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# Investigating the Feasibility and Acceptability of a Facebook Delivered, Parent Mediated, Physical Activity Intervention for Children with Developmental Coordination Disorder

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**ABSTRACT**

**Objective:** Children with Developmental Coordination Disorder (DCD) experience difficulties performing fundamental movement skills, resulting in reduced physical activity (PA). Given low PA can impact mental and physical health, improving PA in DCD appears imperative. This study investigates the feasibility of a Facebook delivered, parent mediated, PA intervention for children with DCD.

**Methods:** Parents of children with DCD (*n*=31; 5-11 years), were invited to private Facebook groups where physical activity resources and questionnaires were provided over 12 weeks. Parents and their children wore activity trackers during the intervention period. Feasibility and acceptability of the intervention was considered with reference to (1) Facebook engagement, (2) adherence intervention components, and (3) parent perspectives.

**Results:** Facebook engagement was high, with 78.03% (*SD*=23.06) of all intervention posts being viewed by parents on average. Activity trackers were worn correctly for 92.45% of intervention days and 95.61% of intervention weeks. Weekly questionnaires were completed, on average, 84.37% of the time. Parent perspectives were positive, with 80.77% somewhat or strongly agreeing that the intervention was useful for themselves and their child.

**Conclusions:** Given the results described, Facebook appears to be a feasible platform through which parent mediated physical activity interventions can be provided to children with DCD.

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**KEYWORDS**
Developmental coordination disorder; ehealth; Facebook; mental health; physical activity

## Introduction

Developmental coordination disorder (DCD) is a neurodevelopmental disorder characterised by significant difficulties in learning and performing gross and fine motor skills (American Psychiatric Association, 2013). Coordination difficulties are observable through

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functional deficits in tasks such as buttoning shirts, tying shoelaces, handwriting, walking, and running, and in fundamental movement domains such as balance (Blank et al., 2019). DCD affects 5–6% of school-aged children (Blank et al., 2019), however, motor skill deficits commonly persist into adulthood (Kirby et al., 2008, 2011). Although motor skill deficits are the primary consequence of DCD, a variety of secondary consequences are also observable. Indeed, primary motor skill deficits impact performance, participation, and health in a number of areas (Cairney et al., 2013; Mancini et al., 2016). One such secondary consequence is low levels of engagement in physical activity (PA).

Recent systematic reviews (Rivilis et al., 2011; Romão et al., 2023) have identified evidence of a significant relationship between motor difficulties and physical inactivity in the context of DCD. This relationship is unsurprising given fundamental components of most physical activities (e.g. walking, running, jumping, object control skills, and balance) are impaired in DCD (Smith et al., 2021) and act as practical barriers to entry (Yu et al., 2021). Furthermore, children with DCD are less inclined to pursue physical activity (PA) on their own accord, as poor fundamental movement skills make engaging with PA more difficult and less enjoyable (Barnett et al., 2013). In addition, children with DCD often report higher levels of fatigue (Wu et al., 2010), lower self-efficacy in physical contexts (Batey et al., 2014), and are more likely to experience social exclusion/ridicule in playground and sport settings (Missiuna & Campbell, 2014), all of which furthers their reluctance in participate in PA.

This reduced engagement in PA has serious implications for the physical and mental health outcomes of children with DCD. The link between physical inactivity and poor physical health in the general population is well recognised (Pišot, 2022), with common outcomes including sub-optimal cardiovascular health, academic performance, and self-esteem (Tremblay et al., 2011). In this way, it is unsurprising that Rivilis et al. (2011) identified cardiovascular health to be at a heightened risk in DCD. Poor mental health is another well recognised outcome of low PA (Biddle & Asare, 2011; Biddle et al., 2019). One recent meta-analysis across 22 studies of children and adolescents with diagnosed or probable DCD identified significantly higher levels of internalising problems (e.g. depression or anxiety) than their neurotypical peers (Omer et al., 2019). Interestingly, while mental health difficulties can be considered an outcome of low PA, previous work has identified internalising problems to represent their own secondary consequence of DCD (Cairney et al., 2013; Mancini et al., 2016).

Although there appears to be a direct link between the motor difficulties observed in DCD and physical inactivity, the link to internalising problems is multifaceted. Cairney and colleagues and Mancini and colleagues (Cairney et al., 2013; Mancini et al., 2016) have proposed the environmental stress hypothesis as a theoretical framework of the mediating and moderating factors between motor difficulties and internalising problems in DCD. This framework suggests that the motor difficulties characterising DCD place children at risk of secondary stressors such as physical inactivity, social exclusion, peer conflict, and poor academic performance. Prolonged exposure to these secondary stressors can lead a child to make negative self-appraisals and develop low self-esteem (Mancini et al., 2016), which contributes to the development of internalising problems (Missiuna & Campbell, 2014). In essence, the environmental stress hypothesis posits that secondary stressors, including physical inactivity, mediate the relationship between motor difficulties and internalising problems (Cairney et al., 2013; Mancini et al., 2016).

Given physical inactivity partially mediates the relationship between motor difficulties and internalising problems in DCD (Li et al., 2018), increasing PA in this population appears critical not only to improve physical health, but mental health as well. Despite a dearth of work investigating the positive impact of PA on internalising problems among children with DCD, the positive effects of PA are well established in other contexts. Indeed, multiple umbrella reviews have identified PA interventions to have a moderate effect on depression symptoms and self-esteem (Biddle et al., 2019; Dale et al., 2019). More recent systematic reviews have also identified PA to moderately reduce anxiety symptoms (Carter et al., 2021). As such, it is reasonable to state that PA is effective in reducing internalising problems.

