Patient Intelligence Predicts Health and Adherence to Treatment:

New Opportunities for Improving and Assessing Clinical Care

Linda S. Gottfredson, PhD
School of Education
University of Delaware
Newark, DE 19716

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Patient Intelligence Predicts Health and Adherence to Treatment:

• Really?
• So what?

New Opportunities for Improving and Assessing Clinical Care

Assess + Audit → Target + Adjust
Usual Focus: Physician Error

Select
Train
Certify
Regulate
Physician IQs Very High

<table>
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<th>IQs of applicants for:</th>
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<tbody>
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Mean
Physician IQs Very High

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Patients are cognitively diverse
IQ $\approx g \approx$ general intelligence

$g$ is general ability to:
- Learn
- Reason
- Solve problems

Literacy?
- Learn
- Reason
- Solve problems
IQ/g is:

- Ability to avoid cognitive error
- Not content specific

“Shhhh, Zog! ... Here come one now!”
Epidemiology of Patient Error

1. Patients differ in cognitive ability (IQ/g)

2. Health tasks differ in complexity (g loading)

3. Error rates (non-adherence)
   - rise at lower IQ
   - rise with complexity
Matrix of Cognitive Risk (error rates)

Can predict error if we know:

Distribution of $g$ in groups of patients:
- race
- age
- locale

Distribution of $g$ loadings in sets of tasks:
- preventive care
- chronic disease

Some errors more dangerous
But all cumulate
But Are IQ Differences Meaningful?

In criterion-related sense?

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Typical IQs in Occupations

Typical IQ range of workers

Assembler
Food service
Nurse’s aide

Clerk, teller
Police officer
Machinist, sales

Manager
Teacher
Accountant

Attorney
Chemist
Executive

No jobs centered here

IQ

MR

MG

70 80 90 100 110 120 130
Typical Learning Needs by IQ Level

- **70**<br>
  - Slow, simple, concrete, one-on-one instruction

- **80**<br>
  - Very explicit, structured, hands-on

- **90**<br>
  - Mastery learning, hands-on

- **100**<br>
  - Learns well in college format

- **110**<br>
  - Can gather, infer information on own

- **120**<br>
  - Written materials & experience

- **130**<br>
  - Military trainability thresholds

IQMR MG

10th 15th 30th
Does IQ Predict Longevity?

8 big cohort studies (Batty, Deary, & Gottfredson, 2007)

<table>
<thead>
<tr>
<th>(Whites)</th>
<th>Birth yr</th>
<th>IQ age</th>
<th>Followed to</th>
<th>(N)</th>
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<td>29-35</td>
<td>1786</td>
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<tr>
<td>Britain</td>
<td>1947</td>
<td>8</td>
<td>54</td>
<td>2057</td>
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<td>Denmark</td>
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<td>Scotland</td>
<td>1946-52</td>
<td>11</td>
<td>50-56</td>
<td>11,859</td>
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<tr>
<td>Scotland</td>
<td>1936</td>
<td>11</td>
<td>65</td>
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<td>Scotland</td>
<td>1921</td>
<td>11</td>
<td>80</td>
<td>922</td>
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<tr>
<td>Scotland</td>
<td>1921</td>
<td>11</td>
<td>76</td>
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<td>Sweden</td>
<td>1936</td>
<td>10</td>
<td>43</td>
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Childhood IQ Predicts Adult Mortality

8 large studies
(Batty, Deary, & Gottfredson, 2007)

1 more IQ point = 1% lower death rate
Childhood IQ Predicts Adult Mortality

8 large studies
(Batty, Deary, & Gottfredson, 2007)

1 more IQ point = 1% lower death rate

SES confound? Material resources, not mental resources?
Material resources not enough

- Equalizing resources *increases* health disparities
  - When Britain introduced **national health care**
  - When media made **health information** *more* widely available (signs and symptoms of cancer, diabetes, etc.)

- Old story—average rises, but variance too
  - Like in schools—some students more effectively exploit the same instruction

- Mental resources matter too—insufficiency means:
  - Inefficient use of available care
  - Inappropriate criticism of care
Does IQ Predict Health Behavior?

"Say ... what's a mountain goat doing way up here in a cloud bank?"
Literacy Example (TOFHLA)

(Controlling for personal resources, access, insurance, education, etc.)

