Descriptive contents analysis of ParticiPAte CP: a participation-focused intervention to promote physical activity participation in children with cerebral palsy

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ABSTRACT

Purpose: ParticiPAte CP is a participation-focused therapy intervention that is effective to increase perceived performance of physical activity (PA) participation goals in children with cerebral palsy (CP). We aimed to characterise the contents of ParticiPAte CP using validated behaviour change frameworks.

Materials and methods: Data came from physiotherapist treatment notes and were used to specify: (1) physiotherapist-perceived barriers to behaviour change (using the International Classification of Functioning, Disability and Health Framework [ICF] and Theoretical Domains Framework), intervention content (Behaviour Change Technique Taxonomy v1), intervention functions (Behaviour Change Wheel) and mechanisms of action (Capability, Opportunity, Motivation – Behaviour model).

Results: Physiotherapist-perceived barriers to participation were identified in all ICF and Theoretical Domains Framework domains. ParticiPAte CP consisted of 32 behaviour change techniques, delivered via six intervention functions of the Behaviour Change Wheel, especially enablement. All six possible mechanisms of action were identified according to the Capability, Opportunity, Motivation – Behaviour model. These were targeted most frequently through Theoretical Domains Framework domains social influences, environmental context and resources, intentions, skills, knowledge, and beliefs about capabilities.

Conclusions: The content of a PA intervention for children with CP can be specified according to behaviour change frameworks. ParticiPAte CP was complex, with multiple targets, constituent behaviour change techniques and mechanisms of action.

Trial Registration: Australian New Zealand Clinical Trials Registry ACTRN12615001064594.

IMPLICATIONS FOR REHABILITATION

- Providing social support to families through practical actions such as motivating conversation, providing information, linking families to community services and participating in activities with children to support their self-efficacy may be a defining feature of effective participation-focused therapies.
- If children with cerebral palsy (CP) and their families nominate goals for increased frequency of attendance or improved involvement in physical activities (PAs), therapists must identify all important barriers to participation, including behavioural barriers that may be thought of less often (e.g. emotions, beliefs, optimism etc.).
- Promoting PA participation in children with CP may require a complex or multi-faceted therapy intervention that supports not only physical capability, but also enhances the social and physical opportunity for participation to take place and promotes the psychological capability and motivation for PA of children and families.
- Therapists or researchers may consider using the Behaviour Change Wheel to prospectively design their own health behaviour intervention for children with CP.

Introduction

Participation is defined as attending and being involved in life situations [1]. Children with cerebral palsy (CP) experience participation restrictions including less frequent participation in leisure-time physical activities (PAs) compared to children without CP [2]. Restricted participation in PAs may be on the causal pathway to reduced moderate-vigorous intensity PA and increased sedentary behaviour identified in children with CP [3]. Compared to people without CP, those with CP have a greatly increased risk of being...
Participation for children with disabilities demonstrated four key psychological needs: autonomy, competence (i.e., self-efficacy), relatedness, and integration. According to Self-Determination Theory, the need for relatedness is essential for intrinsic motivation in typically developing children [11]. Self-Determination Theory posits that individuals will have greater intrinsic motivation for adopting or continuing behaviors when their three basic psychological needs are fulfilled [12].

All PA interventions make use of behavior change techniques, which are the ingredients of the intervention that act to change PA behaviors [6]. Behavior change techniques, defined in the Behaviour Change Technique Taxonomy v1 [6], can be organised into 16 types or clusters according to how they act to change participant behavior, for example, Shaping Knowledge, Goals and Planning, or Self-belief [6]. The more clusters of behavior change techniques an intervention adopts, the greater its complexity, which is necessary in order to effect clinically meaningful change [7]. PA interventions with both an explicit theoretical basis for behavior change and that incorporate at least three clusters of behavior change techniques, on average, demonstrate larger and more consistent effects to increase PA level [8].

In the past, PA in children with CP was not characterised as a health behavior, and therefore, PA interventions lacked both [1] adequate complexity and [2] a theoretical basis [9]. A recent systematic review and meta-analysis of therapy interventions to increase participation in PAs in children with CP, found the majority of approaches contained strategies within only two behavior change technique clusters [1]: shaping knowledge (e.g., information about accessible community PA programs), and [2] repetition and substitution including behavioral practice/rehearsal (e.g., PA skills training including aerobic or strength exercise) [9]. These interventions were, unsurprisingly, not effective to increase sustained participation in PAs in children with CP [9].

Based on the results of this review, an intervention called ParticiPAte CP was developed that characterised PA as a health behavior and provided a theoretical rationale for addressing participation in children with CP. The intervention contained elements hypothesised to be essential to improve participation, including goal directedness and family centredness [10]. The intervention was highly tailored to each individual, with the choice of behavior change techniques guided by barriers to participation goals specific to each child and their family [10]. Furthermore, it was built on the principles of Self-Determination Theory, an empirically validated macrotheory of human behavior and motivation commonly used to explain PA behavior change and motivation in typically developing children [11]. Self-Determination Theory posits that individuals will have greater intrinsic motivation for adopting or continuing behaviors when their three basic psychological needs of autonomy, competence (i.e., self-efficacy) and relatedness are fulfilled [12]. A systematic evidence synthesis of qualitative studies on the meaning of leisure participation for children with disabilities demonstrated four key themes that were fully consistent with Self-Determination Theory. These included "fun" (the enjoyment derived from participating in leisure and aligning with the concept of intrinsic motivation itself), "freedom" (from choice and from constraints, aligning with the need for autonomy), "fulfillment" (discovering, developing and displaying potential, aligning with the need for competence) and "friendship" (social connectedness and belonging, aligning with the need for relatedness) [13].

