

A Model for Ethnicity, Diseases of Aging, and Cognitive Impairment

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Overview

- Challenges in assessing cognitive impairment in ethnic minorities
- General model of determinants of cognitive test scores - Implications for cognitive impairment
- Empirical applications of model
 - Separating age, education, and brain effects
 - Deconstructing ethnicity effects
 - Separating demographic and disease effects

Background

- Reasons to study ethnic minorities
 - **Practicality** - Need for scientific knowledge of diseases affecting cognition in these large (and growing) populations
 - Can be done with homogenous groups
 - **Generality** - Better understanding of general mechanisms of cognitive impairment that apply across older people of diverse backgrounds
 - Requires heterogeneity

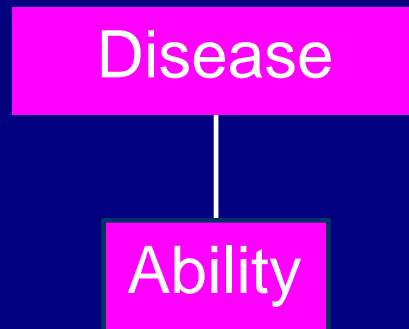
Ethnicity and Cognition

- Well established finding that ethnic minorities have lower average performance on neuropsychological tests
- Cutpoints based upon Caucasian samples result in high false positive rates in minority populations
- Historical context of abuses of IQ testing in minority populations
- Raises important question about measurement bias when using cognitive tests with minority elders

Ethnicity, Cognitive Impairment and Aging

- Context of cognitive assessment in older patients
 - To identify and monitor cognitive impairment associated with diseases of aging
- Questions / Challenges
 - How do we measure cognitive changes of dementing illnesses in ethnically diverse groups?
 - How do non-disease correlates of ethnicity influence sensitivity of cognitive measures to disease effects?

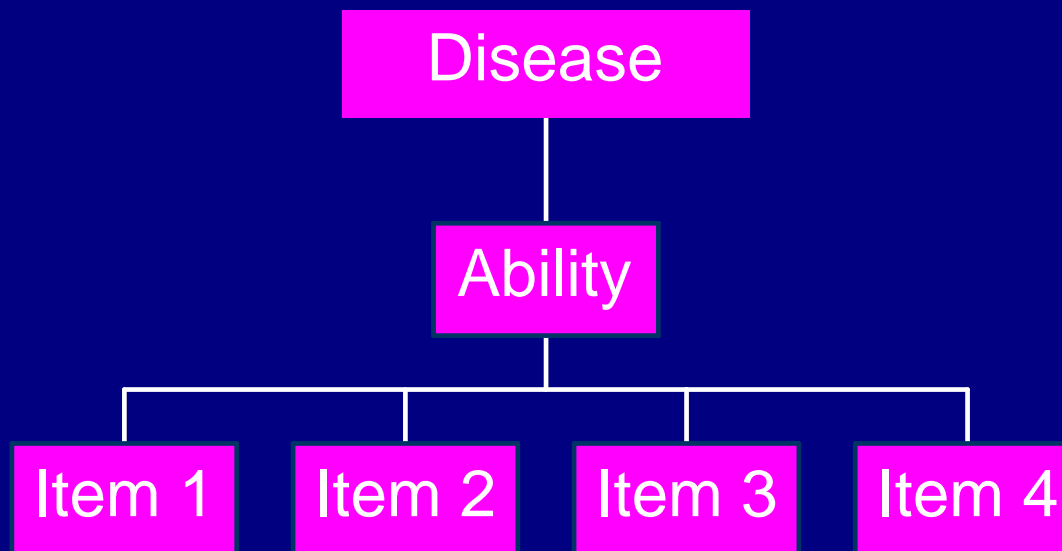
Simple Model of Cognitive Test Performance



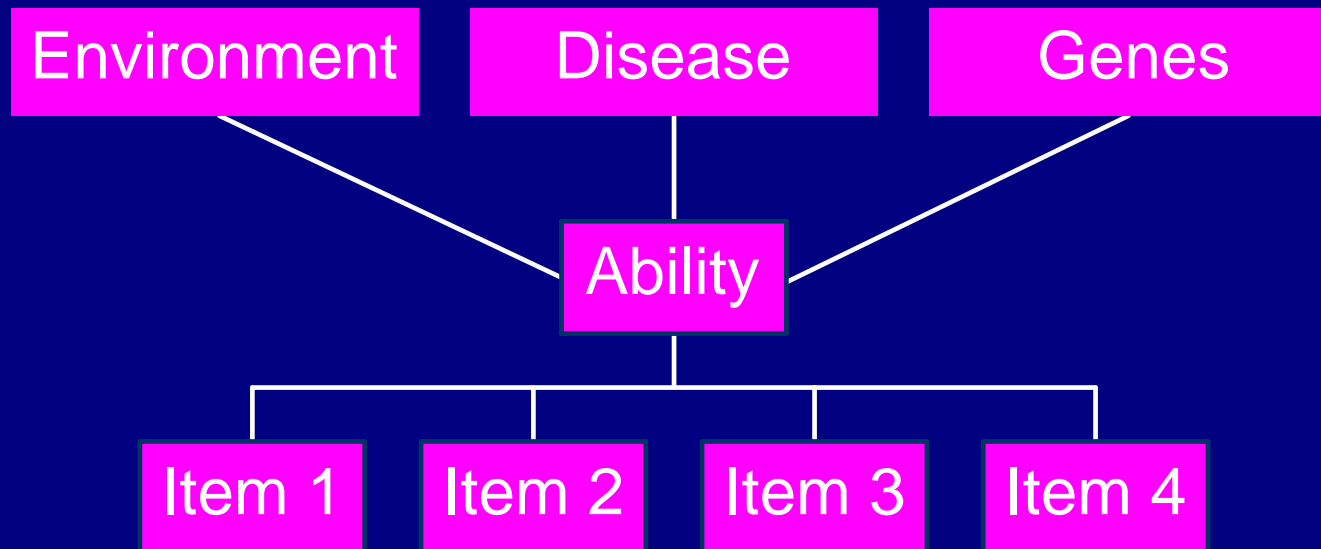
Psychometric Theory

- Definition of **ability**
 - Capacity to successfully respond to test items
 - Net result of all genetic and environmental influences
 - Measured by scales composed of homogenous items
 - In neuropsychology, domains of interest defined by relationships with brain structure and function

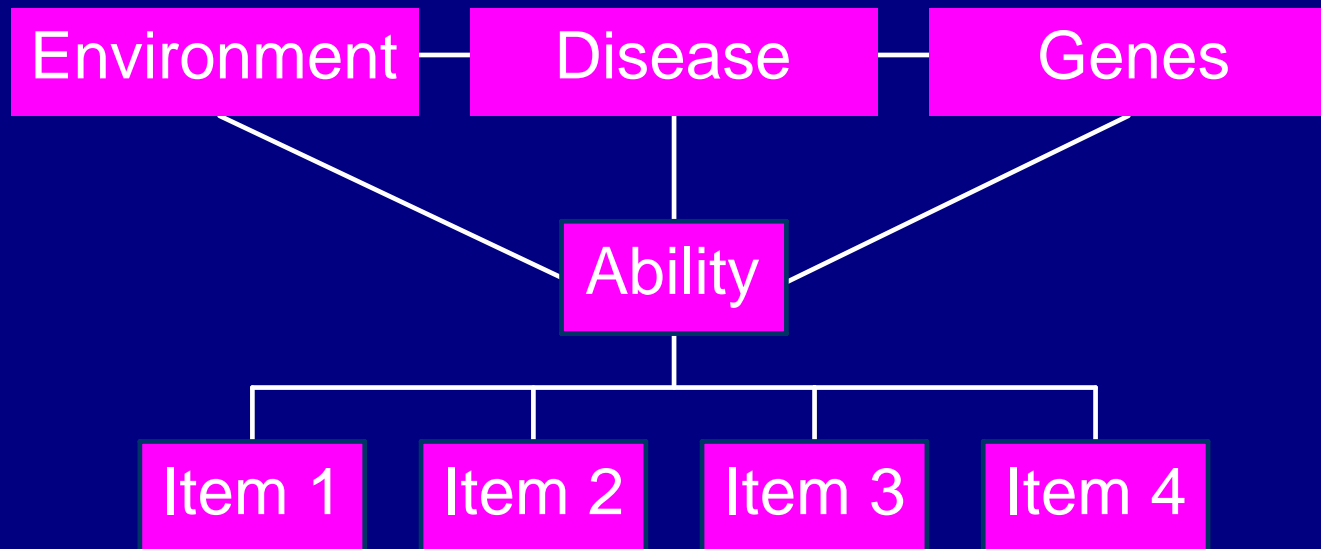
More Complete Simple Model of Cognitive Test Performance



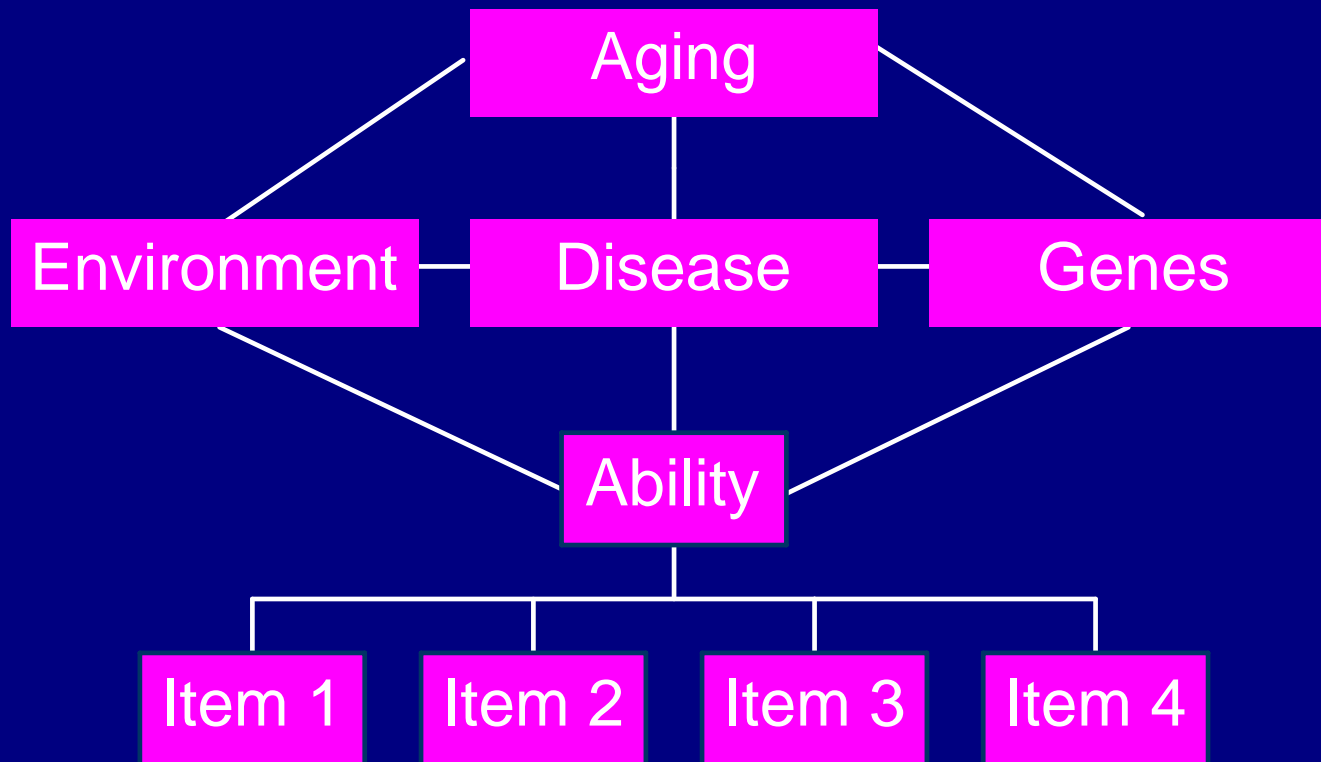
Expanded Model of Cognitive Test Performance



