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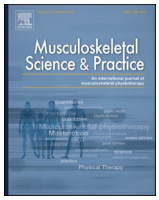

Review article

Digital health self-management interventions for musicians with playing-related musculoskeletal disorders: A scoping review

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ABSTRACT

Introduction: Playing-related musculoskeletal disorders are common in musicians. Self-management interventions are recommended to improve the management of musculoskeletal disorders and support individuals to safely take responsibility for their own health. Digital health interventions are increasingly used to support self-management of musculoskeletal disorders. However, their use in musicians remains poorly understood.
Aim: The aim of this scoping review is to map the available evidence on digital health interventions for the self-management of playing-related musculoskeletal disorders in musicians. This includes summarising the key characteristics of current interventions including content, mode of delivery and theoretical underpinning, their effect on musicians' ability to continue to play, and exploring any reported adverse effects, to inform future interventions.
Methods: The review followed the Joanna Briggs Institute scoping review framework and was reported according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.
Results: Nine studies were included. None of the interventions were underpinned by a theoretical framework. All interventions targeted student and orchestral musicians, involving exercise, health education, or both, and were delivered via pre-recorded videos (n = 4), websites (n = 3), and video conferencing (n = 2). Six interventions were home-based, one was conducted at a university, and two included a combination of home-based and workplace sessions. Exercise-based digital health interventions (n = 7) reported improvements in pain and physical outcomes.
Conclusion: The evidence on digital health interventions for musicians is limited, with studies targeting student and orchestral musicians and none applying theoretical frameworks. This highlights the need for broader and more rigorous self-management interventions for PRMSDs in musicians.

1. Introduction

Musicians are exposed to continuous and repeated physical movements that can affect performance ability (Zaza et al., 1998). This phenomenon was described by Zaza et al. (1998) as playing-related musculoskeletal disorders (PRMSDs) and is defined as any musculoskeletal symptom—such as pain, numbness, tingling, or weakness—that interferes with the ability to play a musical instrument to a normal level. A systematic review investigating PRMSDs in orchestral musicians found the 12-month prevalence rate to be as high as 86 %–89 % (Kok et al., 2016), with 48 % of UK musicians reporting current moderate or severe musculoskeletal pain (Kreutz et al., 2008). Since 72 % of UK professional musicians are self-employed or work in a freelance capacity, with no access to workers' compensation or paid sick leave (Complete Music Update, 2020), PRMSDs can have a significant effect on health and careers (Stanhope et al., 2022).

The evidence suggests that self-management interventions (SMIs) can reduce pain and disability associated with MSDs (Babatunde et al., 2017). SMIs are designed to equip patients with the skills to actively participate and take responsibility for the optimal management of their conditions (Jonkman et al., 2016). This is achieved through education and at least two of the following: monitoring signs and symptoms, managing medications, using problem-solving and decision-making skills for treatment, and modifying health behaviours such as

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engaging in exercise (Jonkman et al., 2016). Evidence further suggests that the effectiveness of these interventions is enhanced when they are underpinned by a behaviour change theoretical framework, which provides structured strategies to support the adoption and maintenance of health behaviours (Michie et al., 2011).

Recent studies have suggested that offering a digital self-management programme could improve the management of PRMSDs by making these interventions more accessible and cost-effective (Roos et al., 2021; Austen et al., 2024). While previous systematic reviews have shown that digital health interventions (DHIs) are comparable to face-to-face interventions in reducing pain and improving physical and psychological outcomes in people with musculoskeletal disorders (MSDs) (Cottrell et al., 2017; de Oliveira Lima et al., 2021), their use for PRMSD self-management in musicians remain poorly understood. The aim of this scoping review is to map the available evidence on DHIs for PRMSD self-management in musicians, summarise the key characteristics of current DHIs including content, mode of delivery and theoretical underpinning and assess its effect on musicians' ability to continue to play, and explore any reported adverse effects, to inform future interventions.

2. Methods

2.1. Scoping review methodology

The scoping review methodology was guided by the Joanna Briggs Institute (JBI) framework (Peters et al., 2020) and the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (Tricco et al., 2018).

2.2. Eligibility criteria

The PCC (population, concept, and context) mnemonic was used to develop the inclusion criteria, as recommended by the JBI framework (Peters et al., 2020). As outlined in Table 1, the population included adult musicians with current or previous PRMSDs or musculoskeletal symptoms related to practising or performing music (Zaza et al., 1998). The study explored DHIs which aimed to support the self-management of PRMSDs in musicians. DHIs were defined as specific functionalities or capabilities provided by digital technologies that aim to fulfil goals related to health and quality of life (World Health Organisation [WHO] 2023). DHIs can be categorised based on the primary users, including patients, healthcare providers, and health management personnel (WHO, 2023), with interventions including internet-based programmes, mobile health applications, virtual reality, video conferencing, video-based content, and text-messaging (Riva, 2000; WHO, 2023).

Table 1
Eligibility criteria.

