SNEB Journal Club 4: Test-retest reliability; internal consistency

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Test-Retest Reliability of a Short Form of the Children’s Social Desirability Scale for Nutrition and Health-Related Research

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Overview

- Objectives
- Background
- Purpose
- Sample
- Methods

- Analyses
- Results
- Discussion
- Limitations
- Questions
Objectives

1. Define test-retest reliability.
2. Define internal consistency.
3. Explain what level is considered adequate for test-retest reliability.
4. Explain what level is considered adequate for internal consistency.
5. Describe how test-retest reliability and internal consistency were assessed for the current study.
Challenge: Do research participants provide answers that are accurate rather than answers that they think they should provide?

Participants may answer questions about sensitive topics, such as eating unhealthy foods, in a socially desirable way.

**Social Desirability**: Reporting that one never performs a behavior that most people perform at least occasionally or always performs a behavior that most people usually perform but omit occasionally.
Most notable questionnaire for adults is Marlowe-Crowne Social Desirability Scale, developed in 1960. a

Hebert et al. found that social desirability correlated positively with dietary reporting errors in adults. b

Children may also exhibit social desirability bias. This could impact self-reports of intake.

Programs to improve child nutrition and reduce obesity increase children’s awareness of less nutrient-dense food, which may make them more likely to give socially desirable answers about food intake.

a Crowne & Marlowe, J Consult Psychol, 1960
b Hebert et al., Ann Epidemiol, 2001
Background

Children’s Social Desirability (CSD) Scale

- Developed by Crandall et al. in 1960s

- Slightly different versions for younger (grades 3-5) and older (grades 6-12) children.

- For grades 3-5, the CSD scale has 46 yes/no items. Examples of items (and their socially desirable response):
  - “Do you ever get angry?” (No)
  - “Do you always listen to your parents?” (Yes)

\(^a\) Crandall et al., J Consult Psychol, 1965
Background

Crandall et al.’s CSD scale

- One-month **test-reliability** was 0.90. The generally acceptable level of agreement for test-retest reliability is 0.70, with 1.0 being perfect agreement.

- **Internal consistency**, measured with Spearman-Brown-corrected split-half reliability, ranged from .82 to .95 for subsamples of boys and girls in various grades. Generally, internal consistency should be at least .70.

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\(^{a}\) Crandall et al., J Consult Psychol; 1965

\(^{b}\) Nunnally and Bernstein, Psychometric Theory, 1994
Background

- Higher scores on the CSD scale indicate a greater tendency to answer in a socially desirable manner.

- At the time of its development, CSD scale scores were higher:
  - for younger than for older children,
  - for girls than for boys,
  - for African American than for European American children,
  - for children with a lower intelligence quotient than with a higher-intelligence quotient, and
  - for children with lower than with higher academic achievement scores.

\(^a\) Crandall et al., J Consult Psychol, 1965
\(^b\) Crandall et al., J Pers Soc Psychol, 1966
With research in schools, it may not be possible to administer the full CSD scale due to limits on class time children can miss. Thus, a short scale with adequate psychometric properties is needed.

For younger children, we developed a short form of the CSD scale (hereafter CSD-Short scale) with samples of 4th graders.

A short form for younger children is important because they:

- tend to have higher socially desirability scores,
- may have more trouble maintaining attention for long forms, and
- are targets of many contemporary health intervention programs.
Our team developed the CSD-Short scale in 2004 as follows:\(^a\)

- We administered the full 46-item CSD scale by telephone to 100 4\(^{th}\)-grade children in Georgia.
- Internal consistency (Cronbach alpha) was .88 and .93 for the 1\(^{st}\) and 2\(^{nd}\) administrations, respectively.
- 1-month test-retest reliability was 0.79 (Pearson correlation).
- Factor analysis of the 46-item CSD scale data showed that the proportion of common variance accounted for by the 1\(^{st}\) factor was vastly greater than that of subsequent factors. Thus, the 46-item scale had a common construct from which one could select items for a short scale measuring the same construct.

\(^a\) Baxter et al, J Nutr Educ Behav, 2004
Next, we selected items for the short form that had high loadings on the 1\textsuperscript{st} factor during both administrations and had non-extreme endorsement rates (required for an item to contribute to differentiation among children).

The set of items had the same proportion of items keyed “yes” for social desirability as in the full 46-item scale.

The 14 items selected, \textit{when administered within the full 46-item CSD scale}, had a test-retest reliability of 0.83.