Health literacy

More health knowledge
Better adherence

Better health
Less hospitalization
Lower health costs/year
Sample TOHFLA Items & Error Rates

Patients examine the actual vials or documents

<table>
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<th>% of urban hospital outpatients not knowing:</th>
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</thead>
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<td>How to take meds 4 times per day</td>
<td>24</td>
</tr>
<tr>
<td>When next appointment is scheduled</td>
<td>40</td>
</tr>
<tr>
<td>How many pills of a prescription to take</td>
<td>70</td>
</tr>
<tr>
<td>What an informed consent form is saying</td>
<td>95</td>
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Many professionals have no idea how difficult these "simple" things are for others.
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<tr>
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<td>13</td>
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<td>72</td>
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But how representative?
Nationally-Representative Sample  
(National Adult Literacy Survey, 1993)

<table>
<thead>
<tr>
<th>NALS Level</th>
<th>% pop (white)</th>
<th>Reading grade level</th>
<th>Simulated Everyday Tasks</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>14%</td>
<td>2.5</td>
<td>Total bank deposit entry</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Locate expiration date on driver’s license</td>
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<tr>
<td>2</td>
<td>25%</td>
<td>7.2</td>
<td>Determine difference in price between 2 show tickets</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Locate intersection on street map</td>
</tr>
<tr>
<td>3</td>
<td>36%</td>
<td>12</td>
<td>Calculate miles per gallon from mileage record chart</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Write brief letter explaining error on credit card bill</td>
</tr>
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<td>4</td>
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<td>16</td>
<td>Use eligibility pamphlet to calculate SSI benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Explain difference between 2 types of employee benefits</td>
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<tr>
<td>5</td>
<td>4%</td>
<td>16+</td>
<td>Use calculator to determine cost of carpet for a room</td>
</tr>
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<td></td>
<td></td>
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# Nationally-Representative Sample

(National Adult Literacy Survey, 1993)

<table>
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<th>Simulated Everyday Tasks Adults ages 16-65</th>
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<td>1</td>
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**Item difficulty is from “process complexity”**

- Level of inference
- Abstractness of info
- Distracting info
Health Adult Literacy Survey (HALS)

- Items simulate everyday health tasks
- Analyzed what increases item difficulty (error rates)
- 3 increasingly difficult questions for this item
HALS LEVELS:
Below Level 1 | Level 1 | Level 2 | Level 3 | Level 4 | Level 5
---|---|---|---|---|---
HALS SCORES: | 175 | 225 | 275 | 325 | 375 | 500

#1—Underline sentence saying how often to administer medication

- One piece of info
- Simple match
- But lots of irrelevant info

% US adults routinely functioning below this level?

20%

Caution!
Could train them do this item, but not all like it

Mean = 272

239
#2—How much syrup for 10-year-old who weighs 50 pounds?

## Pediatric Dosage Chart

<table>
<thead>
<tr>
<th>Age</th>
<th>Approximate Weight Range*</th>
<th>Drops</th>
<th>Syrup</th>
<th>Dosage</th>
<th>Chewables 80 mg</th>
<th>Chewables 160 mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>† Under 3 mo</td>
<td>Under 13 lb</td>
<td>½ dropper</td>
<td>½ tsp</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>† 3 to 9 mo</td>
<td>13-20 lb</td>
<td>1 dropper</td>
<td>½ tsp</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>† 10 to 24 mo</td>
<td>21-26 lb</td>
<td>1½ droppers</td>
<td>¾ tsp</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2 to 3 yr</td>
<td>27-35 lb</td>
<td>2 droppers</td>
<td>2 tsp</td>
<td>2 tablets</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4 to 5 yr</td>
<td>36-42 lb</td>
<td>3 droppers</td>
<td>1 tsp</td>
<td>3 tablets</td>
<td>1½ tablets</td>
<td>—</td>
</tr>
<tr>
<td>6 to 8 yr</td>
<td>44-62 lb</td>
<td>—</td>
<td>2 tsp</td>
<td>4 tablets</td>
<td>2 tablets</td>
<td>—</td>
</tr>
<tr>
<td>9 to 10 yr</td>
<td>63-79 lb</td>
<td>—</td>
<td>2½ tsp</td>
<td>5 tablets</td>
<td>2½ tablets</td>
<td>—</td>
</tr>
<tr>
<td>11 yr</td>
<td>80-89 lb</td>
<td>—</td>
<td>3 tsp</td>
<td>6 tablets</td>
<td>3 tablets</td>
<td>—</td>
</tr>
<tr>
<td>12 yr and older</td>
<td>90 lb &amp; over</td>
<td>3-4 tsp</td>
<td>6-8 tablets</td>
<td>3-4 tablets</td>
<td>—</td>
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</table>

* Consult with physician before administering to children under the age of 2 years.
Dosage may be given every 4 hours as needed but not more than 5 times daily.

