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Genetics/genetics of cognitive aging

Genetic and environmental influences on semantic verbal fluency across midlife and later life

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Abstract

Background: Despite the relevance of semantic fluency measures to risk for dementia and psychiatric disorders, little is known about their genetic and environmental architecture in mid-to-late life. Existing studies in community samples of middle-aged or older adults have yielded a wide range of heritability estimates for semantic fluency (20% to 77%). Some inconsistency may be due to measures available, but genetic variance on semantic fluency may also differ as a function of age, education, or other variables that varied across these studies.

Method: Participants represent 21,684 middle-aged and older adult twins (M = 60.84 years, SD = 11.21; Range 40-89) from six studies from three countries participating in the Interplay of Genes and Environment across Multiple Studies (IGEMS) consortium, representing three countries (Australia, Denmark, and the United States). All subjects completed the same measure of semantic fluency (naming animals in 60 seconds). Education was based on the International standard classification of education (ISCED).

Result: Results revealed small-to-moderate phenotypic associations with age (b = -.182, $p < .001$), age-squared (b = -.005, $p < .001$) and education (b = 1.18, $p < .001$), with education more strongly positively associated with fluency performance in females than males. Heritability decreased with age, ranging from $a^2 = .58$ to $a^2 = .40$ in 40 versus 89-year-olds respectively. Genetic variance increased as education increased and nonshared environmental variance decreased with higher education, but the modification of heritability by education was only observed in males.

Conclusion: Semantic fluency is interwoven with a network of other cognitive abilities and highly relevant to aging/dementia. However, there is much to learn about its genetic and environmental structure and the way these influences vary based on other biological and environmental factors. This is the largest study to examine the genetic and environmental architecture of semantic fluency, and the first to demonstrate that these influences vary based on age, sex, and education. These findings highlight the dynamic interplay of genetic and environmental influences on cognitive function, and highlight the need to examine the genetic underpinnings of cognition using very large samples that can capture these complex associations.