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Experience of activity and participation in individuals with Developmental Coordination Disorder/Dyspraxia and their surrounding people: a qualitative systematic review

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Abstract

Developmental Coordination Disorder (DCD)/Dyspraxia features a significant delay in lifespan motor development, which limits daily activities and restricts participation. This study aimed to systematically review and comprehensively synthesize the subjective experiences of activity and participation in individuals with DCD/Dyspraxia and their families and service providers to inform decisions and strategy development at practice and policy levels. To locate both published and unpublished studies, the following seven main databases were searched in April 2022: CINAHL, PsycINFO, MEDLINE, Embase, ERIC, ProQuest Dissertations and Theses, SPORTDiscus. A total of 48 studies met the inclusion criteria. Of the 48 studies, 20 studies were appraised as being of high quality and were subsequently used in the meta-aggregation. From the 20 studies, a total of 304 findings were extracted, classified into six categories, and used to generate three synthesized statements on activity and participation at the home and family level, school and peer level, and community level. Our findings indicated that individuals with DCD/Dyspraxia experience the deep and pervasive impacts on activity and participation in individually unique and nuanced contexts. Individualized evaluation of context, increased clinical resources, education and training would facilitate activity and participation.

Keywords: activity, developmental coordination disorder, dyspraxia, participation, qualitative research

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INTRODUCTION

Developmental Coordination Disorder (DCD) and Dyspraxia are common developmental conditions with an estimated prevalence of 6% in the motor domain among children aged 5-11 years. Some claim DCD and Dyspraxia are interchangeable (Gibbs, Appleton, & Appleton, 2007; Kirby, Sugden, & Edwards, 2010), while others point out the overlaps between the two (Dewey, 1995; Miyahara & Möbs, 1995). Due to the absence of a commonly accepted definition, assessment, and diagnostic criteria for Dyspraxia (Miyahara, Leeder, Francis, & Inghelbrecht, 2008), the interpretation depends on the role of people surrounding individuals with the condition (Miyahara & Register, 2000; Peters, Barnett, & Henderson, 2001). On one hand, the "neuropsychological definition of Dyspraxia refers to a disorder of motor sequencing and selection" (Miyahara & Baxter, 2011, p. 440), assessed by gesture imitation (Miyahara et al., 2008; Miyahara & Möbs, 1995). On the other hand, some therapists and parents use the term broadly for a wide variety of sensory and motor disorders (Miyahara & Baxter, 2011), to medicalise and legitimise the condition (Correia, 2017). By contrast, a relatively stable definition and diagnostic criteria of DCD exists, featuring two core components (American Psychiatric Association, 2013):

- "**Criterion A.** The acquisition and execution of coordinated motor skills is substantially below that expected given the individual's chronological age and opportunity for skill learning and use. Difficulties are manifested as clumsiness (e.g., dropping or bumping into objects) as well as slowness and inaccuracy of performance of motor skills (e.g., catching an object, using scissors or cutlery, handwriting, riding a bike, or participating in sports).

- **Criterion B.** The motor skills deficit in Criterion A significantly and persistently interfere with activities of daily living appropriate to chronological age (e.g., self-care and self-maintenance) and impacts academic/school productivity, prevocational and vocational activities, leisure, and play."
  (American Psychiatric Association, 2013, p. 74).

To address the diagnostic Criterion A, formal assessment tools have been developed for screening and examining whether an individual assessment result meets the diagnostic threshold. Norm-referenced standardised assessment tools (e.g., Henderson, Sugden, & Barnett, 2007; Wilson et al., 2009) may be sufficient to appraise Criterion A, but not Criterion B; an individual position on the normative scale provides no direct evidence for the significance and persistence of interference, or impact in daily contexts at home, school, and in the community (Cairney, 2010). For the evaluation of Criterion B, qualitative data are required by conducting clinical interviews with children and parents, and obtaining observation reports from teachers and specialists. Such qualitative data are usually stored in private confidential folders, not available to the public unless

specifically elicited by research interviews and focus groups and published as qualitative studies.

This review aims to capture the voices and experiences of individuals with DCD or Dyspraxia and relevant stakeholders. To achieve this aim, the adoption of a broad definition of Dyspraxia, in conjunction with the diagnostic criteria of DCD, provides the foundation for understanding the experiences of individuals with DCD/Dyspraxia for this review.

In addition to Dyspraxia, there is another complication that involves frequently co-occurring developmental conditions with DCD, such as, autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), and specific learning disorder (SLD) (American Psychiatric Association, 2013). When an individual with DCD, who also has ASD, ADHD, or SLD experiences a challenge participating in a physical activity, it is difficult to determine which condition is causing the activity and participation limitations (Caçola, Miller, & Ossom Williamson, 2017; Miyahara, Piek, & Barrett, 2006; Miyahara et al., 1997). However, our interest in the present review lies not in detecting which condition leads to the limitations, but in understanding the subjective experiences of individuals who have DCD/Dyspraxia, regardless of their co-occurring developmental conditions. To address the concomitant issue, the experiences of individuals with DCD/Dyspraxia should be considered, whether they have a comorbid developmental condition or not, as far as an individual is referred to as exhibiting DCD/Dyspraxia.

To date, only one qualitative systematic review has been conducted. O'Dea et al. (2021) used meta-ethnography to synthesize qualitative studies on children and young people's experiences of living with DCD/Dyspraxia from the first person perspective (O'Dea, Stanley, Coote, & Robinson, 2021). Their meta-ethnography developed new conceptual understandings through the reviewers' own interpretive synthesis. By contrast, we employ meta-aggregation (Hannes, Petry, & Heyvaert, 2018; Lockwood et al., 2020) in this review to present common meanings consistent with the intentions of primary study authors. We included both the first-person perspective of individuals with DCD/Dyspraxia and the third -person perspective of people surrounding individuals with DCD/Dyspraxia. The multiple perspectives were considered useful to propose synthesized statements, which are an outcome of meta-aggregation, that are comprehensive, balanced, and realistic. Synthesized statements based on multiple perspectives may be useful in assisting practitioners to make decisions and develop strategies at practice and policy levels (Hannes et al., 2018).

To ultimately produce synthesized statements for practitioners and policy makers (Hannes et al., 2018), the concepts of 'activity limitations' and 'participation restrictions' from the International Classification of Function (ICF) (World Health Organization, 2001) were used to define the phenomena of interest for our review (Miyahara, Moebs, Pocock, & Farquhar, 2020). The ICF defines 'activity limitations' and 'participation restrictions' as

"difficulties an individual may have in executing activities" and "problems an individual may experience in involvement in life situations", respectively. The difficulties and problems can be recognised when teachers and clinicians lack understanding and fail to provide reasonable accommodation and treatment. Such perceived barriers and the perceived impact of the barriers can be considered as experiences of individuals with DCD/Dyspraxia and their surrounding people.

