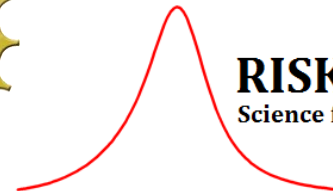


# Simple Decision Support



MAX-PLANCK-GESELLSCHAFT



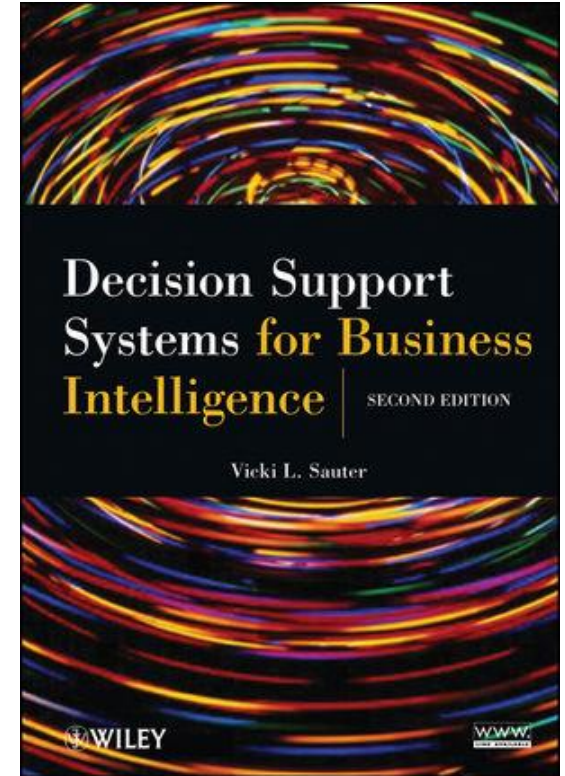
**RISKLITERACY.ORG**  
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**for RISK and RESILIENCE**  
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# Decision Support Systems

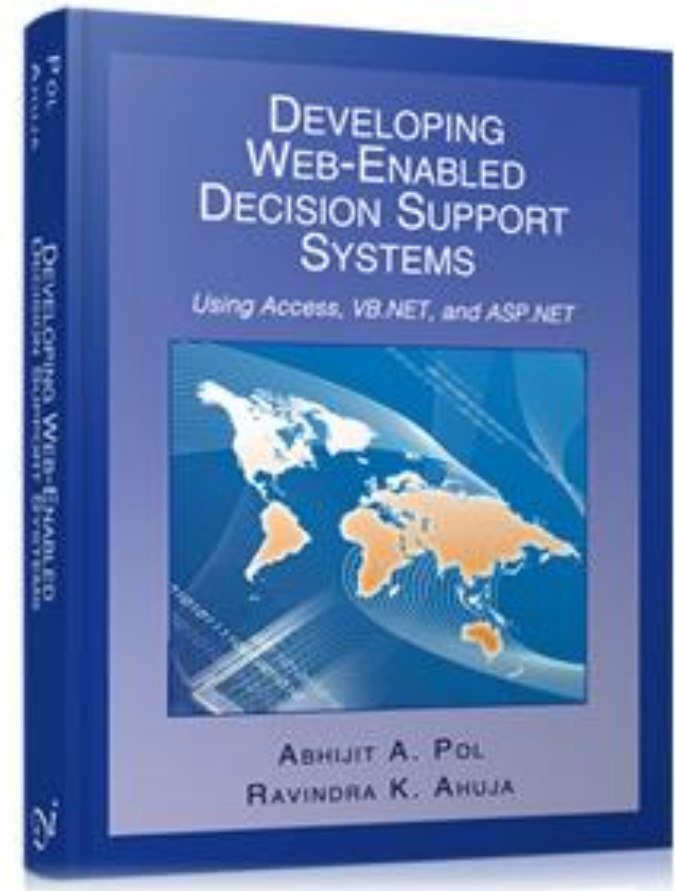
- Since 1960s
- Computer systems designed to support complex decision making
- Major successes (and failures) in:
  - Managerial
  - Clinical/Professional
  - Policy Level



For Review see:  
Gorry and Scott Morton (1971)  
Shim et al. (2002)

# Defining Decision Support

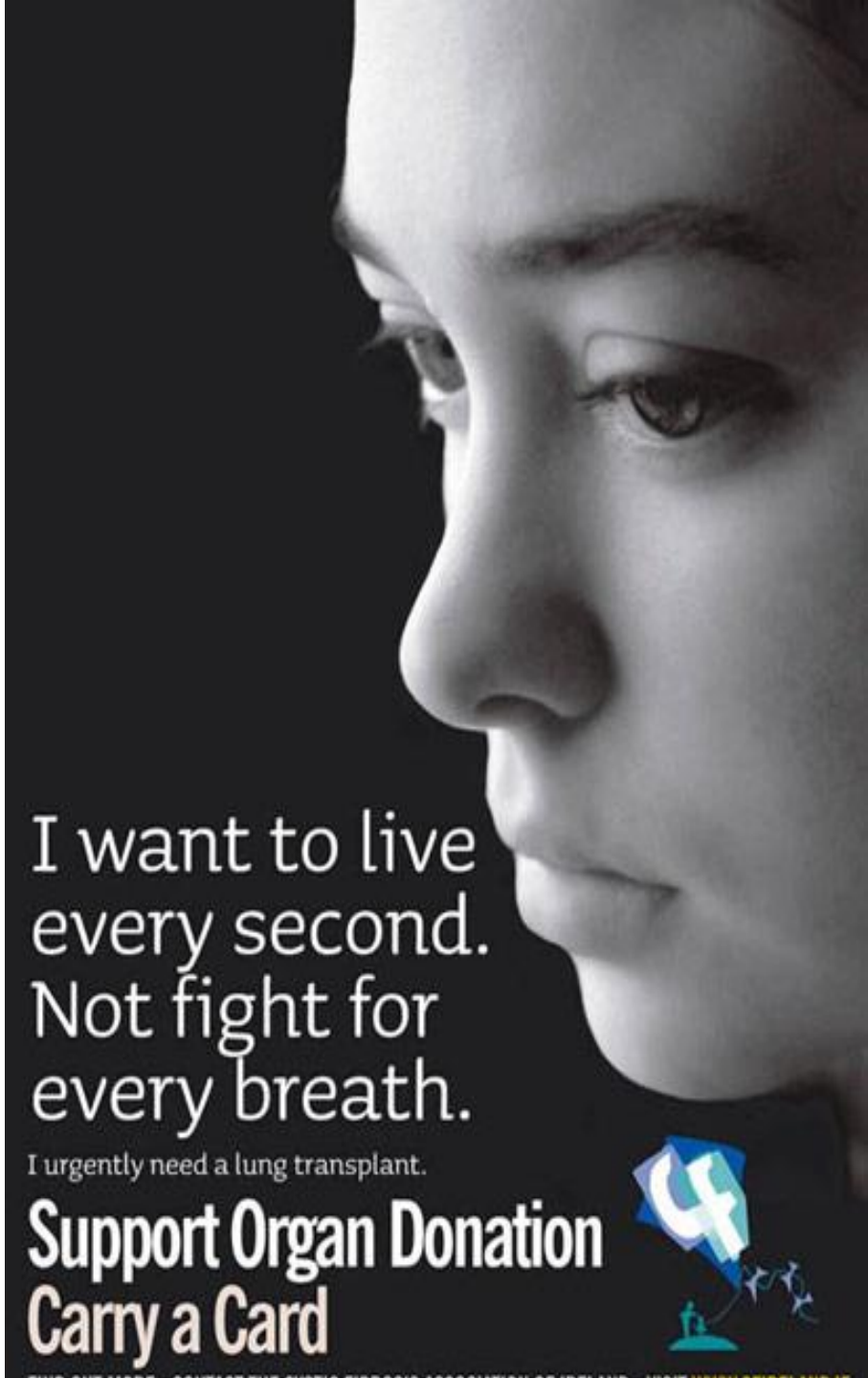
- Evolving Applications
- A Defining Feature of Decision Support Programs: **GOALS**
  - Efficiency
  - Efficacy
- Lots of ways to improve decision making...



# Power of Simplicity

# Organ Donation

- In the US, about 10,000 people per year die waiting for organ donations.
- Despite millions spent on advertising 29% of Americans are donors.



I want to live  
every second.  
Not fight for  
every breath.

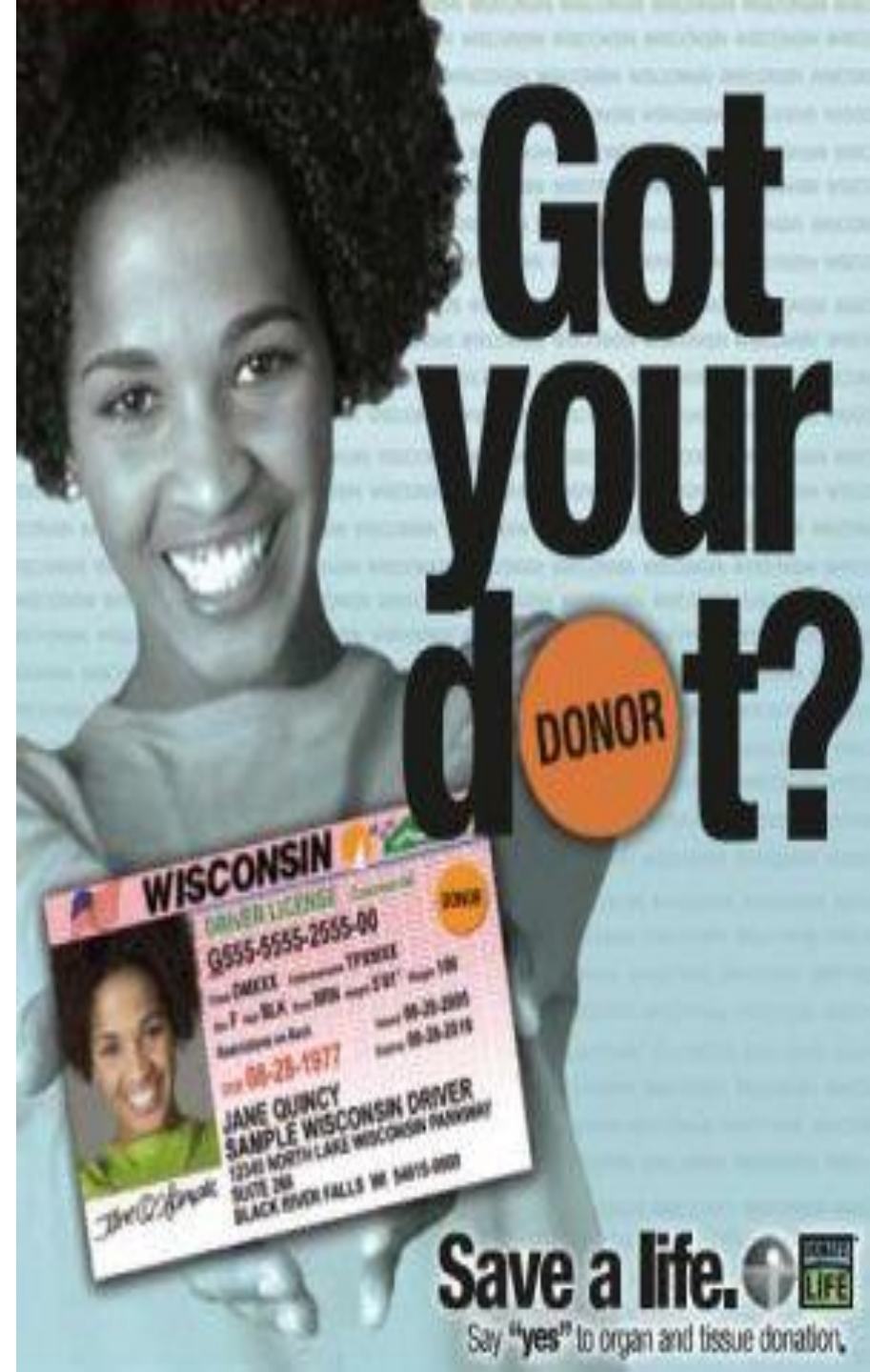
I urgently need a lung transplant.

**Support Organ Donation**  
**Carry a Card**



# Organ Donation

- In France (and many other EU countries) 99.9% of people are donors.
- What's the difference?