	Inclusion criteria	Exclusion criteria
Participants	- Adults aged 18 years or older. - Musicians working in any music-related setting (e.g. orchestras, conservatoires, self-employed). - University-level music students. - Current or previous playing-related musculoskeletal symptoms, such as pain, reduced range of motion, muscle weakness, inability to perform.	- Musculoskeletal conditions caused by trauma, inflammatory conditions, genetic conditions, neurological conditions, or any other condition not related to practising or performing music.
Concept	- Any digital health intervention that supports self-management of PRMSDs in musicians.	- Passive interventions such as ice and heat application, taking medications, using creams/gels, resting, ergonomic equipment. - Post-surgical rehabilitation.
Context	- Any setting (e.g., home or the workplace).	
Studies	- Any primary research study in English, including grey literature.	- Secondary research studies (e.g., literature reviews, editorials) were excluded to ensure the review focused on original data and primary evidence directly relevant to the research aim and objectives. - Conference abstracts.

2.3. Data searches

A three-step search strategy was utilised. One reviewer (NE) developed the search strategy in conjunction with a professional librarian. An initial Medline search helped to identify search terms and phrases relevant to the review question (Appendix Table 1). A comprehensive electronic search was conducted in the following databases: Embase (Ovid), CINAHL (EbscoHost), the Allied and Complementary Medicine Database (AMED) (Ovid), TripPro and Music Index (EbscoHost), and ProQuest. Screening of citation and reference lists of included studies was conducted to identify secondary studies that met the inclusion criteria. The search was not restricted by publication date but was limited to the English language. Keywords and search results are provided in the appendix (Tables 2 and 3).

2.4. Study selection

Titles and abstracts, and subsequently full texts, were screened by three reviewers (NE, LS, RH) independently against the eligibility criteria. Any disagreements were resolved by consensus or by the decision of a fourth reviewer (VS).

2.5. Critical appraisal

Generally, critical appraisal is not recommended in scoping reviews as the aim is to map the available evidence, rather than provide a synthesised and clinically meaningful answer to a question or estimating the strength of the evidence (Peters et al., 2020). However, the field of DHIs is rapidly evolving, and the quality of research can vary (Hewitt et al., 2020; Kelly et al., 2022). Therefore, it was considered important to critically appraise the studies to determine the validity of their results and to distinguish between robust insights and those affected by methodological flaws (Almutairi et al., 2024). Studies were appraised using the JBI critical appraisal tools (Barker et al. 2023, 2024). Critical appraisal was conducted by one reviewer (NE) and checked for accuracy by all other reviewers (LS, RH, VS).

2.6. Data extraction

Data extraction (Table 3) was conducted by one reviewer (NE) and checked for accuracy by all other reviewers (LS, RH, VS). The following data was extracted from each study: intervention content, dose, method of delivery and settings, intended outcomes and completion and adherence rates.

2.7. Data synthesis and analysis

Studies were analysed to identify factors that had a positive or negative association with DHI use for PRMSD self-management in musicians.

Table 2
Critical appraisal summary.

Study	True randomisation	Allocation concealment	Similar baseline characteristics between groups	Deviation from intended protocol	Assessor blinding	Missing outcome data	Appropriate statistical analysis
Austen et al. (2024)	Unclear	No	No	Yes	No	Yes	Yes
Cerveró et al. (2018)	N/A	N/A	N/A	Unclear	N/A	No	Yes
Chan et al. (2013)	N/A	N/A	N/A	Yes	N/A	Yes	Yes
Ingle (2013)	N/A	N/A	N/A	Yes	N/A	Yes	No
Kuo et al. (2020)	N/A	N/A	N/A	Yes	N/A	Yes	Yes
Porter (2021)	Unclear	No	Unclear	Unclear	No	No	Yes
Roos and Roy (2018)	Yes	Yes	Yes	Yes	Yes	No	Yes
Roos et al. (2024)	Yes	Yes	Yes	Yes	Yes	No	Yes
Su et al. (2012)	N/A	N/A	N/A	No	N/A	No	Yes

Key: N/A indicates non-applicable for quasi-experimental studies with a single-group pre-post-test design.

3. Results

3.1. Literature search

As outlined in Fig. 1, from the 1014 identified studies, nine met the inclusion criteria. Seven studies were journal articles (Su et al., 2012; Chan et al., 2013; Cerveró et al., 2018; Roos and Roy, 2018; Kuo et al., 2020; Austen et al., 2024; Roos et al., 2024), one was an undergraduate thesis (Porter, 2021), and one was a master's thesis (Ingle, 2013). Five studies employed quasi-experimental research designs, with two conducted in Australia (Chan et al., 2013; Ingle, 2013), two in Taiwan (Su et al., 2012; Kuo et al., 2020), and one in Spain (Cerveró et al., 2018). Two studies were pilot randomised controlled trials (RCTs) conducted in the UK and Canada (Roos and Roy, 2018; Austen et al., 2024), while two were full RCTs conducted in the USA (Porter, 2021) and in Canada (Roos et al., 2024).

3.2. Critical appraisal

The critical appraisal of the reviewed studies is summarised in Table 2. Of the nine included studies, only two adequately reported randomisation procedures and blinded outcome assessors (Roos et al., 2024; Roos and Roy, 2018). Several studies reported protocol deviations where participants received additional treatments, including physiotherapy, chiropractic care, acupuncture, and osteopathy (Austen et al., 2024; Roos et al., 2024; Roos and Roy, 2018). Four studies had incomplete follow-up data and lacked intention-to-treat analysis (Chan et al., 2013; Ingle, 2013; Kuo et al., 2020; Austen et al., 2024), potentially introducing attrition and reporting bias. Furthermore, two studies reported different baseline characteristics between control and intervention groups (Austen et al., 2024; Porter, 2021), while one study (Ingle, 2013) did not employ statistical testing due to the very small number of participants who completed the course (only four out of 25). This limits the ability to draw reliable conclusions from the data.

