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Assessing children to identify developmental coordination disorder: A survey of occupational therapists in Australia

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Abstract

Background: Developmental coordination disorder (DCD), a prevalent neurodevelopmental disorder with motor and psychosocial consequences, can significantly impact children's quality of life. In Australia, most children with diagnosed/suspected DCD have received occupational therapy services, more so than any other health service. As such, occupational therapists are key in identification and treatment and require a sound knowledge of diagnostic criteria and the best evidence for practice. This study explored current occupational therapy services for children with DCD. Areas for development are identified to improve the identification of, and subsequent intervention for, children with DCD.

Methods: In this cross-sectional study, an online survey was completed in September and October 2020 by 175 occupational therapists working in Australia.

Results: Although all therapists worked with children who met the criteria for DCD diagnosis, 70% worked with children with no specific diagnosis and 50% worked with children with outdated diagnostic labels. Australian occupational therapists used similar models/frameworks (commonly a multisensory/sensory processing approach) to guide practice with children with DCD, regardless of therapist characteristics, practice setting (clinic/community, rural/urban), how therapy is funded, or the state where the therapists completed their training/currently practiced. Although assessment practices did not differ significantly, therapists with greater years of paediatric practice and those who studied and/or practiced in Western Australia were more likely to assess to identify DCD. Half of the therapists did not assess to identify DCD; however, 60% of assessing therapists reported best practice methods in assessment for DCD, indicating emerging best practices in the Australian context.

Conclusion: The findings from this study suggest that small adaptations to current occupational therapy practice may enhance the early identification of children with DCD in Australia. The existing gaps in evidence to practice must be addressed to improve current Australian practice and increase access to

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appropriate services and ultimately improve the quality of life for children with DCD.

KEYWORDS

assessment, developmental coordination disorder, identification, motor skills disorder, occupational therapy practice

1 | INTRODUCTION

Developmental coordination disorder (DCD) is a common neurodevelopmental disorder, occurring in an estimated 5–6% of children (American Psychiatric Association, 2013). The Diagnostic and Statistical Manual—5th ed. (DSM-5) specifies that children with DCD have significant difficulties acquiring and executing motor skills, which substantially negatively impact daily activities, school performance, and participation in play and leisure activities (American Psychiatric Association, 2013). Although motor deficits are the hallmark of this condition, secondary psychosocial issues are also prevalent in DCD, such as anxiety, depression, and low self-esteem; these combined physical and mental health concerns significantly impact the quality of life and tend to persist into adulthood, highlighting the importance of identification and treatment for DCD (Gagnon-Roy et al., 2016; Karras et al., 2019; Kirby et al., 2013, 2014; Zwicker et al., 2013, 2018).

The DSM-5 lists the following criteria for the diagnosis of DCD: (a) the acquisition and execution of motor skills are significantly below peers of the same age, despite children having had opportunities to learn and use these skills; (b) motor difficulties markedly and persistently interfere with activities of daily living, school, and play; (c) the onset of symptoms occurs in early childhood; and (d) difficulties are not attributable to other conditions, such as intellectual disability, visual impairment, or other neurological disorders affecting movement (American Psychiatric Association, 2013).

International guidelines outlining best practices in the identification and management of DCD were published in 2012 and updated in 2019 (Blank et al., 2012; Blank et al., 2019). The assessment processes recommended by Blank et al. (2019) align with the DSM-5 criteria, both of which support a biopsychosocial model of DCD. According to the International Classification of Functioning, Disability and Health (ICF: World Health Organisation, 2001), disorders (such as DCD) are the result of interactions between health conditions and contextual factors, and disability involves dysfunction at one or all of the levels of impairment, activity, and participation (World Health Organisation, 2001). In accordance

Key Points for Occupational Therapy

- An emerging, contemporary view of DCD should include principles of motor learning theory.
- Improved knowledge translation is required to address current gaps in evidence to occupational therapy practice with children with DCD.
- Occupational therapists (key in identifying DCD) require national practice guidelines to operationalise existing international guidelines.
- Improved undergraduate education/postgraduate communities of practice can enhance knowledge translation/best practices for children with DCD.

with such a view, motor coordination difficulties are not necessarily disabling unless they limit activities or restrict participation. To accurately identify DCD, professionals must consider both the motor performance of the child and the effect of poor motor coordination on the child's ability to actively engage in activities at home, at school, and in the community.

Blank et al. (2019) recommended specific assessments to address the first two DSM-5 criteria (American Psychiatric Association, 2013). Specifically for Criterion A, the Movement Assessment Battery for Children—2nd ed. (MABC-2) (Henderson et al., 2007) or the Bruininks-Oseretsky Test of Motor Proficiency—2nd ed. (BOT-2) (Bruininks & Bruininks, 2005) are recommended to assess age-appropriate motor skill acquisition and execution. The Developmental Coordination Disorder Questionnaire (DCDQ) (Wilson & Crawford, 2007) is recommended to provide evidence for Criterion B—that the motor difficulties interfere with activities of daily living.

