

Working with Physical Therapists to Develop and Evaluate an Evidence-Based Online Module
for Developmental Coordination Disorder (DCD):
Bridging the Knowledge-to-Practice Gap

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Abstract

Aims: Developmental Coordination Disorder (DCD) is a chronic condition with potential negative health consequences. Clinicians working with children with DCD need access to tailored, synthesized, evidence-based DCD information; however a knowledge-to-practice gap exists. The aim of this study was to develop and evaluate an evidence-based online DCD module tailored to physical therapists' (PTs) identified needs.

Methods: Guided by the Knowledge to Action framework, we interviewed PTs working with children with DCD (n=9) to identify their information needs. Their recommendations, along with synthesized DCD research evidence, informed module development. PTs (n=50) responded to scaled items and open-ended questions to evaluate module usefulness.

Results: The module incorporated important PT DCD content areas including: 1) Identification; 2) Planning Interventions and Goals; 3) Evidence-Based Practice; 4) Management; and, 5) Resources. Case scenarios, clinical applications, interactive media, links to resources, and interactive learning opportunities were also embedded. PTs perceived the module to be comprehensive and useful and provided feedback to improve module navigation.

Conclusions: Involving end-users throughout the development and evaluation of an online PT DCD module contributed to its relevance, applicability, and utility. The ongoing clinical use of this module may have the potential to improve the quality of PT DCD services.

Keywords: DCD, therapy, evidence-based practice, knowledge translation, online module, web-based resource

Introduction

DCD is a motor disorder that significantly affects a child's ability to learn and perform everyday self-care and academic tasks (American Psychiatric Association (APA), 2013). DCD is common, with consistent prevalence estimates of 5-6% of school-aged children impacted (APA, 2013). There is compelling research evidence that children's motor problems persist into adolescence and adulthood (Cantell and Kooistra, 2002; Cantell et al., 1994; Losse et al., 1991; Rasmussen and Gillberg, 2000). Studies have also shown that these motor difficulties are strongly associated with the subsequent development of physical (Rivlis et al., 2011; Cairney et al., 2010), social, and emotional health problems (Campbell et al., 2012; Piek et al., 2010; Sigurdsson et al., 2002; Skinner and Piek, 2001).

Although the risk of developing secondary health consequences is substantial, many of these long-term sequelae can be prevented. PTs have a critical role to play not only in identifying and helping children with DCD learn motor skills, but also in encouraging physical activity participation, and preventing physical health problems. However, an evidence-to-practice gap exists between the current DCD research evidence and PT practice. PT management of children with DCD often focuses on improving motor task performance and remediating underlying motor impairment (Niemeijer et al., 2007; Pless and Carlsson, 2000; Watenberg et al., 2007). These approaches focus exclusively on the child, may not meet the needs of families and educators caring for children with DCD (Fairbairn and Davidson, 1993; Sayers, 2008), and do not address the transfer and generalization of learned motor skills to real life settings (Banks et al., 2008; Goodgold-Edwards and Cermak, 1990; Hillier, 2007; Missiuna and Mandich, 2002; Polatajko and Cantin, 2006; Rivard et al., 2011). In addition, current recommendations suggest that focusing only on remediation is not sufficient for managing this condition over the long-

term, stressing the importance of engaging children, their families and communities (Forsyth et al., 2008; Sugden et al., 2006). A paradigm shift in clinical practice is needed - one that focuses on motor learning principles, and that helps families to problem-solve, to try out practical strategies to compensate for children's motor difficulties, and to encourage participation, thus preventing secondary issues from developing. It is critical that PTs move away from impairment-based interventions and that they move towards a chronic disease management approach to ensure effective and appropriate rehabilitation services, and to prevent and manage the long-term consequences of DCD.

