Musculoskeletal Science and Practice 44 (2019) 102053

Contents lists available at ScienceDirect

Musculoskeletal Science and Practice

journal homepage: www.elsevier.com/locate/msksp

Original article

A Delphi study to establish consensus on an educational package of musculoskeletal clinical prediction rules for physiotherapy clinical educators

Grahame M. Knox[a,b,*], Suzanne J. Snodgrass[c], Erica Southgate[d], Darren A. Rivett[c]

[a] The University of Newcastle, University Drive, Callaghan, NSW, 2308, Australia
[b] Physiotherapy Department, Orange Health Service, PO Box 319, Orange, NSW, 2800, Australia
[c] School of Health Sciences, Faculty of Health and Medicine, The University of Newcastle, University Drive, Callaghan, NSW, 2308, Australia
[d] School of Education, Faculty of Education and Arts, The University of Newcastle, University Drive, Callaghan, NSW, 2308, Australia

A B S T R A C T

Background: Clinical prediction rules (CPRs) are evidence-based tools to aid clinical decision-making, and there are many that are relevant for physiotherapists, especially in the musculoskeletal field. However, a lack of awareness and understanding by physiotherapy clinical educators could limit students' exposure to these potentially valuable tools. An educational package tailored for clinical educators could help them recognise the value of CPRs and implement them in clinical practice with students.

Objectives: To determine consensus on the essential content and optimal delivery of an educational package on musculoskeletal CPRs for physiotherapy clinical educators.

Design: An online survey of physiotherapy experts who have published on CPRs, using a Delphi approach.

Method: Sixteen experts were recruited for a two-round reactive Delphi study in which they rated previously identified elements, as well as suggesting new items for an educational package.

Findings: A pre-defined consensus of ≥70% identified that the content of an educational package should cover fundamental aspects of CPRs including why, when and how to use them clinically, and their limitations. Information on the evidence-base of different types of CPRs, with specific examples, was also identified as important. Online delivery was recommended via self-directed learning and webinars, along with electronic versions of actual CPRs. A self-assessment component was also supported.

Conclusions: An educational package on musculoskeletal CPRs for clinical educators was supported with key elements outlined by an international panel of experts.

Implications: Improving clinical educators' knowledge of CPRs may lead to physiotherapy students having a greater understanding and ability to use CPRs.

1. Introduction

Physiotherapists have a professional responsibility, primarily to their patients but also to third parties such as employers and funding bodies, to ensure that their clinical consultations include procedures and interventions that are consistent with best practice and are evidence-based (Glasziou and Haynes, 2005). Skills in clinical reasoning or decision-making underpin the clinical consultation process, as the clinician is required to make ongoing decisions about diagnosis, treatment and prognosis based both on the scientific evidence and clinical findings related to the presenting patient. However, effective clinical decision-making is not a skill that is easy to acquire or to teach to others (Jones and Rivett, 2019).

A tool that is increasingly available to assist the physiotherapist with their decision-making is the clinical prediction rule (CPR) (Brehaut et al., 2006; Eagles et al., 2008; Graham et al., 1998). CPRs are evidence-based tools that can assist the clinician with formulating a diagnosis, advancing a prognosis, or guiding the selection of ideal methods of intervention (Childs and Cleland, 2006). A CPR is a statistical algorithm that quantifies the relative contribution of patient characteristics and clinical features into numerical indices to predict the probability of a clinical condition or outcome (Beattie and Nelson, 2006). A CPR is developed in three stages: first derivation, in which it is initially created, usually in a small homogeneous population; second validation, involving testing in other populations for consistency, accuracy and reliability; and finally impact analysis, in which its influence is evaluated for its effect on clinician behaviour and acceptability, with consequent improvements in patient outcomes and/or financial savings while still maintaining standards of clinical care (Cook, 2008; McGinn et al., 2000).

* Corresponding author. Physiotherapy Department, Orange Health Service, PO Box 319, Orange, NSW, 2800, Australia.
E-mail addresses: Grahame.Knox@newcastle.edu.au (G.M. Knox), Suzanne.Snodgrass@newcastle.edu.au (S.J. Snodgrass), Erica.Southgate@newcastle.edu.au (E. Southgate), Darren.Rivett@newcastle.edu.au (D.A. Rivett).

https://doi.org/10.1016/j.msksp.2019.102053
Received 8 March 2019; Received in revised form 5 August 2019; Accepted 26 August 2019
Available online 29 August 2019
2468-7812/ Crown Copyright © 2019 Published by Elsevier Ltd. All rights reserved.

