

Numeracy/Quantitative Literacy

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Definitions

- **Numeracy**
 - mathematical skills that "enable an individual to cope with the practical demands of everyday life"

Wilfred H. Cockcroft, *Mathematics Counts*. 1986

- **Health numeracy**
 - The degree to which individuals have the capacity to access, process, interpret, communicate, and act on numerical, quantitative, graphical, biostatistical, and probabilistic health information needed to make effective health decisions

Bandolier





Components of adult numeracy

- **1. Context** — the use and purpose for which an adult takes on a task with mathematical demands
- **2. Content** — the mathematical knowledge that is necessary for the tasks confronted
- **3. Cognitive and Affective** — the processes that enable an individual to solve problems, and thereby, link the content and context



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Context for numeracy

- **Personal**

- Practical
 - Mortgage rates
- Leisure
 - Sudoku; solitaire, gambling

- **Workplace**

- Required to perform job

- **Further learning**

- Needed for further study in mathematics, or the sciences

- **Societal**

- Civic benefits, philosophy, art
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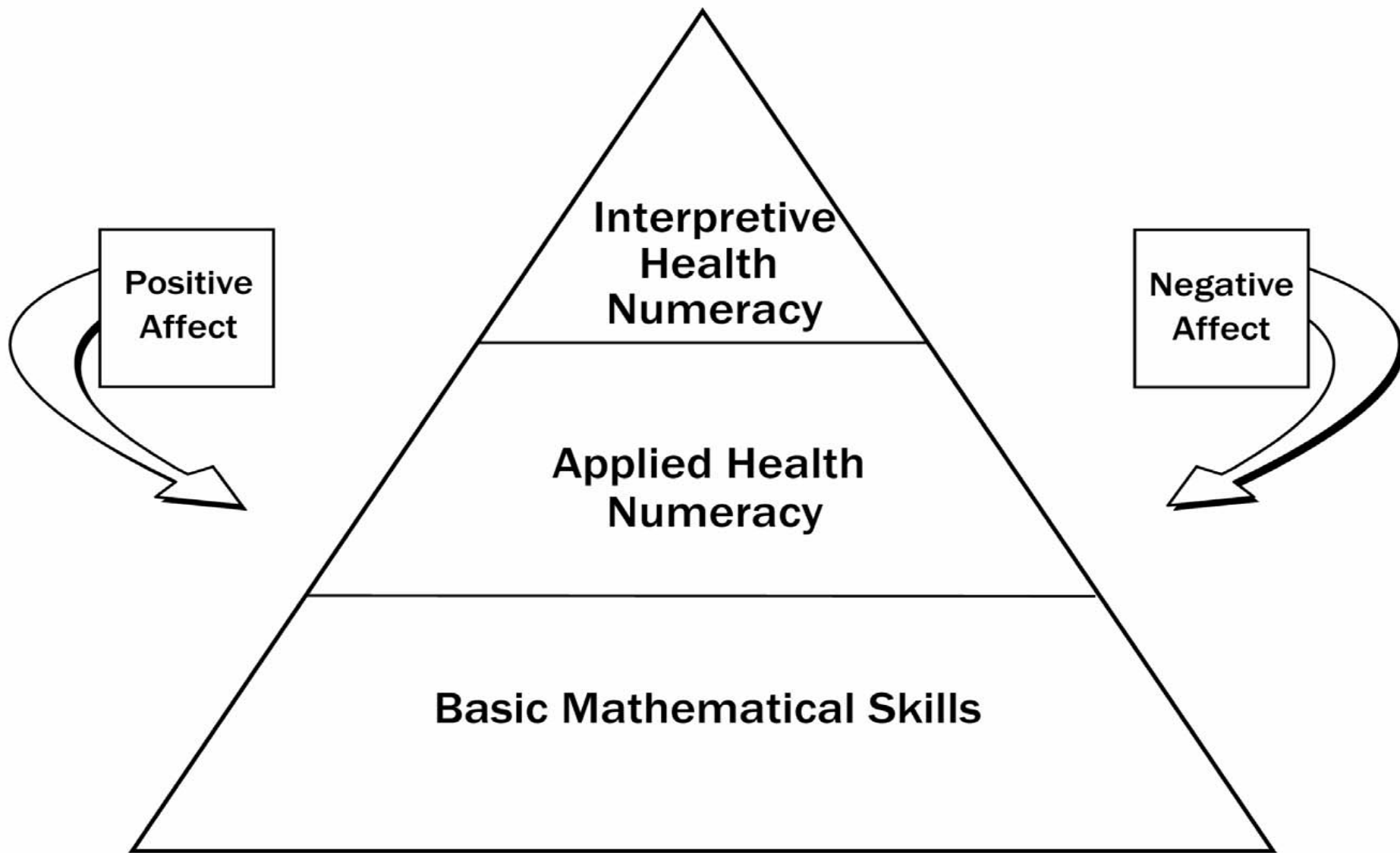
NCSALL





