**Symposium Title**: Mobility and fall risk among adolescents and young, middle, and older adults with intellectual and developmental disabilities

**Chair**: Haylie L. Miller, Ph.D.[[1]](#endnote-1)

**Discussant**: Lauren Bishop, MSW, Ph.D.[[2]](#endnote-2)

**Overview**: Adolescents and transition-aged youth with intellectual and developmental disabilities (IDD) experience mobility limitations and injurious falls at higher rates than their neurotypical peers. In this symposium, we will present global self-reported and observational data that place the issue in the context of lived experience of people with IDD, and national claims data that place the issue in the context of morbidity, mortality, and healthcare costs. Discussion will center on implications for policy and practice to improve individual mobility and health outcomes, reduce the risk of injurious falls, and address systemic barriers to accessing support for motor problems across the lifespan.

**Paper 1 of 3**

**Paper Title**: Postural control differences and falls among adolescent and adult Special Olympics athletes and unified partners

**Authors**: Nicholas E. Fears, Ph.D.3 & Haylie L. Miller, Ph.D.1

**Introduction**: Many individuals with intellectual and developmental disabilities (IDD) exhibit clinically-significant motor difficulties (Kavanagh, Mannien, & Issartel, 2023; Miller et al., 2024). Specifically, postural control differences have been demonstrated in a variety of populations with IDD (e.g., autism, intellectual disability; Kavanagh et al., 2023; Lim et al., 2017). However, there is little research on how these postural control differences are related to fall risk in IDD. Here, we examined postural control differences in Special Olympics athletes with IDD and unified partners without IDD. We hypothesized that athletes with IDD would have shorter single leg stance durations and longer sit-to-stand times compared to unified partners without IDD. We also hypothesized that single leg stance durations would predict the likelihood that a participant had fallen in the home within the past 12 months.

**Method**: We assessed 91 athletes with IDD and 47 unified partners without IDD as part of the Healthy Athlete Screening program at the Special Olympics of Michigan (SOMI) State Summer Games and Special Olympics International (SOI) Unified Cup. Athletes with IDD (Male=49, Female=43) had a mean age of 23.0 years (*SDage*= 7.92, *Median*age=20, *Range*age=15-51). Unified partners without IDD (Male=28, Female=19) had a mean age of 20.1 years (*SDage*= 5.69, *Medianage*=19, *Rangeage*=16-47). Participants were assessed on a range of measures, including left and right single leg stance with eyes open and eyes closed (duration in seconds), timed sit-to-stand (time in seconds), and whether they had fallen in the home within the past 12 months (yes/no).

**Results**: *Single leg stance.* We used a generalized mixed-effects linear model with a gamma distribution and log link to regress single leg stance time onto condition (eyes open, eyes closed), leg (left, right), group (IDD, without IDD), age (continuous), gender (Male, Female), and event (SOMI State Summer Games, SOI Unified Cup) with a random intercept by participant. There was a main effect of age (*χ21*=7.73, p=.005) such that as age increased, single leg stance duration decreased (*b*=-0.025, *SE*=0.009). There were significant main effects of group (*χ21*=11.88, *p*<.001) and condition (*χ21*=460.60, *p*<.001) as well as a significant interaction between group and condition (*χ21*=53.05, *p*<.001). Athletes with IDD (*M*=7.02, *SE*=0.70) had shorter single leg stance durations in the eyes closed condition compared to unified partners without IDD (*M*=13.73, *SE*=1.93, *p*<.001). Athletes with IDD (*M*=17.42, *SE*=1.75) and unified partners without IDD (*M*=21.49, *SE*=3.02, *p*=.110) had similar durations in the eyes open condition (Fig. 1A).

*Timed sit-to-stand.* We used a generalized linear model with a gamma distribution and inverse link to regress sit-to-stand time onto group, age, gender, and event. There was a main effect of age (*χ21*=6.29, *p*=.012) such that sit-to-stand time decreased as age increased (*b*=-0.0005, *SE*=0.0002). There was also a main effect of group (*χ21*=12.01, *p*<.001) with athletes with IDD (*M*=19.0, *SE*=0.83) having longer sit-to-stand times compared to unified partners without IDD (*M*=15.3, *SE*=0.90, *p*<.001, Fig. 1B).

