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Integrated care programmes for sport and work participation, performance of physical activities and quality of life among orthopaedic surgery patients: a systematic review with meta-analysis

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ABSTRACT

Objectives Orthopaedic surgery is primarily aimed at improving function and pain reduction. Additional integrated care may enhance patient's participation in sports and work, possibly improving performance of physical activities and quality of life (QoL). We aimed to assess the effectiveness of integrated care among orthopaedic surgery patients.

Design Systematic review with meta-analysis.

Data source Medline, EMBASE and CINAHL (until 17 June 2019).

Eligibility for selecting studies We searched for controlled studies on integrated care interventions consisting of active referral to case managers, rehabilitation with participation-based goals and/or e/mHealth, with outcomes of sports and work participation, performance of physical activities and/or QoL. Outcomes were normalised to 0–100 scales and statistically pooled.

Results Seventeen articles (n=2494) of moderate quality were included reporting on patients receiving back, upper limb, knee or hip surgery. Only one study reported on return to sports and found no significant benefit. For return to work, one study did (90% vs 82%) and one did not (relative risk=1.18 (0.80 to 1.70)) observe significant benefits. Integrated care showed small effects for improving performance of physical activities (2.69 (–0.20 to 5.58); eight studies, n=1267) and QoL (2.62 (1.16 to 5.05); nine studies, n=1158) compared with usual care.

Summary/Conclusion We found insufficient and inconsistent evidence for the effectiveness of integrated care for orthopaedic surgery patients regarding sport and work participation. Small effects were found for performance of physical activities and QoL. High quality research on integrated care focusing on sports and work participation is needed before integrated care can be implemented for orthopaedic surgery patients.

What is already known

- ► Orthopaedic surgery is primarily aimed at improving function and pain reduction.
- ► Additional integrated care may enhance patient's return to participation in sports and work, thereby improving the performance of physical activities and quality of life.
- ► A systematic review summarising the evidence of these integrated care interventions for patients undergoing orthopaedic surgery is lacking.

What are the new findings

- ► We found insufficient and inconsistent evidence for the effectiveness of integrated care interventions for orthopaedic surgery patients regarding sport and work participation.
- ► We found statistically significant, but small effects, of these interventions regarding performance of physical activities and quality of life.
- ► More high-quality research is needed with a focus on sports and work participation to provide more evidence as to whether integrated care interventions should be implemented for this patient population.

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INTRODUCTION

Orthopaedic surgery, such as hip or knee arthroplasty, ACL surgery, hamstring or rotator cuff repair, is primarily aimed at reducing pain and improving joint function.[1] Usual care for patients eligible for orthopaedic surgery typically consists of the surgical procedure as well as presurgery evaluations, pharmaceutical treatments and postsurgery clinical check-ups and rehabilitation including physical therapy. However, usual care of most patients undergoing orthopaedic surgery is rarely explicitly aimed at participation in daily activities such as sports and work (eg, returning to previous levels of participation). This can be seen in core outcome definitions for orthopaedic conditions in the knee and hip,[2] back[3] and upper extremities.[4] This is remarkable given

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the importance of participation in sports and work for patients after orthopaedic surgery,[5 6] especially for patients who are of working age for whom resumption of societal participation is an important treatment goal. Moreover, return to sports and work is typically delayed and/or not successful for many of these patients.[7–11] For instance, patients undergoing joint replacement surgery considered advice regarding participation to be inconsistent and not tailored to their individual circumstances, which often left them with the feeling that they would have been able to recover sooner than what they had actually accomplished.[5]

Societal participation is considered of primary importance for orthopaedic surgery patients.[5 6] Here, societal participation is both the performance of and the participation in daily activities such as sports and work. Participation in daily activities such as sports and work is highly relevant for many orthopaedic surgery patients in the general population, as inability to participate in society is accompanied by a significant impact on patients' quality of life (QoL),[12] general and mental health.[13] In addition, apart from the medical costs associated with surgery, the economic burden largely consists of indirect costs such as work productivity loss due to absenteeism.[14–16] In line with this evidence, and in accordance with the International Classification of Functioning, Disability and Health (ICF),[17] activities and participation are thought of as a complex interplay between body functions and structures, personal and environmental factors, and health.

To facilitate participation in sports and work in orthopaedic surgery patients, which may thereby improve performance of physical activities and QoL, usual care could be enhanced by transmural integrated care programmes. Integrated care, according to a WHO definition,[18] is 'a concept bringing together inputs, delivery, management and organisation of services related to diagnosis, treatment, care, rehabilitation and health promotion'. Of this rather generic concept of integrated care, we can see various operationalisations related to improving participation of patient in sports or work, all of them adding value to the usual care. Common operationalisations of integrated care can include, and are not limited to:

1. Active referral of the orthopaedic surgeon to a case manager (eg, a sports or occupational physician, physical or occupational therapist or nurse), adding a professional in the patient care to work on issues (eg, sport and work participation) that are typically not addressed in usual care.
2. Rehabilitation programmes based on patient-specific and participation-based goal setting, such as goal attainment scaling.
3. e/mHealth, consisting of elements that go beyond the usual care, that is, not just replacing physical patient–physician usual care by electronic/mobile contact.

