Social Class Disparities in Health: A Vexing Puzzle with a Surprising Answer?

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Presentation to accept 2008 George A. Miller Award for outstanding article across specialty areas, Division 1, APA
Agenda

1. What are “disparities”?
2. What’s the vexing puzzle?
3. Is human cognitive diversity key to solving it?
4. If yes, so what?

Answers: All surprising
Agenda

1. What are “disparities”?  
2. Why such a vexing puzzle?  
3. Is human cognitive diversity the key to solving it?  
4. If yes, so what?
“Disparity” = group differences on health outcome X

“Explaining” between-group variation

Means, rates, etc.

8 yrs  12 yrs  16 yrs

Typical indicators of socioeconomic status (SES)
- Years education
- Occupational status
- Income

But not clear what they really represent or have in common
Typical health disparities by education; in all races & sexes:
% of non-ill 51-year-olds expected to have this chronic illness by age 63
(Hayward et al, 2000)
Typical health disparities by education; in all races & sexes:
% of non-ill 51-year-olds expected to have this chronic illness by age 63
(Hayward et al, 2000)

- Fewer health problems in higher social classes (educ, occup, or $)
- True for all races, sexes
- Exceptions are rare (e.g., cancer morbidity)
Disparities in health behavior by education; all races & sexes:

% who smoke, 2006 (age adjusted)

(CDC, Health in the United States, 2008, Table 64)
Typical course of behavior disparities over time, by education:

% who smoke, 1974-2006, ages 25+ (age-adjusted)

(CDC, Health in the United States, 2008, Table 64)
Many families of health disparities

- Knowledge
- Chronic Illnesses
- Adherence
- Health Habits
- Injuries
- Infectious Diseases
- Mortality
Many families of health disparities

Outcomes for populations

- CHRONIC ILLNESSES
- KNOWLEDGE
- ADHERENCE
- INFECTIOUS DISEASES
- INJURIES
- MORTALITY
This is not about individual differences in health outcomes.

Not “explaining” within-group variation.

Within-group and between-group variance may arise from different mix of causes. Often misunderstood!
Study of populations aided by epidemiological approach

- Outcomes
  - Means, rates, relative risk, odds ratios for groups

- Predictors—classic trio
  - Exposure to hazards, help (probability)
  - Host (susceptibility)
  - Vector (virulence, burden)
Study of populations aided by epidemiological approach

- Outcomes
  - Means, rates, relative risk, odds ratios for groups

- Predictors—classic trio
  - Exposure (probability)
  - Host (susceptibility)
  - Vector (virulence, burden)

Current focus of SES disparities research

Missing 2/3
Agenda

1. What are “disparities”?

2. Why such a vexing puzzle?
   But first, what exactly are we trying to explain?
   - Statistically
   - Substantively

3. Is human cognitive diversity the key to solving it?

4. If yes, so what?
Illustration with 2 disparities
Each disparity is a gradient, with a slope ($\beta$)
Each disparity is a gradient, with a slope.
Each disparity is a gradient, with a slope.
Many families of health gradients (slopes):
Morbidity, mortality, knowledge, prevention, adherence, etc.

Health (group mean or rate)

Social class groupings

β₁
β₂
β₃
β₄
β₅
β₆
β₇
β₈

rare
So, to explain SES disparities: Explain the distribution of co-evolving gradients 
(β, their standardized slopes)

Common policy goal: All β = 0

Slopes (steepness) of gradients
Agenda

1. What are “disparities”? 
2. Why such a vexing puzzle? 
   But first, what exactly are we trying to explain? 
   • Statistically
   ➢ Substantively
3. Is human cognitive diversity the key to solving it? 
4. If yes, so what?
General puzzle: Health disparities are *too* general for SES mechanisms to explain.

They are pervasive, persistent and monotonic regardless of time, place, health system, disease, and behavior. Why??
Exposure hypothesis 1: “Wealth = health” (can afford good care)

REJECTED—Puzzle greater!