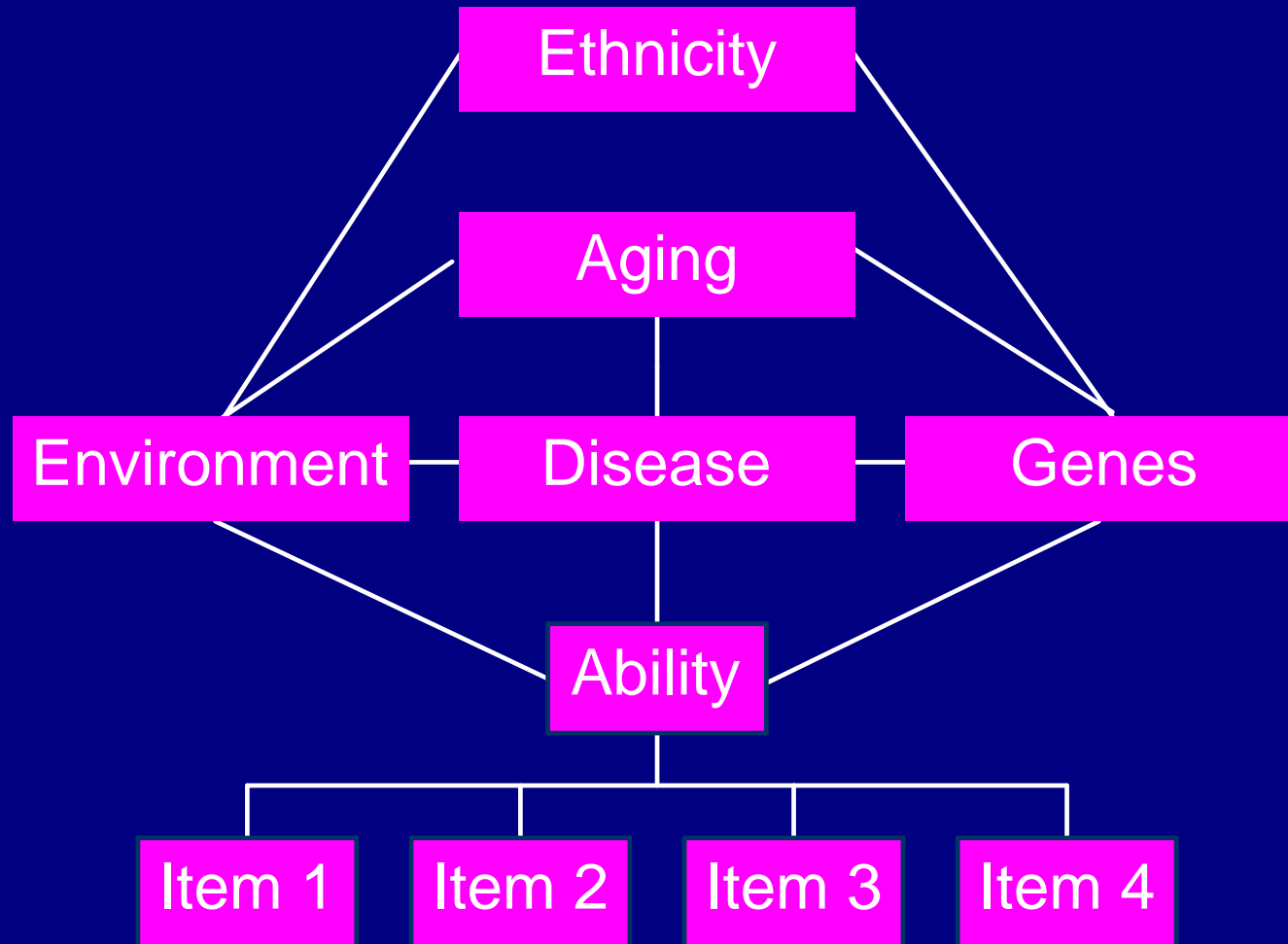
Expanded Model of Cognitive Test Performance



Expanded Model of Cognitive Test Performance with Aging Effects



Model of Ethnicity Effects on Cognitive Test Performance



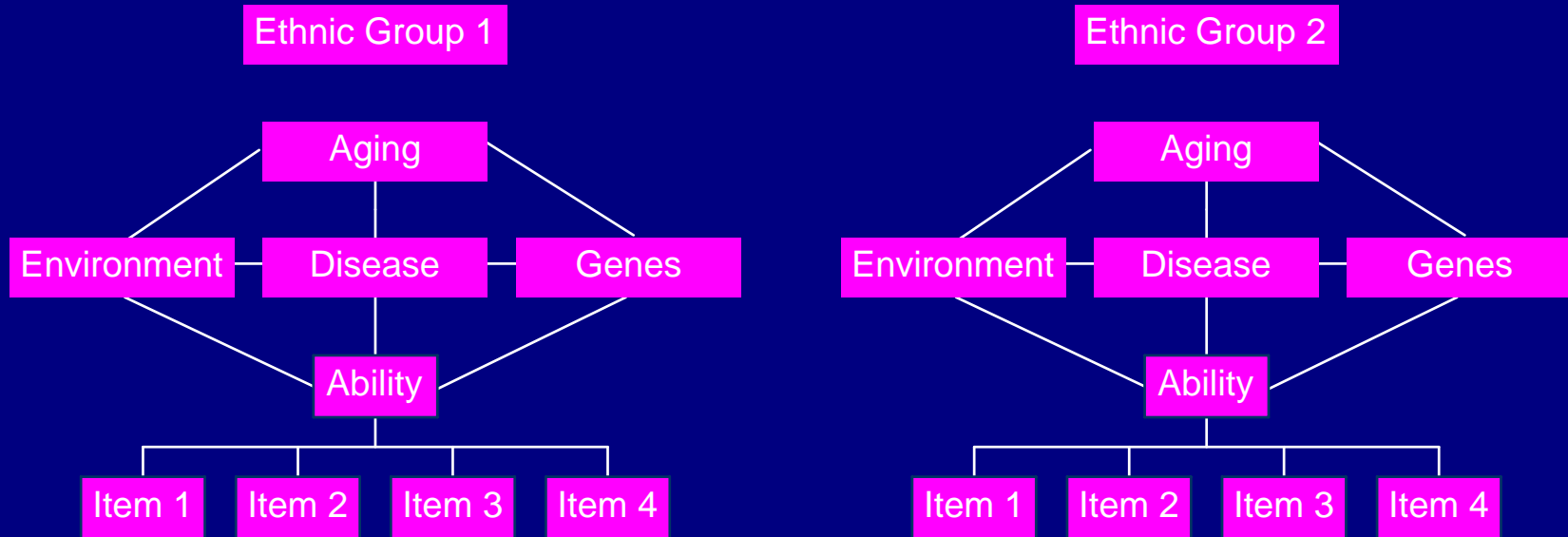
Implications of Model

- Cognition is complexly determined
- Ethnicity effects are mediated by measurable variables
 - Some known
 - Others to be discovered
- Disease effects can be separated from non-disease influences on cognition

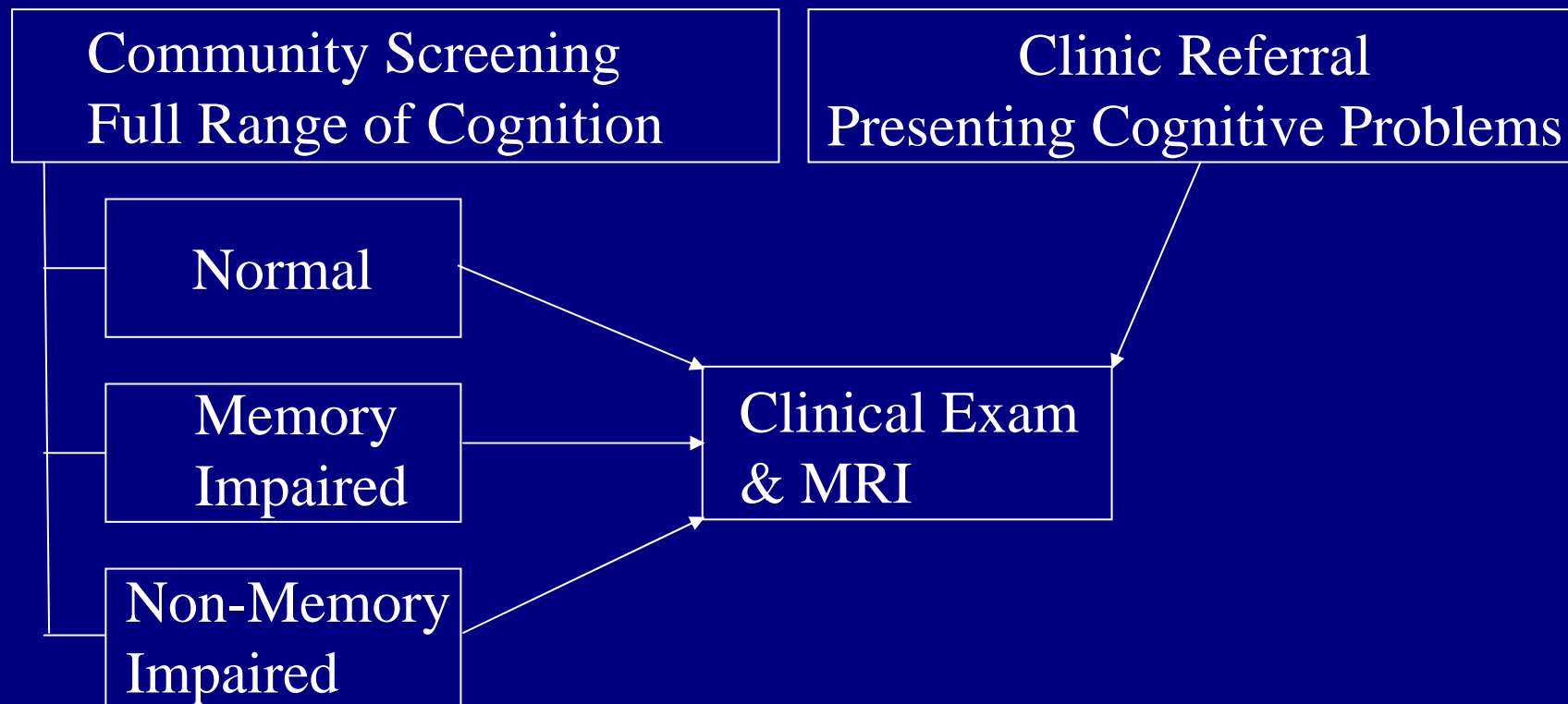
Questions Posed by Model

- Is cognition similarly structured in different ethnic groups?
- Are disease effects on cognition the same in different ethnic groups?
- Are pathways linking environment, genes, disease, and cognition the same in different ethnic groups?