In a randomized waitlist-controlled trial of n = 37 children with CP aged 8–12 years, classified in Gross Motor Function Classification System (GMFCS) levels I–III, ParticiPAte CP was effective at (i): increasing perceived performance of and satisfaction with individualized PA participation goals on the Canadian Occupational Performance Measure (COPM) by a mean of 3.58 points, and (ii) reducing caregiver-perceived behavioural barriers to PA participation on the Barriers to Participation in Physical Activities Questionnaire by a mean of 26.39 points, compared to a waitlist group receiving usual care [14]. In order to explore the mechanism of intervention effect, a secondary analysis of predictors of behavior change was performed. Participants characteristics including intrinsic motivation and self-efficacy for PA were associated with the magnitude of change in participation goal performance in response to ParticiPAte CP [15]. This finding suggests support for the posited theoretical premise of the intervention – Self-Determination Theory [16].

Given the highly individualised nature of ParticiPAte CP and the opportunity to incorporate almost all clusters of behavior change techniques within and across participants, a recognised limitation was the limited ability to describe the intervention in sufficient detail to understand its active ingredients [10,14,15]. Complete descriptions of interventions are required in order to enable replication and implementation of therapy interventions [17]. This study therefore aimed to (i) identify the physiotherapist-perceived barriers to PA within the ParticiPAte trial, (ii) identify the strategies/mechanisms that were employed to overcome the barriers, and (iii) map the barriers and strategies against relevant and recognised behavioural change frameworks. These included: the International Classification of Functioning, Disability and Health Framework (ICF) [18], Theoretical Domains Framework [19], the Behaviour Change Technique Taxonomy v1 [6], and Behaviour Change Wheel (Capability, Opportunity, Motivation – Behaviour model [20].

Materials and methods

Participants

The ParticiPAte CP waitlist-controlled clinical trial has been described in detail elsewhere [10,14,15]. Four of 37 enrolled participants, all in the waitlist group, withdrew prior to receiving the intervention, leaving 33 participants who received ParticiPAte CP and were therefore included in this study. Participants were recruited from databases of the Queensland Children’s Hospital and Queensland Cerebral Palsy and Rehabilitation Research Centre at The University of Queensland. Participants were children with CP between 8 and 12 years (mean 10 years 0 month, SD 1 year 6 months) classified in GMFCS levels I–III, and living within 200 km of South Brisbane, Queensland, Australia. Participants were able to communicate their goals, needs and preferences to the study physiotherapist with minimal support from a caregiver and did not have moderate-severe intellectual disability. The study received ethical approval from the Children’s Health Queensland Hospital and Health Service Ethics Committee (HREC/15/QRCH/162) and The University of Queensland Medical Research Ethics Committee (2015001609), and was prospectively registered (ACTRN12615001064594) on the Australian New Zealand Clinical Trials Registry [14]. Caregivers provided written informed consent on behalf of their child prior to enrolment in the study.

Intervention

ParticiPAte CP was a participation-focused, goal-directed intervention delivered by a physiotherapist with three years of post-graduate experience and training in Motivational Interviewing. The intervention was delivered in the child/family home and community context and consisted of eight face-to-face sessions of one hour duration, once per week for eight weeks. The first and
last sessions were used to set and score (respectively) approximately three participant-identified PA participation goals using the COPM. The child provided Performance and Satisfaction ratings where possible. Goal rating was assisted or proxy-rated by the primary caregiver if the child did not understand the rating where possible. Goal rating was assisted or proxy-rated by the COPM goals reflected either participation attendance or involvement according to the Family of Participation-Related Constructs [1], and could be either formal or informal PAs. Goals that reflected other concepts (e.g. body functions and structure or activity) were not permitted, and children and their families were encouraged through the use of empathetic problem-solving communication to re-word the goals according to participation attendance or involvement. An example of an attendance goal was “To join the local basketball team and play basketball once per week”. The physiotherapist also provided some indirect (non-face-to-face) support to participants as required, ranging in dose from 0 to 8 h in eight weeks. This was comprised of email or phone contact with coaches or activity leaders, completion of equipment applications, or home exercise program development [14].

Analysis frameworks

To provide a structured and defensible analysis of intervention contents, this study employed a qualitative coding process using four validated frameworks. We used a summative content analysis approach [21], whereby instances of barriers and strategies were first counted (manifest), then contextualised with the knowledge of the participants’ goals and the overarching intervention framework to reveal the likely underlying mechanisms of action. The analysis frameworks are described below in more detail.

