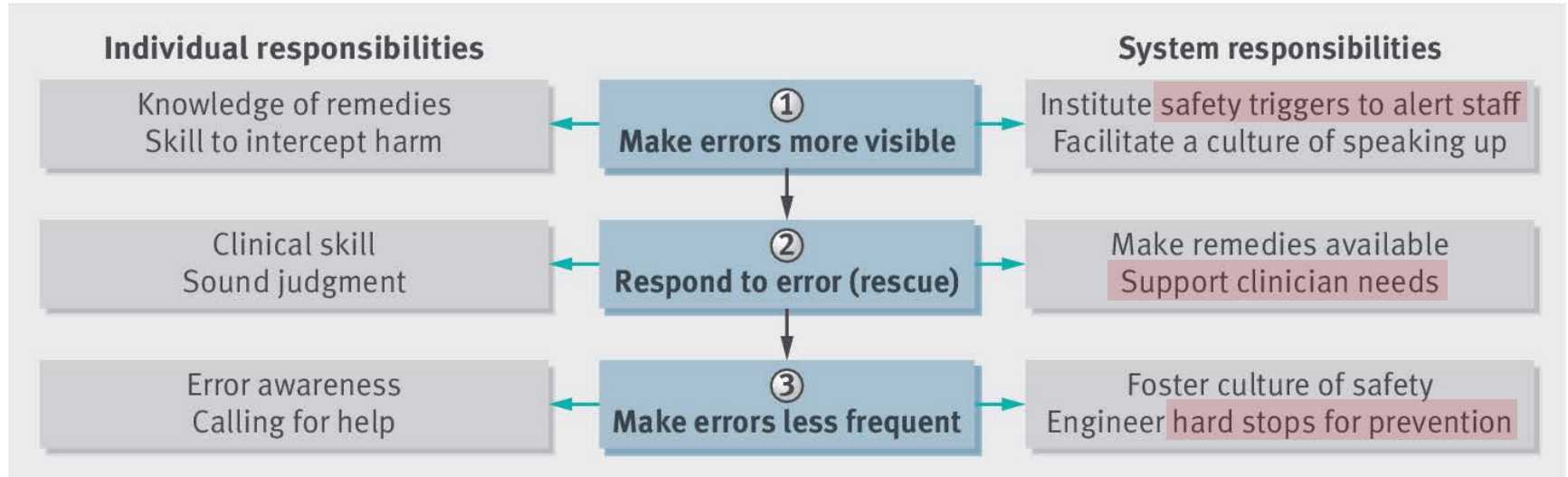
However, we're not even counting this - medical error is not recorded on US death certificates

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Data source:

http://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_02.pdf

Model for reducing patient harm



From: BMJ 2016;353:i2139

Computers in clinical medicine—steps of natural progression

- step 1: patient administration
 - admission, transfer, discharge, and billing
 - step 2: documentation of patients' medical data
 - electronic health record: all media, distributed, life-long (partially fulfilled)
 - step 3: patient and hospital analytics
 - data warehouses, quality measures, reporting and research databases, data and text mining, patient study recruitment
 - ... population-specific
 - step 4: clinical decision support (applying knowledge to data)
 - safety net, quality assurance, evidence-based
 - ... patient-specific
-