Comparative Study of Determinants of Cognitive Test Performance



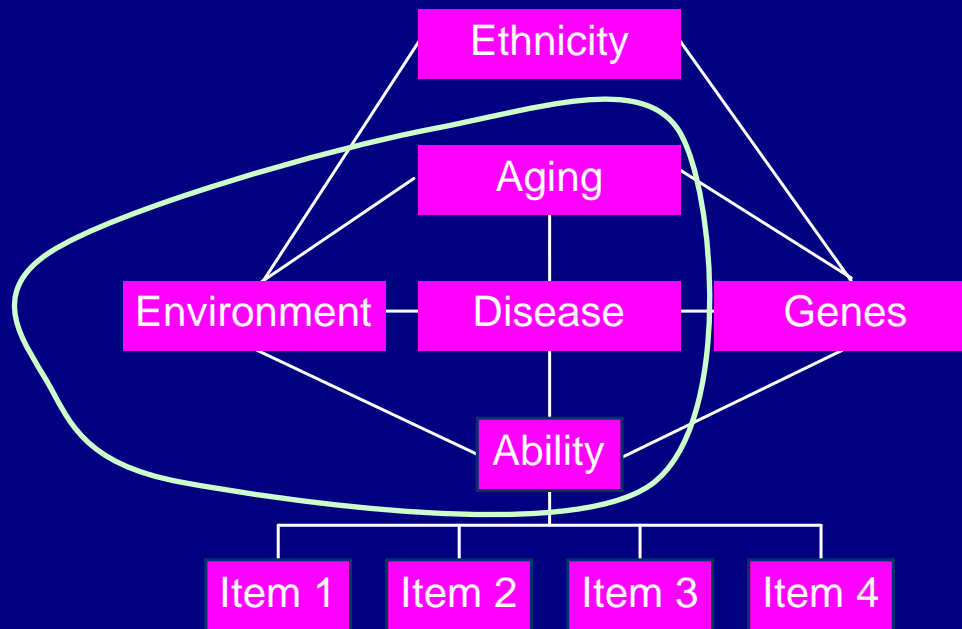
Recruitment Plan



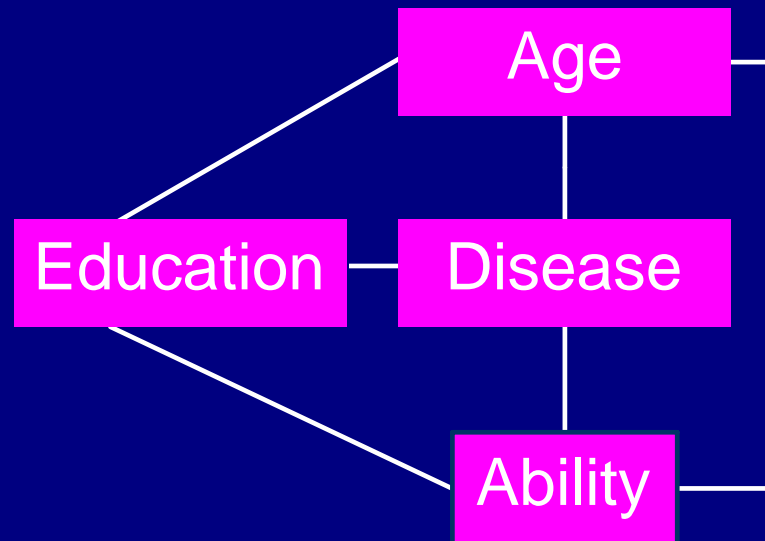
Cognitive Assessment

- Spanish and English Neuropsychological Assessment Scales (SENAS)
 - New Scales
 - Neuropsychologically relevant domains
 - Psychometrically matched
 - English and Spanish
 - Domains within English and Spanish

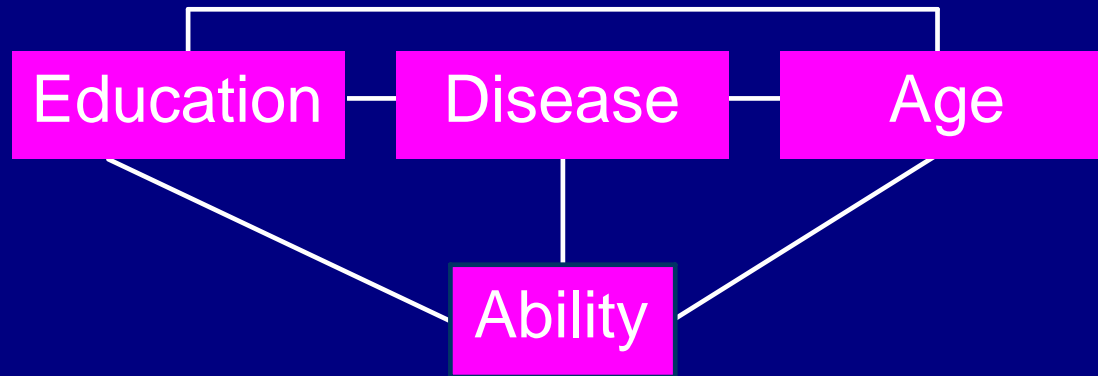
Age, Education, and Brain Structure



Age, Education, and Brain Structure



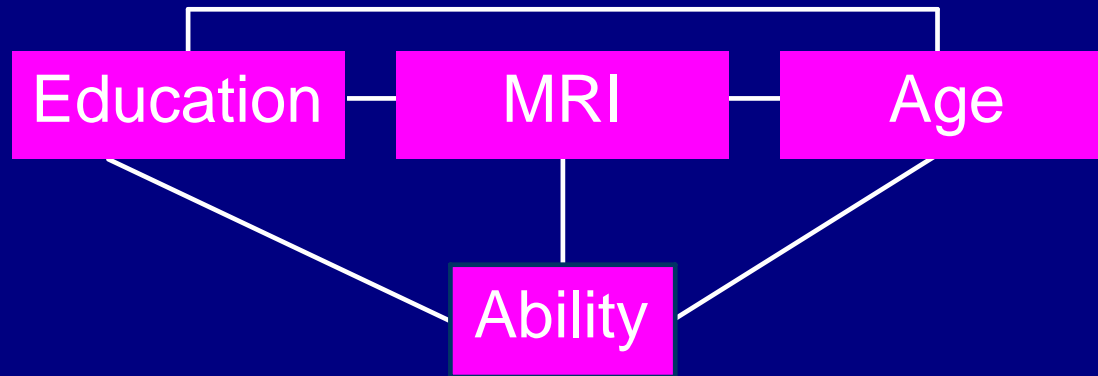
Age, Education, and Test Validity



MRI as Proxy for Disease

- MRI Variables
 - White Matter Hyperintensity Volume
 - Total Brain Matter Volume
 - Hippocampal Volume

Age, Education, and Test Validity



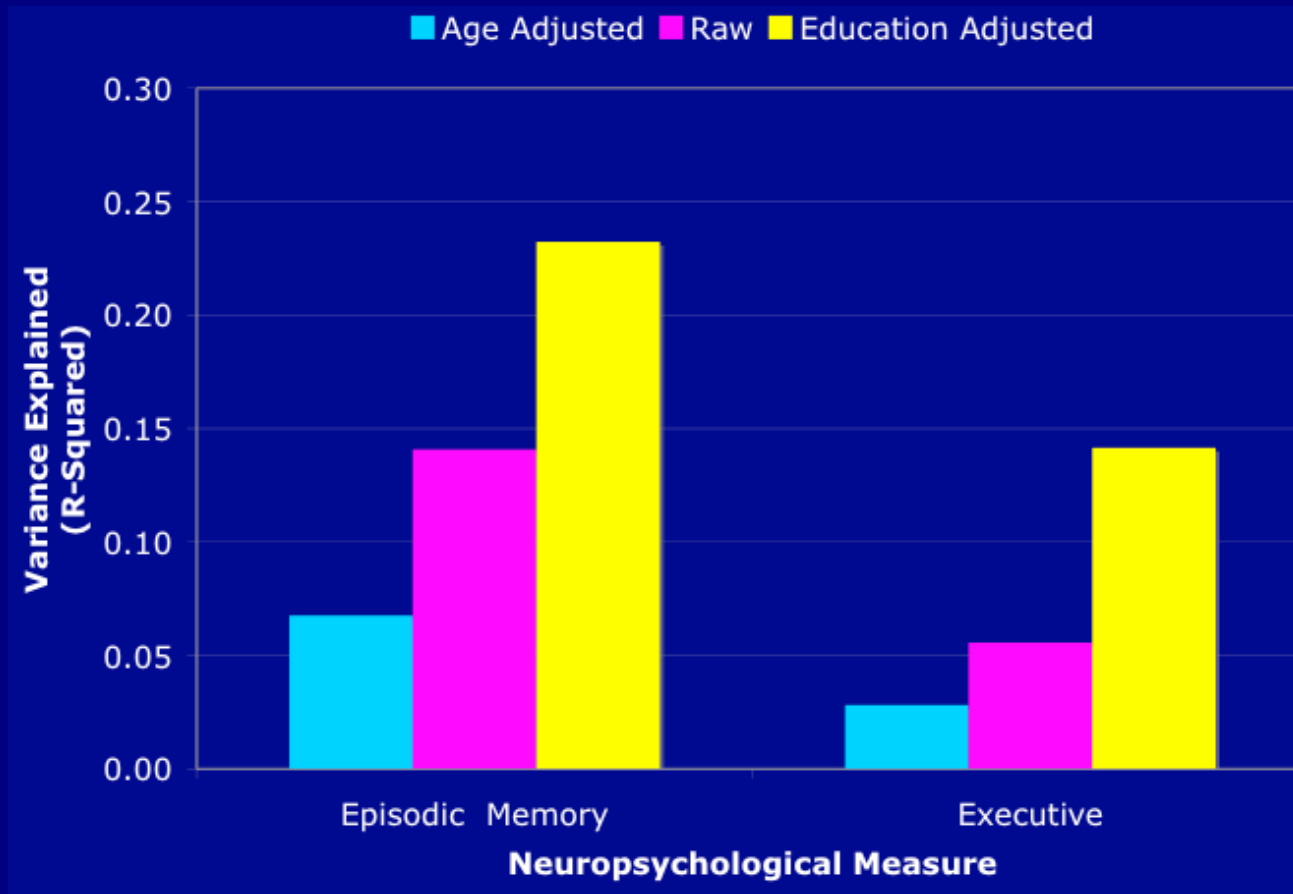
Sample* Characteristics

	Age Mean (s.d.)	Education Mean (s.d.)	Gender % Female
White n = 83	76.8 (8.2)	14.2 (3.1)	51.8
Minority ** n = 113	72.9 (7.1)	9.4 (5.5)	69.0

