CONCEPTUALIZING HEALTH LITERACY FOR MEASUREMENT AND INTERVENTION

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the FLIGHT/VIDAS Team

Importance

- *"Building a comprehensive approach to measurement of the **social construct called health literacy** may well be the most significant and necessary task facing health literacy research and practice."* *(Emphasis added)*

Pleasant A, McKinney J, Rikard RV (2011). Health literacy measurement: A proposed research agenda. *J Hlth Communication* 16:11-21.

Conceptual Definitions

- Institute of Medicine report (2004):
  - *"The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions."*
- Sørensen et al. review article: *"17 definitions and 12 conceptual models"*
  - *BMC Public Health* 2012, **12**:80

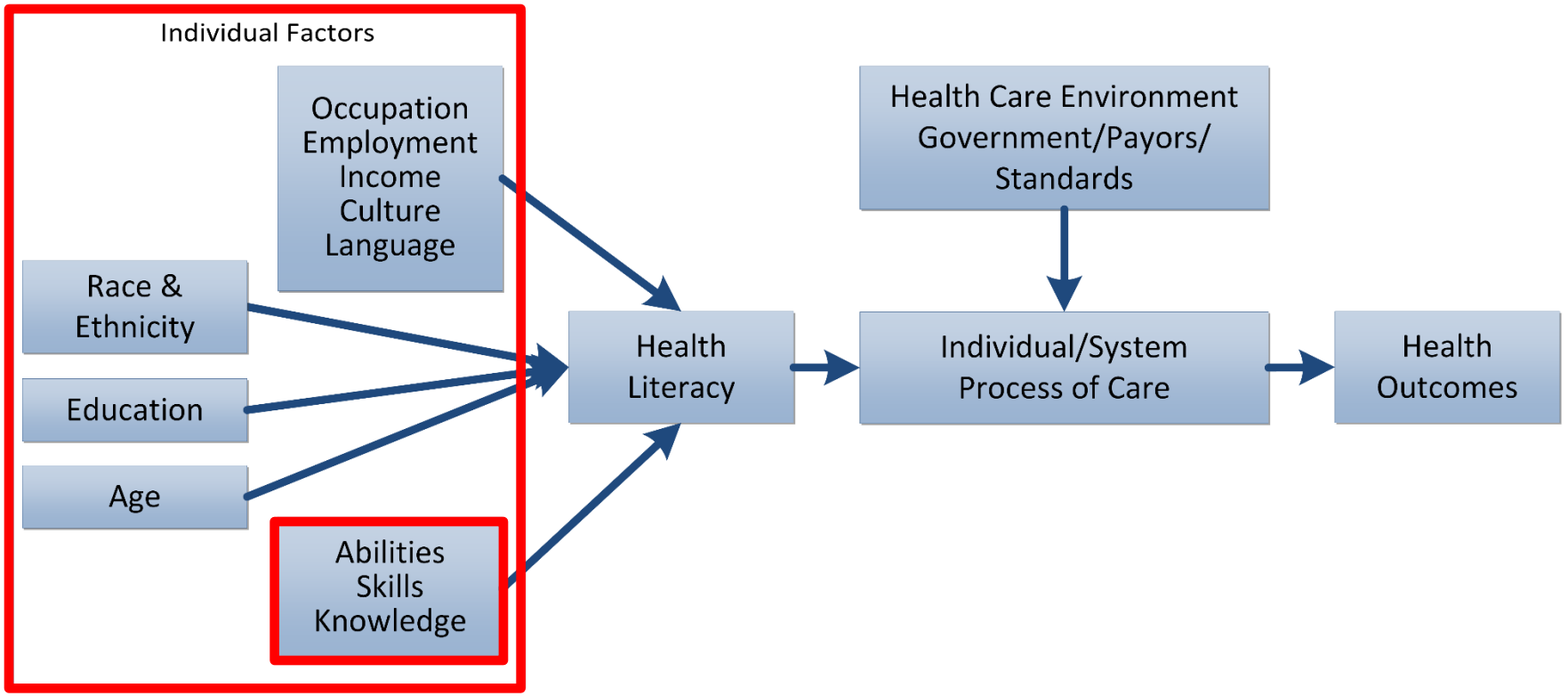
Problem

- How to link concepts to actual measures
- What is “capacity” and how do you to measure it?
  - Cognition, attention, memory
  - Reading, listening, speaking
- What is “obtain, process, and understand” information and how do you measure them?
  - Information search, reasoning, evaluation, problem solving
- What are “appropriate” health decisions?
  - Judgment, integration with personal values, behavior

Proposal

- An *operational* definition should
  - Facilitate measurement
  - Lead to practical interventions
  - Help to assess intervention effects on health literacy
  - Help to assess broader intervention effects
    - E.g. Improving literacy reduced depression (Weiss et al., 2006); health literacy and patient activation are related (Hibbard et al., 2005)

Individual and system