3.3. Description of the studies

As summarised in Fig. 2, the nine included studies captured data from a total of 344 musicians, comprising 112 student musicians and 232 professional orchestral musicians, with a mean age ranging from 21 to 40.9 years. Only three studies included musicians with PRMSDs (Cerveró et al., 2018; Roos and Roy, 2018; Austen et al., 2024). The interventions consisted of exercise and health education, with pain being the most commonly reported outcome measure.

3.4. Intervention characteristics

3.4.1. Exercise programmes

As outlined in Table 3 and Fig. 3, seven studies included therapeutic exercises. Three studies (Chan et al., 2013; Roos and Roy, 2018; Roos et al., 2024) adapted the same motor control exercise programme developed by Chan et al. (2012). Chan et al. (2013) investigated a DVD-based exercise programme with 144 Australian orchestral musicians, though only 50 were included in the final analysis due to non-compliance. Over 12 weeks, PRMSD frequency (mean 3.3 to 2.1, $t = -2.82$, $p < 0.01$) and severity (mean 2.9 to 1.9, $t = -2.79$, $p < 0.01$) significantly decreased, but no follow-up was conducted to assess long-term effects. Although 55 % preferred the video format to face-to-face classes (Chan et al., 2014), adherence was low (41 %). In contrast, Roos and Roy (2018) and Roos et al., (2024) reported higher adherence (70–98 %, respectively) and no dropouts. Only Roos et al. (2024) study with 65 Canadian orchestral musicians found significant pain reductions when combining education, exercise videos, and supervised classes, with between-group differences of −4.2 (95 % CI −7.49 to −0.88, $p < 0.05$) at 14 weeks and −3.7 (95 % CI −7.06 to −0.32, $p < 0.05$) at 11 months.

Evidence for warm-up exercises in students is mixed. Austen et al. (2024) piloted a 2-week video-based exercise programme with 19 conservatoire students but found no significant effects on pain or mood (all $p > 0.05$). However, controlling for anxiety, depression, and sleep revealed significant reductions in pain (e.g., ANCOVA for anxiety: $F(1, 11) = 5.09$, $p = 0.04$). Porter (2021), by contrast, reported significant decreases in head/neck pain (mean change −0.90 vs. 0.44, $p = 0.045$) and back pain (−1.57 vs. 0.43, $p = 0.017$) following an 8-week Zoom-based isometric/stretching warm-up in 19 string students, though the non-validated pain scale limits reliability.

Two further studies explored targeted exercise programmes in clarinettists and violinists. Cerveró et al. (2018) found a 9-week intervention improved pain (from 6.0 ± 0.82 to 4.8 ± 0.63, $p = 0.001$) and postural alignment in 10 clarinettists. Kuo et al. (2020) reported significant improvements in pain (median decrease of 4 points, $p < 0.01$), disability ($p < 0.01$), cervical muscle endurance ($p < 0.01$), and range of motion (extension $p < 0.01$; lateral flexion/rotation $p < 0.05$) in 20 violinists after a 6-week cervical stabilisation programme.

3.4.2. Health education

Four studies delivered digital educational programmes (Su et al., 2012; Ingle, 2013; Roos and Roy, 2018; Roos et al., 2024). Roos and Roy (2018) delivered a single face-to-face session, while Roos et al. (2024) and Ingle (2013) offered a web-based health education course for student musicians. Of these studies, only Roos et al. (2024) found

Table 3
Summary of interventions, intended outcomes, and completion and adherence rates in the reviewed studies (n = 9).