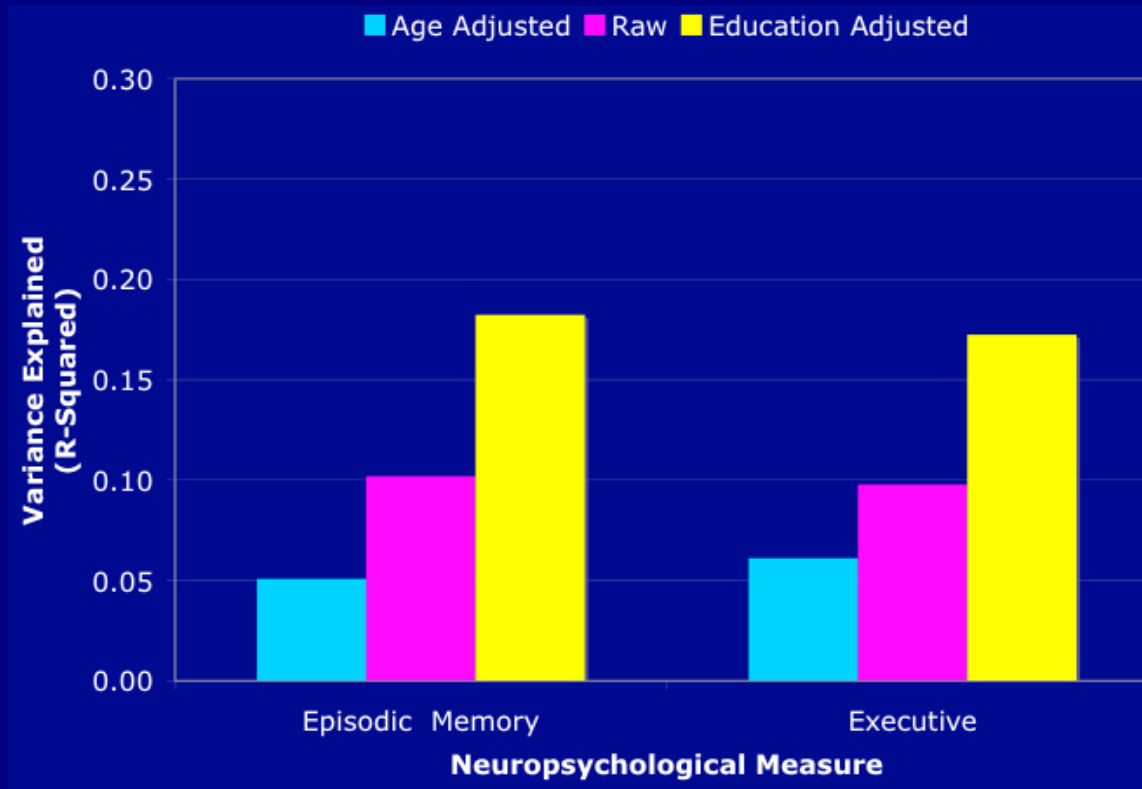
* Community dwelling, Normal, MCI, Demented

** Hispanic - n = 69, Black - n = 38, Other - n = 6

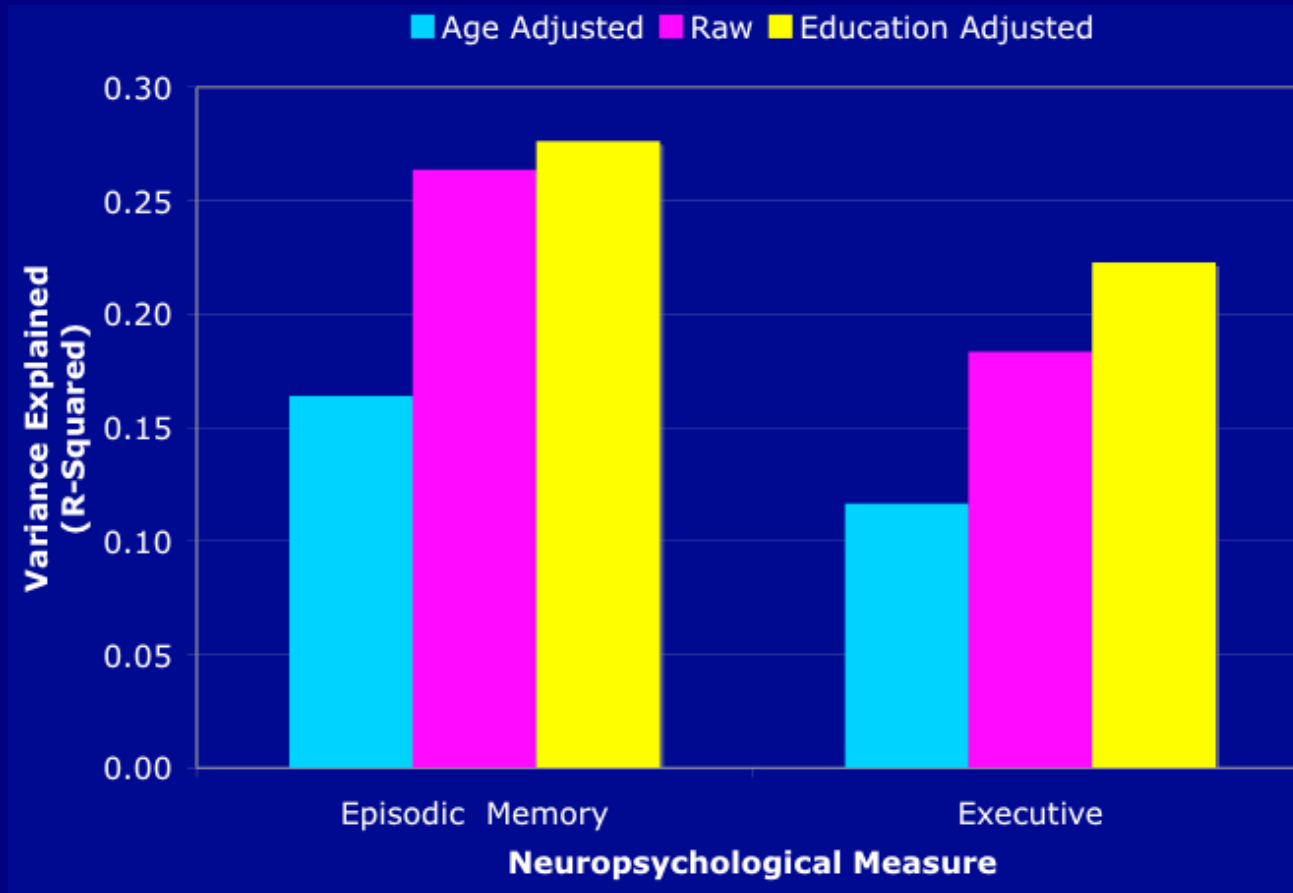
MRI Effect Sizes and Age and Education Adjustment - Full Sample (n=196)



MRI Effect Sizes and Age and Education Adjustment - Minorities (n=113)

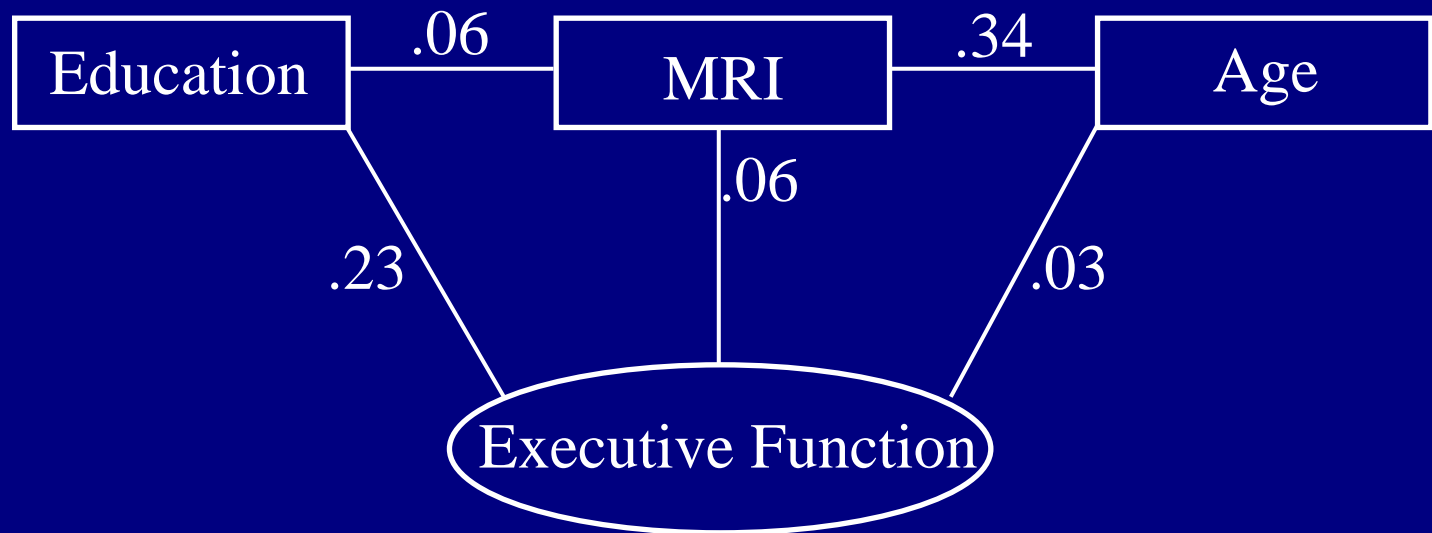


MRI Effect Sizes and Age and Education Adjustment - Whites (n=68)



