

Measuring Survey Reliability and Variability

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Objectives

- Define survey reliability and detail several ways to assess reliability
- Define survey validity and detail several ways to assess validity

Survey Reliability and Validity

Who had to do this?

Was it easy?

The News

Good News !!!

The statistics is easy!!

Bad News...

The methodology is
tedious

Reliability

What is reliability?

Reliability

What is reliability?

A statistical measure of how reproducible the survey instruments data are

How to Assess Reliability

How can we assess reliability?

How to Assess Reliability

How can we assess reliability?

1. Test-Test reliability
2. Alternate form reliability
3. Internal consistency reliability

Test-Test Reliability

How do we measure test-test reliability?

Test-Test Reliability

How do we measure test-test reliability?

- Same set of respondents complete survey at different times
- Can assess single question, scale, or whole survey
- Test Statistic:
 - Correlation coefficient: r
- Look for $r > 0.7$

Test-Test Reliability

What are the advantages and disadvantages of assessing test-test reliability?

Test-Test Reliability

Advantages

- Provides mathematical assessment
- Statistics are simple

Disadvantages

- Must select measures that do not change much over time
- Practice effect
- Anonymity
- Must give survey twice

Alternate Form Reliability

How do we measure alternate form reliability?

Alternate Form Reliability

How do we measure alternate form reliability?

- Use differently worded items to measure the same attribute or different order of scale
- Administer to same population at different time points
- Test Statistic:
 - Correlation Coefficient: r
- Again aim for $r > 0.7$

Alternate Form Reliability

If sample is large, can use the "split halves method" and see if the two halves of the sample agree

Alternate Form Reliability

What are the advantages and disadvantages of assessing alternate form reliability?

Alternate Form Reliability

Advantages

- Math is easy
- Gives statistical value

Disadvantages

- Must be careful that meaning of questions stays the same
- Logistics
- Anonymity

Internal Consistency Reliability

How do we measure internal consistency reliability?

Internal Consistency Reliability

How do we measure internal consistency reliability?

- Look for groups of items to measure the same issue
- Test Statistic: Cronbach's alpha

Internal Consistency Reliability

What are the advantages and disadvantages of assessing internal consistency reliability?

Internal Consistency Reliability

Advantages

- Only requires administering the survey once
- Well documented
- Easy to calculate

Disadvantages

- Works best if survey given to a wide audience
- Watch for backwards rating scales
- Questions should all point to a similar global topic

Cronbach's Alpha

Needs/Satisfaction Survey Disaster Medicine Curriculum

You have been asked to provide your feedback so that the Disaster Medicine Curriculum can be improved. Your feedback is anonymous, and you do not need to put your name on the survey.

Part I

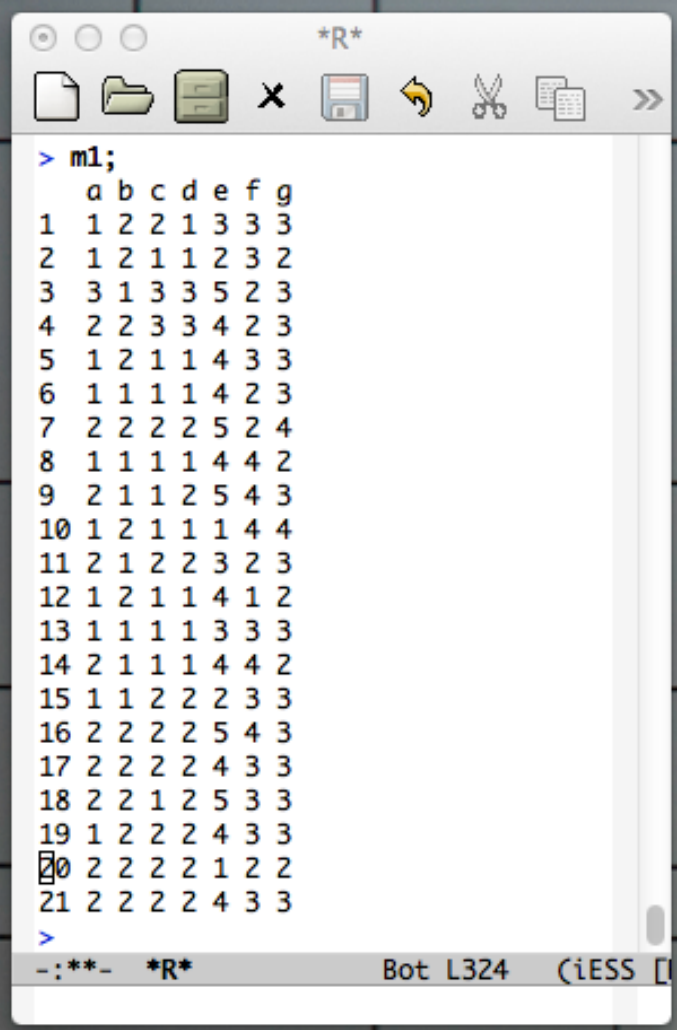
For the following questions, please pick a number from the scale to show how much you agree or disagree with each statement and write it in the space.

