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Detection of neurodevelopmental diversity in memory clinics—Validation of a self-report measure

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ABSTRACT

Background: Neurodevelopmental learning and attentional disorders (NLAD) such as dyslexia, dyscalculia and attention deficit hyperactivity disorder (ADHD) affect at least 6% of the adult population or more. They are associated with atypical cognitive patterns in early and adult life. The cognitive patterns of affected individuals in late life have never been described. One main challenge is detecting individuals in clinical settings during which mild cognitive changes could be confounding the clinical presentation. This is a critical research gap because these conditions interact, across the life course, with an individual's risk for dementia. Also, learning disabilities which present in childhood pose persistent cognitive differences in areas involving executive function, reading and math.

Clinicians lack tools to detect undiagnosed neurodevelopmental in adults with memory disorders. The majority of patients presenting at memory clinics today come from a generation during which NLAD were not yet clinically recognized. In this study, we hypothesized that a self-report scale can detect NLAD in a memory clinic population.

Methods: We developed a self-report, retrospective childhood cognitive questionnaire including key attributes adapted from prior validated measures. 233 participants were included in the primary analysis.

Results: Confirmatory Factor Analysis resulted in a best-fit model with six labelled factors (Math, Language, Attention, Working Memory, Sequential Processing, and Executive Function) and 15 total question items. The model demonstrated unidimensionality, reliability, convergent validity, discriminant validity, and predictive validity. Using 1.5 standard deviations as the cut-off, subjects were categorized into: Normal ($n = 169$), Language ($n = 10$), Math ($n = 12$), Attention ($n = 10$) or Other/Mixed ($n = 32$).

Conclusion: A self-report measure can be a useful tool to elicit childhood cognitive susceptibilities

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in various domains that could represent NLAD among patients in a memory clinic setting, even in the presence of mild cognitive impairment.

What this paper adds?

The influence of neurodevelopmental diversity on cognitive aging patterns re. Our research validates a self-report measure to reliably capture past childhood cognitive difficulties. This will facilitate further research on how early life neurodevelopment influences late life neurodegeneration.

1. Introduction

Neurodevelopmental learning and attentional disorders (NLAD) including Specific Learning Disorder (SLD) and Attention Deficit Hyperativity Disorder (ADHD) fall under the umbrella category of Neurodevelopmental Disorders. NLAD have been associated with structural abnormalities in the brain, potentially resulting in reduced cognitive reserve and an increased susceptibility to age-related changes (American Psychiatric Association, 2013; Seifan, Schelke, Obeng-Aduasare, & Isaacson, 2015; Stern, 2012). SLD may include difficulties in the areas of language, math, or written expression.

In the United States, NLAD collectively affect between 2% and 12% of the adult population. The most common SLD'S include SLD reading, SLD writing, and SLD math, which were previously known as dyslexia, dyscalculia and dysgraphia. The range of neurologically-based NLAD varies considerably, and conditions are often co-morbid. ADHD affects approximately 4% of the adult population and primarily manifests as behavioral disturbances that are classified as inattentive, hyperactive/impulsive, or a combination of both. (Cortiella & Horowitz, 2014; Kessler et al., 2006).

Clinically, NLAD are associated with a spectrum of attributes. The concept of "neurodiversity" has been introduced to capture the infinite biological variations in neurocognitive functioning (Armstrong, 2015; Masataka, 2017). The presence of these, especially if unaddressed, may influence risk of neurodegenerative dementias such as Alzheimer's disease (AD) and Frontotemporal Lobar Degeneration (FTLD) (Golimstok et al., 2011; Rogalski, Johnson, Weintraub, & Mesulam, 2008; Seifan, Assuras et al., 2015).

Surprisingly, despite the prevalence, clinicians and researchers are still unsure of how neurodevelopment influences cognitive aging patterns. This is a critical research gap because the majority of patients presenting to memory clinics today come from a generation during which NLAD were not yet clinically recognized; a recent Veterans Affairs study surveyed 57 memory clinics across the United States to identify and assess whether clinicians consider ADHD as a pre-morbid condition when evaluating dementia patients. Of those surveyed, 40% reported having no contact with ADHD patients in their clinic, suggesting that clinicians may not be adequately considering these contributions in the context of late-onset cognitive changes (Fischer, Gunter-Hunt, Steinhafel, & Howell, 2012).

Current methods to clinically detect NLAD have not been extensively studied in memory clinic settings. We hypothesized that a self-report measure constructed to elucidate a history of NLAD could reliably capture past experiences with childhood cognitive difficulties. This hypothesis was based on the fact that autobiographical information is retained until the latest stages of dementia. Therefore the aim of this study was to evaluate the validity and usefulness of a set of self-report questions specifically created to identify potential past childhood language, math, and attentional disabilities in a sample of adults attending a memory clinic.

2. Methods

2.1. Study population

Participants for this study were drawn from the community-based Weill Cornell Medical College Comparative Effectiveness Dementia & Alzheimer's Registry (CEDAR) project. The CEDAR project is an observational clinical registry that was initiated in 2013 and uses an innovative platform that tracks in-office clinical care that includes an online educational model (www.AlzU.org) aimed at delivering the most up-to-date AD information to patients in real time.

A convenience sample of 369 subjects consented to participate in this IRB-approved study. Participants in this study ranged in age from 20 to 90 years and initially presented to the Weill Cornell Memory Disorders Clinic because they had memory loss symptoms themselves, or because they had a first degree relative diagnosed with AD and were interested in learning about and engaging in prevention behaviors. We excluded patients with dementia from this study to ensure that all answers were as accurate as possible. We included younger people in this study because they are more likely to carry a formal diagnosis of a neurodevelopmental disorder.

2.2. Procedure

As a part of routine clinical care, all participants were screened for cognitive impairment with the Mini Mental Status Examination (MMSE) (Folstein, Folstein, & McHugh, 1975). The 30-point psychometric measure has been used extensively clinically and in research, in both adult and geriatric populations and has a test-retest reliability of $r = 0.83$ to 0.90 (Clark et al., 1999). A MMSE cut-off score of ≤ 26 is indicative of significant mild cognitive impairment and therefore we excluded a total of 142 subjects from this