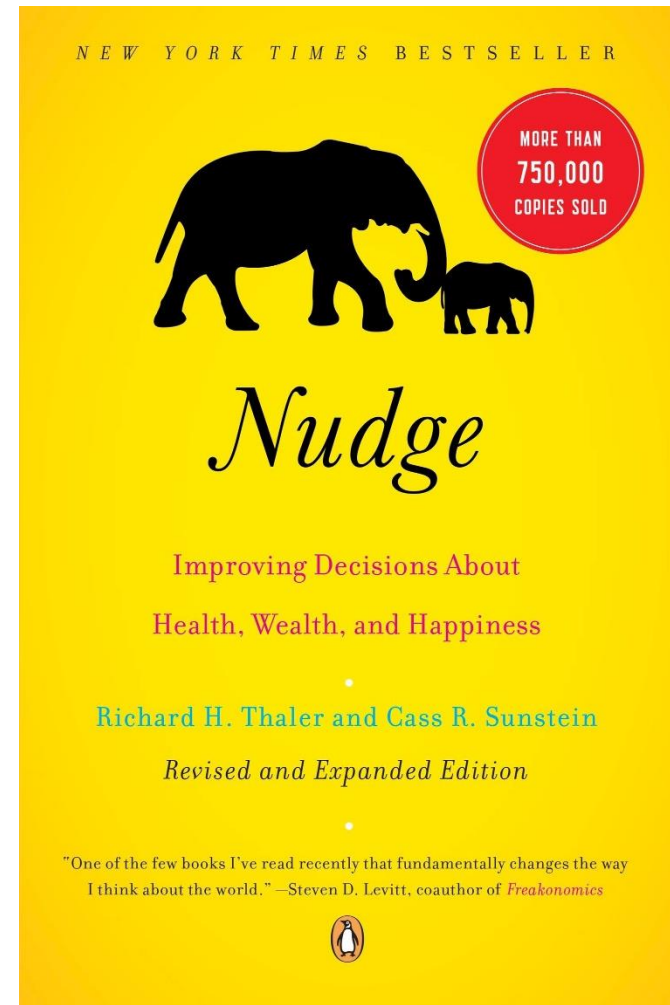


Save a life.  

Say "yes" to organ and tissue donation.

# Choice Architecture

- In the US, the default is **NOT** to donate organs
- In France, the default **IS** to donate organs
- **HEURISTIC**: If you trust, then go with the default
- **“choice architectures”** help people make better decisions
- **Nudged EVERYTHING!**
- From Retirement Plans
- To Toilet Behavior...









BRIEFING ROOM

ISSUES

THE ADMINISTRATION

PARTICIPATE

1600 PENN



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The White House

Office of the Press Secretary

For Immediate Release

September 15, 2015

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# Executive Order -- Using Behavioral Science Insights to Better Serve the American People

EXECUTIVE ORDER

-----

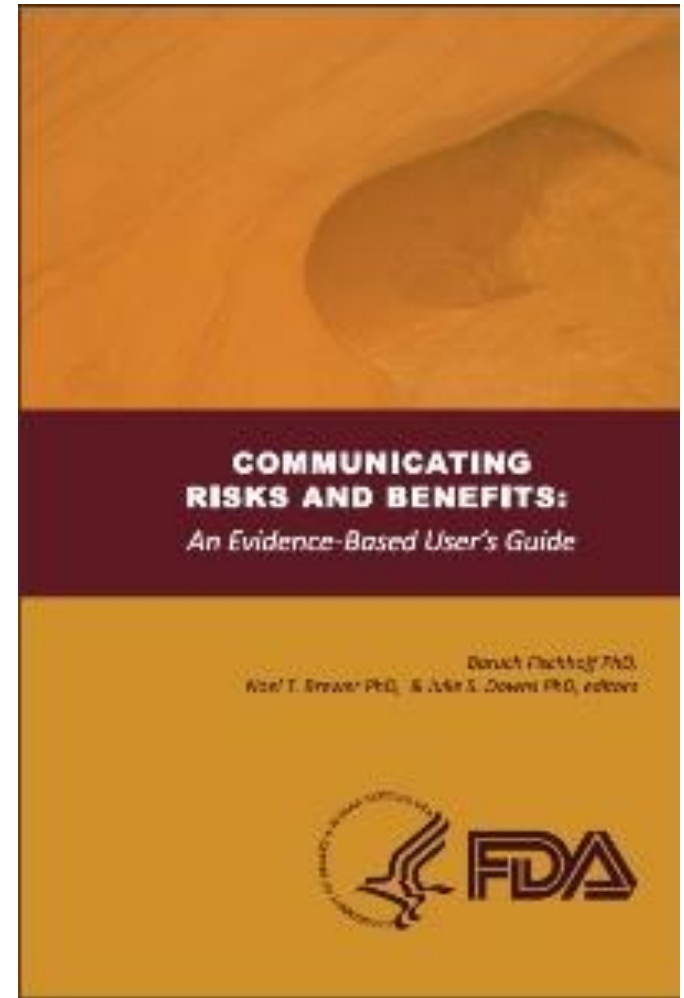
USING BEHAVIORAL SCIENCE INSIGHTS TO

BETTER SERVE THE AMERICAN PEOPLE

A growing body of evidence demonstrates that behavioral science insights -- research findings from fields such as behavioral

# Science for Informed Decision Making

- Choice Architecture isn't primarily about:
  - Nudging
  - Tricking
  - Persuading
  - Framing
- Supporting Skilled and Informed Decision Making
  - Reducing Errors
  - Improving Understanding



# Simple Tech: Checklists

- Checklists save lives...
- A study of 100 hospitals in Michigan
- Adopted a 5 point checklist for placing central line IVs
- Reduced patient deaths by 100/month
- Saved \$13,000,000/month
- WHO estimates | New Surgical Checklist save about 500 people...
- **EVERY DAY**

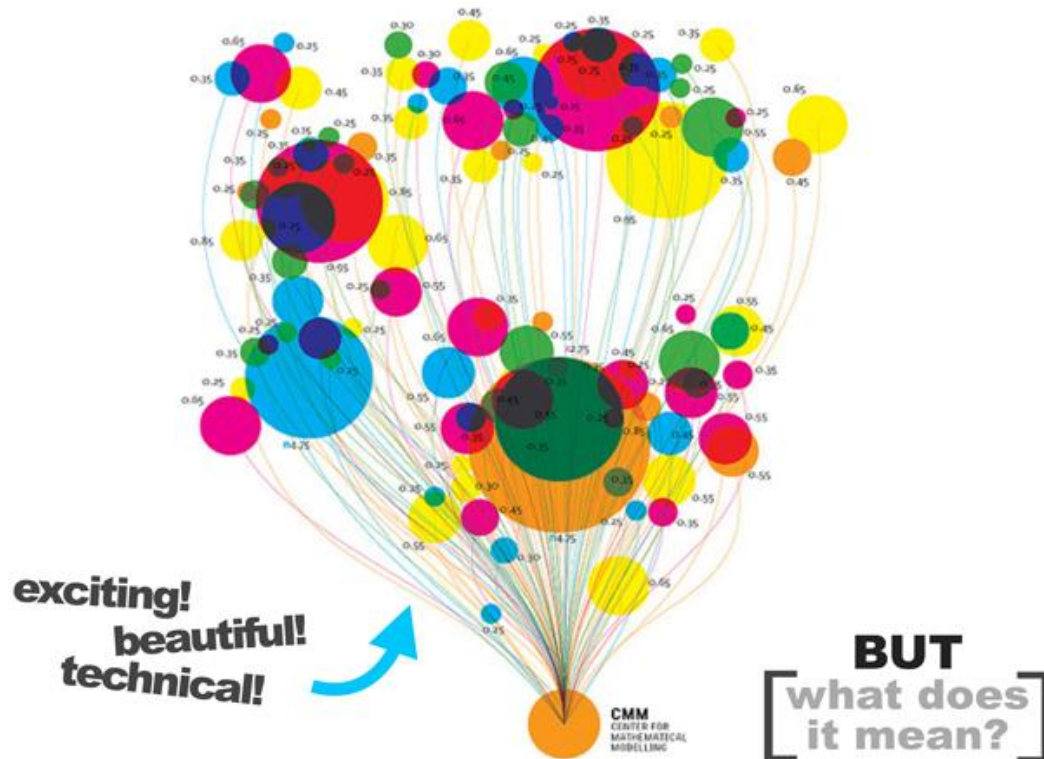




# What other simple factors promote skilled and successful decision making?

# Risk Literacy

“...the ability to evaluate and understand risk”



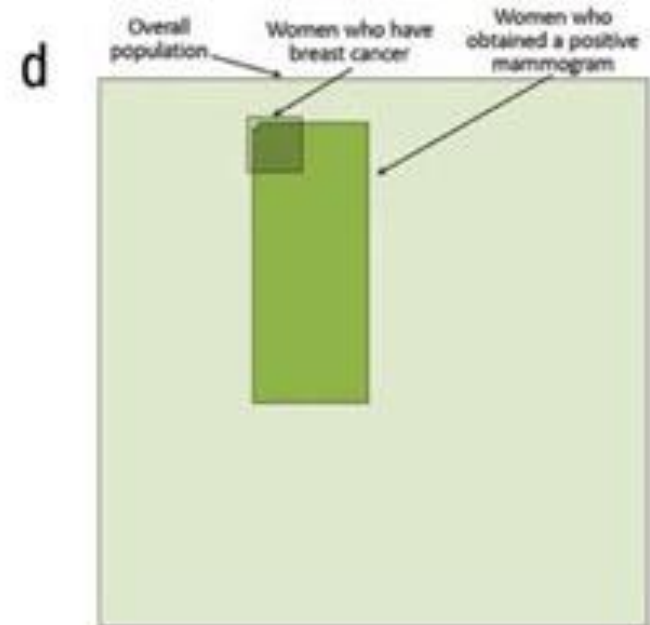
**For reviews see**

Cokely et al. 2012, 2013, 2014, 2017

Garcia-Retamero et al., 2013, 2014

Gigerenzer, 2012

# Simple Visual Aids



# INTERPRETING HOME HIV TEST RESULTS

## SENSITIVITY STUDY FOR HOME HIV TEST

Detection of Antibody to HIV-1 in Oral Fluid Specimens from HIV-1 Seropositive Individuals

Test Group	Total Samples	OraQuick ADVANCE® Reactive	Licensed EIA Repeatedly Reactive	True Positive <sup>1</sup>
Known HIV-1 Positive	767	762	764	767
High-Risk	3150	72 <sup>2</sup>	74 <sup>3</sup>	73
TOTAL	3917	834	838	840

<sup>1</sup> Confirmation performed by licensed HIV-1 Western blot, with confirmation of indeterminate Western blot results by licensed immunofluorescence assay (IFA).

<sup>2</sup> Eight additional specimens were OraQuick ADVANCE® false positive (see Table 7).

<sup>3</sup> One specimen was EIA false positive, with a negative Western blot.

Combining the number of OraQuick ADVANCE® reactive results obtained from the study of confirmed positives with the number of OraQuick ADVANCE® reactive results obtained from the study of high-risk populations, the sensitivity of the OraQuick ADVANCE® Rapid HIV-1/2 Antibody Test in these studies was calculated to be  $834/840 = 99.3\%$  (95% C.I. = 98.4% - 99.7%).

## SPECIFICITY STUDY FOR HOME HIV TEST

Performance of the OraQuick ADVANCE® Rapid HIV-1/2 Antibody Test on Oral Fluid Specimens from Individuals Presumed to be Negative for HIV Infection

Test Group	Total Samples	OraQuick ADVANCE® Non-Reactive	Licensed EIA Non-Reactive	True Negative <sup>1</sup>
Low-Risk	605	605	599 <sup>2</sup>	605
High-Risk	3150	3069 <sup>3</sup>	3076 <sup>4</sup>	3077
TOTAL	3755	3674	3675	3682

<sup>1</sup> Confirmation performed by licensed HIV-1 Western blot, with confirmation of indeterminate Western blot results by RPA or IFA.

<sup>2</sup> Six specimens were EIA false positive, five with a negative Western blot and one with an indeterminate blot which was confirmed negative by IFA.

<sup>3</sup> One additional specimen was OraQuick ADVANCE® false negative (see Table 1).

<sup>4</sup> One specimen was EIA false positive with a negative Western blot.

Combining the number of OraQuick ADVANCE® non-reactive results obtained from the study of the low-risk populations with the number of OraQuick ADVANCE® non-reactive results obtained from the study of the high-risk populations, the specificity of the OraQuick ADVANCE® Rapid HIV-1/2 Antibody Test in these studies was calculated to be  $3674/3682 = 99.8\%$  (95% C.I. = 99.6% - 99.9%).





