Social and Emotional Impact of Motor Disorders in Young Children

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Self-Esteem/Self Worth

- A child’s evaluation of him/herself is closely linked with mental health outcomes such as anxiety & depression.

- The construct of self:
  - Self-concept (self-awareness/perception)
  - Self-esteem (self-respect/worth)

- Children with motor disabilities are AWARE of their difficulties, but how does this affect their self-respect or worth?
Self-Esteem in Children with Physical Disabilities

- We carried out a meta-analysis on studies which met the following criteria:
  - Measured self esteem of children & adolescents with motor disability (e.g., DCD, CP, spina bifida)
  - Studies included a control group (needed for effect size) and reported means and SD for both groups.

- A total of 13 studies were found:
  - 1970-2003
  - Included boys and girls aged 4 -18 years

Miyahara & Piek, 2006
Major versus Minor Motor Disabilities

- **Major Physical Disability (Cerebral Palsy and Spina Bifida):**
  - 6 studies found heterogeneous effect size of 0.23 for general self-esteem.

- **Minor Physical Disability (DCD):**
  - 7 studies found medium effect size for general self-esteem - (0.45 -.53)

- **Conclusion:** General self-esteem appeared lower for children with minor versus major physical disability.
  - The greater the physical disability does not necessarily mean the lower the self-esteem.
Developmental Coordination Disorder
(DCD: DSM-IV, 2000)

A. Poor motor performance in relation to chronological age.
B. Significantly interferes with academic achievement or activities of daily living.
C. Not associated with a general medical condition (e.g., CP) and does not meet criteria for a Pervasive Developmental Disorder.
D. If Mental Retardation is present, motor difficulties are greater than expected.
Movement problems and Psychosocial Development

- **Link between poor motor coordination & poor social/emotional outcome:**
  - Identified as early as the 1930s:
  - Was based primarily on intuition and clinical experience rather than systematic research (Shaffer et al., 1985)

- **In 1980s/1990s, poor motor coordination linked with:**
  - Low self esteem/self perception (Cantell et al., 1994; O’Dwyer, 1987; Rose et al., 1997)
  - Poor attributional style (Henderson et al. 1989)
  - Poor social skills/introverted (Kalverboer, et al., 1990)
  - High levels of anxiety (Schoemaker & Kalverboer, 1994)
Self-Perceptions and Self Worth in 8-10 year old children

**Self Perception Profile for Children**

Mean scores for each domain of the SPP

- **Scholastic**
- **Social**
- **Athletic**
- **Physical**
- **Behavioral**
- **Self-worth**

**DCD** compared to **Control**

Skinner & Piek, 2001
Self-Perceptions and Self Worth in 12-14 year old adolescents

Mean scores on each domain of the SPPA

Self Perception Profile for Adolescents

- Scholastic
- Social
- Athletic
- Physical
- Job
- Romantic
- Behavioural
- Close friends
- Self-worth

DCD vs Control

Skinner & Piek, 2001
Harter’s model of self-worth

- Competence/Importance Discrepancy
- Social Support/Positive Regard

SELF WORTH → Affect → Motivation

Harter, 1987
Anxiety and Depression

- The most common mental health problems found in Australian children and adolescents (Prior, Sanson, Smart, & Oberklaid, 1999)
- Have a significant impact on children’s cognitive, social, emotional, and academic development at a time when they should be building appropriate skills and competencies for later life (Donavon & Spence, 2000; Kovacs, 1997).
- It is therefore crucial to have a better understanding of the factors that contribute to these problems in order to provide early intervention and preventative strategies.
## Cerebral Palsy and co-morbid conditions

Percentage of children with CP meeting DSM- IV diagnostic criteria (N=100; mean age 9.31 years; SD=2.72; range 6-14 years; 54% male; 46% female)