Paasche-Orlow & Wolf (2006) *Am J Health Behav 31(Supp 1)*:S19-S26; Nutbeam (2008) Soc Sci Med 67:2072-2078; Von Wagner et al. (2009) *Health Educ Behav* 36:860-870; Chin et al. (2007) *Med Care Res Rev* 64:7S-28S; Koh et al. (2013) *Health Affairs* 32:357-367.

Factors in health literacy

- Abilities
  - Crystallized and fluid cognitive abilities
  - Attention, problem solving, memory
  - Expressive and receptive language
  - Executive/planning/problem solving
- Skills
  - Reading, arithmetic, understanding probability, quantitative reasoning
- Knowledge
  - Knowledge of health promotion, conditions, treatments

See Baker 2006 *J Gen Int Med* 21: 878-883; Chin et al. 2011 *J Htlh Commun* 16(sup 3):222-141; Levinthal et al 2008 *J Gen Int Med* 23:1172-1176; Ownby & Waldrop-Valverde HARC 2009; Waldrop-Valverde et al (2010) *AIDS Pt Care STDs* 24:477-484.

ASK Model

- Health literacy is a unique combination of
  - General cognitive **abilities**
  - Academic and other **skills**
  - Health-related **knowledge**

Implications for interventions

- General cognitive abilities are considered to be relatively stable
  - i.e., difficult to change
  - Not a target for intervention
- Skills and knowledge can be taught
- Skills and knowledge are targets for intervention

Data from FLIGHT/VIDAS

- ***Fostering Literacy for Good Health Today*** *(FLIGHT)*
- ***Vive Desarrollando Amplia Salud*** *(VIDAS)*
- **Goal:** Develop and validate a measure of health literacy that is useful for older and younger as well as Spanish and English speaking persons and is computer administered and scored

Multidimensional item content

- **Content:** 2004 Institute on Medicine health literacy report domains
  - Seven areas of health literacy goals
- **Formats:** Educational Testing Service
  - Prose
  - Document
  - Quantitative

