Quantitative Methods

Chapter 7 & 8

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Quantitative Research Design

Experimental

True Experiment
Cause and effect
Random Assignment

Single-Subject
Cause and effect
One or few Individuals

Quasi- Experiment
Cause and effect
Intact Groups

Nonexperimental

Correlational
Describe relationships among variables

Survey
Describe trends in a population

Questions?

Your research question drives your research methods.

The Research Process

Research Problem
Explain and measure trends

Literature Review
Prescriptive role

Purpose
Specific questions with hypotheses

Research Design

- *True Experiment*
- *Quasi-Experiment*
- *Single-Subject*
- *Correlational*
- *Survey*

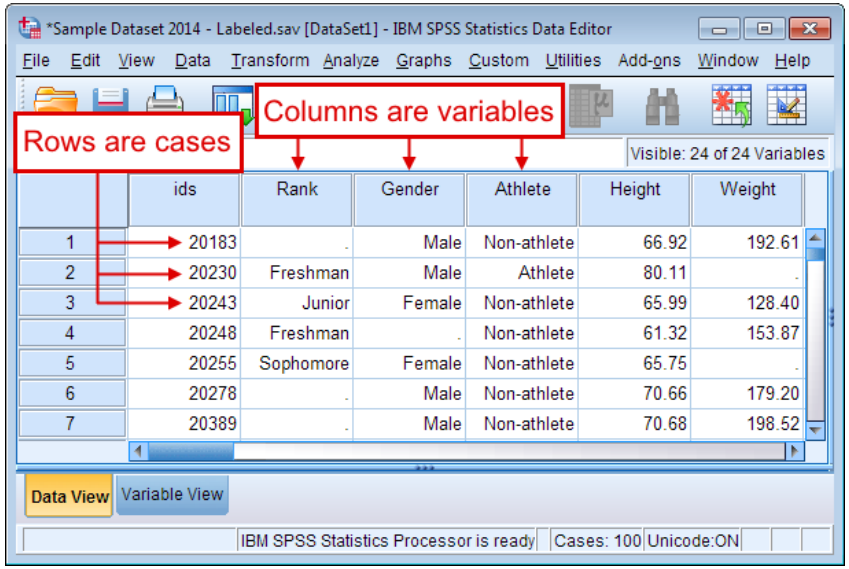
Methods
Instruments to measure variables, large sample

Analysis and Results
Statistics, graphs, compare, relate, describe

Conclusions
Objective comparison of predictors to past studies

Data Collection

- Participants – demographics and location
- Instruments – used to gather numeric information
- Procedures – how did they get the data?



	ids	Rank	Gender	Athlete	Height	Weight
1	20183	.	Male	Non-athlete	66.92	192.61
2	20230	Freshman	Male	Athlete	80.11	.
3	20243	Junior	Female	Non-athlete	65.99	128.40
4	20248	Freshman	.	Non-athlete	61.32	153.87
5	20255	Sophomore	Female	Non-athlete	65.75	.
6	20278	.	Male	Non-athlete	70.66	179.20
7	20389	.	Male	Non-athlete	70.68	198.52

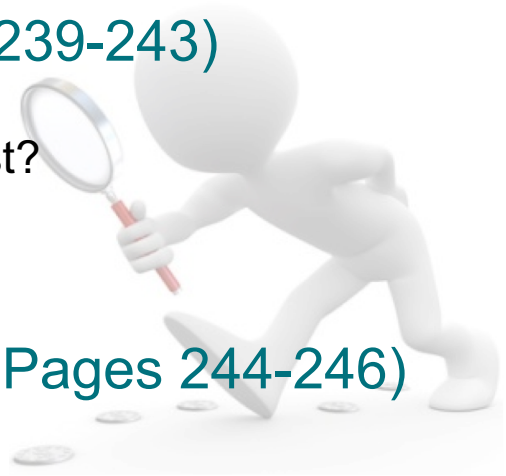
Data Analysis and Results

- Data preparation
- Descriptive Statistics
- Inferential Statistics
- Interpreting Results

