SELF-MANAGEMENT EDUCATION FOR OSTEOARTHRITIS AND RHEUMATOID ARTHRITIS: A SYSTEMATIC REVIEW OF EFFECTS ON PAIN AND FUNCTION

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Abstract

Osteoarthritis (OA) and rheumatoid arthritis (RA) cause chronic pain and functional limitations. This systematic review evaluates self-management education (SME) effects on pain and function in adults with OA or RA. Following PRISMA, we searched PubMed, EMBASE, Cochrane, and Web of Science up to December 2024, including 18 RCTs (n=4,500 participants). Meta-analysis showed moderate pain reduction (SMD = -0.42, 95% CI [-0.58, -0.26]) and function improvement (SMD = -0.35, 95% CI [-0.51, -0.19]) with SME versus usual care, with larger effects in combined exercise programs (pain SMD = -0.55). Heterogeneity was high ($I^2 > 75\%$), and evidence quality was moderate (GRADE). SME benefits pain and function, especially digitally or with exercise, but high-quality trials are needed.

Keywords

Self-management education, osteoarthritis, rheumatoid arthritis, pain, physical function, systematic review, meta-analysis

I. Introduction

Arthritis represents a spectrum of over 100 chronic musculoskeletal conditions, with osteoarthritis (OA) and rheumatoid arthritis (RA) being the most prevalent and debilitating forms, collectively affecting over 500 million people worldwide. Osteoarthritis, characterized by degenerative joint changes, primarily affects weight-bearing joints such as the knees, hips, and spine, leading to cartilage degradation, subchondral bone remodeling, and synovial inflammation. This results in persistent pain, stiffness, and progressive loss of mobility, with global prevalence estimated at 7% of adults, rising sharply with age and obesity (Hunter & Bierma-Zeinstra, 2019). Rheumatoid arthritis, an autoimmune disorder, affects approximately 1% of the global population, causing chronic synovial inflammation, joint erosions, and systemic complications such as fatigue and

cardiovascular risk. Unlike OA's mechanical etiology, RA's inflammatory nature leads to symmetric polyarthritis, often impacting smaller joints like those in the hands and wrists, with profound functional impairment (Smolen et al., 2016). Both conditions share core symptoms—chronic pain and reduced physical function—that significantly diminish quality of life, increase disability, and elevate healthcare costs, estimated at $300 billion annually in direct and indirect expenses globally (Cross et al., 2014).

Pain in OA and RA is complex. In OA, nociceptive pain arises from mechanical stress on damaged cartilage and bone, often exacerbated by central sensitization, where pain perception amplifies over time. RA pain, driven by inflammatory cytokines like TNF-α, combines peripheral and systemic components, with flares unpredictable and debilitating. Functional limitations, measured via validated tools like the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for OA or the Health Assessment Questionnaire (HAQ) for RA, reflect difficulties in daily activities such as walking, climbing stairs, or gripping objects. These impairments not only restrict independence but also contribute to psychological distress, with 20-30% of patients reporting co-morbid depression or anxiety (Sharma et al., 2016).

Conventional management for OA and RA includes pharmacological interventions (e.g., non-steroidal anti-inflammatory drugs, disease-modifying anti-rheumatic drugs) and physical therapy, yet these approaches often provide incomplete relief. Pharmacotherapy carries risks of adverse effects, such as gastrointestinal bleeding or hepatotoxicity, and adherence rates drop below 50% within a year due to side effects or perceived inefficacy (Rannou et al., 2016). Physical therapy, while effective, is resource-intensive and inaccessible for many, particularly in rural or underserved regions. Consequently, non-pharmacological, patient-centered strategies have gained traction, with self-management education (SME) emerging as a cornerstone approach.

SME empowers patients to actively manage their condition through structured programs that deliver knowledge, skills, and behavioral strategies. Rooted in Bandura's self-efficacy theory (1977), SME aims to enhance patients' confidence in controlling symptoms, fostering adaptive behaviors like joint protection, activity pacing, and pain coping. Programs typically include education on disease mechanisms, goal-setting, cognitive-behavioral techniques (e.g., stress management), and often integrate exercise or dietary advice. Delivery modes vary—group workshops, one-on-one counseling, or digital platforms like smartphone apps and web-based modules—making SME versatile and increasingly scalable in the era of telehealth (Patten et al., 2022). For example, digital SME programs have shown promise in improving access for patients with mobility limitations or geographic barriers, with adherence rates exceeding 70% in some trials (Rodríguez Sánchez-Laulhé et al., 2022).

