Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Strategies to support pain self-management among people living with chronic musculoskeletal pain: A mixed methods design and content ideation study

Usman Hussain
Ziauddin University
Shah Bano Jawad
Akhtar Saeed Medical College
Nisma Khan Lodhi
BMY Health
Yusra Ijaz
BMY Health
Aysha Zia
BMY Health
Aliza Hamadani
Lahore Medical and Dental College
Manahil Niazi
BMY Health
Muhammad Hashim
Riphah International University
Saira Elaine Anwer Khan
Shalamar Hospital
Nourah Basalem
University of Manchester
Syed Mustafa Ali
syedmustafa.ali@manchester.ac.uk

University of Manchester

Research Article

Keywords: Chronic musculoskeletal pain, digital health, pain self-management, social and cultural context, mixed methods, health equity

Posted Date: July 6th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10003936/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background:

Chronic musculoskeletal pain is a common condition, for which pain self-management is recommended. Digital tools offer potential to support individuals with chronic pain, but it is unknown to what extent existing tools are responsive to the social context of Pakistanis living with chronic pain and are engaging for them.

Objective:

This study aimed to explore strategies to enhance engagement with digitally enabled pain self-management tools among people with chronic musculoskeletal pain.

Methods:

A mixed-methods sequential explanatory design was used. We first reviewed Android app store and published literature to identify content and engagement strategies incorporated in digital tools. Following this, we conducted a narrative study involving adults with chronic musculoskeletal pain to capture their lived experiences and requirements for pain self-management. Review findings were synthesised descriptively, qualitative data were analysed thematically, and overall findings were combined to generate design and content recommendations.

Results:

Literature and app reviews revealed that digital tools commonly included components related to patient education and physical or mental therapy. They often included engagement features such as personalization and reminders. Dietary advice and peer or social support were less commonly included in digital tools but were commonly discussed during group discussions by individuals living with chronic pain. Nineteen individuals with chronic pain participated in group discussions and described how their pain self-management practices were shaped by cultural beliefs and perceptions and digital health information. These factors also influenced their decision making related to treatment choices and adoption of non-pharmacological strategies. Although participants trusted healthcare professionals but expressed concerns about limited guidance on how to apply clinical advice in their daily lives. Moreover, they identified several requirements for pain self-management tools, including evidence based audio-visual content and incorporating aspects related to symptom monitoring, symptom relief and physical rehabilitation, psychological wellbeing, lifestyle management, social support, patient education.

Conclusion:

Existing pain self-management tools rarely address the social context of South Asians. While pain self-management is shaped by digital information and cultural beliefs and perceptions, participants valued evidence-based digital resources. Therefore, future research should focus on co-developing these resources to ensure they are clinically meaningful, culturally responsive, and supportive of patient-centred and equitable pain self-management.

Introduction

Chronic musculoskeletal pain affects nearly one third of the global population (1) and is a leading cause of years lived with disability worldwide (2). It is a subjective experience which changes over time, influencing both treatment decisions and their outcomes (3). It is therefore a requirement that individuals do not only receive patient-centric and collaborative care, but they also actively engage in managing their symptoms, behaviour and daily functioning, referred to as self-management (4, 5). Effective pain management depends on both professional inputs and patient engagement with treatment (6). However, patient engagement drives overall care and pivots on the perception of self-efficacy (i.e., one's own capacity for self-management), which requires motivation, skills and knowledge to maintain effective physical and psychological functioning (5). That is why, chronic pain management guidelines emphasise patients' knowledge and skills as central components of overall pain management (7).

The chronic pain management guidelines recommend capturing the causes and effects of pain, which are influenced by multiple interacting factors (8), including biological, psychological, and social factors (9). To understand the complex nature of chronic pain, digital pain self-reporting tools may have the potential to capture the dynamic aspects of lived experience of chronic pain (e.g., pain causes and effects) in real time (10). Capturing such information is not only helpful in supporting clinical care but also enables individuals to use that information to improve their self-management practices. While there is no single agreed definition, supported pain self-management focuses on improving collaboration between patients and healthcare professionals by recognising the need for tailored approaches to meet individual pain management needs (11), which are reflected in lived experience of chronic pain of Pakistani people (10, 12, 13). These needs go beyond individuals and include families because they collectively use their knowledge, beliefs and skills to manage chronic pain as confirmed by Ali et al. (12) and supported by the Individual and Family Self-management Theory (14). Ali et al. found that South Asian family carers are involved in behaviour activation of individuals with chronic pain and provided necessary support in maintaining healthy behaviours in their own social contexts (12). This signifies that pain and its management is not only dynamic and context-dependent, but also deeply personal and shaped by individual lived experiences.

While the use of digital health technologies is rapidly increasing, their potential for providing scalable educational and behavioural strategies (such as self-monitoring) leading to better pain self-management is already well established (15–17). These technologies are likely to enhance motivation, adherence, confidence and coping in everyday context through tailored tools and approaches potentially facilitating engagement beyond clinical settings and sustaining it over time (17, 18). In that context, personalising content to individual needs and incorporating game design elements have helped maintain motivation and adherence (19, 20), which ultimately led to behaviour change and better self-management (21, 22). However, the digital divide may limit the potential of these digital health technologies and reduce their long-term positive impact (10).

Despite the importance of digitally enabled pain self-management, existing interventions have shown only modest short-term improvements in pain and physical function, with more consistent long-term benefits observed for self-efficacy in high income countries (23). Although several pain self-management models provide structured guidance, little is known about how South Asian populations, particularly in Pakistan, manage their pain in daily life. As a result, it remains unclear how existing self-management frameworks can be effectively adapted in this context (24). Current evidence on culturally tailored interventions for Pakistani communities is limited and largely focused on language adaptations in high-income countries, despite differences in social and healthcare contexts. Therefore, this study aimed to inform the design of digitally enabled pain self-management tools that promote engagement among Pakistani individuals with chronic musculoskeletal pain. Specific objectives were: (a) To review the existing digital tools or interventions and describe their content and design features offered to enhance engagement; and (b) To explore current practices of pain self-management and gather requirements for content and features to inform future development of a digitally enabled pain self-management tool.