# INTERPRETING HOME HIV TEST RESULTS

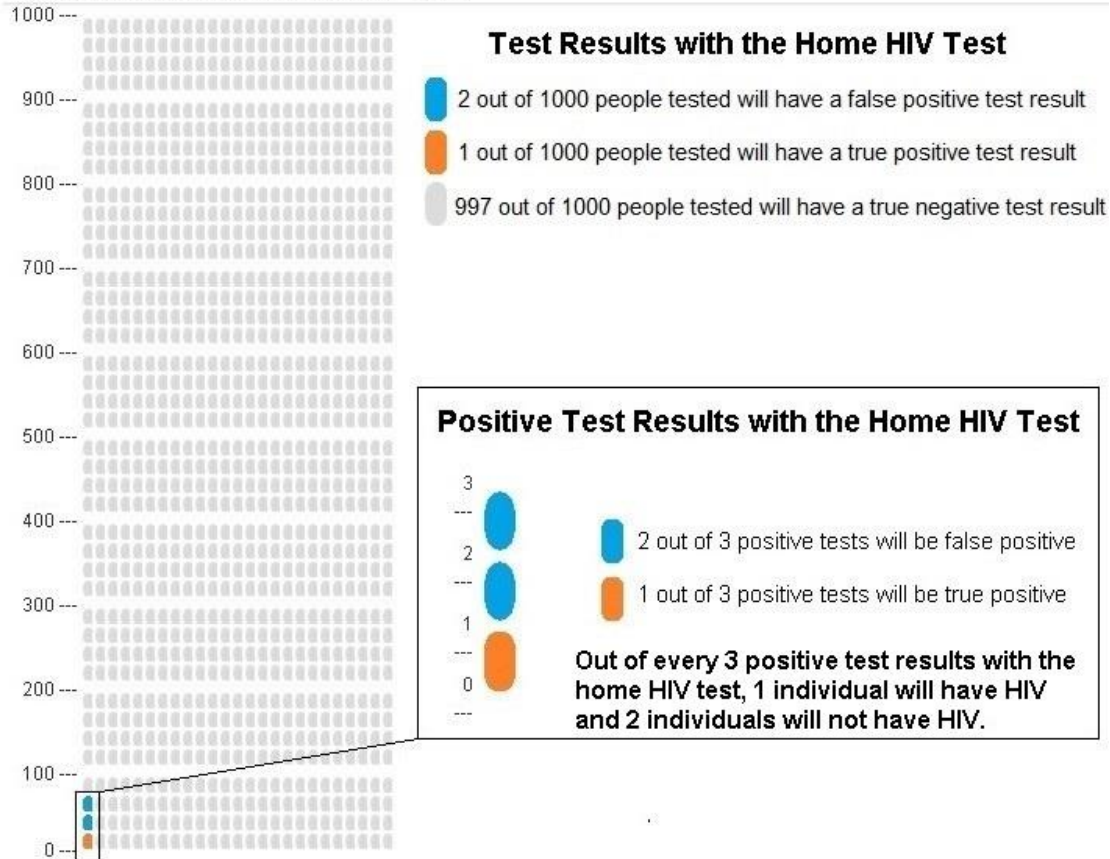
- Test Specificity is 99.8%
- Test Sensitivity is 99.3%
- If a random person gets a positive test result, what is the probability that they actually have HIV?
- Nearly everyone answers this question wrong... unless...



# Visual Aid

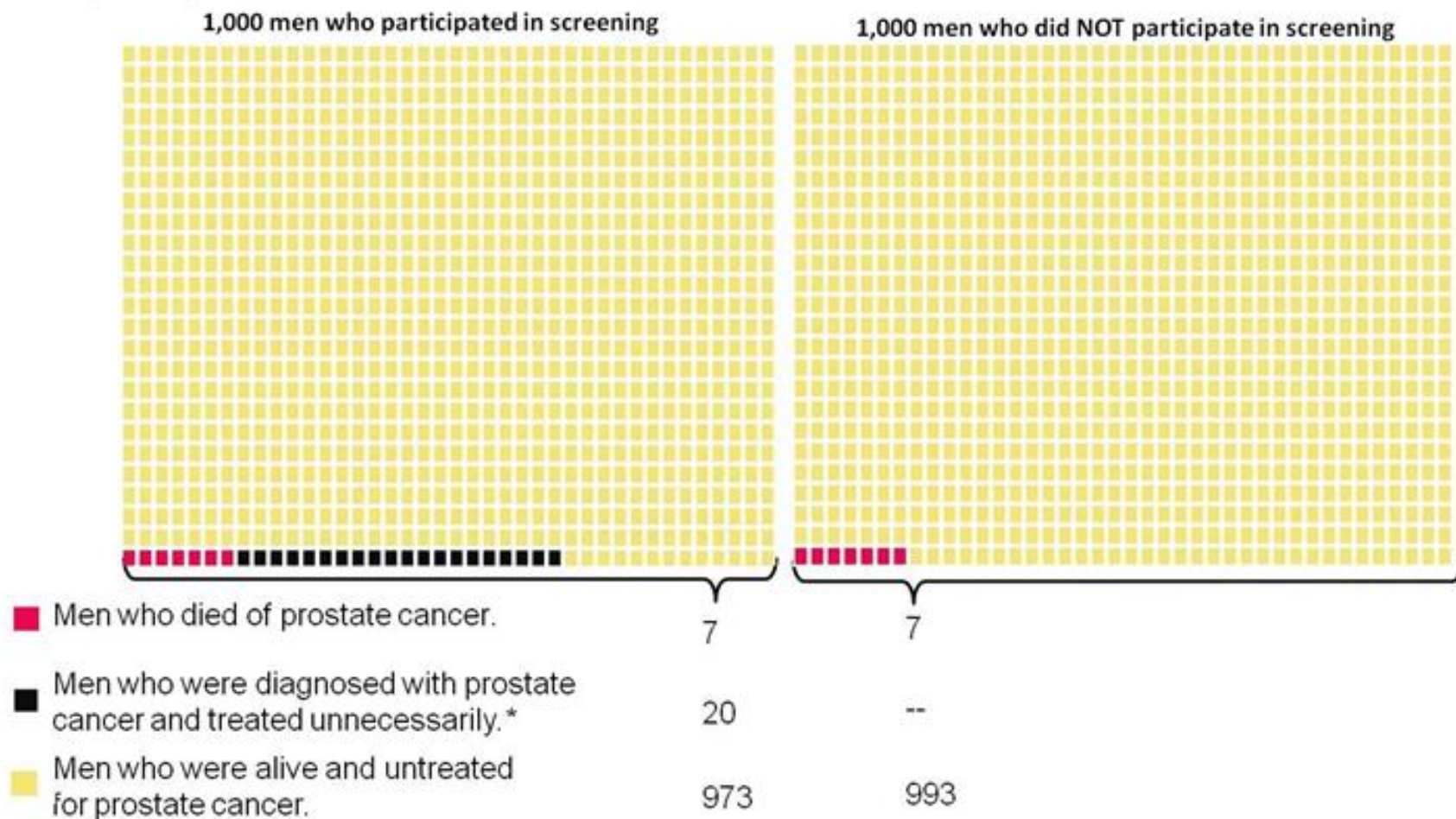
## HOME HIV TEST RESULTS

The following information represents 1,000 young adults in the United States tested for HIV with home HIV test.



# Prostate cancer screening with PSA and DRE tests

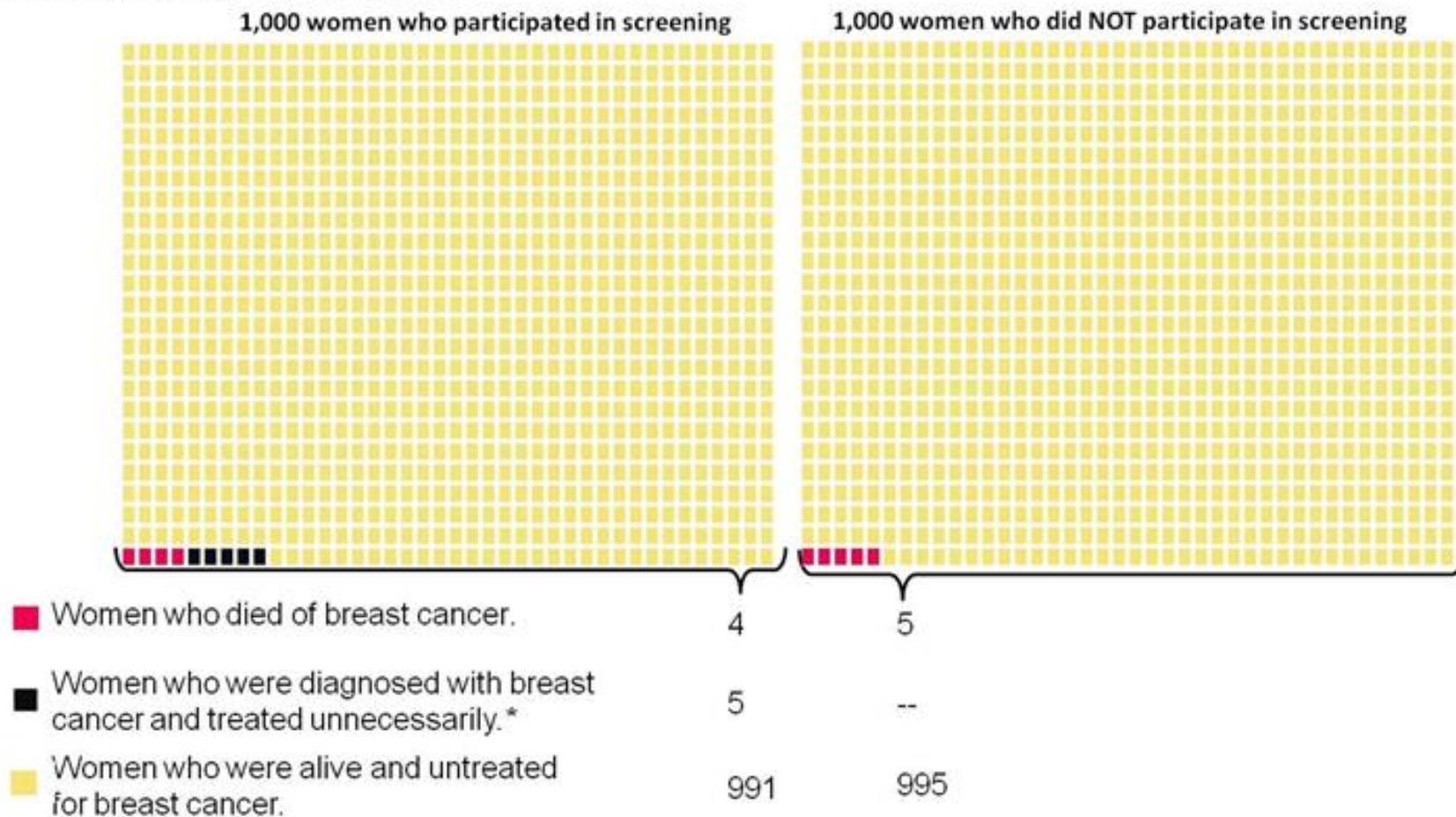
The data below represent men (50 years or older) participating or not in prostate cancer screening for 11 years. Each square represents one man.



\*Often with surgery to remove the prostate or radiation therapy which can cause incontinence or impotence.