Despite clear guidelines, the high incidence of DCD, and the significant impact and enduring nature of this condition, the diagnostic pathway for this disorder is

inconsistent and prolonged (Licari et al., 2020). Across many years, several different terms have been used to describe a child with DCD, including commonly used terms such as dyspraxia, motor learning difficulty, and sensory integration disorder and less frequent terms such as clumsy child syndrome, minimal brain dysfunction, and disorder of attention and motor perception (DAMP) (Gibbs et al., 2007; Hunt et al., 2021). The use of multiple terms to describe children with DCD complicates diagnosis and contributes to the lack of support for children with significant difficulties in motor coordination (Licari et al., 2020). There is poor familiarity and limited knowledge of the features of this disorder among key stakeholders (parents, teachers, and health professionals) in Australia (Hunt et al., 2021), as is the case in Canada, the United States, and the United Kingdom (Wilson et al., 2012).

In the Australian context, Hunt et al. (2021) found that only 53% of Australian allied health professionals have identified DCD and the majority reported difficulties in identifying the disorder. Respondents considered the information provided in the DSM-5 to be inadequate to assist them in making a diagnosis of DCD, and they identified a need for more information to assist in identifying this disorder. Occupational therapists are the health professional most likely to work with children with DCD and to identify movement-related diagnoses (Licari et al., 2020) and were found by Hunt et al. (2021) to have the greatest familiarity and knowledge of this disorder of all stakeholder groups. As such, occupational therapists play an integral role in implementing assessments to address Criteria A and B, before liaising with paediatricians who can rule out other conditions (Criterion D) and confirm (or rule out) a diagnosis of DCD. The perceived lack of knowledge regarding the identification of DCD probably increases the considerable challenges that families encounter when seeking assistance for their child's movement difficulties (Licari et al., 2020) with prolonged diagnostic pathways likely reducing opportunities for essential, early intervention.

To improve the identification of DCD and enhance access to appropriate services, occupational therapists require a sound knowledge of this disorder, clear processes for identifying DCD, and awareness of evidence-based services. Although Australian occupational therapists report having some knowledge of DCD, 53% reported difficulties in identifying the disorder and more than 80% of medical and allied health professionals indicated that there was inadequate information to help them identify this condition (Hunt et al., 2021). Given this information, we hypothesised that current occupational therapy practice for children in Australia does not utilise best practice principles for assessment and intervention.

There are no known Australian studies that report current occupational therapy practice with this population of children; thus, the primary aim of this study was to examine the current practice of Australian occupational therapists with children with DCD (or suspected DCD) and highlight specific areas for development. Part 1 of the study (reported here) examines the models/frameworks used by occupational therapists to guide their practice when working with children with DCD and the assessment processes used by occupational therapists to identify children with DCD. Occupational therapists typically utilise a variety of models, theories, and frameworks to guide service provision (Ikiugu et al., 2019). In 2005, Brown et al. compared the application of theory, assessments, and interventions in Australian and Canadian paediatric occupational therapy; however, no studies have investigated this in therapists working specifically with children with/suspected to have DCD. The study will also examine the effects of therapists' characteristics (such as demographics and practice setting) on current occupational therapy practice. Part 2 of the study relates to intervention practices for children with DCD and will be presented in a subsequent paper. Overall, the findings of the study will assist in addressing the need for early identification of, and evidence-based intervention for, children with DCD.

2 | METHODS

A quantitative cross-sectional survey was designed for the purpose in Qualtrics and distributed online for a 6-week period from September to October 2020. Given the wide geographical distribution of the study's population, a cross-sectional survey was selected as an effective and established means of capturing the sentiments of a specific population at one point in time (Bowling, 2014).

2.1 | Procedure/data collection

Ethical approval (No: 2019-00106-HUNT) was obtained from the Human Research Ethics Committee of Edith Cowan University. A recruitment flyer containing a link to the survey was distributed throughout Australia via targeted occupational therapy social media and e-mails. This included the Occupational Therapy Association of Australia, the Developmental Occupational Therapists Association of WA [DOT (WA)], the Australian Paediatric OT Facebook group, and individual therapy practices. Recipients were asked to share the survey link among occupational therapy colleagues, enabling snowball sampling, consequently preventing any calculation of the

response rate for this survey. The survey remained open for 6 weeks; every 2 weeks, the flyer was re-posted to the original Facebook groups and e-mailed to the therapy services.

2.2 | Participants

Participants were required to be (1) residents of Australia, (2) able to complete the survey in English, (3) registered with the Australian Health Practitioner Regulation Agency (AHPRA), and (4) working with a caseload of at least 15% of children. Participants were also required to work with children who either have a diagnosis of DCD or who do not have a formal diagnosis but are suspected to have the disorder (e.g., the child has significant motor coordination difficulties that are not related to other conditions, such as intellectual disability, visual impairment, and neurological disorders). All respondents who accessed the survey provided online consent before beginning the questionnaire.

2.3 | Data collection

A purpose-designed survey tool was developed from a similar survey conducted in British Columbia, Canada (Karkling et al., 2017; Withers et al., 2017), and was revised to reflect the Australian context. The survey was trialled with three non-practicing (academic) Australian occupational therapists to review the usability of the survey, specifically the survey flow, branching logic, and clarity of questions. Based on their feedback, the survey was revised, and the pilot survey was completed by 13 Canadian Occupational Therapists who met all inclusion criteria except current practice in Australia. Canadian therapists were used so that the pool of potential participants was not impacted, and Canadian paediatric occupational therapy has been shown to bear many similarities to Australian practice (Brown et al., 2005). Of the 13 Canadian therapists, 10 returned two surveys (test and re-test), which were completed a minimum of 7 days apart. Based on the test-re-test results, the wording of some questions was changed to improve clarity. As suggested by pilot respondents, additional questions were also added to capture information from therapists who do not provide direct intervention but provide consultation to children with diagnosed or suspected DCD.