Clinical guidelines, such as those from the European League Against Rheumatism (EULAR) and American College of Rheumatology (ACR), endorse SME as a core component of arthritis care, citing its potential to reduce pain, improve function, and decrease healthcare utilization (Fernandes et al., 2013; Kolasinski et al., 2020). However, while individual studies and reviews have explored SME's efficacy, most focus narrowly on either OA or RA, overlooking shared pain-function pathways that could inform cross-condition strategies. For instance, exercise-integrated SME may

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synergize with biomechanical relief in OA and anti-inflammatory benefits in RA, yet integrated evidence is sparse. Furthermore, the rise of digital health since 2020 has spurred new SME formats, necessitating updated synthesis to guide implementation. This systematic review addresses these gaps by evaluating SME's effects on pain and physical function in adults with OA or RA, synthesizing randomized controlled trials (RCTs) up to December 2024 to provide robust, actionable insights for clinicians, policymakers, and researchers.

Rationale and Hypothesis

Prior reviews have examined SME for OA or RA separately, but none integrate both conditions to compare pain and function outcomes, despite shared pathophysiological and psychosocial mechanisms. For example, Wu et al. (2022) found significant pain relief in knee OA with SME, but RA-specific data remain fragmented (Shao et al., 2021). This review hypothesizes that SME significantly reduces pain and improves function (SMD < -0.3) compared to usual care, with greater effects in multimodal interventions combining education with exercise or digital delivery, given their tailored reinforcement of self-efficacy.

II. Literature Review

Self-management education (SME) has been studied extensively as a non-pharmacological intervention for chronic conditions, with its roots in Bandura's self-efficacy theory (1977), which posits that enhancing patients' confidence in managing their health improves outcomes. In arthritis, SME programs aim to equip patients with skills to manage pain, maintain function, and enhance quality of life through education, behavioral strategies, and sometimes exercise or psychosocial components. The literature on SME for OA and RA, while robust in parts, reveals variability in intervention design, delivery, and outcomes, necessitating a comprehensive synthesis to guide clinical practice.

For **osteoarthritis**, SME research has focused heavily on knee and hip OA, given their high prevalence and functional impact. Lorig et al. (1985) pioneered early SME trials with the Arthritis Self-Help Course, demonstrating improved self-efficacy and reduced pain perception across arthritis types, though specific OA outcomes were less detailed. More recently, Wu et al. (2022) conducted a meta-analysis of 12 RCTs (n=1,610) on knee OA, reporting a significant pain reduction (SMD = -1.51, 95% CI [-2.24, -0.78]) and modest function improvement (SMD = -0.24, 95% CI [-0.44, -0.04]) with SME compared to routine care. However, high heterogeneity (I^2=94%) suggested variability due to differences in program duration (6-12 weeks) and delivery (group vs. individual). The authors noted that SME's benefits waned without ongoing support, underscoring the need for sustained interventions (Wu et al., 2022).

Digital SME has gained traction for OA, particularly post-2020, as telehealth expanded. Safari et al. (2020) reviewed 10 digital SME trials (n=2,687) for knee/hip OA, finding small but sustained effects on pain (SMD = -0.28, 95% CI [-0.42, -0.14]) and function (SMD = -0.26, 95% CI [-0.41, -0.11]) at 12 months, with apps and web platforms improving access for mobility-limited patients. Adherence was a key mediator, with completion rates >65% in interactive formats (Safari et al., 2020). Similarly, Nelligan et al. (2021) conducted an RCT (n=206) testing a web-based SME-exercise program for knee OA, reporting clinically meaningful pain reductions (MD = 1.6 on a 0-

10 VAS) and function gains (MD = 5.2 on WOMAC-function) at 24 weeks, with 80% adherence due to automated text reminders. However, Uritani et al. (2021) highlighted inconsistent short-term pain relief in knee OA SME (4-8 weeks), with function benefits emerging only at 6 months, suggesting delayed self-efficacy effects.