Author/ Year	Intervention					Intended outcomes/ Effect (Yes = significant improvement No = no significant improvement)	Completion rate (CR)/reasons for drop out Adherence rate (AR)/reasons for non-adherence
	Digital tool	Content and structure	Setting	Monitoring and support	Dose and time for follow-up		
Austen et al. (2024)	Exercise videos	Upper limb warm-up, aerobic exercises	Home-based	Check-in emails	15 min daily × 2 weeks	Pain intensity – Yes Pain interference – No Anxiety and depression – No Perceived exertion – No Participants' experiences – overall positive	CR - 84.21 % (reasons not reported) AR – not reported
Chan et al. (2013)	Exercise videos	5 exercise series (neck, shoulder, abdominal, lumbo-pelvic, hip); 6 difficulty levels; warm-up/ cool-down	Home-based	Not reported	40 min × 2/ week × 12 weeks	Frequency and severity of PRMSDs – Yes Perceived exertion – No Participants' experience - Intervention same as or better than face-to-face delivery	CR – 35 % (Reasons: Illness/ injury, too busy, unforeseen family commitments, being overseas, administrative error, participants who completed less than the recommended exercises were excluded from the final analysis) AR – 41 %
Cerveró et al. (2018)	Website	Three phases: adaptation→skills→ functional development; cat-camel, trunk rotation, arm exercises	Home-based	Check-in emails, pain questionnaire	3 × /week × 9 weeks	Improvements in postural alignment – Yes Pain perception – Yes Perceived exertion – No	CR – 100 % AR – not reported
Ingle (2013)	Website	Six modules: anatomy, posture, performance, biomechanics, psychology, injury prevention	Home-based	Online discussion board	40 min/ module × 4 weeks	Increased knowledge of injury prevention, physical fitness, nutrition and emotional well-being – No Behavioural changes – No Physical and psychological health outcomes – No Participants' experiences – further improvements required	CR - 16 % (Reasons: timing conflicts, lack of awareness or interest in the course, limited internet access, technical difficulties, course length) AR - not reported
Kuo et al. (2020)	Exercise videos	Cervical exercises: axial elongation, flexion, extension, scapulothoracic strengthening	Home-based	Phone/video calls, exercise log	20 min × 3/ week × 6 weeks	Reduction in neck pain and disability – Yes Improvement in cervical muscle endurance – Yes Improvement in cervical range of motion – Yes Improvement in postural alignment – Yes Improvement in cervical proprioception – Yes	CR - 83.33 % (four participants who dropped out of the study were excluded from the analysis) AR – 90.1 %
Porter (2021)	Video conferencing	Isometric/stretching exercises: neck, wrists, chest, back, arms	Home-based	Scheduled Zoom meetings, logbook	20 min × 2/ week × 8 weeks	Pain reduction – Yes Participants' experiences – positive	CR and AR were not reported
Roos and Roy (2018)	Exercise videos	In-person education + supervised sessions + home videos	Home-based and in workplace	Exercise logbook	2 × /week × 11 weeks	Intensity and frequency of musculoskeletal symptoms – No. Functional limitations – No Global Physical Health – No	CR – 100 % AR in intervention group – 97.7 % AR in control group – 89 %
Roos et al. (2024)	Website	Health education (3 presentations) and exercise videos	Home-based and in workplace	Patient-reported outcomes	20 min × 4/ week × 14 weeks	Pain intensity – Yes Pain interference – No Pain frequency – No Global physical health – No	CR: 95.4 %. AR of the intervention group: 70 % AR of home exercises: 65 % AR of supervised sessions: 83 %
Su et al. (2012)	Videos and video conferencing	3 courses: foundation (anatomy, fitness), advanced (anxiety, hearing), application (stress management, techniques)	Home-based	Online discussion, teaching assistants	60 min lecture + 40 min discussion × 14 weeks	Awareness of performance and practice issues – Yes Awareness of health and lifestyle issues – No	CR – 100 %. AR – Not reported