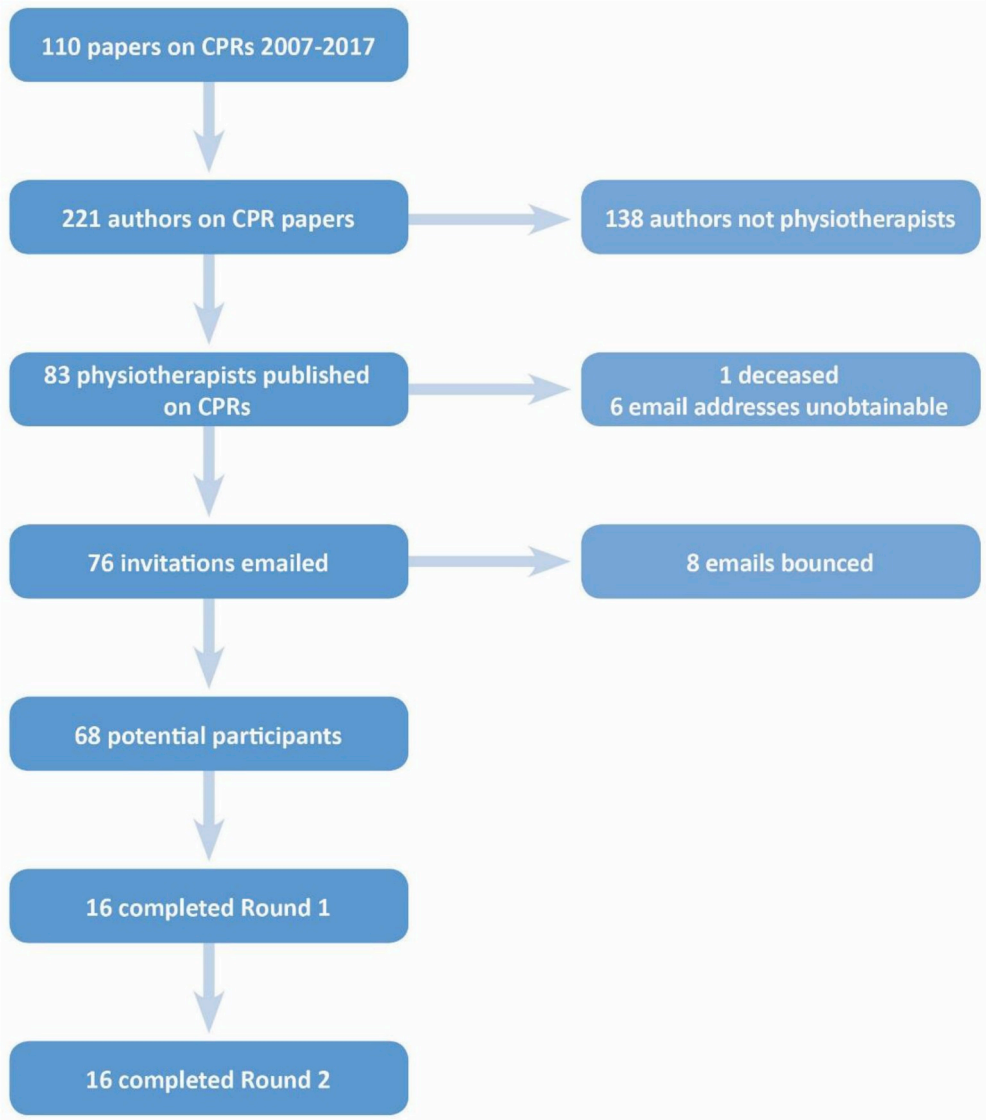

Fig. 1. Flow chart outlining the identification and recruitment of participants.

Although CPRs have been available in medicine since the 1960s (Deandrade and Casagrande, 1965; Keogh et al., 2014), their adoption in clinical practice by physiotherapists has been relatively slow due to a lack of awareness and understanding (Knox et al., 2015), along with a certain scepticism about their value in the clinical encounter (Haskins et al., 2014; Kelly et al., 2017). As physiotherapists who use CPRs report finding them helpful in decision-making (Knox et al., 2015, 2019) and as they are evidence-based, it may be beneficial for students to learn about them from their clinical educators during their formative clinical experiences.

Previous research has suggested physiotherapy clinical educators in Australia do not have much awareness of CPRs and thus are unlikely to use them when educating students, consistent with the reported experiences of Australian physiotherapy students (Knox et al 2015, 2017). In the same studies, both physiotherapy clinical educators and students expressed a desire to learn more about CPRs in physiotherapy practice. Physiotherapy clinical educators may therefore benefit from being offered a tailored educational package on CPRs (Au et al., 2016; Gartshore et al., 2017; Moule et al., 2014), which could enable them to use and teach CPRs to students in clinical practice. Given that nearly all CPRs relevant to physiotherapy practice are in the broader musculoskeletal field (including emergency department and orthopaedic) (Glynn and Weisbach, 2011; Knox et al 2015, 2017) arguably the focus of an educational package should be in this clinical area.

A recent study has identified potential elements of an educational package on musculoskeletal CPRs by interviewing physiotherapy clinical educators, including their suggestions for depth and scope of content as well as preferred options for availability and delivery (Knox et al., 2019). The present study aimed to refine and add to these preliminary ideas by consulting a panel of experts on CPRs for their recommendations on both content and delivery of such an educational package. The purpose of the proposed package would be to facilitate content expertise for clinical educators learning about CPRs, rather than actually provide a resource for teaching the use of CPRs to students – although the package could be the first step towards educators having the necessary understanding of CPRs to enable the teaching to occur. The Delphi approach was chosen as it is an established and reliable method of obtaining and utilising the considered opinion of experts, ascertaining the level of agreement, and determining the measure of consensus (Fink et al., 1984; Hasson et al., 2000; Hsu and Sandford, 2007; Powell, 2003). It is a structured and staged process consisting of iterative rounds designed to converge individual opinion into general agreement using summarised information and feedback.

2. Method

2.1. Design

A modified Delphi study was conducted using an online platform, consisting of two rounds. Although a Delphi study usually consists of three rounds, the main purpose of the first round is to generate factors for consideration, with the latter rounds rating and refining these factors. This generative type of first round was unnecessary in the present study as we used factors already identified by clinical educators in an earlier study (Knox et al., 2019), thereby attempting to link these factors with the experts' opinions, and also reduce the burden of participation for the experts. This modification to the approach is termed a reactive Delphi and is a useful means to avoid a first round which frequently generates an abundance of responses that are inter-related. These inter-related responses can be a problem whereby in condensing data for the second round, items may be omitted with the possibility of researcher bias (McKenna, 1994; Walker and Selfe, 1996). A Delphi study relies on the continued involvement of participants through to its completion, so another advantage is that by minimising the number of rounds there is less chance of participant fatigue and attrition (Fink et al., 1984; Giannarou and Zervas, 2014; Hasson et al., 2000; Powell, 2003).