The ICF also extends the meanings of the terms to include the positive poles of 'activity' and 'participation' beyond their use as indicators of the negative poles of 'activity limitation' and 'participation restriction'. Accordingly, our phenomena of interest for this review also included the positive poles, facilitators of 'activity' and 'participation', enabling us to generate synthesized statements (Hannes et al., 2018). We therefore aimed to synthesize qualitative studies on the experiences of activity and participation in individuals with DCD/Dyspraxia from the first-person and third-person perspectives.
The question of this review is: what are the experiences of activity and participation in individuals with Developmental Coordination Disorder/Dyspraxia and their surrounding people?

METHOD

The meta-aggregation approach to qualitative systematic review was completed in compliance with the guidance provided in the JBI Manual for Evidence Synthesis (Lockwood et al., 2020). An a priori protocol has been published (Miyahara et al., 2020) and our review was registered, and most recently updated on 19 February, 2023, in the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42019137616). As shown in Figure 1, the meta-aggregation approach to qualitative systematic review consists of four major steps:

1) the identification of studies,
2) aggregation of findings,
3) categorising findings, and
4) synthesizing categories to develop synthesised statements to inform the decisions of practitioners and policy makers.

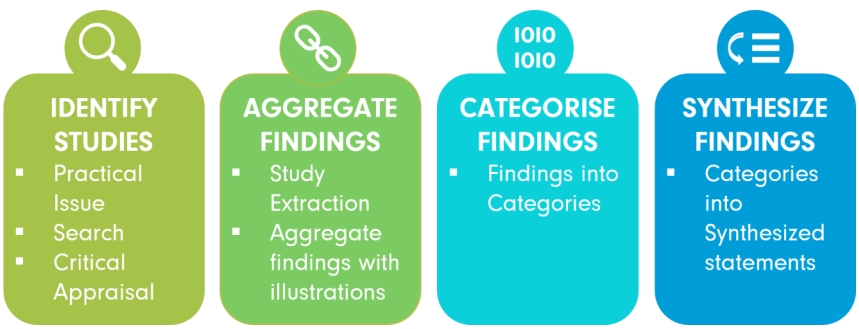

Figure 1. Overview of the meta-aggregation approach to qualitative systematic review

Step 1. Identification of studies

To generate inclusion and exclusion criteria based on our research question, we used a framework of participants, phenomena of interest, and context. Participants were individuals with DCD/Dyspraxia who were aged 5 years and above, their families, and service providers, such as educational (e.g., teachers, teacher aides) and medical professionals (e.g., medical doctors, occupational and physical therapists). Studies including children under 5 years of age were not eligible for inclusion because the diagnosis of DCD or Dyspraxia is not typically made earlier (American Psychiatric Association, 2013). The current review embraced all individuals described in primary qualitative studies as having either DCD, probable DCD, at risk of DCD, or Dyspraxia. Individuals with co-occurring developmental disorders, such as ADHD, Pervasive Developmental Disorders, ASD and SLD were included, as far as DCD/Dyspraxia was present and the primary study described the phenomena of interest in the context specified below.

The phenomena of interest for this review were the experiences of DCD/Dyspraxia on activity and participation defined in the International Classification of Functioning, Disability and Heath (ICF) (World Health Organization, 2001), including, but not limited to 'Activity and Participation' (e.g., carrying out daily routine), 'Body Function' (e.g., control of voluntary movement function) and 'Environmental Factors' (e.g., personal care providers and personal assistants). If the understanding and support for individuals with DCD/Dyspraxia could impact on their activity and participation, such phenomena were considered of interest to include in this review.

The context of this review included activities of daily living, educational, vocational, sports, leisure, and settings of clinical diagnosis, assessment, and treatment. Activity and participation could be experienced by variously gendered individuals in unique ethnic cultures, at different developmental stages in life, from childhood through adolescence and into adulthood, in which DCD/Dyspraxia could persist (American Psychiatric Association, 2013).

This review considered studies which focused on qualitative data, including primary academic studies published in peer-reviewed journals and gray literature (e.g., theses and dissertations). The qualitative studies could be based on the interpretive or critical paradigm, theoretically and methodologically underpinned by phenomenology, grounded theory, ethnography, qualitative description, action research, and mixed methods. Methods of qualitative data collection included, but were not limited to, interviews, focus groups, open-ended survey responses, and observation.

Our search strategy was devised to locate published as well as unpublished primary investigations. To ensure that no secondary qualitative review studies were in progress on the same topic, we searched Cochrane Database of Systematic Reviews, JBI Evidence

Synthesis and PROSPERO on 17 March, 2022. There was no ongoing review on the topic. Then we initiated a limited search for primary studies on the topic in CINAHL, PsycINFO, MEDLINE, Embase, and ERIC with search terms of 'developmental coordination disorder' and 'qualitative research'. Subsequently, we analysed the text words identified from the titles and abstracts of pertinent studies and the index terms that represented the studies. The formulation of full search strategies was based on identified key words, index terms, and our inclusion criteria. The full search strategies were adapted for each of the employed databases: CINAHL (EBSCOHost), MEDLINE (OVID platform), Embase (OVID platform), ERIC (ProQuest platform), PsycINFO (OVID platform), SPORTDiscus (EBSCOHost), and ProQuest Dissertations and Theses (ProQuest platform) as provided in Supplementary Material 1. These database searches were completed between 7 and 10 April, 2022.

To search gray literature, we planned to use OpenGrey in our protocol, but OpenGrey was discontinued in December 2020. Instead, we searched Google Scholar and PMC (Pub Med Central) with the terms "developmental coordination disorder" AND "qualitative, "developmental coordination disorder" AND "interview", "dyspraxia" AND "qualitative", and "dyspraxia" AND "interview". No additional studies of relevance were detected. The search platform of Project Muse did not allow a combination of fields, so the same search terms as Google Scholar and PMC were repeated for the abstract field. No additional studies were detected. SocINDEX was not available in the accessible libraries by the authors, and therefore not searched. A hand search of reference lists of included studies also detected no additional studies. We searched primary studies with identifiable English titles and abstracts in the above contemporary English databases without imposing any limits on publication period or language.

