Managing One’s Diabetes: Lifelong Career with Relentless Reasoning Demands

Linda S. Gottfredson, PhD

Allied Health Symposium: Inform, Perform, Transform
Diabetes Association of Greater Cleveland
March 2, 2006
Diabetes and Its Awful Toll Quietly Emerge as a Crisis

As Cases Surge in New York, So Do Fears Of an Overburdened Medical System

By N. R. KLEINFELD

The prospect is frightening, but it has gone largely unnoticed outside public health circles. As epidemics go, diabetes has been a quiet one, provoking little of the fear or the prevention efforts inspired by AIDS or lung cancer.

In its most common form, diabetes, which allows excess sugar to build up in the blood and exact ferocious damage throughout the body, retains an outdated reputation as a relatively benign sickness of the old. Those who get it do not usually suffer any symptoms for years, and many have a hard time believing that they are truly ill.

Yet a close look at its surge in New York offers a disturbing glimpse of

BAD BLOOD
The Stealth Epidemic

First of Four Articles

Hints of its challenges to providers
The Vexing Compliance Problem

- Low rates of adherence
- Common to all chronic diseases
- Causes not clear
- Consequences costly in lives & dollars
A New Take on the Problem

1. Managing diabetes is like having a job—a lifelong career.

2. Intelligence (learning & reasoning ability) is best single predictor of job performance. It’s more predictive in more complex jobs.

3. Diabetes self-management is complex, but some parts especially so.

4. Intelligence can’t be changed, but task complexity can.

5. So we need to identify, and minimize, the biggest cognitive hurdles to effective self-management.

School of Education, [www.udel.edu/educ](http://www.udel.edu/educ)
How is managing diabetes like having a job—a lifelong career?
DSME Content Areas (Standard 7 Goals for Patient Learning)

- Disease process
- Nutrition
- Physical activity
- Medications
- Monitoring
- Prevent/detect/treat
  - Acute complications
  - Chronic complications
- Goal setting/problem solving for daily living
- Psychosocial adjustment
- Preconception care/gestational management

Patients are not—cannot be—passive recipients of care.
Patient’s Job

- **Learn about diabetes in general** *(At “entry’)*
  - Physical 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
Diabetes Is Like a Career

- Set of duties to perform
- Requires training
- Multitask, deal with ambiguity
- Coordinate & communicate with others
- Exercise independent judgment
- Only occasional supervision
- Job changes as technology & conditions evolve
- Often tiring, frustrating, affects family life
- Central to personal well-being
- Lifelong
- But no vacations, no retirement
Good Performance=Adherence

- **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

Relentless demands for reasoning!
How well does intelligence predict job performance?
Influences Studied

**External**
- Resources
- Working conditions
- Task complexity
  A “Moderator”

**Internal**
- Personality
  “Will Do”
- Interests
- Knowledge
  “Can Do”
- Abilities
- Experience
  “Have Done”

1000’s of studies in personnel selection psychology
Summary of Findings

Conscientiousness

Experience

Knowledge

Mental ability

Performance → Rewards
Results Differ by Type of Work

- Not by content of work
- But by complexity of work

Recall that regimen complexity is also a consistent predictor of adherence rates. Big clue!
IQ Predicts Performance Best in Most Complex Jobs

IQs of applicants for:

- Attorney, Engineer
  - IQs: Middle 50%
  - 108-128
- Teacher, Programmer
  - IQs: Middle 50%
  - 100-120
- Secretary, Lab tech
  - IQs: Middle 50%
  - 96-116
- Meter reader, Teller
  - IQs: Middle 50%
  - 91-110
- Welder, Security guard
  - IQs: Middle 50%
  - 85-105
- Packer, Custodian
  - IQs: Middle 50%
  - 80-100

Diabetes??
Findings for Low-Complexity Jobs

Conscientiousness → Experience → Knowledge → Performance → Rewards

Mental ability
Findings for High-Complexity Jobs

Conscientiousness → Experience → Performance → Rewards

Mental ability → Knowledge

Higher intelligence is bigger advantage in more complex jobs
# Oft-Suggested Determinants of Adherence*