The survey contained six sections. Section A collected demographic information and determined therapists' eligibility. Section B asked participants about the nature of their current caseload and practice setting. Section C

contained two questions about the occupational therapy models/frameworks that influence participants' practice and asked them to rank the top, most influential models/frameworks. Here, the term models/frameworks was utilised to capture the wide range of theoretical influences. Respondents were provided with a range of models (conceptual or practice), theories, frames of reference, and frameworks that might influence a therapist's decision regarding the best assessment and interventions for children with DCD. The use of the term models/frameworks does not differentiate between overarching theory and frames of reference but considers all lenses that guide assessment and intervention (Ikiugu et al., 2019). The options provided to respondents included many of the same models, theories, frames of reference, and frameworks found in the Brown et al. (2005) study in which theories, models, and frameworks were collectively referred to as theoretical models. The current study included several additional models and theories that might influence occupational therapy practice with children with DCD.

Section D of the questionnaire determined the types of services that participants provide to children with DCD, including specific modes of assessment and intervention. According to responses in Section D, participants were then branched into different blocks of questions for each of the different modes of service delivery. Each block of questions asked about the common practice parameters for working with children with DCD, including the type, frequency, format, and duration of assessments and interventions. The final section of the questionnaire contained questions specific to intervention and will not be addressed here.

All sections of the questionnaire provided participants with a choice from several responses, as well as an 'other' response where they could add free text. The final question contained an open textbox to allow the opportunity for participants to provide additional information about their assessment and/or intervention practices.

2.4 | Data analysis

All data were analysed using IBM SPSS Statistics for Windows Version 25.0. Categorical data were summarised using frequency and percentage distributions. Binary logistic regressions were performed to ascertain the effects of therapists' characteristics on the likelihood that therapists would (a) utilise specific models/frameworks to guide their practice, (b) assess for DCD, and (c) utilise assessment tools that are considered best practice in identifying DCD. Characteristics included the location of undergraduate studies in occupational therapy, current

practice location, the practice setting (clinic versus community; rural versus urban), funding sources, years of experience in occupational therapy practice, and years of experience in paediatric occupational therapy. Initially, univariate logistic regressions were performed to examine the association of each characteristic with (a) to (c), using only the top five models/frameworks, from a total of 22. Where there were multinomial/categorical variables, each variable was analysed as a binary outcome where responses were coded as 1 (yes) or 0 (no).

Independent variables with a *p*-value of less than 0.05 in the binary logistic regression were entered into a multivariable logistic regression to control the effect of confounding. Where the state was used as a variable (i.e., for the location of undergraduate studies and current practice location), states with less than five respondents (Northern Territory, Australian Capital Territory, and Tasmania) were excluded from the analysis to ensure estimates were valid. No respondents selected these states for the location of undergraduate studies.

3 | RESULTS

A total of 225 respondents commenced the survey; 14 participants did not provide consent and a further 36 withdrew or did not meet eligibility criteria (i.e., they did not work with 15% of children on their caseload, or they did not provide services to children with diagnosed or suspected DCD). Data from the remaining 175 respondents are presented. As participants were branched into different questions according to the different modes of assessment and intervention they provided, not all 175 respondents answered all questions, and the number of respondents (*n*) varies throughout these results.

3.1 | Participant characteristics

Most therapists (73%) had 6 years or more experience in working in paediatric occupational therapy. Participant characteristics (Table 1) show that respondents currently practiced in all states in Australia, with the largest cohorts from New South Wales, Queensland, and Victoria, which have larger populations than other states, and from Western Australia where the principal investigator is based. Most respondents (136/175; 78%) practiced in an urban setting and worked across multiple setting types with various combinations of work in clinic, education, and/or home settings. A total of 23% worked exclusively in one setting, these being 19% (33/175) in a clinical setting, 2% (4/175) working in schools, and 1% (2/175) working in the child's home.

3.2 | Participant caseloads

The majority of respondents (126/175; 72%) were funded for occupational therapy service provision through a mixture of sources, including private (with or without insurance), health or education department, and/or via the National Disability Insurance Scheme (NDIS). The most common mixture of funding sources was private and NDIS (46%). Logistic and subsequent multinomial regressions for each funding type showed no significant variation among states.

Most respondents (167/175; 95%) worked with a mixture of age groups and all but one therapist worked with children aged 4–11 years. The total number of respondents working with each age group is depicted in Table 2.

As per the inclusion criteria, all participants worked with children with DCD and/or children with no diagnosis but significant motor coordination difficulties that were consistent with DCD. All participants worked with children across a range of diagnoses (Table 2); however, 128/175 respondents (73%) worked with children who did not have a specified diagnosis that pertained to their difficulties in motor coordination but who were likely to meet the criteria for DCD. Given the range of terminology that has been used over the years to describe this group of children, a range of possible terms were provided, with only 47% (82/175) respondents indicating that they had worked with children who had a diagnosis of DCD, whereas 88/175 respondents (50%) indicated that they had worked with children known to have dyspraxia, motor learning disability, or clumsy child syndrome.

