The emergence of modern medicine

~1860 - 1910:

- **new high standards for clinical education**
  - Flexner Report: more than half of all U.S. "medical schools" shut down
  - new model: hospital-based 2 year course of study (integrated clinical exposure)

- **strict requirements for professional licensing**

- **clinical practice founded on scientific research**
  - shift to germ theory, rather than "an imbalance of the 4 bodily humors," as the basis for understanding disease and its treatment
  - health care's first entry into "evidence-based medicine"

- **new internal organization for hospitals**

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"We routinely achieve miracles"

Since 1960, 6.97 years gained over 4 decades = 1.74 years / decade
(from 1900-1960, 20.7 years gained over 6 decades = 3.45 years / decade)

Current health care

is the best the world has ever seen

A few simple examples:

- From 1900 to 2000, average life expectancy at birth increased from 49 years to almost 77 years (28 year gain).

- Since 1960, age-adjusted mortality from heart disease (#1 killer) has decreased by 56% (from 307.4 to 134.6 deaths / 100,000); and

- Since 1950, age-adjusted mortality from stroke (#3 killer) has decreased by 70% (from 88.8 to 26.5 deaths / 100,000)

Initial life expectancy gains almost all resulted from public health initiatives -- clean water, safe food, and (especially) widespread control of epidemic infectious disease. But since about 1960, direct disease treatment has made increasingly large contributions.
Core idea behind variation research

Apply rigorous measurement tools developed for clinical research
to routine care delivery performance
Quality, Utilization, and Efficiency (QUE)

- **Six clinical areas studied over 2 years:**
  - transurethral prostatectomy (TURP)
  - open cholecystectomy
  - total hip arthroplasty
  - coronary artery bypass graft surgery (CABG)
  - permanent pacemaker implantation
  - community-acquired pneumonia

- **Pulled all patients treated over a defined time period**
  across all Intermountain inpatient facilities - typically 1 year

- **Identified and staged** (relative to changes in expected utilization)
  - severity of presenting primary condition
  - all comorbidities on admission
  - every complication
  - measures of long term outcomes

- **Compared physicians with meaningful # of cases**
  (low volume physicians included in parallel analysis, as a group)
Intermountain TURP QUE Study

Median Surgery Minutes vs Median Grams Tissue

Attending Physician

- Median surgical time
- Median grams tissue removed
The opportunity (care falls short of its theoretic potential)

1. **Massive variation in clinical practices** (beyond even the remote possibility that all patients receive good care)

2. **High rates of inappropriate care** (where the risk of harm inherent in the treatment outweighs any potential benefit)

3. **Unacceptable rates of preventable care-associated patient injury and death**

4. **Striking inability to "do what we know works"**

5. **Huge amounts of waste, leading to spiraling prices that limit access to care**
We routinely achieve miracles but as healing professionals, we could be much better.
We have found proven solutions
Dr. Alan Morris, LDS Hospital, 1991

- **NIH-funded randomized controlled trial**
  assessing an Italian "artificial lung" vs. standard ventilator management for acute respiratory distress syndrome (ARDS)

- **discovered large variations in ventilator settings**
  across and within expert pulmonologists

- **created a protocol** for ventilator settings in the control arm of the trial

- **implemented the protocol using Lean principles**
  (Womack et al., 1990 - The Machine That Changed the World)
  - built into clinical workflows - automatic unless modified
  - clinicians encouraged to vary based on patient need
  - variances and patient outcomes fed back in a Lean Learning Loop
Shared Baseline “Lean” protocols (bundles)

1. **Identify a high-priority clinical process** (key process analysis)

2. **Build an evidence-based best practice protocol**
   (always imperfect: poor evidence, unreliable consensus)

3. **Blend it into clinical workflow** (= clinical decision support; don't rely on human memory; make "best care" the lowest energy state, default choice that happens automatically unless someone must modify)

4. **Embed data systems to track**
   (1) **protocol variations** and
   (2) **short and long term patient results**
   (intermediate and final clinical, cost, and satisfaction outcomes)

5. **Demand that clinicians vary based on patient need**

6. **Feed those data back** (variations, outcomes) **in a Lean Learning Loop** - constantly update and improve the protocol
Results:

- **Survival** (for ECMO entry criteria patients) improved from 9.5% to 44%
- Costs fell by ~25% (from ~$160,000 to ~$120,000 per case)
- **Physician time fell by ~50%** (a major increase in physician productivity)
Sepsis bundle compliance

- ER bundle
- ICU bundle
- All components

% compliance

Month

07 Jan, Mar, May, Jul, Sep, Nov, 08 Jan, Mar, May, Jul, Sep, Nov, 09 Jan, Mar, May, Jul, Sep, Nov, 10 Jan, Mar
Sepsis mortality - ER-ICU transfers

125+ fewer inpatient deaths per year
Lesson 1

We count our successes in lives
# Sepsis costs - all ER-ICU transfers

Adjusted for age and severity at admission (CCIS); inflation adjusted to 2012 dollars

