Title: Fluid and Crystallized Ability in Adolescents with Down Syndrome: Change Over Time

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Introduction: Fluid ability is one’s capacity to process and reason in an abstract manner. It is not considered to be a learned ability (Stoner, 1982). In typically developing individuals (TD) this ability tends to increase through childhood, reaching peak capacity in the mid 20s (Staff, Hogan, & Whalley, 2014) and then steadily declining into older adulthood (Staff et al., 2014). In contrast to fluid ability, crystallized ability, or the accumulation of knowledge throughout life experience, tends to increase throughout a TD individual’s life (Stoner, 1982). It is not known if these trajectories follow a similar pattern in individuals with Down Syndrome (DS). However, aging processes are accelerated in DS (Zigman, 2013) and new evidence suggests that some aspects of cognition either decline or slow during adolescence in DS (Conners, et al., in press). Thus, it could be that the trajectories of fluid and crystallized abilities diverge earlier than in the general population, possibly in adolescence. The current study investigated fluid and crystallized abilities across the range of adolescence in DS over a two-year period.

Method: 42 adolescents with DS between the ages of 10 and 21 years (Mage = 15.07; SD = 3.40; Leiter-R Breif IQ range = 36-71; 73.8% White Non-Hispanic; 47.6% male) completed a battery of measures including fluid and crystallized ability at two different testing appointments two years apart. Participants completed the Peabody Picture Vocabulary Test, 4th edition (PPVT-4; Dunn & Dunn, 2007) as a measure of crystallized ability and the Leiter International Performance Test – Revised (brief version) as a measure of fluid ability, each at Time 1 and Time 2. For both measures, growth value scores were used in data analysis.

Results: Paired-samples t-tests were used to compare Time 1 to Time 2 for both fluid and crystallized ability. For fluid ability, there was no significant change over two years, t (41) = 1.426, p = .161, d = .220; however, for crystallized ability there was a significant increase in scores from time 1 (M = 146.07; SD = 21.43) to time 2 (M = 150.33; SD = 25.10), t (41) = 2.49, p = .017, with a small to medium effect size, d = 0.384. To determine whether variability in change over two years was related to age, change scores were computed for both fluid and crystallized ability and correlated with age. Change correlated negatively with age for fluid ability (r = -.359, p = .019) but did not correlate with age for crystallized ability (r = -.161, p = .309). To interpret the relation of change in fluid ability with age, a median split was used to create younger (up to 15.02 years) and older (above 15.02 years) adolescent age groups. In the younger group, change was positive and significantly above zero (Mchange = 3.14; SD = 5.33), t (20) = 2.60, p = .017, with a medium effect size of d = .569. However, in the older group, change was not significantly different from zero (Mchange = -.76; SD = 4.63), t (21) = -0.76, p = .459; d = .165.

Discussion: These results suggest that fluid ability stops improving in mid-adolescence, whereas crystallized ability improves throughout the adolescent years (age 10 – 21 years). Thus, it could be that in DS, fluid and crystallized ability trajectories diverge in mid-adolescence rather than in the mid 20’s as in the general population. Future longitudinal studies that track fluid and crystallized abilities of participants with DS into their mid 20’s and beyond will be needed to confirm that the levelling off we observed in the present study is the beginning of the expected decline in fluid ability. If it is, we can expect that by the end of adolescence, people with DS may exhibit small declines in reasoning and other fluid abilities. However, they may be continuing to make small improvements in crystallized abilities.

References/Citations: