Literacy, Numeracy, Technological Problem Solving, and Health among U.S. Adults: PIAAC Analyses




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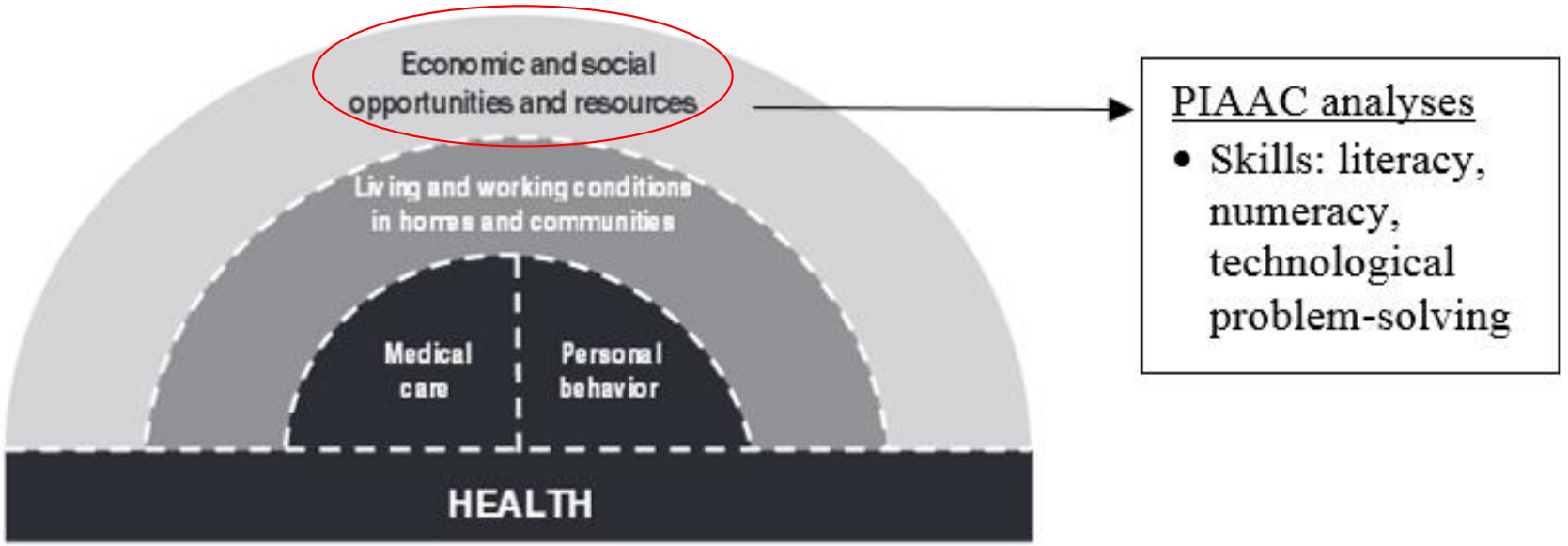
SOCIAL DETERMINANTS OF HEALTH



Adapted from Braveman, Egerter, & Williams (2011, p. 383)

- We know a lot about educational attainment and health…but far less about basic skills.
- Need to know whether immigrants and U.S.-born adults accumulate similar health benefits from basic skills.
- Many prior studies on literacy/numeracy did not account for background characteristics.

RESEARCH QUESTIONS

- **Literacy, numeracy, and problem solving in technology-rich environments (PS-TRE)**
  - RQ 1: Among U.S. adults, are literacy, numeracy, and PS-TRE scores associated with self-rated health (SRH), after controlling for various sociodemographic characteristics?

- **Immigrant status**
  - RQ 2: Are associations between SRH and proficiency in literacy and numeracy moderated by immigrant status?
  - RQ 3: Among immigrants, are literacy and numeracy skills more strongly associated with SRH for Hispanics versus Asians?

VARIABLES

- Dependent (outcome) variable: self-rated health
  - In general, would you say your health is excellent, very good, good, fair, or poor?
- Independent (predictor) variables
  - RQ #1: Literacy, numeracy, PS-TRE scores
    - Excluded people who did not answer PS-TRE questions
  - RQ #2 and 3: Literacy and numeracy scores
- Moderators (RQ #2)
  - Immigrant status – U.S.-born (reference group), foreign-born