The World Health Organization ICF Framework is a universal classification system of functioning, disability and health. The ICF identifies three domains of human functioning relevant to the health condition (i): body functions and structure, (ii) activities, and (iii) participation, and two types of contextual factors which interact with the health condition: (i) environmental factors and (ii) personal factors. Functioning and disability are the outcomes of interaction between and among the domains and contextual factors. Body functions and structure impairments, activity limitations, participation restrictions and contextual factors can be conceptualised as barriers to participation attendance and involvement. For example, if Sally, an 8-year-old girl with unilateral CP, GMFCS III has the goal: “to ride an adapted tricycle with my friends in the park twice a week”, some hypothetical barriers to Sally’s goal could be categorized according to the ICF Framework as follows:

- Body functions and structure impairments: b7302 Power of muscles of one side of the body.
- Activity limitations: d435 Moving objects with lower extremities.
- Participation restrictions: d9201 Sports and d9200 Play.
- Environmental factors: e1401 Assistive products and technology for culture, recreation and sport (i.e., lacking access to an adapted tricycle).
- Personal factors: fear-avoidant coping style (note: there are no personal factor codes in the current version of the ICF).

The Behaviour Change Wheel (Figure 1) is a comprehensive overarching framework covering the full range of behaviour change intervention foci, functions and policy [20]. At the centre of the wheel is the ‘Capability, Opportunity, Motivation – Behaviour’ system designed to reveal the conditions necessary for a given behaviour to occur, based on interactions between capability, opportunity and motivation [20]. The Capability, Opportunity, Motivation – Behaviour system therefore highlights what may need to change in order to address the behaviour (i.e. the intervention focus). Definitions for each of the six segments of the Capability, Opportunity, Motivation – Behaviour model are provided in Supplementary Table 1. The second layer of the Behaviour Change Wheel illustrates nine possible functions for behaviour change interventions, that is, the mechanisms by which interventions act [20]. Definitions for each of the nine intervention functions are provided in Supplementary Table 2, and their linkages to Capability, Opportunity, Motivation – Behaviour segments are provided in Supplementary Table 3. It is important to note that the names of the functions do not always reflect the common understanding of the term outside of behaviour change research. Coercion, for example, is defined as “creating expectation of punishment or cost”, as opposed to more common understanding “the practice of persuasion using force or threats”. The third layer of the Behaviour Change Wheel categorizes the seven types of policies used to support or deliver the nine intervention functions [20].

The Theoretical Domains Framework is a validated, integrative framework of theoretical constructs relevant to health behaviour change research [19]. The Theoretical Domains Framework has 14 domains, covering areas relevant to individuals (e.g. knowledge, skills, and emotion), the environment (e.g. environmental context and resources) and functions or processes of behaviour change (e.g. goals, reinforcement, intentions). The Theoretical Domains Framework can be used to classify interventions according to how they may act to change behaviours (intervention foci) and categorize different barriers to behaviour change. The Theoretical Domains Framework has been used previously to categorize the PA behaviour-changing foci of therapy interventions in children with CP [9].

The Behaviour Change Technique Taxonomy v1 is a comprehensive taxonomy of 93 behaviour change techniques organised into 16 categories, developed through expert consensus [22]. Behaviour change techniques are “observable, replicable, and irreducible component[s] of an intervention designed to alter or redirect causal processes that regulate behaviour; that is, a technique that is proposed to be an active ingredient.” [22] The
Behaviour Change Technique Taxonomy v1 enables description of the nature and content of complex interventions in an internationally standardized way [6]. Techniques are labelled according to their category, for example one behaviour change technique in category 1 (goals and planning) is 1.1 Goal setting (behaviour) “Set or agree on a goal defined in terms of the behaviour to be achieved” [6]. An example of an intervention strategy that could be coded with this behaviour change technique is the collaborative PA participation goal-setting process employed within ParticiPate CP [6].

Coding procedure

There are few content analyses available for therapy interventions aiming to change the health behaviour of patients. Guidance for the coding and linking procedure was therefore drawn from a recent published analysis of content of an implementation intervention to increase the uptake of an evidence-based intervention called ‘Sepsis Six’ by clinicians in one hospital in the UK [23].

Step 1: data source and barriers to participation

During ParticiPate CP, the physiotherapist completed clinical treatment notes for each child including one clinical reasoning sheet [10], between the second and third appointment which was added to throughout the intervention in the event that more barriers became apparent and additional strategies were applied. This clinical reasoning sheet (included as a Supplementary Table 4) described in free text: (i) physiotherapist-perceived barriers to achievement of the participant’s goals and (ii) therapeutic strategies delivered to address the listed barriers. Any barriers perceived by the physiotherapist to be non-modifiable within the scope of the intervention and where no strategy was implemented were not included on this sheet. For example, if the child required access to specialised assistive technology whereby prescription, funding and access was not achievable within eight weeks, this would be considered non-modifiable. Each barrier was coded by the physiotherapist according to two frameworks, the ICF and Theoretical Domains Framework and barriers could be coded to multiple levels of a single framework. The frequency of each code in the dataset was then summarized.