*Fallen in the home within the past 12 months.* We used a generalized linear model with a binomial distribution and logit link to regress a binary factor indicating if a participant had fallen in the home onto right leg single leg stance duration in the eyes closed condition (continuous), group, gender, and event. There was a main effect of single leg stance duration (*χ21*=8.05, *p*=.005) such that as single leg stance duration increased, the probability of having fallen decreased (*b*=-0.168, *SE*=0.071, Fig. 1C)

**Discussion:** The results of this study support our hypotheses that people with IDD exhibit difficulties in single leg stance, especially with eyes closed, and timed sit-to-stand compared to people without IDD. Additionally, we found that single leg stance duration with eyes closed predicted whether a participant had fallen in the home within the past 12 months, regardless of group membership. This indicates that single leg stance with eyes closed may be a useful indicator of fall risk for adolescents and adults both with and without IDD. Further research should examine underlying sensorimotor and cognitive contributors to postural control in IDD, and determine the prospective utility of single leg stance with eyes closed as a predictor of fall risk that can be quickly and easily assessed in community settings.

**References**

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Athletes with IDD

Unified partners without IDD**A group of graphs and diagrams

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**Figure 1. (A)** Single Leg Stance Duration for athletes with IDD (purple circle) and unified partners without IDD (gold triangle) by condition. Large points indicate estimated marginal mean, errors bars indicate 95% confidence limits, small points indicate raw data. **(B)** Sit-To-Stand Time for athletes with IDD (purple circle) and unified partners without IDD (gold triangle). Large points indicate estimated marginal mean, errors bars indicate 95% confidence limits, small points indicate raw data. **(C)** Probability of having fallen in the home in the past 12 months by duration of single right leg stance with eyes closed. Line indicates predicted probability for a 22-yr-old male athlete with IDD from the SOMI State Summer Games and points indicate raw data.

**Paper 2 of 3**

**Paper Title**: Autism, ADHD, AuDHD adults' falls & walking experiences in challenging environments

**Authors**: Julianna M. Hickey1, Isabel Munoz Orozco, B.S. 1, Dominique Kinnett-Hopkins, Ph.D. 1, & Haylie L. Miller, Ph.D.1

**Introduction**: Autistic people experience a higher incidence of falls and fall-related injuries than neurotypical individuals, likely due to undiagnosed and untreated motor problems that persist into adulthood (Gowen, Earley, Waheed, & Poliakoff, 2023; Linke, Kinnear, Kohli, Fong, Lincoln, Carper, & Müller, 2019). Evidence suggests that adults with ADHD also experience challenges with walking, particularly when attentional demands exceed a critical threshold (Saito, Ikeda, Okuzumi, & Kokubun 2017). However, little is known about effects of the combined presentation of autism and ADHD (AuDHD) on walking, and which specific environmental factors exacerbate or alleviate walking difficulty in each of these populations. We aimed to determine whether autistic, ADHD, and AuDHD adults experienced different rates of falls during walking, and whether they attributed difficulty with walking to different environmental features. We predicted that AuDHD participants would report the highest number of falls and resulting injuries, and that ADHD participants would report the lowest number of falls and resulting injuries.

**Method**: We recruited 43 adults from 16 countries via Prolific (Autism: *n* = 14, M = 8, W = 5, NB = 1, ADHD: *n* = 16, M = 8, W = 7, T = 1, AuDHD: *n* = 13; M = 5, W = 6, NB = 2). Autistic participants had a mean age of 26.21 yrs (*range* = 20-34), ADHD participants had a mean age of 33.69 yrs (*range* = 20-56), and AuDHD participants had a mean age of 28.35 yrs (*range* = 22-43). Data were collected in REDCap. Participants submitted one or more photos of environments they found challenging to walk in (Figure 1). 3 autistic, 4 ADHD, and 2 AuDHD participants submitted more than one unique environment. Participants estimated the number of times in the past year they had fallen in each environment, what percent of those falls resulted in an injury, and what percent of injuries they sought medical care for. We excluded 3 participants (2 AuDHD, 1 autistic) who did not give numerical fall estimates.