One way to address the PT DCD knowledge-to-practice gap is through the use of an accessible online evidence-based module that is tailored to PT clinical practice. As the DCD research literature has grown substantially over the last ten years, there is a need for evidence to be synthesized and contextualized to assist PTs in implementing this knowledge in everyday practice. A knowledge tool about DCD for PTs should consider barriers to knowledge uptake such as limited time and lack of access (Grimmer-Somers et al., 2007; Schreiber et al., 2008). An online module would allow busy clinicians to work through material at their own pace, in a setting convenient to them. Online modules have recently been used successfully to change knowledge, beliefs, and clinical practice behaviours among occupational therapists in a school setting (Campbell et al., 2012; Missiuna et al., 2012). The use of an online educational module would also allow PTs the ability to access a variety of resources within the module as needed to support new learning, as well as more in-depth learning, both of which are noted to be necessary for the implementation of new knowledge (Armstrong et al., 2007).

The aim of this study was to develop and evaluate the utility of an online evidence-based PT DCD module, tailored to identified PT needs and preferences.

Methods

The Hamilton Integrated Research Ethics Board (HIREB) for Hamilton Health Sciences and McMaster University approved this research (Project #09-382). All PTs participating in this study provided their consent to participate.

Framework and Process

The Knowledge to Action (KTA) Process Framework (Graham et al., 2006) (Figure 1) guided all phases of the project. The first step in the process was to identify content and format needs and preferences to inform module development. This addressed the KTA aspects of ‘knowledge creation’ (development of module content to address relevant PT practice areas including motor learning, and promoting physical activity participation) and ‘knowledge contextualization’ (tailoring of the module for use by pediatric PTs). A convenience sample of PTs (n=9) known to be working with children with DCD in a variety of settings and service delivery models were recruited to participate in informal, semi-structured interviews. Clinicians were asked to provide general demographic information (e.g. number of years working as a PT, level of DCD knowledge (see Table 1 for participant characteristics)). Interviews lasted approximately one hour. Written notes taken during the interviews were collated and the feedback summarized (Tables 2, 3 and Figure 2).

Table 1: Demographics of Physical Therapists (PTs) Interviewed (n=9)

Demographic Characteristic	Mean (Range) (years)
Number of years working as a PT	18.1 (4-31)
Number of years of pediatric experience	11.4 (2-23)
Number of years working with children with DCD	6.7 (2-15)
Setting where you work with children with DCD	4 school health 2 community 1 private practice 1 children's rehabilitation centre 1 leadership role in pediatric organization
Self-reported knowledge of DCD (basic, intermediate, advanced)	2 Basic 5 Intermediate 2 Advanced

PT = physical therapist

DCD = Developmental Coordination Disorder

Table 2: Summary of Physical Therapist (PT) Content Recommendations (n=9)

General Information	<ul style="list-style-type: none"> • Definition; diagnostic criteria • Prevalence; history/"science" of DCD
PT Role	<ul style="list-style-type: none"> • Facilitating conversation with parents; communicating DCD diagnosis to physicians, supporting physicians • Identification/Assessment/Intervention/Parent Education
Differential Diagnosis	<ul style="list-style-type: none"> • "Red flags", early indicators (preschoolers, toddlers) • Recognizing/understanding co-morbidities • Soft neurological signs; core strength/joint hypermobility/low tone/sensory issues - relationship to DCD
Measurement Tools	<ul style="list-style-type: none"> • History taking; identification screening tools – formal & informal, parent checklist • Best practice regarding assessment tools; tools to assess motor planning; outcome measures • Norms for attainment of learned skills (i.e. bike riding)
Task Adaptation	<ul style="list-style-type: none"> • "Breaking down" leisure activities – skating, bike riding, swimming • Progressing activities
Management	<ul style="list-style-type: none"> • Cognitive intervention use with young children • Intervention frequency • Functional goal setting • Helping children cope with stress of poor motor skill performance • Making an impact with limited resources; innovative waitlist management • Solution-focused/strengths-based/skills-based/context-focused approaches • Community capacity building
Other PT Skills	<ul style="list-style-type: none"> • Explaining DCD to children; handling difficult conversations with parents • Translating knowledge; effecting behavior change • Developing cultural competence; knowledge of different learning styles • Empowering parents; helping them to develop advocacy skills • Consultation/coaching educators