After the search, we collated all identified citations, uploaded into EndNote X9/2018 (Clarivate Analytics, PA, USA), and removed duplicates. Then two of the three independent reviewers (MM, IM, TP) screened all titles and abstracts by assessing against the inclusion criteria.

We retrieved full texts of potentially pertinent studies, and imported the citation details into the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI), (Joanna Briggs Institute, Adelaide, Australia), (Munn et al., 2019). The first author assessed the retrieved full-text studies against the inclusion criteria, which was later confirmed by the second or the third author. Among other studies with main text written in English, the main text of one study (Terčon, 2017) was written in Slovenian and the other in Portuguese (Galvão, Penido Bueno, Rezende, & Magalhaes, 2014). The Slovenian text was translated into English by Google Translate and the Portuguese text was translated into English by DeepL. The machine translations of critical points for us to determine the inclusion or exclusion of these studies were confirmed by a native Croatian and a native Portuguese speaker. When the first three authors had disagreement at each stage of the study selection process, we resolved

through discussion (Cf. Supplementary Material 2). The entire process of study selection is depicted in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher, Liberati, Tetzlaff, & Altman, 2009) flow diagram (Figure 2).

After selecting studies, two independent reviewers (MM and IM or MM and TP) critically appraised methodological quality, using the standard 10-item JBI Critical Appraisal Checklist for Qualitative Research (Lockwood et al., 2020). Seven authors of the appraised studies were contacted to obtain missing or additional data, and five responded. When any disagreements arose between two reviewers, we resolved them through discussion, or through a mediation process with a third reviewer.
The exact questions used to determine methodological quality can be viewed at the bottom of Table 1. Briefly, questions covered "congruity between research methodology" and "philosophical perspective" (Q1), "research question/objectives" (Q2), "data collection methods" (Q3), "representation and analysis of data" (Q4), and "interpretation of results" (Q5). Questions also covered "cultural/theoretical positioning of researcher" (Q6), "influence of the researcher on the research" (Q7), "adequate representation of participant voices" (Q8), "ethical approval" (Q9), and "supported conclusions" (Q10).

For congruity between the research methodology and Q1: the "philosophical perspective", Q2: "research question", Q3: "data collection methods", Q4: the "representation and analysis of data", and Q5: the "interpretation of results", a study received a positive rating only if both methodology (e.g., phenomenology) and the other methodological aspects asked in Q1-Q5 were explicitly stated. A negative or unclear rating was received if one aspect was not specified or ambiguous (e.g., tenets of qualitative research). If a study failed to represent participants' voices adequately (Q8), the study was excluded.

To ultimately produce synthesized statements of high confidence (Porritt, Gomersall, & Lockwood, 2014), studies were only included in our meta-aggregation if they received a high grading for dependability (4 or 5 out of 5). Dependability scores for each study were developed from the aggregation of five items (Q2, Q3, Q4, Q6, Q7) in the JBI Critical Appraisal Checklist for Qualitative Research (Lockwood et al., 2020). Studies with a dependability score of less than four were excluded from our meta-aggregation.

Step 2: Aggregation of findings

Two independent reviewers (MM, TP) extracted study characteristics from studies included in the review, using the data extraction function of JBI SUMARI (Lockwood et al., 2020). The extracted data were tabulated under headings of methods, country, phenomena of interest relevant to the review objective (i.e., the experiences of activity and participation in individuals with DCD/Dyspraxia and their surrounding people),

setting or context, participant characteristics, and main findings. Methodology was added in the column of the methods.

The first author (MM) then extracted all findings and illustrations from studies meeting our inclusion criteria and dependability score threshold. The findings from individuals with DCD/Dyspraxia and their surrounding people were pooled together. Findings represented the verbatim analytic interpretations of authors, while illustrations represented the accompanying participant quotes. To enable assessment of confidence in the review findings at a subsequent stage (detailed below), three levels of credibility were assigned based on the fit between author interpretation (findings) and participant data (illustrations). Unequivocal (U) ratings were given when findings/interpretation were "directly reported/observed and not open to challenge"; credible (C) ratings were given when findings/interpretation "lacked a clear association with the participant data" (i.e., could only be logically inferred but not directly reported) and could be challenged; and not supported (NS) ratings were given when findings/interpretation were "not supported by data" (Munn, Porritt, Lockwood, Aromataris, & Pearson, 2014). Findings/illustrations rated as NS were not included in the meta-aggregation. Two other reviewers (IM, TP) independently checked that extracted findings/illustrations were relevant to the review question and that the credibility rating was accurate. Any disagreements that arose between the reviewers were resolved through discussion.

Step 3: Categorising findings

We pooled qualitative research findings in a web-based software named JBI SUMARI. Meta-aggregation, underpinned by pragmatism (Hannes et al., 2018), involved the aggregation of 'findings' to generate a set of 'categories' based on similarity in meaning.

Step 4: Synthesizing categories

The categories were synthesized to produce a set of 'synthesized statements' that could be used as a basis for evidence-based practice. Only unequivocal and credible findings were used in the synthesis. At least two reviewers undertook repeated readings of all extracted findings and accompanying illustrations. The extracted findings were first identified as relating to activity or participation, grouped on the basis of similarity in the level of experience (i.e., home, school, community, reflecting the approach of Hannes et al., 2018) and classified into draft categories of home, school, and community levels. The draft categories and accompanying findings/illustrations were subjected to iteration, re-examined by the first three authors, and the categories were refined and re-defined until final definitions of categories and synthesized statements were achieved by consensus. The synthesized statements addressed the research question by elaborating the Diagnostic Criterion B at the different levels.

The final synthesized statements were graded in accordance with the ConQual approach (Munn et al., 2014) for establishing confidence in the outcomes of qualitative synthesis. The ConQual score is made up of a combination of dependability and credibility ratings. Grading for dependability took into account how the majority of included studies within a synthesized statement scored in five (Q2, Q3, Q4, Q6, Q7) of the ten items of critical appraisal for dependability (Munn et al., 2014). The credibility for the synthesized statement was recorded as high, if "all research findings comprising the synthesized statement were unequivocal"; as moderate if the research findings were "a combination of unequivocal and credible"; and as low if the research findings were "credible only" (Munn et al., 2014).

RESULTS

Study inclusion

Figure 2 depicts the search results and the processes of screening and study selection, following the PRISMA method (Moher et al., 2009). In total, 2281 studies were identified from the database search. Of these studies, 1441 were eligible for inclusion after duplicates were removed. Following the title and abstract screening, 1366 were excluded. A total of 73 studies were retrieved in full and were assessed for inclusion through full text review; 25 studies were excluded. The remaining 48 studies were appraised for methodological quality (Lockwood et al., 2020).

