Development of a consensus classification of physiotherapy interventions in paediatric neurorehabilitation

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ABSTRACT

Background and Aims
Physiotherapy within paediatric neurorehabilitation is a complex process whereby the relationship between treatments delivered and resultant severity-adjusted patient outcomes have been difficult to demonstrate. An essential pre-requisite for analysing physiotherapy input at the point of its delivery to the patient is to have clear descriptions and categories of physiotherapy interventions. Recent work in this area has focussed on grouping treatments based on their common essential ingredients. The aim of this work is to develop an expert-lead consensus classification of physiotherapy interventions used in paediatric neurorehabilitation, categorised according to their essential ingredients, actions and mediators.

Method
Comprehensive literature searches of five electronic databases (MEDLINE, EMBASE, AMED, CINAHL and PsychINFO) together with supplementary hand searching identified 4,194 studies which were separated into 34 different interventions following cross-referencing with other sources. These were then divided into eight distinct categories according to their essential treatment ingredients. A panel of 13 expert physiotherapists specialising in the field of paediatric neurorehabilitation were consulted in two rounds of an online modified-Delphi survey (a method commonly used to glean expert consensus).

Results
In modified-Delphi survey rounds 1 and 2 respectively, eight (62%) and nine (69%) of the experts responded. Utilising a threshold of ≥75% agreement set a priori to represent expert consensus, there was agreement that the eight categories are comprehensive (complete) and unambiguous (easily understood). What remains less clear is the extent to which these categories are independent of one another.

Discussion
This categorisation of physiotherapy interventions within paediatric neurorehabilitation is the first of its kind to group treatments according to their essential treatment ingredients. Such work adds the potential for gleaning greater understanding regarding how physiotherapy leads to improved patient outcomes within paediatric neurorehabilitation. Further work is required in this area to better understand the extent to which different categories are truly independent or where similarities exist between them.

Introduction

Childhood neuro-disability is a significant and increasing problem in the modern healthcare system (National Institute for Health and Clinical Excellence [NICE] 2010; NHS England, 2013). Neurorehabilitation is an integral aspect of care for this patient group, an essential component of this being physiotherapy (Chartered Society of Physiotherapy [CSP] 2013a). An important aspect of rehabilitation research is to investigate which physiotherapy interventions are effective and lead to clinically important patient change. A prerequisite for conducting clinical trials in this area is to have accurate descriptions of physiotherapy interventions which can be categorised and accurately evaluated (De Wit et al., 2006; Whyte et al., 2014). If successful, results may be generalised, and best practice widely implemented.

Paediatric neurorehabilitation is a highly specialist field within healthcare, focussed around a heterogeneous patient group of children with neuro-disabilities from acquired and congenital causes. With increasing numbers of children requiring neurorehabilitation, the need to identify causal links between rehabilitation delivered and outcomes, as well as identifying cost-effective treatments which lead to optimal outcomes for patients, families and society has never been greater (NHS England, 2013; Forsyth and Basu, 2015).

Physiotherapy has been defined as the process of helping people who are "affected by injury, illness or disability through movement and exercise, manual therapy, education and advice" (CSP, 2013a, para 1). The impact of physiotherapy can be better understood within the widely known framework of the International Classification of Functioning, Disability and Health, commonly referred to as the ICF (WHO, 2002); please see Figure 1 below for an illustration of this classification system.