PT = Physical therapist

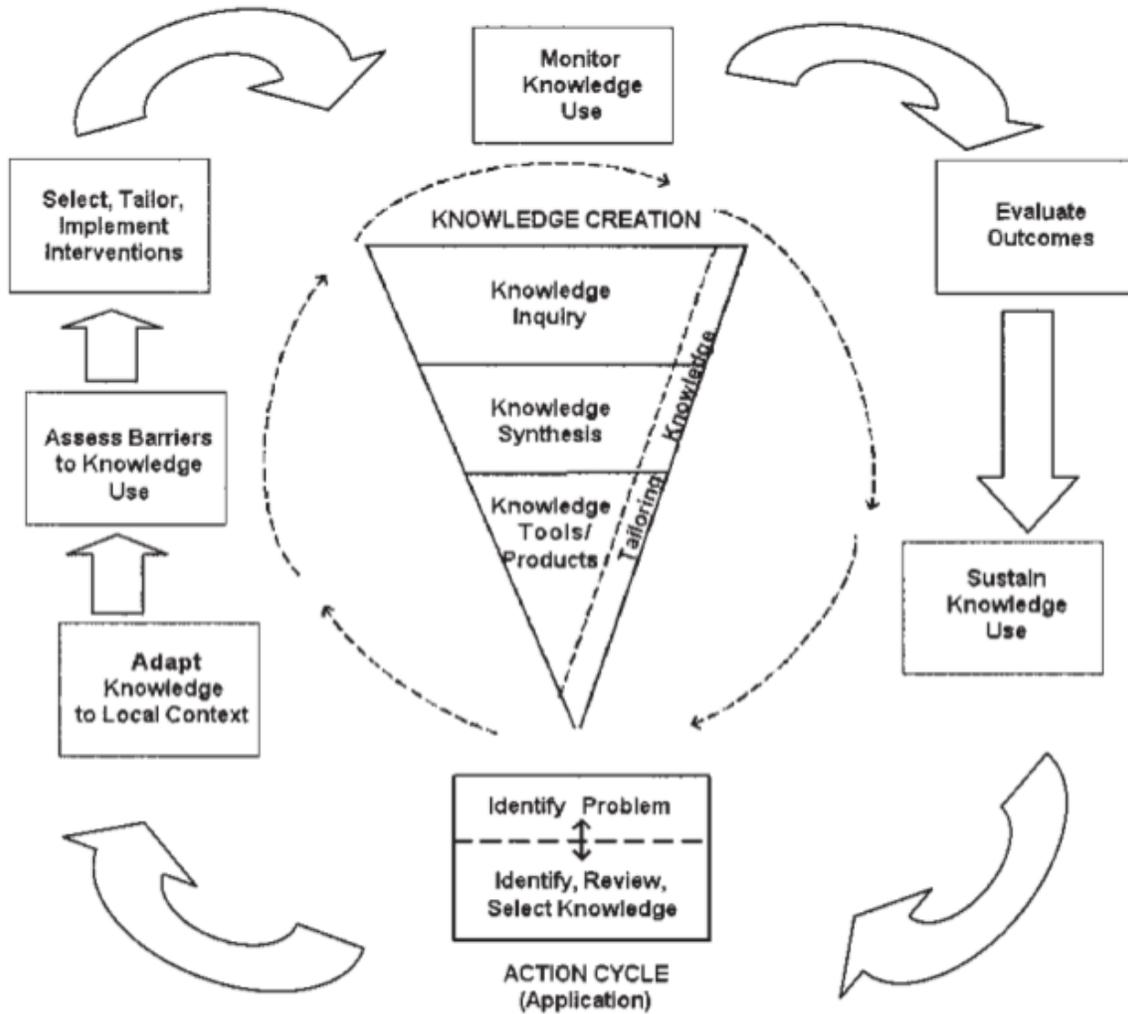
DCD = Developmental Coordination Disorder

