Numeracy and health

Jessica S Ancker, MPH, PhD
Assistant professor
Center for Healthcare Informatics and Policy
Weill Cornell Medical College

Weill Cornell Medical College

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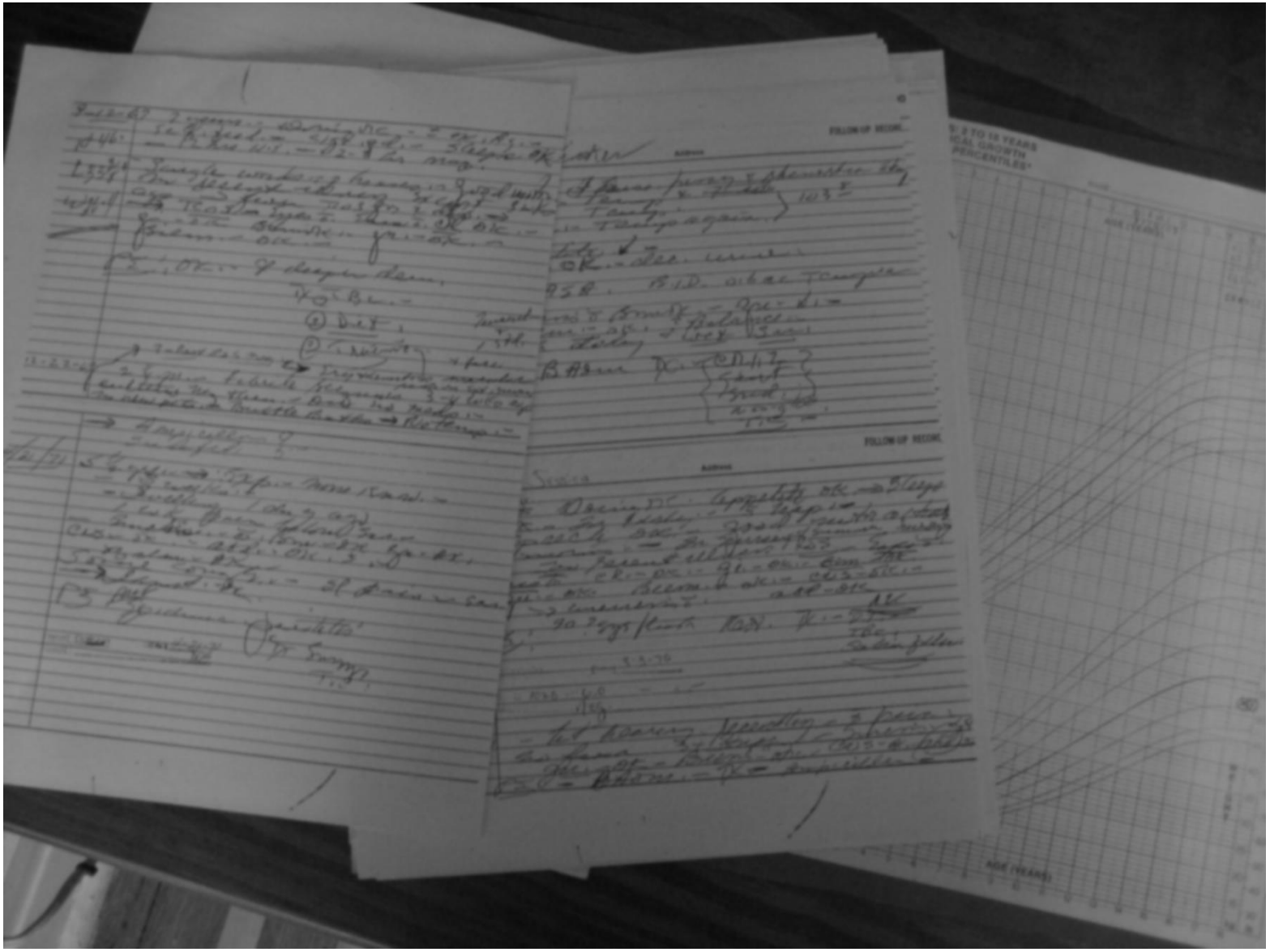
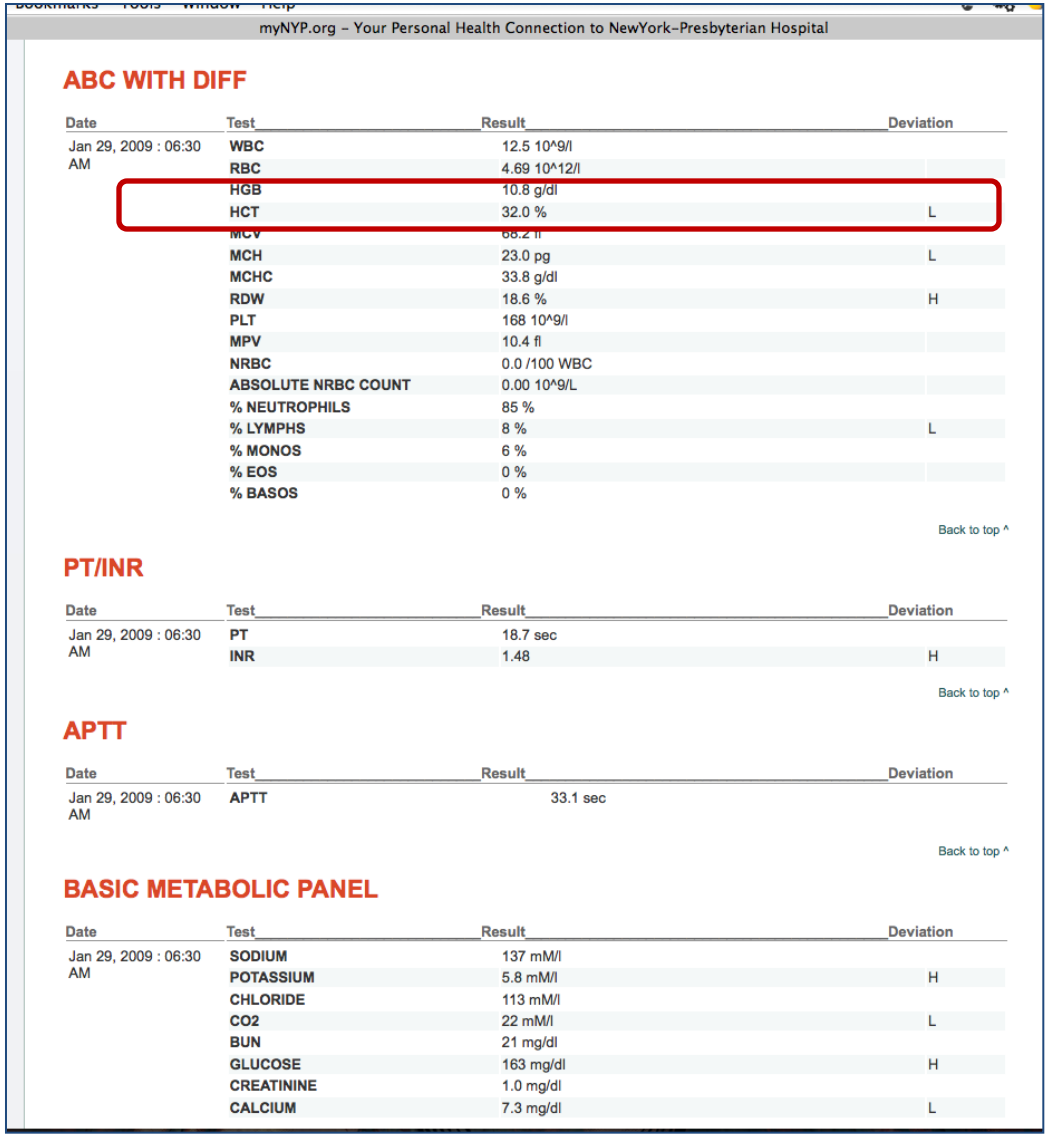
INFORMATICS AND POLICY