Methodological quality

Of the 48 studies, the methodological quality of 20 were of high quality, 5 were of moderate quality, and 23 were of low quality, based on ConQual criteria (Lockwood et al., 2020) (Table 1 and Supplementary Material 3). The majority of the studies (> 80%) adequately represented participants and their voices (Q8), obtained ethical approval (Q9), and drew logical conclusions from the interpretation of the data (Q10). Half of the studies (50%) demonstrated congruity between research methodology and research question (Q2), data collection methods (Q3), the representation and analysis of data (Q4), and the interpretation of results (Q5). Half of the studies (50%) also stated the influence of the researcher on the research, and vice-versa (Q6). However, less than 40% of the studies mentioned specific philosophical perspectives (Q1) or the influence of the researcher on the research (Q7).

Only the 20 studies which rated high in the dependability rating (score of 4 or 5) were used in the meta-aggregation. This decision was made to ensure that the aggregated confidence levels (overall ConQual scores: high, moderate, low, and very low) would be as high as possible in our synthesized statements (Porritt et al., 2014). If the confidence level is low, our synthesized statements from this qualitative review would not be able to form a solid basis to make recommendations for practice or inform policy.

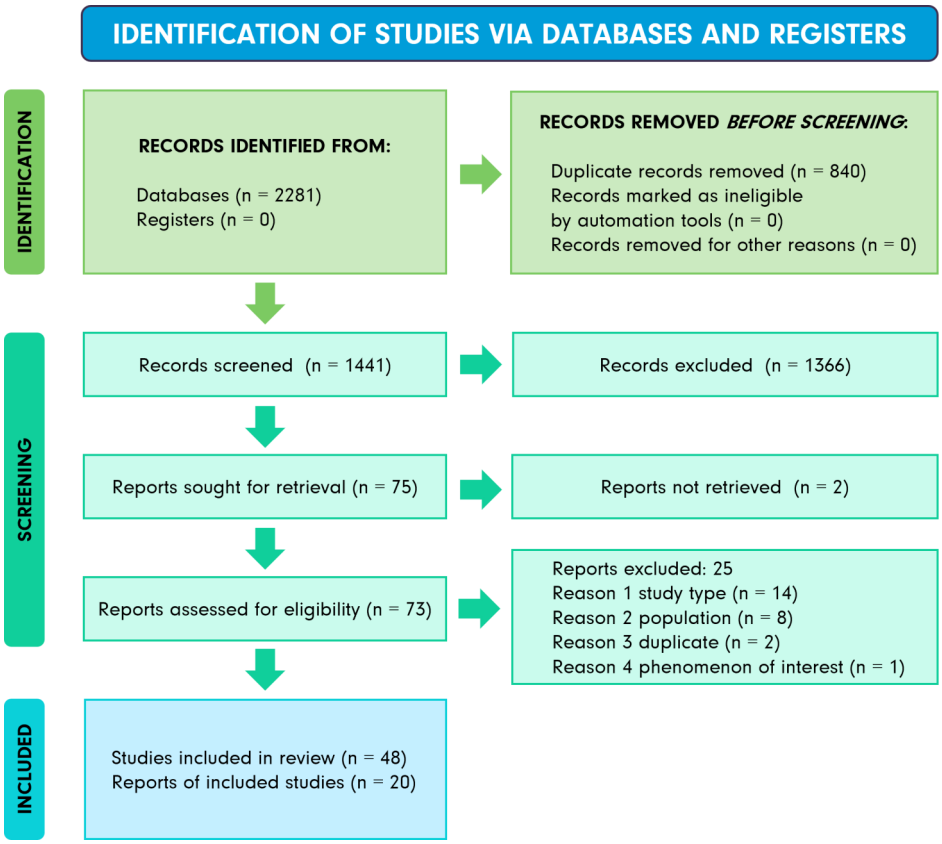

Figure 2. Search results and study selection and inclusion process (Page et al., 2021)

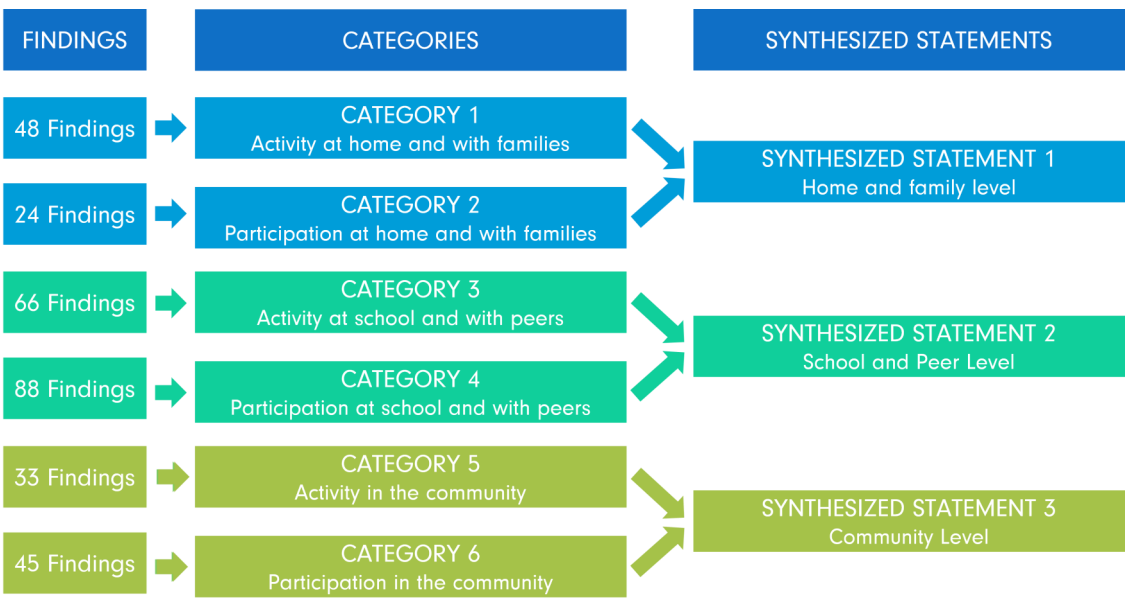

Figure 3. The structure of meta synthesis, comprised of a total of 304 findings, six categories, and three synthesized statements

Characteristics of included studies

The included 20 studies for meta-aggregation were conducted over two decades from 2001 to 2021. Nine of the 20, included studies that were written as PhD theses/ dissertations (Armstrong, 2016; Bolton, 2001; Kane-Hamer, 2018; Kirby, 2008; Lingam, 2012; Payne, 2015; Raleigh, 2013; Ungar, 2010; Winson & Fourie, 2018), and the remaining 11 studies were published in journal article format (Anderson, Wilson, & Carmichael, 2018; Hessell, Hocking, & Davies, 2010; Hitchcock, Hocking & Jones, 2020; Holmes, Fourie, Van Der Merwe, Burke, & Fritz, 2021; Martini et al., 2020; Missiuna, Moll, King, Stewart, & Macdonald, 2008; Missiuna, Moll, Law, King, & King, 2006; Rodger & Mandich, 2005; Scott-Roberts, 2018; Walker, Shaw, Reed, & Anderson, 2021; Zimmer, Dunn, & Holt, 2020).