CONTROL VARIABLES

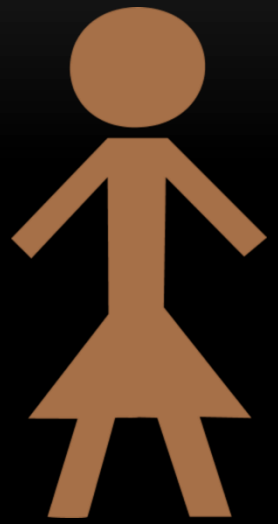
- Age
- Sex
- Employment status
- Living with spouse or partner
- Children 12 or younger
- Household size
- U.S.- or foreign-born
- Mother's and father's educational attainment
- Vision problems, hearing problems, learning disability
- Health insurance status
- English proficiency score
- Race/ethnicity
- RQ #2 & 3:
  - U.S. Census region
  - Rec'd flu shot in past yr.
  - Age of learning English
  - # years in USA

RQ 1: These respondents differ in only 1 way: their literacy, numeracy, or PS-TRE scores.

Maria

Latina
woman
employed
born in US
25-34 years old
no HS diploma
lives with spouse
no health insurance
has children under 12
4 people in household
speaks English “very well”
mother completed HS, father did not
no vision/hearing problems or learning disability

Lucia



literacy score: **230***

*average for U.S. adults with < high school

Does Lucia report better health?

literacy score: **240**

ANALYTIC APPROACH

- Ordinal logistic regression models
  - Unadjusted (no control variables)
  - Adjusted (all control variables)
  - RQ #2 and 3: Interaction models – whether relationship varies by (a) immigrant status or (b) Hispanic vs. Asian

- Can’t determine causality!

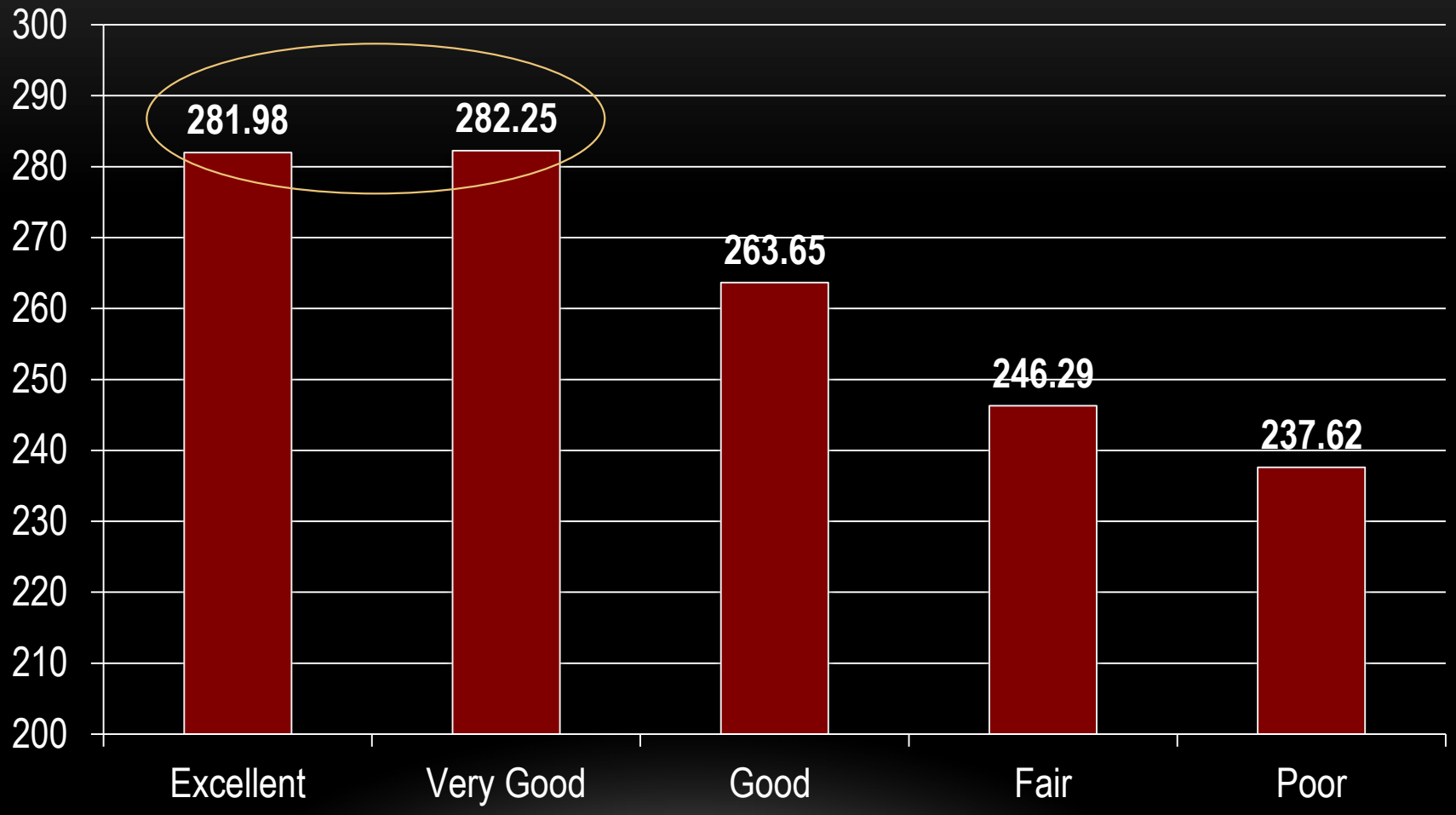
SAMPLE CHARACTERISTICS (RQ #1)

