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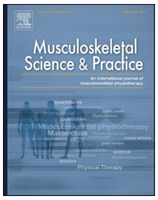

Development and content validity of the musculoskeletal self-management questionnaire (MSK-SMQ)

Nathan Hutting[a,*], Joletta Belton[b], J.P. Caneiro[c], Vinicius Cunha Oliveira[d], Hemakumar Devan[e], Venerina Johnston[f], Pete Moore[g], Julie Richardson[h], J. Bart Staal[i,j], Nicola Walsh[k]

[a] School of Organization and Development, Department of Occupation and Health, HAN University of Applied Sciences, Nijmegen, the Netherlands
[b] Independent Pain Advocate and Patient Partner, Fraser, CO, USA
[c] Curtin School of Allied Health, Curtin University, Perth, Australia
[d] Postgraduate Program in Rehabilitation and Functional Performance, Universidade Federal Dos Vales Do Jequitinhonha E Mucuri (UFVJM), Diamantina, MG, Brazil
[e] Rehabilitation Teaching and Research Unit (RTRU), Department of Medicine, University of Otago, Wellington, New Zealand
[f] School of Health and Medical Sciences, University of Southern Queensland, Ipswich, Australia
[g] The Pain Toolkit, United Kingdom
[h] School of Rehabilitation Science, Department Health Research Evidence and Impact, McMaster University, 1400 Main Street West, Hamilton, ON, Canada
[i] Musculoskeletal Rehabilitation Research Group, School for Allied Health, HAN University of Applied Sciences, Nijmegen, the Netherlands
[j] Radboud Institute for Health Sciences, IQ Health, Radboud University Medical Center, Nijmegen, the Netherlands
[k] School of Health and Social Wellbeing, University of the West of England, Bristol, United Kingdom

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ABSTRACT

Background: Self-management is recommended for managing persistent musculoskeletal conditions. In self-management, standardized and validated measurements (e.g., questionnaires) should be used. However, there is no general questionnaire to evaluate the level of self-management in people with persistent musculoskeletal conditions.

Objectives: To develop a generic questionnaire to evaluate the level of self-management and self-management skills in people with persistent musculoskeletal conditions.

Design: Measurement properties study focused on the development and content validity of the Musculoskeletal Self-Management Questionnaire (MSK-SMQ).

Methods: The MSK-SMQ was developed, consisting of 24 questions. To assess the content validity of the MSK-SMQ, three panels (patients, professionals, researchers/academics) were used. The relevance, clarity and essentiality of each question was evaluated. Moreover, specific feedback could be provided. The Content Validity Index (CVI) was used to test content validity (Item-CV [I-CVI]) and the Scale-level-CVI [S-CVI]). The CVI was calculated for both relevance and clarity. The essentiality of each item was measured with the content validity ratio (CVR).

Results/findings: 91 people participated in this study. The overall content validity (relevance) was excellent, with an S-CVI of 0.96. Overall clarity was also excellent, with a score of 0.97. The range of the I-CVI for relevance was 0.91–1.00 and the range for clarity was 0.93–1.00. The mean CVR value was 0.51 and ranged from 0.14 to 0.87.

Conclusions: The content validity of the questionnaire was found to be excellent. The study resulted in a revised version of the MSK-SMQ, which can be used in future research to determine further psychometric properties.

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* Corresponding author. Department of Occupation and Health, School of Organization and Development, HAN University of Applied Sciences, 6960, 6503, GL, Nijmegen, the Netherlands.

E-mail addresses: nathan.hutting@han.nl (N. Hutting), joletta.belton@gmail.com (J. Belton), jp.caneiro@curtin.edu.au (J.P. Caneiro), vcunhaoliveira@gmail.com (V.C. Oliveira), hemakumar.devan@otago.ac.nz (H. Devan), venerina.johnston@unisq.edu.au (V. Johnston), pete.moore@paintoolkit.org (P. Moore), jrichard@mcmaster.ca (J. Richardson), Bart.Staal@han.nl (J.B. Staal), nicola.walsh@uwe.ac.uk (N. Walsh).

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1. Introduction

Musculoskeletal conditions are ranked as the leading cause of disability worldwide, with low back pain emerging as the main cause of disability in 160 countries (World Health Organization, 2022). These conditions are typically characterised by pain which is often persistent, and limitations in mobility, reducing people's ability to work and participate in society (World Health Organization, 2022). The global burden of disability attributable to musculoskeletal conditions is expected to rise over the coming decades (Ferreira et al., 2023; Gill et al., 2023).