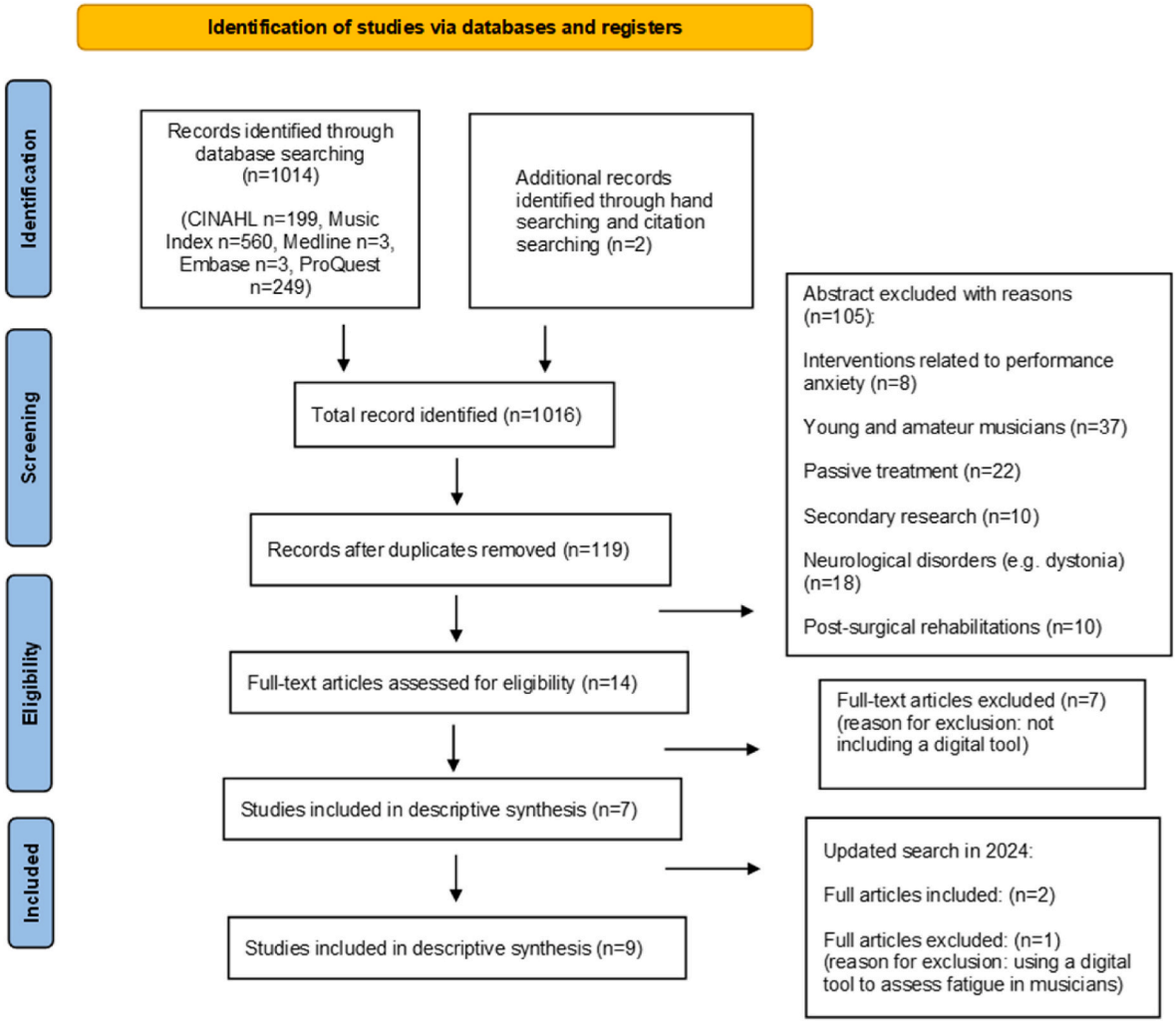

Fig. 1. PRISMA Flow diagram.

significant improvements in pain, but it is difficult to attribute this result to the education course alone, as the intervention was combined with online and supervised exercise sessions. In addition, Roos et al. (2024) did not investigate acquired knowledge or changes in behaviour, which could be relevant outcomes for investigating the impact of health education on PRMSDs.

In contrast, Su et al. (2012) combined pre-recorded lectures with interactive online discussions, and theirs was the only study to find significant improvements in students' awareness of performance issues ($t = 2.731$, $p < 0.05$). Therefore, it is possible that a blended and interactive approach might be more appropriate for health promotion in musicians in the management of PRMSDs.

3.4.3. *Setting and related factors*

Six studies were home-based (Chan et al., 2013; Ingle, 2013; Cerveró et al., 2018; Kuo et al., 2020; Porter, 2021; Austen et al., 2024), one was conducted at a university (Su et al., 2012), and two included a combination of home-based and workplace sessions (Roos and Roy, 2018; Roos et al., 2024). Chan et al. (2013) did not provide any supervision or guidance, while three studies used regular email and phone check-ins (Cerveró et al., 2018; Kuo et al., 2020; Austen et al., 2024) and two employed online meetings and discussion forums (Su et al., 2012; Porter, 2021). It is unclear whether supervision and guidance affected outcomes or adherence, as the results were mixed (Cerveró et al., 2018; Roos and Roy, 2018; Porter, 2021; Austen et al., 2024).

Studies that incorporated self-monitoring methods and in-person supervision tended to report higher adherence and completion rates compared to those that did not (Cerveró et al., 2018; Roos and Roy, 2018; Kuo et al., 2020; Porter, 2021; Roos et al., 2024). Self-monitoring methods included online questionnaires to log exercise completion (Roos and Roy, 2018; Kuo et al., 2020; Porter, 2021; Roos et al., 2024) and self-reported pain and exertion levels after each exercise session (Cerveró et al., 2018; Roos et al., 2024).

3.4.4. *Dose and time of follow-up*

The frequency, duration, and number of sessions varied across the studies, even among those using the same exercise programme and DHI (pre-recorded videos) (Chan et al., 2013; Roos and Roy, 2018; Roos et al., 2024). The number of sessions ranged from daily (Austen et al., 2024) to once weekly (Su et al., 2012), with programme durations spanning from 2 weeks (Austen et al., 2024) to 14 weeks (Su et al., 2012; Roos et al., 2024) and follow-up data provided 11 months later (Roos et al., 2024). Session lengths varied from 15 min (Austen et al., 2024) to 45 min (Roos et al., 2024).

3.4.5. *Adverse effects*

Only three studies explored adverse effects (Chan et al., 2013; Roos and Roy, 2018; Roos et al., 2024). While Roos et al. (2024) reported no