- Average scores
  - Literacy: 272 (Level 2 = 226 – 275)
  - Numeracy: 255 (Level 2)
  - PS-TRE: 278 (Level 2 = 241 – 290)
- Health: excellent (34%), very good (24%), good (28%), fair (11%); poor (3%)
- Female (51%)
- Ethnicity: non-Hispanic White (67%); Hispanic (14%), non-Hispanic Black (11%); Asian (5%); Other (2.5%)
- Education
  - No HS diploma (14%)
  - HS/some college (41%)

- Parents' educational attainment:
  - Mother: < HS (26%), HS (47%), college+ (27%)
  - Father: < HS (27%), HS (45%), college+ (28%)
- Employment:
  - Employed (65%)
  - Unemployed (8%)
  - Not working due to disability (5%)
- No health insurance (20%)
- Vision or hearing problem or diagnosed learning disability (23%)
- Foreign-born (15%)

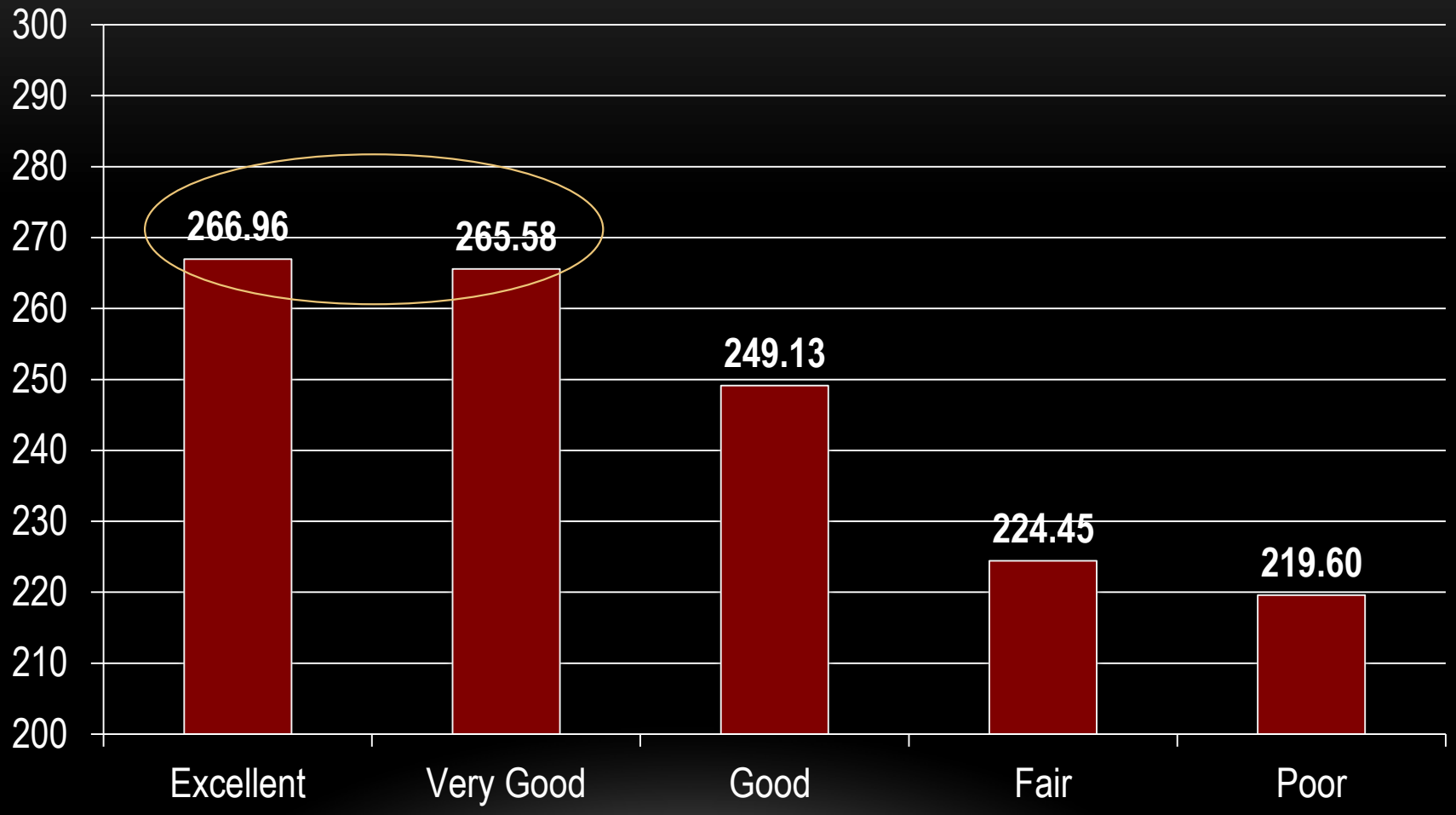
RQ #1
DESCRIPTIVE RESULTS

RELATIONSHIP BETWEEN LITERACY AND HEALTH



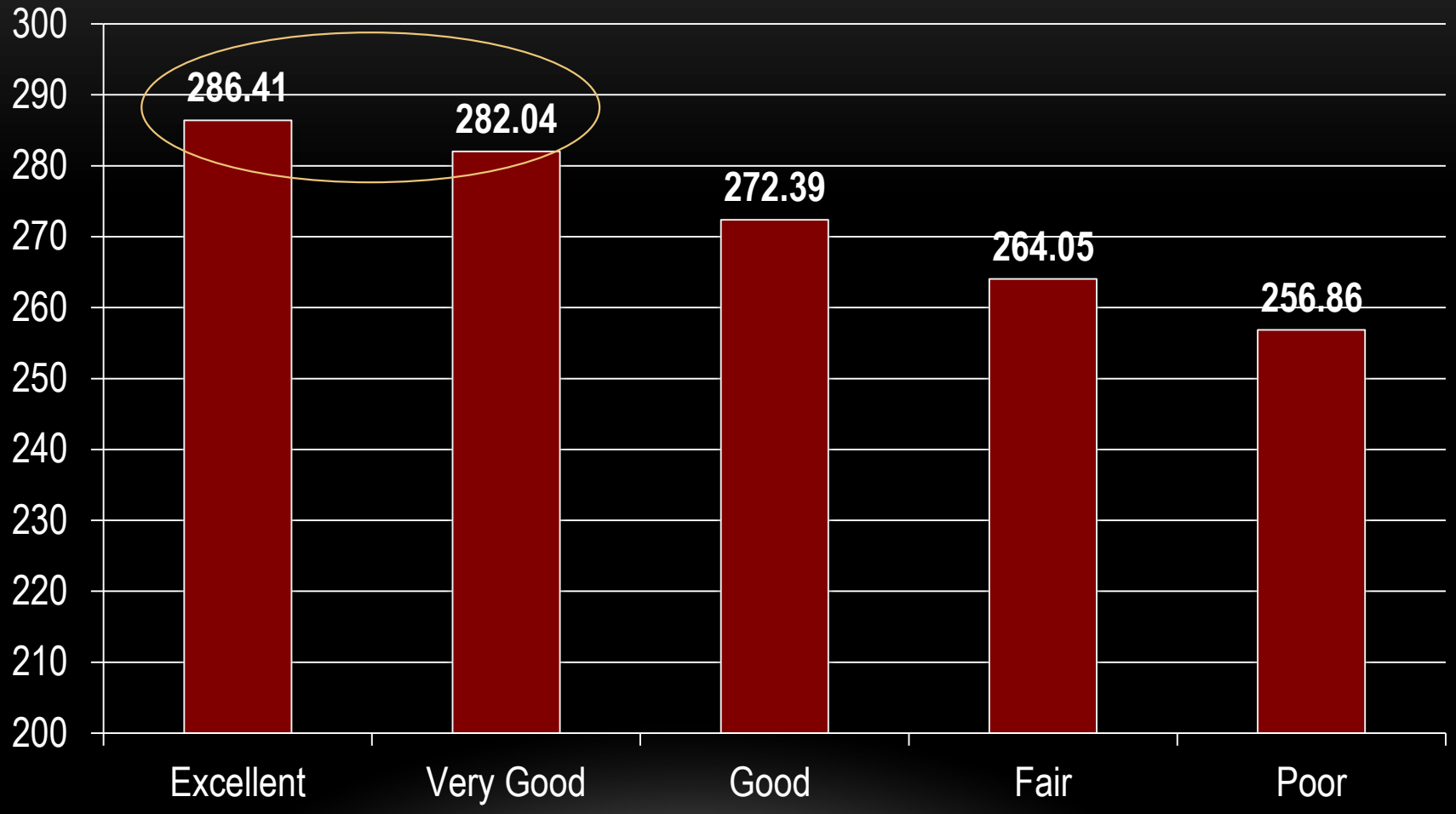
Literacy scores for excellent & very good health significantly higher than good, fair, & poor categories (N=4,647; weighted)