2009 federal mandate (“Meaningful Use Program”) to provide electronic copies of data to patients upon request



myNYP.org – Your Personal Health Connection to NewYork-Presbyterian Hospital

ABC WITH DIFF

Date	Test	Result	Deviation
Jan 29, 2009 : 06:30 AM	WBC	12.5 10^9/l	
	RBC	4.69 10^12/l	
	HGB	10.8 g/dl	
	HCT	32.0 %	L
	MCV	68.2 fl	
	MCH	23.0 pg	L
	MCHC	33.8 g/dl	
	RDW	18.6 %	H
	PLT	168 10^9/l	
	MPV	10.4 fl	
	NRBC	0.0 /100 WBC	
	ABSOLUTE NRBC COUNT	0.00 10^9/L	
	% NEUTROPHILS	85 %	
	% LYMPHS	8 %	L
	% MONOS	6 %	
	% EOS	0 %	
	% BASOS	0 %	

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PT/INR

Date	Test	Result	Deviation
Jan 29, 2009 : 06:30 AM	PT	18.7 sec	
	INR	1.48	H

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APTT

Date	Test	Result	Deviation
Jan 29, 2009 : 06:30 AM	APTT	33.1 sec	

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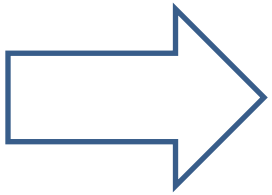
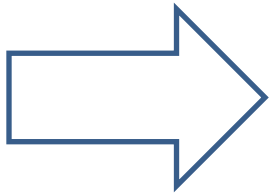
BASIC METABOLIC PANEL

Date	Test	Result	Deviation
Jan 29, 2009 : 06:30 AM	SODIUM	137 mM/l	
	POTASSIUM	5.8 mM/l	H
	CHLORIDE	113 mM/l	
	CO2	22 mM/l	L
	BUN	21 mg/dl	
	GLUCOSE	163 mg/dl	H
	CREATININE	1.0 mg/dl	
	CALCIUM	7.3 mg/dl	L

Data  **Information**  **Knowledge**

"BP = 140/90"

"Your blood pressure is high"
(comparison)

"High blood pressure puts you at risk of having a stroke"
(consequences)

"Here are some very effective ways to help you lower your blood pressure"
(developing and applying generalizable rules and theories)

Increasing expectations for health literacy and numeracy

- Health literacy: Ability to comprehend and make use of written and oral information for one's own health
  - Low/marginal health literacy estimated in nearly half of US population

    Paasche-Orlow 2005

- Health numeracy: Ability to comprehend and make use of quantitative information for one's own health
  - Poor numeracy even more prevalent Ancker, Kaufman *JAMIA* 2007

Numeracy

Questionnaire about bladder infection administered to 600 women -- “Please circle which rate is higher.”