**Results**: We used an ANOVA to determine whether the mean number of falls differed by diagnostic group (autism, ADHD, AuDHD). There were no significant differences in falls by group, F(2, 51) = 1.03, *p* = 0.36. The autistic group reported a mean of 2.47 falls (*Range* = 0-10), the ADHD group reported a mean of 4.50 falls (*Range* = 0-25), and the AuDHD group reported a mean of 4.50 falls (*Range* = 0-11). Only 1 autistic, 3 ADHD, and 2 AuDHD participants reported seeking medical care after their fall. We also examined the frequency with which each group reported particular environmental elements as challenging (Table 1; sample sizes reflect the number of unique environments submitted).

**Discussion:** Contrary to our hypotheses, mean number of falls did not differ by group, and only a small number of participants reported being injured or having sought medical care as a result of these falls. The ADHD group had a notably wider range of falls reported, perhaps due to the wider age range of participants in this group. The three groups also reported relatively similar environmental elements as challenging for walking, with surface condition, visual conditions, auditory conditions, and obstacles posing the greatest challenges. However, there were several notable differences: the autistic group affirmed visual and auditory conditions and navigational concerns more often than the ADHD or AuDHD groups, and the AuDHD group affirmed personal factors and environmental novelty more often than the autistic or ADHD groups. Small sample size is a potential limitation of this study, although the sample was diverse in gender and geographic representation. Future studies of a larger sample should further assess the specific environmental features that contributed to falls, determine the role of age on fall frequency and severity, and identify factors that affect the level of fall severity and follow-up care.

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Saito, R., Ikeda, Y., Okuzumi, H., & Kokubun, M. (2017). Heightened Attention Demand of the Walking Cancellation Task and Its Relation to ADHD Tendency in Young Adults, *Journal of Special Education Research, 6*(2), 81-89.

**Figure 1. Example photos submitted by autistic, ADHD, and AuDHD participants.**

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| --- | --- | --- |
| **A white bag on a bed  Description automatically generated** | **A parking lot with trees and power lines  Description automatically generated** | **A long shot of a road  Description automatically generated** |
| **Autistic Example Photo**  *28 y.o. South African woman*  **“The way the furniture is set out does not provide enough room for me to maneuver.”** | **ADHD Example Photo**  *35 y.o. American man*  **“My building is a steep hill.”** | **AuDHD Example Photo**  *22 y.o. Polish nonbinary person*  **“[A lot of] holes that create with time due to cars [driving] and gravel being quite loose, hard to take steps when not looking at your feet constantly.”** |

**Table 1. Frequency (%) of challenging environmental elements affirmed by diagnostic group**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Group** | **Surface Conditions** | **Visual Conditions** | **Auditory Conditions** | **Personal Factors** | **Environmental Novelty** | **Navigational Concerns** | **Obstacles** |
| Autism (n = 17) | 10 (58.82%) | 12 (70.59%) | 10 (58.82%) | 1 (5.88%) | 2 (11.76%) | 3 (17.65%) | 6 (35.29%) |
| ADHD (n = 20) | 13 (65.00%) | 10 (50.00%) | 7 (35.00%) | 2 (10.00%) | 2 (10.00%) | 0 (0.00%) | 8 (40.00%) |
| AuDHD (n = 17) | 11 (64.71%) | 8 (47.06%) | 6 (35.29%) | 6 (35.29%) | 4 (23.53%) | 1 (5.88%) | 4 (23.53%) |

**Paper 3 of 3**

**Paper Title**: Adults with intellectual disability and cerebral palsy present to the emergency department for falls at higher rates than adults without either diagnosis

**Authors**: M. Natalia Cantet, Ph.D.4, Teal W. Benevides, OT/L, FAOTA, Ph.D. 4, Michelle Meade, Ph.D.1, Deborah A. Jehu, Ph.D.4, & Haylie L. Miller, Ph.D.1

