

Title: Inhibition and Sustained Attention with Reported Changes in Adults with Down Syndrome

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Introduction: Adults with Down syndrome (DS) frequently experience signs of premature aging and are at a substantially increased risk of developing dementia (Head et al., 2016; Zigman, 2013). Executive functions are among the cognitive skills that decline in adults with DS (Adams & Oliver, 2010; Ball et al., 2006). However, Holland et al. (2000) found caregivers frequently reported observed behavioral changes as the earliest signs of dementia in individuals with DS. The goal of this preliminary study was to determine if inhibition and sustained attention were related to caregiver-reported observed changes in aging individuals with DS. Research with a similar goal has been performed with inhibition (Adams & Oliver, 2010), though not with sustained attention in human participants. It is important to expand upon past research due to evidence of declines in sustained attention in aged Ts65Dn mice (Driscoll et al., 2004). Better understanding of the relations between these essential skills and caregiver-reported observed changes could be useful in detecting signs of premature aging and cognitive decline DS.

Method: The sample included 17 adults with DS age 19 to 60 years ($M = 35.52$, $SD = 16.32$; nine males; 14 White non-Hispanic) and their primary caregivers. Per caregiver report, one participant was diagnosed with dementia and another with mild cognitive impairment at the time of the study. Twelve caregivers were participants' parents, three were residential care providers, and two were siblings. Participants with DS completed an animal Stroop task as a measure of inhibition (Wright et al., 2003) and two subtests from the junior sustained attention index of the Test of Everyday Attention for Children – 2nd Edition (Manly et al., 2016): hide and seek (auditory) and simple reaction time (visual). Primary caregivers reported on observed changes in participants with DS using the National Task Group Early Detection Screen for Dementia (NTG-EDSD; Esralew et al., 2013). This survey was designed to assess eight areas (many behavioral) related to early cognitive decline in adults with intellectual disabilities: activities of daily living, language and communication, sleep-wake change patterns, ambulation, memory, behavior and affect, adults' self-reported problems, and notable significant changes observed by others.

Results: Older chronological age was related to increased challenges with inhibition ($r = .62$, $p = .01$), as well as to increased caregiver NTG-EDSD reports of observed changes in six of eight areas assessed (r 's = .47 to .68). Therefore, we included age as a covariate in further analyses. Increased inhibition challenges (i.e., greater accuracy differences between congruent vs. incongruent trials) were strongly related to increased caregiver NTG-EDSD reports of observed changes in memory ($r = .76$, $p < .01$), as well as marginally to language and communication ($r = .48$, $p = .07$) and adults' self-reported problems ($r = .48$, $p = .095$). Increased auditory sustained attention challenges (i.e., longer mean reaction times to auditory stimuli) were related to increased caregiver NTG-EDSD reports of observed changes in behavior and affect ($r = .58$, $p = .04$) and notable significant changes observed by others ($r = .56$, $p = .048$). Increased visual sustained attention challenges (i.e., longer mean reaction times to visual stimuli) were related to increased caregiver NTG-EDSD reports of observed changes in language and communication ($r = .60$, $p = .04$) and adults' self-reported problems ($r = .58$, $p = .047$).

Discussion: Taken together, participants' increased challenges with inhibition and sustained attention were related to greater caregiver-reported declines in five of eight areas assessed. Importantly, this preliminary study newly adds that declines in sustained attention can occur with observed behavioral and cognitive changes in aging individuals with DS. Of course, it is important to investigate sustained attention and observed changes longitudinally as seen with inhibition in Adams and Oliver (2010) to determine the directionality of these relations. Additional research in this area could have implications for clinicians who might consider assessing sustained attention, as well as noting behavioral and cognitive changes observed by others, when working with aging individuals with DS. Combined, these could be important early markers of mild cognitive impairment and dementia in this phenotype. This study also suggests the NTG-EDSD is a useful, easily accessible and easily administered tool in reporting early correlates of cognitive decline in DS.

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