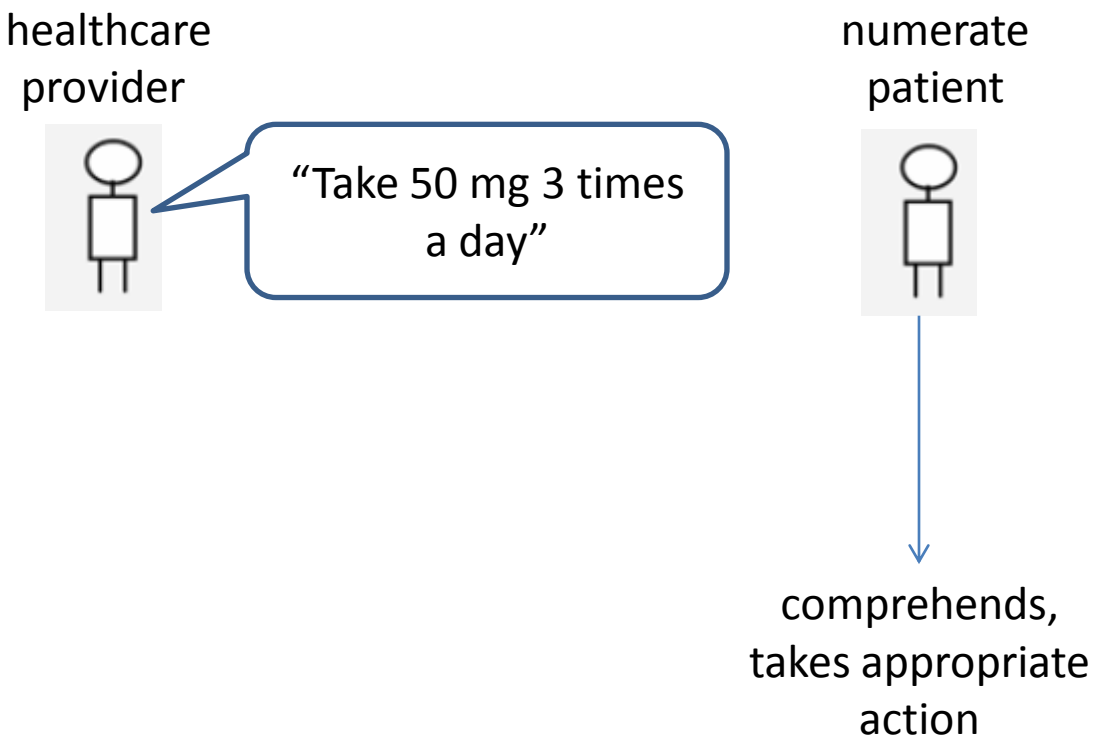
1. 2.6 per 1000 women, or 8.9 per 1000 women
   - 73% of respondents got it right
   - ≤ 9 years of education: 50%
2. 1 in 384 women, or 1 in 112 women
   - 56% of respondents got it right
   - ≤ 9 years of education: 30%