No leveling off when resources are more than sufficient
Experimental test of exposure hypothesis 1:
Equalize access to care ➔ equalize health

• Time 1: Unequal access

• Time 2: After equal access (free care)

E.g., UK in 1950s

Health disparities *grow*, not shrink

FAILED—Puzzle greater!
Experimental test of exposure hypothesis 2: Unequal education → unequal health

- Time 1: Unequal knowledge of

  Knowledge disparities grow, not shrink

- Time 2: After public health campaign

  FAILED—Puzzle greater!
Or disparities even reverse direction with new screening tests (e.g., death rates from breast cancer)

• Negative disparities for Outcome X at Time 1

More educated women have higher death rates

ß

• Positive disparities for Outcome X at Time 2

ß
Access matters, but so does utilization

- Mammograms
- Adherence to treatment
- Seat belt use
- Etc.

Even if equal access
Unequal use & misuse

"Health literacy"
Summary of puzzle

Exposure can’t explain why gradients:
- Virtually never = zero
- Virtually always positive
- All monotonic (~linear)
- For ~all health outcomes & behaviors
- Steepen when resources equalized

What levers the gradients up or down?
Can’t be material resources.
So, the field seeking more “fundamental cause” of SES disparities

- This cause must:
  - be pervasive & domain-general
  - have linear (monotonic) effects
  - not be material

- Most popular suspect = inequality itself
  - relative deprivation → chronic psychological stress → damaging physiological process: “allostatic load”

- Stress important, but can’t explain:
  - why adding resources increases disparities
  - disparities in non-biological outcomes
First, physical illness is only one cause of injury & death:

Causes of death, males by age

(CDC, Health data interactive)

- Illness
- Suicide
- Homicide
- "Accidents"

Biological mechanisms Involved here

Common theme—all are preventable
Example: Unintentional ("accidental") death
Odds ratios by neighborhood income (1980-86)

Odds = % affected
% not

Odds ratio = \[ \frac{\text{Odds for Group 1}}{\text{Odds for reference group}} \]

Just differential exposure??
Selected causes of “motor vehicle traffic” death, by neighborhood income/capita (1980-86)

(Baker, O’Neill, Ginsburg, & Li, 1992)

- Rate per 100,000
- Primarily:
  - elderly
  - adult men
  - toddlers
  - young men
  - MV occupant
  - Pedestrian, traffic
  - Pedestrian, train
  - MV train
  - Ped, off-road
  - All MV

Neighborhood income/capita:
- <6,000
- 6-7,000
- 8-9,000
- 10-11,000
- 12-13,000
- 14,000+
Selected “other” causes of unintentional death, by neighborhood income/capita (1980-86)

(Baker, O’Neill, Ginsburg, & Li, 1992)

- Exposure/neglect
- Natural disasters
- Fires/burns
- Lightning
- Motor vehicle
- Drown
- Choke on food
- Suffocation

Odds ratio

Deaths per 100,000

<6,000

>14,000

Self-exposure

Differential biological susceptibility
The common mechanism for illness and injury?

• Prevention
  o It’s our job
  o It’s daily, unrelenting, life-long (hazards are everywhere)
  o It’s complex

• It’s a highly cognitive, multi-step, active process
  o Spot & avoid hazards
  o Recognize signs of system veering out of control
  o Take action to regain control
  o Limit progression of illness/accident or damage it does
  o Adhere to treatment
  o Learn from experience to adjust future behavior

Passive-patient model is dead wrong
Agenda

1. What are “disparities”? 
2. Why such a vexing puzzle? 
3. Is human cognitive diversity the key? 
4. If yes, so what?

IQ/g
Alternative hypothesis for disparities in health:
“Intelligence (g) differences are the “fundamental cause”

Two g–based levers ratchet up gradients*
• Bigger IQ differences (people)  →  susceptibility
• Heavier cognitive load (tasks)  →  burden

* Based on extensive research in education & employment
Translated: A hypothesis about gradients

Heavier cognitive load
(g loading of tasks)

Gaps in IQ/g (cognitive susceptibility-efficiency)