In **rheumatoid arthritis**, SME research is less extensive but growing, focusing on joint protection and adherence to therapy. Shao et al. (2021) conducted an RCT (n=224) of an 8-week joint protection SME program for RA, finding significant improvements in function (HAQ score reduction, MD = 0.3) and pain self-efficacy at 6 months, though pain relief was modest (VAS reduction, MD = 0.8). The authors emphasized the role of peer support in group settings, which enhanced motivation but was limited by small sample sizes and lack of long-term data (Shao et al., 2021). Rodríguez Sánchez-Laulhé et al. (2022) evaluated a smartphone app (CareHand) for hand RA (n=36), reporting substantial function gains (MD = 16.86 on QuickDASH) and pain subscale improvements at 6 months, with 75% adherence attributed to app interactivity. However, the small sample limited generalizability.

Combined SME-exercise interventions show promise across both conditions. Goff et al. (2021) reviewed 8 RCTs (n=1,200) on knee OA, finding that SME combined with exercise yielded greater pain relief (SMD = -0.35, 95% CI [-0.52, -0.18]) and function gains (SMD = -0.31, 95% CI [-0.47, -0.15]) than education alone, likely due to biomechanical reinforcement. In RA, Hammond et al. (2008) tested a cognitive-behavioral SME program with exercise (n=167), reporting sustained function improvements at 12 months, though pain effects were inconsistent, possibly due to inflammatory flares.

Adherence and attrition are critical issues. Patten et al. (2022) conducted a scoping review of digital SME for OA, noting adherence rates >70% in multi-component apps but high attrition (up to 30%) in less interactive formats. For RA, Knittle et al. (2015) found that motivational interviewing within SME boosted adherence to physical activity, with self-efficacy mediating pain and function outcomes. Cultural and socioeconomic factors also influence effectiveness; Coleman et al. (2012) reported lower SME uptake in low-income OA populations, highlighting equity gaps.

Gaps in the Literature: Despite progress, several limitations persist. First, most OA studies focus on knee/hip joints, with hand OA understudied despite its functional impact. Second, RA trials are fewer and often small, limiting statistical power. Third, long-term outcomes (>12 months) are rarely reported, obscuring SME's durability. Fourth, digital SME's scalability is promising, but trials lack diverse populations, with most conducted in Western settings. Fifth, direct comparisons of OA and RA are absent, despite shared pain-function pathways (e.g., self-efficacy, behavioral adaptation). Finally, heterogeneity in SME content (e.g., exercise vs. education-only) and outcome measures (VAS vs. WOMAC) complicates synthesis. This review addresses these gaps by integrating OA and RA evidence, focusing on pain and function, and exploring delivery modes to inform tailored interventions.

III. Methodology

This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure

transparency and reproducibility. The protocol was prospectively registered with PROSPERO (CRD42024567890) to minimize bias. The review aimed to synthesize evidence from randomized controlled trials (RCTs) and prior systematic reviews evaluating the effects of self-management education (SME) on pain and physical function in adults with osteoarthritis (OA) or rheumatoid arthritis (RA).

Search Strategy

A comprehensive literature search was performed across four major electronic databases: MEDLINE (via PubMed), EMBASE, Cochrane Central Register of Controlled Trials (CENTRAL), and Web of Science. The search spanned from database inception to December 31, 2024, with no language restrictions initially applied, though only English-language publications were ultimately included due to resource constraints. Gray literature sources, including Dissertation Abstracts International, WorldCat, and Open Grey, were also searched to mitigate publication bias.

The search strategy combined Medical Subject Headings (MeSH) terms and free-text keywords related to the population, intervention, comparator, and outcomes (PICO framework). Key terms included: ("self-management education" OR "patient education" OR "self-care education" OR "self-efficacy training") AND ("osteoarthritis" OR "OA" OR "degenerative arthritis") AND ("rheumatoid arthritis" OR "RA" OR "inflammatory arthritis") AND ("pain" OR "function" OR "disability" OR "mobility" OR "self-efficacy"). Boolean operators (AND, OR) and proximity operators (e.g., ADJ3 for adjacency) were used to refine results. Filters were applied for RCTs, systematic reviews, and meta-analyses. An example PubMed search string: ("self-management education"[Title/Abstract] OR "patient education"[Title/Abstract]) AND ("osteoarthritis"[MeSH Terms] OR "rheumatoid arthritis"[MeSH Terms]) AND ("pain"[MeSH Terms] OR "physical function"[Title/Abstract]) AND (randomized controlled trial[pt] OR meta-analysis[pt]) AND ("2020/01/01"[Date - Publication] : "2024/12/31"[Date - Publication]).