Table 3: Summary of Physical Therapist (PT) Format and Resource Recommendations

Formats	Resources
<ul style="list-style-type: none"> • Evaluation component to test learning with answers provided • Interactive (video clips of all aspects of PT role) • Quick and easy • Concrete, straight forward • Short checklists & tip sheets • Incorporate a ‘clinical bottom line’ • Case studies/case scenarios 	<ul style="list-style-type: none"> • List of journal articles to refer to for more information • Reference/link to <i>Physical Therapy for Children</i> book chapter, <i>European Academy for Childhood Disability</i> DCD Guidelines; <i>CanChild</i> Centre for Childhood Disability handouts • Link to blogs/threads focused on DCD (therapists’ insights, experiences, successes); online slideshows • Links to teen websites that emphasize finding your niche, building your strengths • Link to information on cognitive intervention • Specific activities, concrete examples of successful strategies • Progression of activities, fun games • Current resources on skill development – ball skills, skipping, adapted physical education

(n=9)

Figure 1: Knowledge to Action (KTA) Process Framework



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Figure 2: Key Messages from Physical Therapist (PT) Interviews (n=9)

- Coordination may not improve, but “there are things we can do”. We can help children and families “figure out how to make life work”.
- It’s not enough just to teach one skill, it should be about “learning to learn”.
- It’s never just about the motor skill. In basketball, “you need to know how to shoot, but you need to be able to run up and down the court and keep up”. These areas are often as much of a concern as the skill itself.
- “Focus on function – get away from teaching how to jump”!
- Coping mechanisms of children may differ. We can “overlook things if the child is confident”, we can “under-manage”.
- Don’t give up if changes are not seen. The child may not be ready - be patient!
- Capacity building in the community is critical. PTs can mentor others and “find key people who ‘get it’ who you can confidently recommend, and programs with the right kind of approach”.

The next step in the process aligned with the KTA phase ‘Selection, tailoring, and implementation of the knowledge translation intervention’ with development of the module content and format. In addition to the KTA framework, principles of knowledge translation (KT), instructional design, and e-learning (e.g., using multimodal strategies and user-friendly content and format) were utilized. Using the specific content topic areas identified by PTs, as well as an extensive synthesis of the current DCD research evidence (Rivard et al., 2011), two of the investigators (LR and CC) met regularly to condense and tailor the content for an online format. This included an iterative process of ‘mapping out’ and delineating the structure of the web content (headings and sub-headings (the primary and secondary ‘tabs’), links to resources), creating key messages, and discussing the format of webpages, including the flow of pages within the website as well as to downloadable resources and external web links. To address different learning styles, promote interactivity, and facilitate clinical implementation, case scenarios and additional interactive media (video clips for each webpage section) were developed. Effort was taken to ensure a non-linear pathway throughout the module to accommodate all levels of DCD knowledge and to allow learners to access material as they needed it during clinical implementation. We partnered early on with an expert in web design and had meetings with this expert at key points in the development process to ensure we were selecting and developing the content in the most effective way. The other members of the research team (NP and CM) who have expertise in developing and evaluating similar online modules regularly reviewed the content and design and provided additional input.

The completed module contains five major headings: 1) Identification; 2) Planning Interventions and Goals; 3) Evidence-Based Practice; 4) Management; and, 5) Resources (see

Figure 3). These five main headings are further categorized into sub-headings, with five distinct components:

- 1) key messages, general information, definitions, explanations, and examples:
- 2) a case scenario: “What About Max?”, that incorporates evidence-based clinical application recommendations;
- 3) links to additional evidence-based resources (e.g., downloadable one-page flyers, web pages, or documents external to the module which might be of relevance);
- 4) videos demonstrating aspects of clinical management (e.g., use of measurement tools, strategies, and interventions); and
- 5) an interactive learning component with ‘Questions for Reflection’ to challenge the user’s understanding of the information presented and to provide feedback.

Figure 3 illustrates the five main headings, the sub-headings from the ‘Evidence-Based Practice’ section (top of the figure) and the five components found in the sub-heading “Are Some Approaches Better?”.