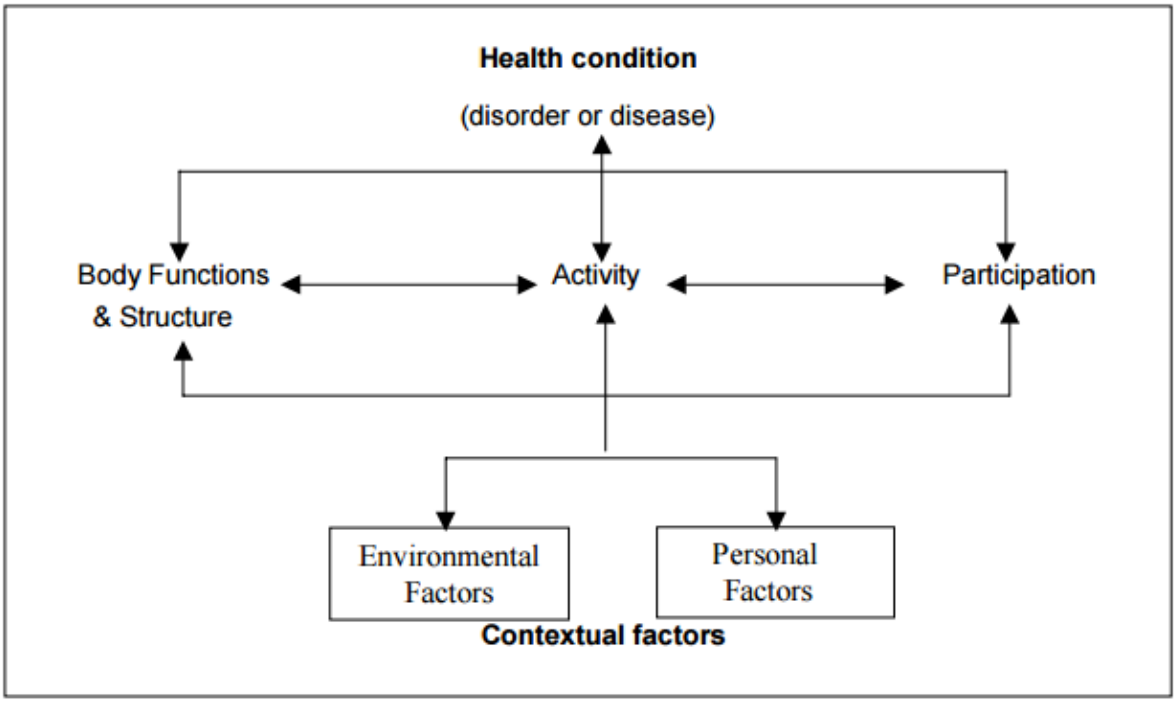

Figure 1 – World Health Organisation International Classification of Functioning, Disability and Health (2002)

It has been said that physiotherapy does not simply include interventions which are 'done to' a patient, but rather it consists of targeted interventions which are centred around the needs of the patient (Cott et al., 2011; CSP, 2013b). To date, extensive research evidence exists which focuses on the

effectiveness of physiotherapy within neurorehabilitation, but much of the evidence focusses on adults with stroke or brain injury (Evidence-Based Review of Stroke Rehabilitation, 2015).

Although physiotherapy is thought of as one of the mainstays of neurorehabilitation for children with neuro-disability (NHS England, 2013), understanding remains limited with regards to which physiotherapy interventions lead to improved outcomes for patients. As a result, physiotherapy has been referred to as a 'black box' whereby the mechanisms by which interventions work are not always well understood (Ballinger et al., 1999). What also remains unclear is the existence of dose-response relationships between the amount of therapy which is delivered (the 'dose') and the resultant severity-adjusted outcome (the 'response') for the patient (Haines et al., 2011). Whilst neurorehabilitation is very difficult to quantify, having a means by which to accurately and reliably measure dose-response relationships is an essential pre-requisite for any research which aims to quantitatively explore which therapeutic interventions lead to improved patient outcomes (Cott et al., 2011). If such a tool existed, then subsequent patient benefits through dissemination of best practice guidelines and protocols could be vast.

To date, attempts in the field of adult stroke have been made to capture and analyse the relationship between content and dose of therapy in terms of their impact on resultant patient outcomes (Horn et al., 2005; De Wit et al., 2006). Approaches which have utilised a taxonomy (classification) of different therapeutic interventions or those describing activity content and duration according to five-minute blocks in sub-acute adult stroke did not appear to demonstrate strong links between the therapy delivered and resultant functional outcomes (Gassaway et al., 2005; Horn et al., 2005; Latham et al., 2005; De Wit et al., 2006).

There are many potential reasons why these multi-centre studies may have been unable to identify strong links between the physiotherapy delivered and patient outcomes. One such reason may be that the methods used to capture and describe the content of physiotherapy were flawed. In both cases, therapy content was provided in micro-level, minute-by-minute detail, however, whilst descriptors such as 'gait training' provide some idea of what the patient was doing during the session, they do not attempt to understand why this intervention was chosen, what the core elements or active ingredients of the intervention were, or how these interventions affect the patient via a known mechanism of action (Dijkers et al., 2014).

An alternative method for the quantification of neurorehabilitation is to look past individual treatments themselves and to consider the theoretical underpinning upon which interventions are based; their ingredients and mechanisms of action (Whyte et al., 2014). Within the treatment theory illustration developed by Whyte et al (2014), the essential ingredients notable within treatment theory are said to be delivered alongside other active and inactive ingredients through a known or otherwise hypothesised mechanism of action, to the treatment target; see Figure 2 for more details.