RELATIONSHIP BETWEEN NUMERACY AND HEALTH



Numeracy scores for excellent & very good health significantly higher than good, fair, & poor categories (N=4,647; weighted)

RELATIONSHIP BETWEEN PS-TRE AND HEALTH



PS-TRE scores for excellent & very good health significantly higher than good, fair, & poor categories (N=3,942; weighted)

RQ #1
REGRESSION RESULTS

LITERACY, NUMERACY, PS-TRE AND HEALTH: WITHOUT CONTROL VARIABLES

	UNADJUSTED (no controls)	ADJUSTED (all controls)
LITERACY	1.105*** (1.090-1.120)	
NUMERACY	1.085*** (1.073-1.098)	
PS-TRE	1.076*** (1.057-1.095)	

***p<.001 (two-tailed tests); weighted

- 10-point increase on literacy scale: +11% odds of being in a better health category
- Numeracy: 9% greater odds
- PS-TRE: 8% greater odds

LITERACY, NUMERACY, PS-TRE AND HEALTH: WITH CONTROL VARIABLES

	UNADJUSTED (no controls)	ADJUSTED (all controls)
LITERACY	1.105*** (1.090-1.120)	**1.026* (1.004-1.049)**
NUMERACY	1.085*** (1.073-1.098)	**1.010 (0.922-1.028)**
PS-TRE	1.076*** (1.057-1.095)	**1.004 (0.983-1.026)**

***p<.001; *p<.05 (two-tailed tests); weighted

- 10-point increase on the literacy scale: +3% odds of better health category
- Significance of numeracy & PS-TRE disappeared
  - Resources that help people improve scores are the same ones that contribute to health

These respondents differ in only 1 way: their literacy, numeracy, or PS-TRE scores.

Maria

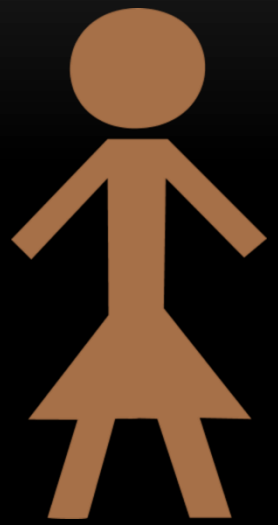
literacy score: **230***
poor health

*average for U.S. adults with < high school

Latina
woman
employed
born in US
25-34 years old
no HS diploma
lives with spouse
no health insurance
has children under 12
4 people in household
speaks English "very well"
mother completed HS, father did not
no vision/hearing problems or learning disability

higher numeracy or PS-TRE score:
not significantly related to health

Lucia



literacy score: **240**
+3% odds of better health (fair)

health categories: poor, fair, good, very good, excellent

WHICH OTHER VARIABLES PREDICT HEALTH?

- Many control variables are more strongly associated with health than is literacy

Characteristic	Odds of being in better health category
LITERACY SCORE	**3%**
Educational Attainment (reference group = <HS)	
Master's degree or higher	212%
Bachelor's degree	92%
Parental Educational Attainment (reference group = <HS)	
Mother completed high school	23%
Father attended college or more	36%
Employment Status (reference group = employed)	
Unable to work due to disability	-96%
Retired	-39%
Foreign-born	48%
Vision/hearing problems or diagnosed learning disability	-42%
Worse English proficiency	-8%
Has health insurance	5%

