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14 June 2005 MAA PREP   1

Statistical Literacy Survey Results

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We all Count: Quantitative Literacy Efforts and Approaches
IASSIST Conference
University of Michigan
26 May 2006
www.icpsr.umich.edu/iassist

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QL
Numbers in Context

"The essence of QL is *to use mathematical and logical thinking in context.*" Lynn Steen 2004

QL is about "numbers in context."

Context can be modeled mathematically
Numbers can be real yet be spurious
Numbers can change if context changes

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Statistical Literacy:
Numbers in Context

Statistical literacy:
   studies math tools that control for context.

1. Quantities measure importance
2. Arithmetic comparisons *control for* context
3. Ratios *take into account* context
4. Comparisons of ratios *control for* context
5. **Standardizing *controls for* context**

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#1:
Numbers Indicate Significance

Descriptions
- Napoleon was short
- Napoleon was 5' 2" tall*

Ordinal vs. arithmetic comparison
Accidental death is
- more likely for men than for women.
- about 3 times as likely for men as for women

* In French feet. 5' 6.5" in English measure.

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Simple Arithmetic Comparisons

Three is 200% -- 2 times -- more than One.

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#3:
Ratios Control For Context

Part-whole ratios are conditional probabilities.
- $P(B|A) = P(A \cap B)/P(A) = $ Part B /Whole A

Algebra is clean and unambiguous.
Ordinary English is messy and ambiguous
But people speak English – not Algebra

Are these the same?
1. The percentage of men **WHO ARE** runners
2. The percentage of men **AMONG** runners

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Q/L: Interpreting Medical Tests
99.9% accurate!

- **Greater Than 99.9% Accurate**
  Reliable as Tests Used by Doctors and Hospitals

- **Confidential and Anonymous**

- **Results 24 Hours a Day**

- **One Spot™ Technology**

FDA APPROVED
U.S. FOOD & DRUG ADMINISTRATION
Premarket approval # BP950002

HIV-1 TEST SYSTEM
for the Detection of Antibodies to HIV-1

Reading a Pie Chart

SMOKERS

Other: 40%
Catholics: 20%
Protestants: 40%

20% of Catholics are smokers.
[Wrong by 19% of students]

Protestants (40%) are twice as likely to be smokers as are Catholics (20%).
[No; Smoker is part] Errors: 62%, 65%, 16%.

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14   ADULTS: HEIGHT VS. WEIGHT

Scatter Plot

Cross-sectional association (difference) versus longitudinal association (change).

Adults who weigh more tend to be taller than those who weigh less. [Yes] Error: 25%, 30%, 11%.

If an adult increases their weight, they can expect to increase their height. [No] Error: 19%, 28%, 16%.

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100% Tables

RACE	SEX		TOTAL
	Male	Female	
Black	75%	25%	100%
White	50%	**50%**	100%
Other	40%	60%	100%
TOTAL	50%	50%	100%

25% of females are blacks. Error: 44%, 28%, 11%.
25% of blacks are females. Error: 13%, 11%, 16%.
25% is the percentage of blacks among females.
    [No] Error: 38%, 28%, 16%.
25% is the percentage who are females among blacks.
    [Yes] Error: 21%, 17%, 14%.

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Can an Association be Spurious?

In 2000, a research hospital had a **higher** death rate than a rural hospital. Each patient's condition was classified as either "poor" or "fair."

*Is it possible that in 2000, this research hospital had a **lower** death rate than this rural hospital for those patients in "poor" condition AND for those patients in "fair" condition?* Possible answers:
> Yes, possible.   No, impossible.   Don't know.
[Yes, possible. This is Simpson's Paradox.]
Error rates: 44%, 68%, 41%.

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"IASSIST" MISSION

Current: International Association for Social Science Information Service and **Technology**
     ** Help the producers **

New: International Association for Social Science Information Service and **Transmission**
     ** Help producers and consumers **