---

**HALS LEVELS:**
- Below Level 1: 175
- Level 1: 225
- Level 2: 275
- Level 3: 325
- Level 4: 375
- Level 5: 500

**HALS SCORES:**
- 239
- 329

---

% US adults routinely functioning below this level? **54%**
#3—Your child is 11 years old and weighs 85 pounds. How many 80 mg tablets can you give in 24-hr period?

- Multiple features to match
- Two-step task
- Infer proper math operation
- Select proper numbers to use
- Ignore the most obvious but incorrect number
- Calculate the result

Pediatric Dosage Chart

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**Recommend**

**A Caring Sponsor of Ronald McDonald House**

% US adults routinely functioning below this level? **99%**

HALS LEVELS:

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Psychometrics of Patient Error

Must reconceptualize the:
1. Provider-patient encounter
2. Provider’s job
3. Patient’s job

Reveals sources of error & touch-points for reduction
MDs Tested on “Standardized Patients”

Items in test of patient care

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Daily MD Performance = “Adherence”

MD’s test items in everyday life:

Many patients

Many days

This “test”:
• Is unstandardized
• Results are cumulative (like GPA)
• MDs differ in performance
Passive-Patient Model

Resulting misconception: Non-adherence ≠ lack of motivation
Reality 1: Faulty Receipt & Application

Conscientiousness is not enough
Errors rise with lower IQ/g
Physician is Test Item for Patient
(stimulus for behavior)

Items in test of self-care

0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0

MD
Patient Adherence

Everyday test of self-care

This “test”:
- Is unstandardized
- Results are cumulative (like GPA)
- Patients differ in performance
Reality 2: Physician Is Only One Among Others

Sometimes conflicting & often unintegrated care
Reality 3: Contact & Supervision Are Minimal—But Demands of Self-Care Are Constant

Occasional consultant

De facto primary care provider
Effective Self-Care Requires Minimizing Error Over the Long Haul

<table>
<thead>
<tr>
<th>S</th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>T</th>
<th>F</th>
<th>S</th>
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<td>.1</td>
<td>.1</td>
<td>.1</td>
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</tbody>
</table>
Insights from Employment Literature

- Where and why IQ predicts job performance
- What makes jobs complex
- Highly regular, predictable patterns
IQ Predicts Best in Most Complex Jobs

IQs of applicants for:
- Attorney, Engineer
- Teacher, Programmer
- Secretary, Lab tech
- Meter reader, Teller
- Welder, Security guard
- Packer, Custodian

Criterion validity (corrected)
- .80
- .20
## Attributes of Complex Jobs

### Job analysis 1 (Gottfredson, 1997)

<table>
<thead>
<tr>
<th>Complex</th>
<th>$r$</th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Simple</td>
<td>-.73</td>
<td>Repetitive</td>
<td>Physical exertion</td>
<td>Supervision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teller</td>
<td>.56</td>
<td>.51</td>
<td>Transcribe</td>
<td>Patient?</td>
<td></td>
<td>Combine information</td>
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<tr>
<td>Attorney</td>
<td>.88</td>
<td>.86</td>
<td>Self-direction</td>
<td>Reason</td>
<td>Combine information</td>
<td>Advise</td>
</tr>
<tr>
<td></td>
<td>.85</td>
<td>.79</td>
<td>Update knowledge</td>
<td>Analyze</td>
<td>Write</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.83</td>
<td>.71</td>
<td>Analyze</td>
<td>Lack of structure</td>
<td>Plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Criticality of position</td>
<td>Negotiate, Persuade</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Coordinate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Instruct</td>
<td></td>
</tr>
</tbody>
</table>

### Positions
- Attorney
- Teller
- Custodian

### Attributes
- Self-direction
- Reason
- Update knowledge
- Analyze
- Lack of structure
- Criticality of position
- Transcribe
- Repetitive
- Physical exertion
- Supervision
- Patient?
## Attributes of Complex Jobs