2.2. Participants

Participants were selected purposefully on the basis of their experience and knowledge of CPRs (Akins et al., 2005; Hasson et al., 2000; Hsu and Sandford, 2007). Target participants were physiotherapy clinicians and academics with experience in post-professional education, and who were experts in CPRs, identified as those with recent (within the years 2007–2017) publications on CPRs in peer-reviewed journals, drawn internationally and recognised in their area of expertise.

2.3. Procedure

A list of potential participants was drawn up from peer-reviewed articles published on CPRs in the target time period (Fig. 1), with particular consideration given to first, second and last authors. From this, physiotherapists were identified and affiliations were scrutinised to confirm their involvement in post-professional education. Then a search for email addresses commenced, from the papers on CPRs, from other papers by the same authors, and from professional networks. This resulted in a list of 82 expert physiotherapists, recently published on the topic of CPRs, although email addresses were unavailable for six of these and many other email addresses could not be confirmed as being current. Initial contact was made by emailed letter of invitation, which described the study aim and included a copy of the participant Information Statement. Sixteen of the 68 potential participants completed both rounds of the Delphi study. Informed consent was implied by the completion of Questionnaire 1.

2.3.1. Question formats

The questions were in two formats. Firstly, participants were provided with a list of suggestions, from which they could select as many or as few as they felt relevant. Secondly there were questions with a five-point Likert scale, with participants being asked to rate factors as follows:

1. *Essential* – the selected item is an extremely important part of a learning package.
2. *Important* – the selected item is an important part of a learning package.
3. *Undecided* – uncertain of the importance of the selected item as part of a learning package.
4. *Not important* – the selected item is not an important part of a learning package.
5. *Insignificant* – there is absolutely no importance whatsoever of the selected item as part of a learning package.

Round 1 The questionnaire for Round 1 was developed from items derived from data obtained in a previous qualitative study (Knox et al., 2019) consisting of interviews with physiotherapy clinical educators, which used thematic analysis to develop themes and sub-themes (Gale et al., 2013). These items were listed as the clinical educators suggested, with no editing by the researchers, and consisted of three sections:

1) Suggestions for content of the educational package, comprising 11 questions with a Likert scale, followed by 12 examples of CPRs for selection;
2) One question on presentation and delivery, with 11 options for selection, along with a question on the length of the package; and
3) A final section on self-assessment, consisting firstly of a Likert scale on whether an assessment should be included, followed by three assessment formats for consideration.

Participants were also given the opportunity to make further suggestions for content, presentation and delivery, and self-assessment, as well as being encouraged to make general comments, such as to explain their choices.

Upon the completion of Round 1, items were analysed for the level of consensus (Likert questions) and the degree of support (optional selections). Suggestions from participants were analysed for similarity to items already in the questionnaire, and to suggestions from others, and any new items were added to the questionnaire for Round 2. This resulted in five extra items within the questions about content to be included in a CPR educational package, and four additional examples of specific CPRs to be included in a package. There were no further suggestions relating to presentation, delivery or self-assessment. Some items were reworded for clarity and for inclusion of new suggestions that were related. Irrespective of the level of support indicated in Round 1, no items were deleted by the authors and all were included in Round 2, in order to avoid any researcher bias.

Round 2 provided participants with a summary of the proportion of responses for each answer to each question from Round 1, and asked the participants to once again rate the factors but with consideration of the relative importance given to the factors by the Delphi group ratings in Round 1. It has been suggested that people may modify their views based on the opinions of others (Mead and Moseley, 2001) and so the feedback process used here gave the participants the opportunity to reconsider their original responses and perhaps change their opinion based on that of the whole group. This opportunity to revise opinions is a critical element in the progression towards consensus (Powell, 2003). The feedback provided did not identify individual participants' opinions or comments and preserved group anonymity, so participants were able to retract, revise or add to their opinions without losing face, and thus the views expressed were likely to be more honest and representative (Sumsion, 1998; Walker and Selfe, 1996; Williams and Webb, 1994).

Each round was conducted over a period of three weeks, with reminders sent at the end of the first and second weeks.

2.4. Data analysis

A critical consideration in any Delphi study is the issue of consensus. The purpose of a multiple-round survey, with feedback to participants as to previous responses, is to achieve consensus by advising participants what others are thinking. A systematic review of Delphi studies found that definitions of consensus varied considerably (Diamond et al., 2014), but several are available and workable (Fink et al., 1984). Consensus in this study was defined as 70% or more agreement within

Table 1
Demographic and academic characteristics of participants.

	n (%)	Range	Mean (SD)
Gender	male 11 (69) female 5 (31)		
Age		32–68	49.7 (9.5)
Years as a physiotherapist		7–45	25.0 (9.9)
Years as a clinical educator		3–36	17.9 (9.3)
Years in conducting research		4–36	19.0 (7.7)
Years teaching and/or researching CPRs		3–18	11.0 (4.1)
Years aware of CPRs		9–20	14.4 (3.3)
Location	Australia 7 (44) United States 7 (44) Canada 1 (6) United Kingdom 1 (6)		

CPR – clinical prediction rule; SD – standard deviation.

two points on the five-point Likert scale, or as a 70% or more level of support of listed items, as used or recommended by many previous studies (Akins et al., 2005; Brown et al., 2005; de Villiers et al., 2005; French et al., 2017; Hasson et al., 2000; McMahon et al., 2014; Rushton et al., 2014; Sumsion, 1998).

Statistical analysis was performed on the Likert scale questions, with mean and median indicating overall support and central tendency, and with standard deviation (SD) reflecting the amount of dispersion between responses, and variance for determining homogeneity (Giannarou and Zervas, 2014; Hasson et al., 2000; Hsu and Sandford, 2007). This process ensured that the opinions of each participant were represented in the final analysis.