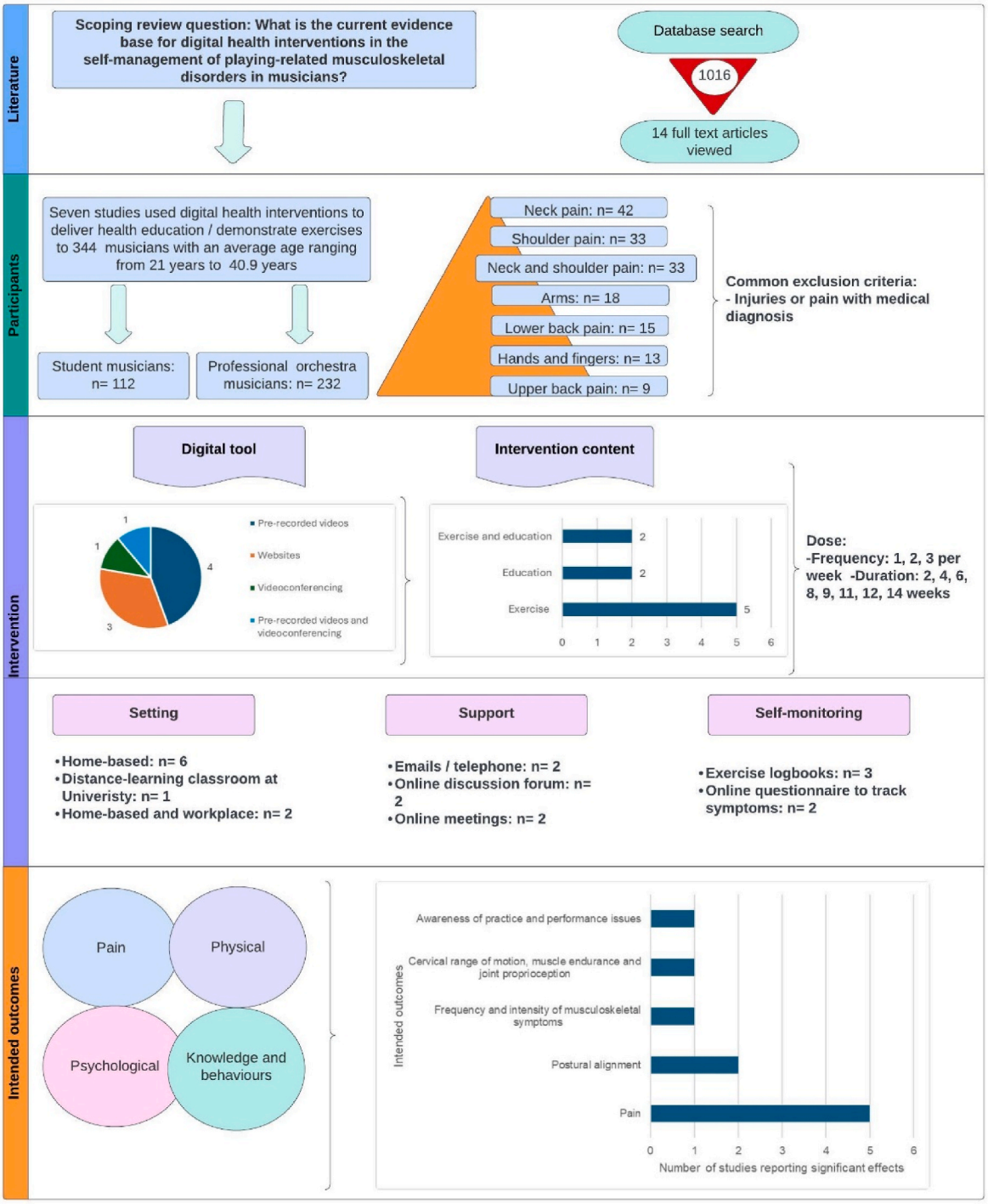

Fig. 2. Summary of the key findings of the scoping review.

adverse effects, Roos and Roy (2018) noted that three participants experienced slight, temporary pain increases during home sessions that resolved after technique correction. Chan et al. (2013) reported one participant with mild exacerbation of a chronic hip condition, who was advised to stop the specific exercise and consult a physiotherapist.

3.4.6. *Participants' experience*

Participants' experiences were investigated in four studies. Three of these studies reported that exercise videos were perceived to be as effective as or better than face-to face delivery (Chan et al., 2013) and that they were enjoyable and helpful (Porter, 2021; Austen et al., 2024). In contrast, the perception of websites was mixed, with Ingle (2013) reporting the lowest completion rate (16 %). Participants generally found the website convenient, as they could access the material at their own pace and from any location; however, some noted a lack of engagement and interaction, as well as technical issues in platform access and navigation (Ingle, 2013). Consequently, participants expressed a preference for more interactive elements, such as face-to-face discussions rather than DHIs: a sentiment echoed in a recent systematic review (Stanhope et al., 2022). It is important to note that this study took place in 2013, and many of these issues may no longer be relevant due to advances in technology (WHO, 2023).

