

Rapid evidence checks are based on a simplified review method and may not be entirely exhaustive, but aim to provide a balanced assessment of what is already known about a specific problem or issue. This brief has not been peer-reviewed and should not be a substitute for individual clinical judgement, nor is it an endorsed position of NSW Health.

## Resuming elective surgery – the evidence for prehabilitation

### Rapid review question

What is the evidence that 'prehabilitation' or preoperative rehabilitation before surgery improves value or outcomes for patients?

### In brief

- Prehabilitation is a process of enhancing patients' physical functionality preoperatively to support them to deal with major surgery.
- Studies vary widely in terms of types of intervention, study population, and outcomes assessed.

### Exercise-based prehabilitation

- A 2014 systematic review, focused on adult surgical populations, found prehabilitation was associated with improved post-operative pain, length of stay and physical function but was not consistently effective in improving quality of life or aerobic fitness, compared with standard care.(1)
- For joint replacement surgery, three systematic reviews reported exercise-based prehabilitation does not demonstrate clinically important benefits.(2-4)
- For cardiac and vascular surgery, four systematic reviews found a positive impact.(5-8) Preoperative inspiratory muscle training in particular is associated with reduced postoperative complications and reduced length of stay.(7)
- For major abdominal surgery, four systematic reviews and meta-analyses report positive effects, with prehabilitation associated with fewer complications and better functional outcomes. (7, 9-11)
- For cancer cohorts, systematic reviews and meta-analyses report positive associations between prehabilitation and some outcomes in broad studies, and in more focused studies on non-small cell lung cancer, breast cancer, oesophageal cancer, abdominal cancer and colorectal cancer. (12-18). Functional outcomes were most frequently affected.
- For liver transplantation, there is insufficient evidence to assess impact.(19)

### Nutrition-based prehabilitation

- A 2018 systematic review found nutritional prehabilitation decreased length of stay by two days and improved outcomes in the 6-minute walk test post colorectal surgery. (20)
- Another 2018 systematic review, focused on patients undergoing surgery for colorectal cancer, reported no reduction in complication rate associated with nutritional prehabilitation. (21)

### Psychological prehabilitation

- A 2015 systematic review reported psychological prehabilitation for cancer surgery was associated positively with psychological outcomes, and quality of life. There was no association with length of hospital stay, complications, analgesia use, or mortality. (22)

### Educational prehabilitation

- A 2015 systematic review on hip and knee replacement found that preoperative patient education does not affect postoperative outcomes, except for a significant reduction in preoperative anxiety. (23)

### Multimodal prehabilitation

- While some small studies are supportive, there are insufficient data to draw conclusions about the role of multimodal prehabilitation in gastrointestinal cancer surgery. (24)
- According to the UK Centre for Perioperative Care (a multidisciplinary group that includes Medical Royal Colleges and NHS England), the PREPARE for surgery program has reduced complications and length of stay in a cost effective way. (25)

### Limitations

This evidence check is limited to systematic reviews, and any studies not yet evaluated in a review would not be included. Prehabilitation is a complex intervention that varies between and within surgery types and programs. This variation, together with underpowered studies, heterogeneity of study methods used and the potential for bias, poses considerable challenges to evidence synthesis.

### Background

Prehabilitation is the process of enhancing physical functionality preoperatively in order to improve patient outcomes. Programs vary but can include a combination of exercise, such as aerobic conditioning and strength training, nutritional care and psychological interventions. Some also include smoking cessation.

Prehabilitation is distinct from preoperative optimisation, which does not involve patient effort or behaviour modification and is managed by the clinicians. Optimisation includes initiation or adjustment of medications to decrease blood pressure or control glucose levels.

In December 2019, the NHS announced it would offer cancer patients a 'prehab' fitness plan. (26)

### Methods (Appendix 1)

PubMed, the Cochrane Library and Google were searched on the 27 June 2020.

