

Synopsis on ‘Divergent Development in Dyspraxic Children (Part I)’

Overview:

- Motivation: Developmental Dyspraxia, or Developmental Coordination Disorder (DCD) is an understudied condition that affects an estimated 5-10% of school-aged children. For example, a simple Google Scholar search of “Attention Deficit Hyperactivity Disorder” will yield 409,000 results; “Dyslexia” will yield 206,000; and “Developmental Coordination Disorder” gets just 12,500 hits.
- Method: In December and January of 2015/16, we launched a questionnaire consisting of ~750 questions, directed at caregivers of children with DCD whose ages ranged from 4 to 14 years. We received responses from 249 families, mostly recruited via Facebook sites and other social media (particularly ‘DCD: One step forward’ and ‘Dyspraxia USA’). We greatly acknowledge the help of Elizabeth Stanley King, Karen Schuld, and Anne Wilks Pare in distributing the questionnaire to interested families and providing feedback on the questionnaire.
- Domains: In the first part of our report, we explore four domains: Basic Medical History, Clinical Measures, Progression of Motor Symptoms, and Early Signs (See below for a summary). The second part of our report (coming soon) will cover detailed medical history, sensory processing, social profile, autistic behaviors, and school life.
- The *Introduction section* presents a comprehensive overview of the scientific literature on DCD including its definition (pp. 3-7) and may be useful for those interested in the state-of-the-art of DCD research; the full references can be found in the *Reference section*.
- The *Discussion section* offers an excellent summary of the main findings and offers a discussion in the context of the literature.

Results Summary:

- Demographics: 75% of questionnaires came from families inside the U.S., 25% from various countries outside the U.S. DCD is more prevalent in boys than in girls: The gender ratio of DCD often reported in the literature is ~1 girl : ~3 boys. In our sample, it is 1:2.2. We find a disproportionately higher amount of left-handed or ambidextrous children than in the normal population.
- Basic medical history:
 - Family history: Higher rates of neurodevelopmental disorders (31%), psychiatric disorders, particularly depression (34%) and anxiety disorder (31%), allergies (34%) and GI diseases (26%) in parents’ medical history.
 - Patient history: One third of participants had allergies and/or gastrointestinal problems, a higher proportion than in the normal

population. Frequent co-morbidity with ADHD, apraxia of speech, and dyslexia (more specifics below).

- Age of DCD diagnosis: Boys were diagnosed on average at age 5.9, whereas girls were diagnosed earlier, on average at 5.26; the professional taking a lead in the diagnosis is most frequently the occupational therapist. Given the typical age when DCD symptoms become significant, it is absolutely critical for Kindergarten and first grade teachers to know the symptoms of DCD!
- Clinical measures: DCDQ
 - The DCDQ is a 15-item questionnaire (Wilson et al., 2009) and provides three subscores with respect to Control During Movement, Fine Motor, and General Coordination.
 - The maximum score on the DCDQ is 75, and the minimum score is 15, with a reported average in the normal population of 61.79 (Wilson et al., 2009). For 8- and 9-year-olds, any score below 46 is an indication of DCD; for 10- to 15-year-olds, any score below 57 qualifies as DCD.
 - One of the myths of DCD is that the kids “grow out of it”. Contrary to that myth, we find that the average total DCDQ score across all age groups remains relatively constant at ~28. Our participants in all three age groups average far below the cutoffs. However, the average scores do not improve significantly even though the DCD cutoff increases, so there is a greater disparity between typically developing and Dyspraxic children’s motor function in later childhood. The motor impairment is observed across the three aspects of motor development emphasized in the DCDQ. There doesn’t appear any “growing out of dyspraxia”!
- Clinical measures: VADPRS
 - The Vanderbilt ADHD Diagnostic Parent Rating Scale (VADPRS) screens for the 18 *DSM-5* criteria for ADHD as well as anxiety.
 - We observe a high co-morbidity of ADHD and DCD in our study sample (70%) regardless of age group.
 - In the groups of 5-9 years old children, the combined (inattentive/hyperactive) type is most prevalent, whereas in the 10-15 age group, the inattentive type is more prevalent. The hyperactive only type is overall rare.
 - About 33% of children in each age group suffer from anxiety in addition to DCD and ADHD.
- Progression of motor symptoms:
 - Control during sequenced movements: By age 10 to 15, more participants were able to swim (68% of participants) than bike (52%). According to a survey given to over 6,000 elementary school students in California, children on average learn to ride a bike at age 5.9 years (Waller, 1970) – an age at which <20% of our participants were able to learn this skill. More than half of our participants over the age of 5.9 years cannot ride a two-

- wheeled bicycle. Although our participants learned to swim earlier than they learned to bike, more participants found swimming exceptionally difficult (82% vs. 74%).
- Motor multi-tasking: We asked participants whether they could perform two motor tasks at a time (e.g. walking and talking). Depending on age group, 50-70% of participants reported to be able to run and kick a ball, whereas only 10-20% report to be able to walk and talk at the same time.
 - Fine motor: 93% of participants report difficulties using a pencil or scissors.
 - Handwriting: One of the hallmark symptoms of DCD is dysgraphia, or difficulty with legible handwriting. More than 30% of participants in the 10-15 age group still struggle with handwriting. The handwriting in this group is in about 80% of cases 'often hard' or 'difficult' to read. Across all age groups, >80% of participants are slow at handwriting, struggled in school to learn how to write and find it 'extremely difficult'. The legibility improves slightly over time, but a greater proportion of older kids find handwriting extremely difficult.
- Early signs:
 - Feeding difficulties are frequently occurring in about 35% of all newborns. Sucking, in particular, presents a challenge because it is one of the first complex movements to be executed for a newborn. In our DCD population, these difficulties appear to be more prevalent. 59% of participants noted "problems feeding, sucking or swallowing", and 49% noted "difficulty nursing or sucking".
 - Feeding difficulties persist throughout childhood. For example, most babies are able to finger-feed themselves by 8 months of age, but the participants of our study did not acquire this skill until an average of 16 months of age. Participants learned to drink from an open cup eat with a spoon at an average age of 33 months and 26 months, respectively. Some participants as old as eight years still were not proficient in drinking from an open cup.
 - Reaching motor milestones (e.g. sitting upright, crawling, or walking) does not appear to have prognostic potential with respect to DCD; most kids later diagnosed with DCD reached their motor milestones.
 - >60% reported problems with toilet training.