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2003 International Adult Literacy and Lifeskills Survey (ALL)

Literacy

Country	Score
Norway	293
Bermuda	285
Switzerland	274
Canada	281
United States	269
Italy	228

Numeracy

Country	Score
Switzerland	290
Norway	285
Bermuda	270
Canada	272
United States	261
Italy	233



Score is significantly higher than the U.S. average.

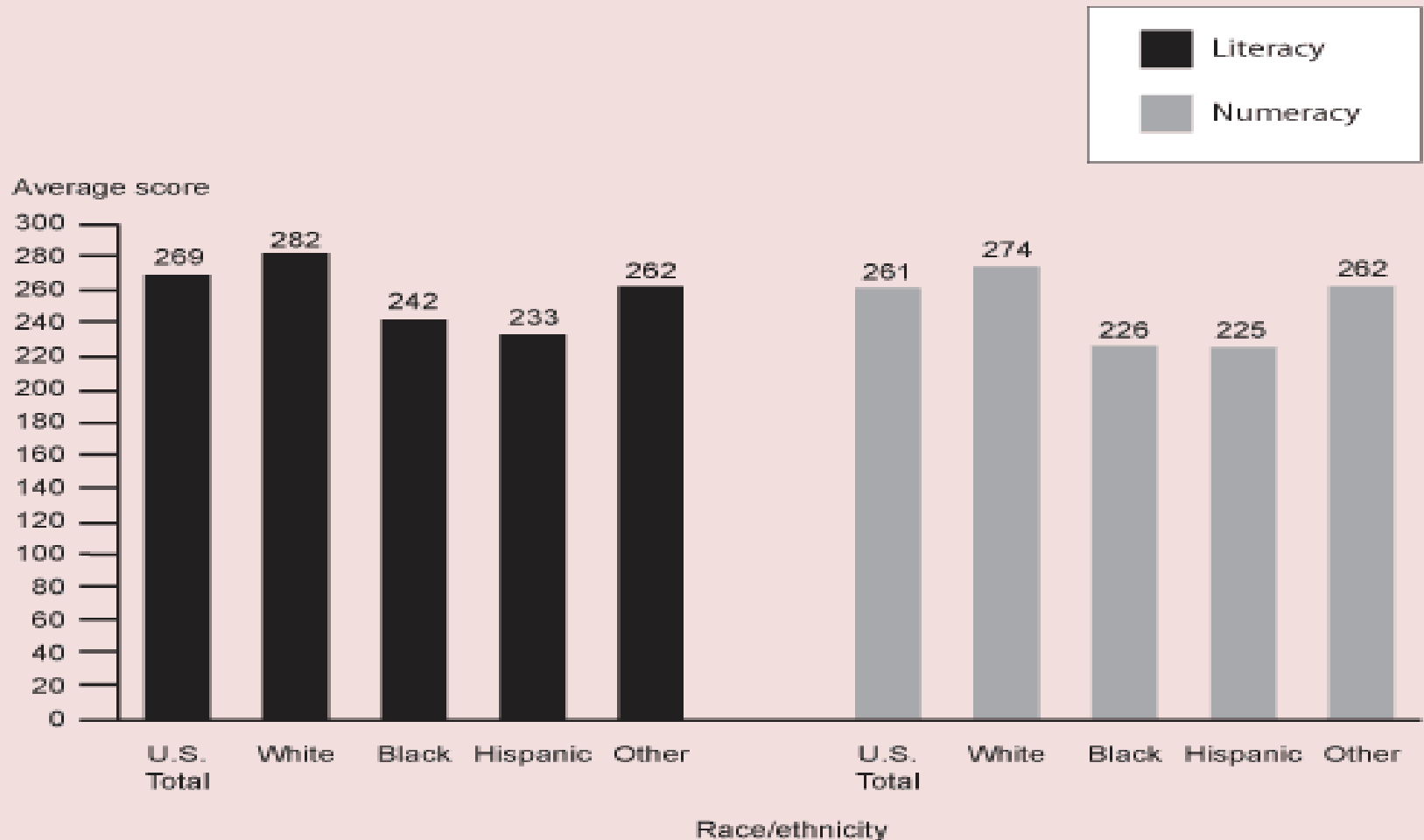


