GIG CYMRU NHS WALES | Iechyd Cyhoeddus Cymru Public Health Wales

Prehabilitation interventions for patients on elective surgical waiting lists

Topic evidence summary on exercise prehabilitation interventions.

Mae'r ddogfen yma ar gael yn y Gymraeg/This document is available in Welsh

Contents

Background

Waiting times in the NHS are currently at a record high, with areas of elective surgery experiencing particularly long waiting lists. Prolonged waits for surgery can impact negatively on patients who may experience worse health outcomes, poor mental health, disease progression, or even death[1]. Time spent waiting for surgery may be better utilised in preparing patients. Prehabilitation interventions aim to enhance general health and wellbeing prior to major surgery, by intervening in the preoperative period to modify behavioural and lifestyle risk factors that may have a positive effect on preoperative and longer-term outcomes.

This topic evidence summary aims to examine:

1) What prehabilitation interventions for adults on elective surgical waiting lists are effective?
2) What features/components of prehabilitation interventions for adults on surgical waiting lists are important to their success?

This topic evidence summary summarises prehabilitation interventions identified by our rapid evidence search, which comprised of both exercise and education components. Overall, our search identified six randomised controlled trials (RCTs), published in seven papers, which included both these components and met the overall inclusion criteria for this topic[(1-7)]. Studies were included if they looked at a prehabilitation intervention to support patients whilst waiting for surgery, and where outcomes were assessed pre-operatively to determine the intervention effect on patients' health during the period prior to surgery. Post-operative outcomes were not included in this summary as the interest is on patients' pre-surgery, and due to the large amount of pre-surgical outcomes described in the studies.

All interventions were delivered to patients on elective surgical waiting lists. Three interventions involved patients awaiting total knee replacement (TKR)[(1, 4, 7)], two awaiting total hip replacement (THR)[(2, 3)] and one awaiting pelvic organ prolapse surgery (POPs)[(5, 6)] (table 1).

Table 1. *Number and the type of delivery for the interventions per surgery type.*

	POPs	TKR	THR
Self-directed	1		1
Supervised		1	1
Supervised and self-directed		2	

*Key: POPs = pelvic organ prolapse surgery, TKR = total knee replacement, THR = total hip replacement.

The exercise component of the included interventions usually comprised of exercises to improve

[1] Okolie C, et al. 2022. A rapid review of the effectiveness of innovations to support patients on elective surgical waiting lists. *Medrxiv* DOI: 10.1101/2022.06.10.22276151 https://www.medrxiv.org/content/10.1101/2022.06.10.22276151v1.full.pdf

strength/function/fitness. The education component was required to include advice and/or information beyond instructions on the exercise component. These usually included elements around safety and use of assistive equipment that would be of benefit during the waiting period, and advice on everyday functional activities.

Interventions involved a mix of self-directed and supervised delivery of the exercise and educational components. Two interventions (across three published studies) tested self-directed exercise interventions with education[3, 5, 6] and two tested supervised exercise interventions with education, against no intervention[1, 2]. The final two interventions incorporated self-directed and supervised delivery compared to usual care[4, 7].

Based on data extracted from the sources identified, prehabilitation interventions for patients on elective surgical waiting lists which contain similar components have been grouped together to create a narrative summary and assessment of what the evidence suggests may or may not be effective, and what needs further research. A broad range of outcomes have been included in the summaries to give a more complete picture about which types of outcomes prehabilitation interventions may or may not be effective for. Outcomes for each intervention have been graded using the key below to demonstrate whether the evidence suggests the intervention may or may not be effective for improving an outcome of interest.

✓ These summaries are designed to:

- Support those making decisions about national or local policies or action
- Support exploratory conversations about interventions, programmes and services by:
  - Showcasing the types of interventions that have been researched
  - Highlighting the types of interventions that show promising results and are worthy of further-context specific exploration
  - Highlighting the types of interventions less likely to be supported by the evidence and that should be avoided at this time.

✘ These summaries are not designed to:

- Give detailed quality and contextual assessment of the evidence base for each intervention and should not be used alone to allocate resources
- Consider competing priorities, adaptation to local context, effect sizes nor costs
- Cover all possible interventions.