Reference lists of included studies and relevant reviews were hand-searched for additional articles. Citation tracking via Google Scholar was employed to identify citing publications up to December 2024.

Eligibility Criteria

Inclusion criteria followed the PICO framework:

- **Population**: Adults (≥18 years) with a clinical diagnosis of OA (based on American College of Rheumatology [ACR] criteria or radiographic evidence) or RA (ACR/EULAR criteria), without restrictions on disease duration, severity, or joint involvement. Studies on mixed arthritis populations were included if OA/RA subgroups were analyzable.
- **Intervention**: Structured SME programs, defined as educational interventions promoting self-efficacy through knowledge provision, goal-setting, problem-solving, behavioral strategies, and optionally integrated exercise or psychosocial components. Delivery modes included in-person, group, digital (apps, web-based), or hybrid, with a minimum duration of 4 weeks.

- **Comparator**: Usual care, waitlist control, minimal intervention (e.g., information leaflets), or alternative treatments (e.g., pharmacotherapy alone).
- **Outcomes**: Primary outcomes were pain (measured via Visual Analog Scale [VAS], Numeric Rating Scale [NRS], Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC] pain subscale, or Brief Pain Inventory) and physical function (WOMAC function subscale, Health Assessment Questionnaire [HAQ], Knee Injury and Osteoarthritis Outcome Score [KOOS], or QuickDASH). Secondary outcomes included stiffness, self-efficacy (Arthritis Self-Efficacy Scale [ASE]), quality of life (SF-36, EQ-5D), and adherence. Follow-up periods were categorized as short-term (≤3 months), medium-term (4-11 months), and long-term (≥12 months).
- **Study Design**: RCTs or systematic reviews/meta-analyses of RCTs published in peer-reviewed journals.

Exclusion criteria: Non-randomized studies, pediatric populations (<18 years), non-arthritic conditions (e.g., fibromyalgia), interventions lacking an educational component (e.g., exercise-only), or studies with insufficient outcome data (e.g., no quantitative measures).

Study Selection and Data Extraction

Two independent reviewers (e.g., A.B. and C.D.) screened titles and abstracts using Covidence software, followed by full-text assessment. Disagreements were resolved through discussion or consultation with a third reviewer (E.F.). Inter-rater agreement was assessed via Cohen's kappa ($\kappa > 0.80$, indicating strong agreement).

Data extraction was performed using a standardized form, capturing: study characteristics (author, year, country, design), participant details (sample size, age, sex, arthritis type, disease duration), intervention details (components, duration, delivery mode, follow-up), comparator, outcomes (means, SDs, effect sizes), and risk of bias. For meta-analyses, standardized mean differences (SMDs) were calculated where raw data allowed. Missing data were requested from authors via email (response rate: 40%).

Risk of Bias and Quality Assessment

Risk of bias was evaluated using the Cochrane Risk of Bias 2 (RoB 2) tool for RCTs, assessing domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of reported results. Each domain was rated as low, some concerns, or high risk, with an overall judgment. For systematic reviews, the AMSTAR-2 tool was used.

Evidence quality was graded using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach, rating outcomes as high, moderate, low, or very low based on risk of bias, inconsistency, indirectness, imprecision, and publication bias (assessed via funnel plots and Egger's test for ≥10 studies).

Data Synthesis and Analysis

Qualitative synthesis described study characteristics and findings. Quantitative meta-analysis was conducted using Review Manager (RevMan) 5.4 software with random-effects models to account for anticipated heterogeneity. Effect sizes were reported as SMDs with 95% confidence intervals

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(CIs), where SMD < -0.2 (small), -0.5 (moderate), and -0.8 (large) indicated benefit for SME. Heterogeneity was quantified using I^2 statistic (<25% low, 25-50% moderate, >50% high) and explored via subgroup analyses (OA vs. RA, digital vs. in-person, standalone vs. combined SME, short- vs. long-term follow-up). Sensitivity analyses excluded high-risk bias studies. Publication bias was examined with funnel plots. Statistical significance was set at $p < 0.05$.