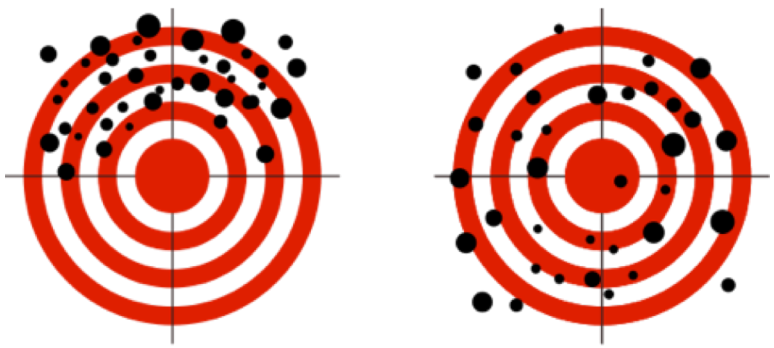
Present key concepts in Chapter 7

Divide into 3 groups, develop a short presentation to explain concepts in Chapter 7 using Raspa et al. as your study example:

- Sites and participants/sample (Pages 233-238)
  - Who are participants? Probably or non-probability sampling? Was it a large sample?
- Identify the instruments used to gather data (Pages 239-243)
  - What instruments were used to measure variables of interest? Reliability and validity of instruments.
- General Procedures for collecting data and Validity (Pages 244-246)
  - Was it ethical and standardized? Internal and external validity.



Is your measure **reliable** (consistent) **and** **valid** (accurate)?



Unreliable & Unvalid

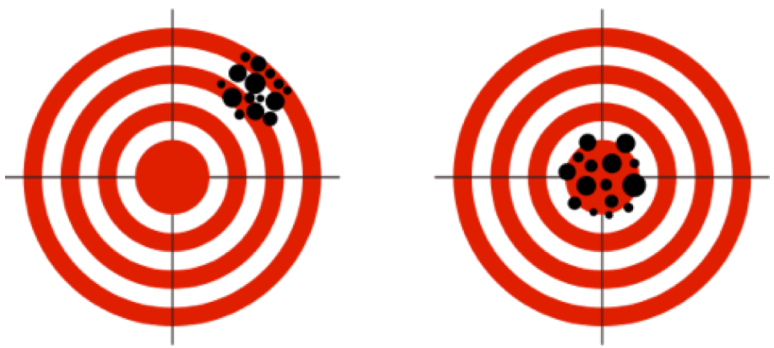
Unreliable, But Valid

Reliability: Does it measure consistently over time?

-
-

Validity: Does it measure what we think it measures?