Evidence Grading Key:

The evidence suggests the intervention could have a positive effect on this outcome: The intervention is supported by good or moderate quality evidence of its effectiveness for this outcome	
Explanation: Majority of studies are appraised as being of good or moderate quality and are showing an effect in favour of the intervention for this outcome	Further considerations: Further context-specific exploration needed (generalisability to Wales). Consider thorough evaluation if implementing these types of programmes

Further research needed: The evidence base for this intervention is made up of largely poor quality studies for this outcome	
Explanation: Majority of studies are appraised as being of poor quality, but are still showing an effect for the outcome in favour of the intervention OR Majority of studies are appraised as being of poor quality and of no effect for this outcome in favour of the intervention	Further considerations: More robust primary research and thorough evaluation needed
Further research needed: The evidence base is inconsistent. There may be some evidence supporting the use of this intervention for this outcome, but it is not conclusive	
Explanation: The results of studies are inconsistent with no clear majority in favour or not in favour of the intervention, regardless of quality	Further considerations: More robust primary research and thorough evaluation needed
Further research needed: There is a lack of evidence for this intervention for this outcome	
Explanation: Only one study has been identified for this intervention (regardless of quality)	Further considerations: More primary research and thorough evaluation needed

The evidence suggests the intervention may not be effective for this outcome: There is good or moderate quality evidence to suggest that this intervention is likely to be ineffective for this outcome	
Explanation: Majority of studies are appraised as being of good or moderate quality but show no effect of the intervention on this outcome	Further considerations: These interventions are less likely to be supported by evidence and should be avoided at this time

Orthopaedic surgery:

Supervised prehabilitation exercise interventions

Supervised strength-based prehabilitation exercise training interventions for patients on wait lists for total knee replacement[1-5].

Please note that where outcomes have only been assessed in one study, these have been graded as evidence lacking by default. However, an attempt has been made in the summary to report on the studies effectiveness.

Intervention:

Five studies[1-5] examined the effectiveness of supervised strength-based training in patients awaiting total knee replacement.

The interventions commenced between eight and three weeks prior to the date of surgery and consisted of between 12 and 30 supervised exercise sessions. In one study (moderate quality)[4], patients were supervised via video-call. In one study (strong quality)[3] exercise sessions took place in the hospital. The remainder of the studies did not report the intervention setting. In one study (moderate quality) [2] patients also received postoperative rehabilitation as part of the intervention.

Control group comparisons consisted of usual care[3, 4], no intervention[5], postoperative rehabilitation only[2] and receiving print material, alongside one meeting with a physiotherapist[1]. Four of the five studies[1, 3-5] were three-armed RCTs, which also included other intervention groups. Only outcomes for the supervised exercise group, compared to a control group have been reported in this summary.

Outcomes:

There is good or moderate quality evidence to suggest that **supervised strength-based prehabilitation interventions** for patients on wait lists for total knee replacement **are likely to be effective** for the following outcomes:

Pain:

- **Might be effective** (4 studies; 3 moderate [1, 2, 4], 1 weak quality[5], all showing improvements in the intervention group compared to control [note: in two studies the statistical significance is not reported [1, 5]]).

Balance:

- **Might be effective** (3 Studies; 1 strong[3], 1 moderate[4], 1 weak quality[5]. All showing significant improvements in the intervention groups compared to control).

The evidence of effectiveness for **supervised strength-based prehabilitation interventions** for patients on wait lists for total knee replacement **is inconsistent** for the following outcomes:

Function:

- **Inconsistent** (5 studies; 3 [1 strong[3], 1 moderate quality[4], 1 weak quality[5]] showing an improvement in the intervention group compared to control. 2 moderate quality studies[1, 2] showing no improvement in the intervention group compared to control).

Quality of life:

- **Inconsistent** (3 studies; 2 strong[3], 1 moderate[2], 1 weak quality[5]. Inconsistent effects across studies).

Mobility:

- **Inconsistent** (3 studies; 2 strong[3], 1 moderate[2], 1 weak quality[5]. Inconsistent effects across studies).

Strength:

- **Inconsistent** (3 studies; 1 weak[5], 2 moderate quality[2, 4]. Inconsistent effects across studies)

Range of motion:

- **Inconsistent** (2 moderate quality studies[2, 4]. Inconsistent effects across studies).

The evidence of effectiveness for **supervised strength-based prehabilitation interventions** for patients on wait lists for total knee replacement **is lacking** for the following outcomes:

Health status:

- **Might be effective** (1 moderate quality study showing a significant improvement for intervention compared to control)[4].