Score is not significantly different from the U.S. average.



Score is significantly lower than the U.S. average.

2003 International Adult Literacy and Lifeskills Survey (ALL)



National Assessment of Adult Literacy (NAAL)

A nationally representative and continuing assessment of English language literary skills of American Adults

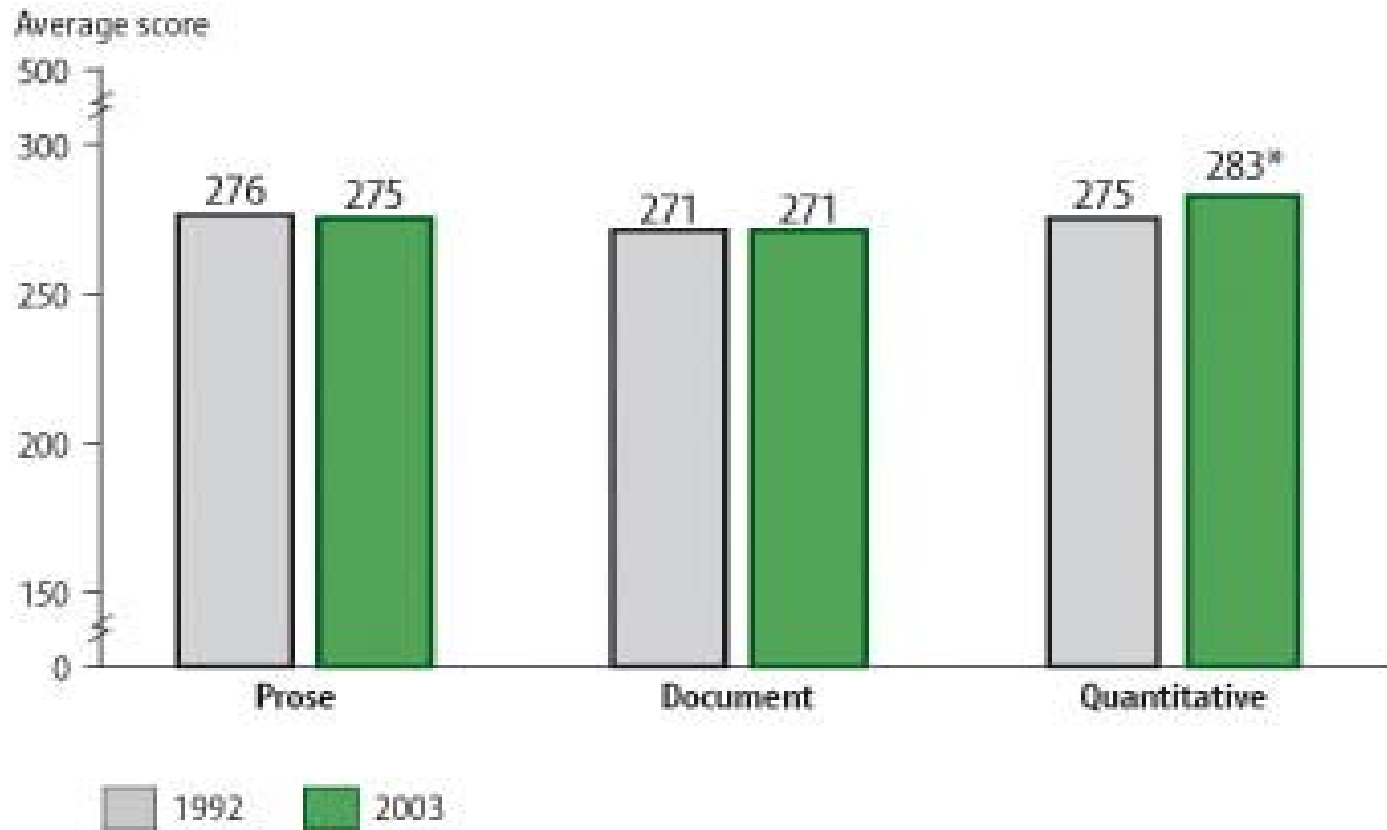
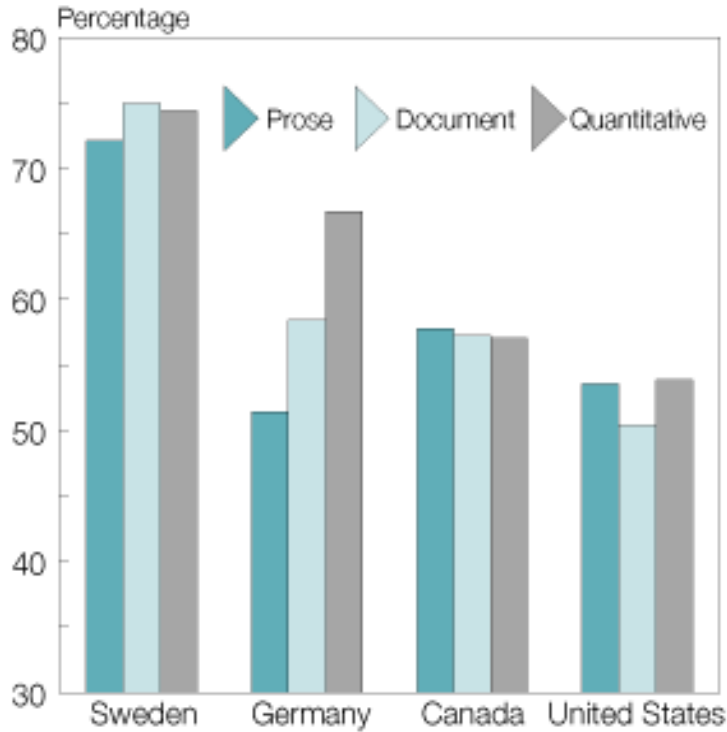