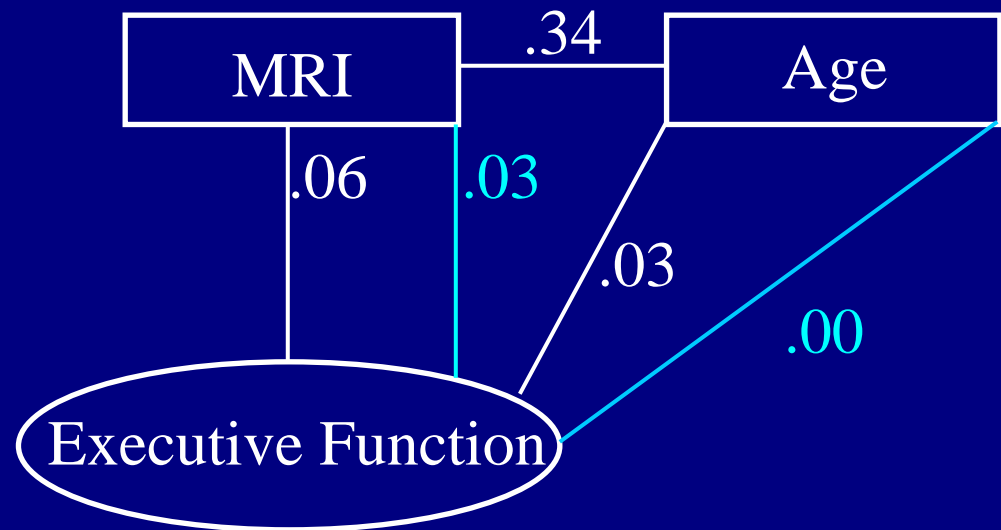
Executive Function, MRI, Age & Education

Bivariate Effects (R-Squared)



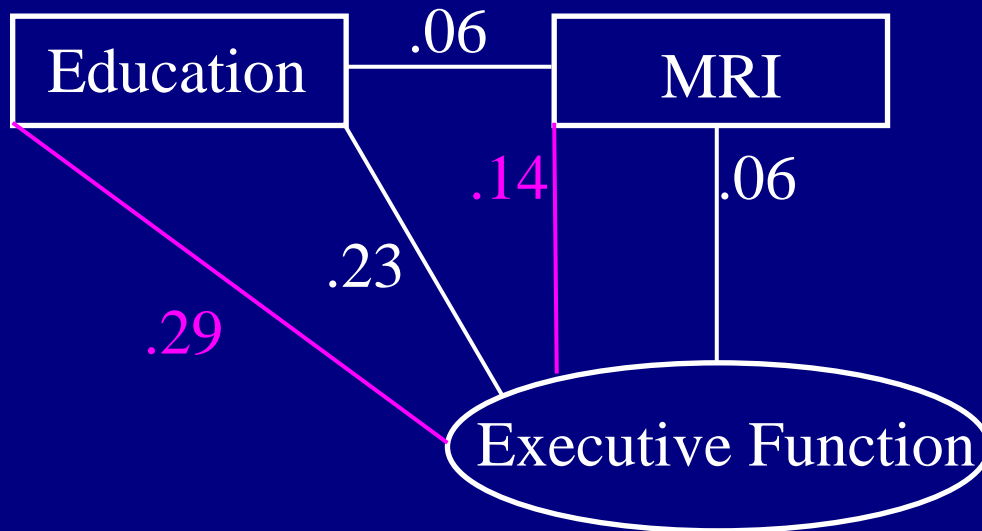
Executive Function, MRI, & Age

Bivariate and Multivariate Effects (R-Squared)

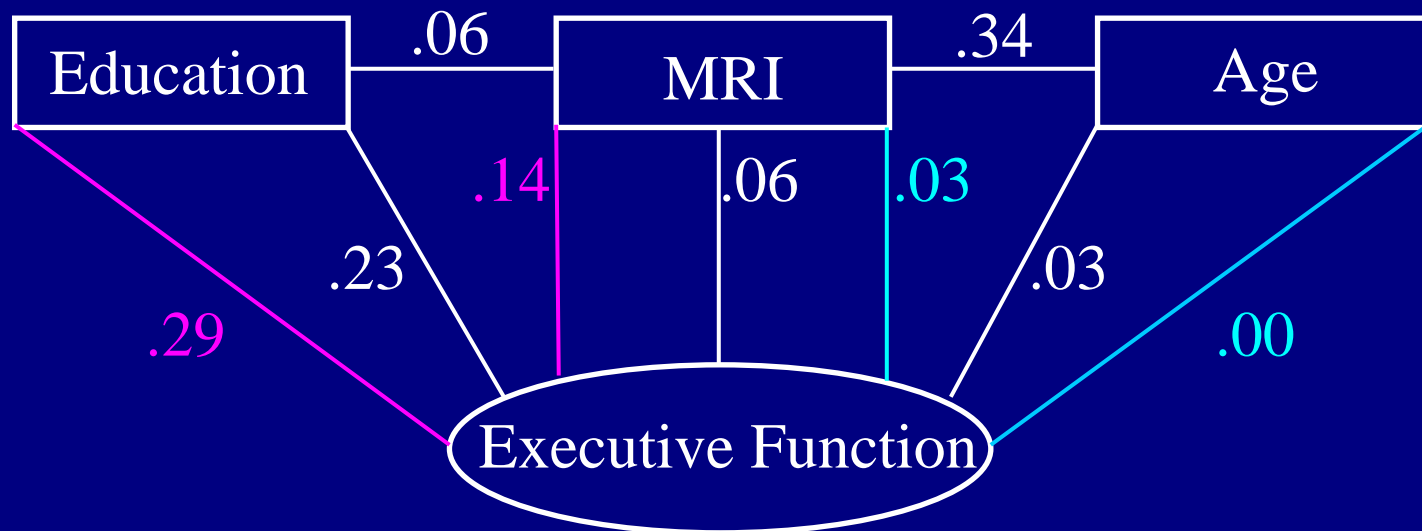


Executive Function, MRI, & Education

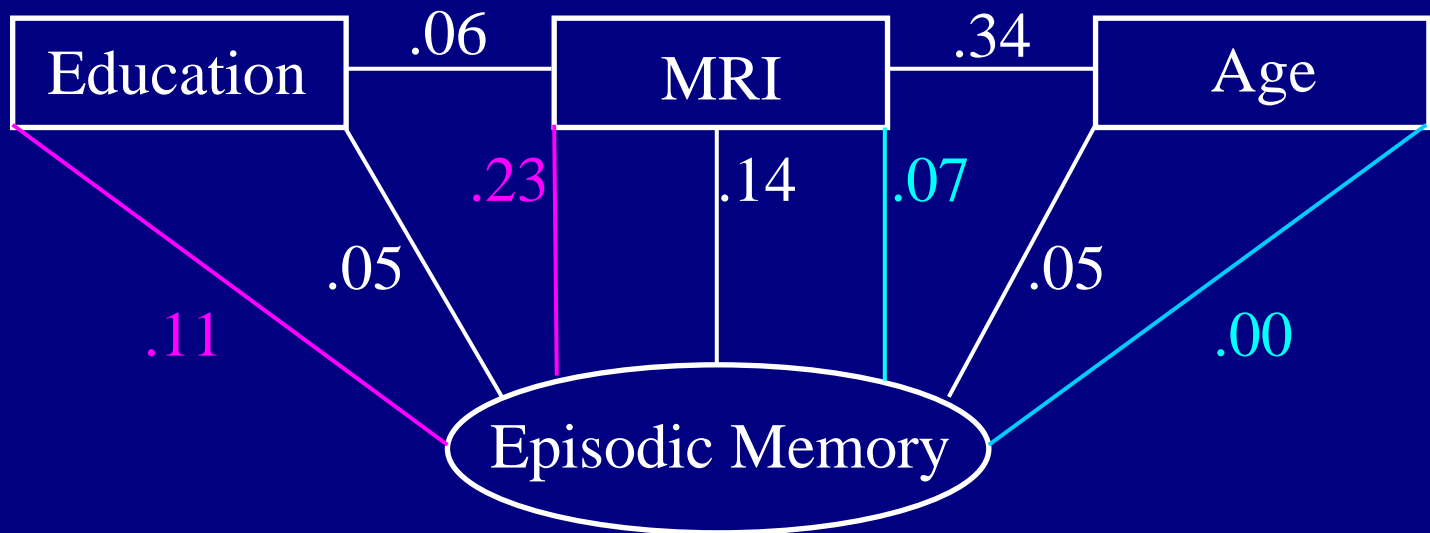
Bivariate and Multivariate Effects (R-Squared)



Executive Function, MRI, Age & Education Bivariate and Multivariate Effects (R-Squared)



Episodic Memory, MRI, Age & Education Bivariate and Multivariate Effects (R-Squared)



Age and Education Influences on MRI - Cognition Relationships

- It is possible to separate disease effects from extraneous influences
- MRI effects on cognition can be obscured by demographic effects on test performance, especially when
 - Demographic relationship with test score is larger than relationship with disease
 - Substantial heterogeneity of demographic variable in population of interest