Previous studies have attempted to bolster PA in children with DCD using in-person and virtual interventions, with varying levels of success (Howie et al., 2016; Noordstar et al., 2017; Sit et al., 2019). However, no published studies have yet attempted to promote PA among children with DCD through a Facebook delivered, parent mediated, intervention. Facebook offers a unique set of benefits for the conduct of PA interventions which are not replicated in traditional settings. Typically conducted via a private intervention group, Facebook interventions can be engaged in by an international cohort of unrestricted size. Furthermore, interventions conducted via Facebook can be provided by far smaller clinician teams, as intervention resources can be simultaneously administered to multiple participants with ease. Facebook also provides opportunities for additional social support and peer guidance, as participants can easily connect with each other in intervention-specific groups.

In the context of Facebook delivered interventions, it is important to note the additional responsibility undertaken by parents. Parents are responsible for not only engaging with intervention-related Facebook content, but also acting upon it to implement the intervention with their child. However, high parental involvement is not necessarily a detriment to PA interventions. Best practice guidelines for interventions promoting PA among children with DCD (Blank et al., 2019) support the active involvement of parents as role models and motivators. Multiple reviews outside of DCD (Brown et al., 2017; Tomayko et al., 2021) corroborate these recommendations, presenting findings that parental involvement benefits the immediate outcomes of PA interventions. Furthermore, a review by Rhodes and Quinlan on over 100 studies found that parent support was the largest and most consistent correlate of PA in children (Rhodes & Quinlan, 2014). Involving parents as fundamental facilitators of an intervention also has implications for sustaining activity gains in the long-term, as parents may continue to implement intervention practices following the program's termination (Brunet et al., 2019). As such, high parental involvement seems beneficial, rather than detrimental, to PA interventions.

Although not previously investigated in the context of DCD, Facebook has been identified as a feasible option for the delivery of parent mediated PA interventions among children with autism (Healy & Marchand, 2020) and attention deficit hyperactivity disorder (ADHD; Ola et al., 2021). In Healy and Marchand (2020), all parents reported being satisfied with their overall experience of the intervention and felt it was a feasible means of supporting their child's PA. Ola et al. (2021) presented similar findings, with the majority of families being observed to regularly use the health behaviour strategies that were provided to them and follow intervention instructions as requested. Retention was high

across both studies. In this way, Facebook appears to be a feasible method of delivery for PA interventions.

The current study sought to investigate the feasibility of a Facebook delivered, parent mediated, PA intervention. Previous studies have identified Facebook to be a feasible method of delivery for PA interventions among other clinical populations (Healy & Marchand, 2020; Ola et al., 2021); as such, it was hypothesised that the current intervention will be a feasible and acceptable method to promote PA among children with DCD. Specifically, we expected that engagement with, adherence to, and perspectives towards the current intervention will be comparable to previous findings from feasibility studies with other clinical populations.

## Methods

### *Sampling*

Families were recruited across Australia and the United Kingdom (UK) through the Australian DCD/Dyspraxia Research Register and social media accounts affiliated with local DCD and ADHD[1] support groups. Inclusion criteria specified that children be aged between 5–11 years of age and had a diagnosis of DCD or dyspraxia. For those with a suspected case of DCD, parents were asked to complete the DCDQ (Wilson et al., 2009) ahead of enrolment in the study. These families were included if their child's DCDQ score indicated the likely presence of DCD. Children with co-occurring developmental disorders were not excluded. All families provided written informed consent. The current study was approved by Victoria University's Human Research Ethics Committee (HRE20–175).

### *Design and Procedure*

The current study followed a $2 \times 3$ randomised controlled design comparing the active treatment with a waitlist control. The intervention ran twice across 2021 and 2022. Families participating in 2021 were randomly assigned to either an intervention or waitlist-control condition via a random number generator. Participants were blinded to their assignment. Due to an operational delay in starting the intervention, the 12-week program was completed in early December 2021. As such, the waitlist group were not immediately enrolled into the intervention but joined the 2022 cohort to commence in February of that year. After running the intervention in 2021, the 12-week waitlist period was deemed less than optimal due to low engagement, likely resulting from infrequent posting. As such, the decision was made to reduce the waitlist period to four weeks in 2022. Thus, families from the 2022 waitlist-control group were administered the intervention after a 4-week waitlist period. As a result, three intervention groups were defined by the amount of time spent in the waitlist-control condition prior to engaging in the experimental condition: no-waitlist, 4-week waitlist, and 12-week waitlist.

Parents were invited to one of two private Facebook groups moderated by a research assistant, which differed based on condition. These Facebook groups were the primary method through which the intervention was delivered, with all intervention content being posted by the moderator. Irrespective of waitlist period (4-week, 12-week, or no-waitlist), the administration and content of the intervention remained the same.

### Intervention

The intervention lasted for 12 weeks. Prior to the first week, general educational material concerning DCD and its relationship to PA was posted to the group. Families were also provided with specific information around how to set PA goals and prepare for barriers that might get in the way of engaging in PA with their child. A specific topic was focused on for each new week that followed, with a relevant video resource being posted every Monday. Topics for each week were as follows: (1) linking mental health and PA, (2) making PA part of a routine, (3) engaging in PA as a family, (4) monitoring screen time, (5) review week, (6) the importance of sleep, (7) the importance of diet, (8) benefits of yoga, (9) exploring the neighbourhood, (10) managing fatigue, (11) dealing with negative self-talk, and (12) maintaining gains. In addition to the weekly video resource, a selection of non-video resources were posted to further promote the messages associated with the weekly topic. Non-video resources included infographics and links to relevant blog posts or articles.[2]

Each week also included posts prompting effective behaviour change techniques of goal setting/reflection and barrier planning/reflection (Michie et al., 2009). Goal setting posts prompted families to develop goals for the upcoming week. Goal reflection posts were typically made towards the end of the week and prompted families to reflect on whether their goals for the week had been met. Barrier planning posts prompted families to anticipate and plan for any barriers to reaching their goals in the upcoming week. Barrier reflection posts were typically posted towards the end of the week and prompted families to consider how barriers from the week had been addressed. Goal setting/reflection and barrier planning/reflection posts also acted as facilitators for group discussion, as posts often prompted parents to share goals or barriers experienced throughout the week.