## Results

**Table 1: Peer reviewed literature, by patient groups**

Source	Summary
<b>General</b>	
<p><a href="#">The effectiveness of prehabilitation or preoperative exercise for surgical patients: a systematic review</a>                      Cabilan, et al. 2015 (2)                      [see also Cabilan et al, 2016 (27)]</p>	<ul style="list-style-type: none"> <li>• Included 17 studies: orthopaedics, mainly knee or hip arthroplasty for osteoarthritis (13 studies); cardiac (2); colorectal (1); and upper gastrointestinal and hepatobiliary (1).</li> <li>• Function, pain and quality of life were quantified according to prehabilitation dose and postoperative months.</li> <li>• Prehabilitation, at any dose, did not demonstrate benefits in objective and self-reported function at any of the postoperative time points. Prehabilitation did not demonstrate benefits in quality of life or pain however, there was significant evidence that prehabilitation doses of more than 500 minutes reduced the need for postoperative rehabilitation, but no significant reduction was found in readmissions or nursing home placement.</li> <li>• Future prehabilitation studies are not recommended in patients with osteoarthritis for whom arthroplasty is planned.</li> </ul>
<p><a href="#">The role of prehabilitation in frail surgical patients: a systematic review</a>                      Milder, et al. 2018 (28)</p>	<ul style="list-style-type: none"> <li>• Included eight studies, two of which were ongoing.</li> <li>• Evidence supporting any outcome is limited, despite high feasibility and acceptability.</li> </ul>
<p><a href="#">Effect of total-body prehabilitation on postoperative outcomes: a systematic review and meta-analysis</a>                      Santa Mina, et al. 2014 (1)</p>	<ul style="list-style-type: none"> <li>• Included 21 studies.</li> <li>• Compared with standard care, the majority of studies found that total-body prehabilitation improved postoperative pain, length of stay and physical function, but it was not consistently effective in improving health-related quality of life or aerobic fitness.</li> <li>• Studies were of moderate to poor quality.</li> </ul>

Source	Summary
<b>Abdominal surgery</b>	
<p><a href="#">Prehabilitation before major abdominal surgery: a systematic review and meta-analysis</a> Hughes, et al. 2019 (9)</p>	<ul style="list-style-type: none"> <li>• Included 15 randomised controlled trials with 457 prehabilitation patients and 450 control group patients.</li> <li>• A significant reduction in overall and pulmonary morbidity was observed in the prehabilitation group.</li> <li>• No significant difference in length of stay or change in 6-minute walking test distance was observed.</li> </ul>
<p><a href="#">The impact of total body prehabilitation on post-operative outcomes after major abdominal surgery: a systematic review</a> Luther, et al. 2018 (10)</p>	<ul style="list-style-type: none"> <li>• Included 16 studies, with 2,591 patients (1,255 with prehabilitation).</li> <li>• Postoperative complication rate was reduced in six gastrointestinal studies using either preoperative exercise, nutritional supplementation in malnourished patients or smoking cessation.</li> <li>• Improved functional outcomes were observed following a multimodal prehabilitation program.</li> <li>• Compliance was variably measured across the studies (range 16-100%).</li> <li>• There was heterogeneity of studies.</li> </ul>
<p><a href="#">Systematic review: the impact of exercise on mesenteric blood flow and its implication for preoperative rehabilitation</a> Knight, et al. 2017 (33)</p>	<ul style="list-style-type: none"> <li>• Included 16 studies, with 305 participants (healthy volunteers in 12 studies).</li> <li>• Investigated the impact of exercise on mesenteric arterial blood flow using Doppler ultrasound (Adaptations in mesenteric flow in response to exercise may play a role in improving post-operative recovery by reducing rates of ileus and anastomotic leak).</li> <li>• Superior mesenteric blood flow was reduced in response to exercise in 12 studies, increased in one and unchanged in two.</li> <li>• Clinical heterogeneity precluded meta-analysis.</li> </ul>