Demographic Influences on Cognition

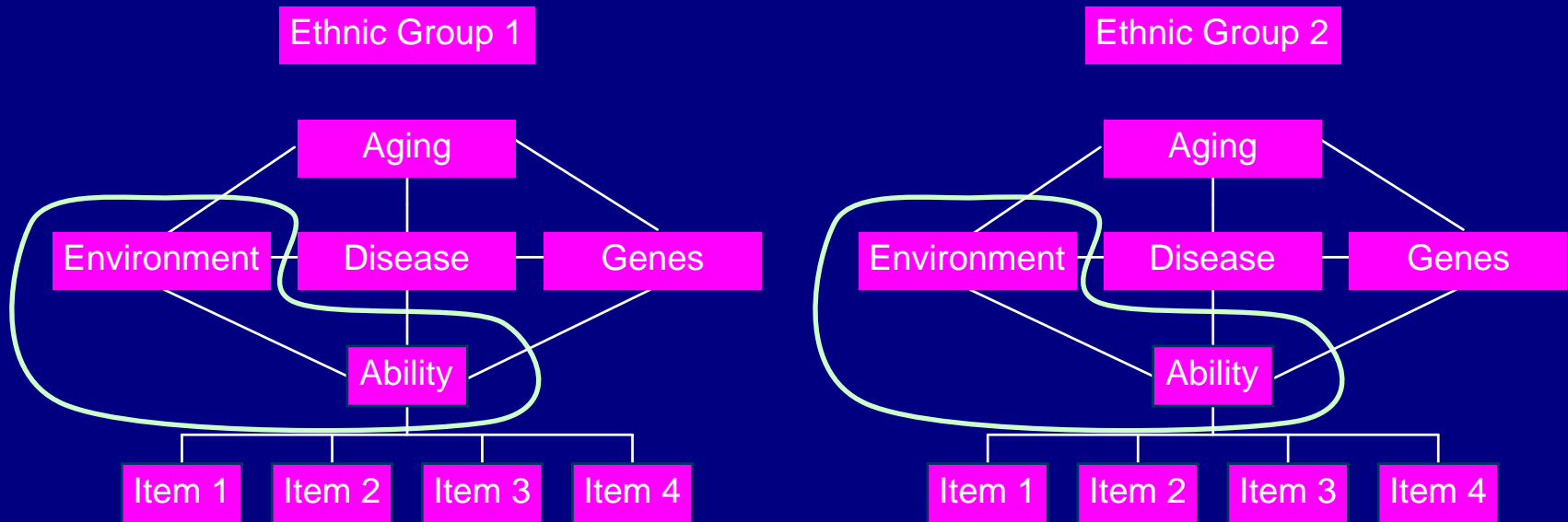
Sample Characteristics - Community Sample

	Age Mean (s.d.)	Education Mean (s.d.)	Gender % Female
White N = 272	73.3 (7.5)	14.2 (3.2)	60.6
Black N = 277	73.0 (7.3)	13.2 (3.0)	62.5
Hispanic N = 355	70.3 (7.1)	6.1 (4.7)	67.0

Background

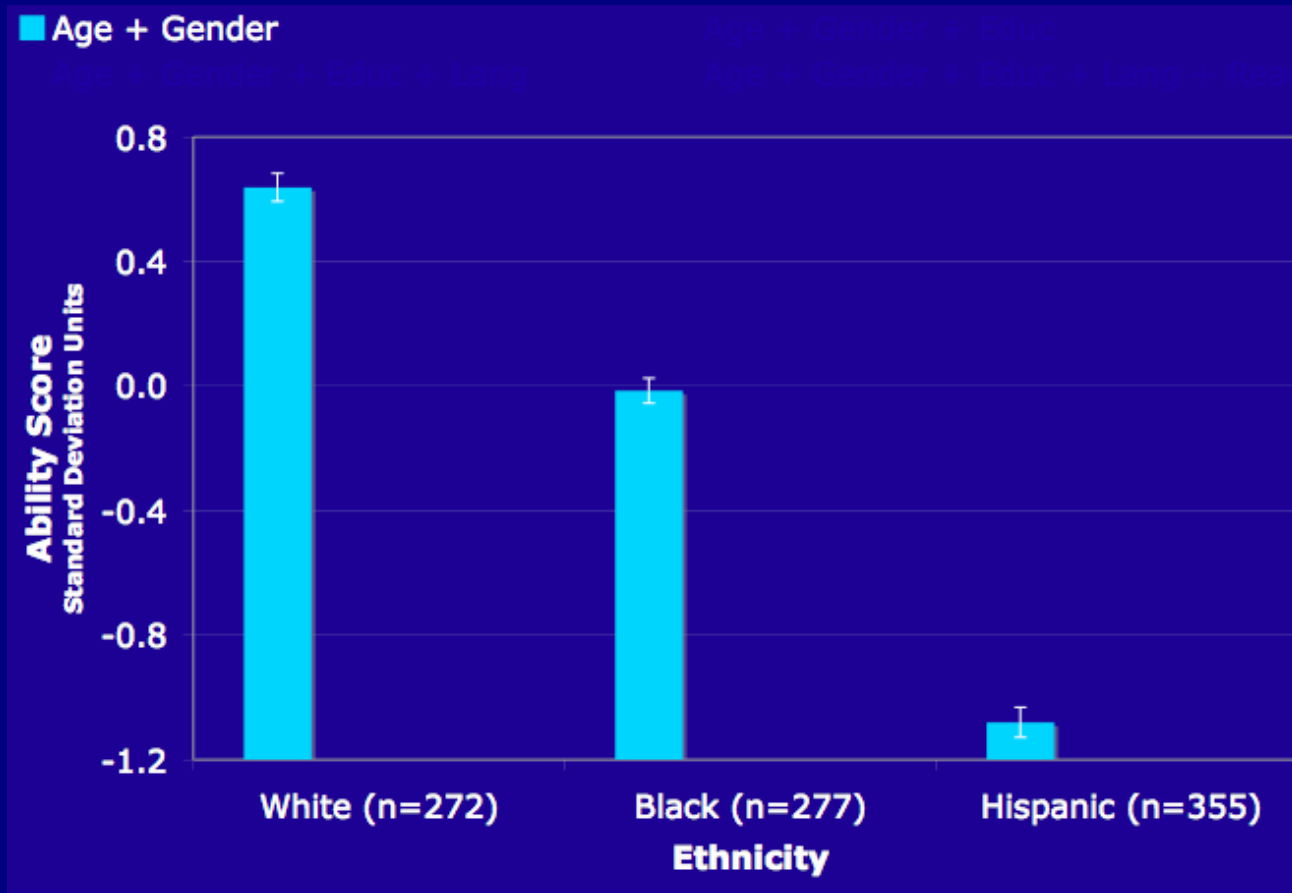
- Average differences between Blacks and Whites can be explained by group differences in education and reading
 - e.g. Manly et al., 2002, 2004
 - Reading a proxy for quality of education
 - Small acculturation effects independent of reading
- Average differences between Hispanics and Whites can be explained by education and language use
 - Mungas et al., 2005
 - English --> higher test scores, Spanish --> lower scores
 - Small acculturation effects independent of language