Job analysis 2 (Arvey, 1986)

<table>
<thead>
<tr>
<th>Job requirements</th>
<th>Correlation with factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learn and recall relevant information</td>
<td>.75</td>
</tr>
<tr>
<td>Reason and make judgments</td>
<td>.71</td>
</tr>
<tr>
<td>Deal with unexpected situations</td>
<td>.69</td>
</tr>
<tr>
<td>Identify problem situations quickly</td>
<td>.69</td>
</tr>
<tr>
<td>React swiftly when unexpected problems occur</td>
<td>.67</td>
</tr>
<tr>
<td>Apply common sense to solve problems</td>
<td>.66</td>
</tr>
<tr>
<td>Learn new procedures quickly</td>
<td>.66</td>
</tr>
<tr>
<td>Be alert &amp; quick to understand things</td>
<td>.55</td>
</tr>
</tbody>
</table>
Common Building Blocks of Job Complexity

- Individual tasks
  - Abstract, unseen processes; cause-effect relations
  - Incomplete or conflicting information; much information to integrate; relevance unclear
  - Inferences required; operations not specified
  - Ambiguous, uncertain, unpredictable conditions
  - Distracting information or events
  - Problem not obvious, feedback ambiguous, standards change

- Task constellation (Often neglected, even in job analyses)
  - Multi-tasking, prioritizing
  - Sequencing, timing, coordinating
  - Evolving mix of tasks
  - Little supervision; need for independent judgment
Chronic Diseases Are Like Jobs

- Set of duties to perform, actions to avoid
- Requires training
- Coordinate & communicate with others
- Exercise independent judgment
- Only occasional supervision or consultation
- Job changes as technology & conditions evolve
- Sometimes tiring, frustrating, affects family life
- Central to personal well-being
- Lifelong
- But no vacations, no retirement
Avoiding Chronic Illness Requires Foresight & Prevention

- Keep informed
- Live healthy lifestyle
- Get preventive checkups
- Detect signs and symptoms
- Seek timely, appropriate medical attention
State launches plan to stop rising rate of killer disease

About 15,000 in Del. don’t know they’re diabetic

Delaware health officials released a plan Tuesday they hope will help stop the rising rate of diabetes in the state by 2010, primarily through better education of adults and children, increased screening and by helping uninsured people treat the disease.

State officials estimate that 45,000 Delaware residents have diabetes, and that 15,000 of them do not know it because they have not been screened or diagnosed. Delaware has the fourth highest diabetes death rate in the nation.

Diabetes is a disease that occurs when the body is not able to use sugar properly. Diabetes can cause adult blindness, kidney failure, heart disease and stroke, and require lower limb amputation. The ailment occurs more often in women than men, more often in blacks than whites and more often among people older than 65. Those with a family history of diabetes also are at a greater risk, according to health officials.

The state’s plan outlines a variety of strategies to avoid preventable cases of diabetes and help those who have the disease better treat it. Central to the plan is increased awareness through education and outreach in communities, schools and businesses, and expanded screening programs.

The plan’s authors also hope by 2010 to provide coverage for diagnosis and treatment for 70 percent of people who have insurance or not enough to cover adequate care. The 54-page document is a follow-up to the “Burden of Diabetes,” a report issued by the state in March documenting the extent of the diabetes problem in Delaware.

Lt. Gov. John Carney said Tuesday that the action plan should help Delaware qualify for $800,000 in federal grants to implement diabetes education and screening programs.

Diabetes facts

**Definition**

Diabetes is a chronic disease that has no cure. Type 1 diabetes, in which the body does not produce any insulin, is most common in children and young adults. In Type 2, the body does not make enough insulin or properly use it to convert food to energy. Type 2 accounts for 90 percent to 95 percent of all cases.

Diabetes is the leading cause of blindness, end-stage kidney disease and non-traumatic lower limb amputations — amputations not caused by accidents.

Diabetics are as much as four times more likely to have heart disease and suffer strokes.

**Who is most at risk?**

- People with high blood pressure — at or above 130/85.
- People in a family with a history of diabetes.
- Mothers who had diabetes during pregnancy or had a baby weighing more than 9 pounds at birth.
- People who are overweight or obese.
- People who do not exercise much.

**What to do**

- Everyone older than 45 should be tested every three years.
- Those who are younger, but at higher risk, should consult with their doctors about starting screenings sooner and more frequently.