RQ #2: IMMIGRANT STATUS - DESCRIPTIVE RESULTS

U.S.-BORN VERSUS IMMIGRANT CHARACTERISTICS: SELECTED DIFFERENCES

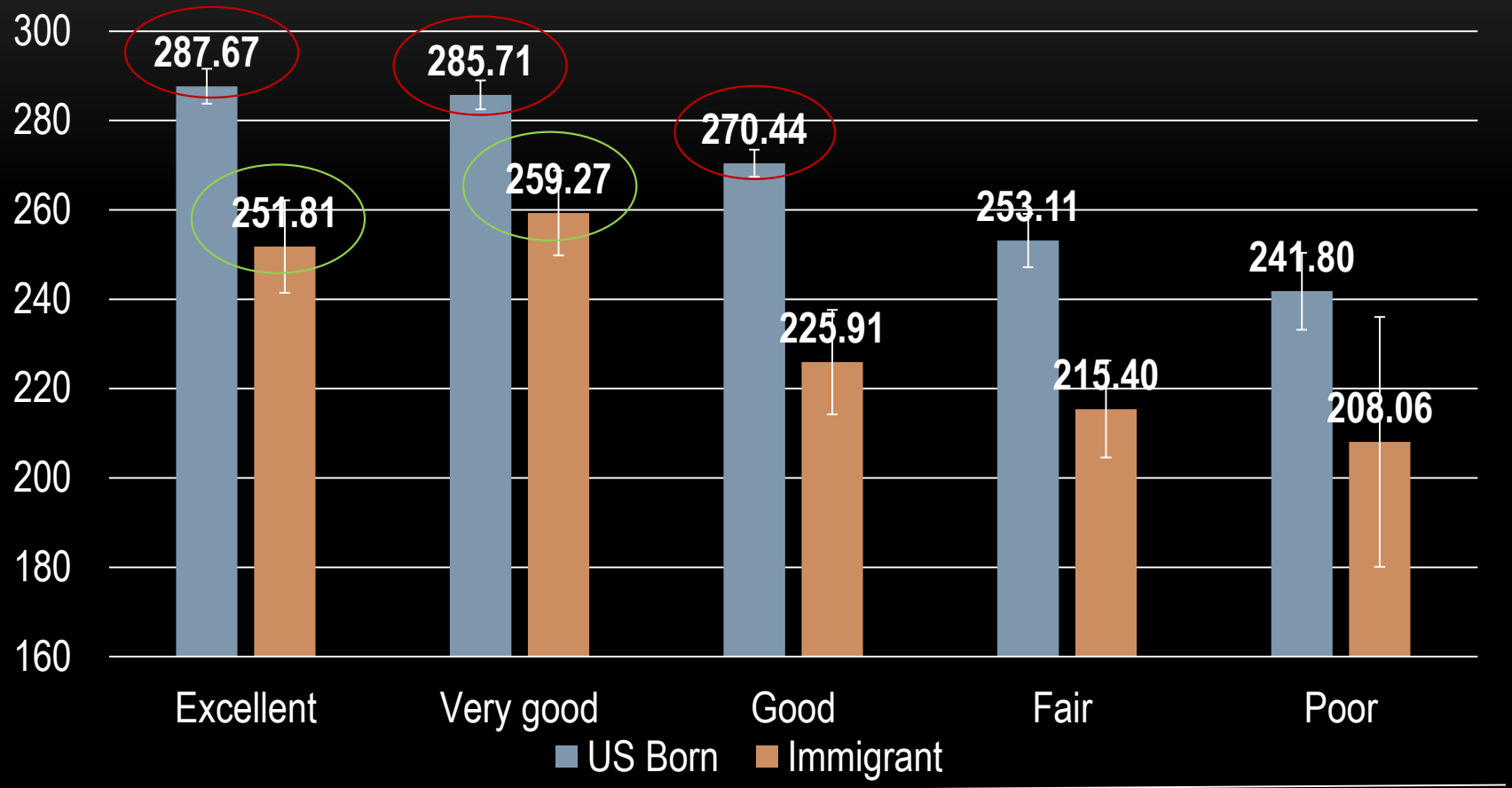
- U.S.-born: significantly higher literacy & numeracy scores; more likely to report very good health

	U.S.-Born (N=4,033)	Immigrant (N=613)	t-value	p
Literacy Score	277	241	15.25	<.001
Numeracy Score	260	228	11.57	<.001
Self-Rated Health				
Excellent	23.9	25.7	-1.04	0.33
Very Good	34.5	29.7	2.49	0.01
Good	27.8	28.8	-0.52	0.60
Fair	10.3	13.0	-1.84	0.07
Poor	3.5	2.9	0.90	0.37