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Attention Deficit Hyperactivity Disorder</td>
<td>34.7%</td>
</tr>
<tr>
<td>Oppositional Defiant Disorder</td>
<td>32.7%</td>
</tr>
<tr>
<td><strong>Specific Phobia</strong></td>
<td><strong>28.6%</strong></td>
</tr>
<tr>
<td>SCQ at Risk for Autism (score ≥ 15)</td>
<td>22.4%</td>
</tr>
<tr>
<td><strong>Generalised Anxiety Disorder</strong></td>
<td><strong>8.2%</strong></td>
</tr>
<tr>
<td>Social Phobia</td>
<td>8.2%</td>
</tr>
<tr>
<td>Separation Anxiety</td>
<td>8.2%</td>
</tr>
<tr>
<td><strong>Major Depression</strong></td>
<td><strong>2%</strong></td>
</tr>
</tbody>
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Pearsall-Jones, Piek, Kane & Swanson, 2003-2005, funded by a Telstra Community Development Grant
We compared 58 children (8-10 years) and 51 adolescents (12-14 years) with DCD with matched control groups and found they had:

- Lower perceptions of competence and social support
- Lower self worth
- Higher levels of state and trait anxiety

Skinner and Piek (2001)
Anxiety in Children and Adolescents with DCD

State and Trait Anxiety

Mean state and trait anxiety:

State Anxiety

Trait Anxiety

DCD  Control

Skinner & Piek, 2001
What about younger children?

- Examined 41 kindergarten children
  - 3.5-5.5 years old ($M = 4$ years 4 months)
  - 22 boys and 19 girls

- A significant negative correlation ($r = -0.402$) found between motor ability (MAND – NDI) and **anxious/depressed** score (CBCL).

- ANCOVA comparing children at risk ($n=14$) and not at risk ($n=27$) of DCD, with gender and full IQ as covariates, found a significant group difference on anxious/depressed scores on the CBCL.
  - **At risk:** $M=3.79$, $SD = 2.75$
  - **Not at risk:** $M=1.92$, $SD = 1.30$

Piek, Bradbury, Elsley & Tate , 2008
Depression and DCD

- Examined depressive symptomatology in 84 children aged 8-10 years
- Dependent variable was Children’s Depression Inventory (CDI) total score
- Groups matched on age and gender

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCD</td>
<td>50.45</td>
<td>9.72</td>
<td>42</td>
</tr>
<tr>
<td>Control</td>
<td>43.93</td>
<td>6.89</td>
<td>42</td>
</tr>
</tbody>
</table>

- Findings
  - Significantly (p=.001) higher levels of depressive symptoms in children with DCD
  - **Perceived athletic competence** was a predictor of depressive symptomatology in children with DCD

Francis & Piek, 2003
“Could concomitant learning or attentional problems contribute to the results?”
(Missiuna, 2003. Commentary: Evidence –Based Mental Health)

- Gillberg (1992) – DAMP model
  - Includes psychiatric problems of depression, conduct disorders and autistic traits
DCD : Co-occurring disorders

- Kadesjö & Gillberg (2001) – ADHD with DCD (DAMP)
  - have an exceptionally poor long-term outcome
  - Antisocial; alcohol and drug abuse; lack of independence

- Kaplan et al (2001)
  - high rates of overlap of behavioral, emotional and educational deficits
The Monozygotic (MZ) differences design

- MZ twins discordant for either DCD or ADHD:
  - share identical genes
  - share the same common or familial environment (when reared together).
- Differences that arise between them (e.g., levels of depressive symptoms) must result, directly or indirectly, from differences in environmental experiences they have not shared with their co-twin
  - i.e., unique environmental experiences
- One twin provides a natural control

Depression in DCD and ADHD

AIM

- To understand the nature of the relationship between ADHD, DCD, and depression by examining the levels of depressive symptomatology in monozygotic (MZ) twins discordant for ADHD or DCD

Discordant MZ twins

Taken from a sample of just over 3000 families from the Australian Twin ADHD Project with over 7000 twins and siblings aged 6-17 years

ADHD twin pairs
- 16 pairs of MZ twins discordant for ADHD-only
- 12 male pairs, 4 female pairs
- Mean age 13.12 years (SD:3.43, range:6.44-16.67)
- Inattentive type (n=11): Hyperactive impulsive (n=2); Combined type (n=3)

DCD twin pairs
- 24 pairs of MZ twins discordant for DCD-only
- 11 male, 13 female pairs
- Mean age was 11.91 years (SD:3.57, range: 6.45-16.99 years)
Measures – Parent questionnaires