Step 2: behaviour change technique taxonomy v1 coding for intervention content

An undergraduate health promotion research student (LJ) with no role in the design, conduct or analysis of the clinical trial and who was naïve to participant identity undertook coding. The student completed standardized online training in coding interventions according to the Behaviour Change Technique Taxonomy v1 (https://www.bct-taxonomy.com/). The student underwent familiarization with the trial by reading the available documentation including the published protocol, primary outcomes paper, and trial registration and reviewed videotapes of treatment sessions. Videotapes were not used as a coding source (only for familiarization) as there were significant limitations to the ability to video-tape a representative sample of intervention sessions. Barriers to filming included: session location in the community with people not consenting to their image being used for research, the physiotherapist forgetting to turn on camera for discussions with caregiver containing elements of Motivational Interviewing, and lack of videotape of non-face to face elements of the intervention. All treatment strategies listed on participant clinical reasoning sheets were then coded by the student according to the Behaviour Change Technique Taxonomy v1. These codes were reviewed and confirmed by the first author and developer of ParticiPate CP (SR), who also undertook standardized training in Behaviour Change Technique Taxonomy v1 coding. SR is an experienced paediatric physiotherapist-researcher with training in PA health behaviour change in children and youth with disabilities. A discussion process between SR and LJ achieved consensus about final coding in the event of disagreement. The frequency of each behaviour change technique in the dataset was then summarized, however only those appearing more than three times were included in the final list to improve certainty for which techniques were consistently applied.

Step 3: linking

The most frequently appearing strategies and their corresponding coded behaviour change techniques were then linked to the intervention functions of the Behaviour Change Wheel using published guidance on the relationship between intervention functions and behaviour change techniques [24], by two authors independently (SR and LS). LS is a senior Occupational Therapist research fellow with extensive experience in clinical trials of interventions for children with CP and understanding of behaviour change frameworks. If a behaviour change technique was linked to more than one intervention function of the Behaviour Change Wheel or the intervention functions selected were different, discussion between the two authors was used to generate consensus on which intervention functions were most likely according to the authors’ expert knowledge of ParticiPate CP.

Step 4: mechanisms of action

Two sources of evidence were initially consulted to identify the relevant Theoretical Domains Framework domains and corresponding Capability, Opportunity, Motivation – Behaviour conditions for each behaviour change technique, including a published expert consensus on the most appropriate behaviour change techniques for each domain of the Theoretical Domains Framework [25], and an expert consensus project mapping behaviour change techniques to the Theoretical Domains Framework domains [26]. Two authors generated the mapping (SR and LS) independently, then resolved any disagreements by consensus.

Results

Thirty-three clinical reasoning sheets (one for each participant) were analysed. One hundred and eighty-three barriers to participation (range 4–7, median 6 per participant) were categorized according to the ICF and Theoretical Domains Framework, and 173 (range 4–7, median 5 per participant) strategies were coded using the Behaviour Change Technique Taxonomy v1.

Barriers to participation

Modifiable barriers to participation were present across all domains of the ICF, most frequently being categorized as belonging to the environment (Table 1). Similarly, when categorized

| ICF Domain                        | Frequency |
|-----------------------------------|-----------|
| Environment                       | 72        |
| Activities                        | 64        |
| Personal factors                  | 62        |
| Body functions and structures     | 55        |
| Participation                     | 17        |
Table 2. Frequency of physiotherapist-perceived barriers according to the Theoretical Domains Framework.

| Theoretical Domains Framework domain                  | Frequency | Illustrative example from data                                                                 |
|------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------|
| Skills                                               | 87        | “soccer skills of dribbling, passing, shooting”                                               |
| Environmental context and resources                  | 64        | “access to equipment (track wheelchair)”                                                     |
| Knowledge                                            | 54        | “task knowledge [for operating] bike gears on longer rides”                                  |
| Memory, attention, and decision processes            | 33        | “remembering, [to do] physical activities”                                                   |
| Emotion                                              | 32        | “fear of falling”                                                                              |
| Beliefs about capabilities                            | 30        | “[low] self-efficacy for handball”                                                            |
| Intentions                                            | 29        | “dad and participant do not prioritise going to the playground”                              |
| Behavioural regulation                               | 28        | “Scheduling riding bikes to park, making time available”                                      |
| Beliefs about consequences                            | 22        | “parental fear of injuries potentially suffered in [sport]”                                   |
| Social influences                                    | 19        | “conflicting needs of siblings”                                                               |
| Optimism                                             | 14        | “[low] confidence in soccer games”                                                             |
| Goals                                                 | 11        | “prioritisation of other activities over physical activities”                                 |
| Professional role and identity                       | 5         | “family cultural values, not comfortable with participant riding alone outside neighbourhood”  |
| Reinforcement                                         | 2         | “needs to be rewarded for doing physical activity”                                           |

Figure 2. Word cloud of physiotherapist-perceived barriers to physical activity participation goals (the larger the word, the more frequently this word or its synonyms appeared in the dataset).

According to the Theoretical Domains Framework, barriers in environmental context and resources (example barriers: “[The] accessible playground is further away”) were prevalent, second only to barriers in the domain of skills (example barrier: “Basketball shooting and dribbling skills”) (Table 2). The words “skill” and “skills” were the most frequently appearing in the dataset (see word cloud, Figure 2) with environmental barriers for example distributed across a greater range of words (e.g. prioritisation, family, parental, access, scheduling, equipment).