Methods

Study design

This study used a mixed-methods sequential explanatory design (25) to identify the content and design features of existing digital pain self-management tools or interventions and guide its future development for Pakistani population. The study was conducted in two phases: the first phase involved reviewing scientific literature and publicly available mobile apps to explore the content of pain self-management tools and the engagement strategies they incorporated; the second phase involved a narrative study exploring lived experience of chronic pain and applying co-design principles (26) to gather user requirements of digitally enabled pain self-management tools using a table of specification approach (27). The narrative study design was used as it is suitable for exploring lived experience through personal stories and meanings, which people tend to assign to different events related to their lived experience (28). The sequential exploratory design was also appropriate as the findings of the first phase guided data collection for the narrative study by using relevant examples from the existing digital solutions, which helped contextualizing and interpreting the findings, resulting in generating actionable design and content recommendations.

We followed the PRISMA (29) and TECH (30) guidelines for reporting results of systematic literature and app reviews, respectively. The methods and results of the qualitative study were reported in accordance with the consolidated criteria for reporting qualitative research (COREQ) (31)

Phase 1: Systematic literature and apps reviews

We systematically reviewed literature and apps available in app stores of Pakistan to identify content of the existing pain management tools and the strategies used to support engagement.

Data sources and search strategy

For the systematic search of literature, we adopted the search results of the previously completed scoping review, which included searching of five electronic databases (i.e., MEDLINE via Ovid, Embase via Ovid, CINAHL, PsycInfo and Google Scholar). Detailed search strategy and screening process can be found here (32). This approach was adopted to avoid unnecessary duplication of a recent and methodologically robust search while enabling focused re-screening of the set of eligible studies.

For the systematic apps review, the Google Play Store of Pakistan was searched by combining “chronic pain” and “pain management” as also adopted by a previous review (33). We only searched Android apps because a vast majority of Pakistani population is Android users (34).

Screening and selection

The systematic review by Khalid et al. (32) included 100 studies, which were reviewed again in duplicate to identify studies meeting our eligibility criteria, i.e., digitally enabled patient self-management tools or interventions for people living with chronic pain and have incorporated any aspect of engagement (e.g., translated materials, content personalisation based on needs, use of avatars, reminders) to support intervention adoption and meet individual pain management needs. Four reviewers (AZ, SBJ, UH, YI) screened all articles in duplicate and compare their screening results, and any disagreement was resolved by another reviewer (SMA).

For the apps review, NKL screened the description of Android apps given in the Google Play app store. The relevant and free apps were downloaded on smartphones for further screening and extracting relevant information (using Samsung Galaxy S23 and Samsung Galaxy S10). For pay to download apps, we used app description alone for screening purpose.

Data extraction and synthesis

For the literature review, we extracted data related to four key domains, including study characteristics (e.g., title, authors, year of publication, country, settings, method), population characteristics (e.g., participant type, priority group, sample size, pain type), intervention or tool characteristics (e.g., type of tool, content format, content type, structure), and engagement strategies (e.g., personalisation or tailoring based on personal characteristics or circumstances, game elements). For engagement strategies, we extracted data on aspects of personalisation and design elements as both are known to be effective for enhancing engagement with digital health tools or interventions (35). Prior to the extraction, a list of data extraction items (annexure A) was prepared and pilot tested using a data extraction template. We synthesized data descriptively using frequencies and percentages.

Similarly for the app review, in addition to intervention content and engagement strategies as described above, we extracted data related to app characteristics (e.g., year of publication, developer, current version, etc.). We used a data extraction template, which was developed and piloted prior to final extraction. We synthesized data descriptively using frequencies and percentages.

Phase 2: Narrative study and user requirement workshop

We organised group discussions with people living with chronic pain and healthcare professionals managing it. All these discussions included exercise related to user requirements for digitally enabled pain self-management. Our user requirement exercise was guided by the table of specification approach previously used for gathering user requirements for digital pain self-reporting tools (36).

Sampling, eligibility criteria and recruitment

We used purposive sampling technique to identify and recruit people living with chronic musculoskeletal pain and healthcare professionals involved in managing chronic pain from pain, rheumatology and physiotherapy clinics in Lahore and Karachi, Pakistan. Adults (> 18 years) diagnosed with musculoskeletal chronic pain conditions (such as osteoarthritis, fibromyalgia) or with primary chronic pain and able to provide written informed consent, regardless of their gender were considered eligible for this study. Adults with acute pain, injury related pain or post-surgical pain conditions were excluded from the study. Healthcare professionals, involved in managing patients with chronic pain patients in Pakistan were considered eligible.

Data collection and analysis

We collected demographic and pain experience or management related experience from all study participants (i.e., patients and healthcare professionals) using brief questionnaires (annexures B, C), which provided useful context for our findings. Using the existing literature (37–39), we drafted a topic guide to facilitate semi-structured group discussions with individuals with chronic pain (annex D) and healthcare professionals involved in its management (annex E). For discussions with individuals with chronic pain, we covered topics related to pain experience, self-management practices, and support for self-management. We also conducted an interactive user-requirements exercise to capture key aspects of pain self-management and explored potential ways to address them through digitally enabled self-management tools. To generate ideas and meaningful discussions, we used visual prompts related to key aspects of pain, such as pain self-reporting (40), education, diet, physical and mental therapy (sourced from online). Our review findings guided the aspects of pain self-management and helped us selecting relevant visual prompts. For discussions with healthcare professionals, we explored the need to support pain self-management, the role of patient education in effective self-management, patients' misconceptions that deter self-management, and the role of digital health technologies in supporting self-management and clinical care.

All discussions were audio-recorded, transcribed, and anonymised prior to data analysis. Two researchers (NKL, SJ) reviewed transcripts line-by-line and assigned codes. A coding structure was developed, refined, and finalised during weekly debriefing meetings. Themes were developed to present key findings, illustrated through participants' quotes. User requirements were presented in tabular form, covering aspects needed for pain self-management, reason why they are needed, and how these requirements could be met digitally.