[Insert Figure 3 about here]

Finally, the last stage of the research was guided by the KTA phase ‘monitoring use’, with evaluation of the utility of the module. PTs participating in the interviews in the first stage of the project, along with practicing PTs from across Canada who were working with pediatric clients, were invited to evaluate the module. PTs were recruited: 1) from children’s rehabilitation centres in Ontario, 2) through the pediatric branch of the Canadian Physiotherapy Association, and 3) from individual clinicians contacting the *CanChild* Centre for Childhood Disability Research with queries related to DCD. Following their electronic consent to participate, PTs were provided access to the online module on a private site hosted by *CanChild*. Additional

research evaluating module use and impact on PT knowledge and skills is reported elsewhere (CC et al., submitted).

Data Collection

PTs evaluating the module provided demographic information and completed pre- and post-questionnaires, before and after viewing the module online. PTs were asked about the ways in which they viewed the module and the usefulness of the content. Scaled items (7-point Likert scale) and open-ended questions were included in the questionnaires. Open-ended questions provided an opportunity for participants to further elaborate on the scaled items (e.g. “Please identify the strengths of the module”, “Please identify the principal areas of improvement for the module”). Preferably, participants were asked to review the entire module at one sitting; however, if needed, they were permitted to view the module on more than one occasion. As the module could also be viewed (and was intended to be viewed) in a non-linear way, an electronic ‘cookie’ system tracked how PTs worked through the module. Once PTs had viewed the five main sections of the module (regardless of the order in which they were viewed), they were directed to complete the post-questionnaire.

Analysis

SPSS Statistics software (PASW 18.0) was used to describe participants’ demographic information and item ratings. Principles of thematic content analysis (Braun and Clarke, 2006) guided analysis of the open-ended questions. Specifically, for each question, one of the investigators (CC) reviewed the data, assigning codes to each statement. Codes were then

collated and organized to identify themes relating to module content and format. All codes and statements were reviewed again to ensure the themes captured the data.

Results

Participants

Fifty (50) PTs participated in the evaluation analysis. PTs worked in different clinical contexts, varied in the number of years of clinical experience (mean:18 years; SD:11 years) and number of years working with children (mean: 13 years; SD: 9 years) (Table 4) (for a more detailed description of the participants see CC et al., submitted).

Table 4: Demographics of Physical Therapists Evaluating the Online Module (n=50)

Demographic Characteristic	n (%)
Gender	
Male	5 (10%)
Female	45 (90%)
Province	
Alberta	14 (28%)
British Columbia	18 (36%)
Newfoundland and Labrador	2 (4%)
Ontario	14 (28%)
Language spoken at work	
English	45 (90%)
English and French	5 (10%)
Work Setting	
Children's Treatment Centre	17 (34%)
School setting	11 (22%)
Hospital	7 (14%)
Private Practice	4 (8%)
Other (e.g., community)	11 (22%)

Module Utilization

Forty-four percent (44%) of participants reviewed the module in one session. The majority of PTs (52%) reported having spent 1-2 hours reviewing the module before completing the post-questionnaire. When they completed the post-questionnaire, PTs had worked through all of the sections, and had read/watched most of the information in the different sections, but hadn't read/viewed it all.

Module Content

PTs perceived the module content as being very useful, as illustrated by high mean score ratings reported for each of the module's five main headings (Table 5). Three sub-themes relating to module content were identified in the qualitative analysis of the open-ended

questions: usefulness, comprehensiveness, and new content ideas. PTs' comments highlight their perception that the information embedded in the module was of high quality and that its continuous access in the future would support them by providing them with a framework to plan services, resolve problems, and offer good quality of services (e.g., by setting relevant goals and focusing on function):

“I am very excited about this module. With this module I learned a lot about why I am using certain approaches and it gave me a lot to think about. In the past I have felt that I want to help these children more but did not really know where to go after providing initial strategies and education. Now I feel like I have the tools to really make a difference in my client's lives.”

“Excellent in all areas. [I] appreciate the thoroughness, the ability to read about DCD and watch video examples of assessments, management strategies and child performance. I love that there are links to access all current info that is out there and all of the handouts for various populations. I really can't say enough about how helpful this module will be in my future practice.”