<table>
<thead>
<tr>
<th>Depression</th>
<th>Dosing frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personality disorder</td>
<td>Cost of therapy</td>
</tr>
<tr>
<td>Drug abuse</td>
<td>Underinsurance</td>
</tr>
<tr>
<td>Patient beliefs</td>
<td>Adverse family dynamics</td>
</tr>
<tr>
<td>Older age</td>
<td>Poor relation with provider</td>
</tr>
</tbody>
</table>

“Can do” factors neglected!
Cognitive Aging: Another Clue

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

Average profile only

But score relative to age mates ("IQ") is stable from adolescence on
Job Model of Adherence

“Will Do” — “Can Do”

Experience ➔ Knowledge ➔ Adherence ➔ Conditions

Resources ➔ Health

School of Education, www.udel.edu/educ
Equality Paradox: Ability Matters More When Resources Equalized

- "Will Do"
- "Can Do"
- Experience
- Knowledge
- Resources
- Adherence
- Conditions

School of Education, www.udel.edu/educ
Is there any evidence that intelligence really does affect health?
Yes, and Mounting

- Early IQ predicts later health outcomes
- Predicts at least as well as does socioeconomic status
### Example: Longevity

- Childhood IQ predicts longevity
- 8 big cohort studies

<table>
<thead>
<tr>
<th>(Whites)</th>
<th>Birth yr</th>
<th>IQ age</th>
<th>Followed to</th>
<th>(N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1947-53</td>
<td>18</td>
<td>29-35</td>
<td>1786</td>
</tr>
<tr>
<td>Britain</td>
<td>1947</td>
<td>8</td>
<td>54</td>
<td>2057</td>
</tr>
<tr>
<td>Denmark</td>
<td>1953</td>
<td>12</td>
<td>48</td>
<td>7319</td>
</tr>
<tr>
<td>Scotland</td>
<td>1946-52</td>
<td>11</td>
<td>50-56</td>
<td>11,859</td>
</tr>
<tr>
<td>Scotland</td>
<td>1936</td>
<td>11</td>
<td>65</td>
<td>908</td>
</tr>
<tr>
<td>Scotland</td>
<td>1921</td>
<td>11</td>
<td>80</td>
<td>922</td>
</tr>
<tr>
<td>Scotland</td>
<td>1921</td>
<td>11</td>
<td>76</td>
<td>2217</td>
</tr>
<tr>
<td>Sweden</td>
<td>1936</td>
<td>10</td>
<td>43</td>
<td>831</td>
</tr>
</tbody>
</table>
Example: Motor Vehicle Deaths

- IQ at Age 18

<table>
<thead>
<tr>
<th>IQ:</th>
<th>Australian veterans followed to age 40</th>
<th>Death rate per 10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>above 115</td>
<td>51.3</td>
<td></td>
</tr>
<tr>
<td>100-115</td>
<td>51.5</td>
<td></td>
</tr>
<tr>
<td>85-100</td>
<td>92.2</td>
<td>2x</td>
</tr>
<tr>
<td>80- 85</td>
<td>146.7</td>
<td>3x</td>
</tr>
</tbody>
</table>

“People with lower IQ may have a poorer ability to assess risks and, consequently, may take more risks in their driving.”

1 more IQ point = 1% lower death rate
But why would intelligence be important in jobs and health?
First, We Need To Know

- What is it?
- How much do people differ?
- Which kinds of tasks call upon it most?
Many Abilities But One Intelligence—The $g$ Factor

- All abilities correlated
- They differ in generality
- $g$ is backbone of all others

$g$ = Skill at processing complex information
Any kind of content

General

Specific
What Is The General Factor \((g)\)?

Everyday meaning:

- Ability to reason, plan, spot and solve problems, think abstractly, comprehend complex ideas, learn quickly and from experience.
- Ability to “catch on,” “make sense of things,” and “figure out what to do.”

Adept learning and reasoning
Most Fundamentally—

- $g$ is ability to mentally manipulate information
- Concrete examples:
  - Digits Forward vs. Digits Backward
- Tests that measure $g$ better are more “$g$ loaded”
  - Reading comprehension vs. spelling
  - Math reasoning vs. arithmetic
  - The former two require more reasoning than the latter
How Much Do People Differ?