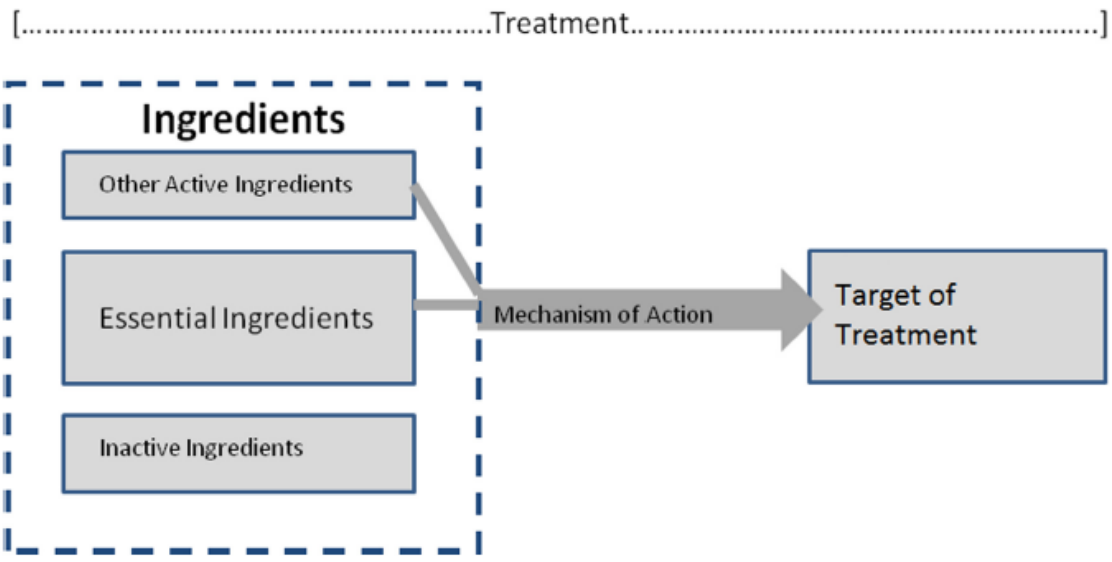

Figure 2 – Illustration of the basic structure of all treatment theories (Whyte et al., 2014)

To date, efforts have been made in paediatric neurorehabilitation to group active treatment ingredients together at the level of the whole Multi-Disciplinary Team; in doing so the Paediatric Rehabilitation Ingredients Measure (PRISM) tool has been developed (Forsyth et al, 2018). Whilst this approach is comprehensive, by design it is unable to 'zoom-in' to consider the impact of physiotherapy alone. The current research therefore aims to adopt complementary methods to those used during the development of the top-level items of PRISM, but instead develop detailed categorical descriptions of physiotherapy practice in paediatric neurorehabilitation. This piece of research falls within PRISM's top-level item improving 'child activity and function' due to the underlying definition of physiotherapy as outlined above. As this approach is novel within paediatric physiotherapy, experts will be consulted to develop an expert consensus. The research question and aims of this research are provided below.

Research question

Based on essential ingredients, actions and mediators expressed within treatment theory, what categories of therapeutic intervention exist within paediatric neurorehabilitation which are specific to physiotherapy? Are these categories well understood and agreeable to experts within the field?

Research aims:

1. To identify physiotherapy interventions used in paediatric neurorehabilitation
2. To group interventions into categories according to their essential treatment ingredients, actions and mediators as expressed within treatment theory
3. To establish expert consensus regarding the categories

Methods

In order to identify a comprehensive list of physiotherapy interventions used with children with neuro-disability a systematic literature search of five online databases; MEDLINE, EMBASE, AMED, CINAHL and PsycINFO was undertaken. Searches were limited to human participants and due to resource constraints only publications in the English language were accepted; no limit was applied to publication date. Hand searching of journal articles was also undertaken and identified papers were independently reviewed by two reviewers (D.Y. and R.F.) according to pre-set inclusion and exclusion criteria. The final list of interventions were then separated into individual treatment

categories based on common essential ingredients, actions and mediators with regular peer-debriefing taking place to ensure that this categorisation appeared appropriate.

A panel of 13 experts were purposively identified from the Association of Paediatric Chartered Physiotherapist's (APCP) Neuro-Disability specialist interest committee and invited to participate. This sample of 'experts', also referred to as informed individuals (McKenna, 1994; see Discussion for further details), were identified due to the fact that they constitute an elected committee specifically designed to represent paediatric physiotherapists working in neuro-disability at a national level. Each round of the survey was sent to experts as a link within an email together with a Participant Information Sheet and consent was sought prior to participation in the study. For each round, the panel were given two weeks to complete the survey with occasional reminders by email in an attempt to optimise response rates (Keeney et al., 2011). Participation was voluntary, and the resultant data captured was both quantitative (participants responding to questions using a five-point Likert scale) as well as qualitative (provision of free-text comments; Keeney et al., 2011). In the absence of a customary consensus threshold, a threshold of ≥75% agreement was set a priori. To undertake the survey, the online platform SurveyMonkey® (SurveyMonkey, 2017) was used and accessed via the University of East Anglia's School of Health Sciences pre-existing account. Ethics approval was obtained via the University of East Anglia's ethics committee (ref: 201617 64).

Quantitative data from the modified-Delphi survey was analysed using Statistical Package for the Social Sciences (SPSS, version 22). Within round-1 of the Delphi survey, the percentage of respondents who stated that they either 'agree' or 'strongly agree' with each statement was analysed to identify whether expert consensus (agreement ≥75%) had been reached. Where this was the case then that particular statement was said to have 'gained expert consensus' and did not proceed to the subsequent round (Keeney et al., 2011). Secondly, as the data was not continuous but could be ordered and divided into ranks then the central tendency and degree of variability of the data was analysed by way of non-parametric tests, providing the Median value and Interquartile Range for each statement (Machin et al., 2007; Barton and Peat, 2014). Statements which achieved an expert consensus of ≥75% in round-1 were removed and those remaining were taken forwards to round-2. In round-2 the consensus threshold was again set a priori to ≥75% to determine whether intervention categories should be combined based on expert consensus.