Grimes et al. *Obstetrics and Gynecology* 1999

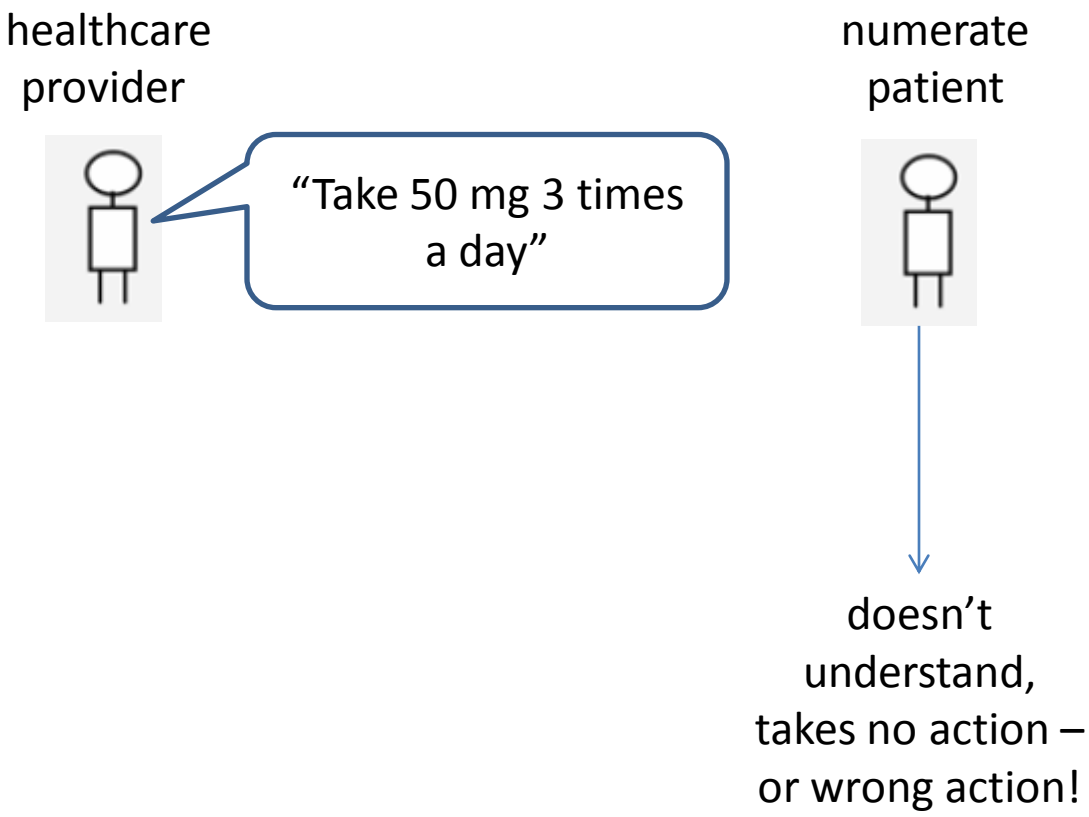
Evidence about importance of numeracy

- Poor numeracy skills associated with poorer medical decisions (Peters et al, 2006)
- Poor numeracy skills associated with worse health:
  - asthma (Apter 2006)
  - anticoagulation (Estrada 2004)
  - diabetes (Osborn 2009)