Heavier cognitive load
(g loading of tasks)
Background fact #1
Great cognitive diversity is a biological fact about all populations
Background fact #2

IQ $\approx g$ (general mental ability factor)

- $g$ is no longer a black box
Background fact #2

IQ $\approx g$ (general mental ability factor)

• $g$ is no longer a black box
• $g$ is a domain-general facility for learning, reasoning, spotting & solving novel problems
  o Higher $g$ reduces susceptibility to error
  o Gives bigger edge as task complexity (cognitive load) increases
  o Allows one to exploit resources more fully & effectively (e.g., classroom instruction, medical treatments)
Gives an edge in planning; anticipating problems

“Shhhh. Zoz! ... Here come one now!”
Background fact #3
Mean IQs differ by occupation level and years education

WAIS-R IQ (mean ± 1 SD), US adults ages 16-74

Occupation:
- Professional & Tech
- Manager, Cler, Sales
- Skilled
- Semiskilled
- Unskilled

Years education:
- 0-7
- 8
- 9-11
- 12
- 13-15
- 16+

IQ

70 75 80 85 90 95 100 105 110 115 120 125 130
Background fact #4:
Some SES indicators correlate more with IQ

- .8 Standardized academic achievement
- .6 Years education
- .5 Occupation level
- .3-.4 Income

All moderately heritable, & overlap genetically with IQ

(prior)
Background fact #4:
Conversely, some are better surrogates for IQ

Better surrogates for $g$ show larger health disparities

- Literacy: 0.8
- Standardized academic achievement: 0.8
- Years education: 0.6
- Occupation level: 0.5
- Income: 0.3-0.4

(prior) IQ
Better surrogates for $g$ show larger health disparities (steeper gradients)
Background fact #4:

Cannot “control” for SES without controlling away much of (genetic) g itself
Background fact #5:
Task complexity increases gaps in performance

- Gaps small when learning & reasoning demands are light
- Gaps large when learning & reasoning demands are heavy

Common in schools & jobs
Background fact #5: Task complexity increases gaps in performance

• Gaps small when learning & reasoning demands are light

• Gaps large when learning & reasoning demands are heavy

Cognitive load brings out differences in cognitive susceptibility
New technologies make life increasingly complex, which puts yet higher premium on g

Preventive & curative care becoming increasing complex
Background fact #6:

People differ more than often assumed

U.S. Dept of Education 1993 survey of adult functional literacy
(nationally representative sample, ages 16+, N=26,091)

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<thead>
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<td>3%</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Use table of information to compare 2 credit cards</td>
</tr>
<tr>
<td>4</td>
<td>17%</td>
<td>• Use eligibility pamphlet to calculate SSI benefits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Explain difference between 2 types of employee benefits</td>
</tr>
<tr>
<td>3</td>
<td>31%</td>
<td>• Calculate miles per gallon from mileage record chart</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Write brief letter explaining error on credit card bill</td>
</tr>
<tr>
<td>2</td>
<td>27%</td>
<td>• Determine difference in price between 2 show tickets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Locate intersection on street map</td>
</tr>
<tr>
<td>1</td>
<td>22%</td>
<td>• Total bank deposit entry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Locate expiration date on driver’s license</td>
</tr>
</tbody>
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Background fact #6:

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Difficulty based on “process complexity”

- level of inference
- abstractness of info
- distracting information

Not reading per se, but “problem solving”
Item at NALS Level 1

22% of US adults

78% of adults do better

Here is a Social Security card. Sign your name on the line that reads “signature.”

SOCIAL SECURITY
ACCOUNT NUMBER
301-02-0304
HAS BEEN ESTABLISHED FOR
FOR SOCIAL SECURITY PURPOSES • NOT FOR IDENTIFICATION

• Literal match
• One item
• Little distracting info

* 80% probability of correctly answering items of this difficulty level
Item at NALS Level 2

22%  27% of US adults  51%

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
Another item at NALS Level 2

22%  27% of US adults  51%

What is the gross pay for this year to date?