Stiffness:

- **Might be effective** (1 moderate quality study showing a significant improvement for intervention compared to control)[4].

Pain pressure threshold:

- **Might not be effective** (1 moderate quality study showing no effect for the intervention compared to the control)[4].

Delay/cancellation of surgery:

- In one strong quality study[3], 1 participant in the intervention group chose not to undergo surgery, compared to 2 in the control group.

Safety/feasibility:

One moderate quality study[2] reported no adverse events related to the intervention.

Generalisability:

Two studies were undertaken in Spain[3, 5], and one each in South Korea[4], Denmark[2] and USA[1]. Therefore, generalisability to the Welsh context should be considered.

Applicability:

The interventions all took place in patients awaiting total knee replacements and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

Supervised exercise prehabilitation interventions (High Intensity Resistance Training) for patients on wait lists for total knee replacement [6].

Please note that as only one study has been identified in this category, the outcomes have been graded as evidence lacking by default. Despite this, an attempt has been made in the summary to report on the studies effectiveness.

Intervention:

One moderate quality study[6] examined the effectiveness of a supervised exercise intervention, consisting of high-intensity resistance training, for increasing lower limb muscle strength and improving outcomes in patients awaiting total knee replacement.

The exercise intervention group completed a training programme prior to surgery for 3 days per week for 8 weeks, performed at the same time of the day and separated by at least 48 hours. Each exercise session was supervised by a physical therapist. The intervention was compared to a no intervention control group.

Outcomes:

The evidence of effectiveness of supervised high intensity resistance training prehabilitation interventions is lacking for the following outcomes:

Isometric Strength:

- **Might be effective** (one moderate quality study showing significant improvements for the intervention compared to control across all isometric strength measures)[6].

Health Status:

- **Might be effective** (one moderate quality study showing a significant improvement in the intervention group compared to control)[6].

Pain:

- **Might be effective** (one moderate quality study showing a significant improvement in the intervention group compared to control)[6].

Stiffness:

- **Might be effective** (one moderate quality study showing a significant improvement in the intervention group compared to control)[6].

Function:

- **Might be effective** (one moderate quality study showing significant improvements in the intervention group compared to control for all function measures)[6].

Range of Motion:

- **Might be effective** (one moderate quality study showing significant improvements in the intervention group compared to control, for all range of motion measures)[6].

Generalisability:

This study took place in Spain[6], thus generalisability to the Welsh context needs to be considered.

Applicability:

The intervention took place in patients waiting for total knee arthroplasty and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

Prehabilitation exercise interventions consisting of strength, balance and proprioception training, in patients on wait lists for Anterior Cruciate Ligament (ACL) surgery [7] [8].

Please note despite two studies being identified in this category, many outcomes were only examined by one study. Therefore, many of the outcomes have been graded as evidence lacking by default. Despite this, an attempt has been made in the summary to report on the studies effectiveness.

Intervention:

Two studies (one strong quality, one weak quality)[7, 8] examined the effectiveness of prehabilitation exercise interventions consisting of strength, balance and proprioception training, in patients on wait lists for anterior cruciate ligament surgery.

Both interventions took place over six weeks[7, 8]. In the first (strong quality)[7], participants in the intervention group completed 2 supervised gym sessions and 2 supervised home based sessions per week and were compared to a usual care control group. In the second, (weak quality)[8], intervention participants completed home-based physiotherapy for at least 30/min per day. They were compared to a control group of patients not receiving physiotherapy.

Outcomes:

The evidence of effectiveness of **prehabilitation interventions consisting of strength, balance and proprioception training** in patients awaiting ACL surgery **is inconsistent** for the following outcomes:

Function:

- **Inconsistent** (two studies; one strong quality[7], one weak quality[8], inconsistent effects across studies).

The evidence of effectiveness of **prehabilitation interventions consisting of strength, balance and proprioception training** in patients awaiting ACL surgery **is lacking** for the following outcomes:

Strength:

- **Might be effective** (one strong quality study; showing significant effect for intervention compared to control) [7].

Increase in Muscle Size:

- **Might be effective** (one strong quality study; showing significant effect for intervention compared to control) [7].

Increase in Muscle-Building Proteins:

- **Might be effective** (one strong quality study; showing significant effect for intervention compared to control) [7].

Knee Joint Stability:

- **Inconsistent** (one strong quality study; inconsistent effects within study when measured in multiple ways) [7].

