Title: Retrospective memory abilities of children with Down syndrome in comparison to typically developing children across time

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Introduction: Down syndrome (DS), the most common form of intellectual disability with a known genetic etiology, is associated with global cognitive impairments, as well as specific memory difficulties that exceed overall cognitive functioning (1, 2). These memory deficits include short-term (STM), long-term (LTM) and working memory (WM) (2). However, research on memory abilities of children with DS remains very limited and research longitudinally examining memory abilities is scarce. Gaining a better understanding of memory abilities across childhood and adolescence has significant implications for real-world functioning, as memory abilities of youth with DS are associated with intellectual functioning, academic skills, adaptive functioning skills, and employment status (3; 4; 5). The current study aims to provide a comprehensive analysis of LTM, STM, and WM across two time points in youth with DS in comparison to mental-age matched typically developing peers.

Method: As a part of a larger study, children with DS (n=19, M CA =11.05, M MA=6.07) between the ages of 6 to 17 were matched to typically-developing (TD) children (n=20, M CA=5.14, M MA=6.50) between the ages of 3 to 7 years old on raw scores from the Kaufman Brief Intelligence Test (DS M=45.47$\pm$13.91; TD M= 49.38$\pm$10.84; 6) at Time 1. Participants completed measures of LTM, STM, and WM at time point 1 (T1) and a subset of participants repeated these assessments approximately 18 months later (T2), which included 19 children with DS (CA=12.82$\pm$2.35) and 12 TD children (CA=6.73$\pm$1.20). STM assessments included the Wechsler Digit Span subtest, which requires repeating a series of digits increasing in length, and the Wechsler Spatial Span subtest, which involves tapping a series of locations on a grid which increase in length (7). LTM tasks included the Selective Reminding Task, which requires children to learn a list of eight foods over six trials and recall these words after a delay (8, 9), and a Paired Associates Learning Task (10), which requires children to learn six pairs of unrelated objects across six trials and recall these pairs after a delay. WM was assessed using the Missing Scan Task (11) which requires children to recall a missing toy animal from a series of previously presented toy animals that are briefly hidden from view. The outcome variable for each memory task was the percentage of correctly answered items. For STM and LTM domains, the average percentage scores across the two tasks for each domain were used to create domain composite scores.

Results: To examine memory performance of children with DS in comparison to the TD group from T1 to T2, three 2x2 mixed measures ANOVAs were completed, with one between-subjects factor (group: DS, TD) and one within-subjects factor (time: T1, T2). Due to significantly higher percentage of females in the DS group (65%) in comparison to the TD group (27.3%), gender was used as a covariate in the analyses. For STM performance, there was significant main effect of group ($F(1,24)=25.15$, $p<0.001$), such that the DS group (M=0.27$\pm$0.02) performed significantly below the TD group (M=0.41$\pm$0.21). There was no significant main effect of time ($F(1,24)=0.07$, $p=.79$) or a significant interaction($F(1,24)=1.36$, $p=0.26$). For LTM performance, there was a trend towards a main effect of group ($F(1,25)=3.26$, $p=0.08$) such that the DS group (M=0.65$\pm$0.05) performed significantly below the TD group (M=0.78$\pm$0.5). There was no significant main effect of time ($F(1,25)=0.08$, $p=0.78$) or a significant interaction ($F(1,25)=2.27$, $p=0.14$). Lastly, for WM performance, there was significant main effect of group ($F(1,25)=18.45$, $p<0.001$), such that the DS group (M=.14$\pm$.03) performed significantly below the TD group (M=.36$\pm$.04). There was no significant main effect of time ($F(1,25)=0.21$, $p=0.65$) or a significant interaction ($F(1,25)=1.91$, $p=0.18$).

Discussion: Overall, children with DS demonstrated significantly weaker performance on STM, LTM, and WM tasks in comparison to TD children at both T1 and T2. However, for all three memory domains, there was no significant interaction between group and time. Given the small sample size, definitive conclusions about the development of these memory skills relative to typically developing youth cannot be made. However, data collection for this project is ongoing. Thus, we will be able to report on findings with a larger sample in 2020.

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