Findings

Systematic literature and apps reviews

We reviewed 21 Android apps and 64 eligible studies (reporting on 52 tools) systematically. We identified key differences between publicly available apps and tool reported in the literature. In the app store, we found relatively more standalone tools (n=12; 57%); e.g., tools related to physical therapy or mental therapy than in the literature (n=9; 17%). Moreover, dietary advice and peer support were seldom incorporated in apps to support self-management. However, tools reported in the literature incorporated peer support (n=4; 8%) and dietary support (n=6; 12%).

Majority of the tools found in literature had patient education component combined with physical and/or mental therapies (n=26; 50%). Among the tools found in literature, majority of them were webpage-based (n=21; 41%), while mobile apps, traditional communication methods (e.g., e-mail, SMS) and portable device (e.g., CD) were less common. Tools reported in the literature used combination of video, audio, images and text formats to deliver intervention content (n=41; 79%). However, single-formatted tools (e.g., text only or video only tools) were more common in the Play Store apps. To promote user engagement with tools, content personalisation or tailoring was guided by personal characteristics and circumstances of the target users, which was more commonly reported in literature. Nonetheless, pain self-assessment or assessment done by healthcare professionals were commonly used for personalising content of tools found in both app store and literature.

In addition to content personalisation, game design elements were also incorporated in digital tools to promote user engagement. However, they were more commonly used in apps available in the app store (n=17; 81%) than in the literature (n=15; 29%). Out of which, daily check-ins (n=3; 14%) and reminders or push notifications (n=3; 14%) were more common features incorporated in apps. In the tools reported in the literature, quizzes (n=3; 20%) and performance tables or graphs (n=3; 20%) were commonly used game design elements. Though patient education was a common component across tools (found in app store and literature), quizzes, challenges, points, and badges were less commonly used design features. Detailed characteristics of the apps and included studies are presented in supplementary table X, however, table 1 provides an overview of the content.

Table 1: Comparison of content found in digital tools found in the app store and literature

Characteristics	**Apps (n=21)**	**Interventions (n=52)**
	Number (percentage*)	**Number (percentage*)**
Content type		
Physical therapy or exercise	8 (38)	Nil
Mental therapy	2 (10)	Nil
Pain education	2 (10)	9 (17)
Combination of the above (including additional aspects**)	9 (43)	43 (83)
Content format		
Video (animated or live action)	7 (33)	4 (8)
Audio	2 (10)	2 (3)
Image (including infographics)	2 (10)	Nil
Text-based	2 (10)	5 (10)
Combination of the above	8 (38)	41 (79)
Personalisation of content		
None	5 (24)	4 (8)
Pain self-assessment	5 (31)	5 (11)
Pain assessed by healthcare professional	4 (25)	3 (6)
Physical or mental capability	2 (13)	4 (8)
Gender	1 (6)	Nil
Language	Nil	3 (6)
Combination of the above	4 (25)	33 (69)
Use of game design elements		
No	4 (19)	37 (71)
Yes	17 (81)	15 (29)

**The sum of percentages might exceed 100% due to rounding off*

*** Additional aspects were peer-support, dietary advice, etc.*

Key learnings from reviews

Below were the key considerations learnt from reviews, which we explored further during the narrative study and user requirement exercise.

· Literature-based interventions more commonly adopted comprehensive and multimodal approaches, whereas publicly available apps often focused on standalone functionalities. This highlights the need to further explore stakeholder perspectives regarding requirement for different support or intervention components.

· Variations in personalisation, educational content, and game design features emphasised the importance of understanding user preferences and engagement needs.

· The limited inclusion of peer support and dietary advice within publicly available apps suggested potential gaps between research evidence and real-world implementation. These findings provided a rationale for examining user expectations and priorities during the narrative study.

Narrative study and user requirement workshop

Six in-person group discussions were conducted, including four with individuals with chronic pain (n=19) and two with healthcare professionals (n=6). Majority of the participants (i.e., individuals with chronic pain) were multilingual (n=17; 89%), female (n=15; 79%), younger than 40 years (n=10; 53%) and of Punjabi ethnic background (see table 2 for details). Half of the healthcare professionals were male (n=3) and majority had pain management experience for more than 10 years (n=5; 83%), representing general physician, physiotherapy and psychology.

Table 2: Characteristics of participants living with chronic musculoskeletal pain (n=19)

Characteristics	Number (percentage)
Age	
18 – 40	10 (53)
41 – 60	7 (37)
Above 60	2 (10)
Gender	
Female	15 (79)
Male	4 (21)
Ethnicity	
Punjabi	17 (89)
Sindhi	2 (11)
Speaking language proficiency	
Punjabi, Urdu or both	11 (58)
Punjabi, English and Urdu (or Sindhi)	6 (32)
Urdu and Sindhi	2 (10)
Formal education	
Up to five years of education	9 (47)
Secondary or higher school	6 (32)
College or University	4 (21)
Employment status	
Full or part time employed	11 (58)
Unemployed (student, housewife)	7 (37)
Retired	1 (5)
Family income (in USD per month)	
Less than 200	9 (47)
Between 200 and 400	7 (37)
Above 400	3 (16)
Pain type	
Primary pain	8 (42)
Secondary pain (e.g., RA, OA)	11 (58)

Through iterative coding and thematic analysis, we developed three themes, including: (a) socially constructed lived experience of chronic pain; (b) treatment perception shaping relationship between clinical advice and self-management practices; and (c) challenges and opportunities in the digital era for better pain management. These themes are illustrated with participant quotes.