Source	Summary
<p><a href="#">The ability of prehabilitation to influence postoperative outcome after intra-abdominal operation: a systematic review and meta-analysis</a> Moran, et al. 2016 (11)</p>	<ul style="list-style-type: none"> <li>• Included nine studies.</li> <li>• Inspiratory muscle training, aerobic exercise, and/or resistance training can decrease postoperative complications after intra-abdominal operations.</li> <li>• Insufficient data to assess impact on postoperative length of stay.</li> <li>• No postoperative mortality was reported in any study.</li> <li>• Methodologic quality of studies was very low.</li> </ul>
<b>Cancer</b>	
<p><a href="#">Perioperative prehabilitation and rehabilitation in oesophagogastric malignancies: a systematic review</a> Bolger, et al. 2019 (16)</p>	<ul style="list-style-type: none"> <li>• Included 12 studies with 937 patients.</li> <li>• Inspiratory muscle training consistently showed improvements in functional status preoperatively, with three studies showing improvements in respiratory complications.</li> </ul>
<p><a href="#">An international review and meta-analysis of prehabilitation compared to usual care for cancer patients</a> Treanor, et al. 2018 (13)</p>	<ul style="list-style-type: none"> <li>• Included 18 studies.</li> <li>• Meta-analyses found that pelvic floor muscle training significantly increased odds of continence at three months but did not significantly reduce daily pad use at six months post-surgery for prostate cancer patients.</li> <li>• Quality of life improved due to pelvic floor muscle training, but functional ability and distress did not.</li> <li>• Pre-surgical exercise significantly reduced length of stay and significantly lowered odds of post-surgery complications for lung cancer patients.</li> <li>• Psychology-based prehabilitation significantly improved mood, physical wellbeing and immune function for prostate cancer patients. It also improved fatigue, psychological outcomes and a trend for better quality of life among breast cancer patients.</li> <li>• Risk of bias was high for most studies.</li> </ul>

Source	Summary
<p><a href="#">The effect of preoperative exercise on upper extremity recovery following breast cancer surgery: a systematic review</a>                      Yang, et al. 2018 (15)</p>	<ul style="list-style-type: none"> <li>• Included six studies.</li> <li>• One randomised controlled trial showed prehabilitation was beneficial in shoulder range of motion and upper extremity functional recovery.</li> <li>• One cohort-control study demonstrated that preoperative exercises reduced postoperative pain without increasing the risk of developing a seroma.</li> <li>• Baseline ipsilateral grip strength, shoulder flexion, and abduction range of motion were reliable predictors of improvements in these measures at one month following breast cancer surgery.</li> </ul>
<p><a href="#">Effects of preoperative combined aerobic and resistance exercise training in cancer patients undergoing tumour resection surgery: a systematic review of randomised trials</a>                      Piraux, et al. 2018</p>	<ul style="list-style-type: none"> <li>• Included 10 studies, with 360 patients.</li> <li>• Lung, colorectal, bladder and oesophageal cancer.</li> <li>• Compared with the control group, combined endurance and resistance training improved physical capacity (3 of 5 studies), muscle strength (2 of 3 studies) and some domains of quality of life (2 of 4 studies), shortened length of stay (1 of 6 studies) and reduced postoperative pulmonary complications (2 of 6 studies).</li> </ul>
<p><a href="#">Effects of nutritional prehabilitation, with and without exercise, on outcomes of patients who undergo colorectal surgery: a systematic review and meta-analysis</a>                      Gillis, et al. 2018 (20)</p>	<ul style="list-style-type: none"> <li>• Included nine studies (five randomised controlled trials and four cohort studies) with 914 patients undergoing colorectal surgery (438 received prehabilitation and 476 served as controls).</li> <li>• Receipt of any prehabilitation significantly decreased length of stay compared with controls.</li> <li>• Three studies reported functional outcomes but could not be pooled due to heterogeneity.</li> <li>• In individual studies, multimodal prehabilitation significantly improved results of the 6-minute walk test at four and eight weeks post-surgery compared with standard enhanced recovery pathway care; and at eight weeks compared with standard enhanced recovery pathway care with added rehabilitation. The observational studies had a high risk of bias.</li> </ul>