Goal	Prose	Document	Quantitative
Health promotion	Read a passage on exercise and identify desirable duration of exercise	Make menu choices based on fat and sodium guidelines	Calculate the number of grams of fat in a package of a product given a per serving value
Understand health information	Read a passage on risk factors for diabetes and identify relevant behaviors that would reduce someone's risk	Given a checklist of risk factors for diabetes, be able to complete a checklist of risk factors for the disease	Given information on normal and abnormal blood glucose levels, identify normal and abnormal levels
Apply health information	After being provided with information on physical activity guidelines, identify appropriate exercise duration and frequencies	Given narrative information on exercise frequency and intensity, complete an exercise log	Calculate the number of calories used during exercise give a table of exercises, times, and values
Navigate the health care system	After reading an informational brochure, be able to describe how specific health care services are covered by an insurance program	Review information from a table on dates and times for applying for specific health care benefits	Calculate relative costs of two insurance plans
Participate in encounters with health care professionals	After viewing a video of a person's encounter with a physician providing a new medicine, identify information provided by the physician about dosage and schedule	After viewing a video describing how to apply for long term care insurance, fill out an application	After viewing a video that presents information on desirable weights, calculate one's own body mass index
Give informed consent	After reading information about a colonoscopy, describe the risks and benefits of the procedure	After reading an informed consent form, describe risks and benefits of a surgical procedure	Given a graphical representation of the probability of a medication side effect, correctly identify how likely its occurrence will be.
Understand rights	After reading an explanation of benefits, correctly identify the procedure to appeal a denial of benefits	Given an insurance explanation of benefits on an insurance payment statement, identify an inappropriate denial	After viewing a video presentation on patient rights, correctly determine the number of options available to access services

Development

- Phase I
  - 225 items created
  - 73 Spanish and 69 English speakers
- Item screening for difficulty and usefulness in Spanish and English
- Phase II
  - 98 items
  - Spanish and English participants
  - 30 participants per group in each language
  - 7 decade-based age groups (N = 420)
  - Validation via relations to other measures

Touch screen computer

The following diagram shows how often people either get a headache or feel tired when they take a medicine. There are 100 stars. The red stars show the chances of getting a headache, and the green stars show the chances of feeling tired. What are the chances of having a headache?