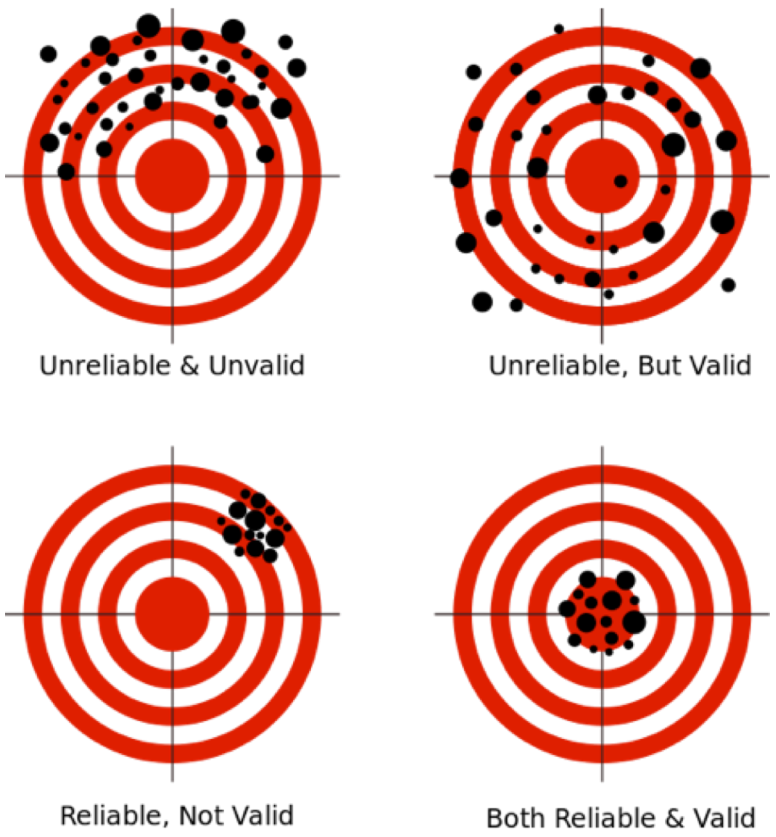
-
-
-



Reliable, Not Valid

Both Reliable & Valid

Is your measure **reliable** (consistent) **and** **valid** (accurate)?



Reliability: Does it measure consistently over time?

-
-

Validity: Does it measure what we think it measures?

-
-
-

Something can be reliable but not valid!

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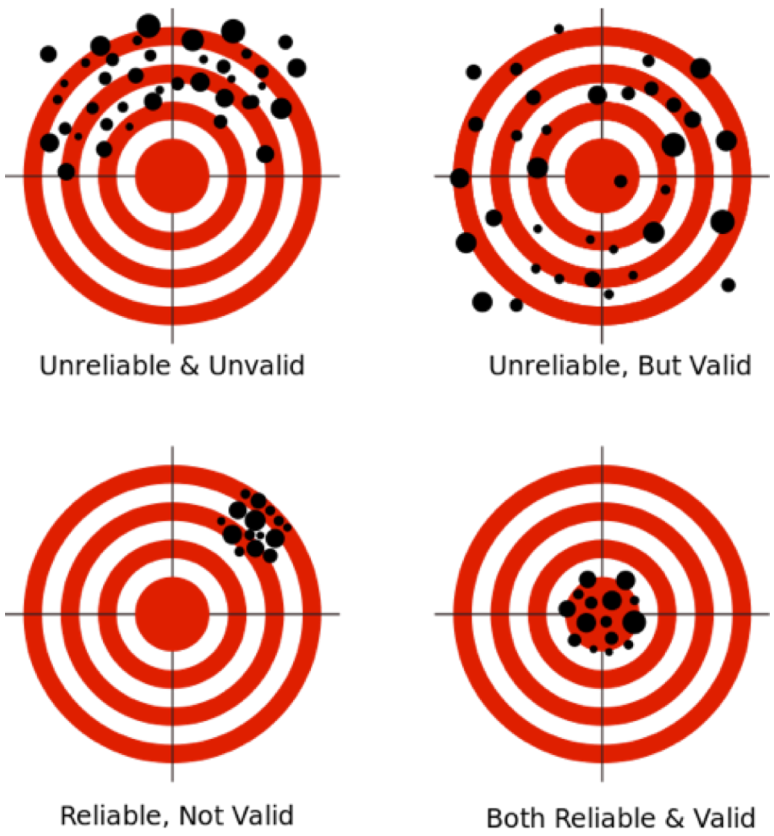

Reliability: Does it measure consistently over time?

- Test-Retest – scores stable over time
- Internal Consistency – responses consistent across constructs

