Data-driven care: Innovation in Practice

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Chair, Israel Society for Quality in Healthcare

Munich, February 2017
Where we are
The resources vs. demand crisis

Our population grows **older**

Chronic **multi-morbidity** ensues

Costs are spiraling out of control

Health professionals are in **relative** shortage

Patients expectations continuously increase

Note: PPP = Purchasing power parity.
Source: OECD Health Data 2014; U.S. National Health Expenditure Accounts.
The care quality crisis

Great physicians + Good intentions = excellent quality of care

?
At best, care is outstanding. Often, care is sub-optimal to alarmingly poor.

Dr. Donald Berwick
Healthcare errors: cause of death

30%

Of care is futile, no net value added

45%

Of necessary interventions missed
Transformation is crucial

Coordinated
Equitable
Preventive
Proactive
Engaging
RWE Based
Patient centered

Work in silos
‘Equal’
Therapeutic
Reactive
Paternalistic
Wasteful interventions
System-centered
Paradigm shift: Our vision

Smart use of data

= a requisite and driving force for transforming care
Clalit Health Services: Israel’s integrated Sick Fund

» Established 1911

» 53% market share - 4.2 million members
  - Over-representing low SES, minorities, elderly

» All services under one ‘roof’
  -> 1,500 clinics
  - 30% of Israel hospital beds
  - National leader in tele-care, online services
Integrated data

Decades of full life-span, Cross-setting, ID-tagged, Geo-coded, EMR-based data on > 4M people

* Claims+EMR data, untainted by financial upcoding drive (no DRG)
Value in care: What actually works?
What good are trials if the results aren’t applicable to real-world patients and if, because of excessive expense, they can be used to answer only a tiny fraction of our important clinical questions?
Are we providing futile care?

Medscape Multispecialty

News & Perspective  Drugs & Diseases  CME & Education

Journal Watch > Journal Watch (General)

Pneumococcal Polysaccharide Vaccine: Efficacy Remains Controversial

Allan S. Brett, MD

Disclosures
Determining treatment effectiveness

IPD rate (per 100,000) and prevalence (%) of PPSV vaccination in Clalit Members (65+ year old)

- IPD Rate (Per 100,000)
- Prevalence of PPSV23 vaccination (%)

- 2007: 22.5, 29.0%
- 2008: 19.4, 45.7%
- 2009: 13.1, 60.4%
- 2010: 13.0, 73.4%
Policy Implications

Pneumococcal vaccination for older adults

Description: The percentage of individuals aged 65–71 years who received a pneumococcal vaccination.

Rationale: Improvement of pneumococcal vaccination coverage in older adults likely reduces morbidity and mortality that is caused by the Pneumococcus bacterium.

Denominator: Individuals aged 65–71 years

Numerator: The number of individuals in the denominator who received a pneumococcal vaccination once after age 65 years or within the past five years.

Comments: This indicator relates to the 23-valent formulation of the pneumococcal polysaccharide vaccine. The age range used for the present report (2008–2010) is a function of data availability.
Pneumococcal vaccine targeting strategy for older adults: Customized risk profiling

<table>
<thead>
<tr>
<th>Vaccination strategy</th>
<th>% of 50+ population targeted (n=526,717)</th>
<th>% of HTP cases in 2009-10 identified (n=10,423)</th>
<th>% of IPD cases in 2009-10 identified (n=90)</th>
<th>% of CTP cases in 2009-10 identified (n=4,603)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 High and Moderate risk groups and all aged 65+</td>
<td>66% (347,008)</td>
<td>94% (9,818)</td>
<td>89% (80)</td>
<td>78% (3,572)</td>
</tr>
<tr>
<td>2 High and Moderate ACIP-based risk groups</td>
<td>51% (268,616)</td>
<td>83% (8,609)**</td>
<td>80% (72)</td>
<td>65% (2,980)*</td>
</tr>
<tr>
<td>3 Clalit model, 51% highest risk scores</td>
<td>51% (267,744)</td>
<td>85% (8,896)**</td>
<td>80% (72)</td>
<td>66% (3,045)*</td>
</tr>
<tr>
<td>4 ACIP-based highest risk group (Immunosuppressed)</td>
<td>17% (88,142)</td>
<td>35% (3,634)†</td>
<td>41% (37)</td>
<td>21% (971)†</td>
</tr>
<tr>
<td>5 Clalit model, 17% highest risk scores</td>
<td>17% (87,853)</td>
<td>54% (5,667)†</td>
<td>46% (41)</td>
<td>27% (1,246)†</td>
</tr>
<tr>
<td>6 Clalit model, 8.6% highest risk scores</td>
<td>8.6% (45,521)</td>
<td>35% (3,634)</td>
<td>31% (28)</td>
<td>15% (692)</td>
</tr>
<tr>
<td>7 Clalit model, 5% highest risk scores</td>
<td>5% (25,580)</td>
<td>23% (2,390)</td>
<td>18% (16)</td>
<td>9% (421)</td>
</tr>
</tbody>
</table>
Determining treatment threshold