Geographically, ten of the 20 studies were undertaken in the UK and the Republic of Ireland, (Armstrong, 2016; Bolton, 2001; Kane-Hamer, 2018; Kirby, 2008; Lingam, 2012; Payne, 2015; Raleigh, 2013; Scott-Roberts, 2018; Ungar, 2010; Walker et al., 2021); five in Canada (Martini et al., 2020; Missiuna et al., 2008; Missiuna et al., 2006; Rodger & Mandich, 2005; Zimmer et al., 2020); two in New Zealand (Hessell et al., 2010; Hitchcock et al., 2020); two in South Africa (Holmes et al., 2021; Winson & Fourie, 2018); and one in an unknown country (Anderson et al., 2018) by Australian and Canadian authors.

The studies employed a range of qualitative methodologies and methods, including phenomenology (Anderson et al., 2018; Kane-Hamer, 2018; Missiuna et al., 2008; Raleigh, 2013; Zimmer et al., 2020), ethnography (Bolton, 2001), descriptive approaches (Missiuna et al., 2006) to conducting interviews (Anderson et al., 2018; Armstrong, 2016; Bolton, 2001; Hitchcock et al., 2020; Holmes et al., 2021; Kane-Hamer, 2018; Kirby, 2008; Lingam, 2012; Martini et al., 2020; Missiuna et al., 2008; Missiuna et al., 2006; Payne, 2015; Raleigh, 2013; Rodger & Mandich, 2005; Scott-Roberts, 2018; Walker et al., 2021; Winson & Fourie, 2018; Zimmer et al., 2020), focus groups (Martini et al., 2020), case studies (Bolton, 2001; Holmes et al., 2021), and questionnaire surveys (Kirby, 2008).

Data were analysed by content (Kirby, 2008; Martini et al., 2020; Rodger & Mandich, 2005; Scott-Roberts, 2018), thematic (Anderson et al., 2018; Hitchcock et al., 2020; Holmes et al., 2021; Scott-Roberts, 2018; Walker et al., 2021; Winson & Fourie, 2018), or phenomenological analysis (Anderson et al., 2018; Kane-Hamer, 2018; Lingam, 2012; Raleigh, 2013; Zimmer et al., 2020). Sample sizes range from 1 to 76 (unknown sample size in one study) with the total aggregate sample size of 241 participants, including school aged children, university students, adults with DCD/Dyspraxia, and their parents, teachers, and clinicians. Supplementary Material 4 provides key characteristics of the 20 studies used for meta-aggregation.

Table 1. Critical appraisal results of eligible studies

STUDY	Q1	Q2†	Q3†	Q4†	Q5	Q6†	Q7†	Q8	Q9	Q10
Adams 2018	N	N	N	N	N	N	N	Y	Y	Y
Anderson 2018*	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Armitage 2017	N	Y	Y	Y	Y	N	N	Y	Y	Y
Armstrong 2016*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Barnett 2013	N	N	N	N	N	N	N	Y	Y	Y
Bolton 2001*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Coussens 2020	N	N	N	N	N	N	Y	N	Y	Y
Coussens 2021	N	N	N	N	N	N	N	Y	Y	Y
DeRoche 2015	N	N	N	N	N	Y	N	Y	N	Y
Edmonds 2012	N	N	N	N	N	Y	N	Y	Y	Y
Foulder-Hughes 2014	N	N	N	N	N	N	N	Y	Y	Y
Galvão 2014	N	N	N	N	N	Y	N	Y	N	Y
Hessell 2010*	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Hitchcock 2020*	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Holmes 2021*	Y	Y	Y	Y	Y	Y	N	Y	N	Y
Jackson 2019	Y	N	N	N	N	N	N	Y	Y	Y
Jackson 2021	Y	N	N	N	N	N	N	Y	Y	Y
Jasmin 2018	N	N	N	N	N	N	N	Y	Y	Y
Kane-Hamer 2018*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kirby 2008*	N	Y	Y	Y	Y	Y	Y	Y	N	Y
Kirby 2011	N	N	N	N	N	N	N	Y	Y	Y
Lingam 2012*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Maciver 2011	N	N	N	N	N	N	N	Y	Y	Y
Mandich 2003	N	N	N	N	N	N	N	Y	N	Y
Martini 2020*	N	Y	Y	Y	Y	N	Y	Y	Y	Y
Medeiros 2019	N	N	N	N	N	Y	N	Y	Y	Y
Missiuna 2006*	N	Y	Y	Y	Y	Y	Y	Y	N	Y

Table 1. Critical appraisal results of eligible studies (Cont.)

STUDY	Q1	Q2†	Q3†	Q4†	Q5	Q6†	Q7†	Q8	Q9	Q10
Missiuna 2007	N	Y	Y	Y	Y	N	N	Y	Y	Y
Missiuna 2008*	N	Y	Y	Y	Y	Y	N	Y	Y	Y
Morris 2021	N	N	N	N	N	N	Y	Y	Y	Y
Novak 2012	N	N	N	N	N	N	N	Y	Y	Y
O'Dea 2021	N	Y	Y	Y	Y	N	N	Y	Y	Y
Payne 2015*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Payne 2020	N	Y	Y	Y	Y	N	N	Y	Y	Y
Pedro 2019a	N	N	N	N	N	N	N	Y	Y	Y
Pedro 2019b	N	N	N	N	N	N	N	Y	Y	Y
Pless 2001	N	N	N	N	N	N	N	Y	N	Y
Raleigh 2013*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rodger 2005*	N	Y	Y	Y	Y	Y	Y	Y	N	Y
Sangster 2010	Y	N	N	N	N	Y	Y	Y	N	Y
Scott-Roberts 2018*	N	Y	Y	Y	Y	Y	N	Y	Y	Y
Segal 2002	N	N	N	N	N	Y	N	Y	Y	Y
Summers 2008	N	N	N	N	N	N	N	Y	Y	Y
Ungar 2010*	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Walker 2021*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Williams 2015	N	N	N	N	N	N	N	Y	Y	Y
Winson 2018*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Zimmer 2020*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
TOTAL %	**33.3**	**50.0**	**50.0**	**50.0**	**50.0**	**50.0**	**37.5**	**97.9**	**81.3**	**100**