Source	Summary
<p><a href="#">Oral nutrition as a form of pre-operative enhancement in patients undergoing surgery for colorectal cancer: a systematic review</a> Bruns, et al. 2018 (21)</p>	<ul style="list-style-type: none"> <li>• Included five randomised controlled trials and one controlled trial, with 583 patients.</li> <li>• Malnourishment rates ranged from 8-68%. All studies provided an oral protein supplement.</li> <li>• There was no significant reduction in the overall complication rate in the interventional groups.</li> <li>• Studies are heterogeneous to conclude that pre-operative oral nutritional support could enhance the condition of patients undergoing colorectal surgery.</li> </ul>
<p><a href="#">Multimodal prehabilitation programs as a bundle of care in gastrointestinal cancer surgery: a systematic review</a> Bolshinsky, et al. 2018 (24)</p>	<ul style="list-style-type: none"> <li>• Included 20 studies in qualitative analysis (multi- and uni-modal interventions).</li> <li>• Only two trials investigated the impact of multimodal prehabilitation (exercise, nutritional supplementation, anxiety management).</li> <li>• Although small studies are supportive of multimodal interventions, there are insufficient data to make a conclusion about the integration of prehabilitation in gastrointestinal cancer surgery as a bundle of care.</li> </ul>
<p><a href="#">Physical and nutritional prehabilitation in older patients with colorectal carcinoma: a systematic review</a> Looijaard, et al. 2018 (30)</p>	<ul style="list-style-type: none"> <li>• Included six studies, one study applied a physical intervention, three applied a nutritional intervention, and 2 applied a combination of both.</li> <li>• None of the preoperative interventions significantly reduced length of stay, mortality, or readmission rates.</li> </ul>
<p><a href="#">Systematic review of exercise training in colorectal cancer patients during treatment</a> Van Rooijen, et al. 2018 (31)</p>	<ul style="list-style-type: none"> <li>• No literature pertaining to exercise training during preoperative neoadjuvant treatment was found.</li> </ul>

Source	Summary
<p><a href="#">A systematic review of prehabilitation programs in abdominal cancer surgery</a> Hijazi, et al. 2017 (17)</p>	<ul style="list-style-type: none"> <li>• Included nine studies, that is seven randomised controlled trials and two prospective non-randomised trials, of patients undergoing surgery for colorectal cancer (five studies), bladder tumours (two studies), liver resection (one study), and unspecified abdominal oncological operations (one study).</li> <li>• Functional walking capacity was evaluated using the 6-minute walk test and maximum walking distance. In four trials, prehabilitation was associated with a positive impact.</li> <li>• Of five studies that assessed postoperative complications, four found prehabilitation had no significant impact.</li> <li>• Of four studies that assessed health-related quality of life, two reported an improvement associated with prehabilitation, while two reported no difference between prehabilitation and control groups.</li> <li>• Prehabilitation programs for abdominal cancer surgery are heterogeneous in composition, mode of administration, and outcome measures.</li> </ul>
<p><a href="#">Effects of prehabilitation and rehabilitation including a home-based component on physical fitness, adherence, treatment tolerance, and recovery in patients with non-small cell lung cancer: a systematic review</a> Driessen, et al. 2017 (14)</p>	<ul style="list-style-type: none"> <li>• Included one prehabilitation study only (and nine rehabilitation studies).</li> <li>• Showed improved physical fitness in patients with non-small cell lung cancer.</li> </ul>
<p><a href="#">The effects of physical prehabilitation in elderly patients undergoing colorectal surgery: a systematic review</a> Bruns, et al. 2016 (18)</p>	<ul style="list-style-type: none"> <li>• Included five studies, with 353 patients.</li> <li>• Compliance rates of the prehabilitation program varied from 16 to 97%.</li> <li>• None of the studies could identify a significant reduction of postoperative complications or length of stay. Four studies showed physical improvement, such as walking distance and respiratory endurance, in the prehabilitation group.</li> <li>• Heterogeneity precluded a meta-analysis.</li> </ul>



Source	Summary
<p><a href="#">Psychological prehabilitation before cancer surgery: a systematic review</a> Tsimoloupou, et al. 2015 (22)</p>	<ul style="list-style-type: none"> <li>• Included seven studies.</li> <li>• Interventions appeared to have an impact on patients' reported outcome measures including psychological outcomes, quality of life, and somatic symptoms.</li> <li>• Interventions did not affect traditional surgical outcomes, e.g. length of stay, complications, analgesia use, or mortality, but positively affected patients' immunologic function.</li> <li>• Assessment of the studies showed four to be of good quality, two to be of moderate quality, and one to be of poor quality.</li> </ul>
<b>Cardiac</b>	
<p><a href="#">Does prehabilitation improve outcomes in cardiac surgical patients?</a> Sandhu, et al. 2019 (32)</p>	<ul style="list-style-type: none"> <li>• Meta-analysis included 10 studies.</li> <li>• Prehabilitation reduced postoperative pulmonary complications.</li> </ul>
<p><a href="#">Preoperative exercise rehabilitation in cardiac and vascular interventions</a> Drudi, et al. 2019 (5)</p>	<ul style="list-style-type: none"> <li>• Included nine studies in total, seven cardiac and two vascular.</li> <li>• Prehabilitation was associated with decreased length of stay, reduced postoperative complications, improved objective physical functioning, and improved quality of life measures (SF-36 physical and mental health domains) in patients undergoing cardiac and vascular procedures.</li> <li>• Studies were heterogeneous in methods used.</li> </ul>
<p><a href="#">The impact of prehabilitation on post-surgical complications in patients undergoing non-urgent cardiovascular surgical intervention: systematic review and meta-analysis</a> Marmelo, et al. 2018 (6)</p>	<ul style="list-style-type: none"> <li>• Included eight studies.</li> <li>• Prehabilitation reduces the number of post-surgical complications and increases maximal inspiratory pressure. A reduction in the length of stay and an improvement of functional capacities are also probable.</li> </ul>