3.3 | Influential models/frameworks

When identifying all models/frameworks that influenced respondents' occupational therapy practice with children with diagnosed or suspected DCD, the top five most common models/frameworks were a multisensory approach/sensory processing (111/170; 65%), developmental theory (100/170; 59%), motor learning theory (89/170; 52%), the Person–Environment–Occupation (PEO) model (81/170; 48%), and the Canadian Model of Occupational Performance and Engagement (CMOP-E) (78/170; 46%). The other models/frameworks (used by less respondents) were environmental adaptation (76/170; 45%), sensory integration (71/170; 42%), role as exploratory learning model (66/170; 39%), Model of Human Occupation (54/170; 32%), sensory diet (53/170; 31%), neurodevelopmental theory (49/170; 29%), biomechanical model (47/170; 28%), cognitive-behavioural theory (46/170; 27%), Occupational Performance Model of Australia (46/170; 27%), compensation (42/170; 25%), occupational

TABLE 1 Occupational therapists' demographic characteristics ($n = 175$).

Characteristics		<i>n</i> (% of total)
Sex		
Male		6 (3)
Female		169 (97)
Age (years)		
≤24		10 (6)
25–34		61 (35)
35–44		46 (26)
45–54		39 (22)
55–64		17 (10)
≥65		2 (1)
Years of experience		
	In occupational therapy	In paediatric occupational therapy
≤2	16 (9)	21 (12)
3–5	25 (14)	26 (15)
6–10	30 (17)	39 (22)
11–15	28 (16)	29 (17)
16–20	21 (12)	18 (10)
21–30	35 (20)	30 (17)
>30	20 (12)	12 (7)
Practice setting ^a		
Centre/clinic		151 (87)
Hospital inpatient		4 (2)
Hospital outpatient		6 (3)
Education setting		124 (72)
Clients' home		89 (51)
Other		14 (8)
Location		
	Current occupational therapy practice*	Initial occupational therapy qualification
Australian Capital Territory	4 (2)	-
New South Wales	41 (22)	38 (22)
Northern Territory	2 (1)	-
Queensland	31 (18)	29 (17)
South Australia	15 (8)	13 (7)
Tasmania	3 (2)	-
Victoria	44 (25)	40 (23)
Western Australia	39 (22)	35 (20)

^aMore than one answer permitted; thus, the total is >175, and the percentage total is >100.

adaptation (40/170; 24%), remediation (32/170; 19%), Piaget's stages of cognitive development (23/170; 14%), behavioural therapy (22/170; 13%), perceptual motor theory (20/170; 12%), and Occupational Performance Process Model (12/170; 7%). Numerous respondents (26/170; 15%) selected 'other' when asked which models influenced their practice with children with diagnosed or suspected DCD and all these respondents listed assessments [such as the Perceive, Recall, Plan & Perform (PRPP) or

The Canadian Occupational Performance Measure (COPM) or intervention approaches (Cognitive Orientation to daily Occupational Performance (CO-OP) or the Developmental, Individual-differences, and Relationship (DIR) Floortime approach], rather than models/frameworks, in the text entry for this response.

No association was found between therapists' practice settings (clinic versus community and rural versus urban) or funding sources and therapists' use of specific models/

TABLE 2 Occupational therapists' caseload characteristics.

Characteristics	n (% of total)n = 175
Funding	
Private (with or without private health insurance)	147 (84)
Public via National Disability Insurance Scheme	136 (72)
Public via health department	20 (12)
Public via education department	13 (7)
Other	22 (13)
Age of clients	
0–3 years	135 (77)
4–11 years	174 (99)
12–18 years	141 (81)
19 years+	33 (19)
Diagnoses of children on caseload	
Autism Spectrum disorder	174 (99)
Attention deficit hyperactivity disorder	172 (98)
Sensory processing difficulties	165 (94)
Global developmental delay	160 (91)
Handwriting difficulties	160 (91)
Learning difficulties	159 (90)
Developmental coordination disorder/dyspraxia	147 (84)
Speech and/or language difficulties	146 (83)
Intellectual disability	133 (76)
No specified diagnosis but significant motor coordination difficulties	128 (73)
Genetic disorders/syndromes	124 (71)
Mental health disorder	84 (48)
Neurological impairment (cerebral palsy, acquired brain injury, and spinal cord injury)	82 (47)
Sensory impairment (vision/hearing)	75 (43)
Eating disorder	35 (20)
Other	9 (5)

Note: Participants were allowed multiple responses to these questions; thus, totals are >175, and percentage totals are >100%.

frameworks. Years of occupational therapy and/or paediatric-specific practice did have some association with the use of two popular models/frameworks, whereby therapists with more years of practice were more likely to use developmental theory and motor learning theory to guide their practice with children with DCD (Table S1). The location of undergraduate studies and the location of current practice showed significant association with the use of models/frameworks for all frequently used models, except motor learning (Table S2).

From the 22 different models/frameworks that respondents identified, therapists were then asked to choose only one model/framework that they felt was the primary model/framework that influenced their practice. The most frequently selected primary models/

frameworks were the CMOP-E (28/166; 17%) followed by motor learning theory (26/166; 16%), the PEO (18/166; 11%), sensory integration (17/166; 10%), a multisensory/sensory processing approach (14/166; 8%), and the Occupational Performance Model of Australia (14/166; 8%). Once again, a portion of respondents (8/166; 5%) selected 'other' as their primary model/framework and all of these identified intervention approaches rather than models/frameworks in the text entry for this response.