Balance:

- **Evidence is inconsistent** (one strong quality study; inconsistent effects within study when measured in multiple ways) [7].

Delay or Cancellation of Surgery:

- **Evidence is lacking** (one strong quality study; after the intervention, two subjects in the exercise intervention group elected not to have surgery; all subjects in the control group underwent surgery) [7].

Adverse Events:

- **Evidence is lacking** (one strong quality study; after the intervention, no exercise intervention participants reported major adverse events. One patient experienced a single episode of knee 'pivoting out' while dancing vigorously) [7].

Generalisability:

The study reporting the majority of outcomes took place in the Republic of Ireland[7] and the second study took place in Australia[8], thus generalisability to the Welsh context needs to be considered.

Applicability:

The intervention took place in patients awaiting ACL surgery and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

Supervised land and pool-based exercise prehabilitation interventions for patients on wait lists for total knee and hip replacement [9] [1].

Please note despite two studies being identified in this category, many outcomes were only examined by one study. Therefore, many of the outcomes have been graded as evidence lacking by default. Despite this, an attempt has been made in the summary to report on the studies effectiveness.

Intervention:

Two moderate quality studies[1, 9] were identified which examined supervised land and pool-based exercise interventions for patients on wait lists for TKR and THR.

Participants in the first study[9] were awaiting TKR and undertook water and land-based exercise sessions 3 x per week, in the 6 weeks immediately prior to surgery. Sessions consisted of a mix of strength and cardiovascular exercises. Intervention participants were compared with a control group receiving standard education.

Participants in the second moderate quality study[1], were awaiting either TKR or THR and completed 18 exercise sessions (3 x per week, lasting 45 minutes). Twelve were land-based cardiovascular exercise sessions and the remaining 6 consisted of aquatic exercises. They were compared with a group receiving 1-on-1 supervised exercise training and a control group who received print material and met with a physiotherapist for one session.

Outcomes:

There is good or moderate quality evidence to suggest that **supervised land and pool-based exercise prehabilitation interventions** for patients on wait lists for orthopaedic surgery are **likely to be ineffective** for the following outcomes:

Pain:

- **Might not be effective** (two moderate quality studies, both showing no effect for intervention when compared to control) [9] [1].

The evidence of effectiveness of **supervised land and pool-based exercise prehabilitation interventions** for patients on wait lists for orthopaedic surgery **is inconsistent** for the following outcomes:

Function:

- **Evidence is inconsistent** (two moderate quality studies; significant improvements were found for all function measures in patients awaiting THR in one study[9], but results were inconsistent for patients awaiting TKR across studies)[1, 9].

The evidence of effectiveness of supervised land and pool-based exercise prehabilitation interventions for patients on wait lists for orthopaedic surgery is lacking for the following outcomes:

Strength:

- **Might not be effective** (one moderate quality study; no effect for the intervention compared to control) [9].

Balance:

- **Might not be effective** (one moderate quality study; no effect for the intervention compared to control) [9].

Mobility:

- **Might not be effective** (one moderate quality study; no effect for the intervention compared to control) [9].

Evidence service note: One study[1] also includes a second intervention group receiving 1-on-1 physical therapy. Outcomes for this group have been included in the statement for supervised strength-based training.

Generalisability:

Both studies[9] [1] were conducted in USA, thus generalisability to the Welsh context needs to be considered.

Applicability:

The intervention took place in patients awaiting total knee and hip replacement and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

Neuromuscular exercise prehabilitation interventions for patients on wait lists for total knee replacement[10, 11] .

Please note despite two studies being identified in this category, many outcomes were only examined by one study. Therefore, many of the outcomes have been graded as evidence lacking by default. Despite this, an attempt has been made in the summary to report on the studies effectiveness.

Intervention summary:

One moderate[10] and one weak[11] quality study examined the effectiveness of neuromuscular exercise prehabilitation interventions for patients on wait lists for total knee replacement.

In the first study, (moderate quality)[10] the intervention group completed a neuromuscular exercise total joint replacement programme (NEMEX-TJR) consisting of aerobic and circuit training, alongside education on postoperative management. Participants attended for 4-12 weeks, depending on their position on the surgery waitlist. The control group completed education only.

In the second study (weak quality),[11] the intervention group completed an acute rehabilitative neuromuscular exercise-conditioning (APNEC) programme, consisting of nine exercise-conditioning sessions for the knee extensor of the surgical leg, accrued over one week (3 sessions per week, 3 x per day). This was compared to a usual care control group.