3. Findings

3.1. Participants

Sixteen experts were recruited for Round 1, with all 16 completing Round 2 for a 100% continuation rate (Fig. 1). A summary of participant demographics is shown in Table 1. The majority had considerable experience as physiotherapists and as academics, and all had been aware of CPRs for at least 9 years. Most participants were from the United States (44%, n = 7) or Australia (44%, n = 7); 69% were male. The 16 participants were broadly representative of the 76 experts identified for invitation, of whom 49% were from the US, 24% from Australia, and 67% were male. The higher relative proportion of Australian participants was likely due to professional networks, with most of the Australian respondents known personally to the authors.

3.2. Content of an educational package

Results are summarised in Tables 2–4. There was strong support from the panel to include almost all of the proposed general information items, including all of the suggestions from the clinical educators and all but one of the new suggestions by participants (Table 2). Except for item 16, "How to explain the use of CPRs to patients", most participants rated items as being either essential or at least important for inclusion; not one item was rated as insignificant and no more than one respondent rated any of these as not important.

Although 16 CPRs were listed as possible examples for inclusion in an educational package, only four gained consensual support above the 70% requirement (Table 3), with most of the rest only gaining support from less than one-third of participants. Table 3 also includes the achieved stages of development for the 16 CPRs, for relative comparison.

Table 2
Consensus from survey of experts in CPRs (n = 16) on content of an educational package (general information) – n (%).

	1. Essential	2. Important	3. Undecided	4. Not important	5. Insignificant	Mean (SD)	Median	Variance
1. Brief definition/description of CPRs	14 (88)	2 (13)	0 (0)	0 (0)	0 (0)	1.1 (0.3)	1.5	0.1
2. Why use CPRs – their purpose, and relevance to clinical practice	13 (81)	2 (13)	1 (6)	0 (0)	0 (0)	1.3 (0.6)	2.0	0.3
3. When & how to use CPRs – the benefits, and integration with other forms of reasoning and with other assessment processes	12 (75)	4 (25)	0 (0)	0 (0)	0 (0)	1.3 (0.5)	1.5	0.2
4. When not to use CPRs – limitations and disadvantages, the ability to "override the rule", and alternatives to using CPRs	12 (75)	4 (25)	0 (0)	0 (0)	0 (0)	1.2 (0.4)	1.5	0.2
5. Information to improve familiarity with & understanding of CPRs	8 (50)	8 (50)	0 (0)	0 (0)	0 (0)	1.5 (0.5)	1.5	0.3
6. Information on the evidence basis of specific CPRs	8 (50)	8 (50)	0 (0)	0 (0)	0 (0)	1.5 (0.5)	1.5	0.3
7. Information to dispel myths & misunderstandings about CPRs	4 (25)	11 (69)	1 (6)	0 (0)	0 (0)	1.8 (0.5)	2.0	0.3
8. Case scenarios demonstrating the use of specific CPRs	4 (25)	11 (69)	1 (6)	0 (0)	0 (0)	1.8 (0.5)	2.0	0.3
9. Background information on CPRs in general, such as their stages of development	3 (19)	13 (81)	0 (0)	0 (0)	0 (0)	1.8 (0.4)	1.5	0.2
10. Examples of CPRs for different purposes and how they need to be developed differently, i.e. interventional, prognostic, diagnostic	3 (19)	11 (69)	1 (6)	1 (6)	0 (0)	2.0 (0.7)	2.5	0.5
11. A list of what CPRs exist	3 (19)	10 (63)	2 (13)	1 (6)	0 (0)	2.1 (0.7)	2.5	0.5
12. Access to further information – research papers where specific CPRs underwent impact analysis	4 (25)	9 (56)	2 (13)	1 (6)	0 (0)	2.0 (0.8)	2.5	0.6
13. Access to further information – research papers where specific CPRs were validated	2 (13)	11 (69)	3 (19)	0 (0)	0 (0)	2.1 (0.5)	2.0	0.3
14. Access to further information – research papers where specific CPRs were derived	1 (6)	14 (88)	1 (6)	0 (0)	0 (0)	2.0 (0.4)	2.0	0.1
15. What happens if you don't use CPRs – such as consistency in clinical decision-making	2 (13)	12 (75)	1 (6)	1 (6)	0 (0)	2.1 (0.7)	2.5	0.4
16. How to explain the use of CPRs to patients	5 (31)	3 (19)	4 (25)	4 (25)	0 (0)	2.4 (1.1)	2.5	1.3
Inclusion of a self-assessment component	9 (56)	5 (31)	2 (13)	0 (0)	0 (0)	1.6 (0.7)	2.0	0.5

CPR – clinical prediction rule; SD – standard deviation.

Table 3
Consensus from survey of experts in CPRs (n = 16) on content of an educational package (specific CPRs to be included).

CPR	Level of support – n (%)	Stage of development of CPR
1. Ottawa ankle rule	16 (100)	Impact analysis
2. Ottawa knee rule	16 (100)	Impact analysis
3. Canadian C-Spine Rule	15 (94)	Impact analysis
4. Diagnosis of Deep Vein Thrombosis	13 (81)	Impact analysis
5. Intervention for low back pain	10 (63)	Validation
6. Prognosis for whiplash associated disorder	9 (56)	Validation
7. When to manipulate a lumbar spine	5 (31)	Validation
8. Diagnosis of a Sacroiliac Joint problem	5 (31)	Validation
9. Diagnosis of rotator cuff tears	4 (25)	Validation
10. Diagnosis of subacromial impingement	4 (25)	Derivation
11. Diagnosis of cervical spine myelopathy	4 (25)	Validation
12. Diagnosis of cervical spine radiculopathy	4 (25)	Derivation
13. Ottawa subarachnoid haemorrhage (SAH) rule for headache evaluation	3 (19)	Validation
14. Intervention for chronic plantar heel pain	2 (13)	Derivation
15. NEXUS C-Spine Rule	1 (6)	Validation
16. Diagnosis of cervical spondylosis	1 (6)	Derivation

CPR – clinical prediction rule.