- A) 5 in 25
- B) 1 in 20
- C) 8 in 100
- D) 5 in 20
- E) 8 in 92

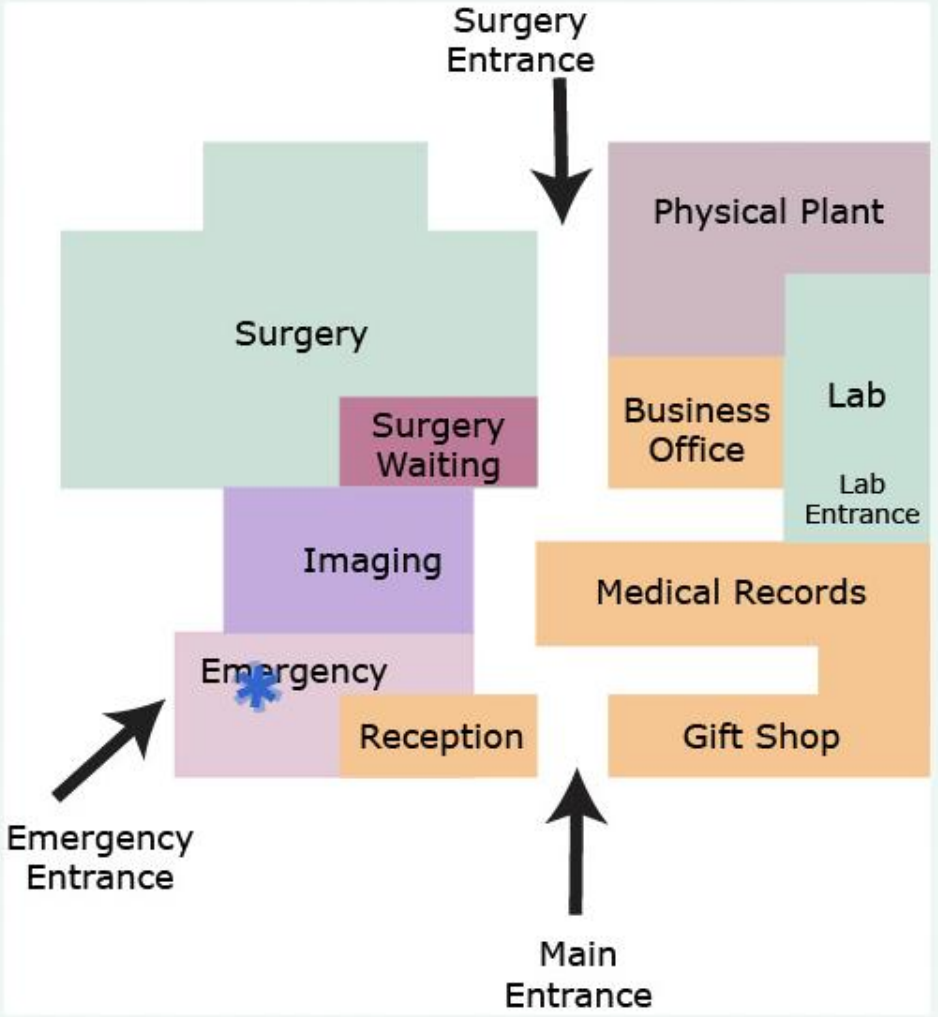
Question 39 of 50

Clear

Submit

Luz' husband suddenly has problems talking. He tries to talk but can barely get words out. He can't move his right arm. She calls 911 and an ambulance comes and takes her husband to the hospital.

Touch or click on the part of the map that shows where they would take her husband.



Question 39 of 48

Clear

Submit

2005
Oncology Nursing Drug Handbook
The Heart & Soul of Ch
REVIEW OF PSYCHIATRY

Continue

Testing the model

- Data include:
  - Woodcock-Johnson/Woodcock-Muñoz Verbal Comprehension composite (**crystallized ability**)
  - Wechsler Adult Intelligence Scale subtests (**fluid ability**)
  - Woodcock-Johnson/Woodcock-Muñoz Passage Comprehension and Applied Problems subtests (**skills**)
  - FLIGHT/VIDAS general health **knowledge** (FACT) scale
    - *"It would be very helpful to have a comprehensive test of the general public's conceptual knowledge about health and illness . . ."* Baker 2006, p.880

Baker (2006) *J Gen Int Med* 21: 878-883; Ownby et al. 2013 *Patient Related Outcome Measures, 4:1-15.*

Analysis strategy

- Evaluate the model by predicting scores on:
  - TOFHLA, REALM, SAHLSA, FLIGHT/VIDAS
- Regression models predict scores:
  - 1. Demographics only
  - 2. + Cognitive Abilities
  - 3. + Cognitive Abilities + Skills
  - 4. + Cognitive Abilities + Skills + Knowledge
- SES = education + income + occupational status

Demographics and health literacy

	English Mean (SD)	Spanish Mean (SD)
N	161	198
Age in Years	52.5 (17.5)	49.8 (15.6)
Education	13.6 (2.3)	12.4 (2.8)
Income	$31, 188	$27,889
SES Factor	0.19 (0.80)	-0.14 (0.82)
Crystallized	95.9 (10.6)	89.6 (9.0)
Fluid	10.6 (2.3)	10.6 (2.7)
TOFHLA Reading	46.4 (4.4)	43.3 (7.6)
TOFHLA Numeracy	47.8 (2.8)	43.5 (6.1)
Gender: Men/Women	70/91	81/118
Race: White/Black	91/70	198/0