LDL in high risk patients: “Lower is Better”?
Real-life Outcomes Research

Association Between Achieved Low-Density Lipoprotein Levels and Major Adverse Cardiac Events in Patients With Stable Ischemic Heart Disease Taking Statin Treatment

Morton Leibowitz, MD1,2; Tomas Karpati, MD1; Chandra J. Cohen-Stavi, MPA1; Becca S. Feldman, ScD1; Moshe Hoshen, PhD1; Haim Bittman, MD1,3; Samy Suissa, PhD4,5,6; Ran D. Balicer, MD, PhD1,7

[+] Author Affiliations

JAMA Intern Med. Published online June 20, 2016. doi:10.1001/jamainternmed.2016.2751

Figure 2. Estimated Cubic Spline Transformation of the Association Between Achieved Low-Density Lipoprotein Cholesterol (LDL-C) Level and the Risk of Major Adverse Cardiac Events (MACEs)

- Vertical dotted lines separate index LDL-C groups (low, ≤70.0 mg/dL; moderate, 70.1-100.0 mg/dL; high, 100.1-130.0 mg/dL). HR indicates hazard ratio.
PILL-OCKS Statins are USELESS at preventing more heart attacks in recovering patients, say boffins

Doubts over effectiveness of pills taken by eight million Brits every day

By Pat H

21st June 2016, 1:20 am

CHOLESTEROL-slashing statins may not protect everyone against heart attacks, a study found.

Around eight million Brits take the pills daily to drive down harmful LDL cholesterol in the blood.
Policy Implications

Percentage of adults after coronary artery bypass surgery and/or interventional cardiac catheterization with LDL levels less than or equal to 100 mg/dL (ages 35-74 years)

Percentage of individuals with LDL levels less than or equal to 100 mg/dL (numerator) among individuals aged 35-74 years, after interventional cardiac catheterization and/or interventional cardiac catheterization who had a record of LDL cholesterol (denominator)

Figure 84 by year

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent</th>
</tr>
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<tbody>
<tr>
<td>2008</td>
<td>70.8%</td>
</tr>
<tr>
<td>2009</td>
<td>71.3%</td>
</tr>
<tr>
<td>2010</td>
<td>71.8%</td>
</tr>
</tbody>
</table>
• What is the impact of antibiotic choice on resistance?

### Quinolone resistance rates in urine culture E.coli by district, by relative use of quinolones

<table>
<thead>
<tr>
<th>Quinolone Resistance</th>
<th>Nitrofurantoin resistance</th>
<th>Rate of using quinolone vs nitrofurantoin</th>
<th>District</th>
</tr>
</thead>
<tbody>
<tr>
<td>30%</td>
<td>4%</td>
<td>4.74</td>
<td>1</td>
</tr>
<tr>
<td>23%</td>
<td>3%</td>
<td>5.50</td>
<td>2</td>
</tr>
<tr>
<td>22%</td>
<td>4%</td>
<td>4.26</td>
<td>3</td>
</tr>
<tr>
<td>21%</td>
<td>3%</td>
<td>2.01</td>
<td>4</td>
</tr>
<tr>
<td>20%</td>
<td>4%</td>
<td>3.94</td>
<td>5</td>
</tr>
<tr>
<td>20%</td>
<td>4%</td>
<td>0.85</td>
<td>6</td>
</tr>
<tr>
<td>12%</td>
<td>3%</td>
<td>1.06</td>
<td>7</td>
</tr>
<tr>
<td>8%</td>
<td>3%</td>
<td>2.79</td>
<td>8</td>
</tr>
<tr>
<td>21%</td>
<td>3%</td>
<td>Overall</td>
<td></td>
</tr>
</tbody>
</table>

- 4 million patients
- 6.6 million patients
- 4.8 million patients
- 2.3 million patients
- 1.9 million patients
- 18% of which

<table>
<thead>
<tr>
<th>Difference Rate %</th>
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<tbody>
<tr>
<td>44</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>67</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>195</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>26</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>101</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>24</td>
</tr>
<tr>
<td>802</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>0.1</td>
</tr>
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Care integration and readmissions
Reducing Readmissions

Real-time data sharing system

Bridging the Silos
7d readmission rate

Blue – to same hospital
Red – to any hospital
Patient experience surveying at Clalit:

» Ongoing, year round
» >250,000 individuals surveyed by phone
» In proximity (in time) to service delivery
» Most extensive customer survey in Israel
Readmission: PREMs

30-day readmission by perceived Hospital discharge preparedness

High: 5.3%
Medium: 7.4%
Low: 12.6%

OR = 0.766; P-value = 0.01
Readmission risk prediction remains a poorly understood and complex endeavor.
Readmission: Predictives
Readmissions prevention

» Indicator in hospital EMR
» Indicator in GP/nurse EMR
» Daily intervention reports
» Introduce to nursing rounds
» Add transition care nurses
» Add to community nurses morning routine + reports
» Monitoring and feedback
The patient is being discharged today. Admitted due to AF. Currently receiving a blood clotting agent (Warfarin). Should be monitored for INR levels on Monday and Warfarin dosage adjusted as needed + continued monitoring.