**For information/help**

- Call (800) 342-2383.

Sources: American Diabetes Association and the Centers for Disease Control and Prevention

See DIABETES — B2
Chronic Illnesses Require Self-Regulation

- Follow treatment regimen
  - Use medications as prescribed
  - Diet, exercise, no smoking, etc.
  - Including for diseases without outward signs (e.g., hypertension)
- Monitor daily signs and symptoms
- Adjust medication and behavior in response to signs
- Have regular check-ups
Example: Diabetic’s Job

- **Learn about diabetes in general** *(At “entry”)*
  - Physiological process
  - Interdependence of diet, exercise, meds
  - Symptoms & corrective action
  - Consequences of poor control

- **Apply knowledge to own case** *(Daily, Hourly)*
  - Implement appropriate regimen
  - Continuously monitor physical signs
  - Diagnose problems in timely manner
  - Adjust food, exercise, meds in timely and appropriate manner

- **Coordinate with relevant parties** *(Frequently)*
  - Negotiate changes in activities with family, friends, job
  - Enlist/capitalize on social support
  - Communicate status and needs to HCPs

- **Update knowledge & adjust regimen** *(Occasionally)*
  - When other chronic conditions or disabilities develop
  - When new treatments available
  - When life circumstances change
### Specific Duties: Insulin-Dependent Diabetics

<table>
<thead>
<tr>
<th>Urban hospital outpatients: % diabetics <strong>not</strong> knowing that:</th>
<th>Health literacy level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signal</strong>: Thirsty/tired/weak usually means blood sugar too high</td>
<td>V-low</td>
</tr>
<tr>
<td>Action: Exercise lowers blood sugar</td>
<td>40</td>
</tr>
<tr>
<td><strong>Signal</strong>: Suddenly sweaty/shaky/hungry usually means blood sugar too low</td>
<td>50</td>
</tr>
<tr>
<td>Action: Eat some form of sugar</td>
<td>62</td>
</tr>
</tbody>
</table>
Good Performance (Adherence) in Job of Diabetes

- **IT IS NOT** mechanically following a recipe
- **IT IS** keeping a complex system under control in often unpredictable circumstances
  - Coordinate a regimen having multiple interacting elements
  - Adjust parts as needed to maintain good control of system buffeted by many other factors
  - Anticipate lag time between (in)action and system response
  - Monitor advance “hidden” indicators (blood glucose) to prevent system veering badly out of control
  - Decide appropriate type and timing of corrective action if system veering off-track
  - Monitor/control other shocks to system (infection, emotional stress)
  - Coordinate regimen with other daily activities
  - Plan ahead (meals, meds, etc.)
    - For the expected
    - For the unexpected and unpredictable
  - Prioritize conflicting demands on time and behavior

Extremely Complex
Cognitive barriers for Many diabetics
Cognitive Barriers for Many Diabetics

- **Known**
  - Abstract concepts in meal planning: carbohydrates ("includes sugar, but not pasta")
  - Immediate costs and benefits are favored over future benefits and costs (cheating on one’s diet, failure to monitor blood glucose)

- **Underappreciated**
  - Assuming that non-adherence which causes no obvious immediate harm isn’t dangerous (DKA from failing to take insulin for several days)
  - False security from not grasping abstract concepts of risk, probability, & cumulative damage ("Not planning ahead/not testing myself hasn’t gotten me in trouble, so there is no need for it.")
  - Not knowing when a deviation is big enough or frequent enough to cause concern (elevated glucose readings)
  - Cognitive overload ("It’s too complicated—too much to bother with.")
  - Distrust created when patients don’t understand the limits of medical understanding and advice ("I’m not going to listen to her anymore because the medicine she gave me didn’t work." Or, “He said he didn’t know if it would work.”)

- **NOTE**: These are not arbitrary “beliefs” that can just be replaced; they are failures to comprehend (“cognitive errors”)
Treatment regimens becoming more complex

- Heart attacks
  - 1960’s—just “good luck”
  - Now often includes:
    - regimen of aspirin, β-blocker, angiotensin-converting enzyme inhibitor
    - low-salt and low-cholesterol diet
    - Medicine to control hypertension, diabetes, & hypercholesterolemia
Complexity Favors Brighter Patients

Look! I just invented writing!