**Introduction:** Adults with neurodevelopmental conditions (NDCs) use the ED for varied reasons including moderate-to-severe injuries1, 2. These injuries result in part from falls, driven by a high prevalence of mobility challenges in this population3. Adults with ID have notable problems with cognition, balance, mobility, and seizures, which place them at high risk of earlier, more frequent, and more injurious falls compared to those without intellectual disability. Adults with CP also experience problems with mobility including pain, unstable gait, and fatigue, all of which tend to decline with age. This increases their risk of falls and in turn, reduces quality of life and mental health. Notably, adults with ID or CP are at elevated risk of injury when they fall, and the risk of severe fall-related injury is elevated by polypharmacy, degree of ID, and age3. It is crucial to identify clinically meaningful patterns in ED visits for injurious falls that can help to inform the development of policies as well as treatment on monitoring strategies.This work is urgently needed to improve the safety, comfort, and quality of life of adults with developmental disabilities. Our objective was to identify age-related trends in falls reported during ED visits by adults with ID and adults with CP compared to adults without either diagnosis (no ID/no CP).

**Method**: We used data from the United States State Emergency Department Databases, made available by the Healthcare Cost and Utilization Project and the Agency for Healthcare Research and Quality for 21 states. We included encounter-level data from adults 18-80 years. We used ICD-10 codes to identify individuals with ID (F70-73, F78-79) or CP (G80). We excluded visits for individuals with both CP and ID due to a low sample size. To descriptively examine injurious fall-related ED visits, we calculated the percentage of visits by age for each group with 95% CI. We used general linear models with robust standard errors interacting group with age to understand how injurious falls vary across the lifespan while controlling for sociodemographic variables (sex, race/ethnicity, payer type), Elixhauser Comorbidity Index, and geographic variables based on Federal Information Processing System (FIPS) code including rurality and percent of adults living in poverty.

**Results**: ED visits for the two NDC groups increased with age, though the rates and variability differed between them. For both the ID group and the CP group, the percentage of admissions started at ~5% and increased with age, reaching ~15% by age 80. The variability also increased with age, as indicated by the widening confidence interval bands. Figure 1a compares the percentage of admissions by age for the ID group (blue long-dashed line) and CP group (orange short-dashed line) against a reference (no ID/no CP; black solid line). Adults with ID or CP were both significantly more likely to have fall-related injury visits compared to the general population (IRR= 1.20, 95%CI: 1.09-1.32; IRR=2.02, 95%CI: 1.82-2.24, respectively). A significant age x group interaction illustrates that those with ID had greater injurious falls as they aged (IRR=1.01, 95%CI: 1.01-1.01); however, those with CP did not differ in rate of falls by age compared to the general population (IRR=1.00, 95%CI: 1.00-1.00). When examining ages at which adults with developmental disability displayed similar fall rates to the general population aged 65+, we found that those with ID or CP between the ages of 42-45 years had similar rates of injurious falls presenting to the ED as the general population without ID or CP aged 66-69 years.