Table 4
Consensus from survey of experts in CPRs (n = 16) on format options for presentation and delivery of an educational package.

	Level of support – n (%)
Format	
Online modules – i.e. self-directed learning	16 (100)
Written information – electronic versions that can be saved	14 (88)
Webinars	12 (75)
Face-to-face lectures involving instruction in CPRs	7 (44)
Face-to-face practical sessions – practising the application of CPRs in the clinic	7 (44)
Apps	7 (44)
Podcasts	5 (31)
Written information – handouts in hard copy	4 (25)
A course or education day specifically on CPRs	3 (19)
As part of education/training days on other subjects as well	2 (13)
Videos	1 (6)
How long should an educational package take to complete?	
15–20 min	1 (6)
2–3 h	3 (19)
4–6 h	3 (19)
8 h/1 day	5 (31)
20 h	1 (6)
Time not specified/missing data	3 (19)
Format of a self-assessment component:	
Scenario-based questions	16 (100)
Multiple choice questions – where just one option is chosen	7 (44)
Tick box questions – where multiple options can be chosen	1 (6)

CPR – clinical prediction rule.

3.3. Presentation and delivery of an educational package

Table 4 shows the level of support for various options for presentation and delivery of an educational package. Even though participants could have supported all of these options had they wished, they varied in their selection and consensus could only be reached on three options, with two of these online (self-directed learning and webinars). There was also considerable support and consensus for clinical educators being able to save electronic versions of actual CPRs. After this, there was moderate support for face-to-face options of instruction and practice. There was no consensus reached on how long an educational package should take to complete with most responses within a range of 2–8 h.

There was strong support and consensus on including a self-assessment component, with no panel member against the idea and only two undecided (Table 2). However the only format that reached consensus was scenario-based questions, which in fact had unanimous support (Table 4), although there was also some support for multiple choice questions.

4. Discussion

This Delphi survey of expert physiotherapy clinicians and academics was conducted to gain consensus on the content and delivery of an educational package on CPRs for physiotherapy clinical educators. The scope of the study was limited to experts commenting on a proposed package to provide educators with a resource to enable them to improve their own awareness and understanding of the use of CPRs in a clinical setting. The Delphi approach is a widely used and recognised method for obtaining expert opinion on a topic. The use of a panel of respondents with relevant knowledge and experience in the subject improves the content validity of the outcome, and the use of consecutive rounds of questionnaires improves concurrent validity (Hasson et al., 2000; Walker and Selfe, 1996; Williams and Webb, 1994). Although each Delphi study is unique, our defined level of consensus at 70% is a commonly chosen mark that reflects a greater measure of support in this group of experts than just a simple majority.

Delphi studies have been undertaken with panels of various sizes ranging from 4 to 3000 (Cantrill et al., 1996) although larger panels become difficult to administer and often have poor response rates (de Villiers et al., 2005). One recent systematic review of Delphi studies found that many had 11-25 participants by the final round (Diamond et al., 2014), and other studies agree that reliable results can be achieved by a homogeneous group of 10–20 experts (Akins et al., 2005; Cook et al., 2006; Giannarou and Zervas, 2014; Henry et al., 1987; Jeffery et al., 2000). Our panel of 16 experts is therefore consistent with these findings. Powell (2003) further suggests that it is the qualities of the panel rather than the number of experts that determine whether it is representative. Even though they are all experts in the given field they are likely to have a variety of viewpoints and opinions, and it is this diversity that results in a valid outcome. Consistency of participation through the rounds is also a significant factor, and enlisting the help of those who are willing to devote the time required is possibly more important than the number recruited (Sumsion, 1998). In this regard it is pleasing all 16 experts in the present study completed all rounds.

The panel of 16 participants selected by consensus a large amount of material to be contained in an educational package on CPRs. A lower SD and variance indicate that scores are closer to the mean and demonstrate a strong consensus (Williams and Webb, 1994): the SD for the first 15 items in Table 2 was no more than 0.8 and variance consistently less than 0.6, indicating strong consensus from our panel. On examining these 15 items, all of which were recommended for inclusion, there is a depth and breadth of information on CPRs that suggests

the expert panel considered clinical educators should be well versed in the use of musculoskeletal CPRs and understand the basis of their development. Notably, the evidence base of specific CPRs, and access to further related information including the research papers describing their derivation, validation, and impact analysis, has strong support. An understanding of the scientific evidence for specific CPRs may arguably improve their acceptability to clinical educators. Further, an understanding of the limitations of CPRs in general and also specific to particular CPRs (e.g. stage of development attained), might assist educators in their judicious application in clinical practice and education.

One particular item, "How to explain the use of CPRs to patients", did not realise a similar level of agreement, with a wider spread of expert ratings from 'essential' to 'not important'. The descriptive statistics confirm the panel had a lack of consensus about this item, with SD and variance both greater than 1. Interestingly, all the other items relate to information directly for clinicians themselves, with this being the only item relating to patients, so it would seem that although there were no comments from the panel clarifying their opinion, there were differing views on the advisability of explaining CPRs to patients.