Source	Summary
<p><a href="#">Preoperative inspiratory muscle training for postoperative pulmonary complications in adults undergoing cardiac and major abdominal surgery</a> Katsura, et al. 2015 (7)</p>	<ul style="list-style-type: none"> <li>• Cochrane systematic review included 12 trials that compared preoperative inspiratory muscle training and usual preoperative care for adults undergoing cardiac (five trials) or major abdominal surgery (seven trials).</li> <li>• Preoperative inspiratory muscle training was associated with a reduction of postoperative atelectasis, pneumonia, and length of stay in adults undergoing cardiac and major abdominal surgery.</li> <li>• A lack of adequate blinding, potential small-study effects, and publication bias is noted.</li> </ul>
<p><a href="#">Preoperative physical therapy for elective cardiac surgery patients</a> Hulzebos, et al. 2012 (8)</p>	<ul style="list-style-type: none"> <li>• Cochrane systematic review focused on whether preoperative physical therapy with an exercise component can prevent postoperative pulmonary complications in cardiac surgery patients.</li> <li>• Included eight randomised controlled trials with 856 patients.</li> <li>• Evidence derived from small trials suggests that preoperative physical therapy reduces postoperative pulmonary complications (atelectasis and pneumonia) and length of hospital stay in patients undergoing elective cardiac surgery. There is a lack of evidence that preoperative physical therapy reduces postoperative pneumothorax, prolonged mechanical ventilation or all-cause deaths.</li> </ul>
<p><b>Liver transplantation</b></p>	
<p><a href="#">Physical exercise in cirrhotic patients: towards prehabilitation on waiting list for liver transplantation. a systematic review and meta-analysis</a> Brustia, et al. 2018 (19)</p>	<ul style="list-style-type: none"> <li>• Included four randomised controlled trials, with 81 patients, that assessed an adapted physical activity program in adults with end stage liver disease.</li> <li>• No severe adverse events were observed, but no published data were available on length of stay or mortality.</li> <li>• No significant changes were observed in body mass index, model for end-stage liver disease or Child-Pugh scores, muscle diameter, 6-minute walking distance or VO<sub>2</sub> peak changes</li> <li>• One study reported a significant reduction in hepatic venous pressure gradient.</li> </ul>

Source	Summary
<b>Orthopaedics</b>	
<p><a href="#">The value of preoperative exercise and education for patients undergoing total hip and knee arthroplasty: a systematic review and meta-analysis</a> Moyer, et al. 2017 (29)</p>	<ul style="list-style-type: none"> <li>• Included 35 studies with 2,956 patients.</li> <li>• Overall effect sizes for prehabilitation were small to moderate. In patients undergoing total knee arthroplasty, significant improvements were observed in function, quadriceps strength, and length of stay. In patients undergoing total hip arthroplasty, significant improvements were observed in pain, function, and length of stay. Included studies were inconsistent with regard to the types of outcome measures reported, and the quality of the interventions varied.</li> </ul>
<p><a href="#">Pre-surgery exercise and post-operative physical function of people undergoing knee replacement surgery: a systematic review and meta-analysis of randomized controlled trials</a> Peer, et al. 2017 (3)</p>	<ul style="list-style-type: none"> <li>• Included three papers.</li> <li>• Results of meta-analysis based on the findings of two of these studies showed that, compared with controls, prehabilitative exercise involving resistance training offered no additional gains in isometric quadriceps muscle strength at 6 and 12 weeks post-operatively.</li> </ul>
<p><a href="#">Does preoperative rehabilitation for patients planning to undergo joint replacement surgery improve outcomes? A systematic review and meta-analysis of randomised controlled trials</a> Wang, et al. 2016 (4)</p>	<ul style="list-style-type: none"> <li>• Included 22 studies with 1,492 patients.</li> <li>• Most studies (n=18) had a high risk of bias.</li> <li>• Prehabilitation may slightly improve early postoperative pain and function among patients undergoing joint replacement; however, effects were too small and short-term to be considered clinically important, and did not affect key outcomes (i.e. length of stay, quality of life, costs).</li> </ul>