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

- A) _____ Disaster Medicine training is important for me
- B) _____ Disaster Medicine training is important for exam preparation
- C) _____ Disaster Medicine training is important for practice in the emergency department
- D) _____ Disaster Medicine teaching is important for my future career
- E) _____ I am well prepared for a disaster
- F) _____ Disaster Preparedness is a high priority at the University of Alberta
- G) _____ My department is well prepared for a disaster

Cronbach's Alpha

We expect the numbers to run together

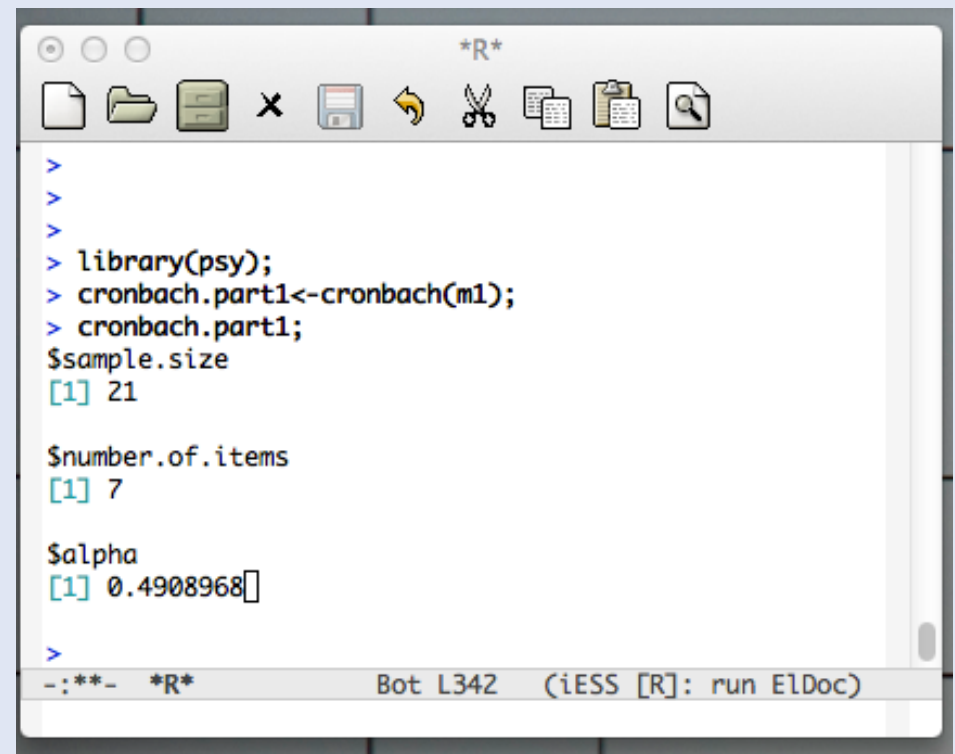


```
> m1;
  a b c d e f g
1  1 2 2 1 3 3 3
2  1 2 1 1 2 3 2
3  3 1 3 3 5 2 3
4  2 2 3 3 4 2 3
5  1 2 1 1 4 3 3
6  1 1 1 1 4 2 3
7  2 2 2 2 5 2 4
8  1 1 1 1 4 4 2
9  2 1 1 2 5 4 3
10 1 2 1 1 1 4 4
11 2 1 2 2 3 2 3
12 1 2 1 1 4 1 2
13 1 1 1 1 3 3 3
14 2 1 1 1 4 4 2
15 1 1 2 2 2 3 3
16 2 2 2 2 5 4 3
17 2 2 2 2 4 3 3
18 2 2 1 2 5 3 3
19 1 2 2 2 4 3 3
20 2 2 2 2 1 2 2
21 2 2 2 2 4 3 3
>
```

Cronbach's Alpha

Poor Reliability

Why?



```
>
>
>
> library(psy);
> cronbach.part1<-cronbach(m1);
> cronbach.part1;
$sample.size
[1] 21

$number.of.items
[1] 7

$alpha
[1] 0.4908968
>
```

Bot L342 (iESS [R]: run E1Doc)

Survey Reliability

Questions?