Zygosity: information from DNA or blood test or a twin similarity questionnaire (Cohen et al., 1975)

Strengths and Weaknesses of ADHD Symptoms and Normal Behaviour (SWAN) (Swanson et al., 2001)

Developmental Coordination Disorder Questionnaire (DCD-Q) (Wilson et al., 2000)

Depressive Symptomatology (“Sad Affect”) (Hartman et al., 2001)- 12 item scale
Results- Co-twin comparisons

Statistical analysis: Wilcoxon signed rank test

**ADHD-twins**
- ADHD-twins (M=6.75, SD=6.18)
- Non-ADHD co-twins (M=4.31, SD=5.12)
- Z=-2.16, p=.016

**DCD-Twins**
- DCD-only twins (M=5.21, SD=4.44)
- Non-DCD co-twins (M=3.75, SD=3.73)
- Z=-2.83, p=.003

**Conclusion:** Twins with ADHD or DCD face unique environmental experiences (e.g., negative self perceptions, poor relationships with peers, negative social feedback, academic underachievement) which may predispose them to many of the risk factors for increased levels of depressive symptomatology.
Discordant twin design to examine anxiety

Using a discordant twin design including both monozygotic (MZ) and dizygotic (DZ) twins

- ADHD or DCD twins > unaffected co-twins
- Twins with ADHD+DCD > unaffected co-twins or co-twins with ADHD but **NOT** compared to co-twins with DCD
- **DCD twins** > ADHD co-twins

Summary

- Higher levels of anxiety in children at risk of DCD aged:
  - 3-5 years (Piek, Bradbury et al., 2008)
  - 6-9 years (Schoemaker & Kalverboer, 1994)
  - 8-10 years (Skinner & Piek, 2001)
  - 12-14 years (Skinner & Piek, 2001)

- Increased depressive symptomatology in children at risk of DCD aged:
  - 3-5 years (Piek, Bradbury et al., 2008)
  - 8-10 years (Francis & Piek, 2003)
  - 6-16 years (Piek, Rigoli et al., 2007)

- Not associated with other disorders such as ADHD
Comorbid anxiety/depression or caused by the motor problem?

- This is important to know in order to understand how best to address these difficulties.
- MZ twin study suggests environmental factors result in the anxious/depressed symptoms.
- Need for longitudinal studies to confirm this.
Longitudinal Research

- Shaffer et al. (1985) found that:
  - neurological soft signs (e.g., awkwardness or poor coordination in finger-nose testing or complex fine motor tests) at age 7 years were the best single predictor of an anxiety-withdrawn diagnosis at age 17 years.
  - if anxious symptoms were also present at age 7 years, the adolescents were at even greater risk of emotional difficulties at age 17 years.

- Shaffer et al. (1985) suggested that children are at **increased risk** of an emotional disorder in adolescence if they have both **motor deficits** and **anxiety problems** in childhood.
Sigurdsson, van Os and Fombonne (2002)

- Used five separate measures of motor skills to define motor impairment
  - not walking by 18 months
  - having poor hand control at 7 years
  - described as ‘clumsy’ at 7 years
  - having poor hand control at 11 years
  - poor coordination at 11 years of age.

- Identified 368 children with motor impairment and *no other disorders* (total sample of 6,850) at age 16 years.

- Found that boys identified with motor impairment were more than three times more likely to be rated by their mother at ages 11 and 16 years as having anxiety problems.
Are infant locomotor experiences crucial for later psychosocial development?

System theorists such as Campos and colleagues (2000) argue that this is the case:

- An extensive discussion paper arguing that early locomotor experiences are an essential agent for developmental change, and should not be neglected when appropriate interventions are considered.
Infant Motor Development Study

- 60+ infants were recruited for this study in the first few months of life.
- Assessed initially using motion analysis and video analysis in a study examining the importance of early spontaneous movements on motor development.
Infant Measure
Ages & Stages Questionnaire

- Measured at ages 4, 6, 8, 12, 16, 18, 20, 24, 30, 36, and 48 months.
  - Five subsections of: communication, **fine motor**, **gross motor**, personal-social, and problem solving skills.