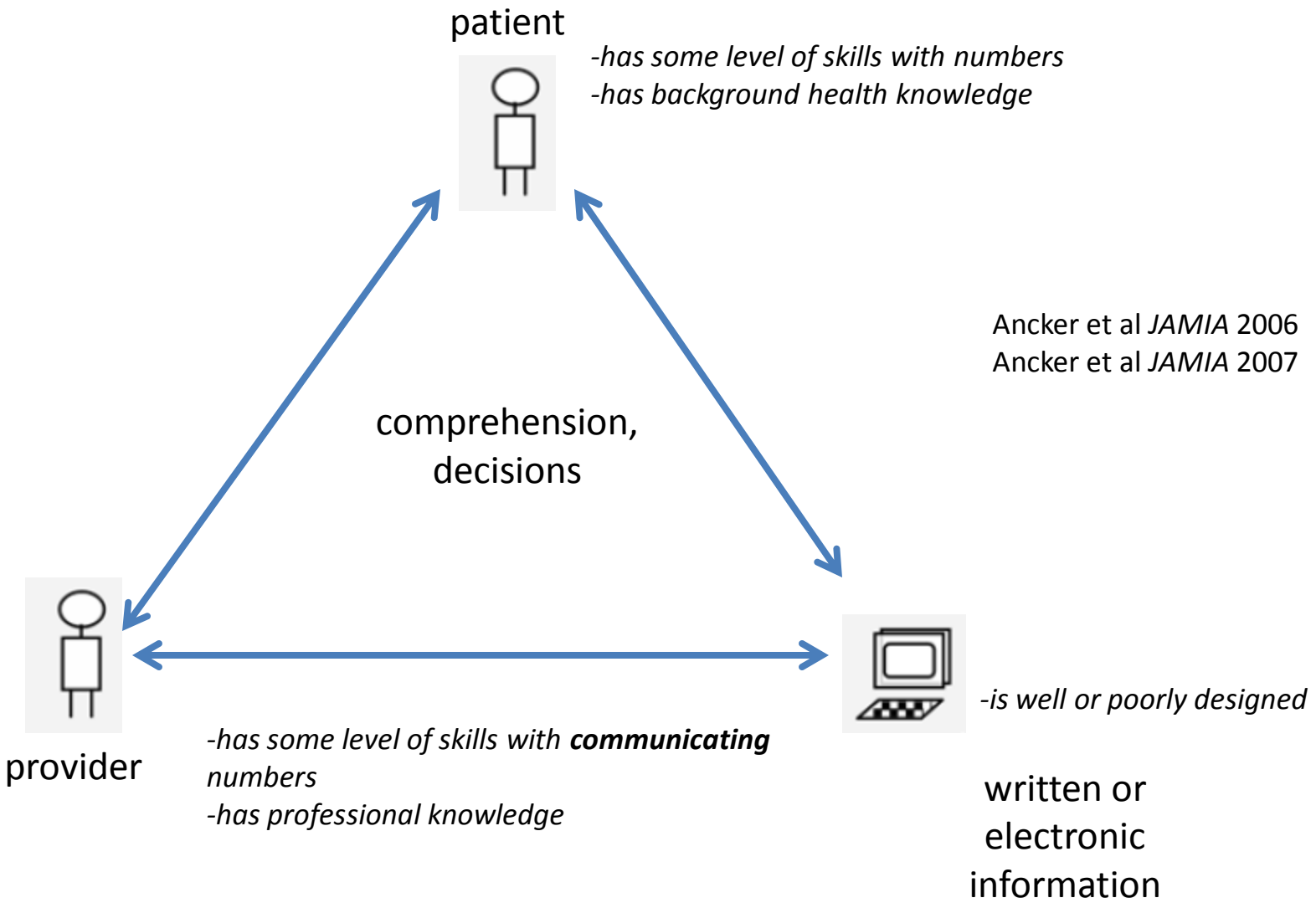
Numeracy: How people think it works



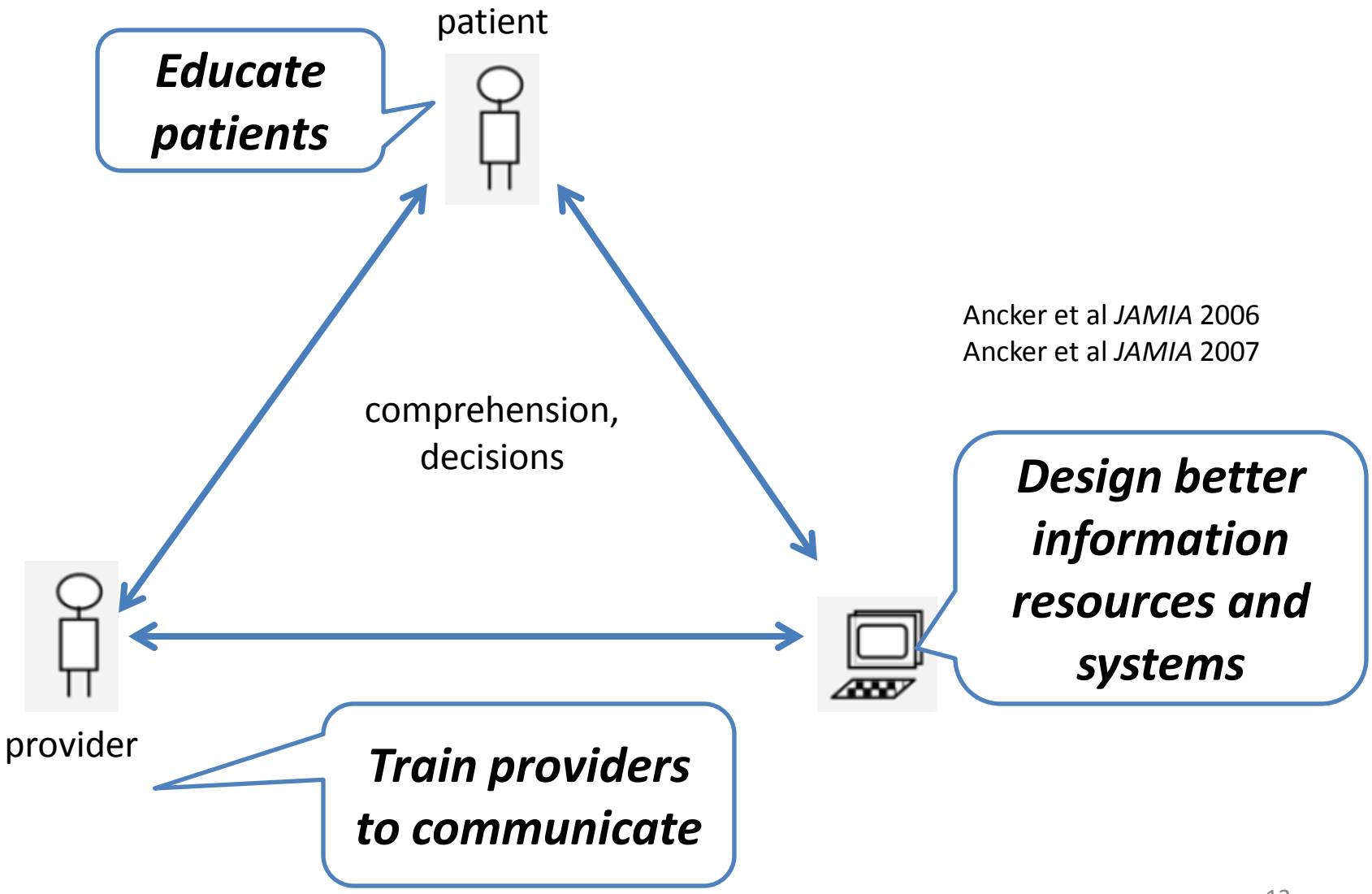
Numeracy: How people think it works



Numeracy: How it really works

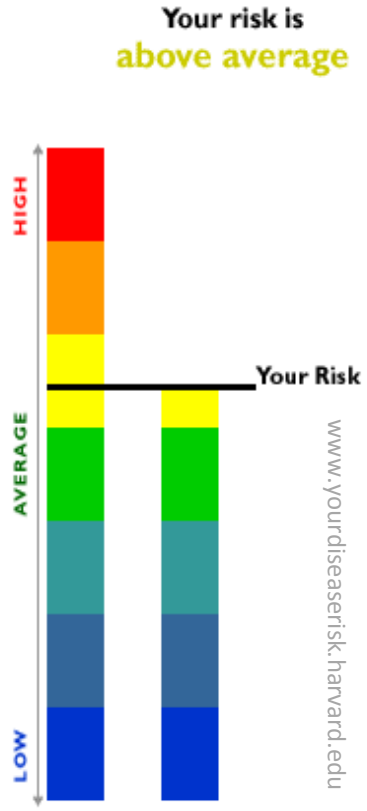


Improving patients' ability to use information

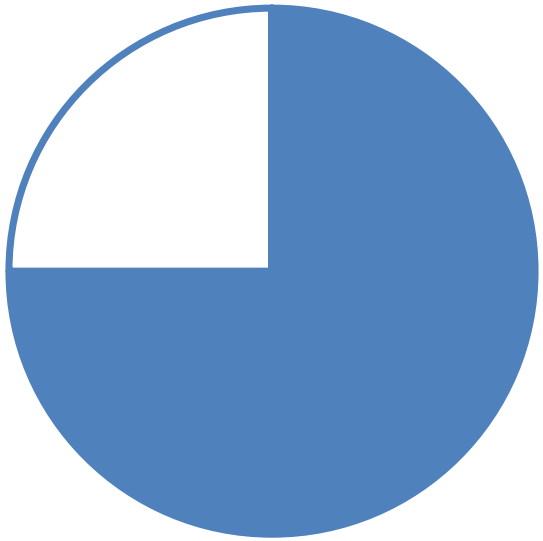


Ancker et al *JAMIA* 2006
Ancker et al *JAMIA* 2007

Good information design helps people use information



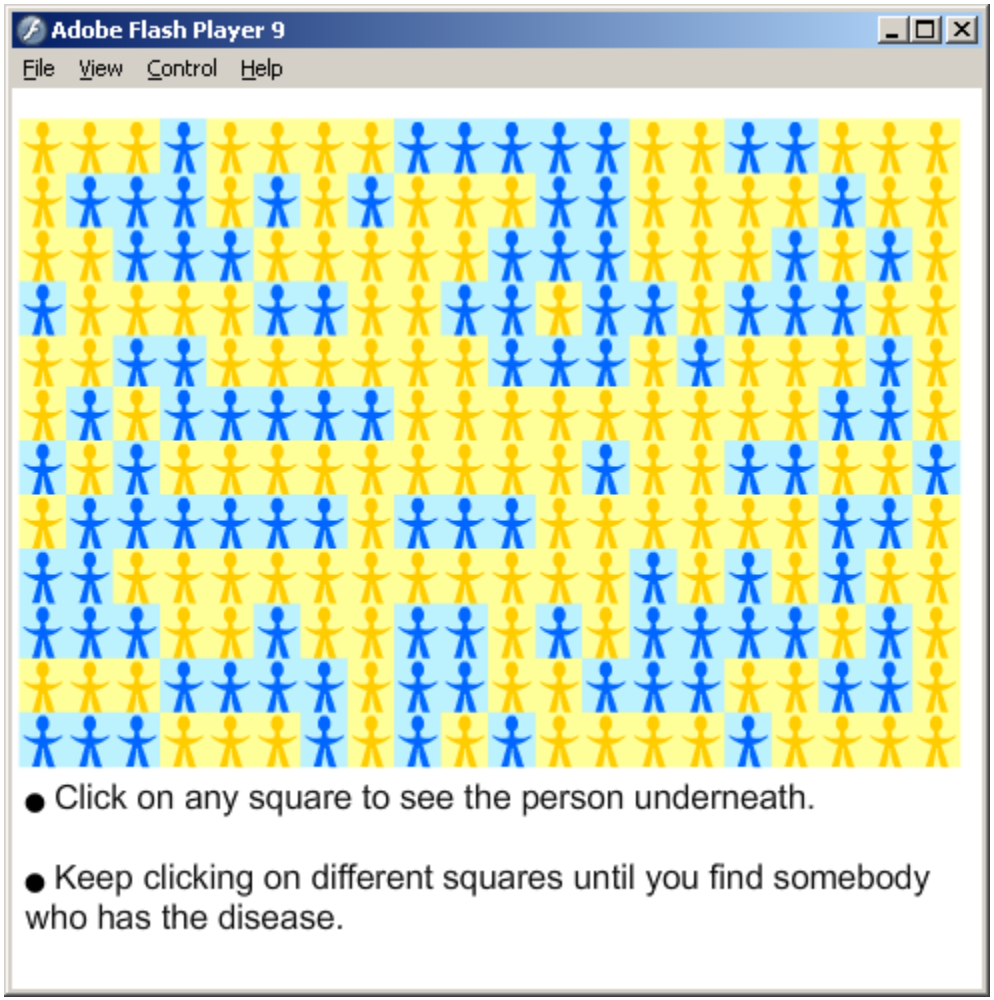
The chance that you have this mutation is 25%.
The chance that you do not have the mutation is 75%.



Rimer, Glassman, 1999

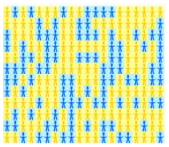
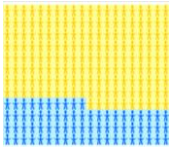
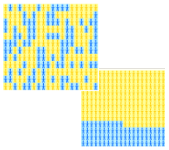