Validity

What is survey validity?

Validity

What is survey validity?

How well the survey measures what it is supposed to

Validity

How can we assess validity?

Validity

How can we assess validity?

1. Face Validity
2. Content Validity
3. Criterion Validity
 - Concurrent Validity
 - Predictive Validity
4. Construct Validity

Face Validity

How do we measure face validity?

Face Validity

How do we measure face validity?

- cursory review by untrained judges
- Test Statistic: None

Face Validity

What are the advantages and disadvantages of measuring face validity?

Face Validity

Advantages

- Easy
- Fast
- No math

Disadvantages

- Questionable benefit
- Unlikely to be accepted by reviewers

Content Validity

How do we measure content validity?

Content Validity

How do we measure content validity?

- Organized review of the surveys contents
- Use a group of trained judges
- Test Statistic: None

Content Validity

What are the advantages and disadvantages of measuring content validity?

Content Validity

Advantages

- Easy
- No math
- More information than face validity

Disadvantages

- Subjective
- Not a scientific measure

Concurrent Validity

How do we measure concurrent validity?

Concurrent Validity

How do we measure concurrent validity?

- Measure instrument against a 'gold standard' (previously published)
- Test Statistic: Correlation Coefficient
- Often used when trying to make a shorter or easier to use scale

Concurrent Validity

What are the advantages and disadvantages of assessing concurrent validity?

Concurrent Validity

Advantages

- Provides a mathematical method of validity
- Math is easy

Disadvantages

- Requires a 'gold standard'

Predictive Validity

How do we measure predictive validity?

Predictive Validity

How do we measure predictive validity?

- Ability of survey to predict future events, behaviors, attitudes, etc.
- Example: Survey of symptoms of peripheral artery disease and later ultrasound results
- Test Statistic: Correlation Coefficient

Predictive Validity

What are the advantages and disadvantages of assessing predictive validity?