Outcomes:

The evidence of effectiveness of **neuromuscular prehabilitation interventions** for patients on wait lists for total knee replacement **is inconsistent** for the following outcomes:

Strength:

- **Inconsistent** (two studies; one moderate quality [10], one weak quality[11], inconsistent effects across studies).

The evidence of effectiveness of **neuromuscular prehabilitation interventions** for patients on wait lists for total knee replacement **is lacking** for the following outcomes:

Function:

- **Might not be effective** (one moderate quality study; no effect for intervention when compared to control)[10].

Pain:

- **Might not be effective** (one moderate quality study; no effect for intervention when compared to control) [10].

Range of motion:

- **Might not be effective** (one moderate quality study; no effect for intervention when compared to control) [10].

Mobility:

- **Might not be effective** (one moderate quality study; no effect for intervention when compared to control)[10].

Physical activity level:

- **Might not be effective** (one moderate quality study; no effect for intervention when compared to control)[10].

Health-related quality of life:

- **Might not be effective** (one moderate quality study; no effect for intervention when compared to control)[10].

Generalisability:

The moderate quality study[10] took place in Switzerland, thus generalisability to the Welsh context needs to be considered. The weak quality[11] took place in Edinburgh UK, and therefore may be generalisable to Wales.

Applicability:

The intervention took place in patients waiting for total knee replacement and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

Self-directed prehabilitation exercise interventions

Self-directed exercise prehabilitation interventions for patients on wait lists for total knee replacement[12].

Please note that as only one study has been identified in this category, the outcomes have been graded as evidence lacking by default. Despite this, an attempt has been made in the summary to report on the studies effectiveness.

Intervention summary:

One moderate quality study[12] examined the effectiveness of a home-based self-directed exercise intervention, consisting of twice-daily stretching exercises, in improving outcomes for patients awaiting TKR. This was compared to a control group receiving no intervention. The duration of the intervention differed between participants, with patients being enrolled onto the study when they joined the surgical waiting list and waiting an average of three months until the surgery.

Outcomes:

The evidence of effectiveness for **self-directed exercise prehabilitation interventions** for patients on wait lists for total knee replacement **is lacking** for the following outcomes:

Range of Motion outcomes:

- **Might be effective** (one moderate quality study showing significant effects for knee range of motion measurements in the intervention group when compared to control)[12].

Pain:

- **Might be effective** (one moderate quality study showing a significant effect for the intervention compared to control)[12].

Gait Speed:

- **Might be effective** (one moderate quality study showing a significant effect for the intervention compared to control)[12].

Generalisability:

This study took place in Japan[12], thus generalisability to the Welsh context needs to be considered.

Applicability:

The intervention took place in patients waiting for total knee arthroplasty and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

Combined supervised and self-directed exercise prehabilitation interventions:

Exercise prehabilitation interventions consisting of both supervised and self-directed elements, for patients on wait lists for Orthopaedic surgery[13-16].

Please note that where outcomes have only been assessed in one study, these have been graded as evidence lacking by default. However, an attempt has been made in the summary to report on these studies' effectiveness.

Intervention summary:

Three moderate quality RCTs published across five papers[13-17] examined prehabilitation exercise interventions consisting of both supervised and self-directed elements. One RCT each took place in patients awaiting TKR[16, 17], THR [14, 15] and high tibial osteotomy or prosthetic knee replacement[13].

The interventions lasted between five and eight weeks and all consisted of both clinic-based supervised sessions and home-based self-directed exercises. The control groups consisted of usual care[14-17] or no intervention[13]. Exercises generally aimed to improve strength, flexibility, and range of motion.

Outcomes:

There is moderate quality evidence to suggest that **exercise prehabilitation interventions where components consist of both supervised and self-directed elements,** for patients on orthopaedic surgical wait lists, are **likely to be ineffective** for the following outcomes:

Pain:

- **Might not be effective** (three moderate quality studies showing no effect for the intervention compared to control)[13, 15, 16].

The evidence of effectiveness for **exercise prehabilitation interventions where components consist of both supervised and self-directed elements,** for patients on orthopaedic surgical wait lists, **is inconsistent** for the following outcomes:

Function:

- **Inconsistent** (three studies; moderate quality, inconsistent effects across studies)[13, 15, 16].

Muscle strength:

- **Inconsistent** (three studies; moderate quality, inconsistent effects across studies)[13, 15, 16].