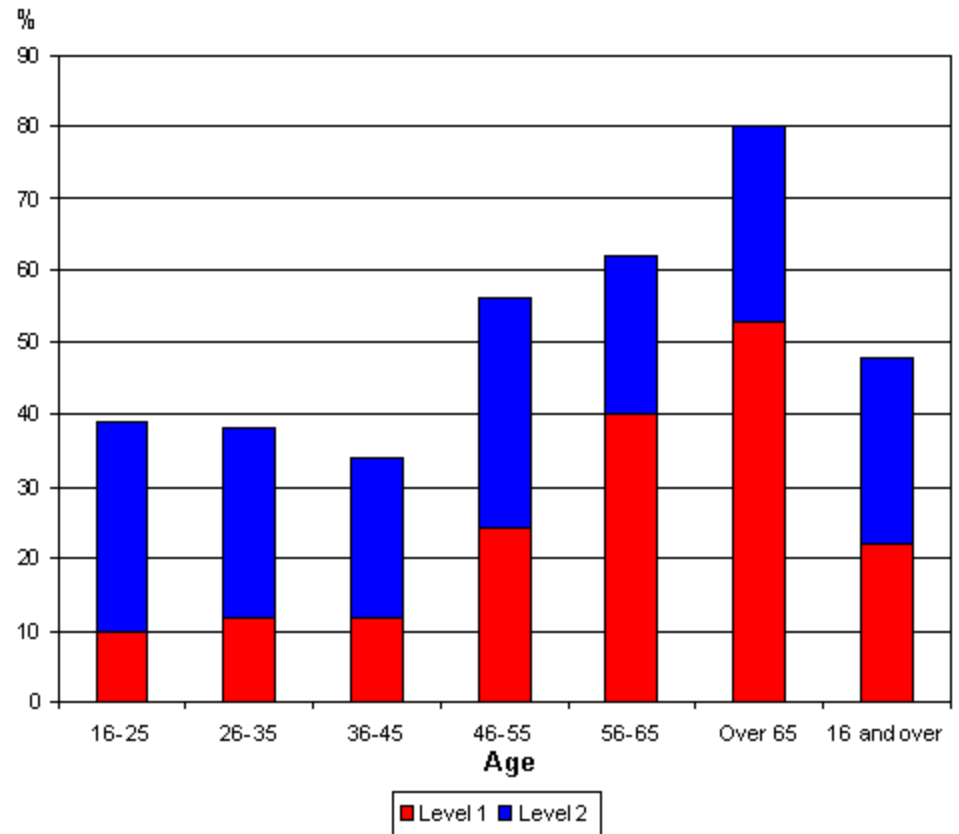


Figure 2.6
Population Aged 16 to 65 Performing
at Minimum Threshold and Above,
Canada, 1995





Note: Minimum threshold (level 3) corresponds roughly to successful high school completion.
 Source: OECD and HRDC, Literacy Skills for the Knowledge Society, 1997.

Quantitative literacy, 1994



Source: Statistics Canada, International Adult Literacy Survey, 1994