For each of the primary models/frameworks used by therapists, there was not significant variation in the likelihood of its use between therapists according to their practice setting (clinic versus community and rural versus urban) or funding source or years of occupational therapy/paediatric-specific practice. The location of

undergraduate degree was a significant predictor of whether therapists used all of these frequently used primary models/frameworks, except the motor learning model (Table S3).

3.4 | Assessing to identify DCD

Half of the respondents indicated that they did not assess children to identify DCD but purely to guide intervention, with 3% of respondents indicating that they did not use assessments in their work with children with/suspected to have DCD at all and a further 3% did not answer this question. Conversely, only one respondent used assessments solely for the purpose of determining if children are eligible for a DCD diagnosis, with 76 respondents (45%) using the assessments for both identifying DCD and for planning intervention.

Therapists' likelihood of assessing for DCD did not differ significantly with practice settings or years of experience in occupational therapy. However, years of experience in paediatric occupational therapy, location of undergraduate studies, and current practice location were all associated with significant variation in the likelihood of assessing for DCD. Therapists who received their undergraduate training or currently practiced in Western

Australia had the highest likelihood of assessing for DCD, and the results for the other states are shown relative to Western Australia in Table 3. Therapists trained in/practicing in all states, except Victoria, were significantly less likely to assess for DCD than those trained in/practicing in Western Australia. None of the therapists who trained in/practiced in South Australia assessed for DCD. Increased years of experience in paediatrics increased the likelihood of assessing for DCD.

Of the therapists who did assess for DCD, 60% (46/76) reported the use of a motor assessment and questionnaire, considered best practice assessment for the identification of DCD (Blank et al., 2019). Again, therapists trained in Western Australia were the most likely 72% (18/25) to use the correct assessments; however, there were no statistically significant relationships between therapists' characteristics and the types of assessments used to assess for DCD.

Figure 1 shows the assessment types most used by therapists to identify DCD. In addition to the assessments listed in Figure 1, 12 therapists (16% of all therapists who assess for DCD) noted various "other" assessments that they use to identify DCD, including the Goal-Oriented Assessment of Life skills (GOAL; Miller & Oakland, 2013), Roll Evaluation of Activities of Life (REAL; Roll & Roll, 2013), Miller Function and

TABLE 3 Logistic regression predicting likelihood of assessing for DCD ($n = 168$).

	<i>n</i>	% of therapists who assess	B	SE	Wald	df	<i>p</i>	Odds ratio [95% CI]
Location of undergraduate studies and years of experience in paediatrics								
Years of experience in paediatrics			0.06	0.02	10.20	1	0.001*	1.06 [1.02, 1.11]
Location of undergraduate studies								
Western Australia	35	74						Reference group
New South Wales	38	37	-1.68	0.55	9.13	1	0.003*	0.19 [0.06, 0.55]
Queensland	29	41	-1.36	0.60	5.17	1	0.023*	0.26 [0.08, 0.83]
South Australia	13	0	-22.55	10,940	0.00	1	0.998	0.00 [0.00]
Victoria	40	48	-0.96	0.54	3.54	1	0.076	0.39 [0.13, 1.11]
Out of Australia	20	30	-2.50	0.73	11.76	1	<0.001*	0.08 [0.02, 0.34]
Current practice location and years of experience in paediatrics								
Years of experience in paediatrics			0.05	0.02	8.04	1	0.005*	1.06 [1.02, 1.09]
Current practice location								
Western Australia	39	74						Reference group
New South Wales	38	32	-1.79	0.52	11.72	1	<0.001*	0.17 [0.06, 0.47]
Queensland	31	39	-1.56	0.55	8.07	1	0.004*	0.21 [0.07, 0.62]
South Australia	15	0	-22.42	10,562	0.00	1	0.998	0.00 [0.00]
Victoria	43	49	-0.93	0.49	3.54	1	0.060	0.40 [0.15, 1.04]

Note: Australian Capital Territory, Northern Territory and Tasmania were removed due to insufficient sample sizes.

Abbreviation: CI, confidence interval.

* $p < 0.05$.

Participation Scales (M-Fun; Miller, 2006), Beery-Buktenica Developmental Test of Visual-Motor Integration—6th ed. (Beery VMI-6; Beery & Beery, 2010), Detailed Assessment of Speed of Handwriting (DASH; Barnett et al., 2007), Developmental Test of Visual Perception—3rd ed. (DTVP-3; Hammill et al., 2014), and Test of Visual Perceptual Skills—4th ed. (TVPS-4; Martin, 2017).

When respondents assessed a child to identify DCD and found that the child was likely to have DCD, most (64%) subsequently referred or sent information to a medical professional. A referral/information was most

often sent to a paediatrician (46/76; 61%), though some therapists (26/76; 34%) referred/sent information to a general practitioner. One-third (26/76) of the respondents who assessed for DCD chose to refer to physiotherapists, teachers, psychologists, and speech pathologists, rather than to a doctor.