<table>
<thead>
<tr>
<th>Time Code</th>
<th>Year-To-Date</th>
<th>Regular</th>
<th>Overtime</th>
<th>Gross</th>
<th>Def. Avl.</th>
<th>Net Pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/15/85</td>
<td></td>
<td>62,500</td>
<td></td>
<td>42,688</td>
<td>45,988</td>
<td></td>
</tr>
</tbody>
</table>

NON-NEGOTIABLE

- Match two pieces of info
You need to smooth wood in preparation for sealing and plan to buy garnet sandpaper. What type of sandpaper should you buy?

**ABRASIVE SELECTION GUIDE**

<table>
<thead>
<tr>
<th>MATERIAL &amp; OPERATION</th>
<th>PRODUCTION</th>
<th>GARNET</th>
<th>WET/DRY</th>
<th>FRE-CUT</th>
<th>EMERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOOD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paint Removal</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>Heavy Stock Removal</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>Moderate Stock Removal</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>Preparation for Sealing</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>After Sealer</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>After Coats</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>After Final Coat</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>METAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rust and Paint Removal</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>Light Stock Removal</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>Preparation for Priming</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>Finishing and Polishing</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>After Primer</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>Between Coats</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>After Final Coat</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>PLASTIC &amp; FIBERGLASS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaping</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>Light Stock Removal</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
<tr>
<td>Polishing &amp; Scruffing</td>
<td>EC</td>
<td>C</td>
<td>M</td>
<td>F</td>
<td>EF</td>
</tr>
</tbody>
</table>

**SAFETY INFORMATION:**
- Wear approved safety goggles when sanding.

Reduction from original copy.
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?

80%  17% of US adults  3%

Or,

- More elements to match
- More inferences
- More distracting information

VISTA GRANDE

ROUTE 5

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.

On Sunday, holiday or night service.

You can transfer from this bus to another heading anywhere else in the city bus system.

OUTBOUND from Terminal

Leaves

Downtown

Terminal

Leave

Hancock and

Buena

Ventura

Leaves

Rustic Hills

Leaves

North Carries

Leave

Flintridge and

Leaves

South Carries

Leaves

Rustic illustrator

Leave

Hancock end

Arrive

Downtown

INBOUND toward Terminal

Leaves

Downtown

Terminal

Leave

Hancock and

Buena

Ventura

Leaves

Rustic Hills

Leaves

North Carries

Leave

Flintridge and

Leaves

South Carries

Leaves

Rustic illustrator

Leave

Hancock end

Arrive

Downtown

56
Item at NALS Level 5

97% of US adults

Using the information in the table, write a brief paragraph summarizing the extent to which parents and teachers agreed or disagreed on the statements about issues pertaining to parental involvement at their school.

Parents and Teachers Evaluate Parental Involvement at Their School

<table>
<thead>
<tr>
<th>Do you agree or disagree that . . . ?</th>
<th>Total</th>
<th>Elementary</th>
<th>Junior High</th>
<th>High School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our school does a good job of encouraging parental involvement in sports, arts, and other nonsubject areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>77</td>
<td>76</td>
<td>74</td>
<td>79</td>
</tr>
<tr>
<td>Teachers</td>
<td>77</td>
<td>73</td>
<td>77</td>
<td>85</td>
</tr>
<tr>
<td>Our school does a good job of encouraging parental involvement in educational areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>73</td>
<td>82</td>
<td>71</td>
<td>64</td>
</tr>
<tr>
<td>Teachers</td>
<td>80</td>
<td>84</td>
<td>78</td>
<td>70</td>
</tr>
<tr>
<td>Our school only contacts parents when there is a problem with their child</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>55</td>
<td>46</td>
<td>62</td>
<td>63</td>
</tr>
<tr>
<td>Teachers</td>
<td>23</td>
<td>18</td>
<td>22</td>
<td>33</td>
</tr>
<tr>
<td>Our school does not give parents the opportunity for any meaningful roles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents</td>
<td>22</td>
<td>18</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>Teachers</td>
<td>8</td>
<td>8</td>
<td>12</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: The Metropolitan Life Survey of the American Teacher, 1987