*Y = Yes, N = No, * = Used in meta-aggregation, † = Used to add the total dependability scores*
JBI critical appraisal checklist for qualitative research. Q1 = Is there congruity between the stated philosophical perspective and the research methodology? Q2 = Is there congruity between the research methodology and the research question or objectives? Q3 Is there congruity between the research methodology and the methods used to collect data? Q4 = Is there congruity between the research methodology and the representation and analysis of data? Q5 = Is there congruity between the research methodology and the interpretation of results? Q6 = Is there a statement locating the researcher culturally or theoretically? Q7 = Is the influence of the researcher on the research, and vice- versa, addressed? Q8 = Are participants, and their voices, adequately represented? Q9 = Is the research ethical according to current criteria or, for recent studies, is there evidence of ethical approval by an appropriate body? Q10 = Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?

REVIEW FINDINGS

From the 20 studies we extracted a total of 304 findings with supporting illustrations, classified them into six categories, (Supplementary Material 5) and generated three synthesized statements (Figure 3). In total, 215 findings were rated as unequivocal and 89 were rated as credible, based on ConQual criteria. Each synthesized statement consisted of two categories related to activity and participation at home and with family, in school and with peers, and in the community. Figure 2 shows the structure of meta-aggregation, with each synthesized statement consisting of the same contextual categories, and the numbers of findings in each category. The confidence in each of the following three synthesized statements is moderate with high dependability (dependability score of 4 or 5) and moderate credibility (downgraded one level from high credibility for a mix of unequivocal and credible findings). Table 2 shows an example of an illustration, supporting finding, and the credibility of the finding for each category.

Synthesized statement 1: Home and family level

DCD/Dyspraxia has a strong physical and emotional impact on family life at home, requiring families to assist with daily activities. Although difficulties often have a negative impact on the confidence of individuals with DCD/Dyspraxia, repeated practice could result in improvement and satisfaction within the family unit. Many families try their best to understand their child's difficulties and facilitate activity and participation at home.

Category 1: Activity at home and with family level

Forty-eight findings were grouped into this category. Parental support facilitated involvement of children with DCD/Dyspraxia in home activities to foster their independence. Repeated practice enabled children with DCD/Dyspraxia to improve their performance of activities of daily living and home-based tasks. Children and parents experienced satisfaction and joy from improvement and success when completing important individual, home, and family activities. While some parents were worried about their child's safety and felt uncertain about their child's ability, other parents developed confidence in their children's ability to succeed.

Category 2: Participation at home and with family level

Twenty-four findings were sorted into this category. Family members varied in their acceptance, understanding of, and support for individuals with DCD/Dyspraxia. Nonetheless, many families made an effort to support individuals with DCD/Dyspraxia, while noting that it takes time, effort, and practice to make positive change happen. Unfortunately, the nature of DCD/Dyspraxia negatively impacted the relationship between parent/s and individuals with DCD/Dyspraxia at times.

Table 2. An exemplary illustration, supporting finding, and the credibility of the finding for each category

EXEMPLARY ILLUSTRATION	FINDING (CREDIBILITY)	CATEGORY
"He's always been different... right from the get go... he never crawled, late with everything" (Hitchcock, 2020, p.26)	Aware from when their child with DCD was young that they had issues (Unequivocal)	Category 1: Activity at home and with families
"David: My Mum doesn't like me using it (the oven) because of my hands. She thinks I'll burn myself. Same with the kettle. See what I mean about the freedom?" (Payne, 2015, p.116)	Not allowed to do things independently because their parents perceived the risks to be too great (Credible)	Category 2: Participation at home and with families
"So dyspraxia does influence spatial relations or spatial perception. So that would definitely [influence] the writing field ... if they reverse letters, they will spell incorrectly and then if they spell incorrectly they will read incorrectly." (Winson, 2018, p.88)	Challenges with academic skills (Unequivocal)	Category 3: Activity at school and with peers
"[He misses out] everyday at school when all the kids have gone out to play and he takes five minutes longer to tie up his shoes." (Rodger 2005, p452)	Missed out on recess and opportunities for participation with peers (Unequivocal)	Category 4: Participation at school and with peers
"Because I consider myself a liability and wouldn't trust myself to be able to control the car say if there was a crash" (Kirby, 2008, p. 235)	Reasons given for not driving (Unequivocal)	Category 5: Activity in the community
"I look at friends skiing and ice skating and think that looks fun but could never think of joining in." "I tend to choose to do physical activities on my own as I know I can't compete in team activities." (Scott-Roberts, 2018, p.30)	Participation in more active leisure pursuits with others outside of the family was also carefully selected (Unequivocal)	Category 6: Participation in the community

Synthesized statement 2: School and peer level

The school environment represents a stage for public performance, peer comparison, and social inclusion and exclusion. The school environment also highlights the difficulties of students with DCD/Dyspraxia, particularly in handwriting and physical education/ sports, which may generate negative reactions from others and lead to anxiety and frustration. Nonetheless, students with DCD/Dyspraxia often find ways to navigate the school environment and seek assistance. Students with DCD/Dyspraxia require understanding, acceptance, and support from peers, teachers, and parents to cope with their physical and psychosocial challenges at school.

Category 3: Activity at school and peer level

Sixty-six findings formed this category. Individual differences at school evoked concerns for the student, parents, and teachers. The school environment (particularly, physical education, handwriting, and comparison with others) can create anxiety for students with DCD/Dyspraxia and an atmosphere of humiliation, frustration, and intimidation from peers and teachers. Many students, parents, and teachers were worried about students with DCD/Dyspraxia not being able to manage school/social life and how their performance differed compared to peers. Students with DCD/Dyspraxia may cope by isolating from peers, seeking additional support, using extra time to complete tasks, or by throwing emotional outbursts. However, students also found ways to compensate for their performance, such as re-writing work at home, learning in ways best suited to them, re-framing what 'success' in physical and/or other activities looked like, celebrating small victories, and seeking guidance to improve their performance. Experiences of achieving mastery and coping with activities that had once been difficult enhanced students' confidence, optimism, and hope.