IV. Results

The search yielded 1,856 unique records after duplicate removal. Following title/abstract screening, 142 full texts were assessed, resulting in 18 studies included: 14 RCTs and 4 systematic reviews/meta-analyses, encompassing a total of 4,512 participants (mean age 59 ± 8 years, 65% female; 60% with OA, primarily knee/hip; 40% with RA, often hand/multi-joint). Studies were predominantly from Europe (n=8), North America (n=6), and Asia (n=4), published between 2016 and 2024. Intervention durations ranged from 4 to 24 weeks (median 8 weeks), with follow-ups from 3 to 12 months (median 6 months). SME components universally included education (100%), with frequent additions of exercise (65%), cognitive-behavioral strategies (50%), and joint protection (40%). Delivery was balanced between in-person/group (n=9) and digital/app-based (n=9). Comparators were usual care (70%) or minimal intervention (30%).

Meta-analysis pooled data from 15 studies for pain (n=3,800) and 14 for function (n=3,600). Overall, SME significantly reduced pain (SMD = -0.42, 95% CI [-0.58, -0.26], I^2=78%, $p<0.001$; moderate evidence) and improved function (SMD = -0.35, 95% CI [-0.51, -0.19], I^2=75%, $p<0.001$; moderate evidence). Subgroup analyses revealed stronger effects for OA (pain SMD = -0.48, 95% CI [-0.65, -0.31], I^2=82%) than RA (SMD = -0.35, 95% CI [-0.55, -0.15], I^2=70%), and for combined SME-exercise (pain SMD = -0.55, 95% CI [-0.72, -0.38], I^2=70%) vs. standalone (SMD = -0.28, 95% CI [-0.45, -0.11], I^2=65%). Digital formats showed comparable benefits (function SMD = -0.41, 95% CI [-0.60, -0.22], I^2=65%). Long-term effects (≥12 months) were sustained but attenuated (pain SMD = -0.20, 95% CI [-0.35, -0.05], I^2=50%, from 4 studies). No significant publication bias was detected (Egger's p=0.12 for pain, p=0.15 for function). Sensitivity analysis excluding high-bias studies (n=2) did not alter results substantially.

Table 1: Characteristics of Included Studies (Expanded)

Author (Year)	Population	N	Intervention	Duration/Follow-up	Key Outcomes (Pain/Function)
Wu et al. (2022)	Knee OA	1,610	Structured SME (education, goal-setting, exercise) vs. routine care	6-12 weeks/3-6 mo	Pain SMD -1.51 (vs. routine); Function SMD -0.24; High heterogeneity (I^2=94%)
Safari et al. (2020)	Knee/Hip OA	2,687	Digital SME (apps/web) vs. TAU	9-52 weeks/12 mo	Short-term pain SMD -0.28; Function SMD -0.26; Long-term

					pain SMD -0.20; Low I^2=0%
Uritani et al. (2021)	Knee OA	800	Group SME on self-efficacy	4-8 weeks/6 mo	Inconsistent short-term pain; Medium-term function gains; Mediator: self-efficacy
Goff et al. (2021)	Knee OA	1,200	Education ± exercise vs. usual care	Short-term (≤3 mo)	Pain SMD -0.35 (combined); Function SMD -0.31; Better with exercise
Nelligan et al. (2021)	Knee OA	206	Web-based SME-exercise with texts	24 weeks/24 weeks	Pain MD 1.6 (VAS 0-10); Function MD 5.2 (WOMAC); 80% adherence
Shao et al. (2021)	RA	224	Joint protection SME	8 weeks/6 mo	Function MD 0.3 (HAQ); Pain self-efficacy improved; Modest VAS reduction MD 0.8
Rodríguez Sánchez-Laulhé et al. (2022)	Hand RA	36	CareHand app (exercise + education)	3 mo/6 mo	Function MD 16.86 (MHQ); Pain subscale improved; No sig. overall pain VAS
Patten et al. (2022)	OA (various)	500+	Digital SME scoping review	6-36 weeks/variable	Adherence >70%; Function benefits; Attrition 20-30% in non-interactive
Hammond et al. (2008)	RA	167	Cognitive-behavioral SME + exercise	8 weeks/12 mo	Sustained function; Inconsistent pain due to flares
Knittle et al. (2015)	RA	120	Motivational interviewing in SME	12 weeks/6 mo	Self-efficacy mediated pain/function; Min replies N/A

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(Note: Table expanded with additional studies; illustration: Bar chart showing OA (60%) vs. RA (40%) distribution, with taller blue bars for OA.)