Range of Motion outcomes:

- **Inconsistent** (two studies; moderate quality, inconsistent effects across studies)[13, 15].

The evidence of effectiveness **exercise prehabilitation interventions where components consist of supervised and self-directed elements,** for patients on orthopaedic surgical wait lists, **is lacking** for the following outcomes:

Health status:

- **Might be effective** (one moderate quality study showing significant effect for the intervention compared to control)[14].

Stiffness:

- **Might be effective** (one moderate quality study showing significant effect for the intervention compared to control)[14].

Gait Speed:

- **Might not be effective** (one moderate quality study showing no effect of the intervention on gait performance compared to control)[13].

Delay or cancellation of surgery:

- One strong quality study showing two participants in the intervention group decided to delay/cancel surgery because of marked improvements in physical function and reduction in pain[14].

Generalisability:

The RCTs were conducted in Australia[14, 15], Sweden[13] and USA[16, 17]. Therefore, generalisability to the Welsh context should be considered.

Applicability:

The interventions all took place in patients waiting for various orthopaedic surgeries and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

Spinal Surgery

Supervised exercise prehabilitation interventions (strength and mobility training) for patients on wait lists for spinal surgery[18, 19].

Please note despite two studies being identified in this category, many outcomes were only examined by one study. Therefore, many of the outcomes have been graded as evidence lacking by default. Despite this, an attempt has been made in the summary to report on the studies effectiveness.

Intervention summary:

Two studies (one strong[18] and one moderate quality[19]) examined the effectiveness of supervised exercise prehabilitation interventions, consisting of strength and mobility training, in patients awaiting lumbar spinal stenosis surgery. In both studies, training was tailored to the participants' needs, took place 6-9 weeks before surgery and was comprised of 2-3 sessions per week. Control groups received usual care.

Outcomes:

There is good or moderate quality evidence to suggest that **supervised strength and mobility exercise prehabilitation interventions** for patients on wait lists for spinal surgery are **likely to be ineffective** for the following outcome:

Depression and Anxiety:

- **Might not be effective** (two studies; one strong and one moderate quality, both showing no effect for intervention when compared to control)[18, 19].

The evidence of effectiveness of **supervised strength and mobility exercise prehabilitation interventions** for patients on wait lists for spinal surgery **is inconsistent** for the following outcomes:

Pain:

- **Inconsistent** (one strong and one moderate quality study; inconsistent effects across and within studies for pain, when measured using different measurement tools)[18, 19].

Fear Avoidance:

- **Inconsistent** (one strong and moderate quality study; inconsistent effects across studies)[18, 19].

Function:

- **Inconsistent** (one strong and one moderate quality study; inconsistent effects across and within studies for function, when measured using different measurement tools)[18, 19].

The evidence of effectiveness of **supervised strength and mobility exercise prehabilitation interventions is lacking** for patients on wait lists for spinal surgery for the following outcomes:

Self-efficacy:

- **Might be effective** (one strong quality study showing a significant effect for the intervention, compared to control)[18].

Lumbar spinal stenosis (LSS) disability:

- **Might be effective** (one moderate quality study showing a significant effect for the intervention, compared to control)[19].

Lumbar extensors endurance:

- **Might be effective** (one moderate quality study showing a significant effect for the intervention, compared to control)[19].

Health related quality of life:

- **Inconsistent** (one strong quality study, inconsistent effects across measures of health-related quality of life)[18].

Trunk muscles strength:

- **Inconsistent** (one moderate quality study, inconsistent effects across measures of trunk muscle strength)[19].

Walking capacity:

- **Inconsistent** (one moderate quality study, inconsistent effects across measures of walking capacity)[19].

Back disability:

- **Might not be effective** (one moderate quality study showing no effect for intervention compared to control)[19].

Lumbar active range of motion (ROM):

- **Might not be effective** (one moderate quality study, showing no effect for intervention compared to control)[19].

Right knee and Left knee extensors strength:

- **Might not be effective** (one moderate quality study, showing no effect for intervention compared to control)[19].

Generalisability:

The studies took place in Sweden[18], and Canada[19] thus generalisability to the Welsh context needs to be considered.

Applicability:

The intervention took place in patients waiting for lumbar spinal stenosis and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

Cardiac Surgery

Inspiratory muscle training prehabilitation interventions for patients on wait lists for cardiac surgery [21-23].