No. of people (whites)

IQ

MR

MG

70  80  90  100  110  120  130

5%  20%  50%  20%  5%
IQ/g Level Affects Life Chances

Typical IQ range of workers

No. of people

Assembler
Food service
Nurse’s aide

Clerk, teller
Police officer
Machinist, sales

Manager
Teacher
Accountant

Attorney
Chemist
Executive

70 80 90 100 110 120 130

MR IQ MG
IQ/g Level Affects Trainability

- IQ 70 - 80 - 90 - 100 - 110 - 120 - 130
- No. of people

Written materials & experience
- Mastery learning, hands-on
- Very explicit, structured, hands-on
- Learns well in college format
- Can gather, infer information on own

- Slow, simple, concrete, one-on-one instruction
- Can gather, infer information on own

MR  IQ  MG
How Cognitively Demanding Are Different Self-Care Tasks?

Broad range is more likely

Easy is unlikely
Why do some tasks require more reasoning?
Tasks Require More Reasoning When They Are More Complex

But what—specifically—makes tasks more complex?

Clues from

- Job analyses
- IQ test items
- Functional literacy tests
Clues From Job Analyses

Complex jobs require workers to: (Arvey, 1986) Correlation with overall job complexity (Applied to health)

- Learn and recall relevant information (symptoms) .75
- Reason and make judgments (timely preventive care) .71
- Deal with unexpected situations (meal delayed) .69
- Identify problem situations quickly (hazards) .69
- React swiftly when unexpected problems occur (injuries, asthma attack) .67
- Apply common sense to solve problems .66
- Learn new procedures quickly (treatment regimens) .66
- Be alert & quick to understand things (feverish child) .55
## Clues From IQ Items

<table>
<thead>
<tr>
<th></th>
<th>Easy item</th>
<th>Harder item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State one similarity</strong></td>
<td><strong>Dog—Lion</strong></td>
<td><strong>Fly—Tree</strong></td>
</tr>
<tr>
<td></td>
<td>3, 5, 7, 9, _, _</td>
<td>10, 9, 8, 9, 8, 7, _, _</td>
</tr>
<tr>
<td><strong>Give the next two numbers</strong></td>
<td></td>
<td><strong>Rule to be inferred has more parts</strong></td>
</tr>
<tr>
<td><strong>Complete the pattern</strong></td>
<td><img src="image" alt="Pattern" /></td>
<td><img src="image" alt="Pattern" /></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Pattern" /></td>
<td><img src="image" alt="Pattern" /></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Pattern" /></td>
<td><img src="image" alt="Pattern" /></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Pattern" /></td>
<td><img src="image" alt="Pattern" /></td>
</tr>
</tbody>
</table>

**Complexity is the active ingredient**
# Functional Literacy in Daily Life

**Simulated Everyday Tasks**  
(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>
</tr>
</thead>
</table>
| 1          | 14%           | 2.5                 | - Total bank deposit entry  
- Locate expiration date on driver’s license |
| 2          | 25%           | 7.2                 | - Determine difference in price between 2 show tickets  
- Locate intersection on street map |
| 3          | 36%           | 12                  | - Calculate miles per gallon from mileage record chart  
- Write brief letter explaining error on credit card bill |
| 4          | 21%           | 16                  | - Use eligibility pamphlet to calculate SSI benefits  
- Explain difference between 2 types of employee benefits |
| 5          | 4%            | 16+                 | - Use calculator to determine cost of carpet for a room  
- Use table of information to compare 2 credit cards |

Health ed says use Grade 5
Functional Literacy in Daily Life

<table>
<thead>
<tr>
<th>NALS Level</th>
<th>% pop (white)</th>
<th>Reading grade level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14%</td>
<td>2.5</td>
</tr>
<tr>
<td>2</td>
<td>25%</td>
<td>7.2</td>
</tr>
<tr>
<td>3</td>
<td>36%</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>21%</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>4%</td>
<td>16+</td>
</tr>
</tbody>
</table>

Just a sample of the many tasks adults expected to learn on their own.

