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Reading tables of ratios — Statistical Literacy

Reading Tables of Rates and Percentages

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Reading tables of ratios — Statistical Literacy

Ambiguous Grammar Rates

1. The <u>accidental death</u> rate among *teenagers*
2. The *teenagers'* <u>accidental death</u> rate is …
3. The <u>accidental death</u> rate of *teenagers* is ...

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4. The *teenager* <u>accidental death</u> rate is ...
5. The rate of *teenager* <u>deaths</u> is …

4 and 5 are ambiguous; possessive is unstated.

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Ambiguous Grammar Percentages

A. *25% <u>of males</u> are smokers*
1. The percentage <u>of males</u> among smokers …
2. The percentage <u>of males</u> who smoke …

B. *Among smokers, the percentage <u>of males</u> is 45%.*
1. 45% <u>of males</u> are smokers.
2. 45% <u>of smokers</u> are <u>males</u>

C. *Among teens, the percentage <u>of females</u> who smoke*
1. Among teens, the percentage <u>of female</u> smokers …
2. Among <u>female</u> teens, the percentage <u>of smokers</u> ...

Semantics: #1 never matches; #2 always matches

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Reading tables of ratios — Statistical Literacy

Rates Ambiguity of '*by*'

No. 139. Age-Adjusted Death Rates, by Selected Causes: 1990 to 1996

[Rates per 100,000 population. For explanation of age-adjustment, see text, Section 2. The standard population is the total population of the United States enumerated in 1940. See also headnote, Table 138]

CAUSE OF DEATH	1990	1991	1992	1993	1994	1995
All causes	520.2	513.7	504.5	513.3	507.4	503.9
Major cardiovascular diseases	189.8	185.0	180.4	181.8	176.8	174.9
Diseases of heart	152.0	148.2	144.3	145.3	140.4	138.3
Rheumatic fever and rheumatic heart disease	1.5	1.4	1.3	1.3	1.2	1.1
Hypertensive heart disease	4.8	4.7	4.8	4.9	5.0	5.1
Hypertensive heart and renal disease	0.5	0.5	0.5	0.5	0.5	0.4
Ischemic heart disease	102.6	99.1	95.7	94.9	91.4	89.5
Other diseases of endocardium	2.5	2.5	2.6	2.6	2.6	2.6
Acute mycocardial infraction	53.7	51.5	49.1	47.5	45.6	43.8
Old mycocardial infraction and other	47.8	46.6	45.7	46.5	45.0	44.9
Hypertension	1.9	1.9	2.0	2.2	2.2	2.3

'by' means 'distributed by'

Source: 1998 US Statistical Abstract. Data for 1996 omitted to improve visibility of title.

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Percents Ambiguity of '*by*'

No. 113. Percent Low Birthweight, by Smoking Status, Age, and Race of Mother: 1993

[Low birthweight is defined as weight of less than 2,500 grams (5 lb. 8 oz.). Excludes California, Indiana, New York, and South Dakota, which did not require reporting of tobacco use during pregnancy]

SMOKING STATUS AND RACE OF MOTHER	All ages	Under 15 years	15-19 years			20-24 years	25-29 years	30-34 years	35-39 years	40-49 years
			Total	15-17 years	18-19 years					
All races [1]	7.4	13.8	9.6	10.5	9.0	7.5	6.5	6.8	8.0	9.0
Smoker	11.8	14.7	10.8	11.4	10.5	10.4	11.5	13.6	16.1	17.8
Nonsmoker	6.6	13.8	9.3	10.3	8.6	6.8	5.6	5.7	6.8	7.9
Not stated	9.2	14.2	11.8	12.9	11.1	9.0	8.2	8.7	9.9	10.3
White	6.1	10.8	7.9	8.6	7.5	6.1	5.4	5.7	6.8	7.7
Smoker	10.1	14.0	10.3	11.0	9.9	9.2	9.4	10.9	13.3	14.7
Nonsmoker	5.2	10.3	7.1	7.9	6.6	5.2	4.6	4.9	5.9	6.9
Not stated	7.6	(B)	9.7	10.9	9.1	7.8	6.6	7.4	8.2	9.5
Black	13.4	16.1	13.4	13.9	13.0	12.3	13.2	14.8	16.6	17.4
Smoker	22.6	19.6	17.2	17.1	17.3	18.8	23.2	26.3	27.8	30.4
Nonsmoker	12.0	15.9	13.1	13.7	12.6	11.4	11.2	11.8	13.6	14.6
Not stated	16.9	(B)	17.5	17.5	17.4	13.9	16.9	18.4	23.7	22.7