U.S.-BORN VERSUS IMMIGRANT CHARACTERISTICS: SELECTED DIFFERENCES

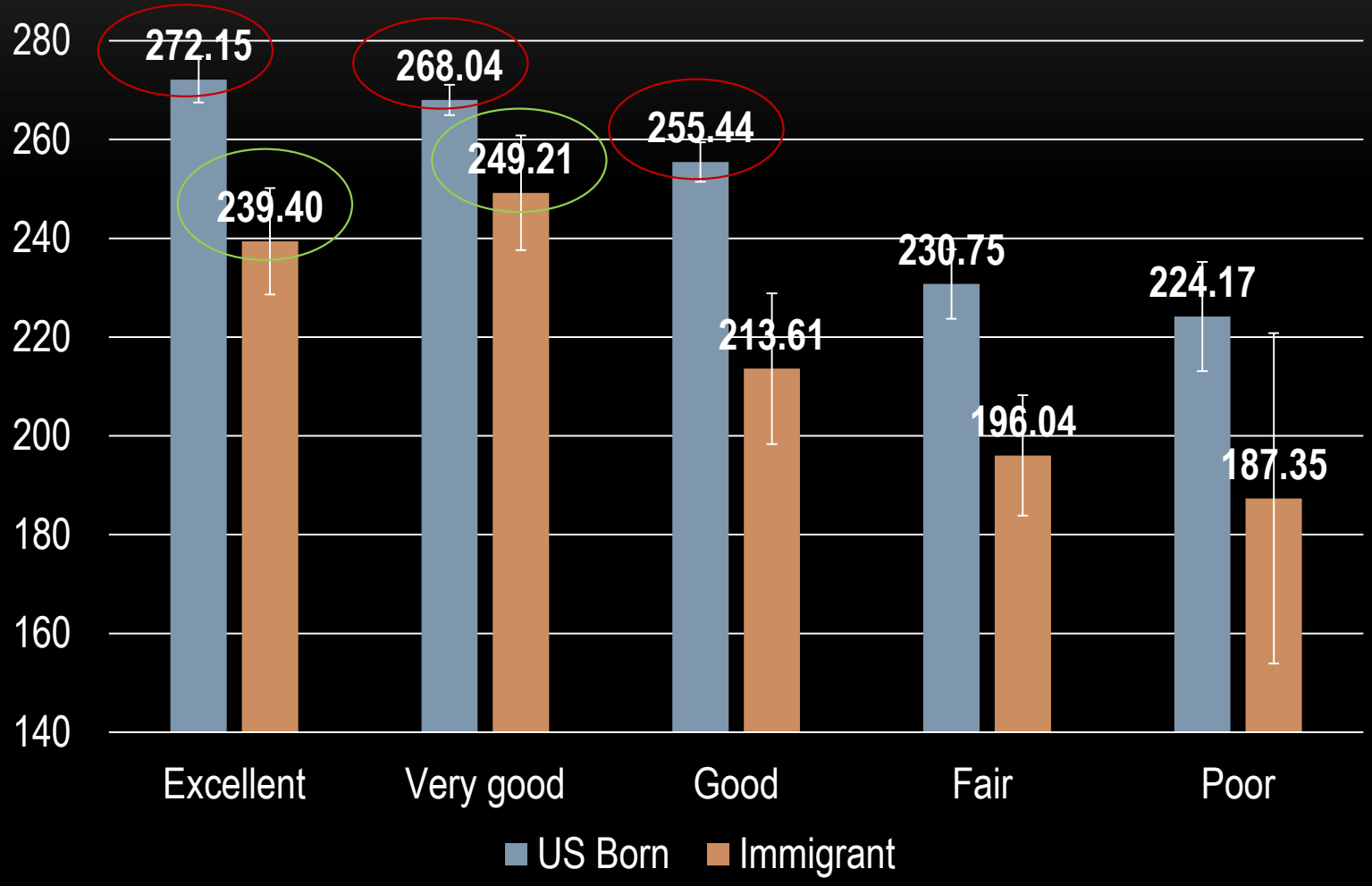
- Compared to U.S.-born respondents, immigrants were
  - significantly more likely to:
    - have < high school degree ($p<.001$)
    - be employed ($p=.037$) or a homemaker ($p=.028$)
  - significantly less likely to:
    - have a master's degree+ ($p<.001$)
    - be a student (.008), retired ($p=.023$), unable to work due to disability ($p<.001$)
    - have health insurance ($p<.001$)

Average Literacy Scores by Health Category for U.S.-Born and Immigrant Respondents (N=4,664)



- US-born: Literacy scores for excellent, VG, & good health significantly higher than fair, & poor
- Immigrants: Literacy scores for excellent & VG health significantly higher than for good, fair, & poor

Average Numeracy Scores by Health Category for U.S.-Born and Immigrant Respondents (N=4,664)