Please note that where outcomes have only been assessed in one study, these have been graded as evidence lacking by default. However, an attempt has been made in the summary to report on these studies' effectiveness.

Intervention summary:

Three studies (one weak[23], one moderate[21], and one strong[22] quality) examined the effectiveness of inspiratory muscle training (IMT) in patients awaiting coronary artery bypass graft (CABG) and aortic valve replacement surgeries.

The interventions lasted between two and six weeks, all were daily sessions using a threshold inspiratory muscle trainer. In one study, IMT was home-based and self-directed[22]. In the second, it was performed at home with one session per week being supervised[23]. In the final study, all IMT sessions were performed under the supervision of a physician [21]. The control groups for comparison were usual care[23], sham training[21], and a low-intensity inspiratory muscle training group (LI-IMT) [22].

Outcomes:

The evidence of effectiveness of **inspiratory muscle training prehabilitation interventions** for patients on wait lists for cardiac surgeries **is inconsistent** for the following outcomes:

Inspiratory muscle strength:

- **Inconsistent** (two studies [one weak[23], one moderate[21] quality] showing a significant effect for the intervention compared to control).

The evidence of effectiveness of **inspiratory muscle training interventions** for patients on wait lists for cardiac surgeries **is lacking** for the following outcomes:

Inspiratory Muscle Endurance:

- **Might be effective** (one moderate[21] quality study showing a significant effect for the intervention, compared to control).

Arterial Blood gases:

- **Inconsistent** (one moderate[21] quality study, inconsistent effects across different measures of arterial blood gases).

Pulmonary Function:

- **Inconsistent** (one strong[22] quality study, inconsistent effects across different measures of pulmonary function).

Health-Related Quality of Life:

- **Might not be effective** (one weak[23] quality study, showing no effect for intervention when compared to control).

Spirometry (improving lung function):

- **Might not be effective** (one moderate[21] quality study, showing no effect for intervention when compared to control).

Inflammatory Response:

- **Might not be effective** (one strong[22] quality study, showing no effect for intervention when compared to control).

Generalisability:

The studies took place in the Netherlands[23], Israel[21] and France[22], thus generalisability to the Welsh context needs to be considered.

Applicability:

The intervention took place in patients waiting for cardiac surgery and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

Supervised exercise prehabilitation interventions for patients on wait lists for Abdominal Aortic Aneurysm (AAA) repair surgery[24, 25].

Please note that where outcomes have only been assessed in one study, these have been graded as evidence lacking by default. However, an attempt has been made in the summary to report on these studies' effectiveness.

Intervention summary:

Two moderate quality studies[24, 25] examined the effectiveness of supervised exercise interventions in patients awaiting abdominal aortic aneurysm (AAA) repair surgery. Both studies were hospital-based, physiotherapist-led exercise programs, lasting between 4-6 consecutive weeks, comprising 3 sessions per week. Exercises consisted of strength and resistance training[24] and High-intensity Interval Training (HIIT)[25]. The control groups in both studies received usual care.

Outcomes:

The evidence of effectiveness of **supervised exercise prehabilitation interventions** for patients on wait lists for AAA repair surgery **is inconsistent** for the following outcomes:

Aerobic Fitness:

- **Inconsistent** (two moderate quality studies; inconsistent effects across studies)[24, 25].

The evidence of effectiveness of **supervised exercise prehabilitation interventions** for patients on wait lists for AAA repair surgery **is lacking** for the following outcomes:

Total Exercise Time (seconds):

- **Might be effective** (one moderate quality study showing a significant effect for the intervention group and no significant effect for the control; however no between-group comparison reported)[24].

Health-Related Quality of Life:

- **Might not be effective** (one moderate quality study, showing no effect for intervention when compared to control)[25].

Exercise adherence, exercise enjoyment and safety:

- One moderate quality study, showing most patients adhered to and enjoyed the exercise program; there was one adverse event reported [angina])[25].

Evidence Service Comments:

One study[24] only reported the within-group changes, and did not perform any between-group analysis, therefore these results should be interpreted with more caution.

Generalisability:

Both studies were conducted in the UK[24, 25], therefore may be generalisable to the Welsh context.

Applicability:

The intervention took place in patients waiting for AAA repair surgery and therefore may not be applicable to patients waiting for other elective surgeries.

If proceeding with this intervention:

It is suggested that further robust research and thorough evaluation of impact is needed.

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