- Search through complex displays
- Multiple distractors
- Make high-level text-based inferences
- Use specialized knowledge
Background fact #6: People differ more than often assumed

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|            |        | • Use table of information to compare 2 credit cards  |
| 4          | 17%    | • Use eligibility pamphlet to calculate SSI benefits  |

US Dept of Education: People at levels 1-2 are below literacy level required to enjoy rights & fulfill responsibilities of citizenship

| 2          | 27%    | • Determine difference in price between 2 show tickets  
|            |        | • Locate intersection on street map  |

| 1          | 22%    | • Total bank deposit entry  
|            |        | • Locate expiration date on driver’s license  |

Could teach these individual items, but not all such tasks in daily life
Agenda

1. What are “disparities”?  
2. Why such a vexing puzzle?  
3. Is human cognitive diversity the key to solving it?  
4. If yes, so what?  
   - Mine the other 2/3 (cognitive susceptibility & cognitive load)
Passive exposure matters

<table>
<thead>
<tr>
<th>Predictors</th>
<th>SES differences predicted</th>
<th>Current SES stress model</th>
<th>Alternative $g$ stress model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure</td>
<td></td>
<td>Time 1</td>
<td>Time 2</td>
</tr>
<tr>
<td>Passive</td>
<td>Ep</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Active</td>
<td>Ea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Susceptibility</td>
<td>Biological</td>
<td>Sb</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Cognitive</td>
<td>Sc</td>
<td></td>
</tr>
<tr>
<td>Burden</td>
<td>Biological</td>
<td>Bb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cognitive</td>
<td>Bc</td>
<td></td>
</tr>
<tr>
<td>Health outcomes</td>
<td>Physiological</td>
<td>Yp</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Behavioral</td>
<td>Yb</td>
<td></td>
</tr>
<tr>
<td>mechanism</td>
<td></td>
<td>Y = $\Sigma$Ep</td>
<td></td>
</tr>
</tbody>
</table>
But so does $g$-based self-exposure, susceptibility, & cognitive load

<table>
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<th></th>
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<td></td>
<td>Current SES stress model</td>
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<td>$E_p$</td>
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<td>mechanism</td>
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<td>$Y = \sum E_p$</td>
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$$Y = \sum E(S)(B)$$
6 (not 1) generators of health disparities, and multiplicative besides

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\[ Y = \sum Ep \]

Some are multiplicative

\[ Y = \sum E(S)(B) \]
2 new points of leverage

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Mechanism:

\[ Y = \sum Ep \]

\[ Y = \sum E(S)(B) \]

Respect diversity of needs

Lighten the load
Need appreciate differential cognitive needs

Life chances:
- “High Risk” 5%
- “Up-Hill Battle” 20%
- “Keeping Up” 50%
- “Out Ahead” 20%
- “Yours to Lose” 5%

Training potential:
- Slow, simple, supervised
- Mastery learning, hands-on
- Written materials plus experience
- Gathers, infers own information

Career potential:
- Assembler
- Food Service
- Nurse’s Aide
- Clerk, teller
- Police officer
- Machinist, sales
- Manager
- Teacher
- Accountant
- Attorney
- Chemist
- Executive

WAIS IQ:
- 70
- 75
- 80
- 85
- 90
- 95
- 100
- 105
- 110
- 115
- 120
- 125
- 130

#1
Need appreciate size of cognitive burdens

Example: Do job analysis of chronic diseases
Guidance for providers?
E.g., Matrices of cognitive risk

- Some errors more dangerous
- But all cumulate

Error rates to expect by
#1 patient susceptibility
#2 task cognitive load
Conclusions

• Key mechanisms unrecognized
• Mechanisms highly exploitable
• Huge opportunity costs
  o For national policy
  o For clinic practice
  o For vulnerable populations
Thank You

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(302) 831-1650