RQ #2
REGRESSION RESULTS

RELATIONSHIPS BETWEEN LITERACY, NUMERACY, AND HEALTH BY IMMIGRANT STATUS

- Model 1: demographic & health characteristics
- Model 2: demographic, health, AND human capital
  - These drove much of the literacy-health relationship
- U.S.-born: 10-point increase in literacy → 3% greater odds of better health category
  - Formal education, employment, income, parental education only partially explain relationship between literacy & health
- Immigrants: literacy became insignificant
  - Assimilation characteristics explained this relationship
    - Income, employment, education, speaking English well

RELATIONSHIPS BETWEEN LITERACY, NUMERACY, AND HEALTH BY IMMIGRANT STATUS

- Added human capital characteristics → numeracy-health relationship became insignificant for U.S.-born and immigrants
  - Human capital characteristics drove this relationship

- Immigrants and U.S.-born respondents derive similar health rewards from higher literacy and numeracy scores

HISPANIC AND ASIAN IMMIGRANT CHARACTERISTICS: SELECTED DIFFERENCES

- Hispanics significantly more disadvantaged than Asians

	Hispanic (N=254)	Asian (N=166)	t-value	p
Literacy Score	210	265	-10.98	<.001
Numeracy Score	192	258	-11.50	<.001
Self-Rated Health				
Excellent	19.9	25.6	-1.34	0.18
Very Good	24.6	36.3	-2.55	0.01
Good	34.3	28.2	1.33	0.16
Fair	18.9	6.4	4.03	<.001
Poor	2.3	3.5	-0.72	0.47

- Vision/hearing problems, learning disabilities, health insurance, employment, educational attainment, parental education, income, English proficiency

RELATIONSHIPS BETWEEN LITERACY, NUMERACY, & HEALTH: HISPANICS VS. ASIANS

- Control variables: added age of learning English and # years in USA
- Positive relationships between literacy and numeracy and health for Hispanics and Asians
  - 10-point increase → 4% greater odds of reporting better health
  - Mostly driven by human capital and assimilation characteristics
- Both groups attain similar health benefits from higher literacy & numeracy scores

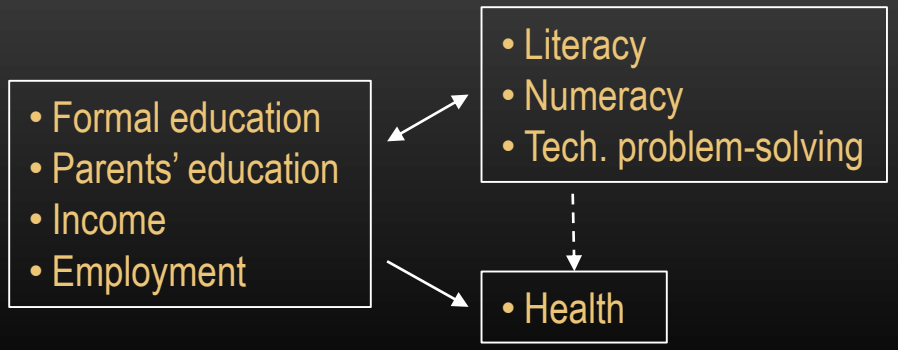
IMPLICATIONS

- Literacy and numeracy are strongly associated with health for immigrants and non-immigrants → social determinants of health
- These relationships are driven almost entirely by human capital resources → help us improve health AND literacy/numeracy/PS-TRE
  - Socioeconomic resources are the pathway through which literacy, numeracy, and PS-TRE are related to health

- Formal education
- Parents' education
- Income
- Employment
- (English proficiency)

- Basic skills instruction: similar health benefits for (1) U.S.-born and immigrants and (2) Hispanic and Asian immigrants

- Need longitudinal data to test causal pathways



- Can't isolate any single thing that improves health → need literacy instruction + other interventions
  - Some strong predictors of health are beyond our control
  - Others CAN be modified through policy:
    - Increase 4-year college completion → multi-generational impact
    - Provide support services for people with disabilities, vision/hearing problems
    - Expand ESL instruction
    - Increase access to health insurance
  - People DON'T have access to same resources → target those with greatest unmet literacy & financial needs, least education (e.g., Hispanic immigrants)

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- http://piaacgateway.com/us-piaac-conference
- Paper: http://tinyurl.com/o5xplpa
- 1-page summary: http://tinyurl.com/pecmbj7

- "Examining Associations between Self-Rated Health and Proficiency in Literacy and Numeracy among Immigrants and U.S.-Born Adults" (Prins & Monnat, 2015). PLOSONE.org