# Breast cancer screening with mammography.

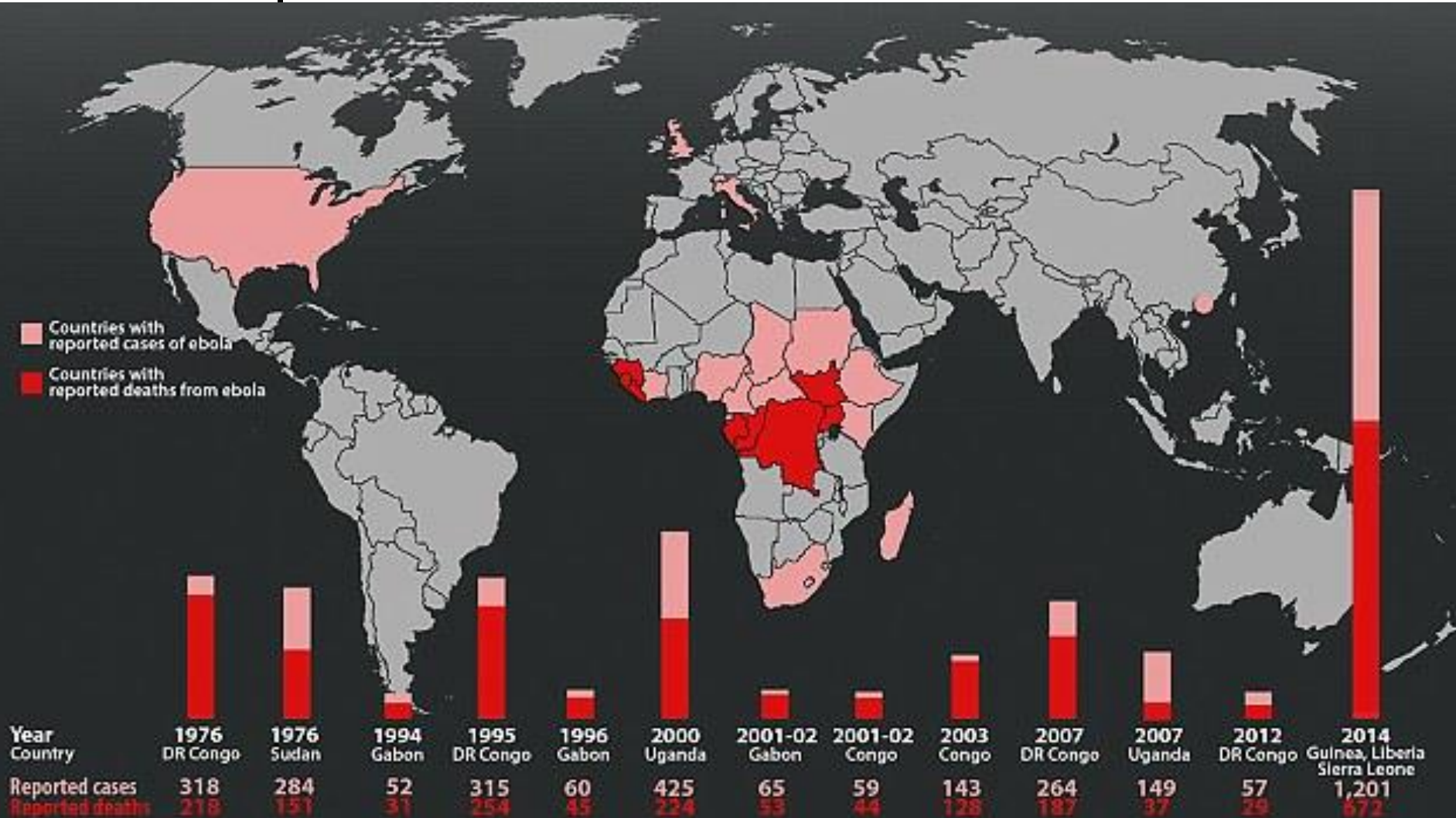
The data below represent women (50 years or older) participating or not in breast cancer screening for 10 years. Each square represents one woman.



\*Often with mastectomy (partial or complete removal of the breast), radiation therapy or chemotherapy, which can cause fatigue and pain.



# 2014 | WORST EBOLA OUTBREAK IN HISTORY



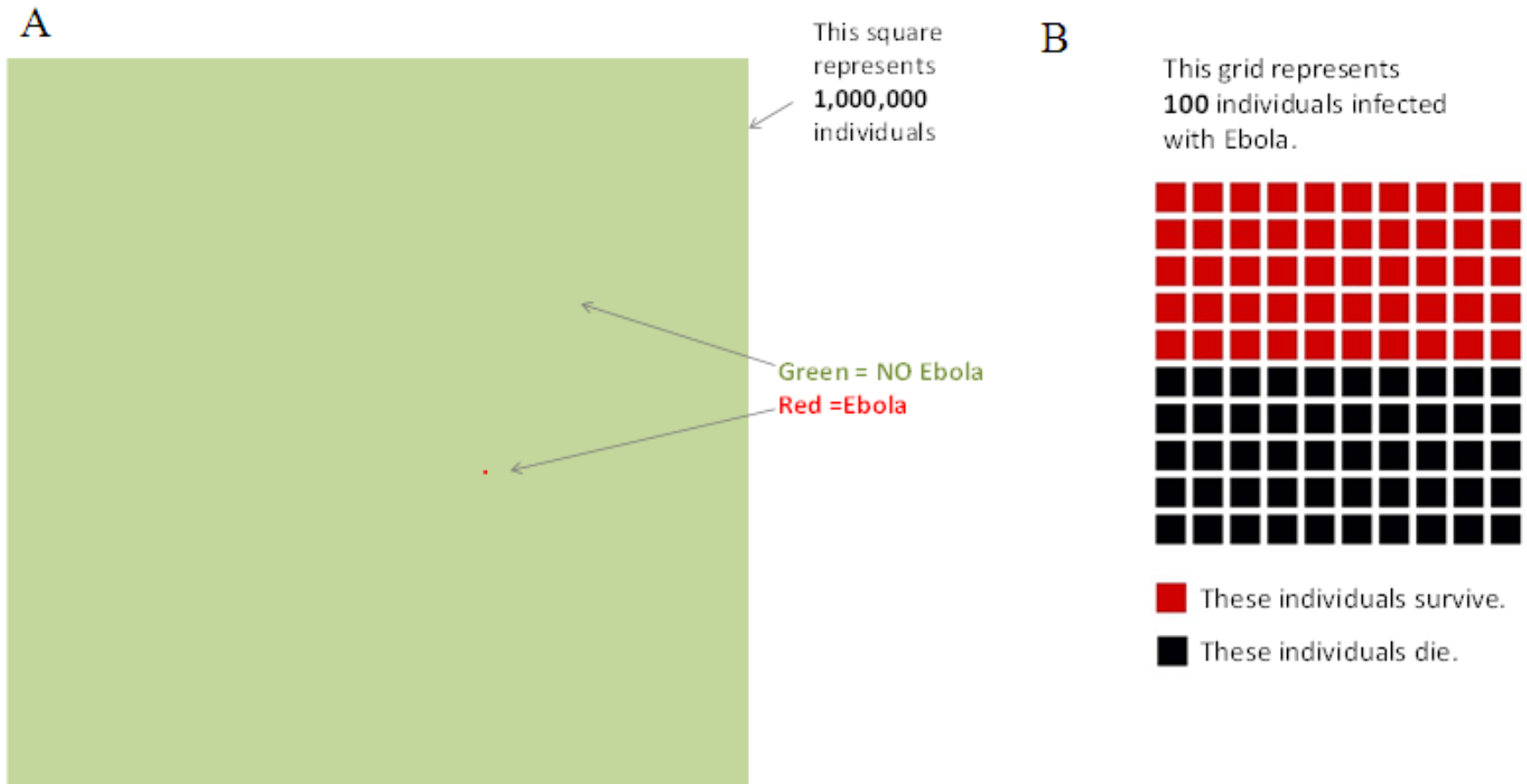
# September 29<sup>th</sup>, 2014

## Every country with confirmed Ebola cases

Sources: WHO, CDC



**Fig. 2.**



Visual aids used to illustrate the risk of getting infected with Ebola (A) and the risk of dying once infected (B). Statistics are from the World Health Organization (28).

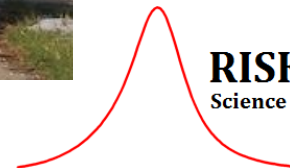


# Behavioral Intentions



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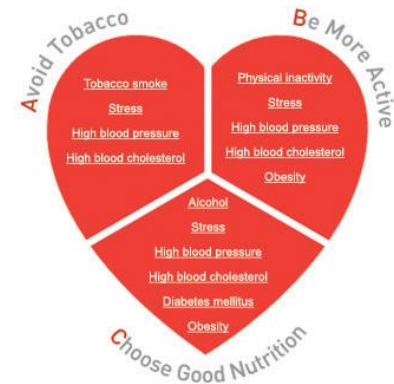


# Policy Recommendations



American  
**Heart**  
Association

American  
**Stroke**  
Association®



**KNOWLEDGE IS POWER**

**MY STORY**

The first time I got tested for HIV I found out I was positive. After I got the results, I sat there waiting for the nurse to tell me how much longer I had to live. Instead, she educated me about HIV/AIDS and told me that with treatment and care I can live a long life with HIV. She gave me hope and told me to never give up!

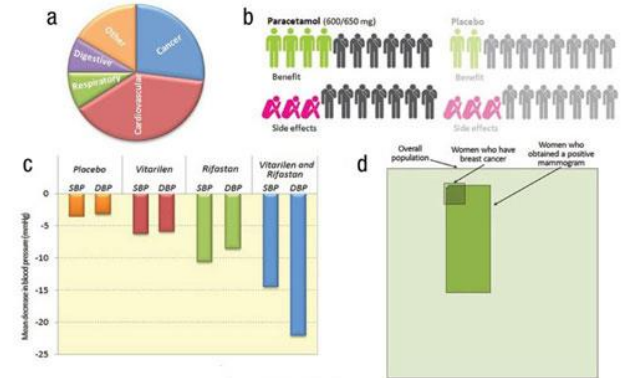
**IGOT TESTED**

**FIND FREE & LOW COST HIV TESTING**  
**512-972-5580**  
[HIVtest.org](http://HIVtest.org)

**AUSTIN AIDS**  
[greaterthan.org](http://greaterthan.org)

# Simple Visual Aids

- Particularly helpful among more vulnerable populations
- Non-native English speaking immigrant samples
- Older Adults
- High risk patients
- People with lower education levels
- As effective as best nudges
- As effective as leading 8 hour educational interventions



For Reviews See:  
Garcia-Retamero & Cokely, 2013  
Garcia-Retamero & Cokely, 2017

# Simple Psychometric Assessments: Numeracy Tests

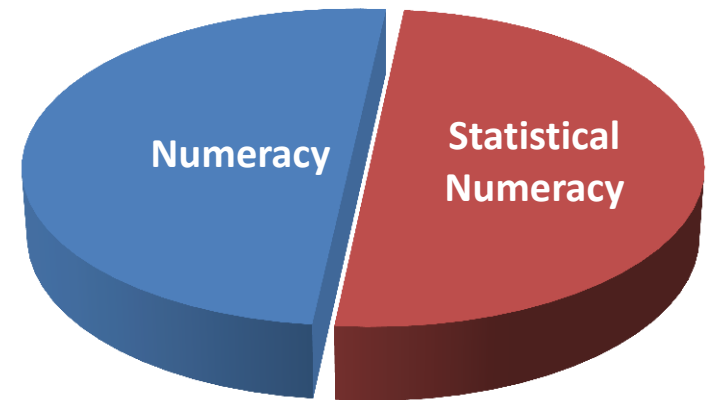
- Practical understanding of mathematics
- Numeracy is one of the strongest predictors of individual differences in *Risk Literacy*...

## For reviews see

Cokely et al. 2009, 2012, 2014

Peters et al. 2006, 2012

Reyna, et al. 2009

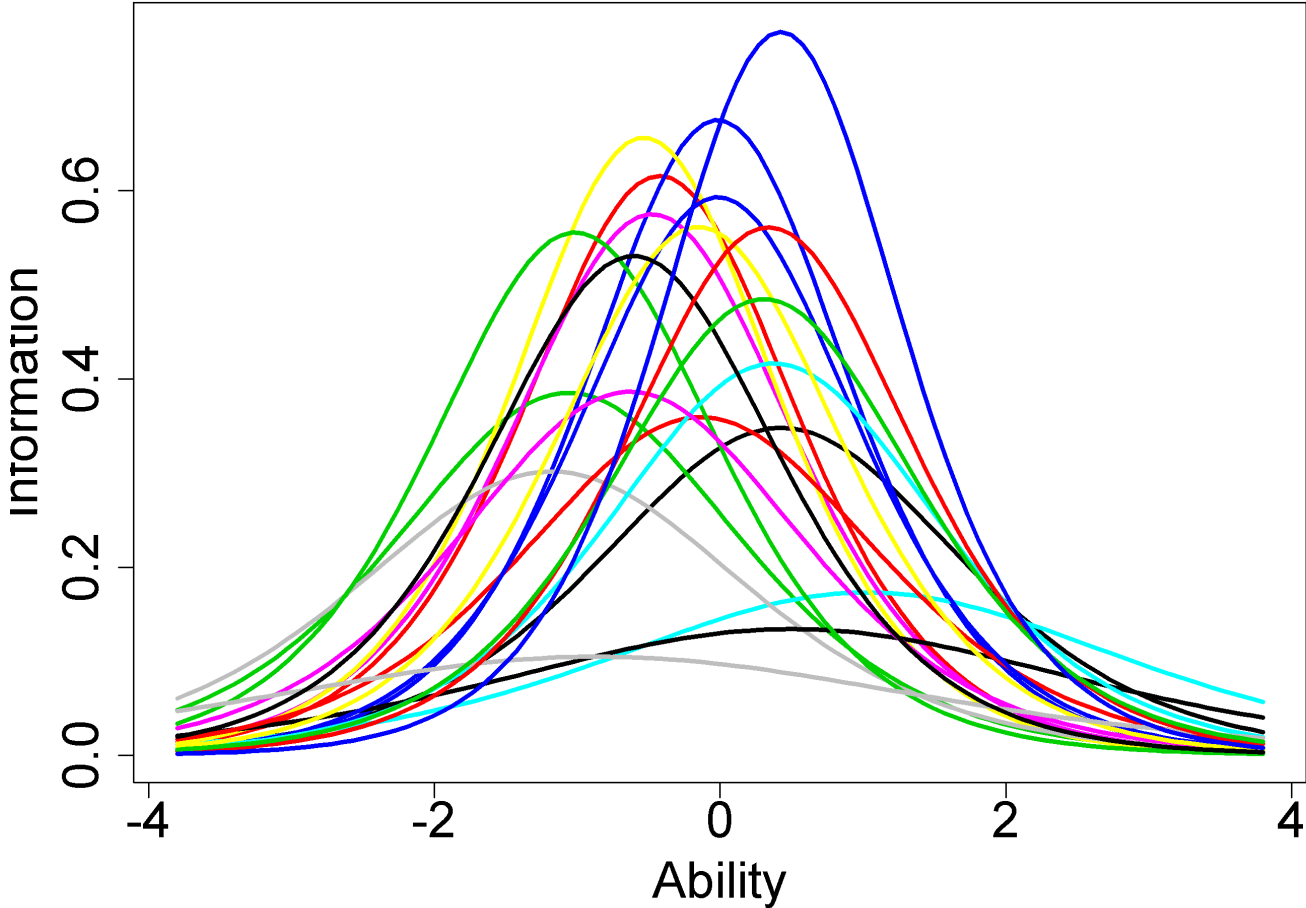


# Measuring Numeracy

- Which of the following numbers represents the biggest risk of getting a disease?
- \_\_\_ 1 in 100, \_\_\_ 1 in 1000, \_\_\_ 1 in 10
- 30% of Americans don't get it right...