A person-centred, biopsychosocial approach focused on self-management is recommended for managing persistent musculoskeletal conditions (Buchbinder et al., 2018; Foster et al., 2018; Hutting, 2024; Hutting et al., 2019, Hutting et al., 2022; Lewis & O'Sullivan, 2018; Lewis et al., 2021). Self-management can be defined as interventions that aim to equip patients with skills that allow them to actively participate in, and take responsibility for, managing their ongoing condition so that they can function optimally (Jonkman et al., 2016). Self-management is often perceived as challenging and characterised by barriers that require support for people with musculoskeletal conditions (Hutting, 2024). Therefore, integrating self-management support as part of routine healthcare is considered important (Bal et al., 2016; Evidence Centre for National Voices, 2014; Hopkins et al., 2022; Hutting, 2024; Hutting et al., 2019). However, research suggests that healthcare professionals often lack the knowledge and skills needed to fully integrate self-management support and that they experience systemic barriers (e.g., practice and resource constraints) to implementing contemporary this in musculoskeletal practice (Feldman et al., 2024; Hutting et al., 2020; Killingback et al., 2021; Monk et al., 2023; van den Heuvel et al., 2021).

In supported self-management, standardized and validated measurements (e.g., questionnaires) should be used to evaluate patients' understanding of their condition, skills and perceived self-efficacy for self-management (Hutting et al., 2022). Re-assessment and reflective practice are necessary to evaluate treatment outcomes. Evaluation of patients' progress must address the intention of care, so the evaluation of self-management interventions should include assessment of patients' understanding of their symptoms, achievements of individual goals and discussion about (future) strategies (Kongsted et al., 2021). Moreover, standardized and validated questionnaires can also be used to measure the effectiveness of self-management interventions in research. However, the use of questionnaires to assess self-management skills in clinical practice appears to be limited, and previous qualitative research has found that healthcare professionals are largely unaware of how to assess their patients' self-management skills (Hutting et al., 2020).

Several questionnaires have been developed to measure aspects of self-management that can be used in people with persistent musculoskeletal conditions (Banerjee et al., 2018; Eikelenboom et al., 2015; NHS, 2023, 2021; NHS England, 2021; Taylor et al., 2016). These outcome measures assess self-efficacy, coping, empowerment, pain attitude and management, self-care, role behaviour, or multiple constructs of self-management (Banerjee et al., 2018). These measures very diverse and measure a variety of constructs, which demonstrates a lack of consistency and consensus around the measurement of self-management in chronic pain (Banerjee et al., 2018). This makes directly comparing findings of studies assessing self-management or related constructs difficult, as it is clear that only effects measured by identical instruments can be directly compared (Banerjee et al., 2018). A general questionnaire that can assess people's ability to self-manage can be easily administered regardless of pain sites and conditions. Therefore, the development of a multi-domain self-management measure that can be used in people with persistent pain is recommended (Banerjee et al., 2018). However, to the best of our knowledge, there is no general questionnaire to evaluate self-management skills in people with persistent musculoskeletal conditions. Musculoskeletal conditions share many similarities, therefore, we believe that the development of a generic questionnaire that can be used in a broad population of people with musculoskeletal conditions is important. Therefore, the aim of this study is to develop a generic questionnaire to evaluate self-management skills in people with persistent musculoskeletal conditions that can be used to assess self-management skills and improvements made over time, and can be used as an outcome measure in scientific research.

2. Methods

2.1. Design

This is a methodological study focused on the development of the Musculoskeletal Self-Management Questionnaire (MSK-SMQ) and the content validity of the developed questionnaire. An expert panel was used to develop the content of the questionnaire and different musculoskeletal populations were used to assess the content validity. The COSMIN Study Design checklist for Patient-reported outcome measurement instruments was used in the design of this study (Mokkink et al., 2019).

2.2. Instrument development

2.2.1. Content specification

Lorig and Holman (2003) identified five core self-management skills: problem solving, decision making, resource utilisation, forming a patient/healthcare provider partnership and taking action. More recently, van de Velde et al. (2019) identified ten self-management attributes that are distinct features of the self-management concept. These attributes were grouped into three categories: person-oriented attributes, person-environment-oriented attributes and summarising attributes.