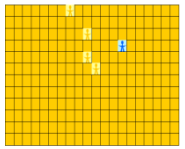
Ancker et al *JAMIA* 2006

Opportunity for innovation



Ancker et al *Medical Decision Making* 2011

Participants (n = 160) liked interactive graphics

Strongly agreed that the graphic...					**p**
Helped me understand the risks					
all participants	33%	41%	44%	**60%**	.08
low numeracy only	46%	50%	46%	**78%**	.46

Graphics affected perceived risk and intention to take protective measures

- Searchers clicked 2-51 times before finding a blue person

- Number of clicks was
  - correlated with feeling vulnerable (rho = −0.52, p=.03)
  - correlated with qualitative risk (rho = 0.67, p=.003)
  - not correlated with numeric risk estimate (rho = 0.001, p>0.9)

- Interactive graphic substantively *reduced* the difference between high-numeracy and low-numeracy patients
  - feelings of vulnerability
  - qualitative descriptions of risk

Summary

- Numeracy is associated with health outcomes
  - plausible causal relationship
- Patient understanding of quantitative information is strongly affected by information design as well as numeracy
- Opportunities for research and innovation into creative and effective ways of presenting medical data to patients
  - data -> information -> knowledge

Thank you!

Jessica S Ancker, MPH, PhD
Center for Healthcare Informatics and Policy
Weill Cornell Medical College
jsa7002@med.cornell.edu

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