(a) Socially constructed lived experience of chronic pain

Participants' pain lived experiences were not shaped in isolation; rather they were formed in a broader social context. Participants described that their pain lived experiences, including pain self-management practices, were shaped by social expectations related to their age and gender. For example, chronic pain is normally attributed to ageing and is often considered inevitable, as one of the participants described it as:

'I personally feel it's because I'm old. I even joke about it with my husband….he says…age is not the reason of pain' (Punjabi female patient aged 25-35)

Participants described the supportive role of family in recognising their problem sooner and supporting pain management. Moreover, healthcare professionals also confirmed the perspective of patients about ageing and chronic pain:

'There is a misperception regarding ageing and disease. Patients believe that once they cross 40 years of age, developing such conditions is inevitable and it's normal so they accept that this is how the rest of their life will be' (Female HCP, Psychologist)

Similarly, the gender norm of performing household chores was perceived as a hurdle in getting recognition of their problem. That is why, while referring to family members one female participant mentioned that *'they thought, I am pretending'*. Given that context, people assigned more value to pain consequences (e.g., impact on daily functions) than to pain intensity. One of the participants mentioned:

"You tell how much force is required to beat an egg? But I cannot do that."

(Punjabi female patient aged 65-75)

Moreover, socio-economic status also affected people's ability to manage their conditions as one participant described it as:

'Sometimes medicines are either not available or too expensive… so we leave the treatment in the middle' (Punjabi male patient aged 35-45)

(b) Treatment perception shaping relationship between clinical advice and self-management practices

Participants expressed their trust in healthcare professionals, but their advice was not consistently followed or adopted. Concerns about medication safety and limited implementation guidance mainly shaped their self-management practices. For example, regular medication use was perceived harmful because of its long-term effects, and one participant described it as:

'Medicine should be taken as sparingly as possible because it can eventually affect your kidneys' (Punjabi female patient aged 30-40)

This negative perception about medication led to self-medication practices of participants, without seeking advice from healthcare professionals: One participant described their experience as:

'Whenever I experience pain, I make a conscious effort to take as little medicine as possible' (Punjabi female patient aged 30-40)

While participants mentioned their reliance on medication for severe pain episodes only, they preferred non-pharmacological approaches to manage their pain:

'Anything, other than medicine. I would prefer anything other than medicines to help ease my pain' (Punjabi female patient aged 50-60)

Despite preference for non-pharmacological approaches to pain management, participants' adoption of physical activities and exercises was relatively poor. One participant described its reason as:

'Doctors told us to do exercises…but they did not explain how exactly to do it' (Punjabi female patient aged 30-40)

However, healthcare professionals mentioned exercising extra caution as a barrier to exercise adoption behaviour at home. However, health professionals also recognised the limitation of healthcare system:

'A 10 to 15-minute consultation isn't a one-shot solution' (Male HCP, Orthopaedic Surgeon)

Without proper implementation guidance, self-management became individually interpreted and culturally mediated. That is why, a range of traditional home remedies were commonly adopted, particularly for early and mild symptom exacerbations. For example, one participant mentioned:

'I did massage with olive oil and I started feeling better the next morning' (Punjabi female patient aged 65-75)

(c) Challenges and opportunities in the digital era for better pain management

Given the limited implementation guidance and negative medication perception, many participants reported accessing digital tools or information to supplement clinical advice and reinforce their self-management practices. One participant gave an example:

'I always search about healthy lifestyle… how much walk a person should do daily' (Punjabi male patient 40-50)

While accessing digital tools or information reflected agency and motivation, participants expressed uncertainty and confusion regarding information abundance. One participant described it as:

'There are a thousand different people giving a thousand different types of advice' (Punjabi female patient aged 30-40)

Another participant said:

'Anyone can make anything and post it… we cannot trust them' (Punjabi female patient 55-65)

Despite these challenges, participants expressed willingness to access digital information and guide their self-management practices. For this, they mentioned the role of healthcare professionals in preparing and recommending information. Participants mentioned the information need as:

'If someone gives me truly good advice that works, I would be more than willing to do it' (Sindhi female patient aged 35-45)

'If some doctors have made mobile application, then it will be easier for me to believe in it' (Punjabi male aged 35-45)

After exploring socially constructed lived experiences of chronic pain and its management, participants mentioned their requirements (referred as content domains) for a future digital tool to support self-management of chronic pain. In addition to its content, participants also shared their ideas about how the content could be delivered and engagement with it could be ensured. Table 3 outlines key domains and engagement strategies relevant for digitally enabled pain self-management.

Table 3: Requirements for digitally enabled pain self-management

What	Why	How
(aspects for pain self-management)	(Pat represents patient, HCP represents healthcare professional)	(content and engagement strategies)
Symptom monitoring		
Pain self-reporting	Pat: It may help explaining pain experience and sharing it directly with clinicians HCP: Real-time pain self-reporting may promote personalised care and build patients' confidence in pain self-management	Reporting pain site, onset, aggravating or relieving factors in visual and audio formats
Psychological wellbeing		
Stress management	Pat: Stress takes a huge toll in pain experience, but knowledge about how to manage it is limited. HCP: Chronic pain causes stress and vice versa and this cycle needs to break because good mental health promotes hope and ability to self-manage pain.	Guidance on meditation, mindfulness and relaxation techniques; Setting personalised goals and developing action plans; Use of emojis for digital mood tracking to convert negative thoughts into positive); Chat function to communicate with psychologists
Sleep	Pat: Chronic pain affects quality of sleep, which leads to severe fatigue and poor quality of life. HCP: Sleep hygiene is important as poor sleep may trigger pain and make pain management less effective	Interactive Chinese sleep clock to improve sleep habit; Videos providing guidance on improving sleep patterns, e.g., deep breathing exercises, audio sounds or music that may induce sleep
Spirituality	Pat: Religion plays an important role because we believe that a strong connection with God and listening to Qur'anic verses may ease our pain. HCP: People with good spiritual connection and strong belief may have better endurance and motivation to manage their pain	Audio recordings of relevant Qur'anic verses and lectures of religious scholars to promote self-reliance and motivation
Symptom relief and physical rehabilitation		
Physical therapy	Pat: Performing stretching exercises may help flex muscles HCP: Doing specific exercises targeting affected muscles may strengthen them and improve their function	Animated videos to provide guidance on training or strengthening specific areas (e.g., lower back, hand); Goal setting and progress tracking; Use of rewards and badges for encouragement
Heat therapy	Pat: Use of hot water bottle or shower may help ease the pain, particularly in winter	Text containing information on how and when to apply or use heat therapy
Body massage	Pat: Applying and massaging turmeric paste, aloe vera gels or oil may ease pain HCP: Patients rely more on remedies, and they are not always effective	Evidence-informed education on commonly available remedies or solutions covering Dos and Don'ts in pictorial charts
Lifestyle management		
Physical activity	Pat: Though physical activity may support weight reduction and pain management, guidance on pacing is required to avoid pain worsening. HCP: Fear of pain limits people's activity, which causes further muscle stiffness and pain	Personlised and coach-led fitness training program and in-app guidance to boost confidence to complete physical activities; Setting personal goals and action plans (e.g., 10 mins walk on terrace)
Diet	Pat: Diet is an essential constituent of our pain experience but knowledge about healthy food choices is limited HCP: Guidance to control weight and manage pain is needed because current dietary choices are guided my myths, which are aggravating pain and inflammation.	Evidence-informed guidance on healthy food choices; Game or interactive exercises on healthy food choices and encouraging their adoption via reward system; Information presented in diet charts as Dos and Don'ts; Easy food recipes in short video form
Postural awareness	Pat: Some daily activities (e.g., lifting things) may trigger pain because of poor postural awareness. HCP: Poor biomechanics and bad postural awareness while performing daily tasks (e.g., lifting things, getting out of bed) may trigger or aggravate pain	Audio-visual content on educating correct postures related to key daily and culturally relevant tasks, e.g., kneading dough, using cooking spatulas, lifting things; Use of avatar and representative visuals (e.g., kitchen)