As one of the aims of this study was to develop a generic questionnaire to assess self-management skills in people with persistent musculoskeletal conditions, the core self-management skills and attributes were taken into account in the development of the questionnaire. In developing the questions (Q) for the questionnaire, we used the following sub-domains published by van de Velde et al. (2019): 1): active involvement in the care process (Q4, Q6); 2) responsibility for the care process (Q1, Q2); 3) coping with adversity (Q3); 4) correctly informed (Q14, Q15); 5) expressing needs, values and priorities (Q8; Q11) 6) reciprocal partnership with healthcare providers (Q12, Q13); 7) social support (Q7, Q9, Q10); 8) lifetime task (Q24); and 9) personal skills (Q16, Q17, Q18, Q19, Q20, Q21, Q22). For the sub-domain (9) personal skills, the following skills were included: general skills, decision making, resource utilisation, goal setting, action planning, execution of action plan, self-monitoring and self-tailoring. In addition, a general question was included that focused on the ability to manage the musculoskeletal condition in the short and long-term. No specific questions were included for attribute 10 (i.e., self-management includes medical, role and emotional domains: medical management, role management and emotional management) as identified by van de Velde et al. (2019) because these topics were largely covered by the questions on the other sub-domains.

2.2.2. Instrument construction

The first draft of the questionnaire was developed by the first author (NH), based on the content specification described above and the author's expertise in this area. The final draft of the questionnaire was developed through five rounds of feedback. The first two rounds of feedback were provided by experts (JPC, VCO, HD, VJ, JR, JBS, NW) in the field of self-management and/or musculoskeletal conditions. The last three rounds of feedback were provided by the same experts and two experts with lived experience of persistent musculoskeletal pain (PM, JB). The experts provided feedback on the content and wording of the questionnaire. Based on the feedback provided, the first author revised the questionnaire. The final version of the questionnaire consisted of a consensus based questionnaire, consisting of 24 questions, formulated as statements. For each question, respondents are asked to indicate how strongly they agree or disagree with the statements by choosing the response that best describes them at that moment. The scoring options for the questionnaire are: strongly agree, agree, disagree and strongly disagree (4-point Likert scale).

2.3. Study populations and procedures

2.3.1. Content validity

To assess the content validity of the MSK-SMQ, three panels were used to provide constructive feedback on the developed questionnaire. One panel consisted of people with lived experience of persistent musculoskeletal pain (patient panel); another panel consisted of professionals involved in the treatment of people with persistent musculoskeletal conditions; and the final panel consisted of researchers/academics focused on self-management for people with musculoskeletal conditions. The aim of the feedback was to include a broad and relevant representation of experiences. The intention was to gather feedback on the clarity and representativeness of the individual questions and the questionnaire as a whole, as well as suggestions for improvement. We aimed to include 30 people in each of the three panels. All panels were recruited from multiple countries. Participants were recruited through social media and the authors' networks. Not being able to read, understand and write English was an exclusion criterion for participation in all panels.

2.3.2. Patient panel

People with lived experience of persistent musculoskeletal pain (existing for at least 3 months or recurrent complaints [more than 3 episodes of complaints in the last 2 years]), aged 18 years or older, were eligible to participate.

2.3.3. Professional panel

All healthcare professionals with experience in the treatment/management of people with persistent musculoskeletal conditions, aged 18 years or older, were eligible for participation. No restrictions were used regarding profession.

2.3.4. Researcher/academic panel

Authors were eligible for participation if they had at least one publication on self-management published between 2019 and May 2024, which focused on people with musculoskeletal conditions, and were aged 18 years or older. In addition to recruitment through social media, participants were recruited using the project group's network and by emailing the corresponding authors of scientific publications on self-management focused on people with musculoskeletal conditions (identified through a search of PubMed). Based on the PubMed search, an invitation to participate was successfully sent to 109 authors.

2.4. Evaluation and measurements

A link to a single survey (Qualtrics Survey Tool, https://www.qualtrics.com/) was provided to all individuals willing to participate in this study. Information about the study was provided and informed consent was obtained before participants could access the survey. Immediately after consent was given, the background of the participant (person with a musculoskeletal condition, healthcare professional, researcher/academic) was asked and the inclusion and exclusion criteria were assessed. Individuals who did not meet the inclusion criteria were thanked and excluded from completing the remainder of the survey. Demographics on age, gender, country and level of education were collected. The survey was open for participation between May and September 2024.

Before participants could provide their feedback on the draft version of the MSK-SMQ, the definitions of self-management (Jonkman et al., 2016) and self-management support (Hutting, 2024) were provided and the core self-management skills (problem solving, decision making, resource utilisation, forming of a patient-healthcare provider partnership, and taking action (Lorig and Holman, 2003) were mentioned.

> Participants were asked to review and to provide feedback on the clarity (not clear, needs some revision, very clear) of the scoring instructions, scoring responses and the introductory statement of the questionnaire. Participants were also able to make recommendations for improvement (only if they felt revision was needed).

To evaluate whether the 24 questions of the MSK-SMQ items were relevant, clear and essential, all panels were asked about the following four aspects along with each question: 1) the relevance of each question (how important is the question); 2) the clarity of each question (how clear is the wording); 3) the essentiality of each question (how necessary is the question); and 4) recommendations to improve each question (Post Sennehed et al., 2017; Rodrigues et al., 2017).