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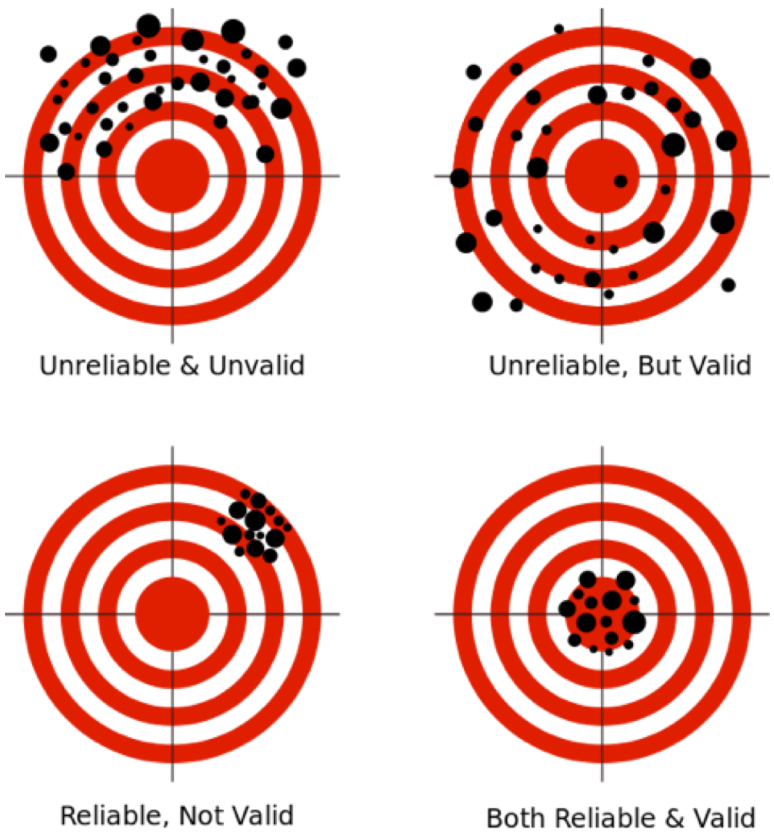

Reliability: Does it measure consistently over time?

- Test-Retest – scores stable over time
- Internal Consistency – responses consistent across constructs

Validity: Does it measure what we think it measures?

- Content – measure the content we intended
- Criterion – do scores predict the measure? do they correlate with other results?
- Construct – do items measure the theoretical/hypothetical constructs or concepts?

Does your measure claim what it measures?

Internal Validity: Extent to which we can claim independent predictor caused an effect on a dependent outcome (Cause and Effect)

-
-
-

External Validity: Extent to which we can generalize the results from the sample to other populations, settings (ecological), and time (historical)

-
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- Measuring other variables to controlling extraneous variables
- Manipulating conditions and standardized instructions
- Random assignment to spread existing differences across groups

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External Validity: Extent to which we can generalize the results from the sample to other populations, settings (ecological), and time (historical)

- Random selection from population
- Maximizing participation
- Examining demographic information to see they are representative of population characteristics
- Conducting in a more natural setting (if possible)

Instruments used to gather information

- **Demographic Forms** – gather basic facts and characteristics of participants
- **Performance Measures** – assess individuals' abilities, achievement, or traits
- **Attitudinal Measures** – measure individuals' attitudes and opinions
- **Behavioural Observation Checklists** – record individuals' behaviours
- **Factual Information Documents** –gather information about public records

FIGURE 1

Sample Item From the Family Outcomes Survey

1. Your child is growing and learning. How much does your family understand about your child's development?						
1	2	3	4	5	6	7
We are just **beginning** to understand our child's development		We understand **some** about our child's development		We understand a **good amount** about our child's development		We understand a **great deal** about our child's development

Descriptive Statistics – Survey Data

TABLE 1

Means and Standard Deviations for Each Item on the Family Outcomes Survey

Item	*Item Description*	N[a]	M	SD
1	Understand child's development	2,839	5.8	1.23
2	Understand child's special needs	2,806	5.8	1.35
3	Understand child's progress	2,833	6.0	1.19
4	Know about services	2,814	4.5	1.62
5	Comfortable participating in meetings	2,798	6.0	1.39
6	Know rights	2,803	5.1	1.75
7	Help child develop and learn	2,832	5.8	1.21
8	Help child behave	2,818	5.3	1.43
9	Practice new skills	2,826	6.1	1.19
10	Have support	2,831	5.6	1.71
11	Someone to call for help	2,827	5.1	2.06
12	Able to do things you enjoy	2,830	5.2	1.60
13	Access to medical care	2,807	6.1	1.33
14	Access to child care	1,004	5.6	1.70
15	Child participates in activities	2,616	4.5	1.97

[a]Families were given the opportunity to skip items 14 and 15 if not applicable.