NOT READING PER SE, BUT:
- “complex information processing skills”
- “verbal comprehension & reasoning”
- “ability to understand, analyze, evaluate”

Predicts life outcomes in the same pattern as does IQ.
# Item Analyses Reveal Same Active Ingredient

## Simulated Everyday Tasks
Adults ages 16-65

<table>
<thead>
<tr>
<th>NALS Level</th>
<th>% pop (white)</th>
<th>Reading grade level</th>
<th>Simulated Everyday Tasks</th>
</tr>
</thead>
</table>
| 1          | 14%           | 2.5                 | ▪ Total bank deposit entry  
▪ Locate expiration date on driver's license  
▪ Determine difference in price between 2 show tickets  
▪ Use eligibility pamphlet to calculate SSI benefits  |
| 2          | 25%           | 7.2                 | ▪ Locate intersection on street map  
▪ Calculate miles per gallon from mileage record chart  
▪ Write brief letter explaining error on credit card bill  |
| 3          | 36%           | 12                  | ▪ Use calculator to determine cost of carpet for a room  
▪ Explain difference between 2 types of employee benefits  |
| 4          | 21%           | 16                  | ▪ Use table of information to compare 2 credit cards  |
| 5          | 4%            | 16+                 | ▪ Item difficulty is from “process complexity”  
▪ Level of inference  
▪ Abstractness of info  
▪ Distracting info  |

Item grade level: 2.5 to 16+
Example: Item at NALS Level 2

You are a marketing manager for a small manufacturing firm. This graph shows your company’s sales over the last three years. Given the seasonal pattern shown on the graph, predict the sales for Spring 1985 (in thousands) by putting an “x” on the graph.

Simple inference
Little distracting information
On Saturday afternoon, if you miss the 2:35 bus leaving Hancock and Buena Ventura going to Flintridge and Academy, how long will you have to wait for the next bus?
What do studies of health literacy find?
Health Adult Literacy Survey (HALS)

- Items simulate everyday health tasks
- Analyzed what increases item difficulty (error rates)
- 3 increasingly difficult questions for this item
Pediatric Dosage Chart

**Recommend**

<table>
<thead>
<tr>
<th>Drops, Syrup, &amp; Chewables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
</tr>
<tr>
<td><strong>Weight Range</strong></td>
</tr>
<tr>
<td><strong>Dosage</strong></td>
</tr>
<tr>
<td><strong>Chewables 80 mg</strong></td>
</tr>
<tr>
<td><strong>Chewables 160 mg</strong></td>
</tr>
<tr>
<td>1 <strong>Under 3 mo</strong> Under 13 lb</td>
</tr>
<tr>
<td>2 <strong>3 to 9 mo</strong> Under 13 lb</td>
</tr>
<tr>
<td>3 <strong>10 to 24 mo</strong> Under 13 lb</td>
</tr>
<tr>
<td>4 <strong>2 to 3 yr</strong> 27-35 lb</td>
</tr>
<tr>
<td>5 <strong>4 to 5 yr</strong> 36-43 lb</td>
</tr>
<tr>
<td>6 <strong>6 to 8 yr</strong> 44-62 lb</td>
</tr>
<tr>
<td>7 <strong>9 to 10 yr</strong> 63-79 lb</td>
</tr>
<tr>
<td>8 <strong>11 yr</strong> 80-89 lb</td>
</tr>
<tr>
<td>9 <strong>12 yr and older</strong> 90 lb &amp; over</td>
</tr>
</tbody>
</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:**

<table>
<thead>
<tr>
<th>HALS LEVELS:</th>
<th>Below Level 1</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HALS SCORES:</td>
<td>175</td>
<td>225</td>
<td>275</td>
<td>325</td>
<td>375</td>
<td>500</td>
</tr>
</tbody>
</table>

**Mean = 272**

% US adults routinely functioning below this level?

**20%**

Caution!

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

% US adults routinely functioning below this level? 99%

<table>
<thead>
<tr>
<th>HALS LEVELS:</th>
<th>Below Level 1</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>HALS SCORES:</td>
<td>175</td>
<td>225</td>
<td>275</td>
<td>325</td>
<td>375</td>
<td>500</td>
</tr>
</tbody>
</table>
So, Exactly The Same Pattern

- Health literacy is:
  - “Problem-solving abilities”
  - “Ability to acquire new information and complete complex cognitive tasks”

- Non-adherence often due to patients failing to “learn, reason, & problem-solve”

- Health literacy (TOFHLA score) predicts:
  - More health knowledge
  - Better health
  - Less hospitalization
  - Lower health costs/year

School of Education, www.udel.edu/educ
### Example: Common Patient Tasks

Patients examine the actual vials or documents

<table>
<thead>
<tr>
<th>% of urban hospital outpatients <strong>not</strong> knowing:</th>
<th>Health literacy level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V-low</td>
</tr>
<tr>
<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>
</tr>
</tbody>
</table>