For the relevance scale, all panels were asked to rate the relevance of each item with regard to the management of a persistent musculoskeletal condition on a 3-point Likert scale. Responses included: 1 = not relevant, 2 = relevant, 3 = very relevant. A 3-point Likert scale was used for the clarity and essentiality scales. The clarity scale was: 1 = not clear, 2 = item needs some revision; and 3 = very clear, and for essentiality: 1 = not essential; 2 = useful, but not essential; and 3 = essential.

Participants were also asked if any items were missing, if there were any unnecessary items, if the questions were clear, and if the questions needed to be rephrased (adapted from Post Sennehed et al., 2017; Rodrigues et al., 2017).

2.5. Statistics

2.5.1. Content validity

For the relevance scale, all answers from the three panels were dichotomised as relevant (relevant and very relevant) OR not relevant. A two-sided Fisher's Exact Test (http://vassarstats.net/fisher2x3.html) was used to test for differences in proportions between the three panels. P-values less than 0.05 were considered significant (Post Sennehed et al., 2017). We hypothesised that no significant difference between the three panels were present.

The Content Validity Index (CVI) was used to test content validity (Polit and Beck, 2006). The CVI is the most widely reported approach for content validity in instrument development and can be calculated using the Item-CVI (I-CVI) and the Scale-level-CVI (S-CVI) (Rodrigues et al., 2017; Zamanzadeh et al., 2015). The CVI was calculated for both relevance and clarity. The I-CVI for relevance was calculated as the number of experts who rated the relevance of each item as 'relevant' or 'very relevant', divided by the total number of experts (Zamanzadeh et al., 2015).

The I-CVI for clarity was computed as the number of experts who rated the clarity of each item as "item needs some revision" or "very clear", divided by the total number of experts (Zamanzadeh et al., 2015). Values range from 0 to 1, and where I-CVI >0.79, the item is relevant/clear, where it is between 0.70 and 0.79, the item needs revisions, and where the value is below 0.70, the item is eliminated (Polit and Beck, 2006; Rodrigues et al., 2017; Zamanzadeh et al., 2015).

Similarly, the S-CVI was calculated using the number of items in a tool that achieved a rating of 'relevant' or 'very relevant' or 'item needs some revision' or 'very clear'. The Average CVI (S-CVI/Ave) was used to calculate the S-CVI. The S-CVI/Ave was calculated by dividing the sum of the I-CVI by the total number of items. An S-CVI/Ave ≥0.9 has excellent content validity (Rodrigues et al., 2017; Zamanzadeh et al., 2015).

Content validity ratio (CVR) measures the essentiality of an item. CVR varies between 1 and -1, and a higher score indicates greater agreement between panel members. The formula for the CVR is $CVR = (N_e - N/2)/(N/2)$, where Ne is the number of panellists who indicated an item as 'essential' and N is the total number of panellists (Rodrigues et al., 2017; Zamanzadeh et al., 2015). The numeric minimum value of the CVR was determined using the Lawshe Table (LAWSHE, 1975). In our study consisting of 91 panellists, we used the maximum number of panellists in the Lawshe Table (n = 40), which indicates that a minimum CVR of 0.29 is needed to keep an item in the questionnaire. The average of all the CVR scores of the items was calculated to determine the total CVR score for the questionnaire (Zeraati and Alavi, 2014).

2.6. Ethics

The Research Ethics Committee of HAN University of Applied Sciences reviewed and approved this study and study protocol (ref.no ECO 253.04/21).

3. Results

3.1. Participants

A total of 91 people participated in this study, including 11 patients, 41 professionals, and 39 academics/researchers. The median completion time of the survey was 20.3 min (range 5.6–156 min). Of the 11 patient participants (mean age 51 years, range 37–70 years), four (36 %) were male and seven (64 %) were female. Nine patients (82 %) had a persistent musculoskeletal pain condition, and two patients (18 %) had an inflammatory condition. Most patients (n = 9, 81 %) had a bachelor's degree or higher. Of the 44 professionals (mean age 41 years, range 22–67 years), 19 (43 %) were male and 25 (57 %) were female. Sixteen (39 %) had a bachelor's degree, 20 (45 %) had a master's degree and 7 (16 %) had a doctorate or equivalent. Forty-one professionals (93 %) had a background in physiotherapy. Of the 36 researchers/academics participated (mean age 48 years, range 28–70 years), 10 (28 %) were male and 26 (72 %) were female. Four (11 %) of the researchers/academics had a master's degree and 32 (89 %) had a doctorate or equivalent. People from 23 countries participated in this study. Most participants came from the Great Britain and Northern Ireland (n = 39, 43 %), the United States (n = 9, 10 %) and Denmark (n = 7, 8 %).