'by' means 'among' -- not 'distributed by'

Source: 1998 US Statistical Abstract

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Rates Ambiguity of '*by*'

No. 149. Death Rates for Injury by Firearms, Sex, Race, and Age: 1995

[Death rate per 100,000 population. Deaths classified according to the ninth revision of the *International Classification of Diseases*]

ITEM	5-14 yrs. old	15-24 yrs. old	25-34 yrs. old	35-44 yrs. old	45-54 yrs. old	55-64 yrs. old	65-74 yrs. old	75-84 yrs. old
MALE								
Firearms: White	2.5	31.4	26.1	21.2	19.6	19.9	26.1	39.8
Black	5.5	140.2	94.4	46.6	32.1	24.3	22.0	20.9
Accidents: White	0.7	1.8	0.8	0.6	0.5	0.4	0.6	0.7
Black	0.8	4.3	1.5	(B)	(B)	(B)	(B)	(B)
Suicide: White	0.8	15.4	15.1	14.2	14.9	16.6	23.9	38.2
Black	(B)	13.2	11.9	7.6	6.9	7.5	10.2	13.9
Homicide: White	0.9	13.6	9.8	6.3	4.0	2.8	1.5	0.8
Black	4.1	121.0	80.7	38.3	24.6	15.9	10.8	(B)

'by firearms' means 'by means of firearms'
'by sex' means 'categorized by sex'

Source: 1998 US Statistical Abstract (See Table 152 for a better title)

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Margin Value Rules
[Almunecar Enchilada]

- Margin values (MV) are *sums* or *averages*
- Heading: *Total* or *All* means 'all subjects'

If the numeric margin value is a:

1. *A sum*, then the pieces are parts
2. *A 100% sum*, then pieces are parts and the group of pieces is whole
3. *An average*, then pieces are wholes

A corner margin value can be a sum one-way and an average the other

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Reading tables of ratios

Statistical Literacy

Missing Margin Values

Margin values are typically omitted when:

1. Table indexes are *non-exhaustive* (e.g., non-contiguous dates: 1990, 2000). *These indicators are usually wholes.*

2. The indicator values obviously total 100% *These indicators are always parts.*

3. The data are rates. *These indicators are usually wholes.*

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Difficulties Reading Rates and Percentages in Tables

Percentage of Smoking Prevalence Among U.S. Adults, 18 Years of Age and Older:

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Year    All   Males Females Whites Blacks
1955    --    56.9  28.4    --     --
1965   42.4   51.9  33.9   42.1   45.8
1970   37.4   44.1  31.5   37.0   41.4
1980   33.2   37.6  29.3   32.9   36.9
1990   25.5   28.4  22.8   25.6   26.2

CHOICES:  Among these adults,
a.  the percentage of smokers who are black
b.  the percentage who are black smokers
c.  the percentage of blacks who are smokers
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Reading tables of ratios

Statistical Literacy

Reading Percentages: *Ambiguity of 'with' and 'to'*

No. 103. Low Birth Weight and Births to Teenage Mothers and to Unmarried Women—States: 1990 to 1996

STATE	PERCENT OF BIRTHS WITH LOW BIRTH WEIGHT[1]			BIRTHS TO TEENAGE MOTHERS, PERCENT OF TOTAL		
	1990	1995	1996	1990	1995	1996
U.S.	7.0	7.3	7.4	12.8	13.1	12.9
AL.	8.4	9.0	9.3	18.2	18.5	18.3
AK.	4.8	5.3	5.5	9.7	11.2	11.2
AZ.	6.4	6.8	6.6	14.2	15.1	15.0
AR.	8.2	8.2	8.5	19.7	19.6	19.8
CA.	5.8	6.1	6.0	11.6	12.4	12.0

Source: 1998 US Statistical Abstract (Section on unmarried women omitted)

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Reading tables of ratios

Statistical Literacy

Reading Tables with Rules Teaching Results

This material has been taught for five years.

- Without the margin value rules, *all students* had considerable difficulty with ratio-tables.
- Given the margin value rules, *good students* can readily describe and compare rates and percentages in the most complex ratio tables *when* these tables
  * have appropriate margin values or
  * are readily decoded from secondary clues.

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Reading tables of ratios

Statistical Literacy

Recommendations

To be statistically literate, one should be able to describe and compare rates and percentages found in tables and graphs.

Students should learn the margin value rules.

Ratio tables should provide margin values to help readers identify part and whole.

When margin values are not provided and the part-whole status is not readily determined, a margin-value example should be given.