A series of posts were also made each week reminding parents to (1) complete a weekly questionnaire, (2) synchronise activity trackers and ensure they are being worn by their child, and (3) review their child's physical activity for the week. Polls were also posted on occasion to gauge participant perspectives and experiences regarding elements of the weekly topic. Video resources and questionnaire reminders were pinned[3] to the group's timeline while other posts were not. To incentivise group engagement, gift vouchers valued at $50 AUD were awarded to parents who actively viewed, reacted to, and commented on Facebook content, and promptly completed questionnaires each week. Participants accessed the aforementioned questionnaires via a link that was posted to the Facebook group at the end of each week during the intervention period. Families not completing the questionnaire within 48 hours were prompted via email, with a further follow-up email if no response was recorded within an additional 48 hours. Items completed in the weekly questionnaire are briefly described in the measures section below.

### Waitlist-Control

Parents in the waitlist-control group were provided the same initial educational material as the intervention group (not including information about goal setting

and barrier planning). However, they were not able to access the weekly educational packages (i.e. video, and non-video resources). Instead, the waitlist-control group posts comprised generic information and reminder posts as described above.

## Measures

At baseline, parents completed the Developmental Coordination Questionnaire (DCD-Q; Wilson et al., 2009) and the Children's Physical Activity Questionnaire (C-PAQ; Corder et al., 2009). The C-PAQ was subsequently repeated weekly throughout the study. Both questionnaires are described below. In addition, at baseline and weeks 4, 8 and 12 of the intervention, parents completed a package of questionnaires aimed at measuring parental perspectives towards physical activity, quality of life, behavioural and emotional development, and ADHD symptomatology. The data extracted from this package will be presented in an additional manuscript examining the effectiveness of the current intervention.

## Developmental Coordination Disorder Questionnaire (DCDQ)

The DCDQ was administered to identify the severity of child motor-coordination problems via parent-report. The DCDQ consists of 15 items identifying coordination issues across gross motor skills, fine motor skills, and general coordination. Scores from each subscale can be combined to create a total, with higher scores indicating lower coordination (Wilson et al., 2009). The DCDQ was administered at baseline and has been identified as valid and reliable in this context (Wilson et al., 2009).

## Children's PA Questionnaire (C-PAQ)

The C-PAQ was used to measure the frequency and duration that specific physical activities were engaged in via parent-report. Use of the CPAQ was necessary as child activity trackers did not measure heart rate, and therefore did not differentiate between different types of PA or record activities unrelated to steps (e.g. swimming, cycling). The C-PAQ was administered at baseline and weekly throughout the intervention period and has been identified as both valid and reliable for use in this context (Corder et al., 2009). The current manuscript only reports on rates of parent completion of this questionnaire, rather than outcome scores.

## Activity Trackers

Families were assigned two Garmin Vivofit activity trackers for the duration of their participation in the experiment. An adult-sized watch (Vivofit 4) was assigned to one parent and a child-sized watch (Vivofit Jnr. 3) for their child (henceforth referred to as activity trackers). Steps and active minutes were measured via wearable activity trackers that were allocated to participating families for the duration of the study. In line with previous work (Baerg et al., 2011), data from the activity tracker was deemed to be valid

for a single day if at least 1000 steps had been recorded. If 1000 steps had been recorded on at least 3 days of a given week, data from the PA tracker was viewed to be valid for that week. Requiring a valid week to consist of at least 3 days of valid step data is a common cut-off point among other activity tracker studies (Chan et al., 2022) and yields a reliability of 0.8 (Tudor-Locke et al., 2005).

Data extraction differed for child and adult data. For adult data, a third-party program called Fitabase (2022) was used. With participant consent, Fitabase extracts synchronised data directly from a participant's Garmin account, allowing for group data to be simultaneously exported to statistical packages. Child data is unable to be collected via Fitabase due to privacy restrictions. As such, participants were asked to either (1) add the research team as a 'guardian' in their child's account, enabling a research assistant to view their account directly and extract their steps, or (2) agree to screenshot and send their child's steps each week. All families agreed to add the research team as guardians for the duration of the study, enabling the research assistant to log in regularly and extract step and active minute data directly. After all data was extracted at the completion of the study, the research assistant promptly disconnected from all family accounts.

### *Data Analyses*

The purpose of this paper is to investigate the feasibility and acceptability of using Facebook to deliver a parent mediated PA intervention for children with DCD. As such the analyses focus on descriptive statistics (e.g. mean, standard deviation, and percentages) rather than inferential statistics. Descriptive statistics are provided for objective and self-reported Facebook engagement, activity tracking, goal setting and barrier planning, questionnaire completion, and perspectives towards the intervention. Data is only presented for each group's intervention period as very few posts were made to Facebook during the waitlist period. In cases where both parents of a child were added to the Facebook group, the parent with the higher level of engagement was chosen as a sole representative.