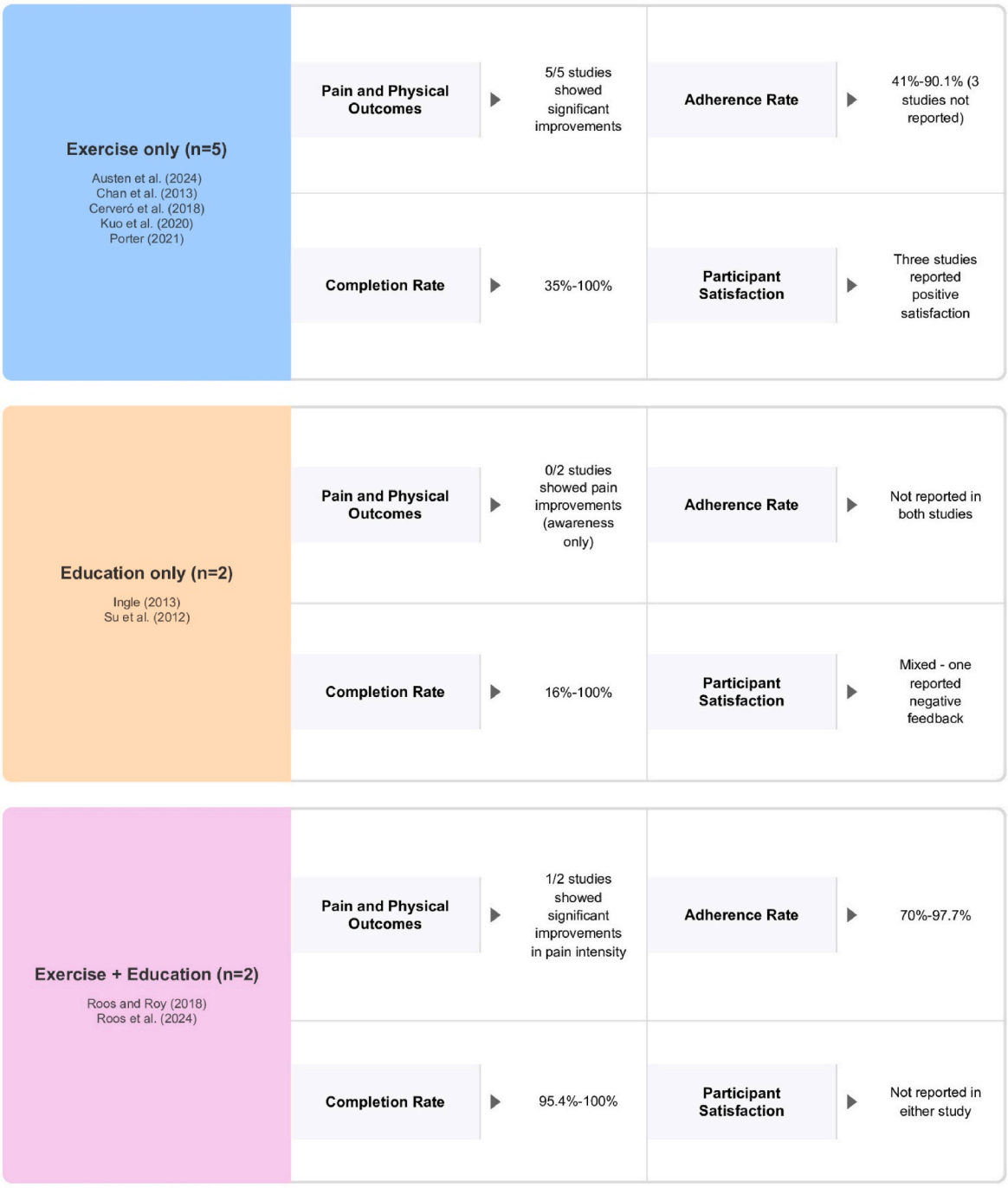

Fig. 3. Intervention types and outcomes.

4. Discussion

4.1. Main findings

This scoping review found that DHIs for PRMSD self-management in musicians involved exercise, education, or a combination of both. The studies utilised pre-recorded videos, video teleconferencing, and websites; however, the integration of DHIs lacked underpinning theories and their applications varied across the studies, primarily targeting pain, physical outcomes (i.e., range of motion, physical exertion, muscle endurance), behaviour change, health knowledge and psychological outcomes. Support and guidance through supervised exercise classes and self-monitoring methods contributed to the positive reception of DHIs, and the higher completion and adherence rates observed in some studies. Only three studies reported adverse effects, all of which were minor and temporary.

4.2. Comparison with other literature

This review builds on existing literature by mapping the available evidence on DHIs for PRMSDs self-management in musicians. Previous systematic reviews on PRMSD prevention and management have indicated exercises may be beneficial for musicians, although the evidence is limited (Stanhope et al., 2022; Laseur et al., 2023). Common issues—also reflected in the current study—include the focus on student and orchestral musicians, small sample sizes, high attrition rates and lack of validated outcome measures. Studies suggest the Disabilities of the Arm, Shoulder and Hand questionnaire, specifically the performing arts module (Stanhope et al., 2019), and the Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians to assess PRMSD and its impact on musicians (Berque et al., 2014).

This review highlights further issues in the current evidence base. First, the limited use of theoretical frameworks. Willis et al. (2019) and Clark and Lisboa (2013) indicated that the absence of theory-driven research limits the progress that can be made in the performing arts health field, as well as the development of evidence-based interventions. In addition, Davis et al. (2015) suggested that designing interventions without considering the target behaviour and the factors influencing that behaviour may lead to poor treatment outcomes. Theoretical frameworks, such as the Behaviour Change Wheel for behaviour change, and Constructive Alignment as a pedagogical model, can offer structured approaches for intervention development, helping researchers to specify target behaviours, match appropriate strategies and evaluate mechanisms of action (Biggs, 1996; Michie et al., 2011).

Second, broader biopsychosocial factors, such as anxiety, stress and inadequate sleep, may also contribute to PRMSDs (Kaneko et al., 2005; Ahlberg et al., 2019). However, none of the reviewed studies incorporated these factors comprehensively or explored musicians' health needs. This is an issue repeatedly criticised in the wider literature on MSDs and the development of DHIs, as it can lead to suboptimal care, poor treatment adherence, and poor self-management (Kress et al., 2015; Cranen et al., 2017). To address this, future research should incorporate a biopsychosocial approach and adopt a co-design model involving musicians and other relevant partners such specialised healthcare professionals to help ensure the relevance of the interventions (Skivington et al., 2021).

Delivery methods also warrant careful consideration. Exercise videos were well received by participants (Chan et al., 2013; Porter, 2021; Austen et al., 2024). Video-based formats offer advantages over traditional methods, such as the ability to pause and replay demonstrations (Peek et al., 2023). Consistent with findings in other MSD populations (Lin et al., 2019), incorporating supervised sessions may improve adherence and completion rates (Su et al., 2012; Roos and Roy, 2018; Roos et al., 2024). However, for musicians, the feasibility of such programmes may be limited by irregular schedules and the high logistical costs of group delivery (Guptill and Zaza, 2010; Baadjou et al., 2021). Therefore, further consideration of hybrid models that combine the flexibility of digital delivery with the accountability of supervised components is warranted.