4 | DISCUSSION

The aim of this study was to explore the current practice of Australian occupational therapists working with

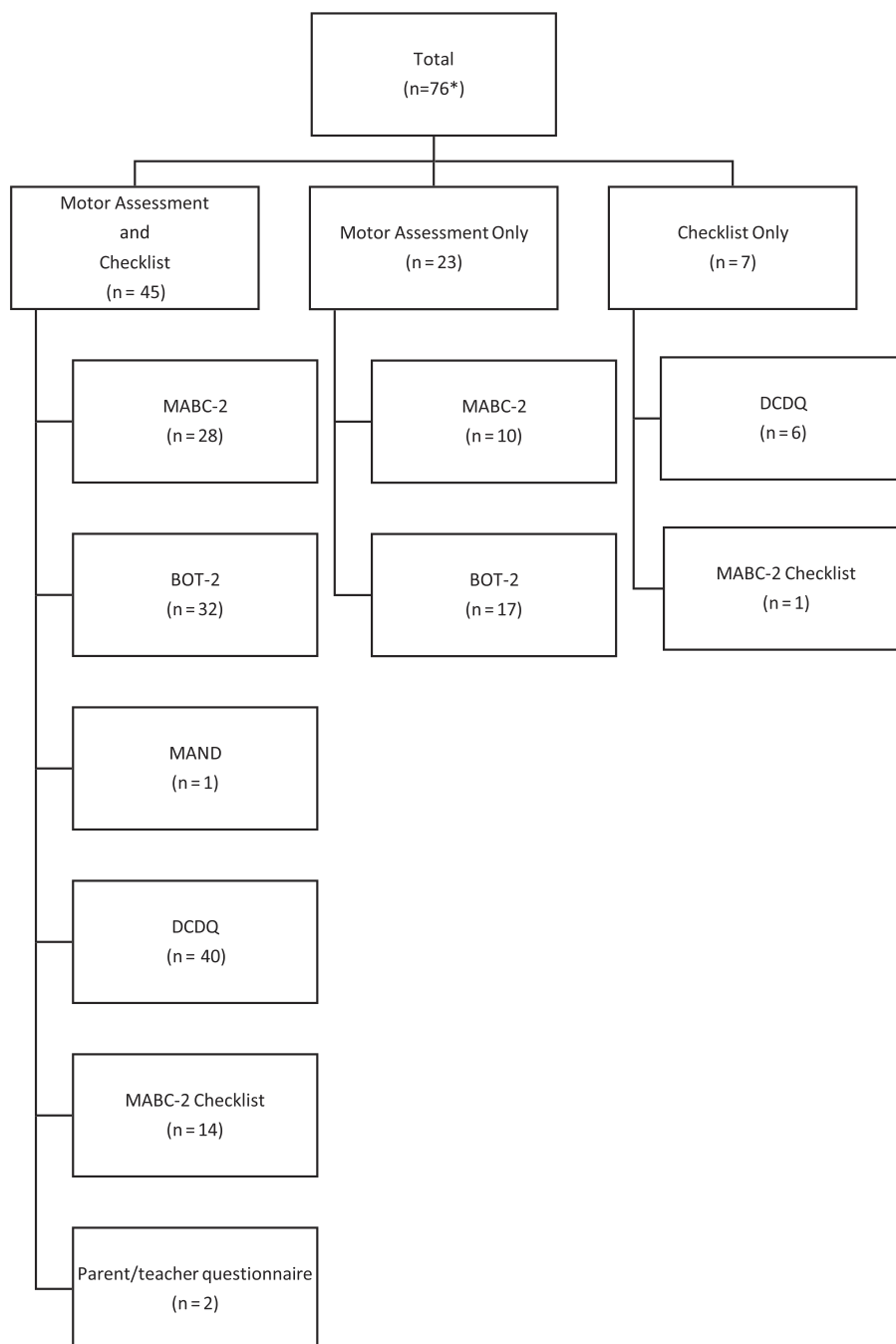


FIGURE 1 Assessments used to identify DCD. One respondent did not indicate which assessments they used. Abbreviations: BOT-2, Bruininks-Oseretsky Test of Motor Proficiency Second Edition; DCDQ, Developmental Coordination Disorder Questionnaire; MABC-2, Movement Assessment Battery for Children, Second Edition; MAND, McCarron Assessment of Neuromuscular Development.

children with DCD. The results reported here focus on the models/frameworks used by occupational therapists to guide their practice when working with children with DCD and the assessment processes used by occupational therapists to identify children with this condition.

Therapists who completed the survey varied in age and worked across different states with children of a variety of ages in different practice settings via a range of funding sources. Despite the variation in therapist characteristics, there was little difference in the models/frameworks used by therapists or in their assessment practice.

This study found that the model/framework used by most therapists was a multisensory/sensory processing framework which mirrors the findings from therapists working with broader diagnostic groups in 2005 Brown et al. (2005) found that sensory integration/sensory processing and multisensory approaches were the most frequent models/frameworks used by Australian occupational therapists when working with children with developmental delay (sensory integration; 77.6%, multisensory/sensory processing; 70.8%) and learning disabilities (sensory integration; 85.6%, multisensory/sensory processing; 62.7%). The continued, dominant use of sensory models to guide work with children with DCD suggests that the unique profile of children with DCD is not necessarily considered and may also indicate that occupational therapists utilise traditional models/frameworks in a rather habitual manner, rather than modifying their therapeutic lens according to the distinct needs of a specified diagnostic group.