ASK model: TOFHLA Reading

	Model 1: Demographics				Model 2: Abilities				Model 3: Skills				Model 4: Knowledge			
	B	SE	t	p	B	SE	t	p	B	SE	t	p	B	SE	t	p
Intercept	57.8	2.69	21.5	**< 0.001**	28.9	4.02	7.18	**< 0.001**	26.79	4.01	6.68	**< 0.001**	27.8	3.98	7.00	**< 0.001**
Age	-0.09	0.02	-4.59	**< 0.001**	-0.07	0.02	-4.13	**< 0.001**	-0.08	0.02	-4.57	**< 0.001**	-0.09	0.02	-4.93	**< 0.001**
SES	1.93	0.33	5.85	**< 0.001**	0.97	0.30	3.23	**0.001**	0.79	0.30	2.62	**0.009**	0.55	0.31	1.76	0.08
Female Gender	0.51	0.54	0.94	0.35	1.56	0.48	3.26	**0.001**	1.50	0.47	3.17	**0.002**	1.23	0.48	2.59	**0.01**
Black Race	-3.10	0.86	-3.62	**< 0.001**	-0.93	0.77	-1.21	0.23	-0.96	0.76	-1.27	0.21	-0.72	0.75	-0.96	0.34
Spanish Language	-3.22	0.72	-4.46	**< 0.001**	-1.17	0.67	-1.74	0.08	-1.40	0.67	-2.10	**0.04**	-1.23	0.66	-1.86	0.06
Crystallized					0.16	0.03	5.30	**< 0.001**	0.10	0.03	3.02	**0.003**	0.08	0.04	2.18	**0.03**
Fluid					0.56	0.11	5.06	**< 0.001**	0.47	0.11	4.13	**< 0.001**	0.46	0.11	4.15	**< 0.001**
Reading									0.09	0.03	3.14	**0.002**	0.09	0.03	2.95	**0.003**
Knowledge													0.28	0.10	2.86	**0.01**

Ownby et al, submitted

ASK model: TOFHLA Numeracy

	Model 1: Demographics				Model 2: Abilities				Model 3: Skills				Model 4: Knowledge			
	B	SE	t	p	B	SE	t	P	B	SE	t	p	B	SE	t	p
Intercept	56.31	2.89	19.48	**< 0.001**	43.12	4.86	8.87	**< 0.001**	38.64	5.34	7.24	**< 0.001**	39.40	5.33	7.40	**< 0.001**
Age	-0.04	0.02	-1.72	0.09	-0.03	0.02	-1.28	0.20	-0.03	0.02	-1.29	0.20	-0.03	0.02	-1.52	0.13
SES	0.85	0.36	2.39	**0.02**	0.38	0.37	1.03	0.30	0.26	0.37	0.70	0.49	0.05	0.38	0.12	0.90
Female Gender	0.39	0.58	0.68	0.50	0.92	0.58	1.58	0.12	1.14	0.59	1.93	*0.054*	0.92	0.60	1.53	0.13
Black Race	-1.67	0.92	-1.81	0.07	-0.61	0.94	-0.65	0.51	-0.43	0.93	-0.46	0.65	-0.24	0.94	-0.26	0.80
Spanish Language	-4.94	0.78	-6.35	**< 0.001**	-4.06	0.82	-4.97	**< 0.001**	-3.49	0.86	-4.05	**< 0.001**	-3.37	0.86	-3.92	**< 0.001**
Crystallized					0.06	0.04	1.68	*0.10*	0.03	0.04	0.91	0.37	0.01	0.04	0.23	0.82
Fluid					0.34	0.14	2.54	**0.01**	0.24	0.14	1.70	0.10	0.23	0.14	1.64	*0.10*
Math									0.07	0.04	1.98	**0.049**	0.07	0.04	2.00	**0.047**
Knowledge													0.23	0.12	1.89	*0.06*