CLINICAL DECISION SUPPORT

The Road to Broad Adoption



2ND
EDITION

Edited by **Robert A. Greenes**



Improving Outcomes with Clinical Decision Support

An Implementer's Guide

Second Edition

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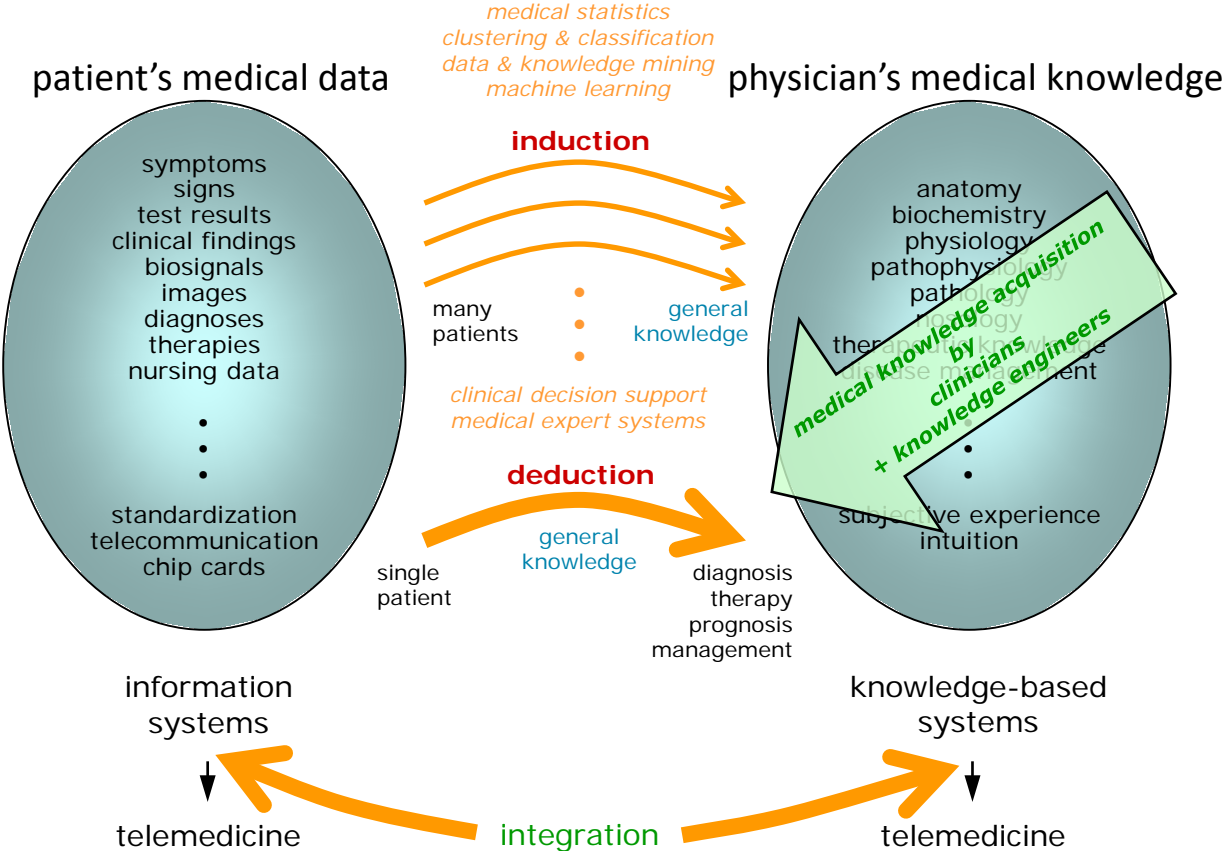
The Institute for Research in Information Management

AMA American Medical
Informatics Association
The professional society for healthcare and health informatics



shM
Society of Hospital Medicine

EHRs and clinical decision support through knowledge-based systems



Clinical decision support with knowledge engines

DIAGNOSIS

- alerts, reminders, to-do lists
- clinical test interpretations and temporal abstraction
- (tele)monitoring of chronic conditions
- differential diagnostics
 - rare diseases, rare syndromes
 - further diagnostic procedures
 - multi-morbidity
- genetics, proteomics
 - molecular variations