3.2. Scoring instructions and introductory statement

Seventy-eight (86 %) participants rated the scoring instructions and scoring responses as very clear, while 13 (14 %) responded that the item needed some revision. Thirteen participants provided specific feedback for revision of the scoring instructions.

The introductory statement at the beginning of the questionnaire was rated as very clear by 61 (67 %) of the included participants, as needing some revision by 29 (32 %) and as not clear by one (1 %). Thirty participants provided specific feedback for revision of the introductory statement.

3.3. Content validity

The three panels (n = 91) scored the overall content validity (relevance) as excellent, with an S-CVI of 0.96. Overall clarity was also excellent, with a score of 0.97. The range of the I-CVI for relevance was 0.91–1.00 and the range for clarity was 0.93–1.00. An overview of the I-CVI for relevance and clarity is provided in Table 1. The Fisher's Exact Test showed no significant differences in the distribution of the responses between the three panels. The distribution of the panel responses for each item, including the results of the Fisher's Exact Test, is presented in Table 2.

The CVR was generated for each item (see Table 2). The CVR ranged from 0.14 to 0.87. The mean CVR value was 0.51. Three items (Q9, Q10, Q17) were marked as non-essential (CVR <0.29). Non-essential items can be eliminated, but were not in this case, taking into account our theoretical framework. However, the questions were refined based on specific feedback from the participants (see questionnaire refinement).

Table 1
Calculation of the I-CVI for relevancy and clarity for each item.

Item	I-CVI (Relevancy)	Interpretation	I-CVI (Clarity)	Interpretation
Q1	0.98	Relevant	0.99	Clear
Q2	0.97	Relevant	0.99	Clear
Q3	0.99	Relevant	1.00	Clear
Q4	0.99	Relevant	0.95	Clear
Q5	0.98	Relevant	0.98	Clear
Q6	0.99	Relevant	0.98	Clear
Q7	0.96	Relevant	0.97	Clear
Q8	0.91	Relevant	0.97	Clear
Q9	0.97	Relevant	0.97	Clear
Q10	0.90	Relevant	0.98	Clear
Q11	0.91	Relevant	0.92	Clear
Q12	0.99	Relevant	0.99	Clear
Q13	0.99	Relevant	0.97	Clear
Q14	0.97	Relevant	0.96	Clear
Q15	1.00	Relevant	1.00	Clear
Q16	0.92	Relevant	0.95	Clear
Q17	0.95	Relevant	0.93	Clear
Q18	0.97	Relevant	1.00	Clear
Q19	0.99	Relevant	0.98	Clear
Q20	0.96	Relevant	0.98	Clear
Q21	0.92	Relevant	0.96	Clear
Q22	0.98	Relevant	0.98	Clear
Q23	0.98	Relevant	0.98	Clear
Q24	0.96	Relevant	0.93	Clear

3.4. Questionnaire refinement

The participants gave specific recommendations for the improvement of each item (see Supplementary File), the number of recommendations per question varied between 11 and 36. Moreover, 26 generic comments were made. All questions were refined based on the feedback provided. The original questionnaire used in this study, including scoring instructions and introductory statement, and the refined questionnaire based on the comments provided are presented in Table 3.

4. Discussion

This study describes the development and content validity of the Musculoskeletal Self-management Questionnaire (MSK-SMQ), a generic questionnaire to evaluate self-management skills in people with persistent musculoskeletal conditions. The MSK-SMQ was developed using a robust process based on self-management literature and expert opinions. Three panels (patient, professional and researcher/academic) were used to assess content validity. The 24 questions of the MSK-SMQ were found to be clear, relevant and essential and the content validity of the questionnaire was supported. The study resulted in a revised version of the MSK-SMQ, based on the specific feedback provided by the three panels.

The scoring instructions and introductory statement of the MSK-SMQ were found to be clear. The three panels (n = 91) rated the overall content validity (relevance) as excellent with an S-CVI of 0.96. The overall clarity was also excellent, with a score of 0.97. The CVR ranged from 0.14 to 0.87. The mean CVR value was 0.51. Only three items (Q9, Q10, Q17) were rated as non-essential (CVR <0.29). It can be concluded that the MSK-SMQ has shown excellent content validity. A high proportion of the panel provided feedback on specific refinements to the scoring instructions, introductory statement and individual questions of the MSK-SMQ. Based on this feedback, the questionnaire was revised (including a thorough revision of the non/essential rated questions Q9, Q10, Q17), while aiming to maintain the specific focus of each individual question and the overall aim of the questionnaire. Moreover, the scoring responses for the questionnaire were changed from a 4 point Likert scale into a 5 point Likert scale, which now includes a neutral option, as advised by the panel. Although the content validity of the

Table 2
Distribution of the panels' answers on each item (including results of Fisher's Exact Test) and calculated CVR.