Patient education		
General pain education	Pat: It may help understanding our condition and underlying reasons HCP: Patient education improves treatment success rate and shapes self-management behaviours.	Awareness messages about causes of pain and approaches to manage them in form of animated videos and audio recordings; Structured interactive and culturally appropriate educational modules (e.g., using female doctor avatar) in different languages (e.g., Urdu language with subtitles in English) and quizzes to promote learning
Self-medication	Pat: Availability of NSAIDs and opioids and information about medications may encourage unsafe medication practices HCP: Self-medication practices are resulting in opioid addiction and NSAID intake without prescription is resulting in renal damage, ulcers and drug reactions.	Audio-visual educational content on correct usage of drugs and their side effects; medicine tracker; Quizzes and alerts to promote safe medication practices
Social support		
Family support	Pat: Family's recognition of the problem and support in managing pain is essential HCP: Family members may help monitoring and motivating patients to adopt a routine (e.g., daily walk)	General awareness about chronic pain and its management and role of family members in it; Interactive game, involving patient and their carer, which may promote family carer involvement
Peer support	Pat: People with similar pain experiences may support and motivate each other. HCP: Information circulated through peers is not personalized and can be hazardous.	Video of success stories of people with similar experiences; Group challenges or games with badges and rewards; Peer support programs

Discussion

This study highlights a mismatch between the existing digital pain self-management tools and the pain self-management needs of Pakistani population. We found more standalone tools in the app store, majority of which focused on physical and mental therapies. Tools reported in the literature used combination of formats (e.g., video, audio, images, text) to deliver educational content, while single-formatted tools were more common in the Play Store apps. Play Store apps more commonly used design features to promote engagement with the content, and aspects related to peer support and dietary advice were more commonly reported in the literature, which were consistently highlighted in group discussions. Findings suggested substantial reliance of people on culturally influenced pain self-management practices, which were also strengthened by their negative medication perceptions and lack of patient education opportunities. These practices were largely influenced by cultural beliefs and perceptions and digital information, rather than guided by professional advice. To manage pain effectively, they identified several requirements for pain self-management tools, including evidence based audio-visual content and incorporating aspects related to symptom monitoring, symptom relief and physical rehabilitation, psychological wellbeing, lifestyle management, social support and patient education. They also supported use of diverse engagement strategies (e.g., personalisation, avatar, quizzes etc) for sustained use and benefit.

Evidence suggests that individuals with chronic conditions frequently seek health-related information from non-clinical settings, including friends and family and online platforms (41, 42). The quality of health information is highly variable, often lacking accuracy and completeness (43, 44), which was also mentioned by our study participants. Participants also recognised that this information is often shaped by personal beliefs rather than evidence-based guidance, potentially reinforcing misconceptions and unsafe self-management practices (45). While participants suggested approaches (e.g., clinician recommendation) to improve trustworthiness of health information, future research should focus on developing evidence-information guidance to support pain self-management.

We found strong preference for non-pharmacological approaches, particularly for dietary home remedies. These preferences are mainly shaped by negative perception about medications and their side effects and influence of cultural beliefs and perceptions (12). Despite the focus on dietary self-management, current pain management guidelines provide limited dietary guidance, primarily focusing on general healthy eating or recommending Mediterranean-style diet (46, 47). However, specific dietary advice, such as anti-inflammatory diets, is found be effective in reducing inflammation and improving pain outcomes (48, 49). Moreover, lack of focus on dietary advice, as we found in our systematic reviews, highlighted a disconnect between patients' needs and existing resources. This also reflects a lack of cultural responsiveness, as current dietary advices do not account for local food choices, culinary or household dietary practices in Pakistan (50). In general, cultural adaptations of dietary interventions were noted for ethnic minority groups living in high-income countries for the management of long-term conditions, whereas such adaptations are largely absent in low- and middle-income settings like Pakistan (51). Therefore, future research should focus on developing evidence-based and culturally responsive dietary guidelines, supporting patients in dietary self-management of pain.

The study had several key strengths. By integrating the findings of systematic reviews with insights from both individuals with pain and healthcare professionals, the research provides a comprehensive overview of what is available and what needs to be considered for future digital pain self-management tools or interventions. This mixed methods approach facilitated a robust triangulation of data, thereby enhancing the validity of the results. In addition, the focus on cultural and social contexts, including dietary practices, social norms, and household dynamics addresses gaps which are underrepresented in

digital health research. Despite these strengths, the study also had some limitations. Searching apps in Apple store and recruiting family carer could enable further insights into current state of digital pain self-management apps and pain self-management experience. Moreover, the limited representation of men in our sample may restrict the generalisability of our findings. In addition, we organised focus group discussions only, which may have introduced social desirability bias and influenced the reporting of self-management practices. Future research should include more diverse population subgroups and provide flexible participation options (i.e., interviews and group discussions). Researchers and technology developers should also prioritise the development and evaluation of digital pain self-management tools in low resource settings to address higher pain management needs of Pakistani populations both within Pakistan and abroad.