## Results

### *Sample Characteristics*

Thirty-one families took part in the intervention. Twenty families were Australian and 11 were from the UK. Of these families, 19 participated in the intervention immediately with no-waitlist period. Eight families took part in the intervention following a 4-week waitlist period, and four families took part after having completed a 12-week waitlist period the year prior (Figure 1). Descriptive statistics for participating children are presented in Table 1. Although one child's DCD-Q scores did not meet established cut-offs for clinical significance (Wilson et al., 2009), they reported having previously received a formal diagnosis of DCD and were still included in the study.

Legend: *M* = mean, SD = standard deviation, *n* = child participants, DCDQ = developmental coordination disorder questionnaire.

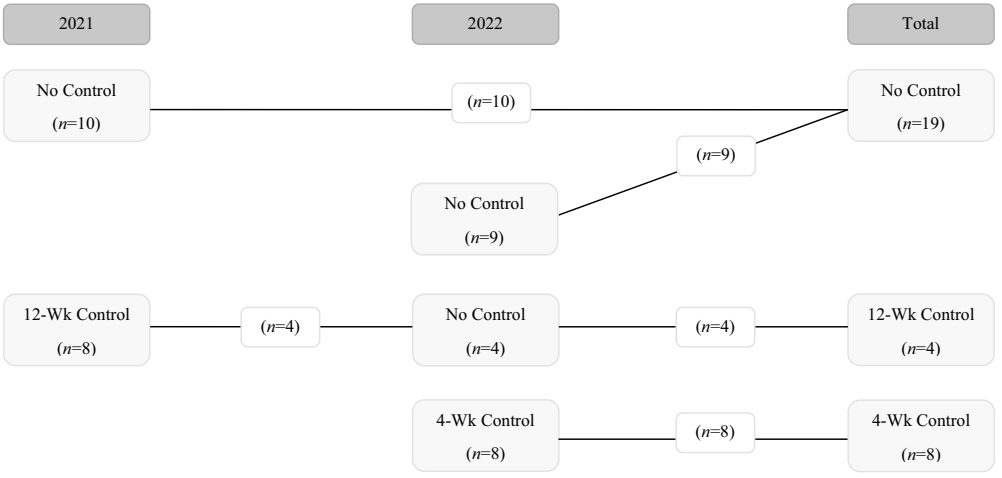


**Figure 1.** Sample flowchart.

**Table 1.** Child demographics and clinical information.

| Variable | No-Waitlist (*n*=19) | 4-Week Waitlist (*n*=8) | 12-Week Waitlist (*n*=4) | Total (*n*=31) |
|---|---|---|---|---|
| Male, *n* (%) | 15 (78.95) | 8 (100) | 2 (50.00) | 25 (80.65) |
| Female, *n* (%) | 4 (21.05) | 0 (0.00) | 2 (50.00) | 6 (19.35) |
| Age, *M* (*SD*) | 8.97 (2.15) | 9.21 (1.35) | 9.40 (1.73) | 9.09 (1.88) |
| DCD diagnosis, *n* (%) | 17 (89.45) | 7 (87.50) | 4 (100) | 28 (90.32) |
| At-risk DCDQ score *n* (%) | 18 (94.74) | 8 (100) | 4 (100) | 30 (96.77) |

Legend: M = mean; SD = standard deviation, *n* = parent representative.

## *Objective Facebook Engagement*

View data was heavily negatively skewed, with 48.38% ($n = 15$) of parents viewing at least 90% of all posts, 12.90% ($n = 5$) viewing 80–89% of posts, and 12.90% ($n = 5$) viewing 70–79% of all posts. Only 25.81% ($n = 8$) viewed fewer than 70% of all posts. Averaged across all posts made in each Facebook group, parents viewed 78.03% (SD = 23.06), reacted (i.e. responded to a post via one of several emoticons) to 12.31% (SD = 15.41), and commented on 8.91% (SD = 9.22). However, engagement varied considerably across groups. Objective engagement statistics are presented as the average percentage of posts viewed, reacted to, or commented on by parents for individual groups in Table 2.

Differences in objective engagement also exist across different post types for both the entire sample and at a group level. View rates are presented in Table 3 for pinned posts (video resources and questionnaire reminders) and a selection of the most relevant non-pinned posts (non-video resources, goal setting/reflection, barrier planning/reflection,

**Table 2.** Objective Facebook engagement across groups.

| Engagement type | No-Waitlist (*n*=19) *M*% (*SD*) | 4-Week Waitlist (*n*=8) *M*% (*SD*) | 12-Week Waitlist (*n*=4) *M*% (*SD*) |
|---|---|---|---|
| Post Views | 72.78 (29.13) | 96.01 (43.09) | 66.99 (29.04) |
| Post Reactions | 12.02 (16.77) | 15.04 (19.15) | 8.17 (15.79) |
| Comments on Posts | 8.76 (25.48) | 9.06 (14.14) | 9.31 (14.63) |