The frequent use of sensory models/frameworks suggests an outdated view of DCD/dyspraxia as a sensory-based motor disorder (Gibbs et al., 2007). Specific intervention approaches are beyond the scope of this paper; however, it should be noted that the original international guidelines for DCD do not support sensory integration. At the time of the guidelines, evidence regarding the effectiveness of sensory integration for children with DCD was considered to be inconclusive and the research found that interventions aimed to improve body functions and structures (including sensory integration) were less effective than task-oriented approaches (Blank et al., 2012). In the review of the guidelines, no new studies comparing sensory integration with another intervention were identified, and as such, the initial recommendations against the use of sensory integration were upheld (Blank et al., 2019). These results indicate a significant evidence-to-practice gap in the use of current literature to guide Australian clinical practice with children with DCD.

Contemporary literature conceptualises DCD as a *motor learning* disorder, which suggests that motor learning theory and ecological models would provide more

appropriate guidance for practitioners working with these children (Wilson et al., 2017). The past dominance of sensory integration and neurodevelopmental treatments in DCD has likely contributed to the under-use of motor learning theories in current practice (Zwicker & Harris, 2009).

Despite the dominance of sensory models, it is promising that more than half of the therapists in this current study indicated that they also use motor learning theory to guide their work with children with DCD. The use of motor learning theory by 52% of therapists in this study contrasts with the findings of Brown et al. (2005) that motor learning theory did not rate among the popular models/frameworks used for children with developmental delays and was used by only 20.4% of therapists working with children with learning difficulties. The upward trend in using motor learning theory found in the current study is a positive shift and may indicate a movement towards a contemporary view of DCD. Greater uptake of evidence is required to address the evidence-to-practice gap. Future work in knowledge translation to improve the identification of, and intervention for, children with DCD should include education regarding motor learning theory and its utility in guiding occupational therapy assessment and intervention. Given that undergraduate location was one of the most frequent predictors of whether a therapist used a particular model/framework (or not), such education should begin at the undergraduate level.

In this study, when asked to identify influential models/frameworks, 15% of respondents added their own text responses to describe specific intervention approaches and/or assessments, indicating a high level of misunderstanding/poor knowledge of terminology. It is important that therapists understand that the terms theories, models, frames of reference, and frameworks are not prescriptive guidelines for practice and do not (in any way) equate to specific assessments. Rather, they describe general principles (theories), they guide professional reasoning (models), and they link theory to practice (frames of reference) (O'Brien & Kuhaneck, 2020). These terms are variably described throughout the literature (Ikiugu et al., 2019), and thus, confusion with this terminology may be understandable; however, the distinction between theoretical constructs and clinical assessments should be clear. Therapists require a greater understanding of assessments used in practice with children with/suspected to have DCD, and further research is required to explore Australian occupational therapists' understanding/application of theories, models, frames of reference, and frameworks, and the distinction between these constructs and clinical assessments.

Although all therapists in this study worked with children with suspected DCD, half of the therapists in

the study reported that the children with whom they worked had received outdated diagnoses, including dyspraxia, motor learning disability, and/or clumsy child syndrome. Mislabelling likely impacts access to appropriate therapy, and consistent nomenclature is necessary to build a research base and inform practice with this population of children (Magalhaes et al., 2006). The preferential use of the term DCD to describe children with significant difficulties in motor coordination was recommended in a 1994 consensus meeting of international DCD experts in London/Ontario, Canada (Polatajko et al., 1995). International clinical guidelines (Blank et al., 2012; Blank et al., 2019) clearly articulate the use of the term DCD, yet translation to clinical practice is seemingly protracted and mislabelling prevails. Consistent use of the term DCD is necessary to close this evidence-to-practice gap.

The absence of any label is equally obstructive and without accurate identification of clinically significant motor coordination difficulties; children are unlikely to access appropriate services. Most therapists in this study reported that some of the children on their caseload had significant motor difficulties but did not have a specified diagnosis. Despite significant difficulties and no diagnoses, more than half of the therapists surveyed did not go on to assess children to determine eligibility for diagnosis.

Therapists with more experience in paediatric practice were more likely to assess for DCD. The reasons for this finding are unknown, and further research is warranted; however, it may suggest that new graduate knowledge of DCD is low. Years of experience do not necessarily indicate the level of expertise (King et al., 2008), but this finding may also suggest that therapists with greater years of experience may have greater confidence, leading to increased identification of specific disorders. Previous studies suggest that clinical experience with a paediatric caseload develops therapists' clinical reasoning and decision-making which, in part, stems from the ability to recognise similarities in children's clinical presentation (Moir, 2022), a key skill in identifying specific disorders. Targeted DCD education may improve therapists' confidence in identifying this disorder, which is crucial given that parents of Australian children with significant, persistent motor deficits report long diagnostic pathways and delayed opportunities for effective interventions for their children (Licari et al., 2021).

Paediatric occupational therapists play an integral role in the identification of the disorder and as such, should assess children's motor skills (to address Criterion A of the diagnosis) and determine if reduced motor skill impacts activities of daily living (Criterion B). In the

current study, therapists who completed their undergraduate training in Western Australia were more likely to assess for DCD, compared to those in other states in Australia. Further research is needed to explore the reasons for this finding; however, this may indicate greater knowledge of the condition in Western Australia. In 2016, The Developmental Occupational Therapy Association of Western Australia [DOT (WA)] established a working group to develop DCD Clinical Practice Guidelines for Occupational Therapists in Western Australia, which were published in 2019 [DOT (WA), 2019]. Licari et al. (2021) suggested that the development and distribution of DCD-specific resources through peak organisations have increased the knowledge of DCD among allied health and medical professionals in Canada, where Karkling et al. (2017) found that all occupational therapists were familiar with DCD but only 64% were familiar with the processes for identification. In the Australian setting, further research is required to determine all of the barriers and facilitators to identifying DCD.