Ownby et al, submitted

ASK model: REALM

	Model 1: Demographics				Model 2: Abilities				Model 3: Skills				Model 4: Knowledge			
	B	SE	t	p	B	SE	t	p	B	SE	t	p	B	SE	t	p
Intercept	64.59	3.29	19.61	**< 0.001**	44.28	5.95	7.45	**< 0.001**	40.00	6.14	6.51	**< 0.001**	42.03	5.80	7.25	**< 0.001**
Age	0.01	0.03	0.20	0.20	0.00	0.03	-0.02	0.98	-0.01	0.03	-0.34	0.73	-0.02	0.03	-0.73	0.47
SES	0.98	0.60	1.63	0.11	0.11	0.61	0.18	0.86	-0.28	0.62	-0.44	0.68	-0.92	0.60	-1.51	0.13
Female Gender	1.82	0.93	1.96	0.052	2.42	0.90	2.69	**0.008**	2.42	0.89	2.73	**0.007**	1.64	0.85	1.93	0.06
Black Race	-3.50	1.12	-3.12	**0.002**	-2.57	1.14	-2.25	0.03	-2.61	1.13	-2.32	0.02	-1.78	1.08	-1.66	0.10
Crystallized					0.20	0.06	3.52	**0.001**	0.12	0.07	1.79	0.08	0.04	0.06	0.62	0.53
Fluid					-0.06	0.25	-0.24	0.81	-0.19	0.25	-0.77	0.44	-0.20	0.24	-0.85	0.39
Reading									0.15	0.06	2.32	**0.02**	0.14	0.06	2.38	**0.02**
Knowledge													0.77	0.17	4.41	**< 0.001**

Ownby et al, submitted

ASK model: SAHLSA

	Model 1: Demographics				Model 2: Abilities				Model 3: Skills				Model 4: Knowledge			
	B	SE	t	p	B	SE	t	p	B	SE	t	p	B	SE	t	p
Intercept	42.40	2.10	20.20	**< 0.001**	29.38	6.12	4.80	**< 0.001**	27.17	6.25	4.35	**< 0.001**	42.03	5.80	7.25	**< 0.001**
Age	0.01	0.04	0.19	0.85	0.04	0.04	0.91	0.36	0.03	0.04	0.77	0.44	-0.02	0.03	-0.73	0.62
SES	1.42	0.55	2.58	0.01	1.19	0.57	2.09	0.04	1.06	0.57	1.86	0.07	-0.92	0.60	-1.51	0.21
Female Gender	1.71	0.92	1.87	0.06	1.83	0.97	1.89	0.06	1.67	0.97	1.73	0.09	1.64	0.85	1.93	0.16
Crystallized					0.15	0.06	2.34	**0.02**	0.10	0.07	1.40	0.16	0.04	0.06	0.62	0.43
Fluid					-0.15	0.20	-0.73	0.47	-0.24	0.21	-1.16	0.25	-0.20	0.24	-0.85	0.25
Reading									0.09	0.05	1.58	0.12	0.14	0.06	2.38	0.17
Knowledge													0.77	0.17	4.41	0.10

Ownby et al, submitted

ASK Model 1: FLIGHT/VIDAS HL

	Model 1: Demographics			
	B	SE	*t*	*p*
Intercept	57.80	2.69	21.51	< 0.001
Age	-0.09	0.02	-4.59	**< 0.001**
SES	1.93	0.33	5.85	**< 0.001**
Female Gender	0.51	0.54	0.94	0.35
Black Race	-3.10	0.86	-3.62	**< 0.001**
Spanish Language	-3.22	0.72	-4.46	**< 0.001**
Crystallized				
Fluid				
Reading				
Knowledge				

ASK Model 2: FLIGHT/VIDAS HL

	Model 2: Abilities			
	B	SE	*t*	*p*
Intercept	2.08	4.37	0.48	0.63
Age	-0.09	0.02	-4.53	**< 0.001**
SES	1.86	0.34	5.50	**< 0.001**
Female Gender	1.82	0.53	3.45	**0.001**
Black Race	-1.26	0.85	-1.48	0.14
Spanish Language	-2.30	0.73	-3.13	**0.002**
Crystallized	0.26	0.03	7.96	**< 0.001**
Fluid	0.58	0.12	4.68	**< 0.001**
Reading				
Knowledge				

ASK Model 3: FLIGHT/VIDAS HL

	Model 3: Skills			
	B	SE	*t*	*p*
Intercept	-0.10	4.38	-0.02	0.98
Age	-0.09	0.02	-4.89	**< 0.001**
SES	1.67	0.34	4.90	**< 0.001**
Female Gender	1.75	0.52	3.34	**0.001**
Black Race	-1.30	0.84	-1.55	0.12
Spanish Language	-2.52	0.73	-3.45	**0.001**
Crystallized	0.21	0.04	5.51	**< 0.001**
Fluid	0.49	0.13	3.86	**< 0.001**
Reading	0.09	0.03	2.81	**0.005**
Knowledge				