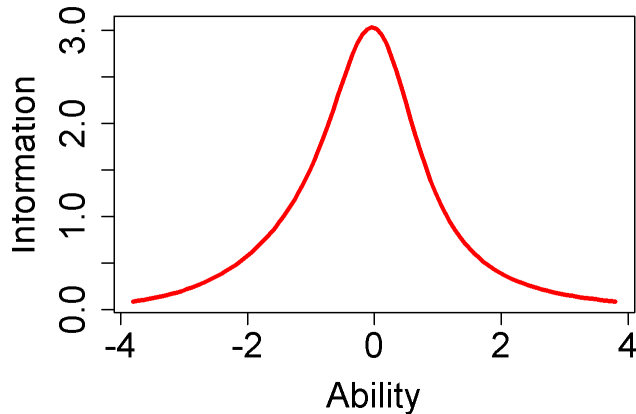
# Psychometrics: Item Response Theory

## Item Information Curves

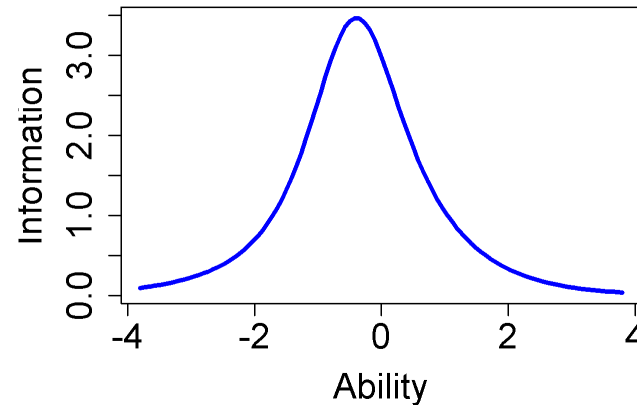


# Berlin Numeracy Components Test

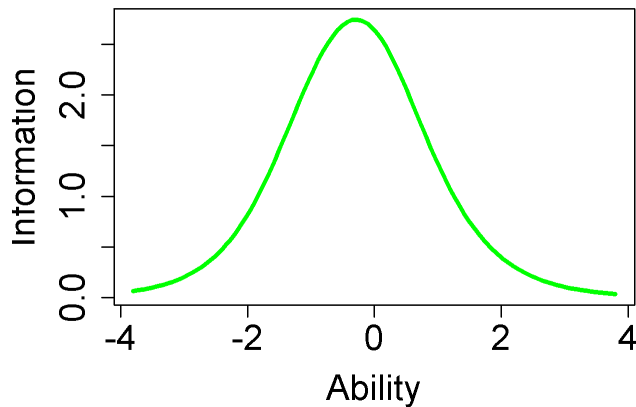
## Operations



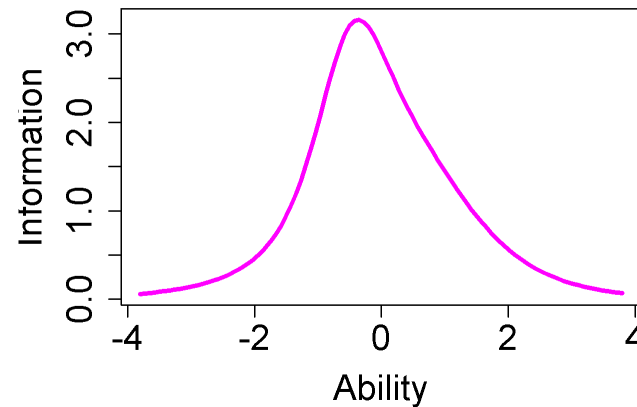
## Probability



## Geometry

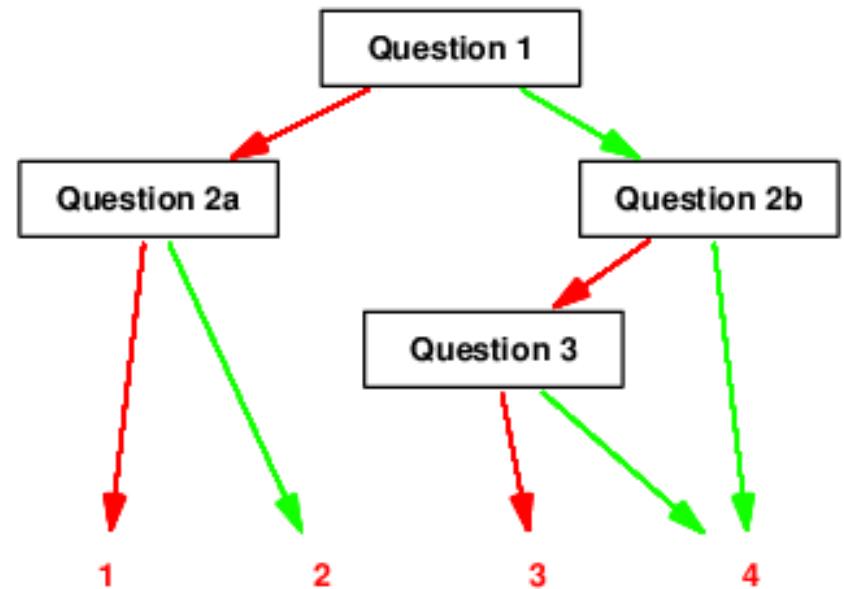


## Algebra



# The Berlin Numeracy Test

- Brief, Efficient Tests
- Adaptive Tests
  - Hard/easier depending on responses of user
- Takes < 2 minutes





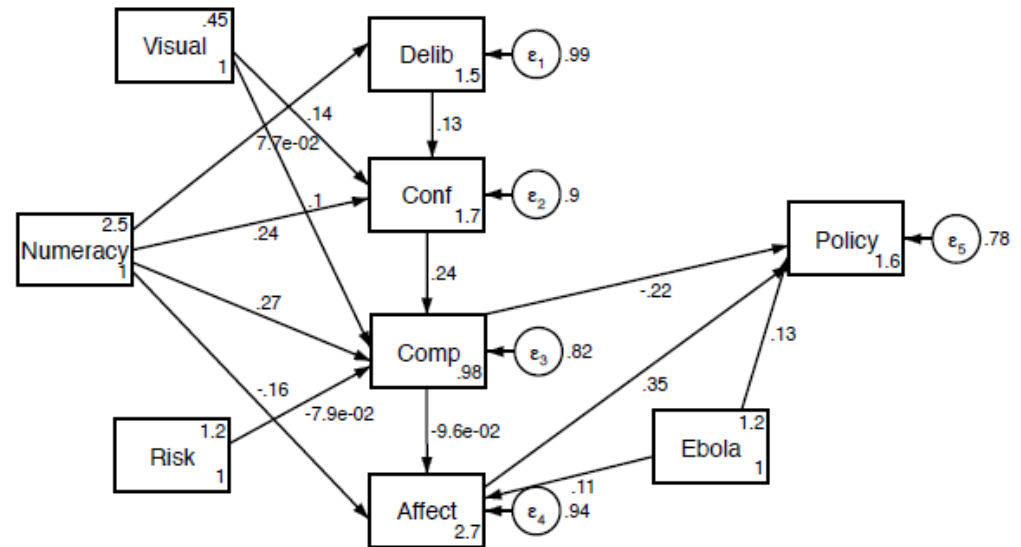
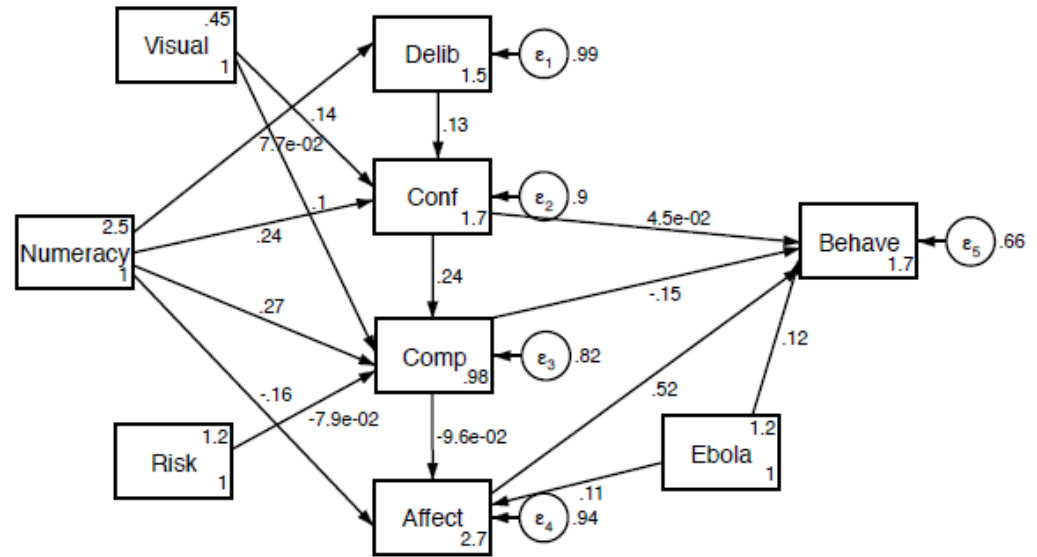
# The Berlin Numeracy Test

21 Studies ( $n = 5036$ )

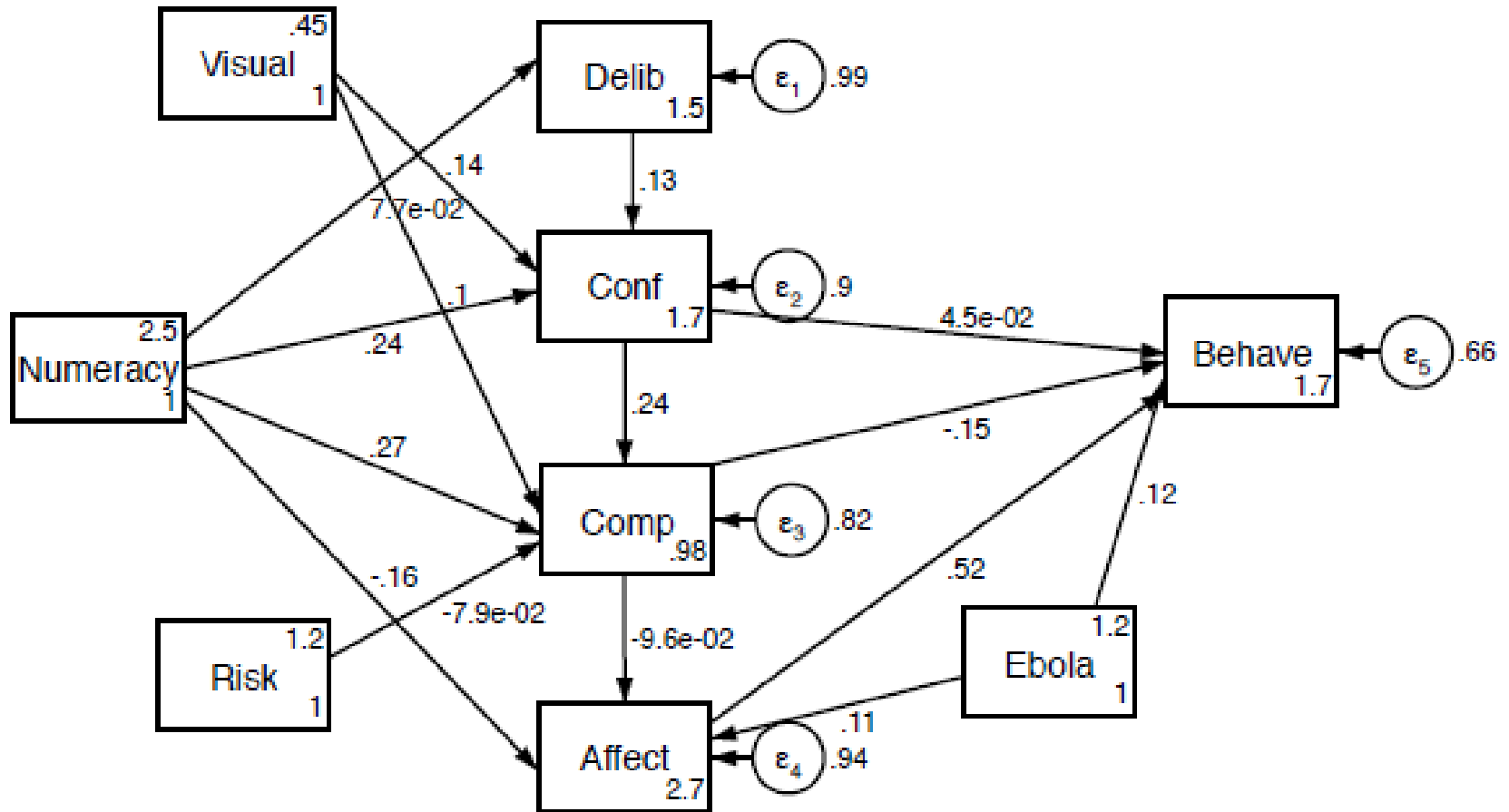
(Cokely et al., 2012)