PROGNOSIS

- illness severity scores, prediction rules
- trend detection and visualization

Knowledge engines

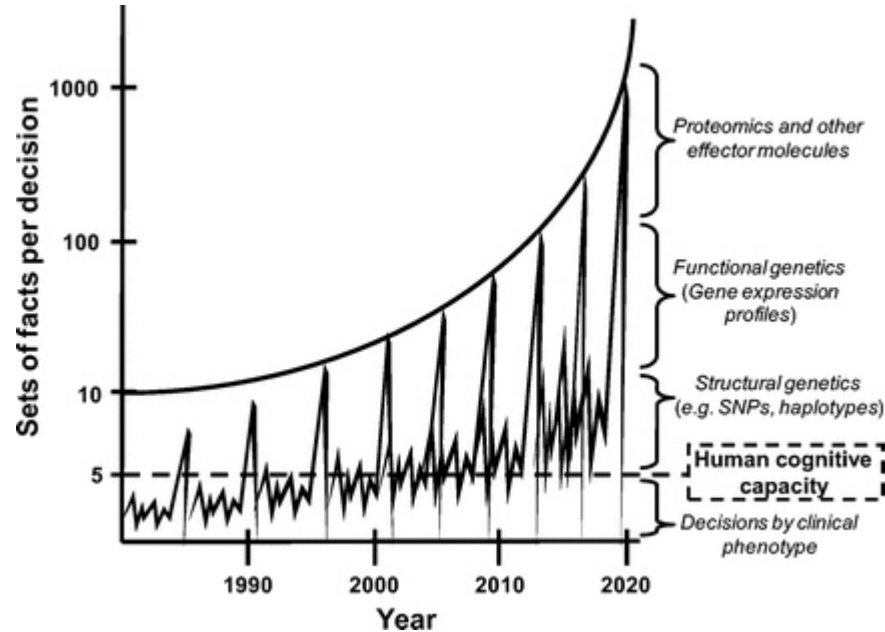
THERAPY

- drug alerts, reminders, calculations
 - indication, contraindications, redundant medications, cost-effective substitutions
 - dosage calculations, drug-drug and gene-drug interactions
 - adverse drug events
- management of antimicrobial therapies
 - susceptibility and resistance rates
- pharmacogenomics

HOSPITAL MANAGEMENT

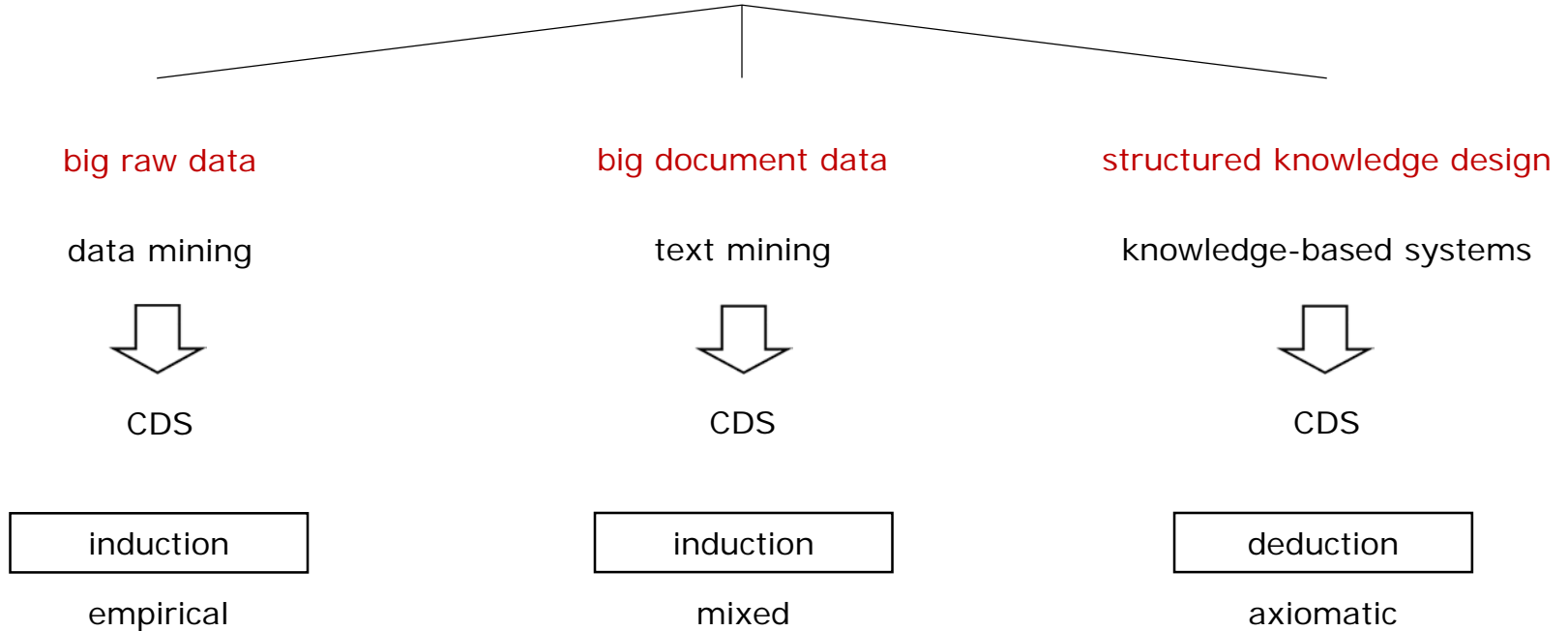
- computerized evidence-based workflows, clinical guidelines, protocols, SOPs
- surveillance criteria and quality benchmarking