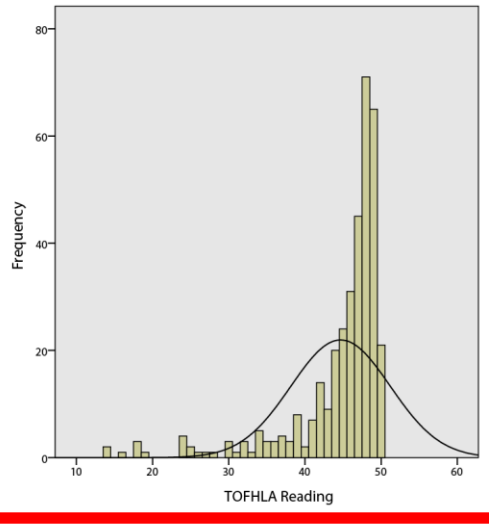
ASK model 4: FLIGHT/VIDAS HL

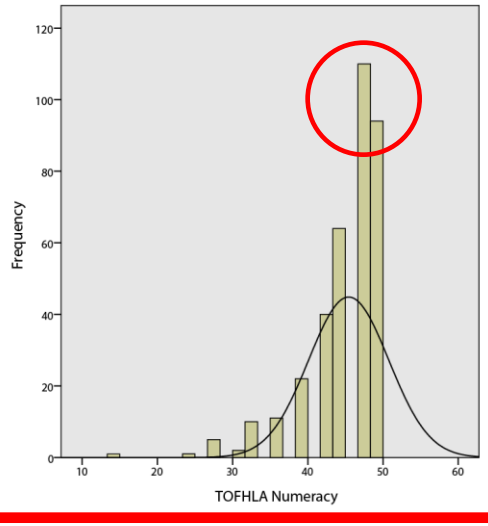
	Model 4: Knowledge			
	B	SE	*t*	*p*
Intercept	4.17	3.44	1.21	0.23
Age	-0.12	0.02	-7.69	**< 0.001**
SES	0.64	0.28	2.30	**0.02**
Female Gender	0.64	0.42	1.54	0.12
Black Race	-0.27	0.66	-0.41	0.69
Spanish Language	-1.82	0.57	-3.18	**0.002**
Crystallized	0.09	0.03	2.99	**0.003**
Fluid	0.46	0.10	4.64	**< 0.001**
Reading	0.07	0.03	2.70	**0.007**
Knowledge	1.18	0.09	13.40	**< 0.001**