- Trajectory information:
  - **Stability**: the variance of all 11 observations from 4 months to 48 months. The direction of the relationship is expected to be negative, with children having higher variances expected to have lower scores on criterion variables.
Longitudinal Study - Aim

Aim. To determine whether information obtained from measures of motor performance taken over a 4 year period in infancy and early childhood, would predict anxious and depressive symptomatology once the children reached school age.
Participants

- 50 children from the original infant study were included in the follow-up at school age.
- 21 were girls and 29 were boys.

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<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
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<tbody>
<tr>
<td>Birthweight (g)</td>
<td>3068</td>
<td>764</td>
<td>900-4815</td>
</tr>
<tr>
<td>Gestational Age (weeks)</td>
<td>37.8</td>
<td>3.1</td>
<td>29-41</td>
</tr>
<tr>
<td>SES</td>
<td>7.6</td>
<td>1.4</td>
<td>4.9-10.7</td>
</tr>
<tr>
<td>Age of testing (years/months)</td>
<td>7.8</td>
<td>1.9</td>
<td>6 -11.6</td>
</tr>
<tr>
<td>Full Scale IQ</td>
<td>107.5</td>
<td>14.6</td>
<td>81-148</td>
</tr>
<tr>
<td>Apgar score (5 min)</td>
<td>9.2</td>
<td>.61</td>
<td>8–10</td>
</tr>
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Piek, Barrett, et al. 2010
School age measures

- **Child Behavior (CBCL: Achenbach & Rescorla, 2001)**
  - ‘anxiety problems’ Cronbach’s alpha = .72; test-retest reliability of .80
  - ‘anxious/depressed’ Cronbach’s alpha = .84 Test-retest reliability .82, and anxiety problems, .80 (Achenbach & Rescorla).

- **Wechsler Intelligence Scale for Children – 4th Edn (WISC-IV)** – contains 15 subtests although only 10 core subtests used
  - Verbal comprehension index (VCI) - Comprehension, similarities, and vocabulary subtests
  - Processing speed index (PSI) - Coding and symbol search
  - Working memory index (WMI) - Digit span and letter–number sequencing
  - Perceptual reasoning index (PRI) - Block design, picture concepts, and matrix reasoning
Results (Hierarchical Regression)

- **Step 1:** Control variables of gestational age, gender and age of testing were NOT significant factors.
- **Step 2:** Gross and fine motor stability (i.e., variability of performance over age) were entered on the second step. In combination these variables added significantly to the variance accounted for:
  - **For anxiety/depression**
    - $RSquare_{change} = .145 \ (p = .033)$
    - the only salient predictor of anxiety and depression was **stability of gross motor skills** ($p = .011$)
  - **For anxiety problems**
    - $RSquare_{change} = .226 \ (p = .003)$
    - **stability of gross motor skills** was the only unique predictor ($p = .001$)
Findings

- The strongest relationship found in this study was that between the stability of the gross motor scores (ages 4 months to 4 years), and the anxiety problems measured at school age.

- If children are inconsistent with their gross motor development from ages 4 months to 4 years, they are more likely to have more anxiety problems recorded by their parents at school age.
What is the pathway from poor motor ability to poorer emotional outcome?

- Children with DCD have been identified with poorer self-worth, and tend to be more withdrawn
- This may impact on the child’s social participation (e.g., Chen and Cohn, 2003).
- Less social participation/poor social skills have been associated with higher levels of anxiety and depression.
Self-perpetuating cycle of perceived lack of competence.

- Poor Motor Ability
- Perceived lack of confidence
- Limited opportunity to practice and develop skills
- Non-participation

Harter, 1978
Intervention: a multidisciplinary approach

- Ideal intervention – one on one multidisciplinary approach with OT, Physio, Psych, Speech Therapist, etc

- Many children do not receive this because:
  - Long waiting lists
  - Children are not identified
  - DCD not considered a disorder to worry about.

- School programs that ‘break the cycle’ may be of benefit.
Animal Fun Program

A universal program developed in consultation with

- teachers
- developmental psychologists
- clinical psychologists
- physiotherapists
- occupational therapists
- speech therapists
- health professionals working in the field with children who have motor disorders.