In addition to delivery method, self-monitoring appeared to support intervention adherence (Roos and Roy, 2018; Cerveró et al., 2018; Kuo et al., 2020; Porter, 2021; Roos et al., 2024). However, research suggests self-monitoring is more effective when combined with other techniques like goal setting and feedback (Khan and Maes, 2021; Peiris et al., 2023). Marques et al. (2021) improved outcomes by incorporating self-monitoring within a theoretical framework that fostered motivation and coping strategies. In contrast, the reviewed studies used self-monitoring merely to assess adherence rather than as part of a comprehensive behaviour change approach. Future interventions should therefore incorporate behaviour change techniques (e.g., goal setting, action planning, and feedback mechanisms) (Michie et al., 2015) to support PRMSDs self-management in musicians.

4.3. Strengths and limitations

A key strength of this review is the transparent reporting of the review process and adherence to JBI guidance. A comprehensive search was conducted across six databases. The search was not limited to published peer-reviewed articles; grey literature was also included to ensure comprehensive coverage of available evidence. However, only studies published in English were included; therefore, relevant material published in other languages may have been missed. Additionally, as with all scoping reviews, the aim is to provide breadth rather than depth of evidence (Peters et al., 2020). Therefore, it is not possible to draw firm conclusions about the effectiveness of DHIs for PRMSD self-management in musicians.

4.4. Future directions

Future research should: 1) prioritise the development of DHIs that are tailored to the unique needs and contexts of musicians through interdisciplinary collaboration with musicians and other relevant partners; 2) incorporate theoretical frameworks such as the Behaviour Change Wheel to promote PRMSD self-management in musicians; 3) include broader recruitment beyond student and orchestral musicians; and 4) monitor and report adverse effects to ensure the safety of future interventions.

5. Conclusion

This scoping review identified nine studies examining DHIs for PRMSD self-management in musicians, primarily involving exercise programmes and health education delivered via videos and websites. The frequency, duration, and number of sessions varied across the studies, and only limited reporting on adverse effects was provided. Overall, important gaps remain in intervention design and theoretical underpinning. Further research is needed to address these gaps and guide the development of future interventions.

CRediT authorship contribution statement

N. Eleryan: Writing – review & editing, Writing – original draft, Methodology. **R. Hemming:** Writing – review & editing, Writing – original draft, Supervision, Methodology. **V. Sparkes:** Writing – review & editing, Writing – original draft, Supervision, Methodology. **L. Sheeran:** Writing – review & editing, Writing – original draft, Supervision, Methodology.

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Declarations of competing interests

None.

Appendix

Table 1
Results of initial search in Medline

Search terms	Records
(Playing-related musculoskeletal disorders OR performance-related musculoskeletal disorders OR PRMDs OR PRMSDs) AND (musicians OR music playing) AND (E-health interventions OR Electronic health OR digital health interventions)	163

Table 2
Search terms

PRMSDs	Performance-related musculoskeletal disorder* OR performance related musculoskeletal disorder* OR PRMD* OR PRMSD* playing-related pain OR playing-related musculoskeletal disorder* OR playing-related condition or music-related musculoskeletal dis* OR music-related musculoskeletal symptom* musculoskeletal symptom* OR musculoskeletal condition*
Music/musical instrument/ musician	Music Or music playing OR musical perform* OR performing art OR instrumental music OR musician* OR conservatory OR orchestra OR orchestral musician* OR music academy student* OR music student* OR student musician* OR tertiary student musician* college-level musician* OR university-level musician* OR instrument play* OR Instrumentalist* OR classical musician* OR piano OR pianist* OR piano play* OR violin OR violinist* OR violin play* OR viola* OR viola play* OR cello* OR cellist* OR cello play* OR double bass OR double bass play* OR double base play* OR bass play* OR bassist* OR flute OR flute play* OR flutist* OR oboe OR oboe play* or oboist* OR clarinet OR clarinet play* OR clarinettist* OR saxophone OR bassoon* OR bassoon play* OR bassoonist* OR trumpet OR trumpet play* OR trumpetist* OR trumpeter* OR trombone* OR trombone play* OR trombonist* OR tuba OR tuba play* OR horn* OR horn play* OR hornist OR harpsichord OR percussion play* OR percussionist* OR harp OR harp play* OR harpist OR harmonica OR organ OR church organ OR pipe organ OR organ play* OR organist* OR keyboard OR ukulele OR guitar OR guitar play* OR guitarist* OR string OR woodwind instrument* OR brass play* OR drum OR drummer* OR recorder OR pipe OR band OR Irish musician* OR military music OR martial music OR army music OR baroque music OR marching music OR jazz OR folk music OR concert* OR country OR opera* OR ensemble playing OR ensemble performance OR musical ensemble OR soloist OR instrumental solo OR solo instrument*
Digital health intervention	E-health intervention* OR Electronic health OR Mobile health intervention* OR m-Health OR digital health intervention* OR digital health OR digital intervention* OR videoconference* OR Zoom OR website* OR internet OR VR or virtual reality or video*

Table 3
Database search results

Database Search	Records identified	Records Screened	Relevant studies
CINAHL (EbscoHost)	199	199	2
Music Index (EbscoHost)	560	560	0
Medline (Ovid)	3	3	2
Embase (Ovid)	3	3	1
AMED (Ovid)	0	0	0
TripPro	0	0	0
Proquest Dissertations and Theses Global	249	249	2

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