Category 4: Participation at school and peer level

Eighty-eight findings were sorted into this category. Students with DCD/Dyspraxia may feel inadequate at school and in peer relationships, particularly situations which involve physical education, sports, practical activities, and navigation around the school. Students with DCD/Dyspraxia were frequently bullied, excluded, and isolated by actions of peers, and were often misunderstood and not supported by teachers or schools. The transition from primary school, through secondary school, and into higher education emphasised students' co-ordination difficulties, and created further challenges in terms of coping with new environments and increased workloads – at times, without additional support being provided. These students often developed negative perceptions of physical education or practical activities and devised various tactics to avoid these situations. Mentoring systems in school, parental support and advocacy, acquisition of skills, support services, positive experiences, and having supportive friends could improve participation patterns and peer relationships of students with DCD/Dyspraxia.

Synthesized statement 3: Community level

Community activities, transport, and work environments do not always accommodate the needs of individuals with DCD/Dyspraxia and can prevent individuals from participating and achieving competency. Participation is further affected by the availability and accessibility of individualised training and appropriate healthcare to support the needs of individuals with DCD/Dyspraxia and their families. An environment that is tailored for individual needs would facilitate participation in the community.

Category 5: Activity at community level

Thirty-three findings were combined to form this category. Situations within the wider community, ranging from childhood community activities, transport on foot and by car, and work environments, often emphasised individual differences in ability. Many individuals experienced bumps, falls, injuries, emotional scars, and reduced confidence during such community activities. However, these situations also helped individuals with DCD/Dyspraxia understand their own needs and limits, either directing effort to achieving competency or opting out of activities. Confidence improved if an individual with DCD/Dyspraxia acquired skills and developed an understanding of their own condition through diagnosis, training, and therapies. However, training and therapies were not always valued by individuals with DCD/Dyspraxia. Individuals with DCD/Dyspraxia highlight the importance of recognising achievements, accepting their own abilities and performance, and making the commitment to improve own skills.

Category 6: Participation at community level

Forty-five findings were classified into this category. Participation in the broader community environment, such as through leisure activities, transport, and work, was affected by a number of facilitators and barriers. The physical environment, requirements/demands of participating in leisure and work activities, and interactions with peers, employers, and the healthcare system uniquely affected the participation level of individuals with DCD/Dyspraxia. To transform barriers into facilitators, the community environment should be tailored to individual needs.

Individualized learning, sports, and recreational activities and programs facilitated participation in the community, especially when individual preferences and needs were met and other individuals with DCD/Dyspraxia were involved. Appropriate and timely support would ease the struggles that families and individuals with DCD/Dyspraxia experience. Proper recognition and support for DCD/Dyspraxia, including primary and secondary care, is needed, but not always available. Parents often need to fight for healthcare professionals' understanding and support for their children with DCD/Dyspraxia.

DISCUSSION

This qualitative systematic review, reported in accordance with the PRISMA 2020 guideline (Cf. Supplementary Material 6), aimed to evaluate the experiences of activity and participation in individuals with DCD/Dyspraxia and their surrounding people. The goal of this review was to provide practitioners with synthesized statements to assist them in decision-making and developing strategies at practice and policy levels. By synthesising findings of 20 high quality studies, we produced three synthesized statements around experiences of activity and participation at the levels of home and family, school and peer, and community. These synthesized statements could be used as a basis for evidence-based practice (Hannes et al., 2018). Recommendations based on our synthesized statements are provided at the end of the conclusion. Furthermore, our synthesis and evaluation of findings helps to elaborate the Diagnostic Criterion B, and could potentially contribute to the development of a tool for assessing this criterion in the future.

Our review is framed with the terms of activity and participation defined in the ICF (World Health Organization, 2001). It was possible for us to classify findings from included studies into relevant ICF codes, such as d540 Dressing and d820 School education. The components relevant to the present review were not limited to 'Activity and Participation' but extended to 'Body Function' and 'Environmental Factors'. However, it was problematic to classify findings from included primary studies into the pre-existing ICF codes for two reasons. Firstly, the illustrations of 'activity and participation' overarch the interrelated components of 'Body Function', 'Activity limitations', 'Participation restrictions' and 'Environmental Factors' in the ICF model, and not all findings could neatly fit into one of the components. Secondly, this review used the meta-aggregation approach to synthesize findings from primary studies to generate a set of categories from which synthesized statements were constructed. Due to the decontextualised nature of the ICF codes, mere categorisation of the findings from primary studies into the ICF codes would not lead to statements that could assist practitioners in decision-making and developing strategies at practice and policy levels.

The first challenge remained when we first classified findings into categories of either activity or participation. We evaluated the relative weight between the two categories based on the illustration associated with each finding. The second challenge was managed by adopting some of the synthesis levels of school, teacher, peer, and individual, (Hannes et al., 2018) based on practical usefulness, and modifying them to represent home and family, school and peer, and community levels. Thus, we have developed three synthesized statements that indicate contextualized synthesized statements for practitioners and policy makers with moderate confidence (as determined by ConQual criteria).

LIMITATIONS

This review has several limitations to note. Our inclusion criteria of qualitative studies, studies searchable by English-language databases, and primary peer reviewed evidence excluded a range of samples, phenomena, and contexts. First, most of the included qualitative studies employed interviews and focus groups, and the validity and appropriateness of these popular data collection, analysis, and interpretation methods have been recently questioned: do interviews and researcher interpretation accurately reflect the true experiences on individuals? (Jackson & Mazzei, 2011). Leaving this fundamental question aside, it is also important to consider the nature of participants who were interviewed by the researchers, clinicians, and postgraduate students who successfully published their interview-based studies in peer-reviewed journals, dissertations and theses, and gray literature. These participants were a particular group of people who were accessible to DCD/Dyspraxia researchers and self-identifying DCD/Dyspraxia discourse. We must further consider a different group of people who deny diagnosis and labels, such as DCD and Dyspraxia, would not engage in the DCD/Dyspraxia discourse (Novak, Lingam, Coad, & Emond, 2012), and would not participate in qualitative studies. Our review is limited to the former group of people who had opportunities and willingness to participate in qualitative research labelled with DCD/Dyspraxia.