**Table 3.** View rates across post types and conditions.

| Post Type | No-Waitlist (*n*=19), *M*% (*SD*) | 4-Week Waitlist (*n*=8), *M*% (*SD*) | 12-Week Waitlist (*n*=4), *M*% (*SD*) | Total (*n*=31), *M*% (*SD*) |
|---|---|---|---|---|
| Video Resources | 75.08 (33.47) | 88.54 (6.20) | 90.00 (12.76) | 80.48 (27.29) |
| Questionnaire Reminders | 64.78 (28.24) | 95.26 (5.81) | 49.17 (26.02) | 70.63 (28.27) |
| Non-Video Resources | 71.17 (27.56) | 99.34 (1.86) | 72.62 (9.82) | 78.63 (24.91) |
| Goal Setting/Reflection | 83.66 (22.96) | 98.95 (2.95) | 86.84 (13.93) | 88.02 (19.54) |
| Barrier Planning/Reflection | 82.11 (26.80) | 98.75 (3.54) | 97.50 (5.00) | 88.38 (22.38) |
| Weekly Review Reminders | 73.33 (31.32) | 96.15 (5.81) | 47.73 (28.14) | 75.91 (29.92) |
| Activity-Tracker Reminders | 51.75 (25.00) | 95.00 (7.56) | 30.56 (16.67) | 60.18 (30.02) |
| Polls | 84.87 (25.20) | 100 (0.00) | 84.37 (23.66) | 88.71 (21.97) |

weekly review reminders, activity tracker reminders, and polls). It is worth noting that the percentage of parents voting on polls was relatively consistent across groups, with polls being voted on by 67.76% (SD = 28.96) of parents in the no-waitlist group, 57.81% (SD = 29.07) in the 4-week waitlist, 68.75% (SD = 29.75) in the 12-week waitlist, and 65.32% (SD = 28.45) across the total sample.

Legend: *M* = mean, SD = standard deviation, *n* = parent representatives.

When separating the intervention period into thirds, percentage of posts viewed appeared to vary across time and group (Figure 2). While an overall downward trend in views is observed when groups are combined, it is not consistent across separate groups.

## *Self-Reported Facebook Engagement*

Twenty-six parents completed a questionnaire in the final week of the intervention. Despite relatively high view rates for video resources, parents who completed this questionnaire only recalled watching 55.94% of the videos produced across the intervention period. Some videos (28.29%) were reported to have been seen on the parents' Facebook timeline, but not watched. A further 9.00% of videos were not seen at all on the parents'

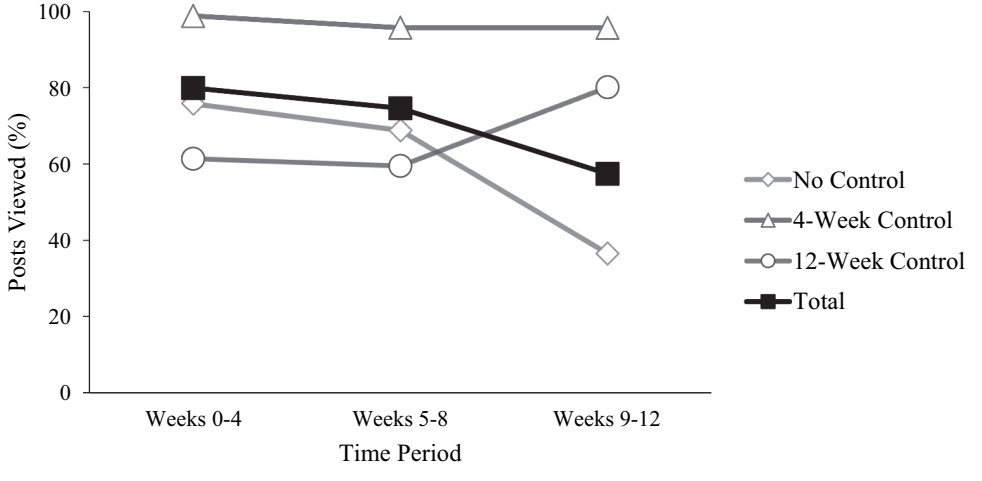


**Figure 2.** Percentage of posts viewed across time.

Facebook timeline. Parents were unsure if they had or had not seen 6.75% of the videos. There appears to have been a downward trend in video views across the intervention, as parents recalled watching 71.15% of videos in weeks 1–4, 51.46% in weeks 5–8, and 45.19% in weeks 9–12.

### *Activity Tracking*

Across all groups, valid PA data was collected for 92.45% of all intervention days and 95.61% of intervention weeks. This implies that activity trackers were worn as instructed for the majority of the intervention. This high level of adherence was consistent across groups, with activity trackers being worn across 91.21%, 95.19%, and 92.86% of intervention days for the no-waitlist, 4-week waitlist, and 12-week waitlist, respectively. While activity trackers appear to have been worn slightly less in the last third of the intervention (Figure 3), the percentage of days and weeks for which valid activity data was collected remained consistently high across the entire intervention.

### *Goal Setting and Barrier Planning*

Most parents (80.77%, $n = 21$) who completed the week-12 questionnaire used the initial resources to set goals for their child's PA at least once, while 19.23% ($n = 5$) did not. Of the parents that did set goals for their child's PA, goals were set for 54.36% of intervention weeks. Across all groups, goals were set in 43.91% of weeks. Goals were most commonly set in the first four weeks of the intervention, with goal setting occurring in 66.35%, 37.50%, and 27.88% of weeks 1–4, 5–8, and 9–12, respectively. In their open-text responses, parents who did not set goals for their child's PA commonly reported feeling too busy or overwhelmed to set goals.

> Three children and busy life means I have let this slide a bit

> . . . have done lots of programmes with OT/Chiro in terms of goals/exercises and writing down and tracking anymore exercise was overwhelming

Fewer parents planned for barriers, with only 61.54% ($n = 16$) planning for barriers at least once during the intervention. Parents who planned for barriers reported doing so in 52.50% of the intervention weeks. Across all groups, barriers were planned for in 20.19% of intervention weeks. The percentage of weeks in which barriers were planned for slightly varied across time, with planning occurring in 24.04%, 17.31%, and 19.23% of weeks 1–4, 5–8, and 9–12, respectively.