Descriptive Statistics – Survey Data

of people who answered each question

How varied or spread out are the responses on each question?

TABLE 1

Means and Standard Deviations for Each Item on the Fa[illegible] Outcomes Survey

Item	*Item Description*	N[a]	M	SD
1	Understand child's development	2,839	5.8	1.23
2	Understand child's special needs	2,806	5.8	[illegible]
3	Understand child's progress	2,833	6.0	1.19
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On a 7 point scale, what was the average response on each question?

Questions developed to capture

Descriptive Statistics – Survey Data

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In pairs, answer the following:

1) How many participants responded to Question #8 and Question #14?

1) Which 3 questions had the highest means, and which 3 questions had the lowest?

2) What is the relationship between *M* and *SD*?

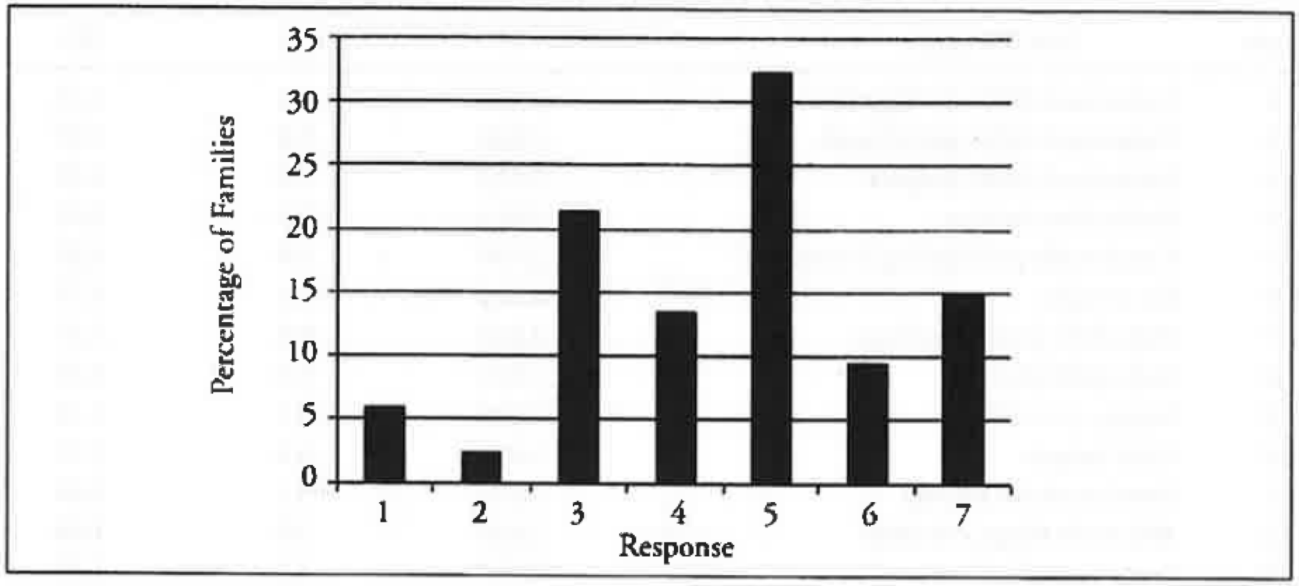
Descriptive Statistics: Frequencies

What labels would you give as anchors for response 1, 3, 5, 7?

Which response had the highest response and which had the lowest? What percentage of families answered each of these questions?