Conclusion

Several pain self-management tools and interventions exist but none of them is responsive to social context of South Asians. While commercially available tools (Play Store apps) integrate interactive design features more frequently, tools described in the literature tend to offer richer educational and support components, such as dietary guidance and peer support. This suggests that commercially available tools may prioritise usability and retention, whereas research-based tools or interventions may place greater emphasis on multimodal and holistic pain management. In real-world context, pain self-management is more commonly shaped by digital health information and individuals own cultural beliefs and perception. While there is a desire for the use of evidence-based information and tools, future research should focus on co-designing and co-developing digitally enabled pain self-management tools to ensure that digital tools are both clinically meaningful and responsive to users' own social and cultural contexts. This way pain self-management approaches would be more patient-centric and equitable.

Human ethics and consent to participate

The study received ethics approval from the ethics committee of the BMY Health (ref # BMY-ERC3-1-2025). All study participants provided informed written consent, including individuals with pain and healthcare professionals. The study was conducted in accordance with the Declaration of Helsinki. Group discussions were conducted at a private place, and data was processed and stored according to established governance and data protection guidelines.

Declarations

Consent for publication

All the authors provided consent for publication.

Clinical trial number

Not applicable

Conflict of interest

None of the authors has to declare any potential conflicts of interest with respect to the research, authorship, and/or publication of this article

Funding

This research did not receive any funding and is supported by the National Institute for Health and Care Research Applied Research Collaboration Greater Manchester. The views expressed in this publication are those of the author(s) and not necessarily those of the National Institute for Health and Care Research or the Department of Health and Social Care.

Author Contribution

SMA conceived the idea of this study. UH and SMA drafted the protocol. SMA created list of data extraction items for reviews to which all authors provided feedback. NKL reviewed mobile apps and extracted data, YI, AZ, and SBJ reviewed literature and extracted data from literature. SMA, SBJ and NKL drafted topic guide and created table of specification template, which all authors reviewed. MH, SEAK, NB, SBJ and AH facilitated data collection for the narrative study. SBJ, NKL, YI and AH were involved in transcriptions and data analysis. All authors were involved in data interpretation. UH drafted the manuscript, to which all authors provided feedback and approved its final version for submission.

Acknowledgement

We would like to thank Huzaifa Naveed for designing and sourcing visual prompts, which supported data collection.

Data Availability

Data will not be available to other researchers owing to the lack of participants' consent.