Currently, a systematic review summarising the evidence of integrated care interventions for patients undergoing orthopaedic surgery is lacking. The aim of this review is to assess the effectiveness of integrated care interventions compared with usual care on sports and work participation, performance of physical activities, and QoL among patients undergoing orthopaedic surgery from randomised and non-randomised controlled studies.

METHODS

For this systematic review, that we have a priori registered in Prospero,[19] we used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. We have followed our registered protocol with the exception that we were not able to assess the impact of risk of bias on the reported findings, since only limited variation in risk of bias between studies was shown (see the Data analysis section).

Search for literature

We conducted systematic searches of the literature in Medline, EMBASE and CINAHL from database inception until 17 June 2019. With the support of a clinical librarian specialised in sports and occupational medicine, we have searched for terms describing (1) the population; for example, orthopaedic surgery, knee or hip arthroplasty, bone fracture reconstruction, ACL surgery, rotator cuff repair, spine; (2) intervention; integrated care consisting of elements such as active referral or case management, goal setting and/or e/mHealth; and (3) outcome; participation in sports or work, performance of physical activities and QoL. A validation of a prefinal version of our search was conducted with the use of a number of articles that were identified in a pilot search and were found to be eligible for the current review. From this validation procedures, it appeared that all a priori identified articles were found by the current database search in Medline, EMBASE and CINAHL. A detailed description of the search is given in online supplementary material 1.

We searched for additional trials and ongoing and unpublished trials using www.controlled-trials.com and http://clinicaltrials.gov. Moreover, we screened the reference lists of included articles, while also citation tracking of the included articles was conducted in Medline. Corresponding authors of protocol articles describing a relevant study design were contacted and asked for the results (published or non-published) of their trials.

Selection procedure

Two reviewers independently assessed identified records on eligibility, that is, meeting the relevant patient, intervention, control and outcome (PICO) elements. Title and abstracts were assessed after which full texts of potentially relevant records were screened. In case of disagreement, consensus was reached during a meeting.

We included studies on patients from the general population (ie, excluding professional athletes), who received an orthopaedic surgical procedure for an acute or chronic musculoskeletal disease and were of working age (ie, with most of the participants between 18 and

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65 years), were resumption of societal participation is an important treatment goal. This included, but was not limited to, surgeries for knee or hip arthroplasty for end-stage osteoarthritis, spinal surgery, bone fracture reconstruction, ACL surgery, hamstring or rotator cuff repair surgery. We included studies describing integrated care interventions with at least a postoperative component that targeted participation, like in sports or work. Integrated care can consist of, but is not limited to, one or a combination of the following operationalisations: (1) active referral of the orthopaedic surgeon to a case manager, for example, a sports or occupational physician, physical or occupational therapist or nurse; (2) a rehabilitation programme based on patient-specific and participation-based goals, such as goal attainment scaling; and/or (3) an e/mHealth intervention, consisting of elements that go beyond the usual care, that is, not just replacing physical patient–physician usual care by electronic/mobile contact. We included studies comparing the above-mentioned intervention components to usual care, which is often limited to the surgical procedure, including presurgery evaluation, pharmaceutical treatment, postsurgery clinical check-ups and, depending on the patient, exercise-based rehabilitation. We included studies in which the following outcome measures were considered: sports or work participation, for example, expressed in return to sports or work, performance of physical activities, for example, measured by the Roland Morris or WOMAC questionnaires and/or QoL, for example, measured by the 36 item short-form (SF-36), 12 item short-form (SF-12) questionnaires or PROMIS.

We included randomised and non-randomised controlled trials, cohort studies with controls and case-control studies and pilot studies with controls, while studies without a control group were excluded. Only studies describing original research written in English or Dutch were included.

Data syntheses and risk of bias assessment

Two reviewers extracted relevant data from all selected papers, independently. The following variables of each included paper were obtained: first author and year of publication, study characteristics (ie, study name and design, information about the patient sample, including the orthopaedic condition and type of surgery, number of participants, relevant inclusion/exclusion criteria, percentages of females, age and country), intervention characteristics (ie, intervention description, element, start and duration of the intervention and number of measurement occasions), control condition, outcomes measures and effect sizes. In the case of multiple articles reporting on the same study, all information from these articles was used for further analysis.

To assess risk of bias, we used the Cochrane risk of bias tool for randomised intervention studies[20] and the ROBINS-I risk of bias tool for non-randomised intervention studies,[21] in accordance with recommendations provided in the Cochrane collaboration handbook.[20] These tools are described in detail in online supplementary material 2 and 5. Risk of bias assessment was performed on the subgroup or outcome of relevance, and multiple assessments were made when required.

Data analysis

All studies were described according to their extracted data and risk of bias. In case of sufficient methodologically and clinically homogeneous data (as determined by considering study samples, interventions and outcome measures) but not statistical homogeneity, a meta-analysis was conducted. In order to do so, effect sizes were harmonised by transforming the respective outcome measure, that is, sports or work participation, performance of physical activities and QoL, into a scale from 0 to 100, with higher values depicting more positive outcomes. As such, effect sizes from similar constructs, which were measured with varying self-reported measurement tools, were harmonised.