Previous research has identified knowledge translation resources specific to medical and allied health staff working with children with DCD in the Australian context. These resources have the potential to close the divide between evidence and practice (Hunt et al., 2021); however, advocacy, awareness, and training specific to DCD are thought to be low to non-existent in Australia (Licari et al., 2021), and there are currently no national guidelines for assessment or diagnosis of DCD (Evans et al., 2022). An effective strategy for allied health professionals is the use of communities of practice, which have proven to be an effective means of knowledge translation and appear useful in changing clinical behaviours and assisting best practices (Camden et al., 2017).

Results in this study also highlight a significant gap from evidence to practice regarding the assessments that Australian occupational therapists use to identify DCD. Among the 46% of therapists who assessed children to identify DCD, almost 40% of them did not follow best practice guidelines, which recommend the combination of clinical observations, parent questionnaires (preferably the DCDQ), and standardised motor assessments (preferably the MABC-2 or BOT-2) (Blank et al., 2019). Of the therapists who reported that they did not use the combination of assessments as per recommendations, most used a motor assessment in isolation to identify DCD. Delayed motor skills alone cannot identify DCD because poor coordination may not affect the function or result in activity limitations or participation restrictions.

Similarly, the use of a checklist, in isolation (utilised by a small number of participants in this study), cannot provide sufficient evidence for a diagnosis. The DCDQ or the MABC-2 checklist can be used to evaluate the

functional impact of motor coordination difficulties (Criterion B), but they cannot determine if the motor difficulties are significant or persistent (Criterion A).

Although the international guidelines clearly identify the appropriate assessments for use in the identification of DCD (Blank et al., 2019), many Australian occupational therapists did not use these and 16% of therapists who assess for DCD added text responses that noted assessments that are not appropriate or recommended for use in the identification of DCD. It is essential that therapists use assessments that (1) directly address the DCD criteria (outlined above) and (2) have been evaluated with respect to the identification of DCD (Blank et al., 2019). A small number of therapists stated that they used visual perceptual assessments/visual motor assessments or handwriting assessments to identify DCD. Although handwriting may be affected in children with DCD, poor handwriting per se cannot be considered a general marker for DCD and it should be noted that handwriting incorporates other skills (particularly language) in which dysfunction is not specific to DCD (Blank et al., 2019). The 'other' assessments suggested by therapists are insufficient to determine if Criteria A and B of the DSM-5 criteria for DCD diagnosis have been met, and further education/improved knowledge translation is essential. Given that choice of assessments did not differ significantly between therapists of any age or location, it would seem likely that Australia-wide education is required at both undergraduate and postgraduate levels of experience.

The assessment of motor skills and the functional impact of motor difficulties is a key step in the diagnostic process and the occupational therapist is ideally placed to implement such assessment. However, it is the responsibility of a medical practitioner to rule out any other cause for motor delays, thus addressing Criterion D of the DSM-5 diagnosis (American Psychiatric Association, 2013), and it is ultimately the medical practitioner's responsibility to provide the diagnosis (Harris et al., 2015; Ip et al., 2021). It is encouraging that most therapists in this study who identified probable DCD either referred to medical professionals or encouraged families to take their assessment findings to a paediatrician or a general practitioner, which is consistent with best practices in DCD.

This study is, to our knowledge, the first Australian study to explore the practices of occupational therapists who work with children with suspected or diagnosed DCD. It should be noted that the overall sample size of the study was small, and some states (with smaller populations) had to be eliminated from data analysis. The survey used in the study was not trialled in the Australian context; however, the Canadian context is likely to be

comparable and the use of Canadian occupational therapists for test-re-test preserved the sample for this study.

4.1 | Conclusion

Occupational therapists are the most likely health professionals to work with children with significant motor issues. As such, occupational therapists play an integral role in the identification of, and early intervention for, DCD. However, significant gaps in evidence to practice are evident, particularly in labelling DCD, utilising appropriate models/frameworks to guide practice for children with DCD, and using appropriate assessments to identify DCD. This study found that many children who are likely to meet the criteria for a DCD diagnosis present to occupational therapy with no diagnosis or with outdated labels such as dyspraxia. Furthermore, many occupational therapists do not complete the appropriate assessments to help identify the disorder and show poor knowledge of existing international guidelines for the identification of DCD. Practices in DCD assessment were largely consistent despite therapists' characteristics and across all practice settings and all states in Australia, and they reflect a slight shift towards a more contemporary view of DCD. Further research is warranted to investigate occupational therapists' understanding of models/frameworks and assessments and to explore the barriers and facilitators to DCD diagnosis among Australian occupational therapists. These findings suggest there are several areas of opportunity for Australian therapists to make simple adaptations to clinical practice to improve services for children with DCD.

AUTHOR CONTRIBUTIONS

All authors contributed to the study design, development of the survey, and interpretation of data. Jacqui Hunt led data collection and analysis and drafted the manuscript. All authors reviewed and revised the manuscript critically for important intellectual content and approved the final version to be published.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

This research received ethical approval through Edith Cowan University, Western Australia (approval number: 2019-00106-HUNT). We were not funded for this research and the findings of this research have not been presented at this time.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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