Item	Total, $n = 91$				Patients, $n = 11$				Professionals, $n = 44$				Researchers/academics, $n = 36$				p[a]	CVR
	Not relevant		(Very) relevant		Not relevant		(Very) relevant		Not relevant		(Very) relevant		Not relevant		(Very) relevant			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		
Q1	2	2	89	98	0	0	11	100	1	2	43	98	1	3	35	97	1.00	0.71
Q2	3	3	88	97	0	0	11	100	2	5	42	95	1	3	35	97	0.74	0.67
Q3	1	1	90	99	0	0	11	100	1	2	43	98	0	0	36	100	1.00	0.87
Q4	1	1	90	99	0	0	11	100	0	0	44	100	1	3	35	97	0.48	0.63
Q5	2	2	89	98	0	0	11	100	2	5	42	95	0	0	36	100	0.52	0.78
Q6	1	1	90	99	0	0	11	100	1	2	43	98	0	0	36	100	1.00	0.56
Q7	4	4	87	96	1	9	10	91	1	2	43	98	2	6	34	94	0.59	0.45
Q8	8	9	83	91	0	0	11	100	5	11	39	89	3	8	33	92	0.68	0.36
Q9	3	3	88	97	1	9	10	91	1	2	43	98	1	3	35	97	0.49	0.14
Q10	9	10	82	90	2	18	9	82	5	11	39	89	2	6	34	94	0.31	0.23
Q11	8	9	83	91	1	9	10	91	2	5	42	95	5	14	31	86	0.29	0.30
Q12	1	1	90	99	0	0	11	100	1	2	43	98	0	0	36	100	1.00	0.78
Q13	1	1	90	99	0	0	11	100	0	0	44	100	1	3	35	97	0.52	0.52
Q14	3	3	88	97	1	9	10	91	0	0	44	100	2	6	34	94	0.09	0.63
Q15	0	0	91	100	0	0	11	100	0	0	44	100	0	0	36	100	1.00	0.87
Q16	7	8	84	92	0	0	11	100	4	9	40	91	3	8	33	92	0.87	0.43
Q17	5	5	86	95	0	0	11	100	3	7	41	93	2	6	34	94	1.00	0.21
Q18	3	3	88	97	1	9	10	91	2	5	42	95	0	0	36	100	0.24	0.30
Q19	1	1	90	99	0	0	11	100	1	2	43	98	0	0	36	100	1.00	0.54
Q20	4	4	87	96	0	0	11	100	2	5	42	95	2	6	34	94	1.00	0.41
Q21	7	8	84	92	2	18	9	82	1	2	43	98	4	11	32	89	0.09	0.43
Q22	2	2	89	98	0	0	11	100	0	0	44	100	2	6	34	94	0.38	0.54
Q23	2	2	89	98	0	0	11	100	1	2	43	98	1	3	35	97	1.00	0.41
Q24	4	4	87	96	1	9	10	91	0	0	44	100	3	8	33	92	0.09	0.56

[a] Fisher's Exact Test, the relationship between the distribution of the responses for the patients, professionals and researchers/academics, significance if $p < 0.05$.

questionnaire was found to be excellent, we expect that the refinement of the questions will result in an improved content validity and will be easier for patients to understand.

Recently, Hutting (2024) defined self-management support as '*a person-centred, collaborative approach used by healthcare providers to* support *people with health conditions to acquire the necessary knowledge, skills,* support *and confidence to take an active and leading role in managing their condition in the context of their daily lives*'. Moreover, Banerjee et al. (2018) found 14 different measures assessing a variety of constructs of self-management including self-efficacy (n = 19), coping (n = 4), empowerment (n = 2), pain attitude and management (n = 3), self-care (n = 1), role behaviour (n = 1) and multiple constructs of self-management (n = 1). As mentioned in our Methods section, we used the sub-domains of self-management published by van de Velde et al. (2019) in the development of the MSK-SMQ. These domains also emphasize the importance of the components of the definition of self-management support (Hutting, 2024) and the variety of constructs of self-management found by (Banerjee et al. (, 2018). Therefore, we believe that the MSK-SMQ successfully covers the broad range of important constructs/components of self-management.