No gender differences were found in social desirability.

On the 1\textsuperscript{st} and 2\textsuperscript{nd} administrations, respectively, 56.9\% and 56.7\% of responses were keyed as socially desirable.
Development of CSD-Short Scale

- The 14 items were *not* administered by themselves in the 2004 study, but only as part of the full 46-item scale.

- Test-retest reliability of the CSD-Short scale as a standalone scale is *unknown*.

- In 2010, we found that 4th-graders’ social desirability scores were inversely related to their dietary reporting accuracy for energy intake at school meals (compared with direct observations of those meals).\(^a\)

\(^a\) Guinn et al., J Health Psychol, 2010
Purpose of current study

- Assess **test-retest reliability** and **internal consistency** of the 14 items as a standalone CSD-Short scale.
- Use a **new sample** of 4th-grade children.
- Examine the sample overall and subgroups of children to determine whether social desirability scores and test-retest reliability varied by:
  - gender,
  - socioeconomic status (SES),
  - child academic achievement, or
  - body mass index (BMI) percentile.
Sample

- We recruited children from all 6 4th-grade classes in 2 South Carolina elementary schools in 1 large metropolitan district.
- Of 134 children invited to participate in the study, 101 (75% agreed).
- Why use 4th-grade children?
  - can read well enough to complete a questionnaire
  - aware of foods that are considered “good” and “bad”
  - generally the youngest age at which children are asked to provide self-reports about their dietary intake.
- The study was approved by the University of South Carolina Institutional Review Board.
- We obtained written assent and consent.
Methods: Instruments & Measures

- In each classroom, 2 research staff members distributed paper CSD-Short forms, read each question aloud while children followed along, asked children to circle “yes” or “no” on their forms, and ensured that only one answer was given for each question.

- The CSD-Short scale was administered again to the same children, in the same manner, by the same research staff, 27-30 days later.

- Each classroom administration of the CSD-Short scale lasted approximately 5 minutes.
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Socially Desirable Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Have you ever felt like saying unkind things to a person?</td>
<td>No</td>
</tr>
<tr>
<td>2.</td>
<td>Are you always careful about keeping your clothing neat and your room picked up?</td>
<td>Yes</td>
</tr>
<tr>
<td>3.</td>
<td>Do you sometimes feel like staying home from school even if you are not sick?</td>
<td>No</td>
</tr>
<tr>
<td>4.</td>
<td>Do you ever say anything that makes somebody else feel bad?</td>
<td>No</td>
</tr>
<tr>
<td>5.</td>
<td>Are you always polite, even to people who are not very nice?</td>
<td>Yes</td>
</tr>
<tr>
<td>6.</td>
<td>Sometimes, do you do things you’ve been told not to do?</td>
<td>No</td>
</tr>
<tr>
<td>7.</td>
<td>Do you always listen to your parents?</td>
<td>Yes</td>
</tr>
<tr>
<td>8.</td>
<td>Do you sometimes wish you could just play around instead of having to go to school?</td>
<td>No</td>
</tr>
<tr>
<td>9.</td>
<td>Have you ever broken a rule?</td>
<td>No</td>
</tr>
<tr>
<td>10.</td>
<td>Do you sometimes feel angry when you don’t get your way?</td>
<td>No</td>
</tr>
<tr>
<td>11.</td>
<td>Do you sometimes feel like making fun of other people?</td>
<td>No</td>
</tr>
<tr>
<td>12.</td>
<td>Do you always do the right things?</td>
<td>Yes</td>
</tr>
<tr>
<td>13.</td>
<td>Are there some times when you don’t like to do what your parents tell you?</td>
<td>No</td>
</tr>
<tr>
<td>14.</td>
<td>Do you sometimes get mad when people don’t do what you want them to do?</td>
<td>No</td>
</tr>
</tbody>
</table>
Methods: Instruments & Measures

- Each CSD-Short form was scored by research staff and by computer.

- Each socially desirable response received 1 point. The CSD-Short scale summed scores ranged from 0 to 14.

- Higher scores indicated a greater tendency to answer in a socially desirable manner.
Methods: Weight & Height Measures

- Research staff used established procedures to measure weight and height in the morning immediately after the first CSD-Short form administration.

- Children were weighed and measured in a private location at school without shoes or heavy coats.

- Intermeasurer reliability was conducted daily to ensure that weight and height measurements were reliable.