The spread of opinion regarding specific CPRs for inclusion likely reflects the backgrounds and personal interests of the panel members, and the four new suggestions by participants (Items 11–14, Table 3) received only minor support. Significantly, the four CPRs with the most support (Items 1–4, Table 3) are well-known, widely-used, and have all gone through the final stage of impact analysis and been found to have a favourable impact on both patient outcomes and healthcare resources. Notably respondents were, by consensus, strongly in favour of the item which recommends including "Examples of CPRs for different purposes and how they need to be developed differently, i.e. interventional, prognostic, diagnostic" (Item 10, Table 2). So although consensus was reached at the predetermined level of 70% on only four specific CPRs (Ottawa ankle rule, Ottawa knee rule, Canadian C-spine rule, and diagnosis of deep vein thrombosis – all of which are screening/diagnostic) it might be worth considering the inclusion of the next two CPRs (Items 5 & 6 Table 3) in an educational package for which there was majority (56% consensus) support and which would satisfy the criterion of examples for each purpose (intervention for low back pain, and prognosis for whiplash associated disorders).

In considering the formats for presentation and delivery, participants recommended the modular, flexible options offered by online self-directed learning and webinars. This is consistent with adult learning theory, whereby adults exhibit characteristics of being ready to learn, being orientated towards learning, and being motivated to learn (Knowles, 1984). Once clinical educators have adopted these characteristics of adult learning, an online educational package may enable them to utilise these characteristics to learn about CPRs. Similarly the other delivery option on which there was consensus, providing electronic versions of CPRs that could be saved, would also enable clinical educators to learn or revise any CPR as the need arose and time permitted. Despite this consensus, some participants supported face-to-face and practical learning modes, commenting "Practical sessions are really critical for administering and interpreting", and a "Mix of independent learning and face to face might work well for this content". So although the face-to-face delivery options did not individually gain sufficient support (Items 4 & 5, Table 4), there was combined approval for one or both of these face-to-face options from ten respondents (63%).

The participants were undecided on the length of any educational package, and this may reflect the challenge of balancing the comprehensiveness of the material with a pragmatic consideration of time available for busy clinical educators. This interpretation is supported by the flexible delivery options chosen by expert consensus which allow clinical educators to learn at their own pace with bite-sized pieces of information. Given the volume of material supported for inclusion, it is not surprising that a majority of those experts that specified a total time period required for learning, recommended between half a day and a full day (8/13, 62%).

There was consensus amongst the panel for some form of self-directed assessment, designed so that the learner (clinical educator) could evaluate their own knowledge acquisition (Eva and Regehr, 2008). The recommendation of scenario-based questions in any self-assessment reflects the importance given by participants to the practical application of CPRs as part of clinical decision-making. This may involve applying clinical reasoning skills, deciding which CPR to use, recognising the criteria in a patient presentation, and using the rule in a real sense. There was some support for multiple choice questions as well, and in preparing an educational package it may be worth scattering some multiple choice questions throughout the material for immediate, instant feedback, while also situating scenario-based questions at key junctures after clinical educators have gained a deeper level of understanding.

An educational package, as proposed and supported by clinical educators (Knox et al., 2019) and endorsed by the expert panel in this Delphi study, could assist physiotherapy clinical educators by promoting their understanding and clinical use of CPRs. The package should be designed such that clinical educators could learn about the extent and purpose of CPRs, and to improve their awareness and understanding of their clinical application. However the scope of the proposed package, and the scope of this study, is limited to developing resources to aid clinical educators as learners about CPRs. It was not intended to additionally develop resources for clinical educators to improve their teaching skills related to CPRs, as this would involve a much greater depth of study to determine and recommend strategies and resources for teaching in a clinical setting. Nevertheless, having learned about CPRs and gained a better understanding, clinical educators may be better prepared to enable physiotherapy students to apply CPRs in their clinical learning and practice.

5. Limitations

Findings in a Delphi study are limited to the panel's experiences, opinions and willingness to share (Cook et al., 2005), and there are no standardised guidelines for the definition or selection of experts (Dewitte et al., 2018; Hsu and Sandford, 2007). The findings describe expert opinion rather than fact, and the development of consensus, even by a panel of experts, does not guarantee that the 'correct' answer has been found. The relatively modest number of participants in the present study, while arguably still being an acceptable number (Diamond et al., 2014), may have somewhat limited the range of views. The original response rate (16 respondents from 68 potential participants, 24%) is also relatively low, although the true rate may actually be higher as some email addresses may not have been current. It is unfortunate that few experts from Europe participated as it would have been interesting to see if their views were reflective of the opinions expressed by North American and Australian participants. On the other hand, the zero attrition rate is a strength of this study.

6. Future research

Further research may seek to validate our findings. Alternatively, it may be viewed that this study's findings form an adequate basis for developing a CPR educational package for physiotherapy clinical educators as learners of CPRs, with due consideration given to educational theory and how it applies to adult learning. Following development, the package would need to be piloted in a study prior to widespread implementation, with ongoing evaluation of its acceptance and effectiveness. Attention would need to be given to ongoing updates as further CPRs are derived and current ones are validated or analysed for impact. Following the implementation of the package, subsequent studies could then explore what clinical educators would need in terms of information, strategies and resources to enable them to teach similar content to students in the clinical setting, and how this might be formulated.

7. Conclusions

This Delphi study has conducted an international consensus survey of physiotherapy experts in CPRs and resulted in recommendations for content of an educational package on CPRs designed for physiotherapy clinical educators, along with recommended methods for presentation and delivery. The key findings from this investigation indicate such a package should contain comprehensive information on all relevant aspects of CPRs, including when, how, and why to use the three types. The provision of background information on the evidence-base of CPRs may improve their clinical acceptance, and the inclusion of a self-assessment component might aid the learning of clinical educators. Specific examples of musculoskeletal CPRs should be included, particularly the better developed ones such as the Ottawa rules. Online availability of the package would ensure access by clinical educators irrespective of geographical location and work hours, and the ability to save electronic versions of individual CPRs would facilitate review and implementation as required.

Conflicts of interest

None declared.