Where participants provided free-text comments, an inductive approach to data analysis was utilised in the form of content and thematic analysis, this enabled any pertinent themes to emerge from the data (Green and Thorogood, 2014). A concurrent reflexive diary was maintained to improve the trustworthiness of the process (Darawsheh, 2014). In addition, peer-debriefing was regularly undertaken to ensure that where emergent themes were identified, interpretations were reviewed to confirm that they appeared appropriate.

Statements within the survey were designed to explore categories in terms of their **comprehensiveness** (are all physiotherapy interventions used in paediatric neurorehabilitation considered); the **unambiguity** (clarity of category headings); and the **clinical meaningfulness** (can categories be carried out independently of one another).

Results

In total 4,191 records were identified through literature searching, with hand searching of electronic journals identifying three additional papers (Siebes et al., 2008; Levac et al., 2013; Di Rezze et al., 2014). Following the removal of duplicates, identified journals were then reviewed by two independent raters (D.Y. and R.F.). Following exclusion of inappropriate articles, a total of 652 articles were assessed for eligibility and 400 were taken forwards to inform intervention categorisation

according to common essential ingredients, actions and mediators; please see the PRISMA flow diagram detailed in Figure 3 for the breakdown of the phases described.

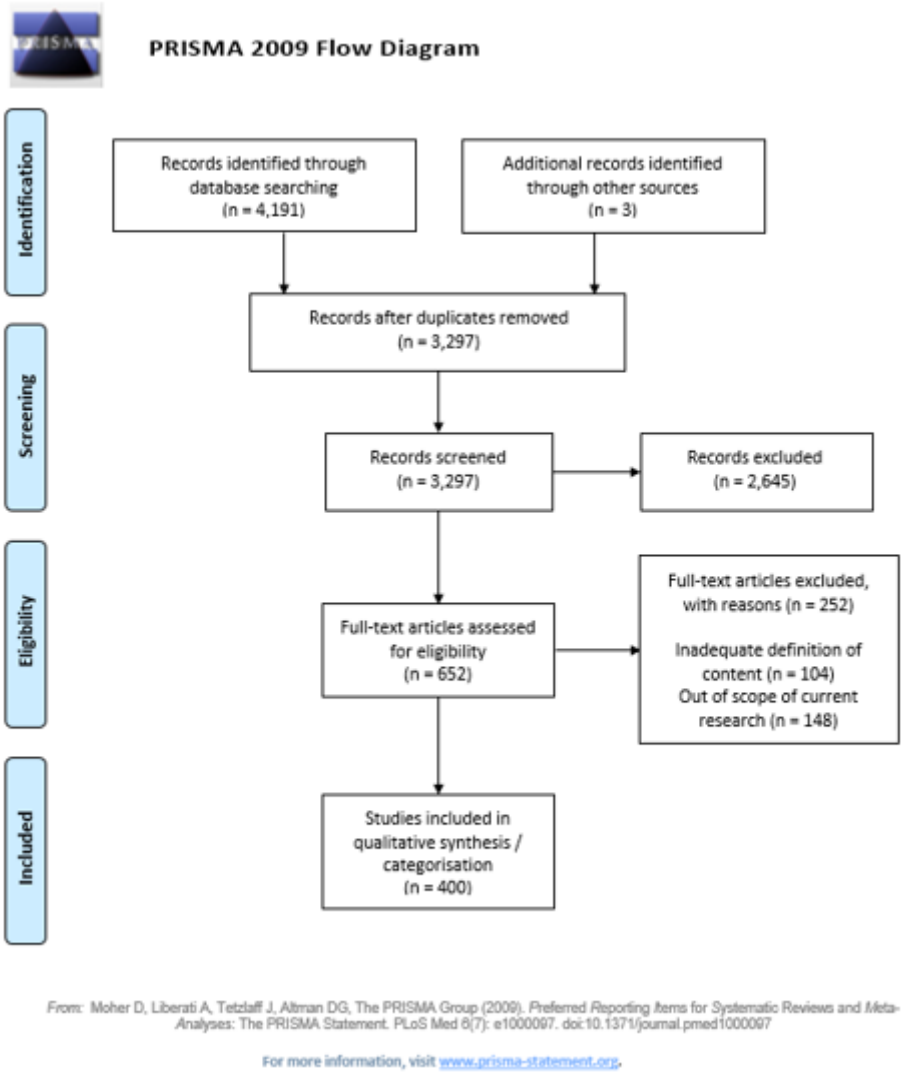

Figure 3 – PRISMA flow diagram

Grouping intervention according to common essential ingredients

Once the final list of 400 articles were identified, the process of grouping interventions according to explicit and theorised essential ingredients, actions and mediators could take place. This process was completed independently by two researchers (D.Y. and R.F.) to improve transparency and reduce the risk of bias (McDonagh et al., 2013). In total, eight distinct categories were identified within which all interventions were felt to have a place; a summary of which can be found in Table 1 and further information can also be found in Appendix 1.