Challenge for CDS: Explosion in data + knowledge

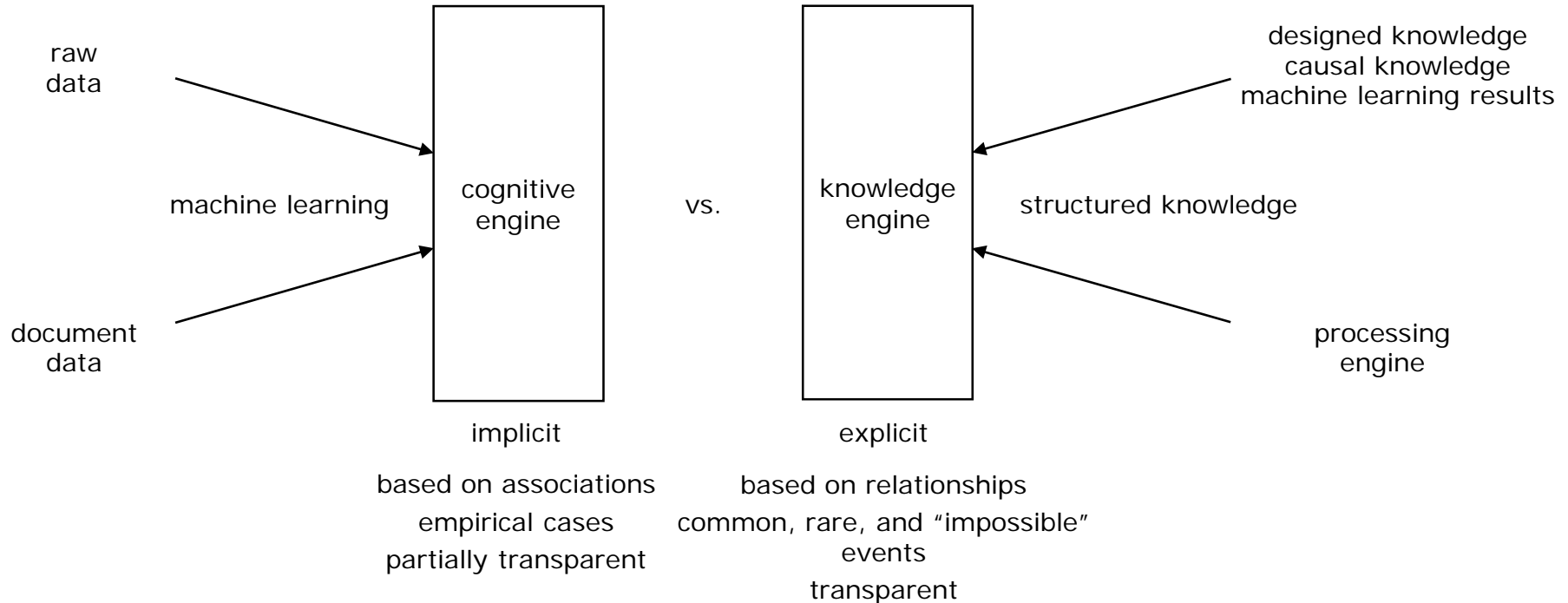


Stead WW, Searle JR, Fessler HE et al. Biomedical informatics: Changing What Physicians Need to Know and How They Learn. *Academic Medicine* 2011; 86(4):429-434.

Big data vs. knowledge design



IBM Watson Health vs. Medexter Health Knowledge



Arden Syntax: HL7- and ANSI-approved

- A standard language for writing situation-action rules, procedures, or knowledge bases that trigger results based on clinical events detected in patient data
- Each module, referred to as a medical logic module (MLM), contains sufficient knowledge to make a single decision
 - extended by medical knowledge packages (MKPs) consisting of interconnected MLMs for complex clinical decision support
 - continuous development since 1989
- The Health Level Seven Arden Syntax for Medical Logic Systems, **version 2.9—including fuzzy methodologies**—was approved by Health Level Seven (HL7) International and the American National Standards Institute (ANSI) in 2013
- Version 2.10—including ArdenML, an XML-based representation of Arden Syntax MLMs—was approved in 2014

⇒ healthcare industry and academic users