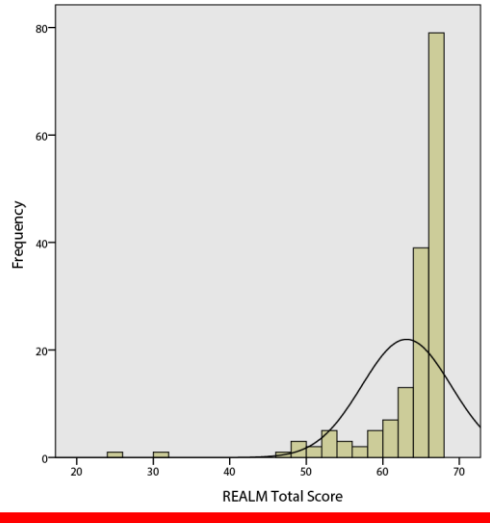
ASK model: FLIGHT/VIDAS NUM

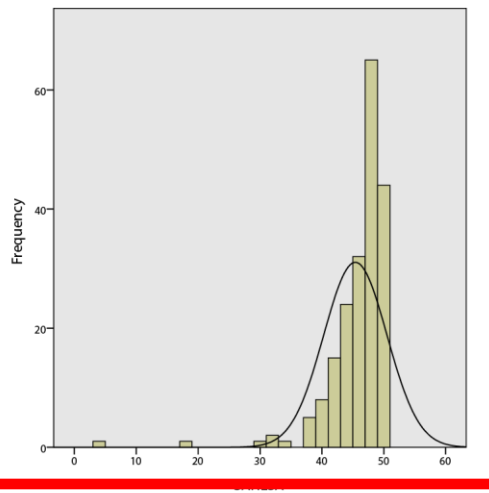
	Model 4: Knowledge			
	B	SE	*t*	*p*
Intercept	-8.88	3.61	-2.46	**0.01**
Age	-0.08	0.01	-5.72	**< 0.001**
SES	0.43	0.27	1.61	0.11
Female Gender	0.25	0.41	0.60	0.55
Black Race	-0.43	0.64	-0.68	0.50
Spanish Language	-0.85	0.58	-1.46	0.14
Crystallized	0.07	0.03	2.43	**0.02**
Fluid	0.59	0.10	6.02	**< 0.001**
Math	0.14	0.02	5.68	**< 0.001**
Knowledge	0.45	0.09	5.25	**< 0.001**

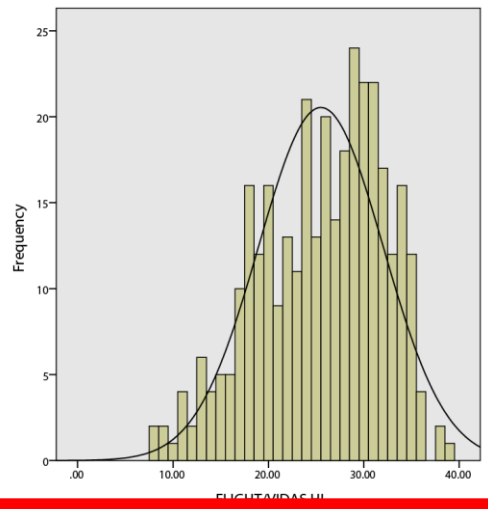
Score distributions

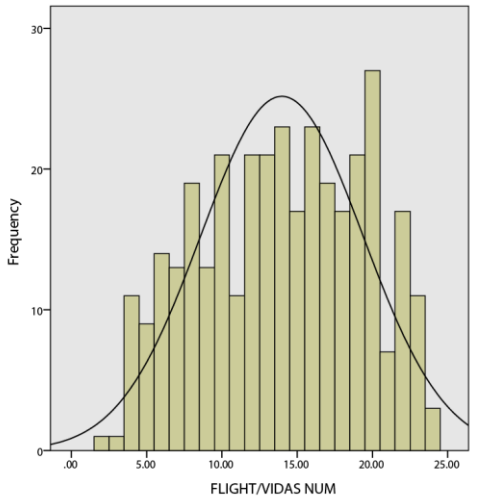












Health literacy intervention

- Computer-delivered intervention to improve health literacy and medication adherence
- Focused on information and skills
  - Information-Motivation-Behavioral Skills model
    - Fisher et al. (2006) *Health Psychol* 25:462-473.
- Increased knowledge and medication adherence
    - Ownby et al. 2012 *Neurobehavioral HIV Medicine* 4:113-121.
- Cost effective
    - Ownby et al. 2013 *BMC Medical Informatics and Decision Making* 13:29.

Conclusions

- The ASK model may be a useful conceptual model of health literacy as an individual characteristic
  - Guidance on what to measure and where to intervene
  - Need to take a number of variables into account
- When it doesn't fit: is it the model, analyses, or measure?
- Possibly divergent findings in Spanish speakers
- May be useful in evaluating intervention effects

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More information at:

- http://www.flightvidas.org
  - Video demonstration of FLIGHT/VIDAS
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