Predictive Validity

Advantages

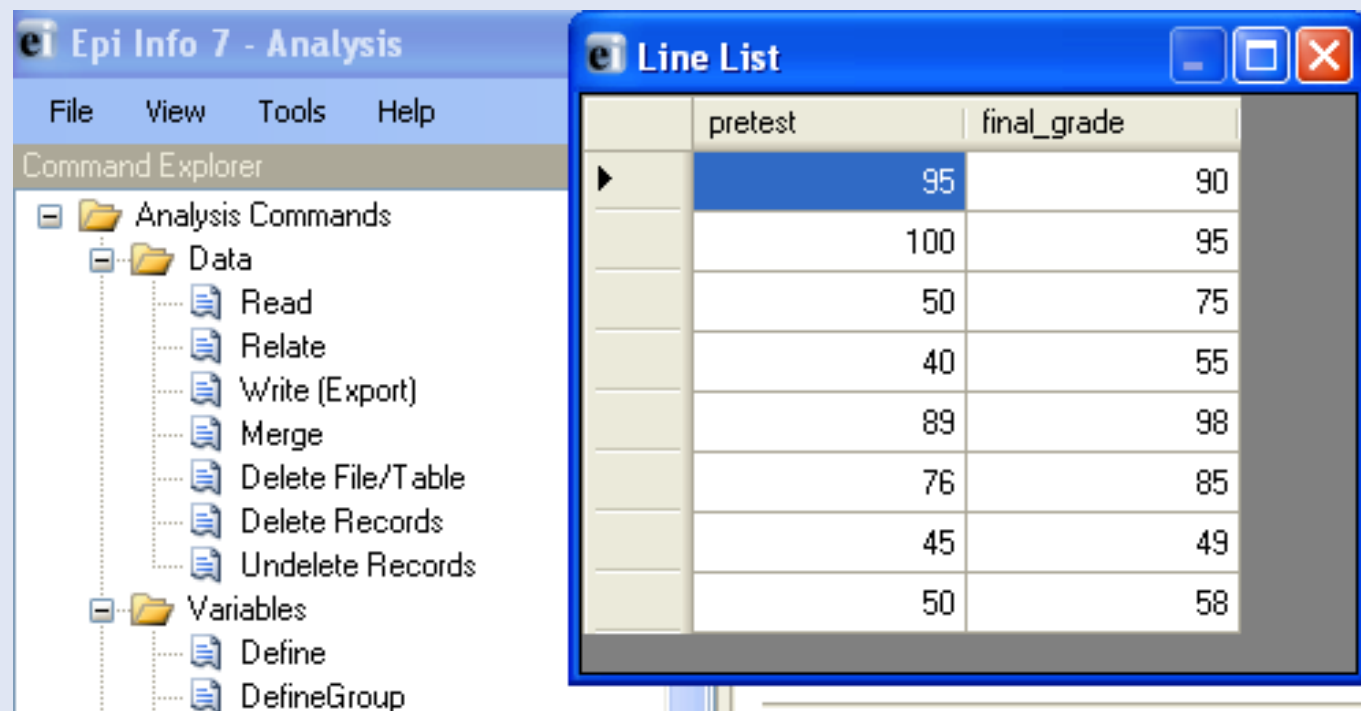
- Mathematical assessment of validity

Disadvantages

- May be difficult to measure the outcome
- Final outcome may have been influenced by other factors in time frame

Predictive Ability

Compare pre-test
grade with the
overall grade for
the course



The screenshot displays the Epi Info 7 - Analysis software interface. The 'Command Explorer' pane on the left shows a tree view with folders for 'Analysis Commands' and 'Variables', and sub-folders for 'Data' and 'Variables'. The 'Data' folder is expanded, showing options like 'Read', 'Relate', 'Write (Export)', 'Merge', 'Delete File/Table', 'Delete Records', and 'Undelete Records'. The 'Variables' folder is also expanded, showing 'Define' and 'DefineGroup'. The 'Line List' window is open, displaying a table with two columns: 'pretest' and 'final_grade'. The table contains the following data:

	pretest	final_grade
▶	95	90
	100	95
	50	75
	40	55
	89	98
	76	85
	45	49
	50	58

Predictive Ability

The screenshot displays the Epi Info 7 - Analysis software interface. The Command Explorer on the left shows a tree view of analysis commands, with 'Linear Regression' selected under 'Advanced Statistics'. The main window shows the output of a linear regression analysis in a text editor. The output includes the current data source, the regression equation, the regression coefficients table, the correlation coefficient, and the ANOVA table.

Current Data Source: Provider=Microsoft.Jet.OLEDB.4.0;Data Source="C:\Documents and Settings\dino\My Documents\StatsSeminar";Extended Properties="text;HDR=Yes;FMT=Delimited":final_scores#csv
Record Count: 8 (Deleted Records Excluded) **Date:** 2014-02-10 11:41:03

