Comparing Ratios

Statistical Literacy 2009
Chapter 6 Overview
by
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Ch 1. Review
Statistics are generally used as evidence to support an argument.
The influences on a statistic are of four kinds:
Context, Assembly, Randomness or Error.

Context and Ratios
Context: Related factors taken into account; the confounders not taken into account.
The easiest way to take into account a related factor are to make a comparison or to form a ratio.
Making a comparison of ratios takes into account two factors: size of a relevant basis for comparison and the sizes of the groups.
The English grammar involved gets very complex.

Three Topics
Percent Attributable: A common almost undetectable, form of comparison. Examples: deaths from second-hand smoke, obesity and radon.
Ratio Comparisons: Distinct Part vs. Common Part
DP: Widows are more likely among suicides than widowers.
CP: Widows are more likely to suicide than widowers.
Comparing ratios using Likely grammar

Inverse Percentages
Inverse percentages: Swap part & whole. Examples:
- Most A are B vs. Most B are A.
  “Most CEOs had a pet as a kid” versus “most kids who had a pet become CEOs.”
- “The percentage of A who are B” versus “the percentage of B who are A.”
  “The percentage of high school dropouts who smoked” versus “the percentage of high school smokers who dropped out.”

Three Factor Percentages
Percentages with more than two factors get confusing.
1. The percentage of AB who are C
2. The percentage of A who are BC
AB is the intersection of A and B (e.g., adjective noun).
If there are differences, AB is less than A and BC is less than C.
So, #1 is always bigger than #2
1. Percentage of U.S. kids 15-24 who died from suicide
2. Percentage of deaths of U.S. kids 15-24 that were suicides
Three Factor Percentages

Unemployed black males:
1. the percentage of black males who are unemployed
2. the percentage of males who are unemployed blacks?

Seniors in nursing homes with no family.
1. 30% of seniors are in nursing homes with no family.
2. 30% of seniors with no family are in nursing homes.
Could both of these be true at the same time and place?
If one is wrong (percentage is too high) which one is it?

Assembly: Choice of Whole

Graphical presentation:
Left circle: Percentage of A who are BC: (BC)/A.
Right circle: Percentage of AB who are C: C/(AB)

Medical Tests

Rerun the O.J. Simpson trial: Suppose 1 chance in a million of an error -- a false match.

Quality/Accuracy: Percentage of outcome that test positive
Prediction: Percentage of positives that have outcome.

<table>
<thead>
<tr>
<th>Adults in Area</th>
<th>Innocent</th>
<th>Guilty</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Negative</td>
<td>8,999,991</td>
<td>0</td>
<td>8,999,991</td>
</tr>
<tr>
<td>Test Positive</td>
<td>9</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>9,000,000</td>
<td>1</td>
<td>9,000,001</td>
</tr>
</tbody>
</table>

Medical Test: Rare Disease

Given: 0.1% have disease and 95% test accuracy.

<table>
<thead>
<tr>
<th>Population</th>
<th>DISEASED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Result</td>
<td>No</td>
</tr>
<tr>
<td>Negative</td>
<td>94,905</td>
</tr>
<tr>
<td>Positive</td>
<td>4,995</td>
</tr>
<tr>
<td>Total</td>
<td>99,900</td>
</tr>
</tbody>
</table>
Medical Test: Common Disease

Given: 5% have disease and 95% test accuracy. Confirmation: Test error = 100% - test accuracy.

<table>
<thead>
<tr>
<th>Test Result</th>
<th>DISEASED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>90,250</td>
</tr>
<tr>
<td>Positive</td>
<td>4,750(✔)</td>
</tr>
<tr>
<td>Total</td>
<td>95,000</td>
</tr>
</tbody>
</table>

If error = disease prevalence, prediction = 50%
If error > disease prevalence, prediction < 50%
If error < disease prevalence, prediction > 50%.

Summary

Context involves what is (not) taken into account.
What is taken into account can influence
• Counts or totals (by forming ratios)
• Averages (by selection or standardizing)

Part-whole ratios are one of the most common ways of taking into account a related factor.
Percentages have many uses – and misuses.