Source	Summary
<p><a href="#">No major effects of preoperative education in patients undergoing hip or knee replacement - a systematic review</a> Aydin, et al. 2015 (23)</p>	<ul style="list-style-type: none"> <li>• Included 12 studies, of written, verbal and audiovisual formats, with 1,567 participants.</li> <li>• No convincing evidence in favour of preoperative patient education on outcomes regarding pain, length of stay, patient satisfaction, post-operative complications, mobility and expectations was found.</li> <li>• There was evidence for a reduction in preoperative anxiety.</li> </ul>

**Table 2: Grey literature**

Source	Summary
<p><a href="#">Prehabilitation for people with cancer</a> Macmillan Cancer Support, 2020</p>	<ul style="list-style-type: none"> <li>• Prehabilitation empowers people with cancer to enhance their own physical and mental health and wellbeing, supporting them to live life as fully as they can.</li> <li>• Benefits can be seen in as little as two weeks.</li> <li>• Prehabilitation is part of a continuum to rehabilitation.</li> <li>• Prehabilitation enables people with cancer to prepare for treatment through promoting healthy behaviours, and prescribing individualised needs-based exercise, nutrition and psychological interventions.</li> </ul>
<p><a href="#">NHS to offer cancer patients 'prehab' fitness plan 'to boost recovery'</a> BBC December 2019 (26)</p>	<ul style="list-style-type: none"> <li>• Newly-diagnosed cancer patients are to be offered NHS gym sessions before they start chemotherapy, in the hope of boosting the speed of their recovery.</li> <li>• Thousands will be invited to sign up for a 'prehab' fitness program within 48 hours of being diagnosed.</li> </ul>

Source	Summary
<p><a href="#">Delivering prevention through perioperative care</a> Centre for Perioperative Care, 2019 (UK) (25)</p>	<ul style="list-style-type: none"> <li>• Cross-organisational, multidisciplinary initiative to facilitate perioperative care for patient benefit.</li> <li>• System level perioperative change is described.                             <ul style="list-style-type: none"> <li>○ Reviewing the surgical perioperative pathway, patient flows, how patients are prepared for surgery, who decides they are optimised for surgery.</li> <li>○ Changing the postoperative course with increased emphasis on enhanced recovery after surgery and redesigning discharge processes so discharge is planned and arranged in advance of the surgical event.</li> <li>○ Designing care pathways that embed shared decision-making where the focus changes from a technically possible surgical procedure, to the delivery of perioperative care designed and wrapped around the patient.</li> </ul> </li> <li>• Features the PREPARE for surgery program (run by the Imperial College Healthcare NHS Trust) which delivers comprehensive prehabilitation services in advance of surgery by helping train patients for surgery, based on individual need. Includes physical activity, diet, psychological wellbeing and medication management.</li> </ul>

## Appendix 1: Methods

### PubMed search

((((((surgery[MeSH Subheading]) OR (surgical procedures, operative[MeSH Terms])) OR (general surgery[MeSH Terms])) OR (surgi\*[Title/Abstract])) OR (surge\*[Title/Abstract]))) AND (prehabilitation[Title/Abstract] OR pre-rehabilitation[Title/Abstract] OR "preoperative rehabilitation"[Title/Abstract]) AND (systematicreview[Filter]) 39 hits

### Cochrane library

prehabilitation OR presurgery

### Google search

prehabilitation, presurgery, NHS, Canada, New Zealand, Colleges, policy

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