Thank you Smadar for this information. I will schedule a house call as I see the patients ADL assessment indicates mobility limitations.
Impact on patient outreach

7-day no-contact rates
Readmissions prevention

Readmission rates by predictive score

- 15% of admissions (Repeated cases): 4.0% decline
- 15% of admissions (Prediction targeted): 9.1% decline
Predictive proactive care
Definition of illness and health

- Full scale disease: Irreversible pathology with severe functional impact
- Early Disease
- Pre-disease signs
- Early tissue pathology
- Pre-pathology Changes: Cellular, epigenetic
- Healthy
Predictive proactive care

Identify patients at:
» Pre-clinical stage (Pre-disease)
» Risk for acquiring the condition

Tailor interventions to:
» Prevent progression to chronic disease
» Treat when treatment most effective
Trends: Renal Replacement Therapy

Prevalence rates (per 1,000 members):
Relative increase vs. 2004, Clalit
Predictive proactive care

5-year deterioration rates to RRT among CKD stage 3 patients, Clalit

100-fold
RRT increased risk!

Clalit Research Institute Risk Scores

96% < 11.50%
92-96%  4.60%
80-92%  1.80%
60-80%  0.60%
30-60%  0.20%
0-30%   0.10%
8% of the subgroup holds 70% of future deteriorations
Preventing Renal Failure

5-year deterioration rates to RRT among CKD stage 3 patients, Clalit

100-fold
RRT increased risk!

Clalit Research Institute Risk Scores

Preventive Nephrology
External validation and comparison of three prediction tools for risk of osteoporotic fractures using data from population based electronic health records: retrospective cohort study

Noa Dagan,1,2 Chandra Cohen-Stavi,1 Maya Leventer-Roberts,1,3 Ran D Balicer1,4

Fig 1 | Population flowchart for comparative and tool specific external validation analyses (FRAX external validation population is same as population used for comparative analysis)
Predictive care in practice

» Nephrology
» Diabetes
» Influenza and pneumonia
» Geriatric syndrome
» Colon cancer
» Multi-morbidity risk
» ...
Clalit Research Institute

» Multi-disciplinary group

» Mandate: Turn data to insights, insights to policy
  - Real-life Effectiveness / Outcomes Research
  - Advanced analytics and predictions
  - Data-driven care models design

» Innovation hub
  - Rapid Transition research -> practice
Big data
The human mind cannot compile so much data
Beyond the structured data
Advanced analytics

Poker program Cepheus is unbeatable, claim scientists

Cepheus learned poker by playing over a billion billion hands - more than have been played in the entirety of human history.

'Perfect' online poker bot Cepheus has one flaw: it can't adapt.

Cepheus can lose a run of poker hands as a result of bad luck, but will always come out on top in the end. (Photographs: Mike Clark/Alamy Getty Images)
The Machine Vision Algorithm Beating Art Historians at Their Own Game

Classifying a painting by artist and style is tricky for humans; spotting the links between different artists and styles is harder still. So it should be impossible for machines, right?
Computerized vision

ImageNet Error rates

2010 2011 2012 2013 2014

Human eye
Computerized vision

ImageNet Error rates

Human eye

Bar chart showing error rates from 2010 to 2014.
Innovation in practice
Getting more out of available tests

Zebra Medical Vision and Clalit Health Services Announce Algorithm That Can Increase Osteoporosis Detection By 50%

Business Wire November 25, 2016

OSTEOPOROSIS

SHEFAYIM, Israel--(BUSINESS WIRE)--

Zebra Medical Vision (https://www.zebra-med.com) and Clalit Health Services are announcing the completion of a software algorithm which uses existing CT data to identify candidates for bone density screening, allowing earlier identification of patients...
Huge Potential – Yet Untapped

December, 2016
Transforming care through data

**Proactive care:** preventing deterioration

**Precise Tx:** Tx selection by personal expected impact

**Improving test interpretation** accuracy

**Safeguards from error & missed care opportunities**

**De-vesting futile interventions & policies**

**Patient self-care decision support**
How can innovative data-driven approaches help tackle NCDs?

23-03-2015

The technical meeting on 10 March 2015 in Tel Aviv, Israel, centred around real-life complexities in the prevention and control of Noncommunicable Diseases (NCDs), and addressed how innovative data-driven approaches can assist in tackling them.

Two key types of complexities were discussed:

- The increasing trend of co-existing multiple risk factors for NCDs;
- Complexities associated with NCD multimorbidity, which is becoming the norm among middle-aged adults.

Clalit Research Institute, the newly designated WHO Collaborating Centre for NCD Research, Prevention and Control that co-hosted the meeting, shared data and insights on the prevalence of these two phenomena, as well as hands-on experience in addressing them using data-driven innovative methods. Experts from ten Member States shared their experience and knowledge, and expressed the need for a new set of integrated tools to address these emerging issues.
We have so much more to do, **together**

“It is not enough to do your best; you must know what to do, and then do your best.

W. Edwards Deming
Thank you!