Statistical heterogeneity of the findings was assessed using I^2 statistics and visual inspection of the forest plots. Since there was evidence of statistical heterogeneity (I^2>50%[22] for some of the associations) random-effects modelling was used to pool effect sizes of individual studies using Review Manager (RevMan) V.5.3. Pooled effect sizes were presented in forest plots. In all quantitative analysis, effect sizes were expressed in mean differences.

Findings were reported stratified on (1) intervention component (ie, active referral, goal setting, and/or e/mHealth); (2) patient group (ie, specified into back, upper limb, knee or hip surgery patients); and (3) outcome (ie, sports or work participation, performance of physical activities and QoL). Although outlined in our a priori registered protocol,[19] due to limited variation between studies, we were not able to stratify our findings by risk of bias. Moreover, results were classified based on the length of follow-up of the intervention into short- (0–3 months postsurgery) and long-term (≥3 months postsurgery) effects, to differentiate potential short term biological recovery from longer term effects of the intervention.

RESULTS

Literature search

The literature search resulted in a total of 9833 records: 3688 in Medline, 4617 in EMBASE and 1528 in CINAHL (figure 1). After removing duplicates and adding an additional 3 articles that were found through forward and backward reference checking, 6325 records were screened on title and abstracts. A total of 82 full-text articles were retrieved, from which 65 articles were removed as they did not meet the inclusion criteria (online supplementary material 3).

Study descriptives

Eventually, 17 articles[23–39] from 14 studies with in total 2494 participants were included. An overview of

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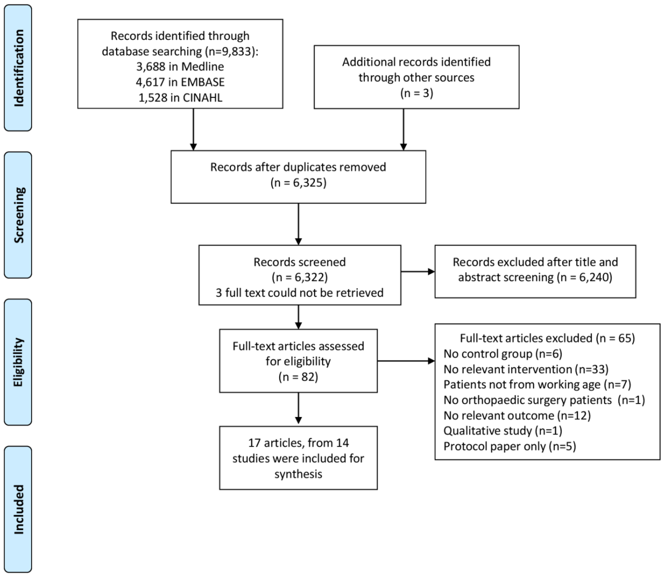

Figure 1 PRISMA flow chart depicting the selection procedure of articles.

extracted data of the included studies can be found in online supplementary material 4. Fifteen of the included articles from 12 studies described randomised controlled trials,[23 24 26–33 35–39] while two articles described controlled before-after studies.[25 34] Most studies were conducted in high-income countries (ie, Western Europe, USA or Australia) and two studies in China[38 39] studying samples of patients undergoing surgeries to their back (ie, laminectomy, lumbar discectomy, disc surgery and spinal stenosis),[23 24 26 28–31 34 39] upper limbs (ie, anterior shoulder dislocation repair),[25 37] hips (ie, total hip arthroplasty)[33 36 38] and knees (ie, ACL reconstruction and knee arthroplasty).[27 32 35] Patient samples consisted of combinations of men and women, and the average age of the study samples ranged from 29 to 70 years, with an average (SD) of 51 (14) years.

Regarding relevant intervention components, five studies used an e/mHealth intervention.[27 34–36 39] Active referral to a case manager was assessed by three studies.[31 33 37] Six studies reported the effects of a combined intervention with two components, that is, active referral to a case manager and goal setting (in four studies),[23–26 28–30] goal setting and e/mHealth (one study),[32] and active referral and e/mHealth (one study).[38] The intervention length ranged from 14 days[35] to 36 months[34]. In 12 studies, the control group received usual care only,[25–31 33–39] while in two studies described in three articles, usual care also included an education programme on postoperative recovery and extra phone meetings.[23 24 32]

Regarding risk of bias (figure 2; online supplementary material 5-6), randomised controlled trials showed a low or unclear risk of bias regarding patient randomisation, allocation concealment, blinding of the outcome assessment and selective reporting. All studies showed high or unclear risk of bias regarding blinding of the participants and care providers while four studies had a high risk of bias due to incomplete outcome data. Also, there were other sources of bias indicated such as selection bias and poor intervention compliance. Out of the non-randomised studies, one study showed a high overall risk of bias[25] and one study showed a low overall risk of bias.[34]