This process took 8 months, and once complete a pilot study was undertaken.
Animal Fun Program

This program has been designed to:

- improve pre-movement fine and gross motor skills
- improve participation in motor skills activities
- promote appropriate social skills

Rationale

Appropriate technique is an important aspect of motor skill development. However, research demonstrates that if a child enjoys movement activities then it is more likely that they will participate, and will begin to build skills. Participation promotes social interaction but also leads to practice which is the key to improving skills. In other words, if the children enjoy what they are doing, they will practice it and will improve their skills.
‘Animal Fun’: A Pre-Primary Program to Promote Motor and Social Development

**Director:**
Prof Jan Piek (Psych)

**Coordinator:**
Ms Sue McLaren (Psych)

**Committee:**
Ms Carly Reid (Psych)
Ms Alma Dender (O/T)
Prof Tanya Packer (O/T)
Prof Leon Straker (Physiotherapy)
Ms Lynn Jensen (Physiotherapy)
A/Prof Clare Roberts (Psych)
Dr Rosie Rooney (Psych)
Dr Nick Barrett (Psychology)
Ms Greer Bradbury (Psych)
Ms Sharon Elsley (Psych)
Program Modules

**Gross Motor**
Module 1: Body Management 1 - Trunk and lower limb
Module 2: Locomotion
Module 3: Object Control 1 – Throwing, catching, kicking
Module 4: Body Sequencing (trunk stability)

**Fine Motor**
Module 5: Body Management: Trunk and Upper Limb
Module 6: Fine Motor Planning
Module 7: Object Control 2 – Manual skills
Module 8: Hand Skills

**Social/Emotional**
Module 9: Social/Emotional Development
Example – Possum walking

- Dynamic balance
- Using same long, thin piece of wood or rope, walk along the rope using hands and feet (this would be quite a difficult task for some children).
Pilot study

Participants
- 80 pre-primary children received program
- 70 control children
- All schools involved were from lower SES areas

Measures
- Motor – MABC, MAND
- Cognitive – WPPSI-III
- Psychosocial – SSRS, CBCL

Procedure
- Pretesting occurred in term 1
- *Animal Fun* program was run in school terms 2 and 3
- Post-testing occurred in term 4.
Results

Pre/post test findings
- Teachers returned 87 social skills forms, and a MANCOVA including all three social skills subtests gave a statistically significant time x group interaction ($p < .001$; partial $\eta^2 = .277$).
- Univariate analyses showed that the intervention produced a significant improvement in cooperation ($p < .001$; partial $\eta^2 = .206$).

Teacher feedback:
- Both teachers and students enjoyed it – “really fun – the kids love it”
- All but one child participated – “all children joined in”
- Easy to incorporate into curriculum and daily activities – “easy to use and easy to follow”, “very little preparation time”, “good range of difficulty levels”
Animal Fun - currently

- Received large 3 year Healthway grant to further evaluate this program
  - currently in 2\textsuperscript{nd} year
- 12 schools (N=530 children)
  - 6 control/6 intervention matched on SES, size and location
- Pretesting (have tested all 12 schools)-term 1
- 12 weeks of program implementation
- 6 months post-testing in term 4
  - tested 10 schools so-far
- 1 year followup
  - tested 4 schools so-far
- Preliminary results at 6 months followup
  - suggest improvements in problem behaviour and academic competence (but failed to reach significance)
Concluding comments

- Children with motor coordination deficits are at higher risk of mood disorders such as anxiety and depression.
- Our longitudinal findings support other researchers (e.g., Campos et al., 2000) who have argued that early locomotor experiences are an essential agent for developmental change.
- Given that Shaffer et al. (1985) found that children with both neurological soft signs and evidence of anxiety problems have a greater risk of later anxiety disorders in adolescence, it is imperative that preventative measures are taken to ensure that children with motor problems do not develop anxiety and depressive disorders at an early age.
- Programs need to target motor ability, participation and social/emotional development at an early age.
Funding Support

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- National Health & Medical Research Council
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- Healthway, WA Health Department
- Curtin University