4.1. Strengths and limitations

A strength of this study is the use of three different panels, incorporating the perspectives of patients, healthcare professionals and researchers/academics. These three panels have different perspectives and experiences of self-management, which were very valuable in refining the questionnaire. On the other hand, a significant limitation is that we could only include 11 patient respondents, possibly due to our recruitment methods. We aimed to include 30 people in each of the three panels. Because we could only include 11 patient respondents, we decided to include more respondents in the other two groups. As Fisher's Exact Test showed no significant differences in the distribution of the responses between the three panels, we believe this did not influence the results of our study. However, it should be noted that the majority of the respondents, including the patient panel, had a bachelor's degree or higher and only two participants had a lower level of education. Therefore, it is not known whether the questionnaire is suitable for people with a lower level of education or health literacy. We used a 3-point Likert scale to rate the relevance and essentiality of the questions of the MSK-SMQ. However, it is questionable if the options 'relevant' and 'very relevant' and the options 'useful, but not essential' and 'essential' are easy to distinguish from each other. There are two well established approaches for examining content validity; a qualitative (using the opinions of experts, often collected by interviews) and a quantitative method (using the CVI and CVR) (Madadizadeh and Bahariniya, 2023). The MSK-SMQ was developed by experts and we used the CVI and CVR to assess the content validity of the questionnaire. We did not use interviews to qualitatively assess the content validity, however, participants were able to provide qualitative feedback on the individual questions and the questionnaire in general in the survey.

Other potential limitations could be that 93 % of the included professionals had a background in physiotherapy and a lack of geographical distribution of the participants, which might influence the generalizability of the results. We also want to emphasize that the range of the reported median completion time of the survey was very broad (5.6–156 min). We are not certain that the recorded completion time is accurate, as 156 min seems high to fill in the questionnaire. It is possible that participants who completed the survey took breaks or fulfilled other tasks, while the survey was still open. Although we did ask the panels' feedback regarding the clarity and readability of the items and feedback was provided to enhance the readability of the items, we did also not use any readability test in the development process of the questionnaire. We did use the NHS Medical Document Readability Tool (https://readability.ncldata.dev/) to evaluate the final questionnaire, based on feedback provided by the reviewers. The tool indicated an estimated UK reading age of 17.4 years and indicated that questions 13, 14, 16 and 18 are potential complex sentences. One final limitation is that we did not ask about pain characteristics in the patient panel (including type of pain, location, duration of symptoms, whether it was secondary to a specific pathology or nonspecific, etc.). It is recommended that these characteristics will be included in the future research.

Table 3
The original MSK-SMQ, including scoring instructions and introductory statement used in this study and the refined questionnaire based on the comments provided.