Participation in sport, work and activities of daily life

Outcome measures

Sports and work participation were measured in four studies[25 26 28–31] as return to sports,[25] returning to work[25 28–31] or not returning to work.[26] Due to limited and

	Randomization	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other sources of bias
Archer, 2014 & 2016	Low	Unclear	High	Low	Low	Low	-
Donceel, 1999	Low	Unclear	High	Unclear	Unclear	Unclear	-
Hou, 2019	Low	Low	High	High	High	Low	-
Levinger, 2017	Low	Low	High	Low	High	Low	High
Martinez-Rico, 2018	Low	Unknown	High	High	Low	Unclear	-
McGregor, 2010 & 2011; Morris, 2011	Low	Low	High	Low	High	Low	High
Oestergaard, 2015	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	-
Paxton, 2018	Unclear	Unclear	Unclear	Low	Low	Unclear	Low
Sandell, 2008	Low	Low	High	Low	High	Unclear	High
Szöts, 2016	Low	Low	High	Low	Low	Low	-
Vesterby, 2017	Unclear	Low	High	Low	Low	Unclear	High
Wang, 2018	Unclear	Unclear	High	High	Low	Unclear	-

	Confounding	Selection of participants	Classification of interventions	Deviations from intended interventions	Missing data	Measurement of outcomes	Selection of the reported result
Damkjær, 2015	Moderate	Moderate	Low	Low	Moderate	Serious	Moderate
Skolasky, 2018	Low	Low	Low	Low	Low	Low	Low

Figure 2 Risk of bias of all included studies. Risk of bias of randomised controlled studies (upper panels) and non-randomised controlled studies (lower panels) are shown.

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heterogeneous data, we were not able to statistically pool data from these studies in a meta-analysis.

Qualitative analysis

Only one study reported on return to sports. In this study on shoulder surgery patients, the intervention, consisting of active referral to a case manager and goal setting, showed non-significant effects on return to sports (0.68 (95%CI −5.36 to 3.99); in weeks). For return to work, this study found also no significant effect (1.78 (95%CI −1.89 to 4.65); in weeks).[25] A study on patients with lumbar spinal fusion using active referral to a case manager showed no statistically significant effects of the intervention on return to work compared with usual care (RR=1.18 (95%CI 0.80 to 1.70)).[31] In two other studies,[26 28 30] using active referral to a case manager and goal setting, one study reported 10% not returning to work in the intervention group and 18% in the control group,[26] with a statistically significant between-group difference (p=0.002). The other study did not report on return to work outcomes, although it was specifically addressed in the protocol paper.[28–30]

Performance of physical activities

Outcome measures

Performance of physical activities was measured in 10 studies[23–25 27–30 32 33 35 37–39] using the Roland Morris Disability questionnaire[23 24] and Oswestry Disability Index (ODI),[28–30 39] SF-12 (using the physical functioning and role physical subscale),[23 24 35] the Western Ontario Shoulder Instability (WOSI) index,[25] the Oxford Shoulder Instability Score (OSIS),[37] the ROWE score,[37] the Knee Injury and Osteoarthritis Outcome Score (KOOS) activities of daily living subscale,[27] the Nottingham Health Profile (NPH) physical subscale,[33] the Arthritis Impact Score (AIS) using walking and bending, self-care tasks, household tasks and work subscales,[33] the Harris hip score,[38] Barthel index,[38] the Western Ontario and McMaster Universities Osteoarthritis (WOMAC) Index,[35] the ability to take part in three self-chosen activities[25] and by physical activity measured with an accelerometer.[32]

Qualitative analysis

A study on physical activity, with no statistically significant between-group differences, could not be used for further quantitative analysis, since no between-group effect sizes were provided and because the outcome variable (ie, physical activity) was too different from the other operationalisations of performance of physical activities.[32] In a study on shoulder surgery patients, the intervention, consisting of active referral to a case manager and goal setting, showed non-significant effects on return to three self-chosen activities (0.41 (95%CI −1.35 to 2.16); 0 to 30 scale).[25] Among patients receiving a Bankart repair surgery, an intervention consisting of referral to a nurse practitioner showed improved performance of activities compared with a control group.[37] However, no appropriate statistics were reported by the study authors.

Quantitative analysis

Eight studies with n=1267 patients could be pooled in a meta-analysis (table 1). Findings showed overall small effects (using effect measures that were normalised to a 0–100 scale) of the intervention, when compared with the control group; non-significant short term (2.69 (95%CI −0.20 to 5.58); I^2=76%) and long term (5.77 (95%CI 2.84 to 8.70); I^2=54%) (figure 3). A single study showed a significant but small short-term effect of active referral as single component (4.33 (95%CI 0.48 to 8.18)) (online supplementary material 7). Three studies showed a negative significant short-term effect of e/mHealth (−0.63 (95%CI −0.75 to −0.51); I^2=0%); however, effects from one study were positive at long term, although non-significant (3.51 (95%CI −0.67 to 7.69)). Three studies reported on short-term significant effects of a multicomponent intervention (4.26 (95%CI 0.13 to 8.39); I^2=50%); three studies reported on long-term significant effects of a multicomponent intervention (6.47 (95%CI 2.94 to 10.00); I^2=59%). Three studies reported on patients undergoing surgery to their back, reporting non-significant short-term (0.52 (95%CI −2.36 to 3.41); I^2=76%) and significant long-term (4.97 (95%CI 1.45 to 8.49); I^2=60%) effects (online supplementary material 8). Two studies reported on patients undergoing hip surgery, showing positive short-term effect (5.79 (95%CI 2.52 to 9.07) I^2=19%) and long-term effects (8.40 (95%CI 4.01 to 12.79), one study only). Two studies reported on patients undergoing knee surgery (short-term effect: 2.12 (95%CI −2.62 to 6.86); I^2=0%). One study reported on patients undergoing surgery to their upper extremities (short-term effect: 0.97 (95%CI −10.90 to 12.85)).