Intervention content

Table 3 provides illustrative examples from the data alongside a concise mapping of behaviour change techniques by therapeutic strategy with their corresponding intention functions, foci and mechanisms. The most frequently coded behaviour change technique with 70 occurrences was 3.2 Social support (practical). The following behaviour change techniques listed in order of descending frequency were coded at least once for each participant: 1.4 Action planning, 3.1 Social support (unspecified), 13.4 Valued self-identity, 4.1 Instruction on how to perform the behaviour, 6.1 Demonstration of the behaviour, 8.1 Behavioural practice/rehearsal, 8.3 Habit formation, 8.6 Generalisation of target behaviour, 8.7 Graded tasks, 12.6 Body changes, 1.2 Problem solving, 1.9 Commitment, 1.1 Goal setting, and 1.5 Review behaviour goal(s). The full list of coded behaviour change techniques appearing more than three times is available in Supplementary Table 5. Intervention content was linked to all components of the Capability, Opportunity, Motivation – Behaviour model, especially Social opportunity (n = 6), Reflective motivation (n = 5), and Physical capability (n = 4).

Mechanisms of action

The most frequent Theoretical Domains Framework domain was social influences (n = 6) which was targeted through the functions of enablement (n = 9) and modelling (n = 2) and delivered via the behaviour change techniques 3.1 Social support (unspecified), 3.2 Social support (practical), 3.3 Social support (emotional), 6.1 Demonstration of the behaviour, 12.2 Restructuring the social environment, 13.1 Identification of self as role model, and 15.1 Verbal persuasion about capability. Environmental context and resources were next most frequent (n = 5), targeted via the function of restructuring the environment (n = 2) and delivered via the behaviour change techniques 12.2 Restructuring the social environment, 12.5 Adding objects to the environment, 3.1 Social support (unspecified), and 3.2 Social support (practical). Other intervention functions identified were: training (n = 4), persuasion (n = 3), and education (n = 1). Twelve of 14 Theoretical Domains Framework domains were represented in the likely mechanisms; professional role and identity and reinforcement were not identified. All six segments of the Capability, Opportunity, Motivation – Behaviour were intervention foci, with the most frequently mapped being psychological capability (n = 6) and least frequently mapped being automatic motivation (n = 1).

Discussion

We have demonstrated that the content of an intervention for PA behaviour change in children with CP can be systematically specified. Furthermore, we have illustrated potential mechanisms of action of the intervention using a content-driven analysis approach consistent with theories of behaviour change. We have also used the ICF and Theoretical Domains Frameworks to categorise physiotherapist-perceived modifiable barriers to PA participation, and which behaviour change techniques were used to address these barriers.

Physiotherapist-perceived barriers to participation were present across all domains of the ICF and Theoretical Domains Framework, as expected according to the theoretical framework of the intervention [10]. Barriers in the domains of the...
| Intervention strategies identified from clinical reasoning sheets | Illustrative example from data | Intervention content | Behaviour Change Wheel functions (the purpose or intent of the strategies) | Capability, Opportunity, Motivation – Behaviour model and Theoretical Domains Framework (narrow foci of behaviour change strategies) |
|---|---|---|---|---|
| **Goal setting and scoring** | “Discussion of current and past PA participation, discussion of potential PA participation targets, in the context of individual barriers and facilitators and child/family preferred future, and collaborative setting of 3–5 participation frequency of attendance and/or involvement goals” [10] | 1.1 Goal setting (behaviour) <br>1.4 Action planning <br>1.5 Review behaviour goals | Enablement | Reflective motivation | Goals, intentions |
| | “Discussion of impact of therapeutic elements on COPM goal performance, confidence and satisfaction, strategy formation and planning for maintenance; collaborative scoring of 3–5 participation frequency of attendance and/or involvement goals” [10] | | | | |
| **Body structure and function-focused treatments, e.g. strength, balance, endurance, or flexibility training** | “Home exercise program for [horse] dismount practice … including glute strength (squats) modified” | 12.6 Body changes | Training | Physical capability | Skills |
| **Activity-focused treatments e.g. sport-specific skills training including part/whole practice and adhering to principles of motor learning** | “Structured task practice of bike riding, feedback – verbal, motor learning techniques” | 2.2 Feedback on behavior <br>3.2 Social support (practical) <br>4.1 Instruction on how to perform the behavior | Training, modelling, enablement | Physical capability, psychological capability, social opportunity | Skills, knowledge, social influences |
| | “[Basketball] part practice, whole practice, motor learning approaches, explicit teaching, contextualised practice, feedback [verbal] “Demonstrations/ modelling of activity [Rugby drills]” | 6.1 Demonstration of the behavior <br>8.1 Behavioural practice/rehearsal <br>8.3 Habit formation <br>8.6 Generalization of target behavior <br>8.7 Graded tasks | | | |
| | “Scaffolded participation together with therapist, modelling rules and social interactions [with siblings]” | 12.6 Body changes | | | |
| | “Scaffolded participation for success and confidence, integrated parents into bike riding practice, fun participation together [as a family]” | 3.1 Social support (unspecified) <br>3.2 Social support (practical) <br>4.1 Instruction on how to perform the behavior | Training, modelling, enablement, persuasion | Physical opportunity, social opportunity, physical capability, psychological capability, reflective motivation | Environmental context and resources, knowledge, skills, social influences, social role and identity, beliefs about capabilities, optimism |
| | “Create experiences of successful [handball] play … constructive praise” | | | | |
| **Participating in the activity, scaffolded by the physiotherapist to deliberately fulfil basic psychological needs of autonomy, competence and relatedness according to Self-Determination Theory** | “Motivational Interviewing, action planning, discussion of scheduling strategies” | 1.2 Problem solving <br>1.4 Action planning <br>3.1 Social support (unspecified) <br>9.1 Credible source | Persuasion, education, enablement | Reflective motivation, psychological capability, social opportunity | Intentions, knowledge, beliefs about consequences, social role and identity, beliefs about capabilities, social influences |
| | “Action planning with [participant] to create goals and responsibilities [for prioritising going to the playground]” | 9.1 Credible source | | | |