 Reading the Future: A Portrait of Literacy in Canada, catalogue no. 89-551-XPE.

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- According to the 2006 National Assessment of Adult Literacy, over a third of Americans have only a basic or below-basic ability to make decisions about their health
 - Kutner, Greenberg, Jin, & Paulsen, 2006
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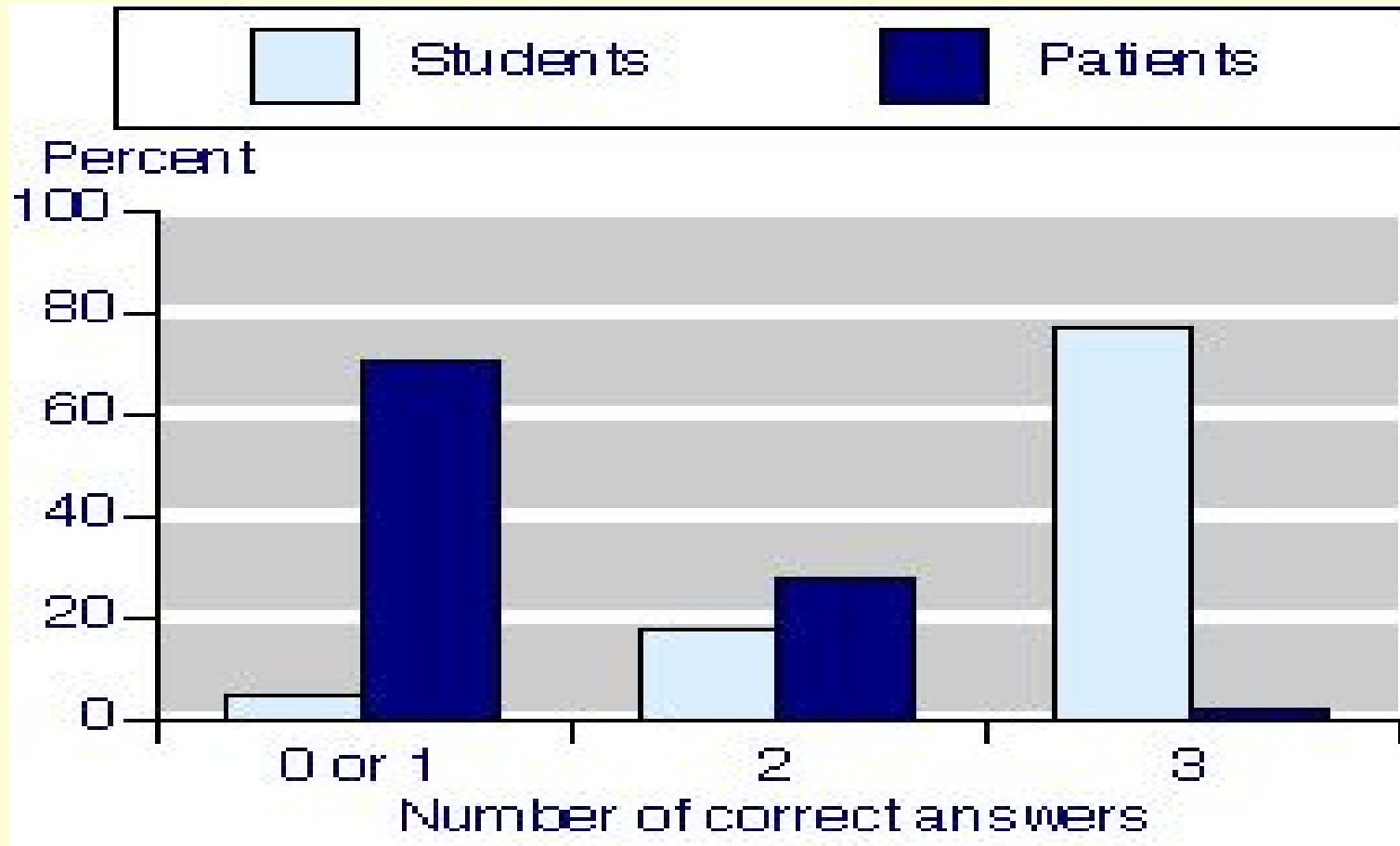