Determinants of Cognitive Test Performance



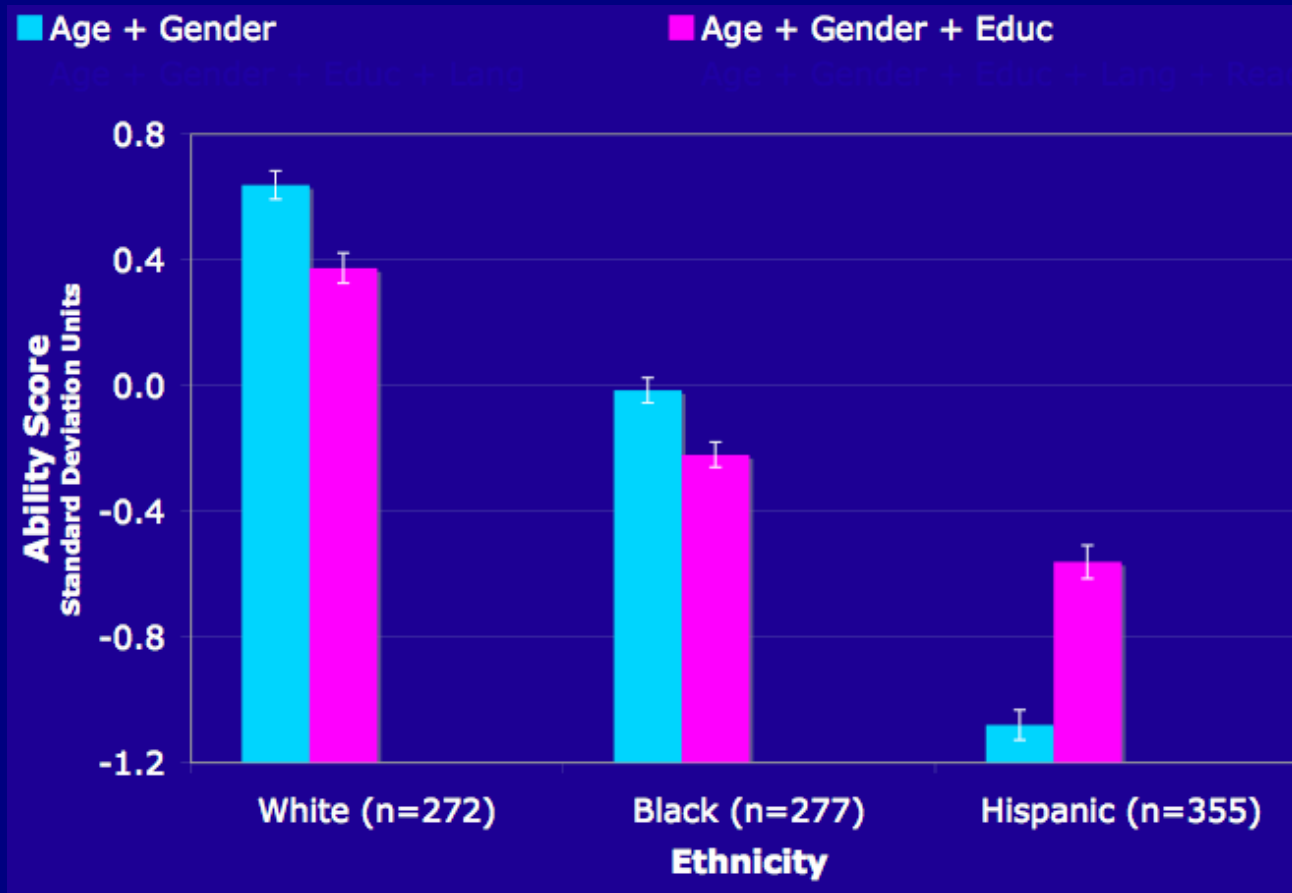
Semantic Memory

Mean Ethnic Group Differences



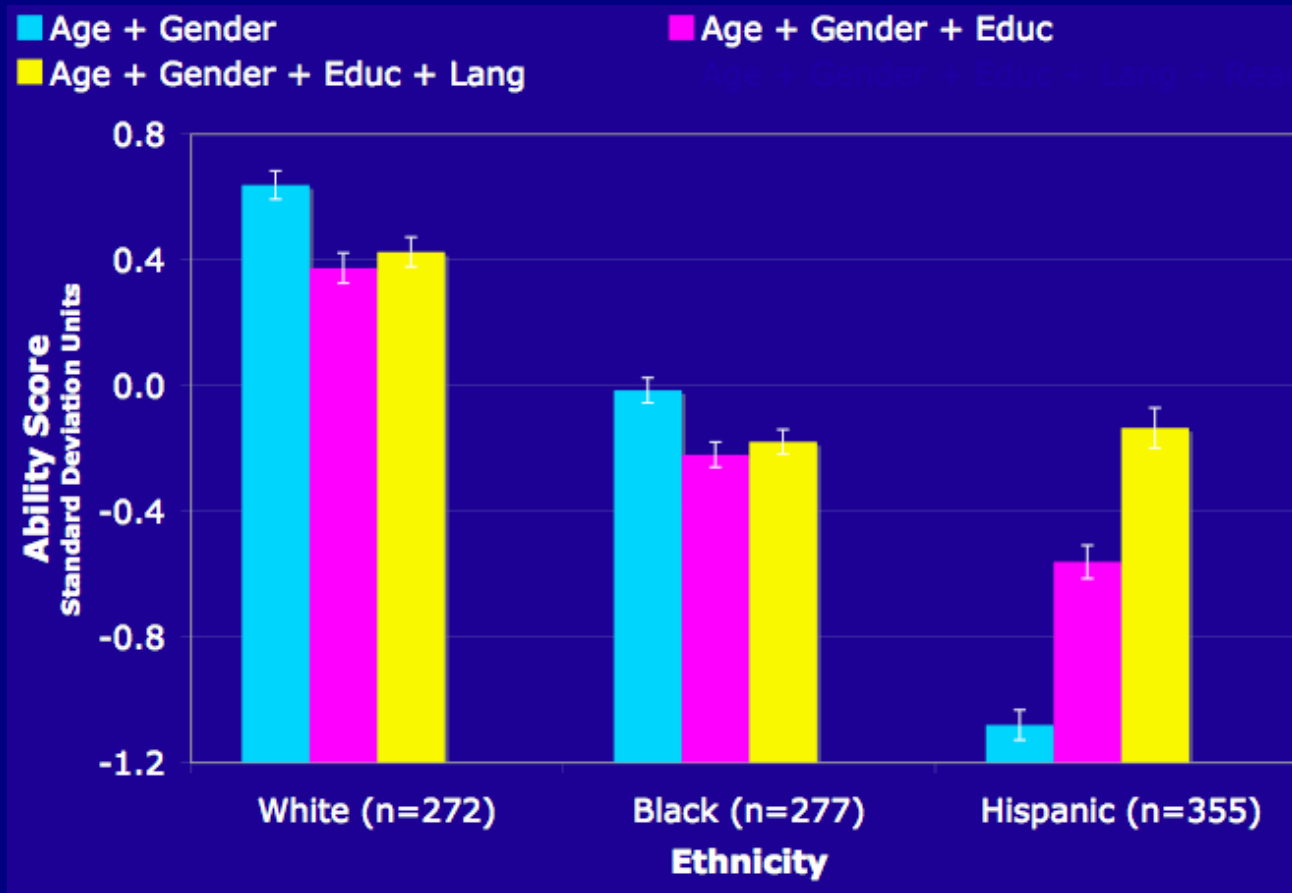
Semantic Memory

Mean Ethnic Group Differences



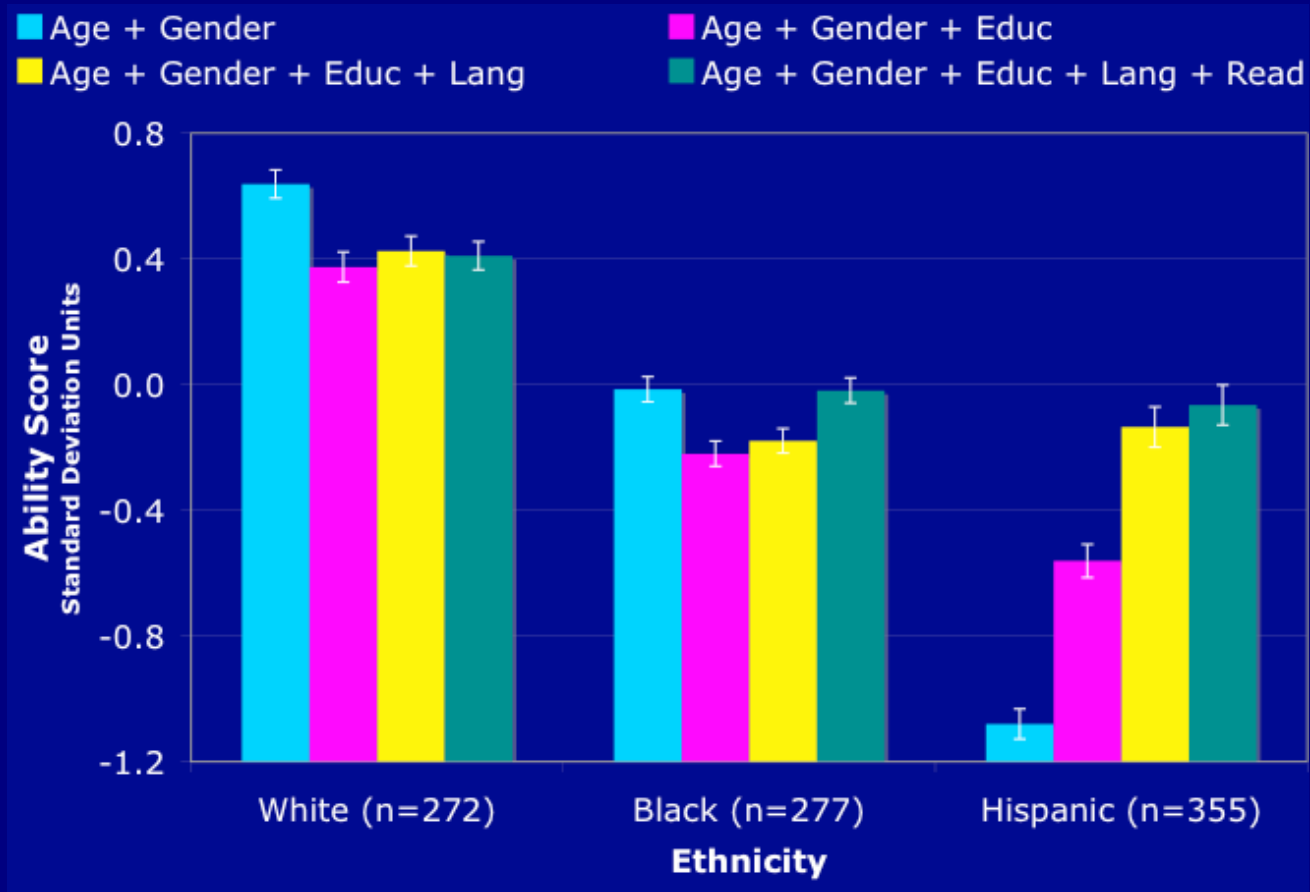
Semantic Memory

Mean Ethnic Group Differences



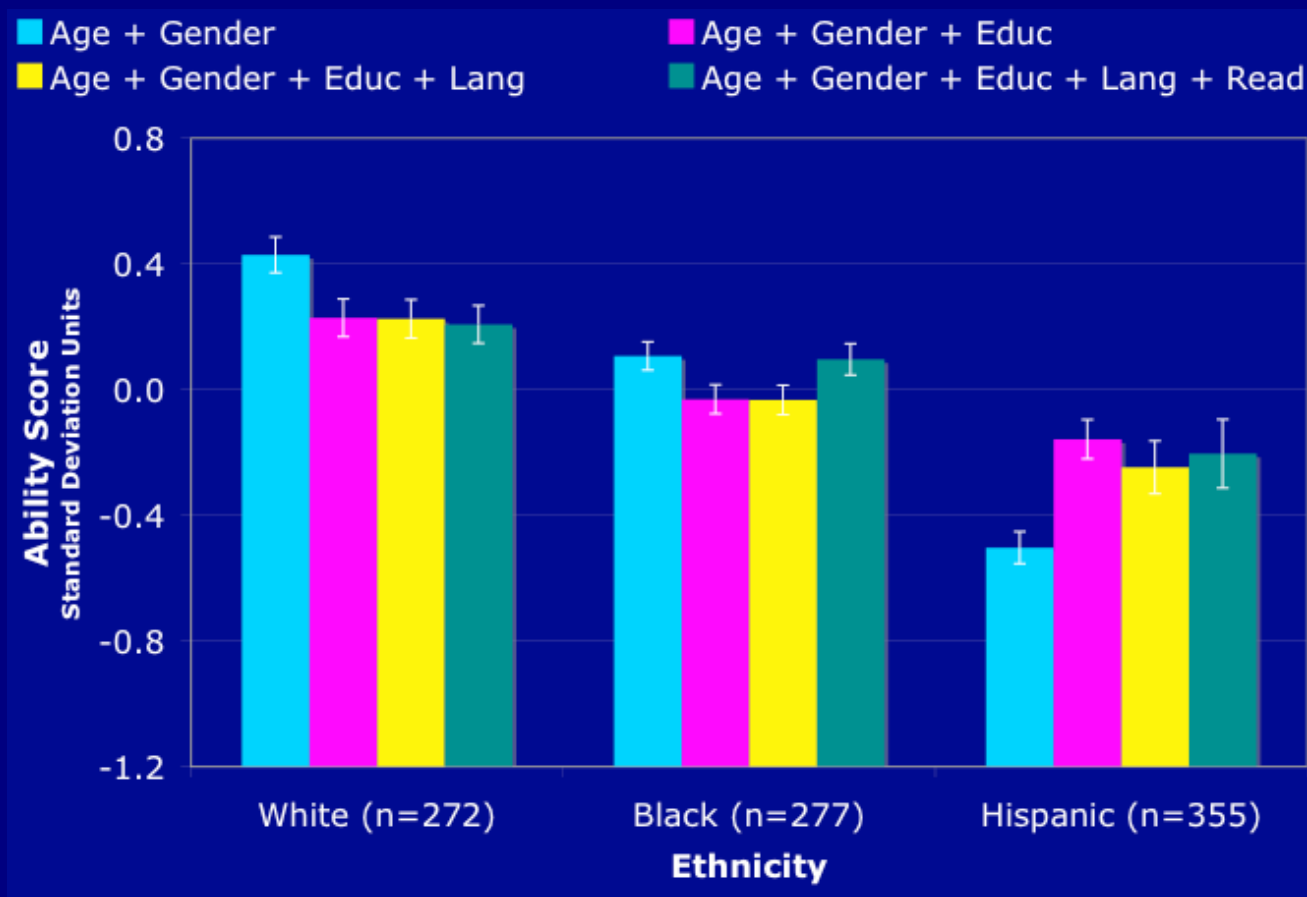
Semantic Memory

Mean Ethnic Group Differences



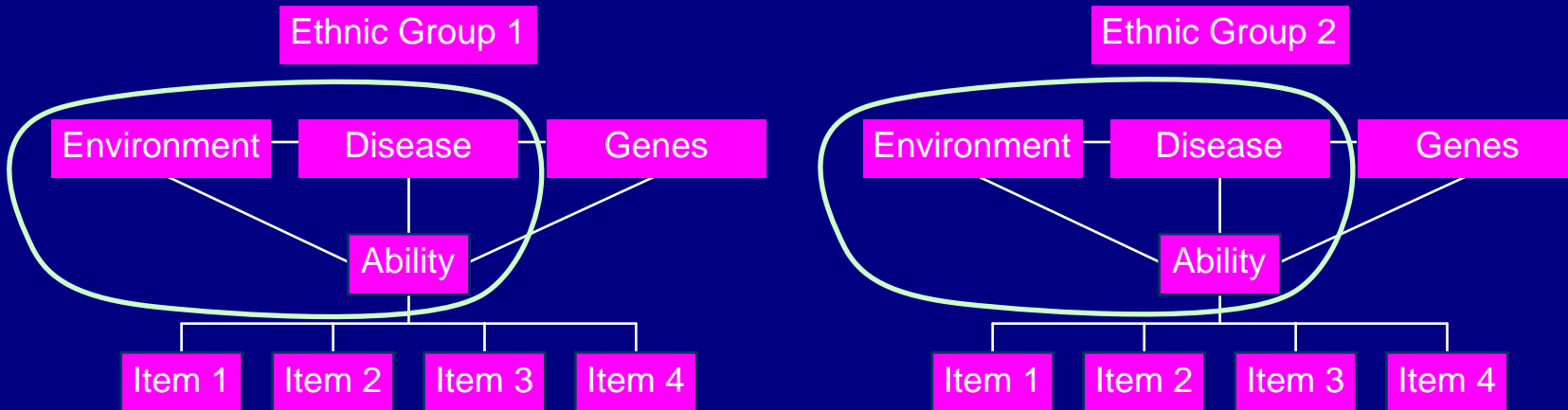
Episodic Memory

Mean Ethnic Group Differences



Ethnicity, Diagnosis, and Cognition

Determinants of Cognitive Test Performance

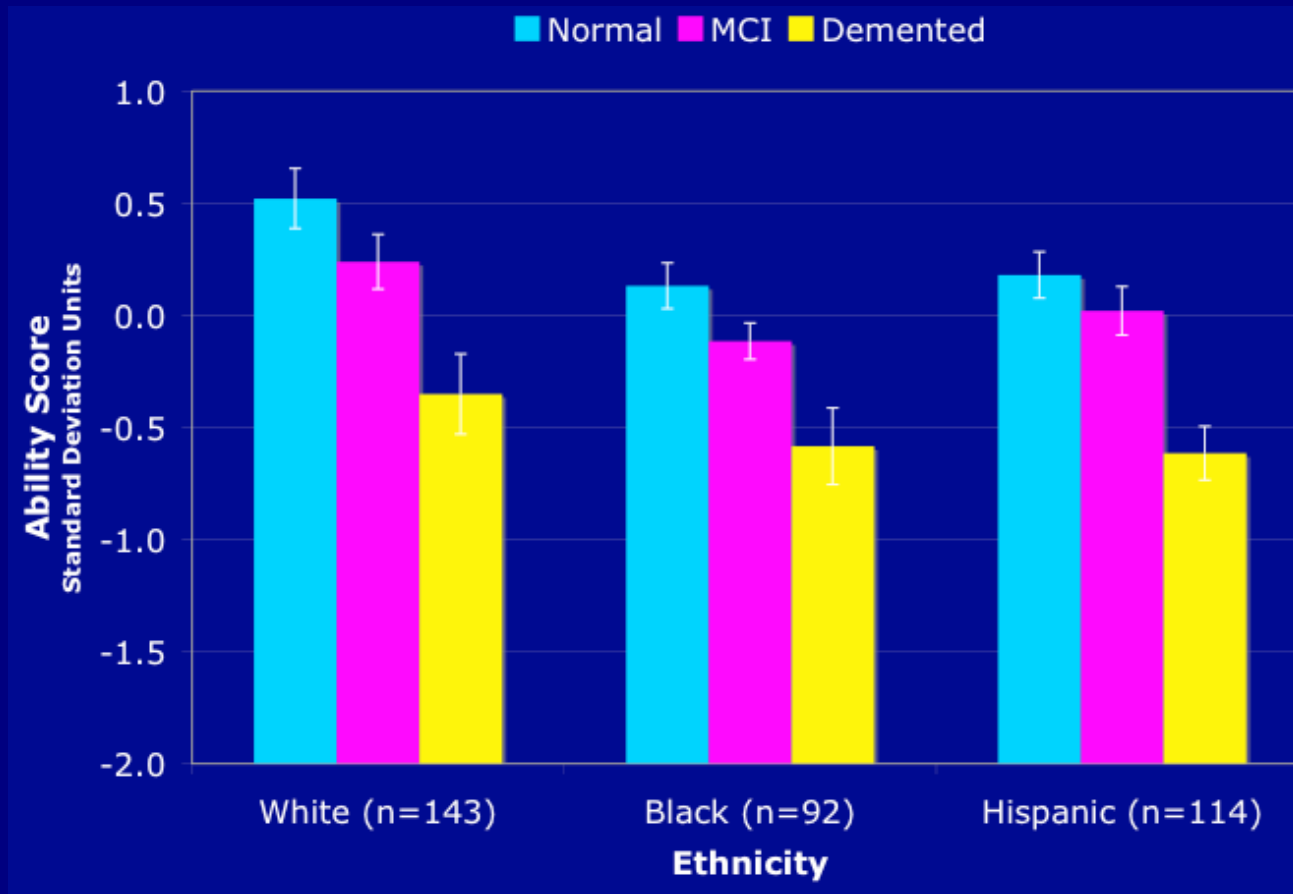


Sample Size - Clinical Evaluation Community + Clinic

	White	Black	Hispanic	Total
Normal	56	45	55	156
MCI	64	33	32	129
Demented	23	14	27	64
Total	143	92	114	349

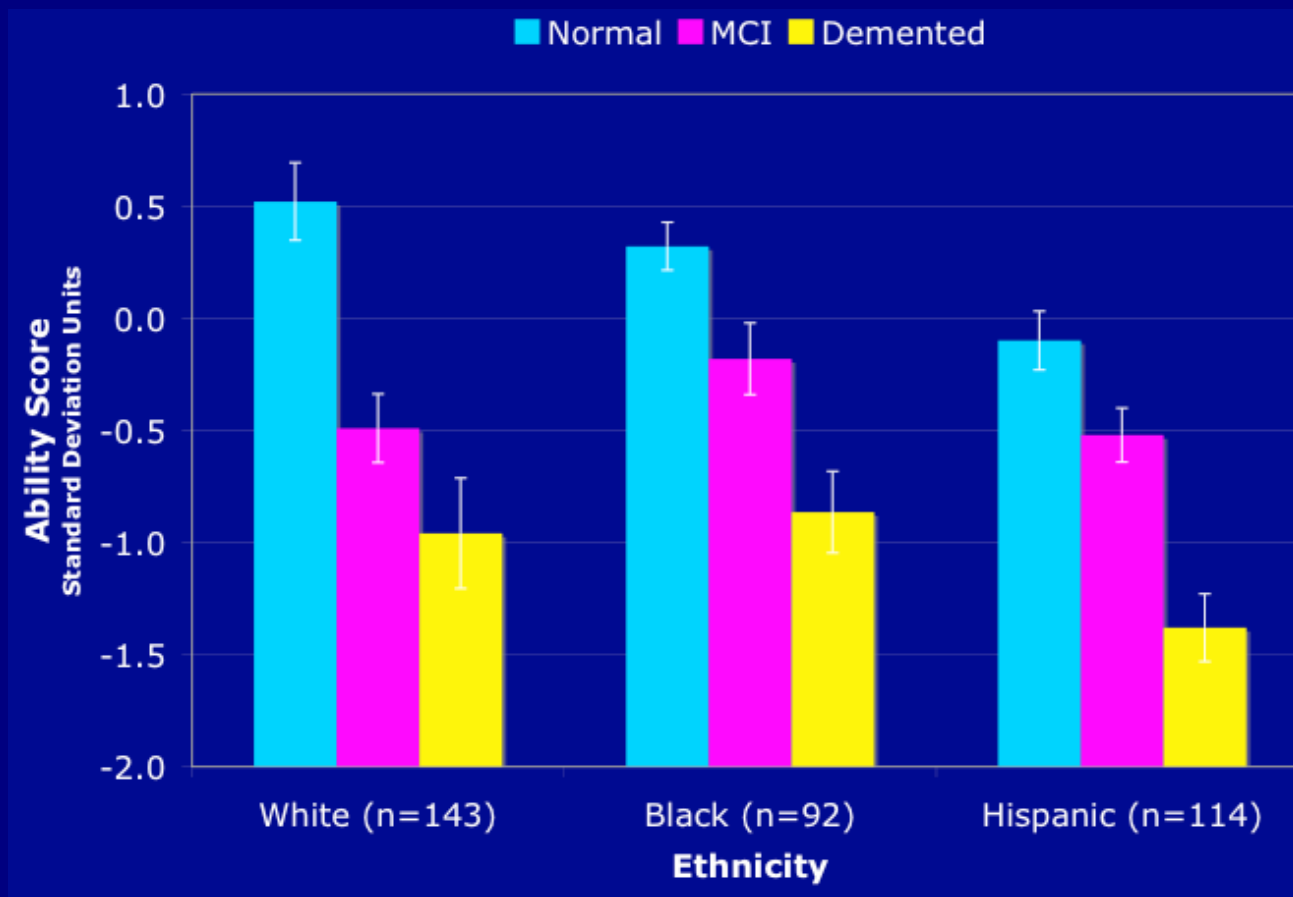
Semantic Memory by Diagnosis

(Age, Gender, Education, Language, Reading Adjusted)



Episodic Memory by Diagnosis

(Age, Gender, Education, Language, Reading Adjusted)



Ethnic Differences and Test Validity

- Sensitivity to diagnostic group differences is a prerequisite for a measure of cognitive impairment
 - Equivalent sensitivity across ethnic groups is an added advantage for comparative studies
 - Differences in mean scores across ethnic groups can lead to differential validity (bias) for detecting cognitive impairment in cross-sectional assessment
 - Importance of understanding and deconstructing ethnic difference

Conclusions

- Cognition in older persons is complexly determined
- Cognitive impairment associated with disease occurs in the context of remarkable heterogeneity of normal cognitive function
- Ethnicity contributes substantially to normal heterogeneity
- Appropriate studies can separate disease effects from demographic heterogeneity

Collaborators

- UC Davis
 - Charles DeCarli, M.D.
 - Bruce Reed, Ph.D.
 - Sarah Tomaszewski Farias, Ph.D.
- UC Berkeley
 - William Jagust, M.D.
- University of Michigan
 - Mary Haan, Dr. Sc.
- University of Washington
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