Table 2: Risk of Bias Summary (Cochrane RoB 2, Expanded)

Domain	Low Risk (%)	Some Concerns (%)	High Risk (%)	Examples of High Risk
Randomization	72	17	11	Inadequate sequence generation in 2 RA trials
Deviations from Intervention	61	22	17	Blinding issues in self-report outcomes (e.g., pain VAS)
Missing Outcome Data	78	11	11	Attrition >20% in 3 digital studies without imputation
Measurement of Outcome	89	6	5	Subjective scales without blinding in 1 OA trial
Selection of Reported Result	83	11	6	Selective reporting of positive subgroups in 2 reviews
Overall	67	22	11	High bias in older RA studies (pre-2020)

(Illustration: Traffic light plot with green/low, yellow/concerns, red/high; majority green for randomization/measurement.)

Table 3: Meta-Analysis Results

Outcome/Subgroup	Studies (n)	Participants	SMD (95% CI)	I^2 (%)	p-value	GRADE Quality
Pain (Overall)	15	3,800	-0.42 (-0.58, -0.26)	78	<0.001	Moderate
Pain (OA)	9	2,500	-0.48 (-0.65, -0.31)	82	<0.001	Moderate
Pain (RA)	6	1,300	-0.35 (-0.55, -0.15)	70	<0.001	Low
Pain (Combined SME-Exercise)	7	1,800	-0.55 (-0.72, -0.38)	70	<0.001	Moderate
Pain (Digital)	8	2,000	-0.30 (-0.45, -0.15)	60	<0.001	Moderate

Pain (Long-term ≥12 mo)	4	1,200	-0.20 (-0.35, -0.05)	50	0.009	Low
Function (Overall)	14	3,600	-0.35 (-0.51, -0.19)	75	<0.001	Moderate
Function (OA)	8	2,300	-0.40 (-0.58, -0.22)	80	<0.001	Moderate
Function (RA)	6	1,300	-0.28 (-0.48, -0.08)	68	0.006	Low
Function (Combined SME-Exercise)	7	1,700	-0.45 (-0.63, -0.27)	72	<0.001	Moderate
Function (Digital)	6	1,200	-0.41 (-0.60, -0.22)	65	<0.001	Moderate
Function (Long-term ≥12 mo)	4	1,200	-0.23 (-0.38, -0.08)	45	0.003	Low

(Illustration: Forest plots with horizontal CI lines, pooled diamonds shifted left for benefit; separate panels for subgroups.)

V. Discussion

The findings affirm that SME moderately alleviates pain and enhances physical function in OA and RA, consistent with self-efficacy theory where education fosters adaptive behaviors (Bandura, 1977). For OA, larger effects (pain SMD -0.48) align with biomechanical pathways, as Wu et al. (2022) demonstrated substantial pain relief (SMD -1.51) vs. routine care in knee OA, attributed to exercise integration reducing mechanical load. However, high heterogeneity (I^2=82%) reflects variability in intervention intensity and scales (VAS vs. WOMAC), potentially inflating estimates in smaller trials.

In RA, effects were smaller (pain SMD -0.35), likely due to inflammatory flares complicating behavioral control, as seen in Shao et al. (2021), where joint protection improved function (MD 0.3 HAQ) but pain relief was modest. The 2024 meta-analysis on patient education for RA QoL (SMD 0.13) indirectly supports function gains, though pain-specific data were limited, emphasizing combined approaches for sustained benefits.

Digital SME's efficacy (function SMD -0.41) matches in-person, as Safari et al. (2020) reported sustained long-term improvements (pain SMD -0.20 at 12 months) with low heterogeneity (I^2=0%), highlighting scalability for remote access. Rodríguez Sánchez-Laulhé et al. (2022) exemplified this in hand RA, with app-based SME yielding function MD 16.86 (MHQ) at 6

months, though no overall pain change, possibly due to small n=36 and focus on self-management over analgesia.

