

Intelligence: Is it the epidemiologists' elusive fundamental cause of social class inequalities in health?

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“Wealth Secures Health”

Psychologists' research is probing why the more money you have, the better health you enjoy.

(APA Monitor, 2001)



The Issue

- Yes, pervasive SES differences in health
- But “poverty paradigm” has failed
- There’s a more “fundamental cause”
- Intelligence (g) may be that cause
 - Predicts better than SES measures
 - Explains better than SES theories



Yes, SES-Health Gradients Are Pervasive

- Higher social class (education, occupation, income) associated with:
 - Lower morbidity
 - Lower mortality
 - Better health behaviors
 - More health knowledge

Example (odds ratios): Same for all sex/race (B/W) groups

Cum. probability of onset by age 63 for persons aged 51 without the disease	Years of Education		
	8	12	16
Diabetes , Chronic obstructive pulmonary disease	2.0	1.0	0.5
Stroke , heart, hypertension	1.5	1.0	0.7
Cancer	0.7	1.0	1.4

Red=prevalence rates higher for black M and F



But “Poverty Paradigm” Has Failed

Health epidemiologists point to two puzzles and a paradox.



Puzzle 1: Effect Too General

- Virtually all major diseases/causes of death
- All demographic groups
- All nations
- All decades

Gradients do not trace variation/change



Puzzle 1: Effect Too General

- Virtually all major diseases/causes of death
- All demographic groups
- All nations
- A **Moreover, gradients are found:**
- **Regardless of the disease's treatability**
- **Even when health care free**
- **Even when treatments identical**



Puzzle 2: Effect Too Linear

- Health is *increasingly* better at higher SES levels, even beyond point where resources are more than sufficient
- “Finely graded”

Paradox: SES-Health Gaps Grow When They Should Shrink



- When health **care** made more widely available
- When health **information** made more widely available

All gain, but higher SES people gain more



Contributing Behaviors

When care is free:

- Lower social classes seek:
 - Less information
 - Less preventive care
 - More—but less appropriate—curative care
- And perform worse:
 - Know, understand less
 - Less healthy behavior (e.g., smoking)
 - Adhere less to treatment regimens



Epidemiologists' Suspect a “Fundamental Cause” At Work

SES-health gradients are so “remarkably” general that there must be some equally general “fundamental cause,” “higher order variable,” or “transportable” resource that maintains the SES-health relation in a **“dynamic system in which risk factors, knowledge of risk factors, treatments, and patterns of disease are changing.”**

(Link & Phelan, 1995)



Their Candidates

- **Cannot** be material resources
- Perhaps psychic mediators of SES?
 - Social support, connectedness, anxiety, stress
 - Sense of control, mastery, esteem, stigma
 - Capacities in coping, resistance, problem-solving
- Perhaps inequality itself (relative deprivation)?
- But **not** IQ!!



Intelligence Might Be That “Fundamental Cause.” Why?

First clue:

- Effects of intelligence (g) in other life arenas mimic the puzzles and paradox for SES in health
 - Highly general, context-insensitive
 - Linear
 - Variance in performance increases as mean rises

Intelligence Might Be That “Fundamental Cause.” Why?

Second clue:

- SES-health gradients steeper when SES scale is a better surrogate for IQ

		<u><i>r</i> with IQ</u>
■ income	+	.3-.4
■ occupation	++	.4-.5
■ education	+++	.5-.6

SES Differences in IQ (WAIS)

Education (Yrs)	IQ	%	Occupation	IQ	%
16+	115	84	Prof/technical	111	76
13-15	107	68	Man/cler/sales	104	61
12 (diploma)	100	50	Skilled	99	48
9-11	96	39	Semi-skilled	93	32
8	91	27	Unskilled	89	24
0-7	82	12			
2.2 SD			1.5 SD		



IQ Predicts Health Better Than SES

Large, prospective IQ-SES-health studies

- Scotland (IQ at age 11)
 - Longevity
 - Heart disease, lung cancer mortality
 - Smoking cessation
- Australia (IQ at Army induction)
 - All-cause mortality
 - Motor vehicle deaths
 - Suicide

Example: Motor Vehicle Deaths

- IQ is best predictor
- Predicts net of 56 other variables

Australian veterans followed to age 40	Death rate per 10,000
IQ: above 115	51.3
100-115	51.5
85-100	92.2
80- 85	146.7

2x
3x

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



IQ Provides Better Explanatory Mechanisms Than SES

- Poverty paradigm has failed
- No viable social class psyche theory yet
- But the SES-health data fit well into the *g* theory of competence in everyday life

Mental, not material, resources the key?