- *Single best predictor of*
  - *Risk Literacy*
  - *General Decision Making Skill*
- Doubled the predictive power of instruments predicting
  - Evaluating medical treatment risks
  - Interpreting forecasts
  - Evaluating **non-numeric claims** about consumer products
- Predicted decisions independent of other general abilities
  - Fluid and Crystallized Intelligence
  - Attentional control & impulsivity

# Cognitive Process Models via Structural Equation Modeling

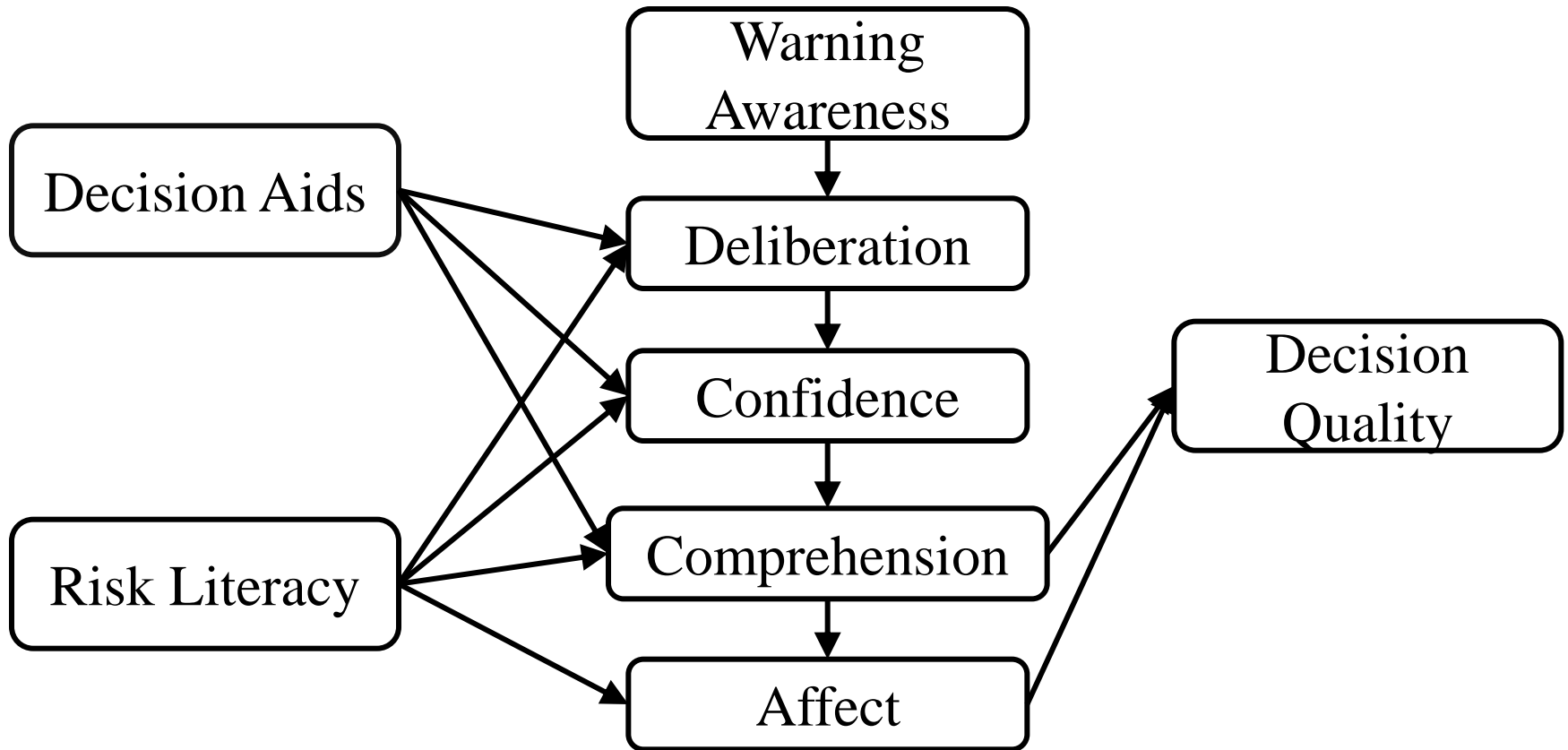


# Predicting Behavior



# A Model of Skilled & Expert Decision Making

(Cokely et al., 2017)



# Simple Decision Support

- Measurement
- Prediction
- Personalization
- Training
- Outreach





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## Do you understand risk?

Click below to find out how risk literate you are compared to educated people from around the world...

Take the 3 minute test in:

[English](#)

[German/Deutsch](#)

[Dutch/Nederlands](#)

[Spanish/Español](#)

### Find us on Facebook

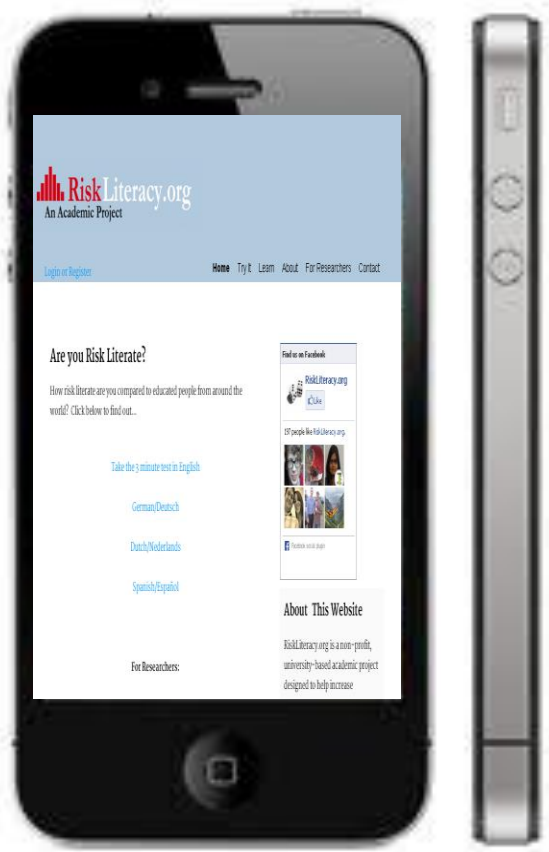


229 people like RiskLiteracy.org.



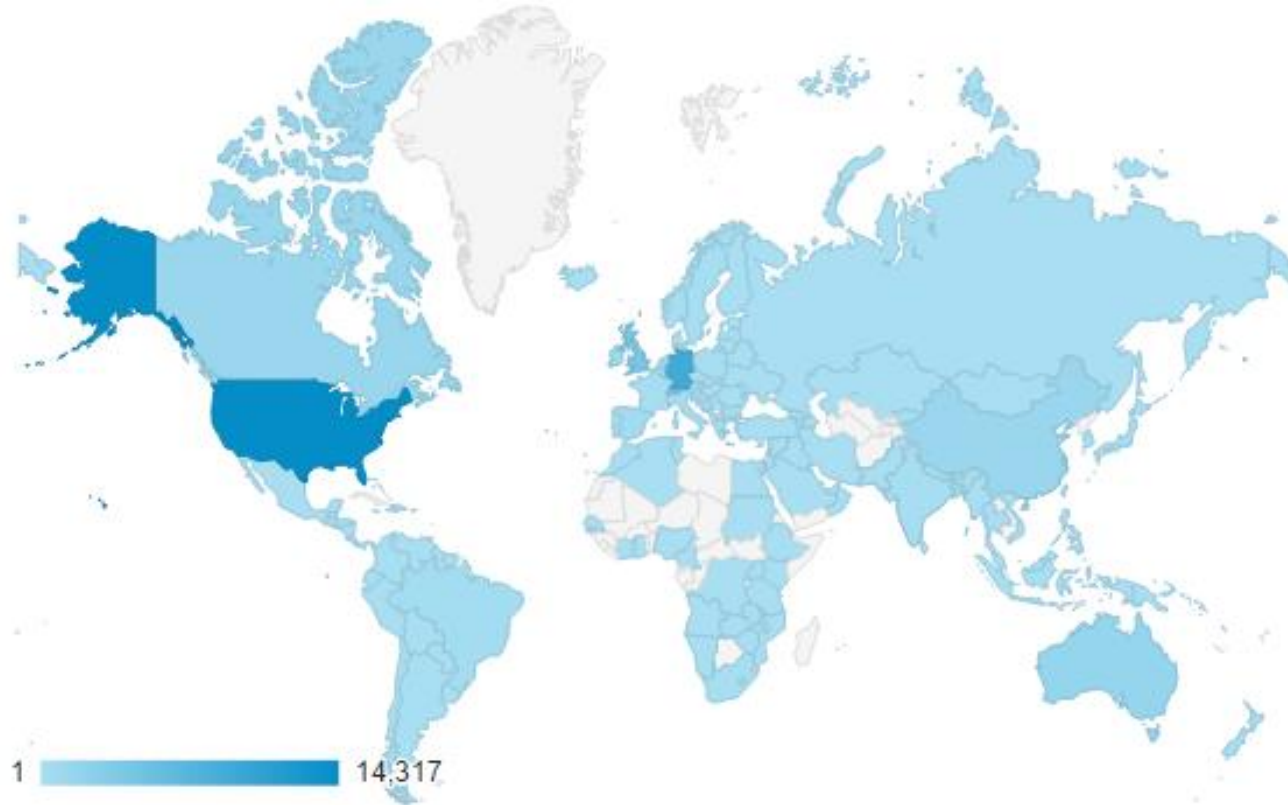
Facebook social plugin

### About This Website



# Since 2012 > 100,000 | 166 Countries

Sessions ▾



Primary Dimension: Country City Continent Sub Continent

Secondary dimension ▾

Search bar with a magnifying glass icon, the text "advanced", and a series of icons for grid, refresh, list, and other interface functions.