(continued)
| Intervention component | Intervention strategies identified from clinical reasoning sheets | Illustrative example from data | Behaviour change techniques (techniques applied to change participant behaviour) | Behaviour Change Wheel functions (the purpose or intent of the strategies) | Capability, Opportunity, Motivation – Behaviour (broad foci of behaviour change strategies) | Theoretical Domains Framework (narrow foci of behaviour change strategies) |
|------------------------|---------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| **Intervention**        |                                                               |                             | 1.8 Behavioural contract                                                       | 1.2 Problem solving                                                             | Physical opportunity, social opportunity, psychological capability            | Environmental context and resources, behavioural regulation, social influences |
| **Strategies**          |                                                               |                             | 1.9 Commitment                                                                | 1.4 Action planning                                                           | Reflective motivation, psychological capability                              | Goals, intentions, memory attention and decision processes                     |
| **identified from**     |                                                               |                             | 3.3 Social support (emotional)                                                | 1.9 Commitment                                                                | Social opportunity                                                           | Environmental context and resources, social influences                         |
| **clinical**            |                                                               |                             | 9.2 Pros and cons                                                             | 1.9 Commitment                                                                | Social opportunity, automatic motivation                                     | Environmental context and resources, social influences                         |
| **reasoning sheets**    |                                                               |                             | 9.3 Comparative imagining of future outcomes                                   | 1.9 Commitment                                                                | Social opportunity, automatic motivation                                     | Environmental context and resources, social influences                         |
| **Intervention**        |                                                               |                             | 13.1 Identification of self as role model                                      | 3.2 Social support (practical)                                                | Physical opportunity, social opportunity, psychological capability            | Goals, intentions, memory attention and decision processes                     |
| **content**             |                                                               |                             | 13.2 Framing/ reframing                                                       | 12.5 Adding objects to the environment                                         | Physical opportunity                                                         | Goals, intentions, memory attention and decision processes                     |
| **Mechanisms of action**|                                                               |                             | 13.3 Incompatible beliefs                                                      | Restructuring the environment                                                  | Environmental context and resources                                           | Beliefs about capabilities, optimism                                          |
| **behaviour**           |                                                               |                             | 13.4 Valued self-identity                                                      | Restructuring the environment                                                  | Physical opportunity                                                         | Goals, intentions, memory attention and decision processes                     |
| **change**              |                                                               |                             |                                                                              | Restructuring the environment                                                  | Environmental context and resources                                           | Beliefs about capabilities, optimism                                          |
| **strategies**          |                                                               |                             |                                                                              |                                                                              |                                                                              |                                                                              |
| **identified from**     |                                                               |                             |                                                                              |                                                                              |                                                                              |                                                                              |
| **clinical**            |                                                               |                             |                                                                              |                                                                              |                                                                              |                                                                              |
| **reasoning sheets**    |                                                               |                             |                                                                              |                                                                              |                                                                              |                                                                              |

*Clinical reasoning sheets did not explicitly contain the goal-setting process. The example from the published protocol is provided here as goal setting and scoring was a fundamental requirement of participation in the study and the primary outcome measure, and the process according to the description provided was standardized across all participants.*

*bNot coded independently of other codes.*
environment (ICF) and environmental context and resources (Theoretical Domains Framework) were the most frequent in the present analysis of ParticiPate CP. This finding is supported by a number of other recent studies, including: a large cross-sectional study, reporting increased prevalence of environmental and contextual barriers to community participation of children with disability compared to typically developing children [27]; a qualitative study canvassing the views of children and their clinicians, reporting a lack of accessible and inclusive opportunities as the most frequent barrier to participation [28]; and a large mixed methods systematic review of 19 studies, demonstrating that participation in PA in young people with childhood-onset disabilities is largely influenced by the social and physical environments [29]. Notwithstanding, the most frequent physiotherapist-perceived barrier in this study according to the Theoretical Domains Framework was skills. This demonstrates that when clinicians are encouraged to identify and address barriers to participation in PAs across all life areas, activity limitations are still consistently identified as modifiable barriers. This may reflect the professional background of the clinician in physiotherapy, which traditionally has focused on development of motor competency in children with CP. Alternatively, strategies aimed at activity limitations may genuinely be required to address barriers in sports and PA skills for children with highly specific PA participation goals (as opposed to a goal to increase participation or PA level in general).