“Well done! I will be visiting [the website] again soon as I feel like I need to read and review again. I think I know and understand most of the work being done for children with DCD but this body of work is very comprehensive. It helps a therapist keep up with the recent developments.”

“As a physiotherapist I often prefer to provide strategies to improve overall trunk tone,

for example. I now appreciate that more task-oriented intervention may be preferred.”

Table 5: Perceived usefulness of module content (n=50)

Module Section	Mean (SD)*
Identification	6.8 (0.4)
Planning Interventions and Goals	6.7 (0.6)
Evidence-Based Practice	6.7 (0.6)
Management	6.6 (0.8)
Resources	6.6 (1.1)

*Using a Likert rating scale (maximum rating 7)

Module Format

For each of the five main module headings, PTs were satisfied with how the information was presented (Table 6). Comments regarding module format were grouped into two sub-themes: the components and resources, and the navigation. With regards to the components and resources, PTs had very positive comments about the case scenarios, the links to additional resources, the videos and the questions for reflection. These different components were perceived as fostering learning for different learner styles and to illustrate the “how-to”:

“All components were excellent and well laid-out and very useful.”

“I liked the “What about Max?” as it was helpful to have a specific case to think about... and questions for reflection were good to help me to try to summarize my thoughts from the page...”

“[It was] very comprehensive, using different media forms to engage different types of learners.”

Comments regarding the navigation concerned the layout, and the overall flow. The layout was perceived to be good, and organized in logical sections with the information written in a clear, easy-to-read language. PTs also felt the layout was attractive, with clear explanations.

“The webpage info was well-organized and well done - very easy to read and access links. [The] links to additional resources were good.”

“The information is parent-, teacher-, and therapist-friendly. It addresses all areas of need for these children.”

Table 6: Perceived usefulness of module format (n=50)

Webpage Components	Mean (SD)*
What about Max (case scenarios)	5.8 (1.6)
Webpage information	6.6 (0.6)
Links to additional resources	6.5 (0.8)
Videos	6.3 (1.3)
Questions for reflection	5.7 (1.4)

*Using a Likert rating scale (maximum rating 7)

With regards to the flow and navigation, comments were mixed: some PTs really liked the non-linear structure with multiple links, while others would have preferred a more linear, hierarchical structure. Some commented that it was challenging to figure out how to navigate through the module initially, but that they appreciated the structure once they were able to figure it out. Many

offered recommendations to ease the navigation (e.g., more ‘pop-ups’ than links exiting the module, and including a user-guide and a navigation bar).

“The information was excellent, but for my own style of learning I would have appreciated a more sort of “linear” progression through the material as opposed to the inter-connecting web, which seemed to be style of the layout.”

“I did find it somewhat disruptive to the flow to be going between the info on the page and then linking to the highlighted info. Felt that perhaps I may have missed some info this way.”

“Suggestions for ease of use - perhaps a brief “user guide” at the beginning that explains how one might work through the information (I found it took me a while to notice all of the various tabs and tools).”

“Once I understood the set up of the module. I found it easy to move around from area to area. I appreciated the ability to move to the area that I was most interested in....I spent more time in that area.”

All of the participants indicated they would recommend the module to their PT colleagues. They also recognized the value of the module for other health care professionals with nearly all PTs reporting that they would recommend the module to occupational therapists, and many suggesting they would recommend it to rehabilitation managers, administrators and decision-makers, as well as parents and teachers.

