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# Technology Assisted Cognitive Assessment

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# Disclosures

- In the past 12 months Dr. Harvey has served as a consultant for:

Boeheringer-Ingelheim, Forum Pharma, Genentech, Lundbeck, Otsuka-America, Sanofi Pharma, Sunovion Pharma, and Takeda Pharma

# Domains of Cognition

- Learning and Memory
- Processing Speed
- Attention and Working Memory
- Reasoning and Problem Solving (Executive Functioning)
- Language
- Self-assessment
- Accrued Knowledge

# Factors Influencing Cognitive Performance

- Age
- Education
- Familiarity with language
- Experience with testing
- Experience with testing technology

# Critical Requirements for a Valid Test

- Reproducible range of scores
  - Avoid Extreme practice effects
  - Avoid Floor and Ceiling Effects
    - Avoid regression to the mean
- Convergent Validity
- Lack of bias

# Typical Validation Process

- Identify item content
- Examine the range of scores and ensure variance
- Examine test retest reliability
- Examine convergent validity
- Develop Normative Scores

# Normative Process

- Norms need to capture the factors that are associated with performance.
  - Age; Education; Sex; Race; Ethnicity
- Normative samples need to be representative of the population as a whole
- An example of an extraordinarily well-normed test is the Wechsler Intelligence Scale

# Case Study

- Norming the Brief Assessment of Cognition in Schizophrenia (BACS)
- 404 healthy controls with demographic characteristics matching the 2005 United States Census of English-speakers (Race, age, education).
- Random digit dialing was used to sample
- Correlate the six test measures with age, gender, and education.
- Individual test scores were converted into standardized (T and z) scores and composite scores that were corrected for age and gender.
- An education-correction factor was calculated and recommended only for non-schizophrenia patients.

# What would make two forms or tests identical?

- Correlation is not enough; a large correlation can reflect small overlapping variance:  $r=.7$  is only 50% shared variance
- The two tests must produce reliable scores at the identical point in the distributions for each test: impairment or lack thereof must be reproduced precisely

# Special Considerations for New Products

- Norms
- Alternate Forms
- Missing Data

# Special Considerations for New Products: Norms

- Norms are critical for multiple purposes
- Norms are also costly to do correctly and are commonly not done right
- Many commercial computerized test companies claim to have norms but do not; a common practice is to take everyone who has ever taken the test and consider that the normative sample. What is they are selected for dementia or psychosis?

# Special Considerations for New Products: Alternate Forms

- Certain cognitive assessments are particularly prone to practice effects
  - Memory Tests; Problem solving tests
- Alternate forms are commonly proposed as a solution
- Development of alternate forms is more complicated than development of norms
- Poorly developed alternate forms are a significant problem in treatment trials
- See the above discussion about test equivalence

# Special Considerations for New Products: Missing Data

- Paper and pencil cognitive assessments are often characterized as leading to missing data and as less systematic than computerized assessments
- In essentially every study where a comparison can be made, computerized tests lead to more missing data.
- This applies to in-person administered computerized tests; likely to be a bigger problem with remote delivery

# Assessment Strategies

- In person, with assessor
- In person, self administered
- Natural environment, with interaction
- Natural environment, fully independent

# Delivery of Assessment

- Standard computer
- Touchscreen
- Tablet
- Smartphone
- Sensor
- Video/sensor/surveillance

# Global Assessment Goals

- Identify problems
  - Screening or based on referral
- Examine treatment effects
- Self Assessment

# Summary

- Technology has huge promise and is the way forward
- The development process for conventional tests still applies, however
- Many considerations for the development of technology oriented assessments