- Age/gender BMI charts were used to determine BMI percentiles.
Methods: Academic Achievement & SES

- To quantify children’s academic achievement, scores on the English Language Arts and Mathematics scales of the Palmetto Assessment of State Standards test were summed. (This was South Carolina’s academic assessment test.)

- Children were classified as low-SES if they were eligible for free or reduced-price school meals, and as high-SES otherwise.

  - Children from families with income <130% of poverty level were eligible for free meals, and those from families with income between 130% and 185% of the poverty level were eligible for reduced-price meals.
Methods: Academic Achievement & SES

- Academic achievement scores and school meal eligibility information (for SES classification) were collected by the state’s Department of Education and housed in the state’s Division of Research and Statistics data warehouse. *(The state’s Division of Research and Statistics is now the South Carolina Revenue and Fiscal Affairs office, Health and Demographics Section.)*

- Permission was given by the Department of Education for the Division of Research and Statistics to link data sets, conduct analyses, and provide aggregate results to us.
Sample

- The sample had 97 children (45 boys, 52 girls).
- The mean age was 10 years, 1 month.
- The sample was 80% African American, 9% Hispanic, 7% European American, and 4% other.
- The mean (± SD) academic achievement score (from PASS testing) was 1234.4 (± 77.0, range, 1,099-1,440). [statewide mean = 1,280].
- The mean (± SD) BMI percentile was 71.1 (± 27.0; range 1.0-99.7).
Social Desirability

- For each administration, social desirability scores ranged from 0 to 14, which showed that the CSD-Short scale differentiated among children. On each administration, the mean was approximately 7.
Questions to be addressed

- What is the internal consistency of the CSD-Short scale?
- What is the test-retest reliability of the CSD-Short scale?
- Do scores change, on average, between administrations?
- Does reliability vary over subgroups of children?
- Are CSD-Short scale scores related to gender, SES, academic achievement, and BMI percentile?
Internal Consistency

What is the internal consistency of the CSD-Short scale?

Measured by Cronbach $\alpha$, which is a number between 0 and 1.

Internal consistency reliability measures the extent to which items are related; it is a sort of average of the correlations between all possible split halves, but also depends on the number of items.

$\alpha$ can be too high: A value that is too high indicates item redundancy.
Internal Consistency

- Internal consistency (Cronbach alpha) for the 1\textsuperscript{st} and 2\textsuperscript{nd} administrations, respectively:

<table>
<thead>
<tr>
<th>Administration-1</th>
<th>Administration-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>.82</td>
<td>.85</td>
</tr>
</tbody>
</table>
Test-retest reliability

- What is the test-retest reliability of the CSD-Short scale?
- Test-retest reliability is a measure of consistency of ordering of scores over individuals between administrations.
- We used the Pearson correlation coefficient. Practically, values are between 0 and 1.
- The higher the test-retest reliability, the greater the degree to which the distribution of scores over a set of respondents is consistent over administrations.
Test-retest reliability

- For the entire group of 97 children, 1 month test-retest reliability was 0.70 (Pearson r, $P < .001$).

- This value, although considered “adequate”, is at the low end of what one would want to see in a measure of a stable trait.
Average scores

- Do scores change, on average, between administrations?
- Mean CSD-Short scale scores did not differ for the two administrations (t-test; \( P = .68 \)):

<table>
<thead>
<tr>
<th>Administration-1</th>
<th>Administration-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.8 ± 3.7</td>
<td>6.7 ± 3.9</td>
</tr>
</tbody>
</table>
Subgroups

- Does test-retest reliability vary over subgroups?
Subgroups

- We compared test-retest reliability of CSD-Short scale scores between subgroups:
  - Gender (boy vs girl)
  - SES (eligible for free/reduced-price meals vs not eligible)
  - Academic achievement (< state mean vs ≥ state mean)
  - BMI percentile (<85th percentile vs 85th percentile [an expert committee’s definition of “overweight or obese” for children]).

