What Big SIZE you have!

Using Effect Sizes to Measure Impact of Public Health Nursing Interventions

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Illustration by Carl Ofterdinger, end of the 19th century.
Source: Published by Wilhelm Effenberger (F. Loewes Verlag), Stuttgart, end of the 19th century.
Background

- Evaluating client/patient progress
- Electronic Health Records
- BIG data = large n’s
  → sample size affects statistical tests

- Data from the Omaha System
  - low-income parents discharged from Midwest PHN agency in 2009
The Omaha System

Problem Classification Scheme
(42 problems)

Intervention Scheme

Problem Ratings for Outcomes
range: 1-5 for Knowledge, Behavior, Status [KBS]

13 documented in current study, range: 6 to 906 times

Examples:
- Abuse
- Caretaking/parenting
- Health care supervision
- Mental health
- Pregnancy
- Substance use

Differences in KBS scores at admission vs. scores at discharge
Problem

- How to measure treatment effectiveness?
  - statistical tests:  \( p < 0.05 \)
    - tell whether differences occurred by chance
    - do not tell much about size of differences

*statistical significance ≠ practical/clinical significance*
## Solution: Calculate Effect Sizes

<table>
<thead>
<tr>
<th></th>
<th>Cohen’s D (speculative)</th>
<th>Lipsey (empirical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small effect</td>
<td>0.20</td>
<td>0.15</td>
</tr>
<tr>
<td>Medium effect</td>
<td>0.50</td>
<td>0.45</td>
</tr>
<tr>
<td>Large effect</td>
<td>0.80</td>
<td>0.90</td>
</tr>
</tbody>
</table>


How to Calculate?

One group pretest-posttest design (RM)

1. \( d_{RM} = \frac{\bar{x}_2 - \bar{x}_1}{s_d} \)

2. **Calculate se of** \( d_{RM} \)

\[
se_{d_{RM}} = \sqrt{\frac{2(1 - r_{12}) + \frac{d^2_{RM}}{n}}{2(n-1)}}
\]

3. **Calculate 95% CI**

\[
CI_{d_{RM}} = d_{RM} +/- (1.96\times se_{d_{RM}})
\]
Or...Let the Computer Do It!


http://analytics.ncsu.edu/sesug/2012/SD-06.pdf
<table>
<thead>
<tr>
<th>Sample Characteristics (N = 1,016)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>% Female</td>
<td>98</td>
</tr>
<tr>
<td><strong>Age (mean)(^a)</strong></td>
<td>23</td>
</tr>
<tr>
<td>Range 13-66 years</td>
<td></td>
</tr>
<tr>
<td><strong>Race/ethnicity (%)</strong></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>32</td>
</tr>
<tr>
<td>Black</td>
<td>32</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>23</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
</tr>
<tr>
<td>Hispanic</td>
<td>20</td>
</tr>
<tr>
<td><strong>Problems per client (mean)</strong></td>
<td>4.2</td>
</tr>
<tr>
<td>Range 1-13 problems</td>
<td></td>
</tr>
<tr>
<td><strong>Ave length of services (median)</strong></td>
<td>223</td>
</tr>
<tr>
<td>Range 2-2954 days</td>
<td></td>
</tr>
</tbody>
</table>
## Paired T-Test Results for KBS Mean Difference Scores

<table>
<thead>
<tr>
<th>Problem</th>
<th>Scale</th>
<th>N</th>
<th>Mean diff</th>
<th>p-value</th>
<th>Cohen’s d (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognition</td>
<td>B</td>
<td>24</td>
<td>0.45</td>
<td>0.024</td>
<td>0.51 (0.07, 0.94)</td>
</tr>
<tr>
<td>Communication with Community Resources</td>
<td>K</td>
<td>116</td>
<td>0.78</td>
<td>&lt;0.0001</td>
<td>0.99 (0.75, 1.24)</td>
</tr>
<tr>
<td>Mental Health</td>
<td>B</td>
<td>247</td>
<td>0.28</td>
<td>&lt;0.0001</td>
<td>0.31 (0.19, 0.44)</td>
</tr>
<tr>
<td>Caretaking/Parenting</td>
<td>S</td>
<td>906</td>
<td>0.12</td>
<td>&lt;0.0001</td>
<td>0.15 (0.10, 0.21)</td>
</tr>
</tbody>
</table>
Scatter Plot: Effect Sizes by Mean Differences

Cohen's D

Mean differences between admit & discharge

Grief (K)

Caretaking/parenting (S)

Large effect

Medium effect

Small effect

Group 1 (n=6-24)
Group 2 (n=102-173)
Group 3 (n=247-307)
Group 4 (n=559-906)
Implications

- Large effect size = KBS change score of 0.60
- Look beyond p-values
- Effect sizes = standardized metric
  - “easy” to calculate

- Omaha System users should report effect sizes
  → empirically establish what is practical and clinically meaningful
Thank You!

What Big SIZE you have!

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