Preview of Explanation: Health Is a “Job”

1. IQ/*g* is a general learning, reasoning ability
2. This ability is the best predictor of job performance, especially in complex jobs
3. Health self-care is a life-long, increasingly complex career
4. Health self-care is at least as important as medical care

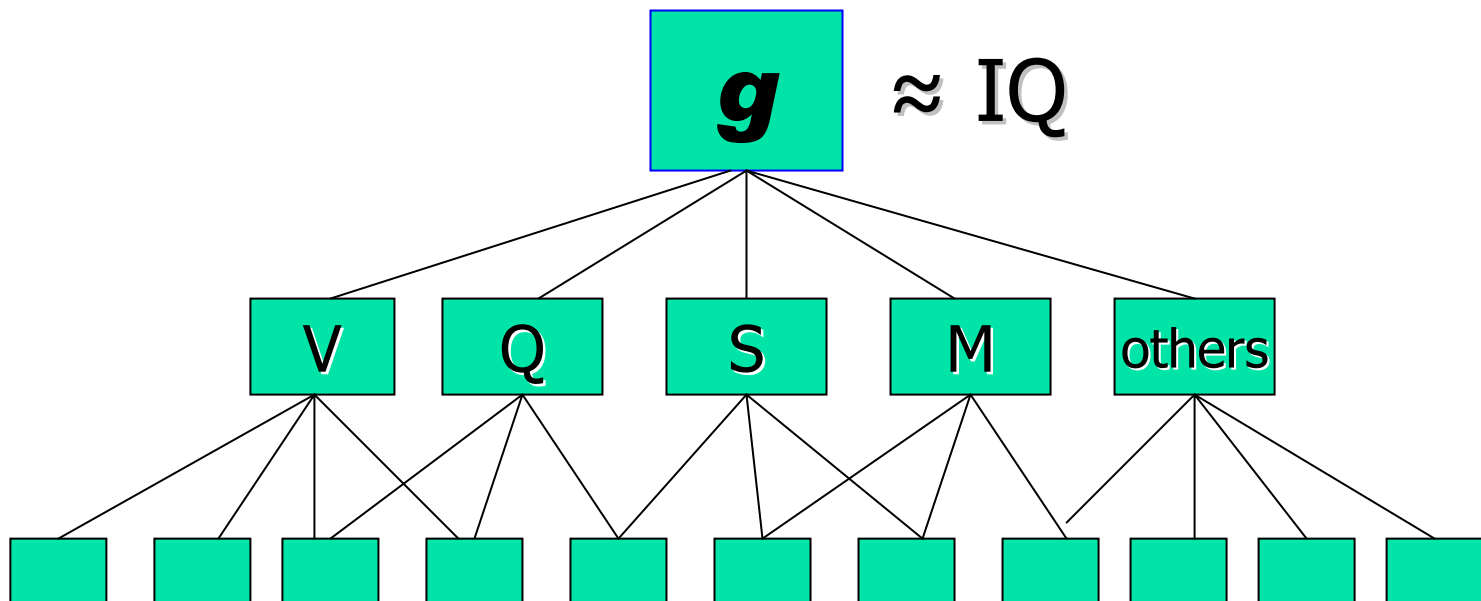


1. IQ/*g* Is a Highly General & Highly Practical Ability

- All mental tests measure mostly the same ability:
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- All mental tests measure mostly the same ability: *g*
- IQ/*g* reflects generic content-free thinking skills: learn quickly and from experience, reason, think abstractly, spot and solve problems, etc.

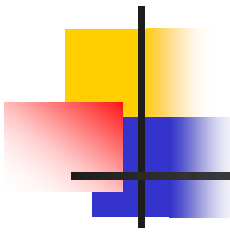
The ability to process complex information efficiently and accurately.