Category	Description	Rationale	Examples
1.	Enabling implicit learning (learning-by-doing)	Providing feedback regarding body position, movements, forces generated	Hippotherapy, biofeedback, mirror therapy, Lycra suits, virtual reality
2.	Provision of explicit feedback (providing knowledge that can be understood and repeated back)	Learning through conscious, intentional thought; the provision of knowledge which can be understood and, where possible, repeated back	Giving written or verbal advice, cueing, mental practice, strategies
3.	Alteration of the properties of tissues through passive application of external forces	Utilise external forces to maintain or improve range of movement and function as well as aid or manage secondary complications from tonal changes	Serial casting +/- prior botulinum toxin-A injections, use of specialist seating to maintain alignment, use of standing frames for weight bearing
4.	Alteration of the dynamics of movement	Compensation for an impairment through the action of altering natural pattern of movement using an external aid or device	Ankle-Foot Orthoses, Functional Electrical Stimulation
5.	Use of task-specific, functional goals which are meaningful to the patient	Completing tasks which have a purpose within the daily life of the patient	Sitting and transfer practice, reach-to-grasp tasks
6.	Use of tailored progression	Graded exposure to tasks whereby the difficulty, intensity or complexity is tailored to provide the optimal level of challenge for the patient	Partial body weight device, strength training, aerobic training
7.	Repetition of movement	Completing treatments which require multiple repetitions of specific movements	Constraint induced movement therapy, treadmill walking
8.	Sensory integration	Treatments which aim to stimulate sensory systems and enable adaptation	Vestibular rehabilitation

Table 1 – Summary table outlining identified intervention categories, rationale and examples.

Modified-Delphi survey, round-1

Following the classification of interventions into the eight individual categories, a panel of 13 experts were consulted to seek expert opinion in an attempt to develop a consensus classification.

In total, eight out of 13 experts (62%) which worked across a range of clinical settings from acute care to the community completed the survey. All participants had over 10 years clinical experience of working in paediatric neurorehabilitation; five (63%) were Band 8a physiotherapists, two (25%) were Band 7 physiotherapists and one (13%) was an independent physiotherapist working privately.

Firstly, experts were in consensus agreement that they were clear about what this work is trying to achieve (12.5% Strongly Agree; 87.5% Agree). Secondly, respondents were in consensus agreement that the category headings appeared appropriate to them as a paediatric physiotherapist (25% Strongly Agree; 62.5% Agree). Consensus was not present, however, around the comprehensiveness of the categories as only 62.5% of respondents agreed that the categories included all possible treatments which are used in paediatric neurorehabilitation. In addition, only 62.5% of participants felt that categories were independent and could be targeted separately.

With regards to each of the eight treatment categories in turn, without a single exception, respondents were in consensus agreement that each of the individual category headings were sufficiently clear and unambiguous (≥75% agreement). What the participants were less certain about was the independence of each category to one another. For a full breakdown of results please see Appendix 2.

Findings gleaned through qualitative analysis identified that certain interventions were not included; these were 'hands on facilitation of movement', 'vibration therapy' and 'casts to support function'. It was also evident that respondents felt certain categories should be combined based on the similarity of their essential ingredients. For example, participant-8 commented that "when using virtual reality, you carry out repetition of movement within a situation meaningful to the patient". Additionally, of task-specific interventions, participant-4 commented that it was "clinically meaningful but not in isolation of other categories". As per design, these suggestions were taken forward to inform the content of round-2 of the modified-Delphi survey (Keeney et al., 2006).

Modified-Delphi survey, round-2

Statements which achieved an expert consensus of ≥75% in round-1 were removed; this therefore meant that all statements which related to the understanding and unambiguity of categories were removed. It was very apparent from the statements which remained that the independence of categories, and therefore the possibility that certain categories were different expressions of the same essential ingredients, required further investigation in round-2. For this reason, round-2 of the Delphi survey was redesigned to make this the central focus.

Typically, subsequent rounds of a Delphi survey are only sent to the respondents from the previous rounds, however the conscious decision was made to circulate round-2 of the Delphi survey to all 13 members of the expert panel. This decision was made as the focus of round-2 was slightly different to that of round-1 and the potential for receiving responses from more diverse pool of experts would be beneficial. This was a pragmatic decision which was made based on the level of consensus achieved for many of the statements in round-1 (Thangaratinam and Redman, 2005).

Round-2 of the modified-Delphi survey was completed by nine (69%) of the 13 members of the expert panel. Within this group of nine experts there were five (56%) band 8a physiotherapists, three (33%) were band 7 physiotherapist and one (11%) was a private practitioner. There were representatives of a range of clinical fields including inpatients, the community and a mixture of both. All nine (100%) of the respondents had extensive experience of over 10 years working in paediatric neurorehabilitation.

Only one question which did not achieve consensus from round-1 was repeated in round-2 and concerned the comprehensiveness of the work. In round-1, only 62.5% of respondents agreed that the eight category headings covered all relevant areas under which to consider any physiotherapy intervention within paediatric neurorehabilitation. Following the addition of recommended items (as outlined above), when this statement was repeated in round-2 it gained 100% consensus from the expert panel.