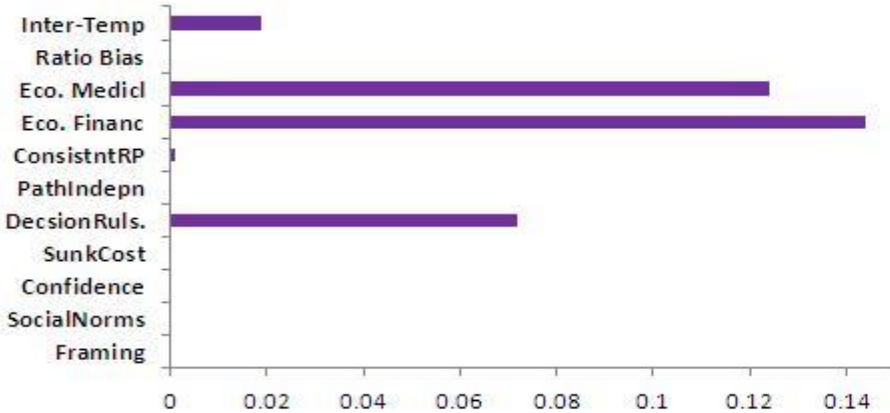
# RiskLiteracy.org Coalition



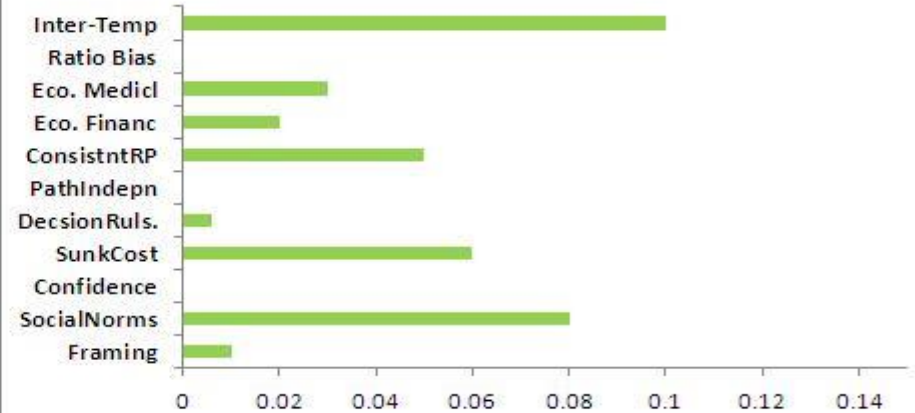


# Reverse Engineer Performance: Assess Decision Making Biases

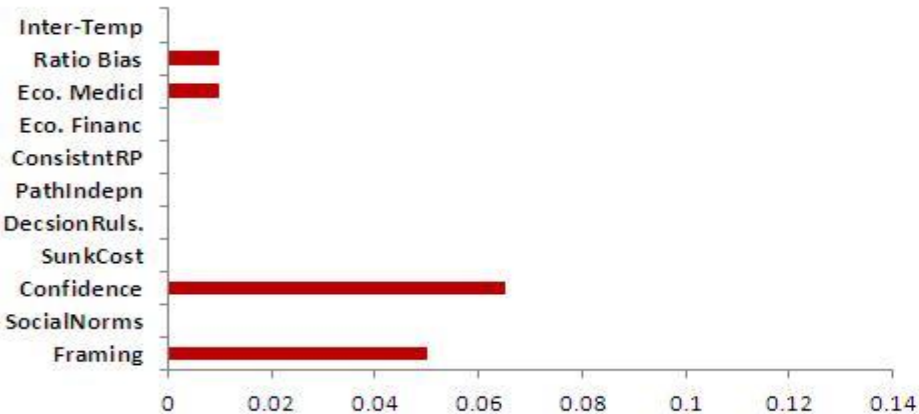
## Operatinos



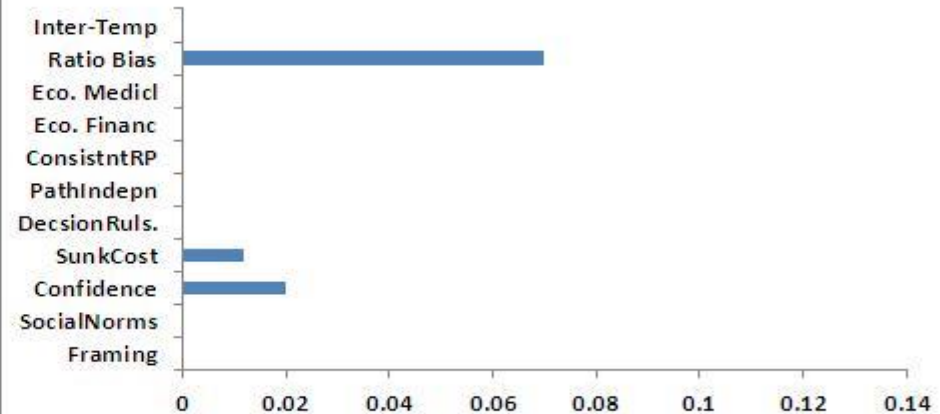
## Probability



## Geometry



## Algebra



# RiskLiteracy.org Adaptive Tutor

- Intelligent Risk and Science Comprehension Tutor
- Online Curriculum (e.g., K8-16 & beyond)





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Ever wonder what your Zombie IQ is? Who compares to other people's Zombie IQ? Even if you who really like zombies whereas others like them, ZombieIQ.org will help you answer those questions.

[The Zombie IQ test](#)

(a 3-item instrument testing your Zombie IQ)

[The SciFi Affinity Scale](#)

(an 8 item instrument testing your SciFi Affinity)

To learn more about your philosophical bent, visit [PhilosophicalCharacter.org](#).

## About

ZombieIQ.org is a non-profit, university-based organization designed to help increase awareness and understanding of science fiction and their real-world implications. This site features the Zombie IQ test and other interactive content, offering immediate scoring and feedback.



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# Numeracy Predicts Heart Attack Risks

- 1/3 of all deaths
- MANY people ignore heart attacks
- One numeracy question predicts risk of decision delay during ACS
- 2-3 times greater risk of death or major morbidity

## Golden Hour

- Maximum damage to heart muscle
- Maximum efficacy of treatment seen
- Survival is best if thrombolysis is given within this period

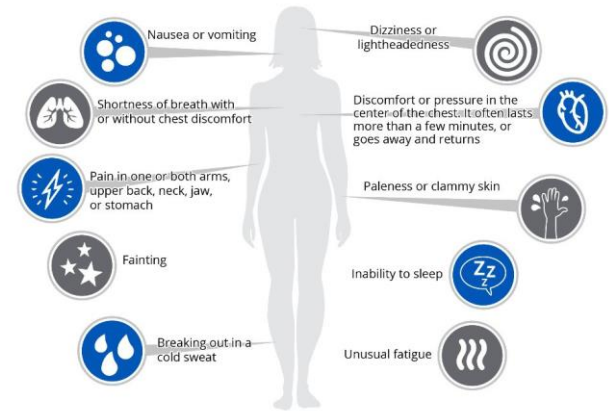
**“Time is muscle and muscle is time”**

**“Each minute of delay in the first 3 hours confers 10 lost days of survival”**

## SIGNS OF A HEART ATTACK

### Symptoms Every Woman Should Know and Pay Attention to

Women and men may differ in their experience of heart attack symptoms, as women are more likely to have unusual or “atypical” signs of a heart attack. Some of these may come and go before a heart attack occurs.



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[www.ACLSMedicalTraining.com](http://www.ACLSMedicalTraining.com)



# Numeracy IS a Vulnerability Index

## ~ “Risk Reading Level” ~

READING LEVEL CORRELATIONS		AGES	GRADE	GUIDED READING	R/R INTERVENTION	DRA	LEXILE
Foundation Level	Lilac	4-5	PreK-K	A	I	A	BR-70
Pre-Reading Level	Pink	4-5	PreK-K	A	I	A	BR-70
Emergent Level	Magenta	5-6	K	A-B	1-2	1-2	BR-70
Early Level 1	Red	5-6	K	B-D	3-5	3-6	BR-70
Early Level 2	Yellow	5-7	1	C-F	6-8	6-8	80-450
Early Level 3	Blue	6-7	1	D-H	9-11	8-12	80-450
Early Level 4	Green	6-7	1	F-J	12-14	12-14	80-450
Fluency Level 1	Orange	6-8	1	H-J	15-16	16	80-500
Fluency Level 2	Turquoise	6-8	1-2	I-K	17-18	18	80-500
Fluency Level 3	Purple	6-8	2	J-O	19-20	20-22	451-550
Fluency Level 4	Gold	6-8	2	K-N	21-22	20-28	501-650
Advanced Fluency 1	Silver	7-10	3	N-O	23-24	30-34	651-770
Advanced Fluency 2	Emerald	7-10	4	P-Q	25-26	38-40	731-830
Advanced Fluency 3	Ruby	8-11	4	R-S	27-28	40	801-860
Advanced Fluency 4	Sapphire	8-11	5	T-U	29-30	50	861-980

# Understandability Indices

Preventing Influenza in Adults and Adolescents | Tamiflu® (oseltamivir phosphate)

For Patients and Caregivers | For Pharmacists | Important Safety Information | Search Tamiflu | Go

Tamiflu  
oseltamivir phosphate  
treat, prevent, protect.

Influenza Management | Prescribing Tamiflu | Clinical Information | Physician Resources

## Preventing Influenza in Adults and Adolescents

**PRESCRIBING TAMIFLU**

Treating Influenza in Adults and Adolescents

Preventing Influenza in Adults and Adolescents

Administration and Storage for Adults and Adolescents

Side Effects and Safety for Adults and Adolescents

Treating Influenza in Children Aged 1-12 Years

Preventing Influenza in Children Aged 1-12 Years

Administration and Storage for Children Aged 1-12 Years

Side Effects and Safety for Children Aged 1-12 Years

Extemporaneous Preparation

### Preventing Influenza in Adults and Adolescents Aged 13 Years and Older

If you have a patient with flu symptoms, you can take action to protect family members by prescribing Tamiflu as a prophylaxis.<sup>1</sup>

**Indication**

Tamiflu is indicated for prophylaxis of influenza in patients 1 year and older.<sup>1</sup>

**Flu prevention for your practice and your patients' family members<sup>22</sup>**

Treatment	Household influenza cases (%)
placebo	24 of 200 household contacts
TAMIFLU prophylaxis	2 of 205 household contacts

92% reduction (P<.0001)

**Did you know?**  
In a clinical study, Tamiflu prophylaxis usage reduced post-exposure flu transmission in adults and adolescents aged 13 years and older by 92%.<sup>22</sup>

**Learn more >**

**Indications and Usage**

**Treatment of influenza.**  
Tamiflu is indicated for the treatment of uncomplicated acute illness due to influenza infection in patients 1 year and older who have been symptomatic for no more than 2 days.

**Prophylaxis of influenza.**  
Tamiflu is indicated for the prophylaxis of influenza in patients 1 year and older.

**Limitations of Use**  
The following points should be considered before initiating treatment or prophylaxis with Tamiflu:

- Efficacy of Tamiflu in patients who begin treatment after 48 hours of symptoms has not been established.
- Tamiflu is not a substitute for

FLU LEVEL IN YOUR AREA | Learn More | FLU ALERTS EMAIL UPDATES | Sign Up | CDC View CDC Guidelines >

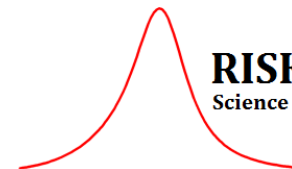
According to the graph, TAMIFLU prevents flu infections for 92 out of 100 people (92%)

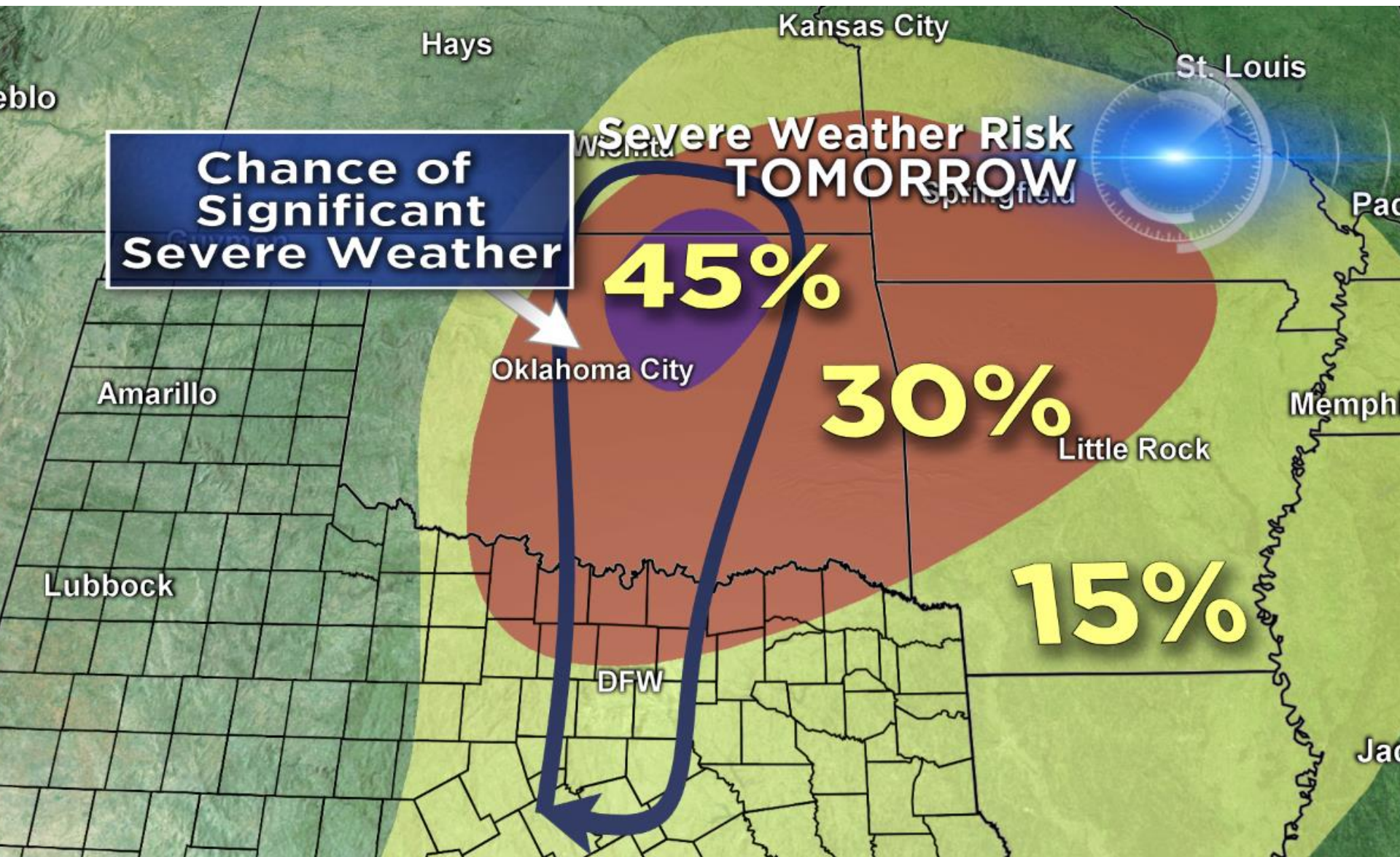
There is an alternative medicine which competes with TAMIFLU. This medicine prevents infections for 22 out of 100 people. Imagine you are trying to prevent the flu. Taking into account the information on the graph, which medicine would you prefer to take?