Second, with regard to cultural geography where included primary studies were conducted, our search was limited to English-language databases. While we attempted translation of all non-English studies, two non-English study conducted in Slovenia and Brazil were located.

The majority of studies included in this review came from a Western perspective and Western research agenda of qualitative methodology. No included studies were conducted in Asia, the Middle East, Central America, or Africa except South Africa. We potentially missed other relevant studies in these areas which were inaccessible from our selection of databases. As a result, our synthesized statements may not be directly transferrable into other geographical or cultural contexts.

Third, in our critical appraisal of included studies, we checked if each study located the research culturally or theoretically (Q6) and addressed the influence of the researcher on the research, and vice versa (Q7) (Lockwood et al., 2020). The same questions should be directed to ourselves as reviewers, and our potential personal, theoretical, or cultural influence on the present review. In this regard, we used meta-aggregation underpinned by pragmatism (Hannes et al., 2018), which is our philosophical, theoretical, and methodological perspective adopted for this review. Culturally, the first three authors are based in Aotearoa New Zealand, a nation which embraces multiculturalism based on biculturalism of indigenous Māori and non-Māori. Admittedly, the nation is strongly influenced by English culture, which enables us to write this review in English language.

Personally, the first author MM, feels obliged to disclose that he has been motivated to conduct this review to compensate for the equivocal quantitative evidence that he and his collaborators revealed through the Cochrane review on the effect of task-oriented interventions for children with DCD (Miyahara, Hillier, Pridham, & Nakagawa, 2017); the Cochrane review indicates a moderate positive intervention effect supported by very low-quality evidence and no effect supported by low-quality evidence. With very little confidence in the effect estimates, the intervention effect has turned out to be inconclusive. This experience might have influenced his efforts to include only the studies with high dependency scores in the current review to maximise the confidence level in our conclusions (i.e., synthesized statements). Second author, TP has been educated in the field of physical activity and health. Her learnings and outlook have been influenced by the concept of inclusion and a belief that environments should be adapted, when needed, to facilitate the full and meaningful participation of all individuals. Working as a consultant psychiatrist for the past 13 years in New Zealand, IM the third author, has been using DSM and interested in developing an assessment tool for Criterion B which is often not investigated in a structured manner in making diagnoses. RK, the fourth author, is from a nursing background. She has worked on various systematic review projects largely in the area of dementia care. Not so familiar with the review topic of DCD/ Dyspraxia, she is, in a way, able to contribute to this review in an unbiased manner.

Finally, our synthesized statements were assessed as being of 'moderate level of confidence'. This level of confidence is achieved by aggregating findings of only the studies with high dependability scores (See Supplementary Material 7 for this and other deviation from protocol). There is a trade-off between including diverse lower-quality studies and compromising the confidence level; we might have failed to represent significant voice from participants in the excluded studies, albeit with a lower quality of methodological reporting (Soilemezi & Linceviciute, 2018). Given the goal of meta-aggregation is to generate synthesized statements to make recommendations for practice and inform policies, our priority of confidence over breadth would be justified for maximising potential utility of our synthesized statements.

CONCLUSIONS

The review has assembled the independently conducted qualitative studies in various contexts and painted a collective picture of experiences that reflect the deep and pervasive impact of DCD/Dyspraxia. Our three synthesized statements reflect activity and participation at home and with family, school and peer, and community levels. To conclude, we draw on findings of our review and synthesized statements to generate a series of recommendations for practice.

RECOMMENDATIONS FOR PRACTICE AND POLICY

Synthesized statements 1, 2, and 3 indicate that individuals with DCD/Dyspraxia experience difficulties in a wide breadth of activities and situations as a result of the status of motor skill development. Because exact activities and situations vary, a checklist type assessment, such as ICF codes, may overlook some activities and situations for participation that individuals with DCD/Dyspraxia or their surrounding people hold personal or social significance for. Therefore, to evaluate the DSM-5 Criterion B for DCD, specific activities and environmental situations surrounding participation in activities of importance should be reported by individuals with DCD/Dyspraxia or proxies by responding to open-ended questions.

Synthesized statements 2 and 3 suggest that teachers, health care professionals, educational and health policy makers should be the targets of campaigns to increase understanding around the significant physical and psychosocial impact of DCD/Dyspraxia on the life of the individual who has the condition. Guidelines and practical training are required for teachers to increase understanding of DCD/Dyspraxia and employ practical strategies for reasonable accommodation within educational environments. To alleviate stress, provision of psychological support is crucial either individually or in group settings within the existing systems, or if feasible, with additional systems.

Synthesized statement 3 indicates the need for increased resources for screening, diagnosis, and age-appropriate individual and social interventions for individuals with DCD/Dyspraxia. Such support systems should be available from an early age and remain present in educational and vocational settings within the existing systems, or if feasible, with additional systems.

RECOMMENDATIONS FOR RESEARCH

The directions for further research are threefold. First, a set of open-ended questions should be prepared, refined, and validated to assess the DSM-5 Criterion B for DCD. Our qualitative synthesis could inform the preparation for a prototype assessment tool, such as one drafted in Supplementary Material 8. Further development and standardization of the tool would contribute to a transparent evaluation process of and transparent reporting for Diagnostic Criterion B.

Secondly, more qualitative systematic reviews are needed to address the synthesis gaps that our qualitative systematic review and O'Dea et al.'s (2021) meta-ethnographic synthesis have not yet tapped into. The gaps include different approaches (e.g., thematic synthesis, realist synthesis, content analysis), different foci on condition (e.g., co-occurring dyslexia and DCD/Dyspraxia), phenomenon of interest (e.g., cognitive and emotional regulation) and context (e.g., self organisation at school). Further qualitative syntheses

with different goals, approaches, and analyses would shed new light on qualitative data and produce distinct understanding and insights from the two predecessor reviews.

Thirdly, future primary qualitative studies should avoid overlaps and seek untapped population (e.g., older adults, preschool teachers, pediatricians, psychiatrists, GPs, people in non-Western nations and cultures, people who refuse to engage in the DCD/ Dyspraxia discourse), phenomenon of interest (e.g., assessment experience, real-time account of activity and participation experience in situ) and context (e.g., different vocational settings).

Finally, but not least, authors of primary qualitative studies should transparently report their philosophical perspective, research methodology, cultural and theoretical orientation, and influence of the researcher on the research.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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SUPPLEMENTARY MATERIAL 1-8

Supplementary Materials are available for download at this weblink

https://das.org.sg/images/publications/apjdd/VOL10NO2/APJDD-10-2-Article-7-SupplementaryMaterials.pdf

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