Many professionals have no idea how difficult these "simple" things are for others.
## Example: Diabetes Self-Care

<table>
<thead>
<tr>
<th>Urban hospital outpatients:</th>
<th>Health literacy level</th>
</tr>
</thead>
<tbody>
<tr>
<td>% diabetics <em>not</em> knowing that:</td>
<td>V-low</td>
</tr>
<tr>
<td><strong>Signal:</strong> Thirsty/tired/weak usually means blood sugar too high</td>
<td>40</td>
</tr>
<tr>
<td><strong>Action:</strong> Exercise lowers blood sugar</td>
<td>60</td>
</tr>
<tr>
<td><strong>Signal:</strong> Suddenly sweaty/shaky/hungry usually means blood sugar too low</td>
<td>50</td>
</tr>
<tr>
<td><strong>Action:</strong> Eat some form of sugar</td>
<td>62</td>
</tr>
</tbody>
</table>
Rising Complexity: An Engine for Non-Adherence

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

School of Education, www.udel.edu/educ
Aging Population: Another Engine for Non-Adherence

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

Average profile only

Basic cultural Knowledge ($G_C$)

g - Basic information processing ($G_F$)
Much Complexity Is Inherent—But Not All!

Confusing forms, handouts, labels; clinic layout, provider’s vocabulary, etc.
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. IF NOTICED ANY SIGNS OR SYMPTOMS OF OVERDOSE, IF YOU ARE PREGNANT OR NURSING, IF YOU ARE ALLERGIC TO ANY INGREDIENTS, IF YOU HAVE A HEALTH PROBLEM BEFORE USING THIS PRODUCT. DO NOT GIVE THIS PRODUCT TO CHILDREN UNDER 12 YEARS OF AGE OR USE FOR MORE THAN 3 DAYS WITHOUT A HEALTH PROFESSIONAL PRESENT. CONSULT A DOCTOR. DO NOT EXCEED RECOMMENDED DOSAGE. DISCONTINUE IF UNEXPECTED SYMPTOMS OCCURS. CONSULT A DOCTOR IF PERSISTENT HEAT, CONGESTION, SNEEZING, OR السابך THAN 3 DAYS, OR IF NEW SYMPTOMS OCCUR WITH SMOKING, ASTHMA OR EMPIRICAL, OR THE COUGH IS ACCOMPANIED BY EXCESSIVE PHLEGM (MUCUS/SPUTUM) UNLESS DIRECTED BY A DOCTOR. A SORE THROAT IS SEVERE, PERSISTS FOR MORE THAN 2 DAYS, IS ACCOMPANYED OR FOLLOWED BY A FEVER, HEADACHE, RASH, NAUSEA OR VOMITING, CONSULT A DOCTOR.
Well Known Ways to Simplify Written Materials

Such as simpler words

But written materials are only a small part of the problem
Returning to the DSME Content Areas…

- Disease process
- Nutrition
- Physical activity
- Medications
- Monitoring
- Prevent/detect/treat
  - Acute complications
  - Chronic complications
- Goal setting/problem solving for daily living
- Psychosocial adjustment
- Preconception care/gestational management

Compartmentalized for instruction, but miss key complexities confronting patients
So, what *are* the biggest cognitive hurdles in diabetes self-care?

Probably the usual suspects
Common Building Blocks of Task 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
Cognitive Hurdles in Diabetes: Examples

- **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")
More Examples of Cognitive Hurdles

- Hypertension
  - No outward symptoms
  - So treatment is a nuisance without obvious benefits

- Asthma
  - Symptoms are obvious, but benefits of the superior drug are not
    - Brochodilators give immediate but only temporary relief
    - Inhaled steroids don’t give fast relief but provide better long-term control
3 Ways to Minimize Cognitive Barriers

1. Mobilize person’s abilities
2. Provide cognitive assistance
3. Reduce task complexity
3 Options Require 3 Audits

1. Mobilize person’s abilities
2. Provide cognitive assistance
3. Reduce task complexity

Cognitive abilities

Cognitive resources available to patients

Task demands

Cognitive variation among patients

Cognitive hurdles
- major/minor
- inherent/not
Thank you.