Sample IQ Items

	Easy	Moderate	Hard
Fill in the next two numbers	3, 5, 7, 9, __, __	3, 5, 6, 8, 9, __, __	10, 9, 8, 9, 8, 7, __, __
Name one similarity	orange—banana (93%)	table-chair (55%)	fly-tree (18%)
Define the word	level-foot	what-street	essence

**Complexity is the active ingredient:
More complex tasks are more “g loaded”**

% = % of 16-65 year-olds getting at least partial credit for answer, WAIS, 1955



Example of Mental Manipulation

- Digits Subtests: Forward vs. Backward
- Letter is twice as *g* loaded ($\approx .2$ vs. $.4$)



1. IQ/*g* Is a Highly General & Highly Practical Ability

- All mental tests measure mostly the same ability: *g*
- IQ/*g* reflects generic content-free thinking skills: learn quickly and from experience, reason, think abstractly, spot and solve problems, etc.
- Everyday tasks require the same generic learning, reasoning, and problem-solving skills

Example: Functional Literacy (NALS)

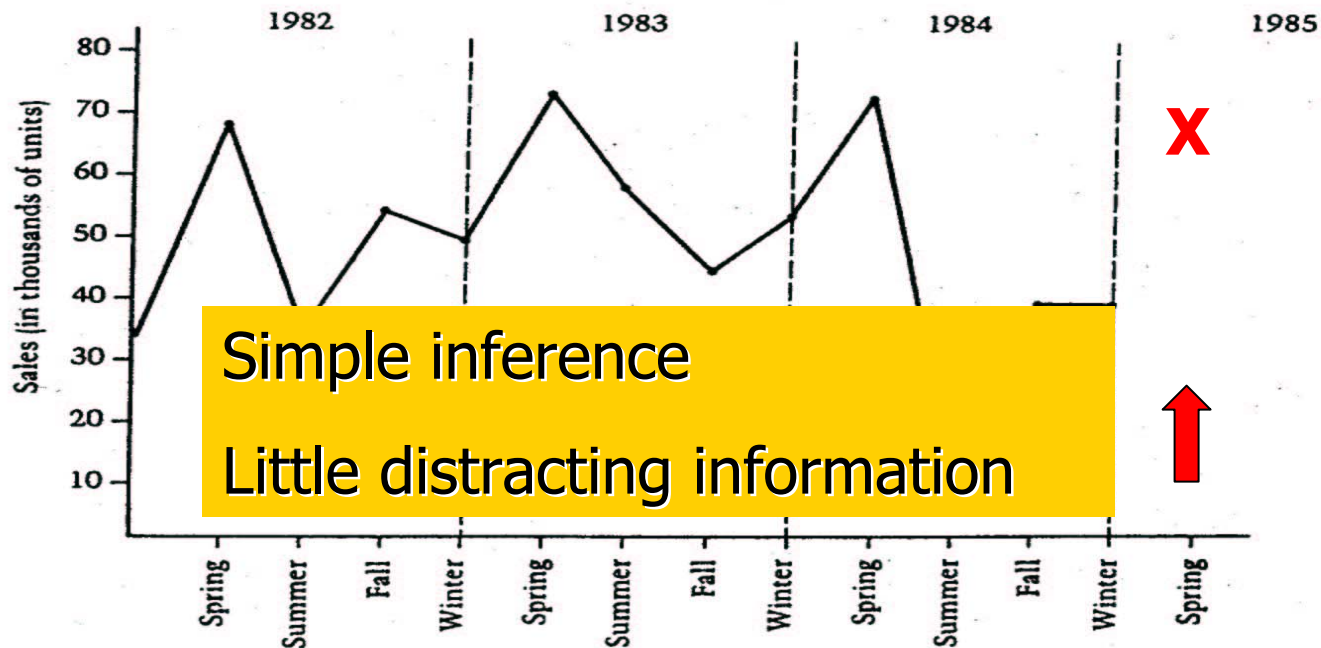
NALS Level	% pop. (white)	Simulated Everyday Tasks
5	4%	<ul style="list-style-type: none">▪ Use calculator to determine cost of carpet for a room▪ Use table of information to compare 2 credit cards
4	21%	<ul style="list-style-type: none">▪ Use eligibility pamphlet to calculate SSI benefits▪ Explain difference between 2 types of employee benefits
3	36%	<ul style="list-style-type: none">▪ Calculate miles per gallon from mileage record chart▪ Write brief letter explaining error on credit card bill
2	25%	<ul style="list-style-type: none">▪ Determine difference in price between 2 show tickets▪ Locate intersection on street map
1	14%	<ul style="list-style-type: none">▪ Total bank deposit entry▪ Locate expiration date on driver's license