The role of personal factors (ICF) as barriers at the child and family level, including: beliefs about capabilities, optimism, beliefs about consequences, intentions, memory attention and decision processes, emotion, and behavioural regulation (Theoretical Domains Framework) have been less frequently explored in research. One recent qualitative study revealed that parents perceive their concerns about risk (emotion and beliefs about consequences), and their own PA behaviours (intentions and behavioural regulation) as barriers to the participation in PAs of their child with a physical disability [30]. Prior to the development of the Barriers to Participation in Physical Activities Questionnaire (BPPA-Q) based on the Theoretical Domains Framework [10], to our knowledge, there was no tool that was capable of capturing barriers/facilitators to PA participation in all domains of the Theoretical Domains Framework. Our findings highlight the importance of exploring barriers and facilitators to PA behaviour change across all ICF and/or t Domain Framework domains.

ParticiPate CP consisted of 32 behaviour change techniques, mostly belonging to the Behaviour Change Technique Taxonomy v1 clusters of goals and planning, repetition and substitution, social support, identity, comparison of outcomes and self-belief. There were six intervention functions (Behaviour Change Wheel), especially enabling, training, and to a lesser extent persuasion, modelling, education, and restructuring the environment. These functions were likely to have led to PA behaviour change through several mechanisms, especially social influences (social opportunity), environmental context and resources (social opportunity and physical opportunity), intentions (reflective motivation), skills and knowledge (physical capability and psychological capability), and beliefs about capabilities (reflective motivation). This was consistent with both the planned delivery outlined in the published intervention protocol and the hypothesised mechanisms of action [10]. All possible broad foci of behaviour change interventions (Capability, Opportunity, Motivation – Behaviour segments) were represented, which is important as it demonstrates that all salient barriers are likely to have been addressed [6].

This is, to our knowledge, the first participation-focused therapy intervention to be coded according to the Behaviour Change Technique Taxonomy v1. It is therefore difficult to make direct comparisons to the content of other participation-focused interventions. As previously mentioned, most existing PA interventions for children with CP were likely characterised by strategies targeting the Behaviour Change Technique Taxonomy v1 clusters shaping knowledge and repetitions and substitution (via the intervention function of training) [9]. Several newer, participation-focused interventions including the Local Environment Model [31], Pathways and Resources for Engagement and Participation (PREP) [32], and Physical Activity on Prescription [33], likely contain a large number of behaviour change techniques and have multiple intervention functions.

A recent qualitative study using an ethnographic approach with staff interviews and observations aimed to evaluate the active ingredients of the Local Environment Model, which is applied at a unique healthcare facility in Norway called the Beitostol Healthsports Centre [34]. Out of 53 unique ICF categories identified within the active ingredients, 26 were in the environment domain, 26 in the activities and participation domains, and none were in the body functions and structures domain [34], echoing the findings of the present content analysis of ParticiPate CP. The Local Environment Model had 14 active ingredients mostly operating at the level of the intervention, the organisation, and the individual [34]. This demonstrates both the complex nature of participation-focused therapies and the necessity of focus beyond impairments and activity limitations when addressing PA participation for children with disabilities.

Parental perspectives on the nature and mechanisms of PREP were explored in a qualitative study [35]. Parents perceived the intervention as being multi-faceted, and noted the role of the Occupational Therapist as a “guiding figure” and “facilitating youth independence” [35]. These perceptions likely align with the behaviour change technique 3.2 Social support (Practical) and the intervention function of enablement, which means “to reduce barriers and/or increase facilitators”. This was also a feature of ParticiPate CP, whereby the physiotherapist’s presence, guidance, and practical “help” to facilitate inclusion was a prominent vehicle for PA behaviour change as demonstrated by the high frequency of behaviour change techniques in the social support cluster, and the mechanism of social opportunity. Consistent with ParticiPate CP and PREP, content analysis of the Local Environment Model highlighted that social support and relationships were key components of the intervention [34]. This concept aligns strongly with support for the basic psychological need for relatedness according to Self-Determination Theory. The recurrence and prominence of the theme of social support and relationships across these three examples of contemporary participation-focused therapies suggests that both (i) strengthening of the individual’s social connection to their family, friends and community, and (ii) the use of local, multidisciplinary networks, are critical ingredients [34, 35]. As demonstrated, this can occur through many mechanisms, but consistently these are practical therapeutic guidance, opportunities for safe participation that is enriching and promotes self-efficacy, and environmental redesign [10, 32, 34, 35].

ParticiPate CP also included approaches with a function of training, and aimed to address physical capability. This differs from PREP, for example, which is supposed to include only strategies directly aimed to modify the environment or adapt activities [32]. Other contemporary participation-focused interventions effective to promote participation in PAs do not include such a restriction on physical training. SPORTS STARS was a recent,
randomized controlled trial of a sport-specific physical literacy intervention in \( n = 54 \) children with CP classified in GMFCS levels I-II [36]. While the intervention has not undergone content analysis, based on the description provided, it featured an even higher proportion of behaviour change techniques aligning to skill development compared to Participate CP [36]. As Participate CP [14], SPORTS STARS [36], PREP [32], and the Local Environment Model [31], all demonstrated statistically and clinically meaningful change in participation goal performance on the COPM, it is likely that there are multiple successful pathways to achieve PA behaviour change in children with disabilities. Without direct comparison of these approaches however, at present it is only known that physical training alone is not sufficient [9].