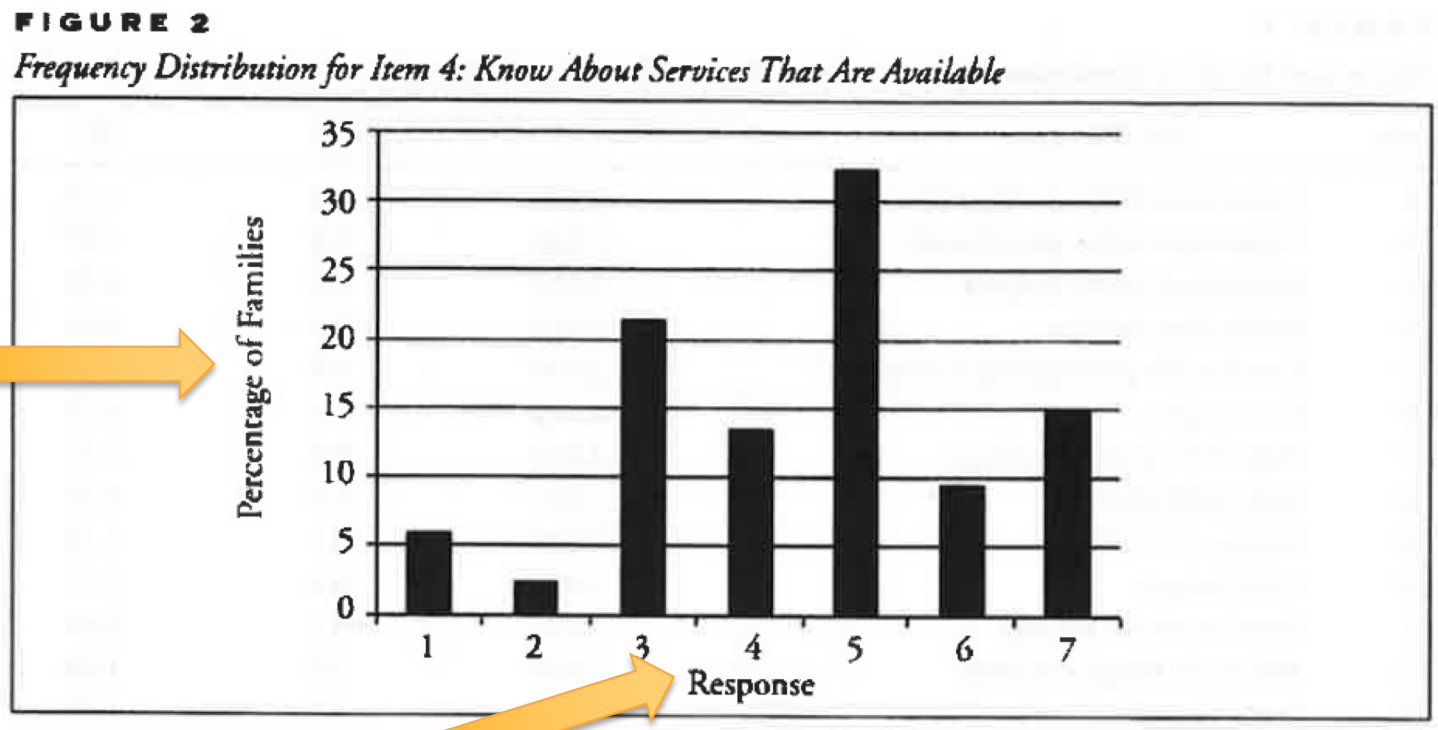
FIGURE 2

Frequency Distribution for Item 4: Know About Services That Are Available



Descriptive Statistics: Frequencies of specific items

Y axis can be continuous data such as achievement score



X axis can be continuous data to look at relationships between two measured variables or categorical data such as groups or time points

Correlation matrix: Relationships between variables

- **n** = sample size

TABLE 3

Correlation Matrix Among the Five Subscales on the FOS and the Mean Score (n = 2,849)

Subscales	*Strength and Ability (α = 0.73)*	*Rights and Services (α = 0.66)*	*Develop and Learn (α = 0.75)*	*Social Support (α = 0.73)*	*Community Access (α = 0.62)*	*Mean Score (α = 0.88)*
	1	2	3	4	5	Mean
1	1.00	0.50	0.65	0.37	0.33	0.74
2		1.00	0.53	0.38	0.32	0.74
3			1.00	0.46	0.40	0.80
4				1.00	0.51	0.77
5					1.00	0.67
Mean						1.00

Note. All correlations significant at the $p < .001$ level. FOS = Family Outcomes Survey.