### *Questionnaire Completion*

Relatively high completion rates were observed for the weekly questionnaires, with 84.37% of all questionnaires being completed across groups. The non-intervention group completed 82.99% of the questionnaires, and participants from the 4-week and 12-week waitlist groups completed 79.80% and 100%, respectively.

### *Perceived Feasibility, Acceptability and Effectiveness of the Intervention*

The 26 parents who completed the week 12 questionnaire also provided their perspectives towards the intervention's feasibility, acceptability, and effectiveness. Most parents (80.77%, $n = 21$) somewhat or strongly agreed that the intervention was useful for themselves and their child; 96.15% ($n = 25$) somewhat or strongly agreed that the intervention would be beneficial to other families; and 88.46% ($n = 23$) somewhat or strongly agreed that they would recommend the intervention to other parents of children with DCD. Furthermore, many parents somewhat (84.62%, $n = 22$) or strongly (96.15%, $n = 25$) agreed that they enjoyed the intervention and were excited to participate in it. Most parents (88.46%, $n = 23$) intended to maintain their PA levels after the conclusion of the intervention.

## Discussion

The objective of the current study was to investigate the feasibility and acceptability of a Facebook delivered parent mediated PA intervention for children experiencing DCD. Feasibility and acceptability will be discussed with reference to (1) objective and self-reported Facebook engagement, (2) adherence to different components of the intervention, and (3) parent perspectives.

### *Facebook Engagement*

Objective Facebook engagement was high, with an average of 78.03% of posts being viewed by parents across all intervention groups. View data were heavily positively skewed, with almost half of the entire sample (48.38%) viewing at least 90% of all posts, further indicating a high level of engagement across all groups. Although conducted with parents of children with autism, Healy and Marchand (2020) reported comparable results, with Facebook posts being viewed, on average, by 76% of parents. Similarly high view rates have been observed in Facebook interventions promoting PA among cancer survivors (Mendoza et al., 2017) and healthy adolescents (Pumper et al., 2015). A slight downward trend in views emerged across time when view data for all groups was combined in the current study (Figures 2 and 3), potentially resulting from fatigue throughout the intervention. However, this trend appears only minor and seems heavily influenced by the no-waitlist group. Taken together, objective view data appears to have been in line with the findings of previous studies.

Interestingly, the percentage of posts viewed according to objective data does not align with parents' self-reports. Consider, for example, video resources. Although objective data indicates that on average 80.48% of video resources were viewed by parents across all groups, parents only recalled watching 55.94% of the videos across the intervention period in their final questionnaire. This discrepancy may have resulted from Facebook's tendency to mark a post as 'viewed' once it has appeared on a user's timeline (i.e. passive engagement), rather than after it has been actively engaged with for an appropriate amount of time (e.g. watched in its entirety) (Facebook, 2022). As such, objective view data should be interpreted with caution, as it does not necessarily reflect active engagement with posted material. Unfortunately, it is unfeasible to compare

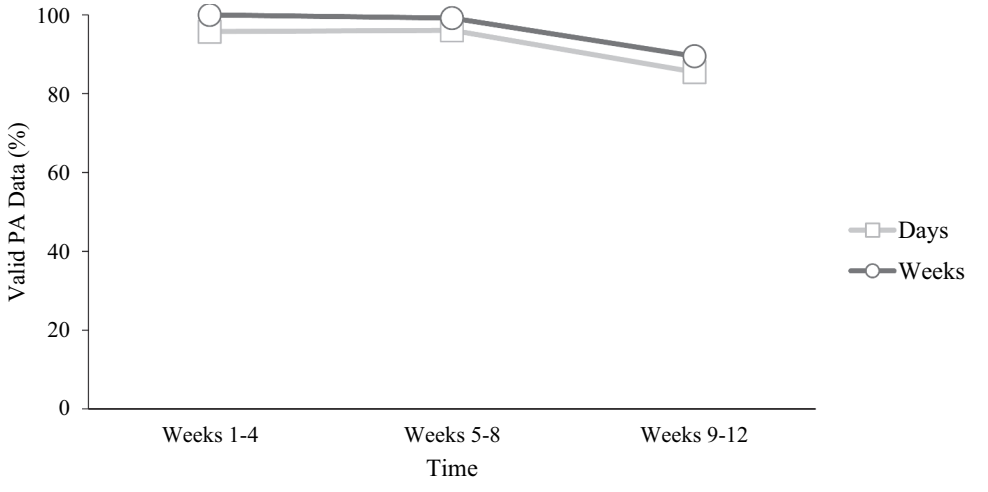


**Figure 3.** Days and weeks of valid physical activity data from child physical activity trackers.

objective and self-reported view data for all post types, as participants cannot be expected to recall engaging with each specific post across the entirety of the intervention. As such, other metrics are necessary to accurately depict Facebook engagement.

The percentage of posts reacted to and commented on provide a potential metric of active engagement, though not without limitation. Reactions and comments reflect when users respond to a post, indicating more active engagement with the post's content. On average, 12.31% of posts were reacted to and 8.91% of posts were commented on by parents across all groups. This data could be interpreted to suggest active engagement was very low. However, it is important to note that while people who like or comment are likely to have read or watched a post's content, they do not exclusively represent all actively engaged individuals. Individuals in online group settings who participate without posting or reacting are known as 'passive readers', or more commonly, 'lurkers' (Setoyama et al., 2011). Lurkers are thought to account for approximately 90% of any online community's user base, with fewer users replying to or writing posts (Carron-Arthur et al., 2014). Setoyama and colleagues found benefits of group inclusion to be present among lurkers as they still engaged with the group's content. Thus, reaction and comment data may underrepresent the percentage of posts that were actively engaged with.