	MSK-SMQ used in the study	Refined MSK-SMQ
Scoring	Strongly agree Agree Disagree Strongly disagree	Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree
Statement	NOTE: 1. The words ‘musculoskeletal condition’ represent conditions such as ‘back pain’, ‘rheumatoid arthritis’, ‘osteoarthritis’, ‘neck pain’, ‘shoulder pain’, etc. 2. Managing a musculoskeletal condition could include performing exercises; seeking care from healthcare professionals; using medication; obtaining support from family, friends colleagues, employer; adopting a healthy lifestyle; dealing with pain, misunderstanding, emotions, fatigue, medication side effects, financial consequences, social consequences, etc.	NOTE: 1. Musculoskeletal conditions include all conditions that affect joints, bones, muscles, etc. For example: ‘back pain’, ‘neck pain’, ‘shoulder pain’, ‘rheumatoid arthritis’, ‘osteoarthritis’, ‘osteoporosis’, ‘fibromyalgia’, etc. 2. Managing a musculoskeletal condition refers to the capability of managing the impact of the condition on your daily life.
Q1	I am the person in charge of managing my musculoskeletal condition.	I am in charge of managing the impact of my musculoskeletal condition on my daily activities.
Q2	I can take responsibility for managing my musculoskeletal condition.	I am responsible for managing the impact of my musculoskeletal condition.
Q3	I know what to do if I experience a temporary and sudden increase in pain or other symptoms.	I know what to do if I experience a sudden increase in symptoms.
Q4	I am actively involved in the management of my musculoskeletal condition.	I am actively involved in managing my musculoskeletal condition.
Q5	I have the skills needed to manage my musculoskeletal condition on a day to day basis.	I can manage my musculoskeletal condition on a day to day basis.
Q6	I have the strategies to actively manage my musculoskeletal condition in the long term.	I have a plan how to manage my musculoskeletal condition in the long term.
Q7	It is important for me to have support from other people (e.g. family, friends, employer, healthcare providers) in managing my musculoskeletal condition.	It is important for me to have support from other people (e.g. family, friends, colleagues, employer, healthcare professionals) in managing my musculoskeletal condition.
Q8	I am able to express my needs to others (e.g. to family, friends, employer, healthcare providers).	I am able to express what I need to manage my musculoskeletal condition.
Q9	I am able to obtain support from other people (e.g. family, friends, employer, healthcare providers).	If needed, I ask for support from healthcare professionals, colleagues, employer, etc. In managing my musculoskeletal condition.
Q10	I feel supported by other people in managing my musculoskeletal condition (e.g. family, friends, employer, healthcare providers).	I feel supported by family and friends in managing my musculoskeletal condition.
Q11	I am able to set my agenda and priorities in managing my musculoskeletal condition.	I can prioritise activities in order to help me manage my musculoskeletal condition.
Q12	I am involved in making the decisions regarding my health and treatment together with my healthcare provider(s).	I am involved in making decisions regarding my health and treatment.
Q13	I am able to work together with my healthcare provider(s) on a plan to achieve my goals.	I can work together with my healthcare professional(s) on a plan to achieve my goals regarding my musculoskeletal condition.
Q14	I understand the causes of my musculoskeletal condition and what treatments may be helpful or harmful.	I know what treatments may be helpful or harmful in the management of my musculoskeletal condition.
Q15	I can identify factors that influence my musculoskeletal condition (e.g. emotions, stress, fatigue, pain, lack of support, lifestyle).	I can recognise things that affect my symptoms (e.g. emotions, stress, sleep, support, lifestyle, physical activity, overuse).
Q16	I am able to deal with problems related to my musculoskeletal condition as they occur.	I have the skills to deal with the (physical and mental) impacts of my musculoskeletal condition as they arise.
Q17	I am able to make decisions on my own regarding what is needed to manage my musculoskeletal condition.	I can make decisions regarding what is needed to manage my musculoskeletal condition.
Q18	I am able to find helpful resources (e.g. via other people, organisations, books, newspapers, the internet) to help me to manage my musculoskeletal condition.	I can find and understand credible and relevant resources (e.g. support groups, organisations, books, newspapers, the internet, healthcare professionals) to help me to manage my musculoskeletal condition.
Q19	I am able to set goals that are meaningful and achievable to me.	I can set goals to manage my musculoskeletal condition that are meaningful and achievable.
Q20	I am able to make action plans to achieve my goals.	I can make plans to achieve my goals.
Q21	I am able to act on my action plans to achieve my goals.	I can act on my plans to achieve my goals.
Q22	I am able to monitor changes (e.g. in symptoms, lifestyle, treatment) with regard to my musculoskeletal condition.	I can notice changes in my musculoskeletal condition (e.g. in symptoms, lifestyle, treatment).
Q23	I am able to adapt my goals and plans as my musculoskeletal condition changes.	I change my goals and plans if my musculoskeletal condition changes.
Q24	I have the ability to manage my musculoskeletal condition in the short and long term.	I can manage my musculoskeletal condition now and in the future.

4.2. Implications for clinical practice and future research

This study has resulted in a practical and comprehensive 24-item questionnaire that can potentially be used by healthcare professionals in people with musculoskeletal conditions to assess self-management skills. However, in this first phase of the study we only assessed the content validity of the questionnaire, and further psychometric properties, including other aspects of validity and the test-retest reliability should be determined in future research. This future evaluation should include the perspectives of people with low levels of education or health literacy.

4.3. Conclusion

Using a robust process based on self-management literature and expert opinions, we developed the MSK-SMQ, an English language questionnaire to evaluate self-management skills in people with persistent musculoskeletal conditions. The content validity of the questionnaire was found to be excellent. The study resulted in a revised version of the MSK-SMQ, based on specific feedback from three panels of patients, healthcare professionals and researchers/academics, which can be used in future research to determine further psychometric properties of the MSK-SMQ, including other aspects of validity and test-retest reliability.

CRediT authorship contribution statement

Nathan Hutting: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Joletta Belton:** Writing – review & editing, Conceptualization. **J.P. Caneiro:** Writing – review & editing, Conceptualization. **Vinicius Cunha Oliveira:** Writing – review & editing, Conceptualization. **Hemakumar Devan:** Writing – review & editing, Conceptualization. **Venerina Johnston:** Writing – review & editing, Conceptualization. **Pete Moore:** Writing – review & editing, Conceptualization. **Julie Richardson:** Writing – review & editing, Conceptualization. **J. Bart Staal:** Writing – review & editing, Conceptualization. **Nicola Walsh:** Writing – review & editing, Conceptualization.

Ethics

The Research Ethics Committee of HAN University of Applied Sciences reviewed and approved this study (ref.no ECO 253.04/21).

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Appendix A. Supplementary data

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