- (These analyses included only 92 children because academic achievement scores were not available for 4 children, and 1 child was not weighed/measured.)
### Test-retest reliabilities and results of z tests

<table>
<thead>
<tr>
<th>Gender</th>
<th>n</th>
<th>Mean (SD) Score Administration-1</th>
<th>Mean (SD) Score Administration-2</th>
<th>Test-retest Reliability</th>
<th>z test P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>50</td>
<td>6.5 (3.8)</td>
<td>6.7 (3.9)</td>
<td>0.66</td>
<td>1</td>
</tr>
<tr>
<td>Boys</td>
<td>42</td>
<td>7.2 (3.6)</td>
<td>6.8 (3.9)</td>
<td>0.71</td>
<td></td>
</tr>
</tbody>
</table>

**SES**
- Free/reduced price meals
- Full-price meals

**Academic Achievement**
- < State mean
- ≥ State mean

**BMI percentile**
- < 85th percentile
- ≥ 85th percentile

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*a* Pearson correlations

*b* z tests based on Fisher z transformation of correlation coefficients; compares reliabilities for children at 2 levels of each variable. *P* for z-tests was adjusted using Bonferroni method.
## Test-retest reliabilities\(^a\) and results of \(z\) tests\(^b\)

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\(^a\) Pearson correlations

\(^b\) \(z\) tests based on Fisher \(z\) transformation of correlation coefficients; compares reliabilities for children at 2 levels of each variable. \(P\) for \(z\)-tests was adjusted using Bonferroni method.
Test-retest reliabilities\textsuperscript{a} and results of z tests\textsuperscript{b}

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\textsuperscript{a} Pearson correlations
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<td></td>
</tr>
<tr>
<td>&lt; 85th percentile</td>
<td>50</td>
<td>6.7 (3.8)</td>
<td>6.4 (3.9)</td>
<td>0.72</td>
<td>1</td>
</tr>
<tr>
<td>≥ 85th percentile</td>
<td>42</td>
<td>7.0 (3.6)</td>
<td>7.1 (3.9)</td>
<td>0.63</td>
<td></td>
</tr>
</tbody>
</table>

a Pearson correlations

b z tests based on Fisher z transformation of correlation coefficients; compares reliabilities for children at 2 levels of each variable. P for z-tests was adjusted using Bonferroni method.
Relationship to participant variables

- Are social desirability scores related to the participant characteristics that we measured — gender, SES, academic achievement, and BMI percentile — controlling for the others?
We regressed CSD-Short scale scores from administration-1 on gender, SES, academic achievement, and BMI percentile and their first-order interactions.

- We used administration-1 scores because, in practice, researchers would administer the CSD-Short scale only once.
Results: Degree of Social Desirability

- For each of these variables (gender, SES, academic achievement, BMI percentile), controlling for the other 3 variables, none had a unique relationship to social desirability.
The CSD-Short scale exhibited adequate test-retest reliability and internal consistency. There was reasonable test-retest reliability for subgroups of children formed by gender, SES, academic achievement, and BMI percentile. This suggests that the CSD-Short scale is appropriate for general use.

Reliabilities for the CSD-Short scale were slightly less than those for the full 46-item CSD scale; test-retest reliability was 0.70 for the 14-item CSD-Short scale vs 0.79 for the 46-item CSD scale (administered by telephone to a similar sample).

Internal consistency was .82 and .85 for the 1st and 2nd 14-item CSD-Short scale administrations, respectively, vs .88 and .93 for the 46-item CSD scale.

- With everything else equal, internal consistency reliability increases with an increase in the number of items.
We found no effects on CSD-Short scale scores of any of gender, academic achievement level, SES, and BMI percentile when controlling for the other 3 variables.

In contrast, previous studies have reported higher social desirability scores by children with lower than with higher intelligence scores, and by girls than by boys.

The different gender result may reflect a change in gender roles since the 1960s. A 1994 publication reported only weak evidence of gender differences.
Discussion

- Differences in the sample and mode of scale administration may account for the different outcomes. The scale was administered individually for this age group by Crandall et al. in 1965, but was administered to an entire class in a classroom in the current study.

- The lack of relation between CSD-Short scale and BMI percentile is consistent with an earlier study with a similar sample.

- The lack of relation between CSD-Short scale and SES is also consistent with other studies.
Limitations

- The sample did not include enough children of various races to test for generality across different races or ethnic groups.

- The sample included only a single grade from 2 schools in 1 school district. Thus, age differences in test-retest reliability and internal consistency could not be examined.

- Only 1-month test-retest reliability was investigated. More intervals would help contextualize the observed test-retest reliability of 0.7.
Conclusions

The CSD-Short scale:

- can help nutrition and health researchers and practitioners understand inaccuracies in children’s reports of their nutrition and health-related behaviors,
- can be group administered, and
- can reliably and efficiently detect which children may provide socially desirable responses on nutrition and health measures.

- Adequate psychometric properties of the CSD-Short scale pertain to subgroups of particular interest to researchers studying health disparities, obesity, and nutrition.
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