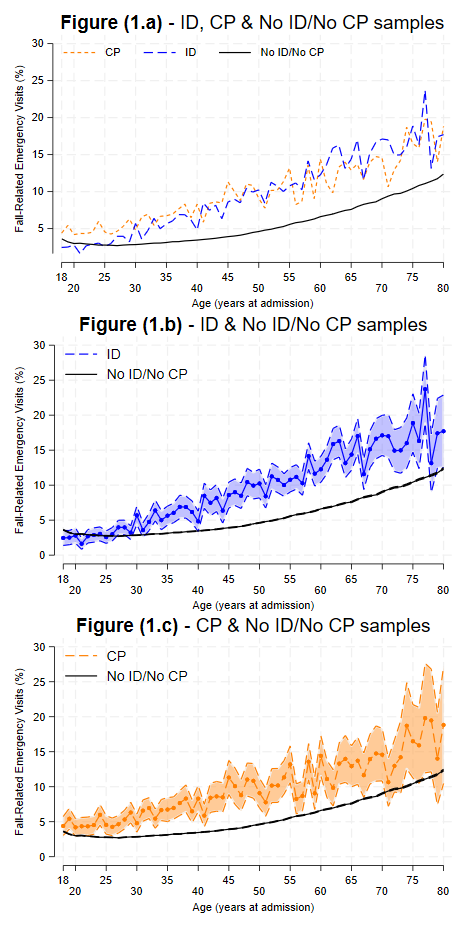
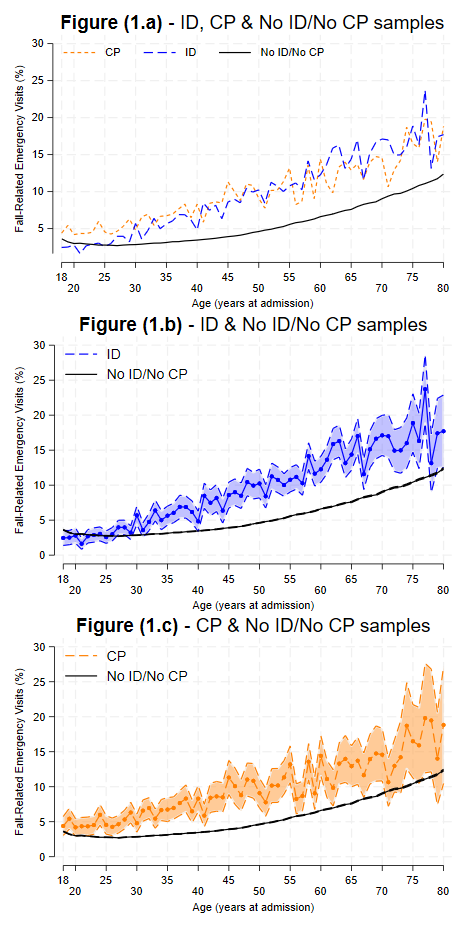
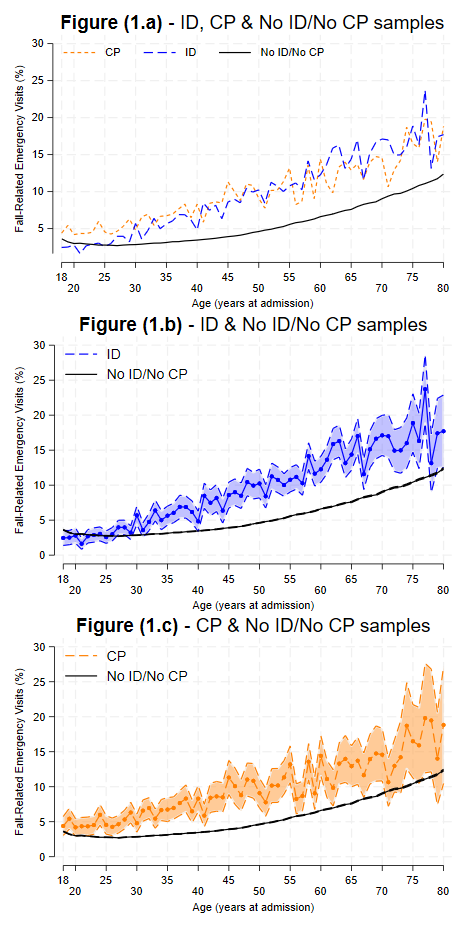
**Discussion:** Individuals with ID or CP present to the ED at greater rates across most of the adult lifespan than adults with no ID/no CP, suggesting that falls are an important and unaddressed reason for injury. Our data, however, do not provide insight into the fall context or severity, something that future analyses should address among individuals with developmental disabilities. Further, our data are limited to visit-level (not individual-level) data, without other medical history, suggesting that future analyses are warranted to examine repeat fallers. While adults with ID or CP may present to the ED with their most severe, injurious falls, the influence of so-called “benign” falls on the quality of life and future fall risk should not be ignored. Primary care data can provide valuable insight into the incidence and severity of falls within these populations6, and they warrant consideration in the search for modifiable risk factors for falls.

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**Figure 1.** **(a)** Percentage of admissions by age for the ID group (blue long-dashed line) and CP group (orange short-dashed line) compared against the no ID/no CP reference group (black solid line); **(b)** ID group with 95% confidence interval band compared against the no ID/no CP reference group; **(c)** CP group with 95% confidence interval band compared against the no ID/no CP reference group.

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