Navigating the Perfect Storm through Simulation: Interprofessional Practice, Big Data and Watson

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Healthcare in the U.S.

- Complicated
- Expensive
- Moderately effective
- Sometimes unsafe
- Based on the wrong “average”
- Based on rapidly evolving BOK
**IMPRECISION MEDICINE**

For every person they do help (blue), the ten highest-grossing drugs in the United States fail to improve the conditions of between 3 and 24 people (red).

<table>
<thead>
<tr>
<th>1. Abilify (aripiprazole)</th>
<th>2. Nexium (esomeprazole)</th>
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<tbody>
<tr>
<td>Schizophrenia</td>
<td>Heartburn</td>
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<td>3. Humira (adalimumab)</td>
<td>4. Crestor (rosuvastatin)</td>
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<td>Arthritis</td>
<td>High cholesterol</td>
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<td>5. Cymbalta (duloxetine)</td>
<td>6. Advair Diskus (fluticasone propionate)</td>
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<td>Depression</td>
<td>Asthma</td>
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<td>7. Enbrel (etanercept)</td>
<td>8. Remicade (infliximab)</td>
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<td>Psoriasis</td>
<td>Crohn’s disease</td>
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<td>9. Copaxone (glatiramer acetate)</td>
<td>Multiple sclerosis</td>
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<tr>
<td>10. Neulasta (pegfilgrastim)</td>
<td>Neutropenia</td>
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Based on published number needed to treat (NNT) figures. For a full list of references, see Supplementary Information at go.nature.com/4dr78f.
38 Competencies for Interprofessional Collaborative Practice Identified by IPEC

Four Levels of Impact (Issenberg et.al.)

• Participation Effectiveness 63%
• Change of Attitudes and Knowledge 30%
• Behavior Change 30%
• Change in Professional Practice and Benefit to Patient 4%
Vanessa Díaz-Zuccarini, one of the leading researchers in the field, defines the Digital Patient as "a technological framework that, once fully developed, will make it possible to create a computer representation of the health status of each citizen that is descriptive, interpretive, integrative and predictive."
A Sampling of Data Sources for the Digital Patient
Next generation clinical decision support

- Cognitive assistants using multimodal reasoning
  - A combination approach
    - Employ machine learning in all stages of disease detection combining with advanced shape modeling
    - Feature generation & selection for medical images also with machine learning
    - Use unsupervised patient similarity to learn from EHR data on large patient collections
    - Employ knowledge and reasoning to do inference in a top-down + bottom-up fashion
  - Emphasizes summarization as an important role for CDS
    - Anomaly-driven summaries use advanced machine learning and shape modeling
Challenges facing clinical decision support

- How to combine EHR data with clinical knowledge
  - When should the EHR data be trusted over clinical knowledge.
- Generation and labeling of large-scale data
  - Semi-automatic versus automatic ground trothing of large-scale medical image collections
- Adding pathologic and genomic data to the analysis
  - How does genomic information factor into the CDS analysis?
- Benchmarking grand challenges to compare the performance of algorithms
  - How to evaluate the accuracy of the algorithms on datasets and by clinician verification
- Adoption by clinicians.
  - What use scenarios are best to attempt?
- FDA approval status
  - Does CDS need approval as a class 2 or 3 device?
Challenges

Providing medical professionals and biomedical researchers with advanced user interfaces that make it easier to cope with large amounts of information related to different organ systems, different space/time scales and different diagnostics.
Challenges (continued)

Providing healthcare practitioners with an information and communication technology (ICT) layer capable of integrating all available health information for each patient into a coherent whole.
References