Ethical approval

Ethical approval for the study was granted by the University of Newcastle Human Research Ethics Committee (approval number H-2018-0154).

Funding

Not applicable.

Acknowledgments

We gratefully acknowledge the participation of our international panel and thank them for their time and expertise, including Kim Bennell, Mark Bishop, Josh Cleland, Chad Cook, Sarah Eberhart, Tim Flynn, Doug Gross, Mark Hancock, Robin Haskins, Joan Kelly, Tom McPoil, Stephen May, and Zoe Michaleff.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.msksp.2019.102053.

References

Akins, R.B., Tolson, H., Cole, B.R., 2005. Stability of response characteristics of a Delphi panel: application of bootstrap data expansion. BMC Med. Res. Methodol. 5, 37. https://doi.org/10.1186/1471-2288-5-37. 2005 Dec 1.

Au, J., Perriman, D.M., Bolton, C., Abbott, L., Neeman, T., Smith, P.N., 2016. AO pelvic fracture classification: can an educational package improve orthopaedic registrar performance? ANZ J. Surg. 86 (12), 1019–1023. https://doi.org/10.1111/ans.13761. Epub 2016 Sep. 14.

Beattie, P., Nelson, R., 2006. Clinical prediction rules: what are they and what do they tell us? Aust. J. Physiother. 52 (3), 157–163.

Brehaut, J.C., Stiell, I.G., Graham, I.D., 2006. Will a new clinical decision rule be widely used? The case of the Canadian C-spine rule. Acad. Emerg. Med. 13 (4), 413–420.

Brown, A.K., O'Connor, P.J., Roberts, T.E., Wakefield, R.J., Karim, Z., Emery, P., 2005. Recommendations for musculoskeletal ultrasonography by rheumatologists: setting global standards for best practice by expert consensus. Arthritis Rheum. 53 (1), 83–92. https://doi.org/10.1002/art.20926.

Cantrill, J.A., Sibbald, B., Buetow, S., 1996. The Delphi and nominal group techniques in health services research. Int. J. Pharm. Pract. 4 (2), 67–74.

Childs, J.D., Cleland, J.A., 2006. Development and application of clinical prediction rules to improve decision making in physical therapist practice. Phys. Ther. 86 (1), 122–131. https://doi.org/10.1093/ptj/86.1.122.

Cook, C., Brismee, J.M., Fleming, R., Sizer Jr., P.S., 2005. Identifiers suggestive of clinical cervical spine instability: a Delphi study of physical therapists. Phys. Ther. 85 (9), 895–906.

Cook, C., Brismee, J.M., Sizer Jr., P.S., 2006. Subjective and objective descriptors of clinical lumbar spine instability: a Delphi study. Man. Ther. 11 (1), 11–21. https://doi.org/10.1016/j.math.2005.01.002.

Cook, C., 2008. Potential pitfalls of clinical prediction rules. J. Man. Manip. Ther. 16 (2), 69–71.

de Villiers, M.R., de Villiers, P.J., Kent, A.P., 2005. The Delphi technique in health sciences education research. Med. Teach. 27 (7), 639–643.

Deandrade, J.R., Casagrande, P.A., 1965. A seven-day variability study of 499 patients with peripheral rheumatoid arthritis. Arthritis Rheum. 8 (2), 302–334.

Dewitte, V., De Pauw, R., De Meulemeester, K., Peersman, W., Danneels, L., Bouche, K., Roets, A., Cagnie, B., 2018. Clinical classification criteria for nonspecific low back pain: a Delphi-survey of clinical experts. Musculoskelet. Sci. Pract. 34, 66–76. https://doi.org/10.1016/j.msksp.2018.01.002.

Diamond, I.R., Grant, R.C., Feldman, B.M., Pencharz, P.B., Ling, S.C., Moore, A.M., Wales, P.W., 2014. Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. J. Clin. Epidemiol. 67 (4), 401–409. https://doi.org/10.1016/j.jclinepi.2013.12.002.

Eagles, D., Stiell, I.G., Clement, C.M., Brehaut, J., Taljaard, M., Kelly, A.M., Mason, S., Kellerman, A., Perry, J.J., 2008. International survey of emergency physicians' awareness and use of the Canadian cervical-spine rule and the Canadian computed tomography head rule. Acad. Emerg. Med. 15 (12), 1256–1261. https://doi.org/10.1111/j.1553-2712.2008.00265.x.

Eva, K.W., Regehr, G., 2008. "I'll never play professional football" and other fallacies of self-assessment. J. Continuing Educ. Health Prof. 28 (1), 14–19.

Fink, A., Kosecoff, J., Chassin, M., Brook, R.H., 1984. Consensus methods: characteristics and guidelines for use. Am. J. Public Health 74 (9), 979–983.

French, S.D., Beliveau, P.J.H., Bruno, P., Passmore, S.R., Hayden, J.A., Srbely, J., Kawchuk, G.N., 2017. Research priorities of the Canadian chiropractic profession: a consensus study using a modified Delphi technique. Chiropr. Man. Ther. 25, 38. https://doi.org/10.1186/s12998-017-0169-4.

Gale, N.K., Heath, G., Cameron, E., Rashid, S., Redwood, S., 2013. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. BMC Med. Res. Methodol. 13, 117. https://doi.org/10.1186/1471-2288-13-117.

Gartshore, E., Briggs, L., Blake, H., 2017. Development and evaluation of an educational training package to promote health and wellbeing. Br. J. Nurs. 26 (21), 1182–1186. https://doi.org/10.12968/bjon.2017.26.21.1182.

Giannarou, L., Zervas, E., 2014. Using Delphi technique to build consensus in practice. Int. J. Bus. Sci. Appl. Manag. 9 (2), 65–82.