Although low in comparison to view data, the percentage of posts reacted to and commented on is consistent with results from previous Facebook delivered PA interventions. Indeed, in a running program conducted with Australian adults, Edney et al. (2018) recorded an average of 3.5 likes and 1.5 comments per post from 41 participants, indicating posts were only liked by 8.53% of the sample, and commented on by 3.66%. Similarly, Mendoza et al. (2017) identified that 50% of participants (childhood cancer survivors) did not like a single post, and 34.6% of participants did not leave a single comment across the entirety of the intervention. Despite being conducted with samples outside of the current study, these results indicate a trend of fewer likes and comments being observed than views. As such, although only few posts received reactions and comments in the current study, this may be the norm in Facebook interventions.

Currently there exist no methods to accurately differentiate active from passive Facebook engagement. As such, the best method to determine acceptable Facebook engagement is through comparison with previously conducted PA interventions. Given rates of views, reactions, and comments in the current study were comparable to results from previous PA interventions across various populations (Edney et al., 2018; Healy & Marchand, 2020; Mendoza et al., 2017; Pumper et al., 2015), Facebook engagement could be considered as acceptable across all groups.

Due to sample limitations, between-groups differences in Facebook engagement cannot be quantified. There are apparent numerical differences in objective view rates across all post types (no-control 72.78%, 4-week control 96.01%, 12-week control 66.99%; Table 2) which are maintained after splitting the intervention timeline into thirds (Figure 2). However, without appropriate statistical analyses it is difficult to assign meaning to these differences given the heterogeneity between group sample sizes. Differences in view rates across post-types (Table 3), however, can be interpreted across all groups. Interestingly, posts involving polls, barrier planning/reflection, and goal setting/reflection recorded numerically higher view rates than pinned posts such as video resources and questionnaire reminders (Table 3). This may reflect a difference in opportunities for engagement with different post types. Available information surrounding Facebook's algorithm suggests that posts associated with more active engagement (e.g. comments and votes) are more likely to be promoted to a user's individual timeline (Lada et al., 2021), and therefore more likely to be seen. This provides a potential explanation for the difference in views between post types, as the most highly viewed posts encouraged the sharing of experiences and opinions, while less viewed posts did not. In other words, it is possible that posts providing more opportunities for engagement were more likely to be seen by parents. With this in mind, future Facebook interventions should be oriented to maximise user engagement.

### *Intervention Adherence*

Adherence to the intervention was measured through (1) the percentage of days and weeks that activity trackers were worn as instructed, (2) the percentage of parents that set goals and planned for barriers, and (3) the percentage of weekly questionnaires that were completed.

Activity trackers were distributed to parents and their children prior to commencing the intervention. Parents were responsible for ensuring their children wore their assigned activity tracker each day, with reminders being posted frequently in each Facebook group. Across all groups, valid child PA data was collected for 92.45% of all intervention days (Baerg et al., 2011) and 95.61% of all intervention weeks (Chan et al., 2022; Tudor-Locke et al., 2005), with figures remaining relatively consistent across the majority of the intervention (Figure 3). Ola et al. (2021) presented similar results following their Facebook delivered parent mediated PA intervention for children with ADHD. On average, children were observed to wear activity trackers six days per week across the intervention period, however, it is unclear how a valid day of data was determined (Ola et al., 2021). Given most days and weeks in the current study were associated with valid PA data, and in alignment with previous findings, it is reasonable to state that activity trackers

were worn as instructed for the majority of the intervention period. As such, activity trackers can be considered a feasible means of measuring physical activity among children.

Goal setting and barrier planning resources were distributed to parents prior to the intervention period, with encouragement to engage in both activities being given throughout each week that followed. Most parents (80.77%) set goals for their child's PA at least once throughout the intervention. Of these parents, goals were set for 54.36% of all intervention weeks. While goal setting was observed to decline throughout the intervention, this does not necessarily reflect stagnation in goal-achieving behaviours. Rather, it is possible that goals set early in the intervention were relevant to later weeks and not in need of updating. Few parents planned for barriers, with only 61.54% planning for barriers at least once during the intervention. Parents who planned for barriers reported doing so for 52.50% of all intervention weeks. Given weekly goal setting and barrier planning were encouraged but not mandatory components of the intervention, the fact that parents did not engage with both activities every week should not be viewed as a detriment to the feasibility of the intervention. It is possible that rates of goal setting and barrier planning would improve if they were framed as mandatory components of the intervention, however this would alter the nature of the intervention. The intervention was designed to encourage families to be active in a way that suited their lifestyle; as such, mandating goal setting and barrier planning would not have fit with the values of the intervention.

Parents were required to complete a questionnaire at the end of each intervention week where they self-reported PA as described in the methods section above. Questionnaire completion rates were high, with parents across all intervention groups completing 82.99% of all questionnaires on average. Slightly higher rates of questionnaire completion were observed by parents in Ola et al. (2021), however, only three sets of questionnaires were administered throughout the course of their study. Parents in the current study completed relatively time-consuming questionnaires each week for 12 weeks (in addition to a baseline questionnaire), with weeks 4, 8 and 12 involving longer questionnaire sets that included measures of quality of life and mental health etc; as such, some level of survey fatigue should be expected. Given the number and length of questionnaires that parents were expected to complete in the current study, an average of completion rate of 82.99% should be considered as acceptable.