Functional Literacy (NALS)

NALS Level	% pop. (white)	Simulat	
5	4%	<ul style="list-style-type: none"> Use calculator to Use table of infor 	<p>Difficulty based on "process complexity"</p>
4	25%	<ul style="list-style-type: none"> Use eligibility pan Explain difference 	<ul style="list-style-type: none"> level of inference
3	36%	<ul style="list-style-type: none"> Calculate miles pe Write brief letter 	<ul style="list-style-type: none"> abstractness of info
2	25%	<ul style="list-style-type: none"> Determine differe Locate intersectio 	<ul style="list-style-type: none"> distracting information
1	14%	<ul style="list-style-type: none"> Total bank deposit Locate expiration 	

NALS Level 2—Sample Item

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.



NALS Level 4—Sample Item

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?

ROUTE 5 VISTA GRANDE

This bus line operates Monday through Saturday providing "local service" to most neighborhoods in the northeast section. Buses run thirty minutes apart during the morning and afternoon rush hours Monday through Friday. Buses run one hour apart at all other times of day and Saturday. **←**

No Sunday, holiday or night service.

OUTBOUND from Terminal						INBOUND toward Terminal						You can transfer from this bus to another headed anywhere else in the city bus system
Leave Downtown Terminal	Leave Hancock and Buena Ventura	Leave Citadel	Leave Rustic Hills	Leave North Carefree and Oro Blanco	Arrive Flintridge and Academy	Leave Flintridge and Academy	Leave North Carefree and Oro Blanco	Leave Rustic Hills	Leave Citadel	Leave Hancock and Buena Ventura	Arrive Downtown Terminal	
AM	6:20	6:35	6:45	6:50	7:03	7:15	6:15	6:27	6:42	6:47	6:57	7:15
	6:50	7:05	7:15	7:20	7:33	7:45	6:45	6:57	7:12	7:17	7:27	7:45 Monday through Friday only
	7:20	7:35	7:45	7:50	8:03	8:15	7:15	7:27	7:42	7:47	7:57	8:15
	7:50	8:05	8:15	8:20	8:33	8:45	7:45	7:57	8:12	8:17	8:27	8:45 Monday through Friday only
	8:20	8:35	8:45	8:50	9:03	9:15	8:15	8:27	8:42	8:47	8:57	9:15
	8:50	9:05	9:15	9:20	9:33	9:45	8:45	8:57	9:12	9:17	9:27	9:45 through Friday only
	9:20	9:35	9:45	9:50	10:03	10:15	9:15	9:27	9:42	9:47	9:57	10:15 through Friday only
	10:20	10:35	10:45	10:50	11:03	11:15	9:45	9:57	10:12	10:17	10:27	10:45 through Friday only
	11:20	11:35	11:45	11:50	12:03	12:15	10:15	10:27	10:42	10:47	10:57	11:15
	PM	12:20	12:35	12:45	12:50	1:03	1:15	10:45	10:57	11:12	11:17	11:27
1:20		1:35	1:45	1:50	2:03	2:15	11:15	11:27	11:42	11:47	11:57	12:15 through Friday only
2:20		2:35	2:45	2:50	3:03	3:15	11:45	11:57	12:12	12:17	12:27	12:45 through Friday only
2:50		3:05	3:15	3:20	3:33	3:45	12:15	12:27	12:42	12:47	12:57	1:15 through Friday only
3:20		3:35	3:45	3:50	4:03	4:15	12:45	12:57	1:12	1:17	1:27	1:45 through Friday only
3:50		4:05	4:15	4:20	4:33	4:45	1:15	1:27	1:42	1:47	1:57	2:15 through Friday only
4:20		4:35	4:45	4:50	5:03	5:15	1:45	1:57	2:12	2:17	2:27	2:45 through Friday only
4:50		5:05	5:15	5:20	5:33	5:45	2:15	2:27	2:42	2:47	2:57	3:15 through Friday only
5:20		5:35	5:45	5:50	6:03	6:15	2:45	2:57	3:12	3:17	3:27	3:45 through Friday only
5:50		6:05	6:15	6:20	6:33	6:45	3:15	3:27	3:42	3:47	3:57	4:15 through Friday only
6:20	6:35	6:45	6:50	7:03	7:15	3:45	3:57	4:12	4:17	4:27	4:45 through Friday only	