In total, from round-2 none of the possible category combinations achieved group consensus that they should be combined (i.e., no pairwise combination of categories exceeded the 75% threshold set to indicate group consensus). On three occasions, possible pairwise combinations were approaching group consensus, however did not meet the ≥75% consensus threshold (categories 1+5, 1+7 and 3+4, respectively). On each of these occasions, only six of the respondents (67%) indicated that they felt categories should be combined whilst three (33%) indicated that they did not feel categories should be combined. For a full breakdown of results from round-2 of the modified-Delphi survey, please see Figure 4 below.

Categories	1	2	3	4	5	6	7	8
1		22	11	33	67	33	67	11
2			11	22	22	33	44	11
3				67	0	22	22	11
4					22	44	44	11
5						56	56	22
6							56	22
7								0
8								

Key – box colour

- Quintile 5 (80-100% of participants felt that these categories represent the same essential ingredients)
- Quintile 4 (60-79% of participants felt that these categories represent the same essential ingredients)
- Quintile 3 (40-59% of participants felt that these categories represent the same essential ingredients)
- Quintile 2 (20-39% of participants felt that these categories represent the same essential ingredients)
- Quintile 1 (<20% of participants felt that these categories represent the same essential ingredients)
- Box representing the same category repeated twice
- Repetitions of previous category combinations

Figure 4 – Grid representing results from round 2 of the modified Delphi survey divided into quintiles.

Please note, individual cells have been colour coordinated according to the division of results into quintiles (results broken down into five equal thresholds of agreement; <20%, 20-39%, 40-59%, 60-79% and 80-100%) to aid interpretation.

Discussion

Through rigorous and structured literature searching together with dual-review of the literature, 34 distinct approaches utilised by physiotherapists in neurorehabilitation have been identified. A range of interventions shared common features and have been grouped together based on similarities expressed within treatment theory; the first of its kind within paediatric neurorehabilitation. Whilst interesting and potentially useful, in isolation the resulting classification of eight individual treatment categories lacks validity; it is for this reason that the acceptability, completeness and clarity of this categorisation has been further investigated through consulting experts within two rounds of a modified-Delphi survey (Morgan et al., 2007).

Qualitative data from round-1 suggests that certain categories could not be delivered independently of one another and therefore should be combined. This then became the primary focus of round-2 of the modified-Delphi survey. To explore this, experts were asked to identify whether they felt different categories were fundamentally expressions of the same essential ingredients and should therefore be combined. This question of the independence of different ingredient categories is very complex, particularly in neurorehabilitation where the distinction between ingredients of interventions are not always clear or well understood (Lang et al., 2015). Results from round-2 demonstrate that although certain categories were approaching the ≥75% consensus threshold (on three occasions 67% of experts were in agreement that categories should be combined), no categories were in fact combined.

Results from the modified-Delphi survey demonstrates that the division of physiotherapy interventions into eight categories is well understood, clear and acceptable to experts in the field. It has also been demonstrated that the same panel of experts are in consensus agreement that the categories which have been developed are both comprehensive, in that all interventions have a place to fit in this classification, whilst also being unambiguous, in that all who consider this categorisation will understand what is meant by each of the eight category headings. Furthermore, at no point did the expert panel suggest the need for any supplementary categories.

This research has utilised methodology which offers a more 'zoomed-out' perspective on conceptualising and measuring the effects of treatment ingredients as opposed to relatively 'zoomed-in' perspectives taken in previous work (Gassaway et al., 2005; De Wit et al., 2006; Dijkers et al., 2014; Whyte et al., 2014). This research also offers potential for quantitatively analysing the impact of paediatric physiotherapy on the functional outcomes of children with ABI. In doing so it has built on recent developments in the field of paediatric neurorehabilitation which has broadly categorised interventions into five comprehensive top-level items (Forsyth et al., 2018).

By the very nature of the research question being so specific to paediatric physiotherapy, the expert panel were required to be a homogenous group as consulting non-physiotherapists or physiotherapists working outside of paediatric neurorehabilitation would have been inappropriate (McKenna, 1994). The panel were purposively identified, and consideration was given to ensure that it included representatives from a range of different clinical specialisms and settings. Furthermore, all participants had over 10 years of experience working in paediatric neurorehabilitation and were highly banded senior clinicians which further strengthens the claim that they are informed individuals and therefore experts in the field (McKenna, 1994; Hamzeh et al., 2016).

Limitations of the current research do however exist and must be acknowledged. The purpose of this investigation was to develop an expert-lead consensus classification of physiotherapy interventions in paediatric neurorehabilitation. Here the approach used took the form of a modified-Delphi survey whereby original items were identified following a thorough review of the literature and categorisation of physiotherapy interventions prior to consulting experts. Whilst this is a recognised

and well-respected modification, a more traditional Delphi approach would have been to firstly consult experts to gain an understanding of current practice and identify a range of initial items which could be grouped together through thematic analysis (Jerosch-Herold, 2011; Keeney et al. 2011).