<table>
<thead>
<tr>
<th>Year</th>
<th># cases</th>
<th>Compliance rate</th>
<th>Mortality rate</th>
<th>Total cost reduction ($)</th>
<th>Annual NOI impact ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>384</td>
<td>4.4%</td>
<td>21.2%</td>
<td>18,062</td>
<td>9,967</td>
</tr>
<tr>
<td>2005</td>
<td>469</td>
<td>23.2%</td>
<td>15.0%</td>
<td>115,628</td>
<td>63,752</td>
</tr>
<tr>
<td>2006</td>
<td>395</td>
<td>24.8%</td>
<td>14.5%</td>
<td>103,774</td>
<td>57,362</td>
</tr>
<tr>
<td>2007</td>
<td>680</td>
<td>35.0%</td>
<td>13.5%</td>
<td>252,652</td>
<td>139,374</td>
</tr>
<tr>
<td>2008</td>
<td>756</td>
<td>50.0%</td>
<td>13.2%</td>
<td>401,436</td>
<td>221,760</td>
</tr>
<tr>
<td>2009</td>
<td>927</td>
<td>70.2%</td>
<td>8.8%</td>
<td>692,416</td>
<td>381,746</td>
</tr>
<tr>
<td>2010</td>
<td>965</td>
<td>73.4%</td>
<td>8.7%</td>
<td>752,292</td>
<td>414,876</td>
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<tr>
<td>2011</td>
<td>1097</td>
<td>81.2%</td>
<td>9.1%</td>
<td>948,500</td>
<td>523,658</td>
</tr>
<tr>
<td>2012</td>
<td>1146</td>
<td>85.1%</td>
<td>8.2%</td>
<td>1,036,648</td>
<td>573,038</td>
</tr>
<tr>
<td>2013</td>
<td>1405</td>
<td>87.3%</td>
<td></td>
<td>1,302,379</td>
<td>719,258</td>
</tr>
</tbody>
</table>

No significant inflation-adjusted financial change for patients presenting w septic shock.

For patients presenting with severe sepsis, savings of

- 11% ($2557 per case) in total cost,
- 12% ($1288 per case) in variable cost.
Lesson 2

*Most often*  
*(but not always)*

better care is cheaper care
No good deed goes unpunished

- **Neonates > 33 weeks gestational age who develop respiratory distress syndrome (RDS)**
- **Treat at birth hospital with nasal CPAP (prevents alveolar collapse), oxygen, +/- surfactant**
- **Transport to NICU declines from 78% to 18%**
- **Financial impact** (NOI; ~110 patients per year; raw $):

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
<th>NOI +/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated health plan</td>
<td>900,599</td>
<td>512,120</td>
<td>388,479</td>
</tr>
<tr>
<td>Medicaid</td>
<td>652,103</td>
<td>373,735</td>
<td>278,368</td>
</tr>
<tr>
<td>Other commerical payers</td>
<td>429,101</td>
<td>223,215</td>
<td>205,886</td>
</tr>
<tr>
<td>Payer total</td>
<td>1,981,803</td>
<td>1,109,070</td>
<td>872,733</td>
</tr>
<tr>
<td>Birth hospital</td>
<td>84,244</td>
<td>553,479</td>
<td>469,235</td>
</tr>
<tr>
<td>Transport (staff only)</td>
<td>22,199</td>
<td>-27,222</td>
<td>-49,421</td>
</tr>
<tr>
<td>Tertiary (NICU) hospital</td>
<td>958,467</td>
<td>209,829</td>
<td>-748,638</td>
</tr>
<tr>
<td>Delivery system total</td>
<td>1,064,910</td>
<td>736,086</td>
<td>-328,824</td>
</tr>
</tbody>
</table>
Lesson 3

The long-term organizational viability of clinical quality improvement strategies requires aligned financial incentives
Without access, "quality" is meaningless;

"Accessible" means "Affordable"
Goal: Limit rate increases

<table>
<thead>
<tr>
<th>Year</th>
<th>Status Quo Net Rev</th>
<th>2011 5-Yr Plan Net Rev</th>
<th>Actual Net Rev</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>$728MM (~13%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>$688MM (~13%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Net Revenue (in Millions)
Process management is the key

- *better clinical results produces lower costs*

- *more than half of all cost savings will take the form of unused capacity* (fixed costs: empty hospital beds, empty clinic patient appointments, reduced procedure, imaging, and testing rates)

- *balanced by increasing demand:*
  - demographic shifts (Baby Boom);
  - population growth;
  - behavioral epidemics (e.g., obesity);
  - technological advances
A model health care system, changing the health care delivery world

the ATP - Advanced Training Program in Clinical Practice Improvement

- started in 1992; emerged from Facilitator Workshop Series (FWS), which started in 1987

- 5,000+ senior health leader graduates – 42% physician executives, 25% nursing leaders, 17% support staff, 8% C-suite

- 50+ "sister" training programs - ~10 international:
  Australia, Singapore (2), Canada (2), Argentina, Israel, Switzerland, Scotland, England (2), Sweden, France

- Formal collaborations in France, Sweden
Better has no limit ...

an old Yiddish proverb