### *Parent Perspectives*

Parents self-reported their perspectives towards the intervention via a questionnaire in the final week of the study. Perspectives towards the intervention were positive, with most parents agreeing that the intervention was useful for themselves, their child, and other families as well. Similarly positive perspectices were reported by parents in Healy and Marchand's (2020) Facebook delivered, parent mediated, PA intervention for children with autism. Indeed, all parents in Healy and Marchand's study reported being satisfied or very satisfied with their overall experience of the intervention. Although conducted with different populations, parents appear to be generally accepting of engaging with PA interventions via Facebook.

### *Limitations*

As discussed, there are currently no accurate methods of discerning active from passive Facebook engagement. As such, results from the current study have been compared to findings from previous PA interventions to provide a benchmark for typical Facebook engagement. Future studies of this type should consider asking participants which posts they engaged with in a weekly questionnaire to discern active from passive engagement. Furthermore, heterogeneous sample sizes prevented between-group analyses in Facebook engagement or any other collected data. Sample inequality resulted partially from changing the length of the waitlist-control condition between 2021 and 2022. This change was made following the realisation that an extended waitlist-control period was unnecessary. Future studies should aim to maintain equal sample sizes, thereby enabling the investigation of between-groups differences in this context.

## Conclusion

The current study investigated the feasibility and acceptability of a Facebook delivered parent mediated PA intervention for children experiencing DCD. Engagement with intervention content via Facebook appeared to be acceptable in reference to previous studies. Adherence to different components of the intervention was high, with activity trackers being worn as instructed and weekly questionnaires being completed for the majority of the intervention. Perceived usefulness of the intervention was overwhelmingly positive. Taken together, engaging parents as intervention facilitators through Facebook appears to be a feasible method of promoting PA among children experiencing DCD.

## Notes

1. Advertised through ADHD as well as DCD groups due to high comorbidity between the two disorders.
2. See Appendix for post examples.
3. Pinning a post in a Facebook group will move it to the top of the group's timeline, making the post more visible.

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## Guarantor

Jacqueline Williams

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## Ethical Approval

The current study was approved by Victoria University's Human Research Ethics Committee (HRE20–175).

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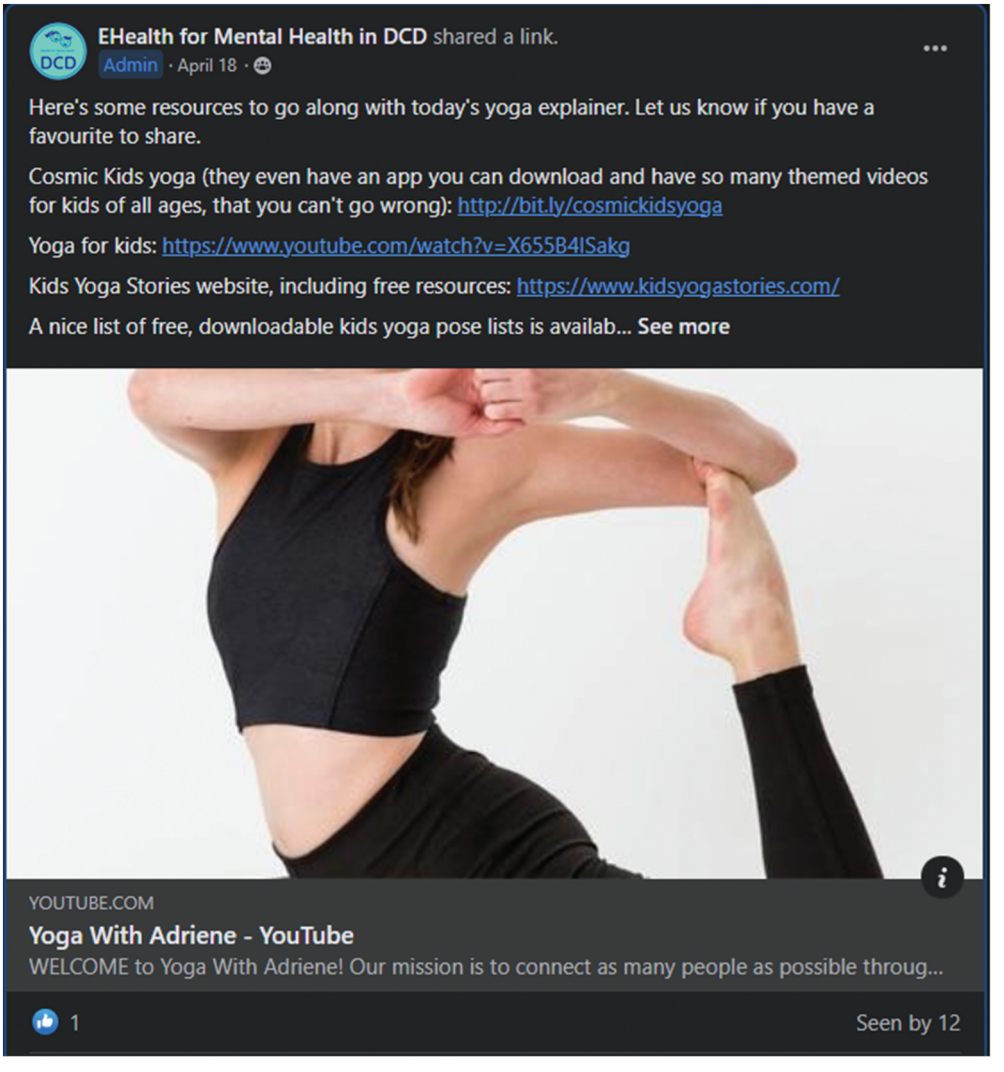
## Appendix

*Non-Video Resource.s*



*Goal Setting/Reflection*.

*Barrier Planning/Reflection.*