Thanks a lot!... you just made everybody else in the world illiterate!
Increasing Complexity Favors the Young

Raw mental horsepower (ability to learn and reason) rises into early adulthood, then falls.

*Average profile only*

Score relative to age mates ("IQ") is stable from adolescence on.
"Okay your father managed to get a mouse. Now how do we use it?"
Distribution of Cognitive Hurdles?

- Medical advances increase complexity
- Easy is unlikely
- Broad range is more likely

No. of tasks

70  80  90  100  110  120  130

MR  IQ  MG
Distribution of Cognitive Hurdles?

Medical advances increase complexity

Some complexity unnecessary, but much inherent

No. of tasks

70  80  90  100  110  120  130

MR  IQ  MG
Distribution of Cognitive Hurdles?

Aging lowers our ability to deal with it

Raw mental power (scores not age-normed)
But $g$ Theory Opens New Vistas

Strong evidence base, clockwork patterns

- What to do
  - How to audit task complexities in self-care
  - How to audit total job complexity (e.g., diabetes self-management)
  - How to audit patient populations’ cognitive needs
  - How to quickly estimate individual patient’s cognitive needs and supports
  - How to fashion instruction more sensitive to patient’s cognitive needs

- What to expect
  - Which self-care tasks will have highest error rates (non-adherence)
  - How changes in task complexity will change adherence rates
  - Size of age & race disparities to expect on different health tasks
  - How disparities will increase or decrease with as treatment complexity rises or falls

- New tools for providers—all providers
- More feasible than eradicating social inequality
- More humane than denying ability differences
Specific Opportunities—1

- Patient differences in $g$
  - Train providers
    - Size, nature, distribution, practical meaning of differences
    - Recognize/communicate across large IQ gaps
  - Create short unobtrusive measure of “literacy”
  - Target pockets of high error
  - Identify options for cognitive scaffolding
    - Tailored instruction, comprehension checks
    - Feedback, monitoring, retraining, reminders, hotlines
    - Auxiliary staff, family

Schools do it, military and employers do it
Specific Opportunities—2

- Task differences in complexity
  - Audit complexity in:
    - Information & instructions
    - Individual treatments, diseases
    - Clinic layout, patient interface
  - Target tasks with:
    - High expected error rates
    - Needless complexity
  - Write job descriptions for chronic diseases
    - Biggest cognitive barriers to adherence
    - Touch-points for intervention to surmount barriers
    - Set priorities for triage

[box]
Badly neglected, everywhere
Unnecessary Complexity

Back of a box of cold medicine

INDICATIONS: These Maximum Strength Tablets contain four effective ingredients for the temporary relief of these major cold and flu symptoms: A Nasal Decongestant — to relieve stuffy nose and sinus congestion. An Antihistamine — to dry up runny nose and relieve sneezing. A Cough Suppressant — to quiet cough. A Non-aspirin Analgesic — to relieve headache, fever, minor sore throat pain and body aches and pain.

DIRECTIONS: Adults: 2 tablets every 6 hours while symptoms persist, not to exceed 8 tablets in 24 hours, or as directed by a doctor. Children under 12: Consult a doctor.

WARNINGS: KEEP THIS AND ALL OTHER MEDICATIONS OUT OF THE REACH OF CHILDREN. IN CASE OF ACCIDENTAL OVERDOSE, SEEK PROFESSIONAL ASSISTANCE OR CONTACT A POISON CONTROL CENTER IMMEDIATELY. PROMPT MEDICAL ATTENTION IS CRITICAL FOR ADULTS AS WELL AS FOR CHILDREN. NOT NOTICE ANY SIGNS OR SYMPTOMS. If you are pregnant or nursing a baby, consult a health professional before using this product. Do not give this product to children under 12 years of age ever for more than 3 days without a doctor's advice. May cause drowsiness, dizziness or dizziness. Do not take this product for more than 7 days, except to relief of is accompanied by rash, persistent headache, sneezing, or if on symptoms may occur with smoking, asthma or emphysema, or if cough is accompanied by excessive phlegm (mucus/sputum) unless directed by a doctor. If sore throat is severe, persists for more than 2 days, is accompanied or followed by a fever, headache, rash, nausea or vomiting, consult a doctor promptly. Do not take this product, unless directed by a doctor, if you have a breathing problem such as emphysema or chronic bronchitis, or if you have heart disease, high blood pressure, thyroid disease, diabetes, glaucoma or difficulty in urination due to enlargement of the prostate gland. May cause drowsiness, dizziness or dizziness. Do not drive or operate machinery if you are taking sedatives or tranquilizers without first consulting your doctor. Use caution when driving a motor vehicle or operating machinery. May cause excitability, especially in children.