More elements to match
 More inferences
 More distracting information



IQ/Literacy Relate in Same Way to Same Life Outcomes

- General:
 - High: Education level
 - Moderately high: Occupation level
 - Moderate: Income, adult poverty, welfare use
 - Low: Not employed
- Linear

NALS literacy and IQ are “functionally equivalent” (among the native-born).



2. IQ/*g* Is the Best Predictor of Job Performance

Meta-analyses show that:

- *g* predicts performance to some extent in all jobs
- it is best single predictor overall
- it has average (corrected) validity of .4-.5
- its validity is higher in more complex jobs
- its validity does not fade among experience

Why so predictive?

Jobs Differ Most in Their Learning/Reasoning Demands

Reasoning & Judgment Factor (Arvey) *r* with factor


- | | |
|--|------------|
| ■ Learn and recall relevant information | .75 |
| ■ Reason and make judgments | .71 |
| ■ Deal with unexpected situations | .69 |
| ■ Identify problem situations quickly | .69 |
| ■ React swiftly when unexpected problems occur | .67 |
| ■ Apply knowledge to solve problems | .66 |
| ■ Learn from experience | .66 |
| ■ Be a good problem solver | .55 |

g: A general ability to learn, reason, and solve problems.

Jobs Therefore Differ in Their Demands for g (g Loadedness)

<u>Occupation</u>	<u>IQs: Middle 50%</u> (Applicants)	<u>%ile</u>	<u>Criterion validity</u> (Corrected)
Attorney, Engineer	108-128	70-97	<p>.80</p> <p>.20</p>
Teacher, Programmer	100-120	50-90	
Secretary, Lab tech	96-116	40-85	
Meter reader, Teller	91-110	27-75	
Welder, Security guard	85-105	15-63	
Packer, Custodian	80-100	10-50	

More *g*-Loaded Jobs Are More Complex



Complex	<i>r</i>		
	.88	Self-direction	Combine information
	.86	Reason	Advise
	.85	Update knowledge	Write
	.83	Analyze	Plan
	.79	Lack of structure	Negotiate, Persuade
	.71	Criticality of position	Coordinate
			Instruct
	.51	Transcribe	
	.36	Recognize	
	-.49	Repetitive	
	-.56	Physical exertion	
Simple	-.73	Supervision	

Attorney

Teller

Custodian

Patient?



3. Health Self-Care is a Complex Job

- Top 4 killers today (developed world)
 - Cancer
 - Heart disease
 - Stroke
 - Injuries
- Keys to good health
 - Prevention
 - Controlling damage



Life Requires “Defensive Driving” to Prevent Accidents

Highly cognitive process

- Recognize hazards
- Prevent incidents starting
- Halt progress of incidents
- Limit damage during incidents
- Recover and redesign

Same process as with chronic illness.

Non-Work Accidental Death Rates Higher in Lower Classes

Relative risk for
poor vs. middle \$

- Suffocation (infants) 1.3
- Choking on food (infants & elderly) 1.5
- Drowning (young males) 2.0
- Motor vehicle (young males) 2.4
- Fires/burns (children & elderly) 2.5
- Lightning (young males) 3.4
- Firearms (young males) 4.4
- Natural disasters (all ages, sexes) 5.0
- Exposure/neglect (infants & elderly) 7.4

Accidents and Chronic Diseases Are Like Complex Jobs

Recall these job analysis results

Complex jobs require you to:	<i>r</i> with complexity
■ Learn and recall relevant information	.75
■ Reason and make judgments	.71
■ Deal with unexpected situations	.69
■ Identify problem situations quickly	.69
■ React swiftly when unexpected problems occur	.67
■ Apply common sense to solve problems	.66
■ Learn new procedures quickly	.66
■ Be alert & quick to understand things	.55