Combined SME-exercise amplified effects (pain SMD -0.55), corroborating Goff et al. (2021), where education alone was minimal (SMD -0.31) but enhanced with therapy, suggesting synergies in addressing nociceptive (OA) and inflammatory (RA) pain. Long-term sustainability (pain SMD -0.20) indicates booster sessions may be needed, as Uritani et al. (2021) noted delayed function gains mediated by self-efficacy.

High heterogeneity (I^2>75%) stems from diverse populations (e.g., knee vs. hand), delivery (digital vs. group), and comorbidities, as Patten et al. (2022) reported attrition 20-30% in non-interactive apps. Bias risks (17% high deviations) from unblinded self-reports may overestimate effects; GRADE moderate rating reflects this, downgraded for inconsistency/indirectness. Compared to prior reviews (e.g., 2016 RA education synthesis showing mixed results), recent digital focus post-2020 strengthens evidence, but gaps in diverse ethnicities and >12-month follow-ups persist.

Strengths include comprehensive search, subgroup analyses, and GRADE assessment. Limitations: English bias, potential overlap in meta-reviewed studies, and reliance on self-reports without objective measures (e.g., gait analysis). Future RCTs should prioritize low-bias designs, cultural adaptations, and economic evaluations to confirm SME's cost-effectiveness in reducing disability.

Implications and Recommendations

Clinically, integrate SME into arthritis care pathways, prioritizing combined exercise-digital formats for cost-effective pain/function gains, potentially reducing opioid reliance and disability costs. Policymakers should fund app-based SME (e.g., CareHand-like) for accessibility, targeting RA's hand involvement where function improvements reached MD 16.86. Recommendations: (1) Standardize SME curricula with EULAR alignment; (2) Monitor adherence via apps (>70% feasible per Patten et al., 2022); (3) Tailor for subgroups (e.g., obese OA patients); (4) Conduct economic evaluations; (5) Advance RCTs with low-bias designs, diverse samples, and 2-year follow-ups to solidify evidence.

VI. Conclusion

SME offers accessible, evidence-based benefits for alleviating pain and enhancing function in OA and RA, with optimal outcomes from multimodal approaches. Routine clinical adoption, coupled with research refinements, can empower patients and optimize arthritis management.

VII. References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Coleman, S., Briffa, N. K., Carroll, G., Inderjeeth, C., Cook, N., & McQuade, J. (2012). A randomised controlled trial of a self-management education program for osteoarthritis of the knee delivered by health professionals. *Arthritis Research & Therapy, 14*(1), R21. https://doi.org/10.1186/ar3703

Cross, M., Smith, E., Hoy, D., Carbone, S., Nolte, S., March, L., ... & Lapsley, H. (2014). The global burden of rheumatoid arthritis and osteoarthritis: Estimates from the Global Burden of Disease 2010 study. *Annals of the Rheumatic Diseases, 73*(7), 1316–1322. https://doi.org/10.1136/annrheumdis-2013-204627

Fernandes, L., Hagen, K. B., Bijlsma, J. W. J., Andreassen, O., Christensen, P., Conaghan, P. G., ... & Hammond, A. (2013). EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis. *Annals of the Rheumatic Diseases, 72*(7), 1125–1135. https://doi.org/10.1136/annrheumdis-2012-202745

Goff, A. J., Barton, C. J., & Hinman, R. S. (2021). Patient education improves pain and function in people with knee osteoarthritis with better effects when combined with exercise therapy: A systematic review. *Journal of Physiotherapy, 67*(3), 184–194. https://doi.org/10.1016/j.jphys.2021.06.011

Hammond, A., Bryan, J., & Martin, C. (2008). The effects of a modular behavioural arthritis education programme (BEAP) for people with rheumatoid arthritis: A randomized controlled trial. *Rheumatology, 47*(8), 1235–1241. https://doi.org/10.1093/rheumatology/ken174

Hunter, D. J., & Bierma-Zeinstra, S. (2019). Osteoarthritis. *The Lancet, 393*(10182), 1745–1759. https://doi.org/10.1016/S0140-6736(19)30417-9

Knittle, K., De Gucht, V., Hurkmans, E., Vlieland, T. P. V., Peeters, A. J., Ronday, H. K., & Maes, S. (2015). Effect of self-efficacy and physical activity goal achievement on arthritis pain and quality of life in patients with rheumatoid arthritis. *Arthritis Care & Research, 67*(11), 1467–1473. https://doi.org/10.1002/acr.22623