REGRESS pretest = final_grade

Linear Regression

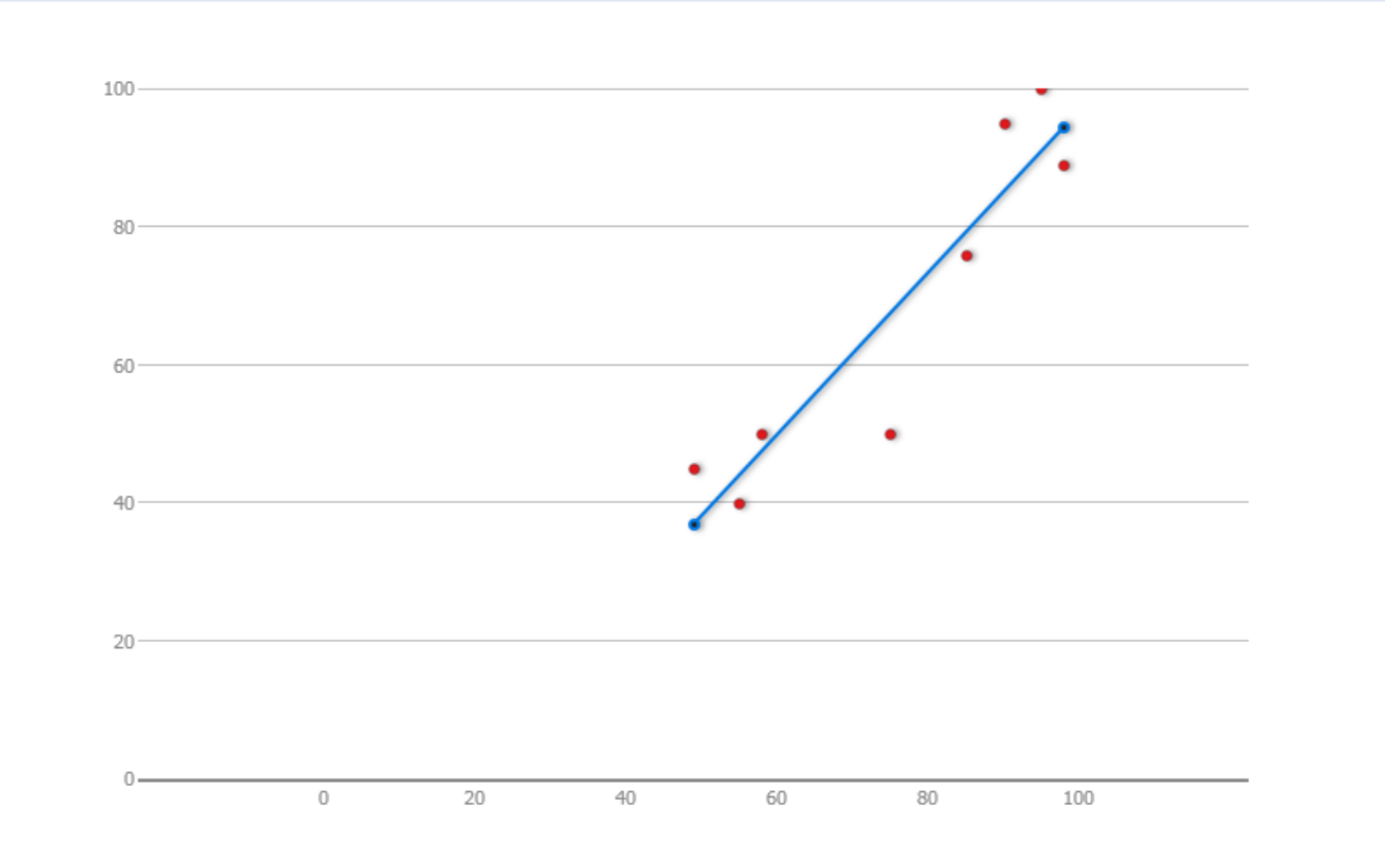
Variable	Coefficient	Std Error	F-test	P-Value
final_grade	1.174	0.198	35.3153	0.001014
CONSTANT	-20.669	15.363	1.8100	0.227126

Correlation Coefficient: $r^2 = 0.85$

Source	df	Sum of Squares	Mean Square	F-statistic
Regression	1	3606.191	3606.191	35.315
Residuals	6	612.684	102.114	
Total	7	4218.875		

The bottom of the window shows a 'Program Editor' with a menu bar (File, Edit, Fonts) and a toolbar with icons for 'New Pgm', 'Open Pgm', 'Save Pgm', 'Print...', and 'Run Commands'. The status bar at the very bottom indicates 'Ready' and system settings like 'en-US', '7.1.3.3', 'CAPS', 'NUM', and 'INS'.

Predictive Ability



Construct Validity

How do we measure construct validity?

Construct Validity

How do we measure construct validity?

- Looks at how meaningful the survey instrument is in practical use
- Includes:
 - Convergent Validity: Several methods for obtaining the same information give similar results
 - Divergent Validity: Does not correlate too closely with other distinct concepts
- Test statistic: ???

Construct Validity

What are the advantages and disadvantages of using construct validity?

Construct Validity

Advantages

- Considered the best overall assessment of validity
- No simple statistical method

Disadvantages

- No simple statistical method
- Often requires use of the survey for many years

Survey Validity

Questions?

Objectives

- Define survey reliability and detail several ways to assess reliability
- Define survey validity and detail several ways to assess validity

Math Lesson

How to calculate a correlation coefficient