ALCOHOL WARNING: If you generally consume 3 or more alcohol-containing drinks per day, you should consult your physician for advice on when and how you should take this product and other pain relievers.

DRUG INTERACTION PRECAUTION: Do not use this product if you are currently taking a prescription monoamine oxidase inhibitor (MAO I) (certain drugs for depression, psychiatric or emotional conditions, or Parkinson's disease), or for two weeks after stopping the MAOI drug. If you are uncertain whether your prescription drug contains an MAOI, consult a health professional before taking this product.

ACTIVE INGREDIENTS (PER TABLET): Acetaminophen 500mg; Dextromethorphan HBr 15mg; Chlorpheniramine Maleate 2mg; Pseudoephedrine HCl 30mg.

OTHER INGREDIENTS: Carnauba Wax, Croscarmellose Sodium, D&C Yellow No. 10 Aluminum Lake, FD&C Red No. 40 Aluminum Lake, Hydroxypropyl Methylcellulose, Magnesium Stearate, Microcrystalline Cellulose, Polydextrose, Polyethylene Glycol, Povidone, Sodium Starch Glycolate, Starch, Stearic Acid, Titanium Dioxide, Triacetin.

STORE AT ROOM TEMPERATURE.

*This product is not manufactured or distributed by Bristol-Myers Products, distributor of Comtrex®.

DISTRIBUTED BY
AMERICAN PROCUREMENT AND LOGISTICS COMPANY
PO. BOX 27447, SALT LAKE CITY, UT 84127-0447 • 800-405-7787
New Labeling Regulations

Simpler words, etc.

<table>
<thead>
<tr>
<th>Active ingredients (in each softgel)</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guaifenesin, USP 200 mg</td>
<td>Expectorant</td>
</tr>
<tr>
<td>Pseudoephedrine HCl, USP 30 mg</td>
<td>Nasal decongestant</td>
</tr>
</tbody>
</table>

**Uses**
- temporarily relieves nasal congestion associated with:
  - the common cold
  - hay fever
  - upper respiratory allergies
  - sinusitis
  - helps loosen phlegm (mucus) and thin bronchial secretions to make coughs more productive

**Warnings**
**Do not use** if you are now taking a prescription monoamine oxidase inhibitor (MAOI) (certain drugs for depression, psychiatric, or emotional conditions, or Parkinson’s disease), or for 2 weeks after stopping the MAOI drug. If you do not know if your prescription drug contains an MAOI, ask a doctor or pharmacist before taking this product.

**Ask a doctor before use if you have**
- heart disease
- high blood pressure
- thyroid disease
- diabetes
- trouble urinating due to an enlarged prostate gland
- cough that occurs with too much phlegm (mucus)
- cough that lasts or is chronic such as occurs with smoking, asthma, chronic bronchitis, or emphysema

**Drug Facts (continued)**
**Stop use and ask a doctor if**
- you get nervous, dizzy, or sleepless
- symptoms do not get better within 7 days or are accompanied by fever
- cough lasts more than 7 days, comes back, or is accompanied by fever, rash, or persistent headache. These could be signs of a serious condition.

If pregnant or breast-feeding, ask a health professional before use.
**Keep out of reach of children.** In case of overdose, get medical help or contact a Poison Control Center right away.

**Directions**
- do not use more than 4 doses in any 24-hour period

<table>
<thead>
<tr>
<th>Age</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>adults and children 12 years and over</td>
<td>2 softgels every 4 hours</td>
</tr>
<tr>
<td>children 6 to under 12 years</td>
<td>1 softgel every 4 hours</td>
</tr>
<tr>
<td>children under 6 years</td>
<td>ask a doctor</td>
</tr>
</tbody>
</table>

**Other information**
- store at 20-25°C (68-77°F)

**Inactive ingredients**
FD&C green no. 3, gelatin, glycerin, mannitol, pharmaceutical glaze, polyethylene glycol, povidone, propylene glycol, sorbitan, sorbitol, titanium dioxide, water

But written materials are only a small part of the problem
Can Reduce Risk of Error

1. Provide cognitive assistance
2. Reduce task complexity
Thank you.