What was the maximum value represented on the y axis?

(N = 422 residents of the United States, Amazon's Mechanical Turk)

	Graph Liter	Y-Axis Fixations	Total Fixations	Memory
Perfor	.342**	.366**	.350**	.556**
Memor	.463**	.412**	.476**	





# Tornado Risk Literacy

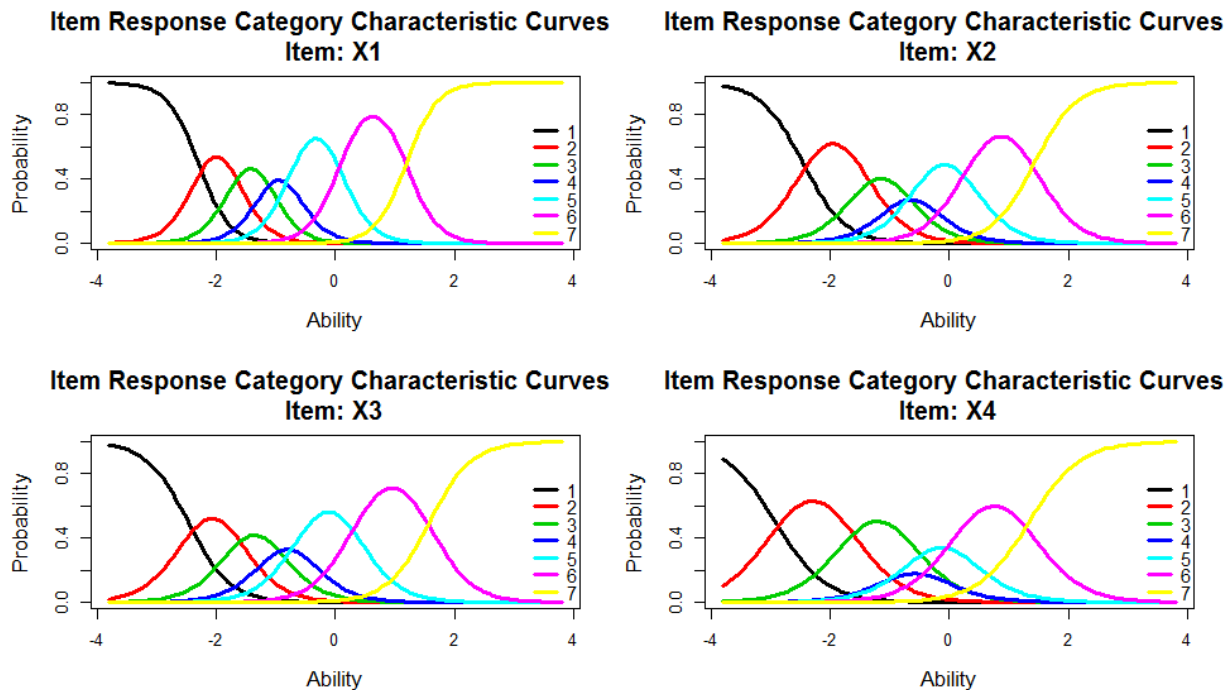
- What kinds of knowledge reduce risks and biases?
- How do people prepare and how should they prepare?
- What about other risk factors (e.g., age, lifestyle)
- What kinds of information is most useful and why?
- Do people actually get warning messages?





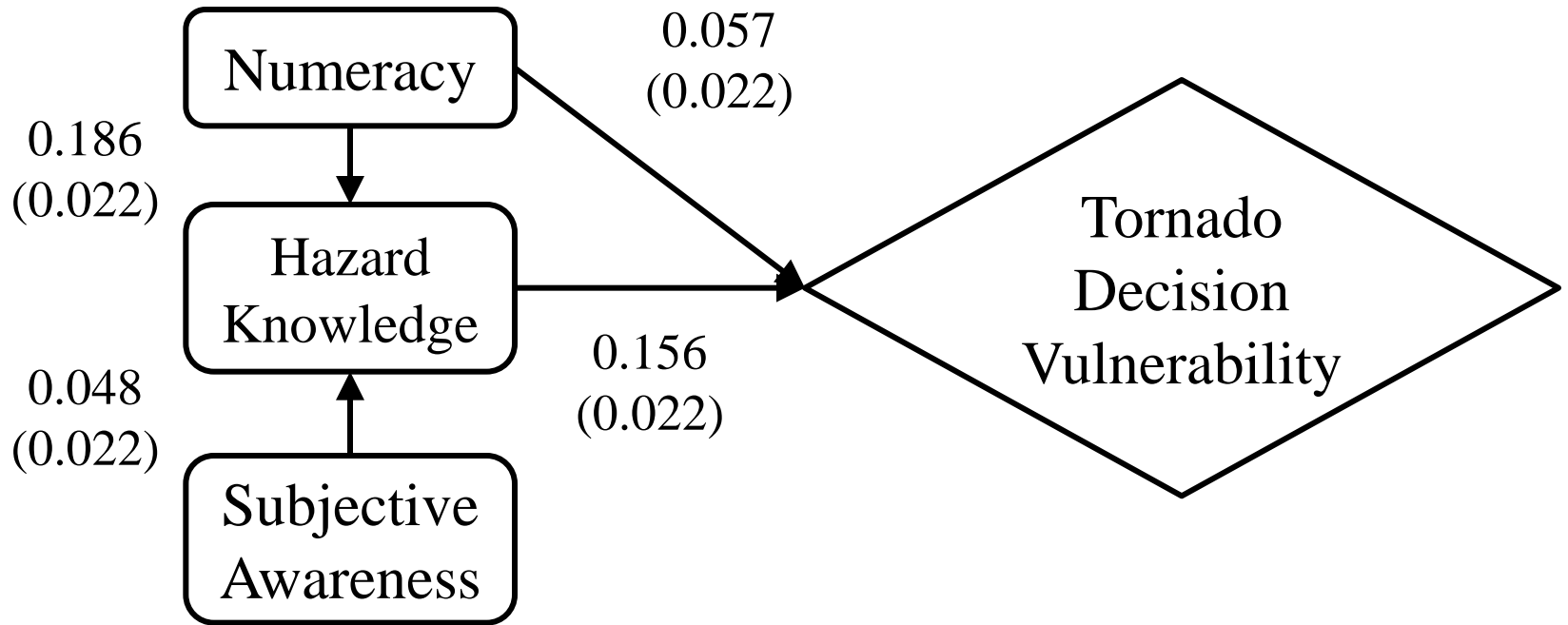
# Subjective Warning Awareness

1. I receive all important weather and hazard alerts issued in my area.
2. I never miss important weather or hazard warnings issued for my area.
3. I usually know about weather and hazard alerts as soon as they are issued.
4. I sometimes miss important weather and hazard warnings.\*

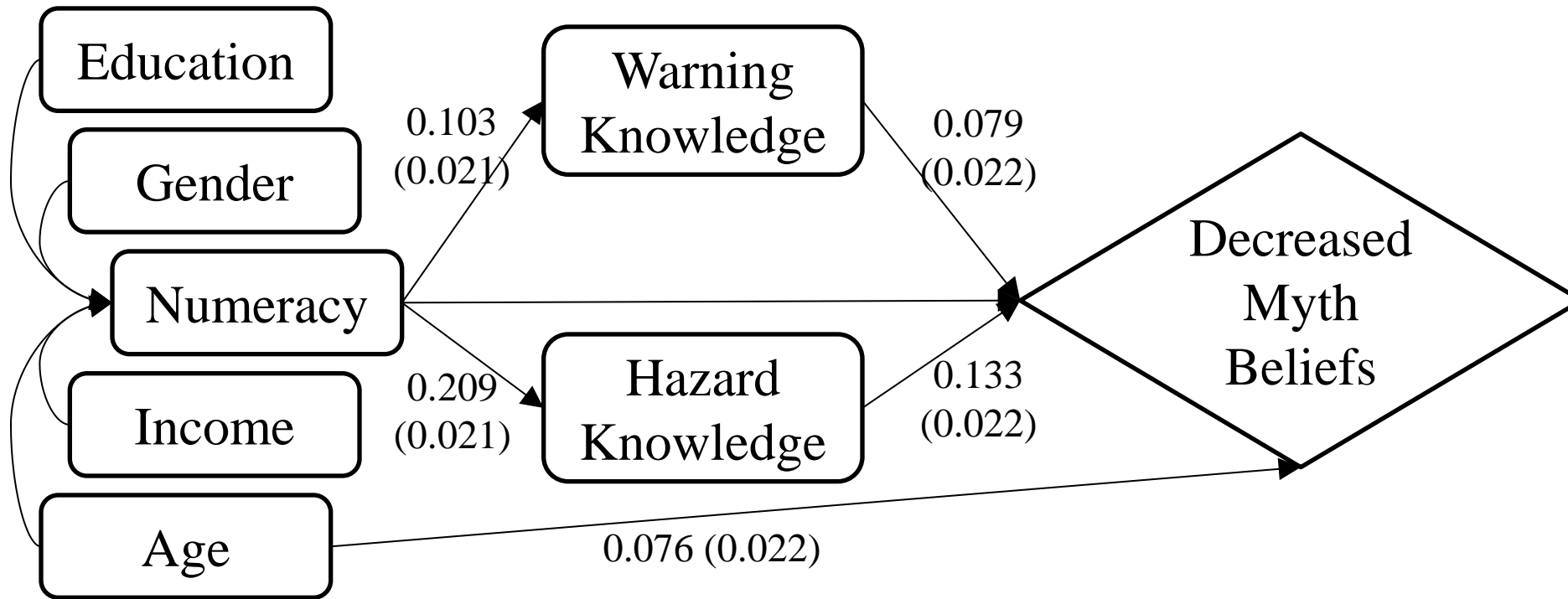


# Warning Awareness

Vulnerability = Belief in Tornado Myths



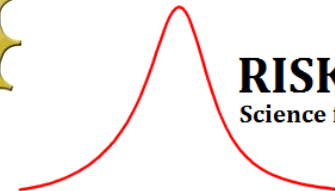
# PREDICT & EXPLAIN BELIEF IN TORNADO MYTHS



# Simple Decision Support can have a big impact...



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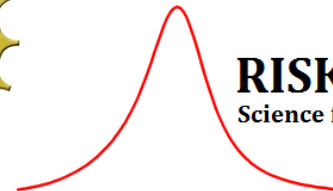


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# Simple Decision Support can have a big impact... IF



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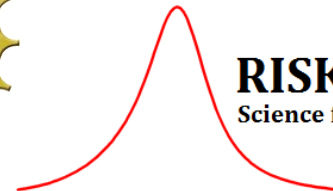
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# Simple Decision Support can have a big impact... IF

1. Identify the decision we want to improve (and why)



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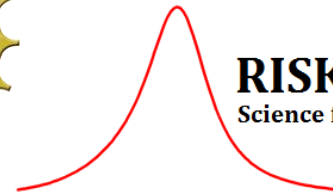
# Simple Decision Support can have a big impact...

## IF

1. Identify the decision you want to improve (and why)
2. Assess User Needs, Capabilities, and Processes



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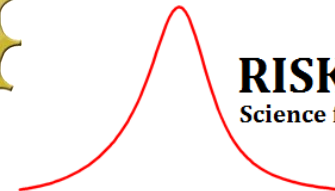


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# Thanks!



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