Glasziou, P., Haynes, B., 2005. The paths from research to improved health outcomes. Evid. Based Nurs. 8 (2), 36–38. https://doi.org/10.1136/ebn.8.2.36.

Glynn, P.E., Weisbach, P.C., 2011. Clinical Prediction Rules: A Physical Therapy Reference Manual. Jones & Bartlett Publishers, Sudbury, MA.

Graham, I., Stiell, I.G., Laupacis, A., O'Connor, A.M., Wells, G.A., 1998. Emergency physicians' attitudes toward and use of clinical decision rules for radiography. Acad. Emerg. Med. 5 (2), 134–140.

Haskins, R., Osmotherly, P.G., Southgate, E., Rivett, D.A., 2014. Physiotherapists' knowledge, attitudes and practices regarding clinical prediction rules for low back pain. Man. Ther. 19 (2), 142–151. https://doi.org/10.1016/j.math.2013.09.005. Epub 2013 Oct 3.

Hasson, F., Keeney, S., McKenna, H., 2000. Research guidelines for the Delphi survey technique. J. Adv. Nurs. 32 (4), 1008–1015.

Henry, B., Moody, L.E., Pendergast, J.F., O'Donnell, J., Hutchinson, S.A., Scully, G., 1987. Delineation of nursing administration research priorities. Nurs. Res. 36 (5), 309–314.

Hsu, C., Sandford, B.A., 2007. The Delphi technique: making sense of consensus. Pract. Assess. Res. Eval. 12 (10), 1–8. http://pareonline.net/pdf/v12n10.pdf.

Jeffery, D., Ley, A., Bennun, I., McLaren, S., 2000. Delphi survey of opinion on interventions, service principles and service organisation for severe mental illness and substance misuse problems. J. Ment. Health 9 (4), 371–384.

Jones, M., Rivett, D.A., 2019. Clinical Reasoning in Musculoskeletal Practice. Elsevier, Edinburgh.

Kelly, J., Sterling, M., Rebbeck, T., Bandong, A.N., Leaver, A., Mackey, M., Ritchie, C., 2017. Health practitioners' perceptions of adopting clinical prediction rules in the management of musculoskeletal pain: a qualitative study in Australia. BMJ Open 7 (8). https://doi.org/10.1136/bmjopen-2017-015916.

Keogh, C., Wallace, E., O'Brien, K.K., Galvin, R., Smith, S.M., Lewis, C., Cummins, A., Cousins, G., Dimitrov, B.D., Fahey, T., 2014. Developing an international register of clinical prediction rules for use in primary care: a descriptive analysis. Ann. Fam. Med. 12 (4), 359–366. https://doi.org/10.1370/afm.1640.

Knowles, M., 1984. In: The Adult Learner: A Neglected Species, third ed. Gulf Publishing, Houston, TX.

Knox, G.M., Snodgrass, S.J., Rivett, D.A., 2015. Physiotherapy clinical educators' perceptions and experiences of clinical prediction rules. Physiotherapy 101 (4), 364–372. https://doi.org/10.1016/j.physio.2015.03.001.

Knox, G.M., Snodgrass, S.J., Stanton, T.R., Kelly, D.H., Vicenzino, B., Wand, B.M., Rivett, D.A., 2017. Physiotherapy students' perceptions and experiences of clinical prediction rules. Physiotherapy 103 (3), 296–303. https://doi.org/10.1016/j.physio.2016.04.001.

Knox, G.M., Snodgrass, S.J., Southgate, E., Rivett, D.A., 2019. The preferences of physiotherapy clinical educators on a learning package for teaching musculoskeletal clinical prediction rules – a qualitative study. Musculoskelet. Sci. Pract. https://doi.org/10.1016/j.msksp.2018.10.005.

McGinn, T.G., Guyatt, G.H., Wyer, P.C., Naylor, C.D., Stiell, I.G., Richardson, W.S., for the Evidence-Based Medicine Working Group, 2000. Users' guides to the medical literature, XXII: how to use articles about clinical decision rules. J. Am. Med. Assoc. 284 (1), 79–84.

McKenna, H.P., 1994. The Delphi technique: a worthwhile research approach for nursing?

J. Adv. Nurs. 19 (6), 1221–1225.
McMahon, S., Cusack, T., O'Donoghue, G., 2014. Barriers and facilitators to providing undergraduate physiotherapy clinical education in the primary care setting: a three-round Delphi study. Physiotherapy 100 (1), 14–19. https://doi.org/10.1016/j.physio.2013.04.006.
Mead, D., Moseley, L., 2001. The use of the Delphi as a research approach. Nurse Res. 8 (4), 4–23.
Moule, P., Lewis, J., McCabe, C., 2014. Designing and delivering an educational package to meet the needs of primary care health professionals in the diagnosis and management of those with complex regional pain syndrome. Musculoskelet. Care 12 (2), 114–117. https://doi.org/10.1002/msc.1057. Epub 2013 Jul 23.
Powell, C., 2003. The Delphi technique: myths and realities. J. Adv. Nurs. 41 (4), 376–382.
Rushton, A.B., Fawkes, C.A., Carnes, D., Moore, A.P., 2014. A modified Delphi consensus study to identify UK osteopathic profession research priorities. Man. Ther. 19 (5), 445–452. https://doi.org/10.1016/j.math.2014.04.013.
Sumsion, T., 1998. The Delphi Technique: an adaptive research tool. Br. J. Occup. Ther. 61 (4), 153–156.
Walker, A.M., Selfe, J., 1996. The Delphi method: a useful tool for the allied health researcher. Br. J. Ther. Rehabil. 3 (12), 677–681.
Williams, P.L., Webb, C., 1994. The Delphi technique: a methodological discussion. J. Adv. Nurs. 19 (1), 180–186.