Discussion

In order to provide effective services and prevent the negative health consequences that are so common to children with DCD, PTs need to embed the most current research evidence into their clinical management. Recent evidence supports more contemporary thinking around promoting activity and participation, as well as the use of motor learning strategies for skill transfer and generalization (Blank et al., 2012). While many PTs are moving towards these goals, such practices are not yet universal (Levac et al., 2009). This may be in part because, with few exceptions (Rivard et al. 2011), the DCD research literature is not tailored specifically to interventions that might be used in PT practice. In addition, current DCD knowledge may not be readily translated into practice for reasons cited in the knowledge translation literature such as lack of time and/or access (Grimmer-Somers et al., 2007; Schreiber et al., 2008). The online PT DCD module developed in this study attempted to meet PTs' needs and to overcome the barriers to knowledge uptake. Our findings suggest that the web-based medium as well as the design, content and format of the current module appeared to support PTs in developing their DCD knowledge base and planning future management of children with DCD. Several of the PTs' qualitative comments highlighted a shift in clinical reasoning beyond traditional impairment-based intervention models. From the high ratings of the module's utility and the qualitative comments, particular elements of the module that PTs appreciated included the interactive media, case scenarios, clinical application examples and learning opportunities. This is consistent with the knowledge translation literature that points to the importance of multiple, interactive strategies for effective knowledge transfer (Zidarov, 2012; Grimshaw, 2012). As has been recommended by other researchers (Zidarov, 2012), involving PTs in the development of the

module from the beginning, as well as throughout the processes outlined in the KTA framework, strengthened the module's utility and clinical relevance.

When synthesizing and tailoring a body of research evidence for an online format, such as was done in this study, it can be challenging to determine the 'right' amount of content to address the differing needs (and knowledge levels) of all intended users (comprehensiveness), while at the same time ensuring that the content does not overburden the user (appropriate length) (Levac et al., submitted). Many of the participants in this study reported viewing the module over more than one occasion and over several hours. While every attempt was made to ensure that the module was not too lengthy for viewing, it was nonetheless difficult to keep it short while still including content that would be applicable for learners at all stages of knowledge about DCD, and to ensure a 'repository' of information for ongoing, in-depth learning. Use of a web-based knowledge tool was deemed important for sharing DCD research knowledge, as the embedded "pop-ups" and hyperlinks to different resources will allow future users to tailor their online visits to the information they need, at the time they need it. In this study, many PTs navigated the content in a non-linear way, a mechanism that allows information to be tailored to the user, including to their level of DCD knowledge. This is an important aspect to examine further in subsequent revisions to the module as the need to move through the module easily may outweigh the need to be comprehensive. Suggestions provided by participants with regards to content and format improvements (including navigation supports such as a navigation guide) have been used to refine the module and improve its effectiveness. The module is now posted on the *CanChild* Centre for Childhood Disability Research website at dcd.canchild.ca/en/ (search under "Resources" and "Workshops").

This study is not without limitations. The use of a convenience sample of PTs in the initial interviews, all of whom were experienced therapists and had a lot of knowledge about DCD, suggests that we may have missed important perspectives from clinicians with less DCD knowledge and experience. In addition, the 50 PTs included in our sample who examined module utility were also experienced therapists who may have been highly motivated to increase their understanding of DCD and were, therefore, more receptive to incorporating newer research evidence and/or theoretical frameworks that challenge their clinical reasoning. However, attempts were made to overcome the impact of these limitations by ‘purposeful sampling’ of PTs from different clinical settings across the country. Further evaluation of the module with the same group of PTs indicated that the module did, in fact, increase PT DCD knowledge and skills (CC et al., submitted).

Finally, while this online PT DCD module does appear to be both useful and relevant, it will be important to test whether ongoing implementation of the module with PTs will translate into more effective services for children with DCD. Ultimately, and with ongoing implementation, this educational module could be linked with a DCD community of practice, an active knowledge translation strategy that assists with changing clinical behaviour and facilitating implementation (Grimshaw et al., 2006; Grimshaw et al., 2001; Li et al., 2009).

Conclusions

This study presents use of a knowledge-to-action approach to transfer evidence-based DCD knowledge to clinical practice in an attempt to close the knowledge-to-practice gap. A needs assessment with PTs working with children with DCD, along with a comprehensive synthesis of current DCD research evidence, informed the content, structure, and format of an

online DCD module. The online module was perceived to be useful, relevant, and supportive of PT clinical practice. It is anticipated that, through continued clinical implementation and further research on the impact of its use over time, the module will foster evidence-based PT clinical practice with children with DCD, and ultimately improve health outcomes for this population.

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