QoL

Outcome measures

QoL was measured in 11 studies[23–25 27–30 33–39] using the SF-12,[23 24 34] SF-36,[35 38 39] the WOSI index on shoulder-related function and QoL,[25] the QoL subscale of the KOOS,[27] the NHP,[33] EQ-5D-3L[36 39] and EQ-5D.[28–30] In the latter study, QoL was expressed in quality-adjusted life years (QALYs) gained.

Qualitative analysis

The non-statistically significant findings of one of the studies could not be pooled with the other study outcomes.[28–30] In another study among patients receiving a Bankart repair surgery, QoL was measured using the quick DASH.[37] In this study, the intervention consisting of referral to a nurse practitioner showed an improvement in QoL compared with a control group; however, no appropriate statistics were reported by the study authors.

Quantitative analysis

Nine studies with n=1158 patients could be pooled in a meta-analysis (table 2). Findings showed overall small significant effects (scale 0–100) of the intervention, when compared with the control group; short term (2.62 (95%CI 1.16 to 4.08); I^2=17%) and long term (5.05

Table 1 Summary of results from the quantitative analyses regarding performance of physical activities (eight studies with n=1267 participants reporting on short-term and long-term effects combined). Number of studies and participants, (pooled) effect sizes and, if applicable, I^2 statistics (depicting heterogeneity) are shown. Short-term and long-term effects are presented. Total results as well as results stratified by intervention component (active referral, e/mHealth and multicomponent interventions with a combination of elements) and patient category (back, knee, hip and upper extremity surgery) are shown.

	Short term					Long term				
	N	n	Effect size	I^2	Forest plot	N	n	Effect size	I^2	Forest plot
Total	7	929	2.69 (–0.20 o 5.58)	76%	Figure 3	4	986	5.77(2.84 to 8.70)	54%	Figure 3
Active referral	1	63	4.33 (0.48 to 8.18)	–	Online supplementary material 7	–	–	–	–	–
e/mHealth	3	311	–0.63 (–0.75 to 0.51)	0%	Online supplementary material 7	1	162	3.51(–0.67 to 7.69)	–	Online supplementary material 7
Combined	3	582	4.26 (0.13 to 8.39)	50%	Online supplementary material 7	3	824	6.47(2.94 to 10.00)	59%	Online supplementary material 7
Back	2	248	0.52 (–2.36 to 3.41)	76%	Online supplementary material 8	3	586	4.97(1.45 to 8.49)	60%	Online supplementary material 8
Hip	2	463	5.79 (2.52 to 9.07)	19%	Online supplementary material 8	1	200	8.40(4.01 to 12.79)	–	Online supplementary material 8
Knee	2	149	2.12 (–2.62 to 6.86)	0%	Online supplementary material 8	–	–	–	–	–
Upper extremity	1	96	0.97 (–10.90 to 12.85)	–	Online supplementary material 8	–	–	–	–	–

I^2, heterogeneity; N, number of studies; n, number of participants.