References

1. World Health Organization. WHO [World Health Organization] [Internet]. World Health Organization; 2022 [cited 2025 Oct 30]. Musculoskeletal health. Available from: https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions
2. Ferreira ML, de Luca K, Haile LM, Steinmetz JD, Culbreth GT, Cross M, et al. Global, regional, and national burden of low back pain, 1990–2020, its attributable risk factors, and projections to 2050: a systematic analysis of the Global Burden of Disease Study 2021. Lancet Rheumatol. 2023;5(6):e316–29. 10.1016/S2665. -9913(23)00098-X PubMed PMID: 37273833.
3. Hutchings A, Calloway M, Choy E, Hooper M, Hunter DJ, Jordan JM, et al. The Longitudinal Examination of Arthritis Pain (LEAP) study: relationships between weekly fluctuations in patient-rated joint pain and other health outcomes. J Rheumatol. 2007;34(11):2291–300. PubMed PMID: 17937461.
4. Thielke S, Corson K, Dobscha SK. Collaborative care for pain results in both symptom improvement and sustained reduction of pain and depression. Gen Hosp Psychiatry. 2015;37(2):139–43. 10.1016/j.genhosppsych.2014.11.007 . PubMed PMID: 25554014; PubMed Central PMCID: PMC4361309.
5. Kerns RD, Burgess DJ, Coleman BC, Cook CE, Farrokhi S, Fritz JM, et al. Self-Management of Chronic Pain: Psychologically Guided Core Competencies for Providers. Pain Med Off J Am Acad Pain Med. 2022;23(11):1815–9. 10.1093/pm/pnac083 . PubMed PMID: 35642906; PubMed Central PMCID: PMC9629397.
6. Fu Y, Yu G, McNichol E, Marczewski K, Closs SJ. The effects of patient-professional partnerships on the self-management and health outcomes for patients with chronic back pain: a quasi-experimental study. Int J Nurs Stud. 2016;59:197–207.
7. Promoting Chronic Pain Self-Management Education - International Association for the Study of Pain (IASP). Promoting Chronic Pain Self-Management Education | IASP. International Association for the Study of Pain (IASP) [Internet]. [cited 2026 Feb 9]. Available from: https://www.iasp-pain.org/resources/fact-sheets/promoting-chronic-pain-self-management-education/
8. Anesthesiology [Internet]. [cited 2026 Feb 9]. Available from: https://journals.lww.com/anesthesiology/fulltext/2010/04000/practice_guidelines_for_chronic_pain_ management_.11.aspx
9. Meints SM, Edwards RR. Evaluating Psychosocial Contributions to Chronic Pain Outcomes. Prog Neuropsychopharmacol Biol Psychiatry. 2018;87(Pt B):168–82. 10.1016/j.pnpbp. .2018.01.017 PubMed PMID: 29408484; PubMed Central PMCID: PMC6067990.
10. Ali SM, Gambin A, Chadwick H, Dixon WG, Crawford A, Van der Veer SN. Strategies to optimise the health equity impact of digital pain self-reporting tools: a series of multi-stakeholder focus groups. Int J Equity Health. 2024;23(1):233. 10.1186/s12939-024-02299-w . PubMed PMID: 39529006; PubMed Central PMCID: PMC11555918.
11. Kang Y, Trewern L, Jackman J, Irani. (Nee Soni) A, McCartney D. Chronic pain: supported self-management. BMJ. 2024;384:e072362. 10.1136/bmj-2022-072362.
12. Ali SM, Currie MR, Rousoki A et al. Grandchildren are like my medicine': Practices and expectations of South Asian individuals and their families for digitally enabled and carer supported pain self-management in the United Kingdom. BMC Public Health.
13. Ali SM, Lee RR, McBeth J, James B, McAlister S, Chiarotto A, et al. Exploring the Cross-cultural Acceptability of Digital Tools for Pain Self-reporting: Qualitative Study. JMIR Hum Factors. 2023;10:e42177. doi:10.2196/42177 PubMed PMID: 36753324; PubMed Central PMCID: PMC9947768.
14. Ryan P, Sawin KJ. The Individual and Family Self-management Theory: Background and Perspectives on Context, Process, and Outcomes. Nurs Outlook. 2009;57(4):217–e2256. 10.1016/j.outlook.2008.10.004 . PubMed PMID: 19631064; PubMed Central PMCID: PMC2908991.
15. MacLean RR, Shor R, Reilly ED, Reuman L, Solar C, Halat AM, et al. Engagement in Digital Self-management Interventions for Chronic Pain: A Systematic Review. Clin J Pain. 2025;41(6):e1289. 10.1097/AJP.0000000000001289.
16. Bostrøm K, Børøsund E, Varsi C, Eide H, Flakk Nordang E, Schreurs KM, et al. Digital Self-Management in Support of Patients Living With Chronic Pain: Feasibility Pilot Study. JMIR Form Res. 2020;4(10):e23893. 10.2196/23893 . PubMed PMID: 33094734; PubMed Central PMCID: PMC7647816.
17. Scholz C, Schmigalle P, Plessen CY, Liegl G, Vajkoczy P, Prasser F, et al. The effect of self-management techniques on relevant outcomes in chronic low back pain: A systematic review and meta-analysis. Eur J Pain. 2024;28(4):532–50. 10.1002/ejp.2221.
18. Strain JDR, Welch L, Sadler E. Systematic review and narrative synthesis of the experiences of individuals with chronic pain participating in digital pain management interventions. PLoS ONE. 2024;19(7):e0306455. 10.1371/journal.pone.0306455.
19. Johnson D, Deterding S, Kuhn KA, Staneva A, Stoyanov S, Hides L. Gamification for health and wellbeing: A systematic review of the literature. Internet Interv. 2016;6:89–106. 10.1016/j.invent.2016.10.002.
20. AlMarshedi A, Wills G, Ranchhod A. Gamifying Self-Management of Chronic Illnesses: A Mixed-Methods Study. JMIR Serious Games. 2016;4(2):e14. 10.2196/games.5943 . PubMed PMID: 27612632; PubMed Central PMCID: PMC5035381.
21. Lee EH, Lee YW, Chae D, Lee KW, Hong S, Kim SH, et al. Pathways Linking Health Literacy to Self-Management in People with Type 2 Diabetes. Healthcare. 2021;9(12):1734. 10.3390/healthcare9121734 . PubMed PMID: 34946460; PubMed Central PMCID: PMC8701917.
22. The Effect of Digital Health Literacy. Self-Efficacy on Self-Care Behaviors among Community-Dwelling Elderly: Focusing on Gyeongsangbuk-do [Internet]. [cited 2025 Oct 30]. Available from: https://rcphn.org/journal/view.php?number=1453
23. Elbers S, Wittink H, Pool JJM, Smeets RJEM. The effectiveness of generic self-management interventions for patients with chronic musculoskeletal pain on physical function, self-efficacy, pain intensity and physical activity: A systematic review and meta-analysis. Eur J Pain Lond Engl. 2018;22(9):1577–96. 10.1002/ejp.1253 . PubMed PMID: 29845678; PubMed Central PMCID: PMC6175326.
24. Afzal N. Chronic Disease Self-Management Digital Interventions: A Review and Recommendations for Future Design and Development of Patient Self-Management Interventions. Divers Equal Health Care 18(3):0–0. 10.36648/2049-5471.21.18.231