SL Sheridan, M Pignone. Numeracy and the medical student's ability

to interpret data. *Effective Clinical Practice* 2002 5: 35-40

- Imagine that we flip a coin 1000 times.
What is your best guess about how many times the coin would come up heads?
 1000×0.5
500
 - In the lottery, the chance of winning a prize is 1%.
What is your best guess about how many people would win a prize if 1000 people each buy a single ticket to the lottery?
 $1/100 = X/1000$
10/1000
 - In the publishing sweepstake, the chances of winning a car is 1 in 1000.
What percent of tickets to the publishing sweepstake wins a car?
 $1/1000 = X/100$
0.10%
-

Numeracy as measured in medical students and patients



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- **Patients older than 50 years attending anticoagulation management units had significantly poorer control of INR when they had low numeracy skills, while low literacy made no difference**
 - CA Estrada et al. Literacy and numeracy skills and anticoagulant control American Journal of Medical Science 2004 328: 88-93 de no difference
 - **When asked which of 5% or 1 in 20 sounded bigger, 81% thought 1 in 20 sounded bigger in context of prenatal diagnosis of chromosome abnormalities**
 - L Abramsky, O Fletcher. Interpreting information: what is said, what is heard – a questionnaire study of health professionals and members of the public. Prenatal Diagnosis 2002 22: 1188-1194
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Asthma as an example

- What types of numerical skills might a patient with asthma need?