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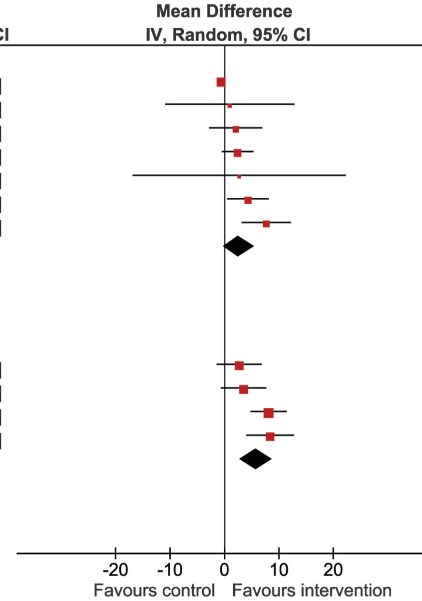
Study or Subgroup	Mean Difference	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.4.1 Short-term						
Hou 2019 (short-term)	-0.63	0.06	82	80	25.3%	-0.63 [-0.75, -0.51]
Damkjaer 2015 (short-term)	0.973	6.058	44	52	4.8%	0.97 [-10.90, 12.85]
Szöts 2016 (short-term)	2.08	2.492	59	58	14.7%	2.08 [-2.80, 6.96]
Archer 2016 (short-term)	2.4	1.48	43	43	20.2%	2.40 [-0.50, 5.30]
Levinger 2017 (short-term)	2.7	10	16	16	2.0%	2.70 [-16.90, 22.30]
Sandell 2008 (short-term)	4.33	1.962	33	30	17.5%	4.33 [0.48, 8.18]
Wang 2018 (short-term)	7.7	2.31	200	200	15.6%	7.70 [3.17, 12.23]
Subtotal (95% CI)			**477**	**479**	**100.0%**	**2.69 [-0.20, 5.58]**
Heterogeneity: Tau² = 8.58; Chi² = 24.87, df = 6 (P = 0.0004); I² = 76%						
Test for overall effect: Z = 1.82 (P = 0.07)						
1.4.2 Long-term						
McGregor 2010 (long-term)	2.7	2.117	177	161	24.1%	2.70 [-1.45, 6.85]
Hou 2019 (long-term)	3.51	2.133	82	80	23.9%	3.51 [-0.67, 7.69]
Archer 2016 (long-term)	8.11	1.696	43	43	29.2%	8.11 [4.79, 11.43]
Wang 2018 (long-term)	8.4	2.24	200	200	22.8%	8.40 [4.01, 12.79]
Subtotal (95% CI)			**502**	**484**	**100.0%**	**5.77 [2.84, 8.70]**
Heterogeneity: Tau² = 4.78; Chi² = 6.48, df = 3 (P = 0.09); I² = 54%						
Test for overall effect: Z = 3.86 (P = 0.0001)						



Test for subgroup differences: Chi² = 2.16, df = 1 (P = 0.14), I² = 53.6%

Figure 3 Study findings (ie, effect sizes and risk of bias) for articles reporting on the effect of the intervention on performance of physical activities. Findings are stratified by timing (short-term vs long-term effects). Individual study and pooled effects are presented. IV, inverse variance.

(95%CI 2.64 to 7.46); I^2=53%) (figure 4). A single study showed a non-significant small short-term effect of active referral as single component (2.87 (95%CI −3.84 to 9.58)); three studies reported on intervention elements of e/mHealth, reporting significant short-term (1.98 (95%CI 1.38 to 2.58); I^2=0%) and long-term (3.52 (95%CI 1.62 to 5.41); I^2=0%) effects (online supplementary material 9). Three studies reported on a multicomponent intervention, showing significant short-term (5.13 (95%CI 2.33 to 7.90); I^2=0%) and long-term (7.76 (95%CI 5.02 to 10.51); I^2=0%) effects. Three studies reported on patients undergoing surgery to their back, reporting significant short-term (2.04 (95%CI 1.44 to 2.64); I^2=0%) and long-term (5.22 (95%CI 2.18 to 8.26); I^2=51%) effects (online supplementary material 10). Two studies reported on effects of patients undergoing hip surgery, significant at short term (5.49 (95%CI 2.36 to 8.61); I^2=0%) and non-significant at long term (4.37 (95%CI −1.58 to 10.31); I^2=76%). Two studies reported on patients undergoing knee surgery with a non-significant short-term effect: 0.62 (95%CI −3.55 to 4.79); I^2=0%. One study reported on patients undergoing surgery to their upper extremities also with a non-significant short-term effect: 1.48 (95%CI –5.60 to 8.56).

DISCUSSION

Interpretation of findings

This systematic review of 17 articles showed that limited studies are available regarding the effectiveness of integrated care interventions on sports and work participation. Only one study reported on return to sports and found no significant beneficial effects of the intervention. For return to work, one study did and one did not report significantly beneficial effects of the intervention, and a third study did not report on their (a priori proposed) return to work outcomes. An explanation for this might be that in the identified articles integrated care was not fully focused on return to sports or work given that only three reported on these specific outcomes. Another explanation may be that although the focus of usual care is not on return to sport or work per se, patients receiving such usual care do quite well in returning to sports or work. For example, one study among patients receiving a Bankart (shoulder) operation showed that 32% of those receiving usual care and 19% in the integrated care group returned to sport within 18 weeks after surgery.[25] This phenomenon could be reinforced by the fact that there is no clear distinction between integrated care and usual care, and as such, also usual care can vary. In some of the studies included in our review,[23 24 32] even in the control group elements of integrated care, such as an education programme on postoperative recovery and phone meetings were reported.

Our quantitative analysis showed that, compared with usual care, integrated care interventions had small effects on performance of physical activities and QoL with pooled effect sizes ranging from 2.62 to 5.77, on a scale from 0 to 100. Reported minimal clinically important differences for the outcome measures of our review vary substantially in the literature. It was, for example, reported that, for the widely adopted SF-36 to measure QoL, minimal clinically important differences vary a lot between knee and hip replacement patients and can be as much as 20 on a 0–100 scale.[40] This renders the clinical relevance of the effect sizes from our quantitative analysis questionable. In contrast, clinically relevant improvements in QoL are described after integrated care interventions, compared with usual care, among non-surgical back pain patients[41 42]

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Table 2 Summary of results from the quantitative analyses regarding quality of life activities (9 studies with 1158 participants reporting on short-term and long-term effects combined). Number of studies and participants, (pooled) effect sizes and, if applicable, I^2 statistics (depicting heterogeneity) are shown. Short-term and long-term effects are presented. Total results and results stratified by intervention component (active referral, e/mHealth and multicomponent interventions with a combination of elements) and patient category (back, knee, hip and upper extremity surgery) are shown.