Theory-driven PA interventions are not necessarily more effective than those with no-stated-theory, however even no-stated-theory interventions include behaviour change techniques [8]. Participate CP was explicitly theory-driven, with empirical evidence to support the premise of Self-Determination Theory, including the mechanisms of social opportunity (aligning with the basic psychological need of relatedness), reflective motivation (aligning with autonomy) and psychological capability (aligning with competence) [15]. With more than six Behaviour Change Technique Taxonomy v1 clusters, Participate CP exceeded the ‘minimum’ level of complexity required for effectiveness to change PA behaviours [8]. Prospectively designing PA interventions may lead to more optimal outcomes through selection of multiple behaviour change techniques. When incorporating the Behaviour Change Wheel and Capability, Opportunity, Motivation – Behaviour model, this process is divided into eight steps across approximately three stages, including: (i) understanding the behaviour, (ii) identifying intervention options, and (iii) identifying content and implementation options [37]. The selection process for target behaviours and relevant behaviour change techniques must draw upon the research evidence, knowledge (preferably involvement) of the patient group, incorporation of their preferences, and understanding of the intervention context [20]. A team of clinician-researchers designing an Audiology implementation intervention noted that use of the Behaviour Change Wheel “encouraged the research team to specify the target behaviours for change into simpler and more focussed behaviours rather than attempting to change too many or too complex behaviours at once.” [37] Best-practice rehabilitation interventions are top-down, i.e. they are child/family-centred, participation-focused, and with explicit reference to the child’s environment and context [38]. This content analysis of Participate CP demonstrates the ingredients and mechanisms of one effective participation-focused intervention, not a recipe. Therapists and researchers should carefully consider the unique situation and needs of their clients, their own practice context, and their broader social and political environment when developing and implementing participation-focused therapy, as these factors are likely to differ from those experienced by the Participate CP physiotherapist and participants.

**Limitations**

We had to retrofit Participate CP to the frameworks with this coding approach because we did not pre-specify behaviour change techniques during the design phase. While suboptimal, this was the approach taken by the authors of the ‘Seepis Six’ implementation study contents analysis [23]. In therapy literature, retrospective coding of behaviour change techniques has also been applied in cardiac rehabilitation [39] and aphasia treatment [40], however this is the first use to our knowledge with an intervention aiming to improve PA behaviours in children (or adults) with a physical disability. The study is also limited by having only one quasi-objective source for coding of behaviour change techniques, the interventionist’s clinical notes. We believe however that involving both naïve and experienced investigators in the coding process reduced the likelihood for bias associated with a single source. The exclusion of videotapes as an additional coding source limited the ability to triangulate intervention strategies described in clinical reasoning sheets and the intervention protocol with their actual delivery. For example, every time Motivational Interviewing was listed as a strategy, some behaviour change techniques were assumed including 1.6 Discrepancy between current behaviour and goal, 1.8 Behavioural contract, 1.9 Commitment, 3.3 Social support (emotional), 9.2 Pros and cons, 9.3 Comparative imagining of future outcomes, 13.1 Identification of self as role model, 13.2 Framing/reframing, 13.3 Incompatible beliefs, and 13.4 Valued self-identity as they were consistent with the physiotherapists’ training in Motivational Interviewing. It is however extremely unlikely that all of these behaviour change techniques were applied during every instance of Motivational Interviewing. Finally, as the physiotherapist was not required to note barriers that they perceived to be non-modifiable, it was not possible to provide any comparative analysis of barriers that were addressed versus those that were noted, but not targeted with any specific strategies.

**Conclusion**

Application of a behaviour-change lens to a PA intervention for children with CP can enable specification of its contents and possible mechanisms of action. Participate CP is a complex intervention consisting of a large number of behaviour change techniques across multiple clusters. This reflected both the wide variety of physiotherapist-perceived barriers and facilitators to participation in PAs faced by included children with CP and their families, and the subsequent degree of individual tailoring of the intervention. The behaviour change techniques used most frequently applied in Participate CP were linked to the function of enablement, demonstrating fidelity to the planned intervention delivery. This approach centred on addressing child- and family-specific barriers to PA behaviour change and supporting child and family autonomy according to an underlying theoretical basis of Self-Determination Theory. Like other examples of participation-focused therapy (i.e. PREP and the Local Environment Model) with available evidence of content and/or perceived mechanisms of action, Participate CP utilised social support to promote participation through social opportunity, and environmental redesign (restructuring the environment) to create physical and social opportunity for participation. It fundamentally differed from these examples however with a greater focus on the development of physical capability through training. This is likely to result from a combination of factors associated with unique goal, intervention and context-specific factors. We have demonstrated that using validated frameworks to describe health behaviour-change interventions in paediatric rehabilitation may facilitate improved understanding of contents and mechanisms. Prospective use of the Behaviour Change Wheel during intervention design is highly recommended for future studies in this field.

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Data availability statement

A de-identified dataset can be provided upon written request to the corresponding author.

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