

## Big Data Analytics and Clinical Decision Support

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## Waste

- Between 21% and 47% (average 34%) of what we spend on healthcare in the US is for things of no value
- Categories:
  - Failure of care processes
  - Overtreatment
  - Administrative complexity
  - Failure of Care Coordination

\*Berwick D, Hackbarth A. Eliminating Waste in US Healthcare. JAMA 2012;307(14):1513-1516

## The Future

1. Triple Aim of Don Berwick
  1. Improved Population Health
  2. Improved Patient Experience
  3. Controlled Per Capita Cost
2. Evidence-Supported Decisions
  1. Use all data available
  2. Make it easy to use data
3. Viable Incentives
4. Medical Education for the Current State of Information
5. Collaboration

## Clinical Decision Support - Analytics

### Five Ps

- Personalized (or precision) healthcare
- Prevention
- Prediction
- Patterns – identify complex patterns in big data that are new evidence
- Persistence

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## SPECIAL ARTICLE

### INDIVIDUAL MEDICINE\*

WILLOUGHBY LATHEM, M.D.

July 4, 1968

**Table 1** Characteristics of System 1 and System 2 approaches in decision making

Characteristic	System 1 (intuitive)	System 2 (analytic)
Cognitive style	Heuristic	Systematic
Operation	Associative	Rule based
Processing	Parallel	Serial
Cognitive awareness	Low	High
Conscious control	Low	High
Automaticity	High	Low
Rate	Fast	Slow
Reliability	Low	High
Errors	Normative distribution	Few but significant
Effort	Low	High
Predictive power	Low	High
Emotional valence	High	Low
Detail on judgment process	Low	High
Scientific rigor	Low	High
Context	High	Low

Adapted from *Concise Encyclopedia of Information Processing in Systems and Organizations*,<sup>8</sup> and *The Robot's Rebellion: Finding Meaning in the Age of Darwin*.<sup>11</sup>

Croskerry P, Norman G "Overconfidence in Clinical Decision Making. *The Amer J Med* (2008) Vol 121 (5A), 524-529

## Political Challenges

- SB 1275 Medical data in an electronic or digital format; limitations on use, storage, sharing, & processing.  
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### SUMMARY AS INTRODUCED:

- **Medical data.** Prohibits any person that regularly stores medical data in an electronic or digital format from (i) participating in the establishment or implementation of the Nationwide Health Information Network; (ii) performing any analytic or statistical processing with regard to any medical records from multiple patients for purposes of medical diagnosis or treatment, including population health management; or (iii) processing medical data at a facility within the Commonwealth in any instance where a majority of the patients whose medical data is being processed do not reside in the Commonwealth. A database at which medical data is regularly stored in an electronic or digital format shall not store or maintain in a manner that is accessible by the operator or any other person, in an electronic or digital format, at any one time, medical data regarding more than 10,000 patients. The measure provides that any health care provider shall not be subject to any penalty, sanction, or other adverse action resulting from its failure or refusal to implement an online computerized medical record system. A patient's consent to the sharing of his health care information shall be presumed not to grant consent to the electronic or digital storing or transmission of the information to any person other than for health care coverage purposes. Finally, the measure prohibits the Commonwealth from authorizing the establishment or operation of a health information exchange.

## Politics

- Prohibits... (ii) performing any analytic or statistical processing with regard to any medical records from multiple patients for purposes of medical diagnosis or treatment, including population health management ...

## Overconfidence

..the perception that physicians are arrogant and pervasively overconfident about their abilities  
 ...line of evidence...general tendency on the part of physicians to disregard, or fail to use, decision-support resources.  
 ...a failure of metacognition (the willingness and ability to reflect on one's own thinking processes and to critically examine one's own assumptions, beliefs, and conclusions).  
 Physicians admit to having many questions that could be important at the point of care, but which they do not pursue

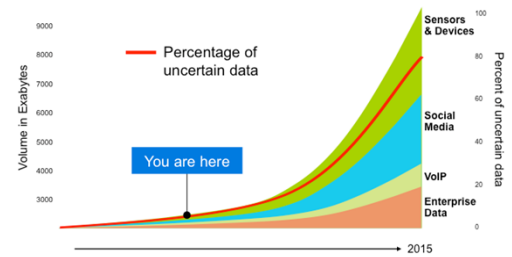
Berner E, Graber M. Overconfidence as a Cause of Diagnostic Error in Medicine. *Amer J Med* (2008) Vol 121 (5A), 52-523

...surveys of academic professionals, 94% of whom rate themselves in the top half of their profession.  
 ...national clinical guidelines have a high rate of noncompliance.  
 Most of the research ...has concluded that rapid and accurate pattern recognition is characteristic of experts  
 The cost of defensive medicine is estimated to consume 5% to 9% of healthcare expenditures in the United States

## Big Data

- The four Vs
- Volume
- Velocity
- Variety
- Variability, Value, Veracity

## Uncertainty



IBM Global Technology Outlook 2012

## Clinical Decision Support - Analytics

- Confused Sea of “Big Data”
- Cognitive Computing
- Non-Hypothesis testing
- Decision Support – not Decision Making

## Limitations of Big Data

- ...although big data is very good at detecting correlations, especially subtle correlations that an analysis of smaller data sets might miss, it never tells us which correlations are meaningful
- big data can work well as an adjunct to scientific inquiry but rarely succeeds as a wholesale replacement
- risk of too many correlations
- ...the hype

\*Marcus and Davis, NY Times Eight (No, Nine!) Problems With Big Data April 7, 2014

## Published Data - John Ioannidis

“Much of what medical researchers conclude in their studies is misleading, exaggerated, or flat-out wrong.”

<http://www.theatlantic.com/magazine/archive/2010/11/lies-damned-lies-and-medical-science/308269/>, accessed 3/11/2014

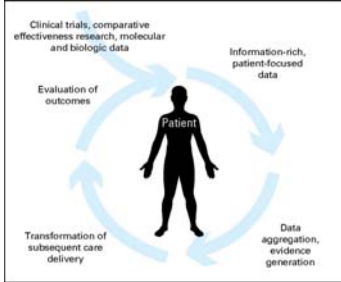
“There is increasing concern that in modern research, false findings may be the majority or even the vast majority of published research claims.”

PLoS Med. Aug 2005; 2(8): e124.  
Published online Aug 30, 2005. doi: [10.1371/journal.pmed.0020124](https://doi.org/10.1371/journal.pmed.0020124)

## Role of Technology

1. Enabler
2. Overcome Obstacles
3. Augment Human Perception, Analysis and Decision-making

Cycle of evidence in rapid-learning health care



Abernethy A, et al. J Clin Oncol. 2010;28:4268-4274

Questions?

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