25. Ivankova NV, Creswell JW, Stick SL. Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. Field Methods. 2006;18(1):3–20. 10.1177/1525822X05282260.
26. O'Donnell M, Collier M, Pineda-Pinto M, Cooper C, Nulty F, Castañeda NR. Redefining co-design for social-ecological research and practice: A systematic literature review. Environ Sci Policy. 2025;164:103998. 10.1016/j.envsci.2025.103998.
27. Newman I, Lim J, Pineda F. Content Validity Using a Mixed Methods Approach: Its Application and Development Through the Use of a Table of Specifications Methodology. J Mix Methods Res. 2013;7(3):243–60. 10.1177/1558689813476922.
28. Narrative analysis. the constructionist approach [Internet]. [cited 2025 Nov 4]. Available from: https://www.academia.edu/14788118/Narrative_analysis_the_constructionist_approach?auto=download
29. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. 10.1136/bmj.n71 . PubMed PMID: 33782057.
30. Conducting a systematic. review and evaluation of commercially available mobile applications (apps) on a health-related topic: the TECH approach and a step-by-step methodological guide | BMJ Open [Internet]. [cited 2026 Feb 9]. Available from: https://bmjopen.bmj.com/content/13/6/e073283
31. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19(6):349–57. 10.1093/intqhc/mzm042.
32. Khalid H, Basalem N, Saleem S, Shoaib H, Ahmed N, Baloch K et al. Digitally enabled patient education for self-managing chronic musculoskeletal pain: a scoping review. J Med Internet Res. 2026.
33. Devan H, Farmery D, Peebles L, Grainger R. Evaluation of Self-Management Support Functions in Apps for People With Persistent Pain: Systematic Review. JMIR MHealth UHealth. 2019;7(2):e13080. doi:10.2196/13080 PubMed PMID: 30747715; PubMed Central PMCID: PMC6390192.
34. StatCounter Global Stats [Internet]. [cited 2025 Nov 1]. Mobile Operating System Market Share Pakistan. Available from: https://gs.statcounter.com/os-market-share/mobile/pakistan?utm_source=chatgpt.com
35. Saleem M, Kühne L, De Santis KK, Christianson L, Brand T, Busse H. Understanding Engagement Strategies in Digital Interventions for Mental Health Promotion: Scoping Review. JMIR Ment Health. 2021;8(12):e30000. doi:10.2196/30000 PubMed PMID: 34931995; PubMed Central PMCID: PMC8726056.
36. Ali SM, Lee RR, McBeth J, James B, McAlister S, Chiarotto A, et al. Exploring the Cross-cultural Acceptability of Digital Tools for Pain Self-reporting: Qualitative Study. JMIR Hum Factors. 2023;10(1):e42177. 10.2196/42177.
37. Campos HLM, Liebano RE, Lima CA, Perracini MR. Multidimensional investigation of chronic pain experience and physical functioning following hip fracture surgery: clinical implications. Br J Pain. 2020;14(1):5–13. doi:10.1177/2049463719861994 PubMed PMID: 32110393; PubMed Central PMCID: PMC7026833.
38. Crofford LJ. Chronic Pain: Where the Body Meets the Brain. Trans Am Clin Climatol Assoc. 2015;126:167–83. PubMed PMID: 26330672; PubMed Central PMCID: PMC4530716.
39. Jull G. Biopsychosocial model of disease: 40 years on. Which way is the pendulum swinging? Br J Sports Med. 2017;51(16):1187–8. 10.1136/bjsports-2016-097362 . PubMed PMID: 28062465.
40. JMIR Preprints [Internet]. [cited 2026 Mar 4]. Gathering user requirements and assessing usability of a digital pain self-reporting tool among people living with chronic musculoskeletal pain in Pakistan: A qualitative study. Available from: https://preprints.jmir.org/preprint/84612
41. Fox S, Duggan M, Health Online. 2013. Pew Research Center [Internet]. 2013 Jan 15 [cited 2026 Mar 25]. Available from: https://www.pewresearch.org/internet/2013/01/15/health-online-2013/
42. Tan SSL, Goonawardene N. Internet Health Information Seeking and the Patient-Physician Relationship: A Systematic Review. J Med Internet Res. 2017;19(1):e9. 10.2196/jmir.5729 . PubMed PMID: 28104579; PubMed Central PMCID: PMC5290294.
43. (PDF) Quality of health information for consumers on the web: A systematic review of indicators, criteria, tools, and evaluation results: Quality of Health Information for Consumers on the Web [Internet]. [cited 2026 Mar 25]. Available from: https://www.researchgate.net/publication/275673699_Quality_of_health_information_for_consumers_on_the_web_A_systematic_review_of_indicators_c_tools_and_evaluation_results_Quality_of_Health_Information_for_ Consumers_on_the_Web
44. Daraz L, Morrow AS, Ponce OJ, Beuschel B, Farah MH, Katabi A, et al. Can Patients Trust Online Health Information? A Meta-narrative Systematic Review Addressing the Quality of Health Information on the Internet. J Gen Intern Med. 2019;34(9):1884–91. 10.1007/s11606-019-05109-0 . PubMed PMID: 31228051; PubMed Central PMCID: PMC6712138.
45. Dwarswaard J, Bakker EJM, van Staa A, Boeije HR. Self-management support from the perspective of patients with a chronic condition: a thematic synthesis of qualitative studies. Health Expect Int J Public Particip Health Care Health Policy. 2016;19(2):194–208. 10.1111/hex.12346 . PubMed PMID: 25619975; PubMed Central PMCID: PMC5055271.
46. Overview. | Chronic pain (primary and secondary) in over 16s: assessment of all chronic pain and management of chronic primary pain | Guidance | NICE [Internet]. NICE; 2021 [cited 2026 Mar 25]. Available from: https://www.nice.org.uk/guidance/ng193
47. Kolasinski SL, Neogi T, Hochberg MC, Oatis C, Guyatt G, Block J, et al. 2019 American College of Rheumatology/Arthritis Foundation Guideline for the Management of Osteoarthritis of the Hand, Hip, and Knee. Arthritis Rheumatol Hoboken NJ. 2020;72(2):220–33. 10.1002/art.41142 . PubMed PMID: 31908163; PubMed Central PMCID: PMC10518852.
48. Asadi S, Grafenauer S, Burley CV, Fitzgerald C, Humburg P, Parmenter BJ. The effectiveness of dietary intervention in osteoarthritis management: a systematic review and meta-analysis of randomized clinical trials. Eur J Clin Nutr. 2025;79(10):959–71. 10.1038/s41430-025-01622-0 . PubMed PMID: 40295866; PubMed Central PMCID: PMC12537491.

49. Schönenberger KA, Schüpfer AC, Gloy VL, Hasler P, Stanga Z, Kaegi-Braun N, et al. Effect of Anti-Inflammatory Diets on Pain in Rheumatoid Arthritis: A Systematic Review and Meta-Analysis. Nutrients. 2021;13(12):4221. 10.3390/nu13124221 . PubMed PMID: 34959772; PubMed Central PMCID: PMC8706441.
50. Tariq O, Rosten C, Huber J. Cultural Influences on Making Nutritional Adjustments in Type 2 Diabetes in Pakistan: The Perspectives of People Living With Diabetes and Their Family Members. Qual Health Res. 2024;34(6):562–78. doi:10.1177/10497323231219392 PubMed PMID: 38131164.
51. Basalem N, Astek AA, Sroge RA, Ali SM, Gangannagaripalli J, Stanmore E, et al. Cultural tailoring of pain management approaches: a scoping review. Int J Equity Health. 2025;24:354. 10.1186/s12939-025-02743-5 . PubMed PMID: 41422041; PubMed Central PMCID: PMC12752237.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AnnexBBaselinequestionnairepatients.docx
- AnnexAListofdataextractionitems.docx
- AnnexETopicguideforHCPs.docx
- AnnexCBaselinequestionnaireHCPs.docx
- AnnexDTopicguideforpatients.docx