	Short term					Long term				
	N	n	Effect size	I^2	Forest plot	N	n	Effect size	I^2	Forest plot
Total	7	956	2.62 (1.16 to 4.08)	17%	Figure 4	5	846	5.05 (2.64 to 7.46)	53%	Figure 4
Active referral	1	63	2.87 (–3.84 to 9.58)	–	Online supplementary material 9	–	–	–	–	–
e/mHealth	3	311	1.98 (1.38 to 2.58)	0%	Online supplementary material 9	3	360	3.52 (1.62 to 5.41)	0%	Online supplementary material 9
Combined	3	582	5.13 (2.33 to 7.90)	0%	Online supplementary material 9	2	486	7.76 (5.02 to 10.51)	0%	Online supplementary material 9
Back	2	248	2.04 (1.44 to 2.64)	0%	Online supplementary material 10	3	373	5.22 (2.18 to 8.26)	51%	Online supplementary material 10
Hip	2	463	5.49 (2.36 to 8.61)	0%	Online supplementary material 10	2	473	4.37 (–1.58 to 10.31)	76%	Online supplementary material 10
Knee	2	149	0.62 (–3.55 to 4.79)	0%	Online supplementary material 10	–	–	–	–	–
Upper extremity	1	96	1.48 (–5.60 to 8.56)	–	Online supplementary material 10	–	–	–	–	–

I^2, heterogeneity; n, number of participants; N, number of studies.

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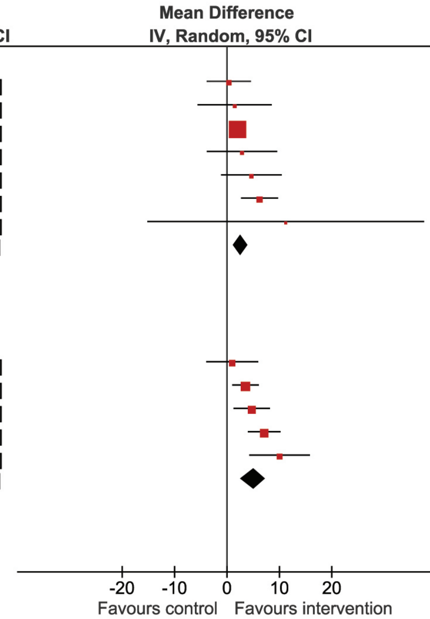
Study or Subgroup	Mean Difference	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.1.1 Short-term						
Szöts 2016 (short-term)	0.35	2.153	59	58	10.2%	0.35 [-3.87, 4.57]
Damkjaer 2015 (short-term)	1.48	3.61	44	52	4.0%	1.48 [-5.60, 8.56]
Hou 2019 (short-term)	2.01	0.309	82	80	61.5%	2.01 [1.40, 2.62]
Sandell 2008 (short-term)	2.87	3.421	33	30	4.4%	2.87 [-3.84, 9.58]
Archer 2016 (short-term)	4.67	2.952	43	43	5.8%	4.67 [-1.12, 10.46]
Wang 2018 (short-term)	6.21	1.8	200	200	13.7%	6.21 [2.68, 9.74]
Levinger 2017 (short-term)	11.2	13.469	16	16	0.3%	11.20 [-15.20, 37.60]
Subtotal (95% CI)			**477**	**479**	**100.0%**	**2.62 [1.16, 4.08]**
Heterogeneity: Tau² = 0.81; Chi² = 7.25, df = 6 (P = 0.30); I² = 17%						
Test for overall effect: Z = 3.51 (P = 0.0004)						
1.1.2 Long-term						
Vesterby 2018 (long-term)	1	2.526	36	37	14.8%	1.00 [-3.95, 5.95]
Skolasky 2018 (long-term)	3.53	1.293	65	60	27.6%	3.53 [1.00, 6.06]
Hou 2019 (long-term)	4.73	1.776	82	80	21.7%	4.73 [1.25, 8.21]
Wang 2018 (long-term)	7.1	1.59	200	200	23.8%	7.10 [3.98, 10.22]
Archer 2016 (long-term)	10.04	2.949	43	43	12.1%	10.04 [4.26, 15.82]
Subtotal (95% CI)			**426**	**420**	**100.0%**	**5.05 [2.64, 7.46]**
Heterogeneity: Tau² = 3.82; Chi² = 8.47, df = 4 (P = 0.08); I² = 53%						
Test for overall effect: Z = 4.11 (P < 0.0001)						



Test for subgroup differences: Chi² = 2.87, df = 1 (P = 0.09), I² = 65.1%

Figure 4 Study findings (ie, effect sizes and risk of bias) for articles reporting on the effect of the intervention on quality of life. Findings are stratified by timing (short-term vs long-term effects). Individual study and pooled effects are presented. IV, inverse variance.

and patients undergoing abdominal or gynaecological surgeries.[43–45] Studies reporting on interventions of e/mHealth[34 35] and, in particular in combination with active referral or goal setting,[24] showed additional effectiveness in reducing pain and pain interference. These pain reduction effects may explain the associated effects in QoL and performance of physical activities, since pain intensity and QoL are known to be highly correlated.[46] The mentioned intervention components can provide effective elements for future intervention development. The range of different integrated care components and the heterogeneity between them suggest the need for continuity in integrated care intervention development.