Correlation matrix: Relationships between variables

- **n** = sample size
- **Alpha** = Reliability of each subscale

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Note. All correlations significant at the $p < .001$ level. FOS = Family Outcomes Survey.

Correlation Coefficients = range from +1 (positive) to -1 (negative)

In pairs, write one sentence to report the direction and strength of the relationship:

- Strength and Ability and Develop and Learn
- Social Support and Community Access
- What two variables had the strongest relationship and which two had the weakest?

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Correlation matrix: Relationships between variables

- **n** = sample size
- **Alpha** = Reliability of each subscale
- **Correlation Coefficients** = range from +1 (positive) to -1 (negative)
- **P-value** = level of significance (e.g., how likely is this due to chance? $p < .05$)

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Exploratory Factor Analysis – How do the items on the measure relate?

TABLE 4

Standardized Regression Coefficient (and Final Communality) Results of a Principal Components Analysis of the FOS (Items 1–15) Using an Oblimin Rotation (n = 917)

Item	*Item Description*	*Factor 1*	*Factor 2*
1	Understand child's development	0.81 (0.62)	
2	Understand child's special needs	0.76 (0.53)	
3	Understand child's progress	0.64 (0.41)	
4	Know about services	0.55 (0.46)	
5	Comfortable participating in meetings	0.58 (0.30)	
6	Know rights	0.65 (0.43)	
7	Help child develop and learn	0.81 (0.68)	
8	Help child behave	0.66 (0.57)	
9	Practice new skills	0.63 (0.47)	
10	Have support		0.60 (0.52)
11	Someone to call for help		0.80 (0.60)
12	Able to do things you enjoy		0.74 (0.56)
13	Access to medical care		0.49 (0.33)
14	Access to child care		0.74 (0.50)
15	Child participates in activities		0.68 (0.45)

- We can examine the factor structure of a survey that we created, or modified from another study
- Items are grouped based on their relationship to one another and to an underlying construct we call "factors"

Exploratory Factor Analysis – How do the items on the measure relate?

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This is done mathematically using statistical software. We identify the # of factors to retain based on the items that "hang" together.

These are correlations between each item and the factor.

Exploratory Factor Analysis – Naming Factors

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Qualitative component:

In groups of 3-4, review the questions under Factor 1 and Factor 2. Come to a consensus about the label or name you would give to Factor 1 and Factor 2?

What variables predict FOS outcomes and factors?

Sample

TABLE 5

Summary of HLM Regression Results Predicting Mean Score on the Family Outcomes Survey Using Child, Family, and Program Characteristics (n = 1,392)

Predictors

	Mean Score		Factor 1		Factor 2	
Variable	β	SE	β	SE	β	SE
Gender	0.068	0.042	0.065	0.044	0.063	0.062
Race/ethnicity	–0.097***	0.024	–0.087***	0.025	–0.116**	0.036
Age in months	–0.006*	0.003	–0.009**	0.003	–0.002	0.004
Eligibility types	–0.006	0.016	–0.006	0.016	–0.007	0.023
Family income	0.072***	0.019	0.017	0.019	0.175***	0.028
Time in early intervention	0.007*	0.003	0.012***	0.003	–0.003	0.005
FOS perception items	0.189***	0.030	0.115***	0.030	0.309***	0.043
Family-Centered Services items	0.350***	0.023	0.412***	0.024	0.248***	0.034

*$p < .05$. **$p < .01$. ***$p < .001$.

Level of significance

Which variables significantly predict outcomes?

Identify which predictors explain Mean Score, Factor 1 and Factor 2?

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What are the similarities and differences?

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