Contact Information

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

Phone: (302) 831-1650
Fax (302) 831-6058
Email: gottfred@udel.edu
Website: http://www.udel.edu/educ/gottfredson/
Bibliography

Brief overviews of major research findings on general intelligence for the general reader

IQ, Functional Literacy, and Everyday Life

IQ, Health, and Health Knowledge

Health literacy and patient outcomes

School of Education, www.udel.edu/educ
#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>⅛ dropper</td>
<td>⅛ 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>1 ½ droppers</td>
<td>½ 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>3 tsp</td>
<td>3 tablets</td>
<td>1 ½ tablets</td>
<td>—</td>
</tr>
<tr>
<td>6 to 8 yr</td>
<td>44-62 lb</td>
<td>44-62 lb</td>
<td>2 tsp</td>
<td>4 tablets</td>
<td>2 tablets</td>
<td>2 tablets</td>
</tr>
<tr>
<td>9 to 10 yr</td>
<td>63-79 lb</td>
<td>2 tsp</td>
<td>4 tablets</td>
<td>2 tablets</td>
<td>2 tablets</td>
<td>2 tablets</td>
</tr>
<tr>
<td>11 yr</td>
<td>80-89 lb</td>
<td>3 tsp</td>
<td>6 tablets</td>
<td>3 tablets</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>12 yr and older</td>
<td>90 lb &amp; over</td>
<td>3-4 tablets</td>
<td>6-8 tablets</td>
<td>3-4 tablets</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</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.

How Supplied:
- **Drops:** Each 0.8 ml dropper contains 80 mg (1.23 grains) acetyaminophen.
- **Syrup:** Each 5 ml teaspoon contains 160 mg (2.46 grains) acetyaminophen.
- **Chewables:** Regular tablets contain 80 mg (1.23 grains) acetyaminophen each. Double strength tablets contain 160 mg (2.46 grains) acetyaminophen each.

* If child is significantly under- or overweight, dosage may need to be adjusted accordingly.

The weight categories in this chart are designed to approximate effective dose ranges of 10-15 milligrams per kilogram.

---

- Spot & reconcile conflicting info
- Inference from ambiguous info
- Multiple features to match
#2—How much syrup for 10-year-old who weighs 50 pounds?

**Pediatric Dosage Chart**

**Recommend**

[Image of Pediatric Dosage Chart]

<table>
<thead>
<tr>
<th>Age</th>
<th>Approximate Weight Range*</th>
<th>Drops</th>
<th>Syrup</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>† Under 3 mo</td>
<td>Under 13 lb</td>
<td>½ dropper</td>
<td>¼ tsp</td>
<td>80 mg</td>
</tr>
<tr>
<td>† 3 to 9 mo</td>
<td>13-20 lb</td>
<td>1 dropper</td>
<td>½ tsp</td>
<td>80 mg</td>
</tr>
<tr>
<td>† 10 to 24 mo</td>
<td>21-26 lb</td>
<td>1 ½ droppers</td>
<td>½ tsp</td>
<td>80 mg</td>
</tr>
<tr>
<td>2 to 3 yr</td>
<td>27-35 lb</td>
<td>2 droppers</td>
<td>1 tsp</td>
<td>160 mg</td>
</tr>
<tr>
<td>4 to 5 yr</td>
<td>36-43 lb</td>
<td>3 droppers</td>
<td>1½ tsp</td>
<td>160 mg</td>
</tr>
<tr>
<td>6 to 8 yr</td>
<td>44-62 lb</td>
<td>–</td>
<td>2 tsp</td>
<td>160 mg</td>
</tr>
<tr>
<td>9 to 10 yr</td>
<td>63-79 lb</td>
<td>–</td>
<td>2½ tsp</td>
<td>160 mg</td>
</tr>
<tr>
<td>11 yr</td>
<td>80-89 lb &amp; over</td>
<td>–</td>
<td>3 tsp</td>
<td>160 mg</td>
</tr>
<tr>
<td>12 yr and older</td>
<td>90 lb &amp; over</td>
<td>–</td>
<td>3-4 tsp</td>
<td>160 mg</td>
</tr>
</tbody>
</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
- Level 1
- Level 2
- Level 3
- Level 4
- Level 5

**HALS SCORES:**
- 175
- 225
- 275
- 325
- 375
- 500

% US adults routinely functioning below this level? 46%

- Spot & reconcile conflicting info
- Inference from ambiguous info
- Multiple features to match

Mean = 272