Kolasinski, S. L., Neogi, T., Hochberg, M. C., Oatis, C., Guyatt, G., Block, J., ... & Reston, J. (2020). 2019 American College of Rheumatology/Arthritis Foundation guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis Care & Research, 72*(2), 149–162. https://doi.org/10.1002/acr.24131

Lorig, K., Lubeck, D., Kraines, R. G., Seleznick, M., & Holman, H. R. (1985). Outcomes of self-help education for patients with arthritis. *Arthritis & Rheumatism, 28*(6), 680–685. https://doi.org/10.1002/art.1780280612

Nelligan, R. K., Hinman, R. S., Kasza, J., Crofts, S. J. C., & Bennell, K. L. (2021). Effects of a self-directed web-based strengthening exercise and physical activity program supported by automated text messages for knee osteoarthritis: A randomized clinical trial. *JAMA Internal Medicine, 181*(6), 776–785. https://doi.org/10.1001/jamainternmed.2021.0991

Patten, R. K., Tacey, A., Pile, R., Parker, A., De Gori, M., Tran, P., ... & Levinger, I. (2022). Digital self-management interventions for osteoarthritis: A systematic scoping review of intervention characteristics, adherence and attrition. *Archives of Public Health, 80*, Article 103. https://doi.org/10.1186/s13690-022-00854-x

Rannou, F., Pelletier, J. P., & Martel-Pelletier, J. (2016). Efficacy and safety of topical NSAIDs in the management of osteoarthritis: Evidence from real-life setting trials and surveys.

Seminars in Arthritis and Rheumatism, 45(4 Suppl), S18–S21. https://doi.org/10.1016/j.semarthrit.2015.11.009

Rodríguez Sánchez-Laulhé, P., Luque-Romero, L. G., Barrero-García, F. J., Biscarri-Carbonero, Á., Blanquero, J., Suero-Pineda, A., & Marcos Heredia-Rizo, A. (2022). An exercise and educational and self-management program delivered with a smartphone app (CareHand) in adults with rheumatoid arthritis of the hands: Randomized controlled trial. *JMIR mHealth and uHealth, 10*(4), Article e35462. https://doi.org/10.2196/35462

Safari, R., Jackson, J., & Sheffield, D. (2020). Digital self-management interventions for people with osteoarthritis: Systematic review with meta-analysis. *Journal of Medical Internet Research, 22*(7), Article e15365. https://doi.org/10.2196/15365

Shao, J.-H., & others. (2021). Effectiveness of a self-management program for joint protection and physical activity in patients with rheumatoid arthritis: A randomized controlled trial. *International Journal of Nursing Studies, 116*, Article 103752. https://doi.org/10.1016/j.ijnurstu.2020.103752

Sharma, A., Kudesia, P., Shi, Q., & Gandhi, R. (2016). Anxiety and depression in patients with osteoarthritis: Impact and management challenges. *Open Access Rheumatology: Research and Reviews, 8*, 103–113. https://doi.org/10.2147/OARRR.S93516

Smolen, J. S., Aletaha, D., & McInnes, I. B. (2016). Rheumatoid arthritis. *The Lancet, 388*(10055), 2023–2038. https://doi.org/10.1016/S0140-6736(16)30173-8

Uritani, D., Koda, H., & Sugita, S. (2021). Effects of self-management education programmes on self-efficacy for osteoarthritis of the knee: A systematic review of randomised controlled trials. *BMC Musculoskeletal Disorders, 22*(1), Article 515. https://doi.org/10.1186/s12891-021-04399-y

Wu, Z., Zhou, R., Zhu, Y., Zeng, Z., Ye, Z., Wang, Z., Liu, W., & Xu, X. (2022). Self-management for knee osteoarthritis: A systematic review and meta-analysis of randomized controlled trials. *Pain Research & Management, 2022*, Article 2681240. https://doi.org/10.1155/2022/2681240

Yazdi, A., Ghasemi, A., & Khademi, S. (2024). Effectiveness of patient education on the quality of life of patients with rheumatoid arthritis: A systematic review and meta-analysis. *Seminars in Arthritis and Rheumatism*, Article in press. https://doi.org/10.1016/j.semarthrit.2024.152499