Numeracy/Quantitative Literacy

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Definitions

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

• 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

NCSALL
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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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### 2003 International Adult Literacy and Lifeskills Survey (ALL)

#### Literacy

<table>
<thead>
<tr>
<th>Country</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway</td>
<td>293</td>
</tr>
<tr>
<td>Bermuda</td>
<td>285</td>
</tr>
<tr>
<td>Switzerland</td>
<td>274</td>
</tr>
<tr>
<td>Canada</td>
<td>281</td>
</tr>
<tr>
<td><strong>United States</strong></td>
<td><strong>269</strong></td>
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<tr>
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<td>228</td>
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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

Quantitative literacy, 1994

Note: Minimum threshold (level 3) corresponds roughly to successful high school completion.

Source: Statistics Canada, International Adult Literacy Survey, 1994
*Reading the Future: A Portrait of Literacy in Canada*, catalogue no. 88-551-XPE.
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
• Imagine that we flip a coin 1000 times. What is your best guess about how many times the coin would come up heads? 
  1000 x 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

![Bar chart showing the number of correct answers among students and patients. The chart indicates a higher percentage of students having 0 or 1 correct answers compared to patients, with a notable spike among patients having 3 correct answers.](chart.png)
• 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
d• 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
Asthma as an example

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

• 73 subjects
  • Mean age 47
  • 85% female
  • 58% African American
  • 62% High school education or less
<table>
<thead>
<tr>
<th>Question</th>
<th>Correct Answers</th>
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<tbody>
<tr>
<td>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?</td>
<td>61</td>
</tr>
<tr>
<td>2. If a patient has a 1% chance of developing osteoporosis or bone loss:</td>
<td>28</td>
</tr>
<tr>
<td>a. out of 1,000 patients, one will develop bone loss</td>
<td></td>
</tr>
<tr>
<td>b. out of 100 patients, one will develop bone loss</td>
<td></td>
</tr>
<tr>
<td>c. out of 10 patients, one will develop bone loss</td>
<td></td>
</tr>
<tr>
<td>d. out of 5 patients, one will develop bone loss</td>
<td></td>
</tr>
<tr>
<td>e. the patient will develop bone loss</td>
<td></td>
</tr>
<tr>
<td>f. the patient will never develop bone loss</td>
<td></td>
</tr>
<tr>
<td>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?</td>
<td>52</td>
</tr>
<tr>
<td>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?</td>
<td>21</td>
</tr>
<tr>
<td>a. Between 300 and 400 L/min</td>
<td></td>
</tr>
<tr>
<td>b. Between 200 and 320 L/min</td>
<td></td>
</tr>
<tr>
<td>c. Between 200 and 300 L/min</td>
<td></td>
</tr>
<tr>
<td>d. Between 240 and 320 L/min</td>
<td></td>
</tr>
<tr>
<td>e. Between 100 and 300 L/min</td>
<td></td>
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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

Reyna & Farley, 2006
Resources

• The components of numeracy
  • [http://www.ncsall.net/fileadmin/resources/research/op_numeracy.pdf](http://www.ncsall.net/fileadmin/resources/research/op_numeracy.pdf)

• Laboratory for Rational Decision Making:

• National Cancer Institute Basic and Applied Decision Making website:
  • [http://dccps.nci.nih.gov/bbrb/ba_decision_making.html](http://dccps.nci.nih.gov/bbrb/ba_decision_making.html)