There are additional limitations which are innately associated with the use of a modified-Delphi survey to consult experts. Firstly, there is no established agreement in the literature which determines the appropriate percentage threshold to indicate group consensus (Boulkedid et al., 2011). The threshold which was set for this research was consensus agreement among experts of ≥75%; it could be argued that this was an arbitrary figure. Having said that, it was felt to be justified as it represents the current Median value within the published literature (Diamond et al., 2014).

There is additional disagreement with regards to the optimal size of an expert panel with reference in the literature being made to panel sizes of between 10 and 1,685 (Powell, 2003), whilst other research has consulted a panel of fewer than 10 experts (Jerosch-Herold, 2011). As homogeneous groups of experts are said to require fewer respondents (Skulmoski et al., 2007) and a larger number of experts have been shown to not influence the reliability and validity of the consensus process (Murphy et al., 1998) then a panel consisting of 13 paediatric physiotherapists was felt to be of an appropriate size for this research.

As with any survey, a small sample of participants leaves results susceptible to the influence of individuals, particularly those that vehemently maintain their view between rounds, referred to as outliers (Keeney et al., 2011). Within a small sample, the influence of an individual to dramatically alter results is far starker than the influence of an individual amongst a panel of tens or hundreds. A good illustration of this is that when comparing different ingredient categories in round-2, the current modified-Delphi survey was completed by nine participants. On three occasions, six of the nine participants (67%) were in agreement that categories should be combined; however, group consensus was not reached as this fell below the consensus threshold of ≥75%. If only one of the three individuals that answered 'no' would have changed their mind, then consensus would have been reached.

A further limitation of the current investigation is that ethics approval allowed for only two rounds of the modified-Delphi survey to be conducted. Whilst this is in accordance with the scope of this research, due to the overwhelming consensus gleaned in round-1, it could be said that each round represented a distinct survey which had a unique focus. It could also be argued that as a consequence, this modified-Delphi survey required additional rounds to provide the possibility of reaching group consensus, particularly in relation to the independence of different categories. It is plausible that with an additional round some participants may have changed their minds based on the strength of group opinion. In addition, the initial literature searches were subject to language limits being applied and therefore any literature which was not published in English was not identified. Whilst this is a genuine limitation of the current investigation, this pragmatic decision was required based on limited resource.

A final limitation is that expert opinion is considered to be the lowest level of research evidence within the hierarchy of evidence (Burns et al., 2011). As this research represents preliminary work for a novel approach designed to capture and analyse the content of physiotherapy treatment, it was not suitable to employ other forms of experimental design such as a randomised controlled trial, for example. At this stage, expert consultation was necessary with a view to undertaking further empirical research.

Thus far, a consensus has been reached regarding the comprehensiveness and unambiguity of this work amongst a small sample of expert paediatric physiotherapists. Further work is required which considers the opinions of a larger and more heterogeneous sample of participants. Consideration should additionally be given to the inclusion of literature which is not published in English and consultation of an international panel of experts would be beneficial which goes beyond the opinion of only those based in the United Kingdom. Exploration of the distinctions between the eight treatment categories is also required to gain a deeper qualitative understanding of whether they are truly independent of one another with regards to the essential ingredients, or whether certain categories should be combined.

In conclusion, it is evident that physiotherapy interventions within paediatric neurorehabilitation can be identified and divided into individual categories. It is also evident that this is a well understood approach which is acceptable to experts within the field. Whilst these categories have been said to be comprehensive and unambiguous according to expert consensus, it is also important to further investigate their independence from one another. This could then facilitate the development and subsequent implementation of a valid measurement tool for the analysis of physiotherapy treatment within clinical practice and empirical research. It is hoped that this work will positively contribute to the growing body of evidence which aims to improve the functional outcomes for children with neuro-disability in years to come.

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Appendix 1 – Summary table of ingredient categories

1. Enabling implicit learning (learning by doing)

- for example providing feedback regarding body position, movements, forces generated. We believe this is an important element of the mechanisms of action of
  - e.g. hippotherapy, EMG biofeedback, mirror therapy, lycra suits, virtual reality

2. Provision of explicit feedback (providing knowledge that can be understood and repeated back)

- for example giving written or verbal advice. We believe this is an important element of the mechanisms of action of
  - e.g. cueing, mental practice, strategies

3. Alteration of the properties of tissues through passive application of external forces

- for example of stretching muscles, tendons, capsules; techniques to reduce oedema. We believe this is an important element of the mechanisms of action of
  - e.g. serial casting +/- prior botulinum toxin injections, use of specialist seating to maintain alignment, use of standing frames for weight bearing

4. Alteration of the dynamics of movement

- for example provision of orthoses or devices which alter direction and magnitude of forces (biomechanics) upon the patient. We believe this is an important element of the mechanisms of action of
  - e.g. Ankle-Foot Orthoses, Functional Electrical Stimulation

5. Use of task-specific, functional goals which are meaningful for the patient

- for example practicing functional tasks. We believe this is an important element of the mechanisms of action of
  - e.g. sitting on the edge of the bed, transfers, reach to grasp tasks