**Apter, et al (2006) Asthma numeracy skill
and health literacy J Asthma 43:705-710**


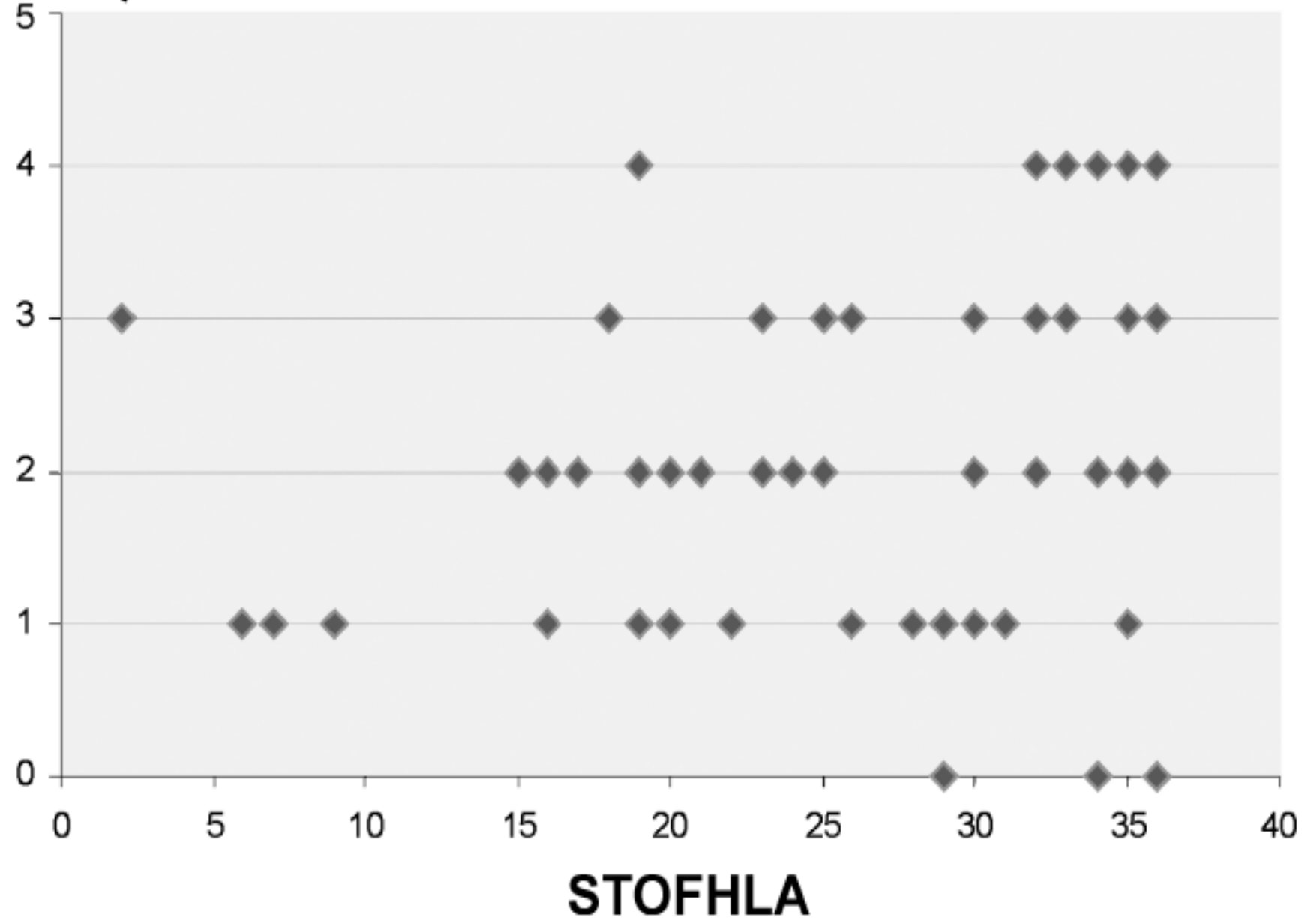
- **73 subjects**
 - **Mean age 47**
 - **85% female**
 - **58% African American**
 - **62% High school education or less**
- 

TABLE 2.—4-Item Asthma Numeracy Questionnaire

	No. of participant with correct response (<i>n</i> = 73)
Here are some examples of statements or questions that patients might hear in a doctor's office:	
1. Your doctor asks you to take 30 mg of prednisone every day for a week. The pharmacist gives you a bottle of 5 mg tablets. How many pills should you take each day?	61
2. If a patient has a 1% chance of developing osteoporosis or bone loss: that means	28
a. out of 1,000 patients, one will develop bone loss	
b. out of 100 patients, one will develop bone loss	
c. out of 10 patients, one will develop bone loss	
d. out of 5 patients, one will develop bone loss	
e. the patient will develop bone loss	
f. the patient will never develop bone loss	
3. You have a peak flow meter. Your Danger or Red Zone is 50% of your best reading. Your best reading is 400 L/min. What is your Danger Zone? <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> L/min or less	52
4. You are told the Green Zone (the OK zone) is a reading between 80% and 100% of your best reading. Your Worry Zone is between 50% and 80% of your best reading. Your best reading is 400 L/min. When are your readings in the Worry Zone?	21
a. Between 300 and 400 L/min	
b. Between 200 and 320 L/min	
c. Between 200 and 300 L/min	
d. Between 240 and 320 L/min	
e. Between 100 and 300 L/min	



ANQ





What can we do?

- **Fuzzy trace theory**
 - Reasoning follows two processes
 - One that is precise
 - One that is the “gist”
 - **Harnessing the power of gist**
 - Explain quantities *qualitatively*
 - Display information visually



Resources

- The components of numeracy
 - http://www.ncsall.net/fileadmin/resources/research/op_numeracy.pdf
 - Laboratory for Rational Decision Making:
 - <http://www.human.cornell.edu/che/HD/reyna/index.cfm>
 - National Cancer Institute Basic and Applied Decision Making website:
 - http://dccps.nci.nih.gov/bbrb/ba_decision_making.html
 - Steen LA (1990). Daedalus 19:2 (Spring 1990) 211-231
 - <http://www.aris.com.au/cgea/>
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