Chronic Illnesses: Cognitively Demanding, Long-Term Careers

- Chronic illnesses are “slow-acting, long-term killers that can be treated but not cured”
 - Develop slowly, hard to detect
 - Damage process slow, invisible
 - Lengthy treatment requiring continued need “to learn,” “reason,” and “solve problems”
 - No immediate consequences of backsliding



Chronic Illnesses Require Foresight & Prevention

- Keep informed
- Live healthy lifestyle
- Get preventive checkups
- Detect signs and symptoms
- Seek timely, appropriate medical attention

All are less frequent in lower social classes

State launches plan to stop rising rate of killer disease

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

By SEAN O'SULLIVAN
Staff reporter

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 75 percent of people who have no 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

See DIABETES — B2



Registered nurse Bonnie Cunningham of Beebe Medical Center demonstrates the effect of high blood sugar on a person's veins.

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.

Symptoms

- Frequent urination
- Excessive thirst
- Extreme hunger
- Unusual weight loss
- Increased fatigue
- Irritability
- Blurry vision
- Frequent infections

If you have one or more symptoms, see your doctor.

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
- Visit the American Diabetes Association Web site at www.diabetes.org.

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



Chronic Illnesses Require Self-Regulation/Treatment

- 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

All are less frequent in lower social classes

Chronic Illnesses Require Self-Regulation to Limit Damage

Urban hospital outpatients: % diabetics <i>not</i> knowing that:	Health literacy level		
	V-low	Low	OK
Signal: Thirsty/tired/weak usually means <u>blood sugar too high</u> →	40	31	25
Action: Exercise lowers blood sugar →	60	54	35
Signal: Suddenly sweaty/shaky/hungry usually means <u>blood sugar too low</u> →	50	15	6
Action: Eat some form of sugar →	62	46	27

Even Simplest Tasks Pose Barriers for Some People

Label on a prescription vial:

Acme Pharmacy Dept.

7806

Rt. 4 & Elkton Road

Newark, DE

Date: 07/05/03

Phone: (302) 453-2335

Rx# 19253

LINDA GOTTFREDSON

TAKE 4 CAPSULES BY MOUTH

1 HOUR PRIOR TO DENTAL

APPT.

AMOXYCILLIN 500MG CAPSULE By GENEV

Orig.

Date 7/31/02

Refill Y

Qty. 4

RPh SSM



Literacy Researchers' Conclusion

Non-compliance with treatment a huge problem

- Often due to a failure to “learn, reason, & problem-solve”
- Leads to higher morbidity
- Leads to higher mortality
- Can create new health problems (e.g., by taking medication incorrectly)

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
- **“A patient’s ability to learn this regimen and follow it correctly will determine a trajectory toward recovery or a downward path to**

Higher-*g* individuals can take better advantage of medical advances like this



4. Health Self-Care Is As Important as Medical Care

“Mortality could be reduced substantially if people at risk would change just five behaviors:

Adherence to medical recommendations (e.g., medication), diet, smoking, lack of exercise, and alcohol and drug use.”

(American Psychological Society, 1996)



4. Health Self-Care Is As Important as Medical Care

“Beginning in childhood and throughout life, each of us makes decisions affecting our health. They are made, for the most part, without regard to, or contact with, the health care system. Yet their cumulative impact has a greater effect on the length and quality of life than all the efforts of medical care combined.”

(Surgeon General Report, 1979)



In Short—

**You are your own
“primary health care”
provider**



Conclusion—

- g is only one factor affecting health
- But it may be the health factor that differs most across social classes
- Narrowing gaps in material access to health care will not equalize health
- But improving cognitive access to health care may help flatten SES-health gradients



Cognitive Access Can Be Improved Using *g* Theory

- Reduce unnecessary complexity
 - E.g., simplify labels
- When complexity inherent in task, provide more cognitive support
 - E.g., monitor understanding, adherence

Material resources require mental resources for their safe and effective use



Thank You

Two in-press articles available at:
www.udel.edu/educ/gottfredson/reprints