For the outcome measures performance of physical activities and QoL, effect sizes appeared to be larger when considering long-term effects (>3 months postsurgery) compared with short-term effects (<3 months postsurgery). A plausible explanation is that in the first period after surgery, mainly physiological recovery with increase in function and reduction of pain takes place, while only after this initial post-surgery period patients start to focus on sport and work participation again. This is also supported by the two studies with the largest effect sizes, both evaluating active referral and goal setting, resulting in an increase of 11% more patients returning to work[26] and more than 10% increase in QoL[24] both after 3 months. It should be noted that when considering longer follow-up periods than the ones reported in the current review, stronger effects may be seen. This is in particular relevant for some type of surgeries, for example, ACL reconstruction surgery, where return to activities is typically seen only long after surgery. Moreover, future studies could consider to assess not just return to work or sport but also the successfulness of this return.

Study limitations

As far as we are aware, this is the first review to systematically evaluate the effectiveness of integrated care interventions on participation, that is, return to sports or work, performance of physical activities and QoL among patients receiving orthopaedic surgery. An asset of this study is that we have summarised the identified evidence, if possible, in a meta-analysis. Another strength of our study is the methodological quality of our work, by following the PRISMA guidelines as well as the preregistration of our systematic review, thereby dealing with publication bias. We have also aimed to identify unpublished work in another attempt to address publication bias.

A potential limitation of our study is the heterogeneity in the identified data, as indicated by I^2 (statistical heterogeneity) up to 76% among long-term effects in performance of physical activities. Moreover, we found evidence from different patient populations, intervention elements, outcome measures and follow-up durations, which can all have resulted in methodological and/or clinical heterogeneity. For this reason, study findings were stratified based on body area (ie, back, upper extremity, knee and hip) all showing effect sizes in the same direction. This is based on evidence from patients undergoing shoulder dislocation repair, hip and knee surgery, as well as surgery to their back, including such as laminectomy, lumbar discectomy, disc surgery and spinal stenosis. However, there was insufficient information to further stratify our findings according to these and other potential sources of heterogeneity. Also, the current findings cannot be extrapolated to patients with surgical procedures that have not been described in our study. As a result of this heterogeneity, in combination with the relatively limited amount of studies and participating

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patients, the interpretation of the presented results should be done with due caution.

We have found various sources of bias in the studies in our review. While two studies were based on non-randomised study designs, in the randomised controlled trials high or unknown risk of bias regarding blinding of patients and personnel was seen. We acknowledge blinding is difficult in studies with integrated care interventions, especially for outcomes that are based on self-reports. For some objectively measured outcome variables, for example, return to work based on company data or device measured physical activity, blinding may be better feasible. Other potential sources of bias that were identified were incomplete outcome data indicating low compliance with the described interventions and small study samples with the risk of selection bias. Due to limited variation in risk of bias between studies, we were not able to assess the extent to which abovementioned sources of risk of bias have impacted on the reported findings which would have been in accordance to our a priori registered study protocol. Future research should consider these sources of bias.

Future research

In the articles identified in our review, integrated care was not fully focused on return to sports or work given that only three reported on these specific outcomes. As such, we encourage future research to consider designing interventions for and reporting on return to sports and work given the importance for numerous orthopaedic surgery patients. By doing this, stronger evidence will become available for practitioners and policy makers as to whether integrated care interventions should be implemented for this particular patient population.

Important sources of risk of bias that we identified were incomplete outcome data indicating low compliance with the described interventions and small study samples with the risk of selection bias. Such sources of bias should be addressed in future studies in order to build an evidence base with higher quality studies.

CONCLUSIONS

Orthopaedic surgery is primarily aimed at improving function and pain reduction. Additional integrated care may enhance patient's participation in sports and work, thereby improving the performance of physical activities and QoL. From our systematic review, we found insufficient and inconsistent evidence for the effectiveness of integrated care interventions regarding sport and work participation for orthopaedic surgery patients. Only small effects of these interventions were found regarding performance of physical activities and QoL.

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Competing interests JA intends to set up a spin-off company concerning the implementation of a mobile application concerning the IkHerstel intervention in the Netherlands, holds a chair in Insurance Medicine paid by the Dutch Social Security Agency Is stockholder of Evalua Received grants from ZonMw/NWO, Instituut Gak, UWV, SZW, VWS, Pfizer, Achmea, CVZ/Zorg Instituut outside the submitted work. All other authors declare no conflicts of interests, financial of other.

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