6. Use of tailored progression

- for example where the difficulty of the task is tailored to provide the optimal level of challenge for the patient. We believe this is an important element of the mechanisms of action of
  - e.g. use of a partial body weight device, strength training, aerobic training

7. Repetition of movement

- for example completing treatments which require multiple repetitions of specific movements. We believe this is an important element of the mechanisms of action of
  - e.g. constraint induced movement therapy, treadmill walking

8. Sensory integration

- for example treatments which aim to stimulate senses and enable adaptation. We believe this is an important element of the mechanisms of action of
  - e.g. vestibular rehabilitation

Appendix 2 - Results table pertaining to participant's understanding of the contents and meaningfulness of the category headings

Question	Responses*	% (n)	Mean (SD)	Median	Interquartile range	Reached group consensus (Yes/No)
1. Implicit learning						
a. I understand what is being referred to under this heading	5	0 (0)	3.75 (0.46)	4.00	0.50	Yes
	4	75 (6)				
	3	25 (2)				
	2	0 (0)				
	1	0 (0)				
b. This category is clinically meaningful and using treatments wouldn't inevitably involve using other categories also	5	0 (0)	3.13 (0.83)	3.00	1.50	No
	4	37.5 (3)				
	3	37.5 (3)				
	2	25 (2)				
	1	0 (0)				
2. Explicit learning						
a. I understand what is being referred to under this heading	5	0 (0)	4.00 (0.00)	4.00	0.00	Yes
	4	100 (8)				
	3	0 (0)				
	2	0 (0)				
	1	0 (0)				
b. This category is clinically meaningful and using treatments wouldn't inevitably involve using other categories also	5	0 (0)	3.38 (0.74)	3.50	1.00	No
	4	50 (4)				
	3	37.5 (3)				
	2	12.5 (1)				
	1	0 (0)				

3.	**Application of external forces**						
	a. I understand what is being referred to under this heading	5 4 3 2 1	50 (4) 37.5 (3) 12.5 (1) 0 (0) 0 (0)	4.38 (0.74)	4.50	1.00	Yes
	b. This category is clinically meaningful and using treatments wouldn't inevitably involve using other categories also	5 4 3 2 1	12.5 (1) 37.5 (3) 37.5 (3) 0 (0) 12.5 (1)	3.38 (1.19)	3.50	1.00	No
4.	**Alterations of the dynamics of movement**						
	a. I understand what is being referred to under this heading	5 4 3 2 1	12.5 (1) 75 (6) 12.5 (1) 0 (0) 0 (0)	4.00 (0.53)	4.00	0.00	Yes
	b. This category is clinically meaningful and using treatments wouldn't inevitably involve using other categories also	5 4 3 2 1	12.5 (1) 37.5 (3) 37.5 (3) 12.5 (1) 0 (0)	3.50 (0.93)	3.50	1.00	No

5.	**Task-specific functional goals**						
	a. I understand what is being referred to under this heading	5 4 3 2 1	50 (4) 37.5 (3) 0 (0) 12.5 (1) 0 (0)	4.25 (1.04)	4.50	1.00	Yes
	b. This category is clinically meaningful and using treatments wouldn't inevitably involve using other categories also	5 4 3 2 1	25 (2) 25 (2) 37.5 (3) 0 (0) 12.5 (1)	3.50 (1.31)	3.50	1.50	No
6.	**Tailored progression**						
	a. I understand what is being referred to under this heading	5 4 3 2 1	50 (4) 37.5 (3) 12.5 (1) 0 (0) 0 (0)	4.38 (0.74)	4.50	1.00	Yes
	b. This category is clinically meaningful and using treatments wouldn't inevitably involve using other categories also	5 4 3 2 1	25 (2) 50 (4) 25 (2) 0 (0) 0 (0)	4.00 (0.76)	4.00	1.00	Yes

7.	**Repetition of movement**						
a.	I understand what is being referred to under this heading	5 4 3 2 1	50 (4) 50 (4) 0 (0) 0 (0) 0 (0)	4.50 (0.53)	4.50	1.00	Yes
b.	This category is clinically meaningful and using treatments wouldn't inevitably involve using other categories also	5 4 3 2 1	12.5 (1) 25 (2) 50 (4) 12.5 (1) 0 (0)	3.38 (0.92)	3.00	1.00	No
8.	**Sensory integration**						
a.	I understand what is being referred to under this heading	5 4 3 2 1	12.5 (1) 75 (6) 12.5 (1) 0 (0) 0 (0)	4.00 (0.53)	4.00	0.00	Yes
b.	This category is clinically meaningful and using treatments wouldn't inevitably involve using other categories also	5 4 3 2 1	0 (0) 62.5 (5) 25 (2) 12.5 (1) 0 (0)	3.50 (0.76)	4.00	1.00	No

*5-point Likert scale consisting of 5.Strongly agree/4.Agree/3.Neither agree nor disagree/2.Disagree/1.Strongly disagree