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DELIVERING MULTIMODAL PREHABILITATION IN THE NEOADJUVANT WINDOW BEFORE ESOPHAGOGASTRIC CANCER SURGERY: HOME-BASED MODELS, DIGITAL HEALTH, AND IMPLEMENTATION – A NARRATIVE REVIEW

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ABSTRACT

Esophagectomy and gastrectomy for esophagogastric cancer are among the most physiologically demanding oncological operations and carry high rates of postoperative morbidity. Because neoadjuvant chemotherapy or chemoradiotherapy now precedes surgery in most patients with locally advanced disease, the preoperative interval offers an opportunity to intervene through multimodal prehabilitation, combining aerobic and resistance exercise, inspiratory muscle training, nutritional optimization, and psychological support. This narrative review synthesizes the rationale and current evidence for prehabilitation during the neoadjuvant window and, in particular, examines how it can be delivered in practice. Prehabilitation consistently improves preoperative functional capacity and respiratory muscle strength, and inspiratory muscle training is associated with fewer postoperative pulmonary complications, although effects on overall morbidity, length of stay, and mortality remain inconsistent. Beyond efficacy, the review foregrounds delivery and implementation: supervised hospital-based programmes are resource-intensive and geographically limiting, whereas home-based and digitally supported models — using smartphone applications, wearable sensors, and telehealth contact — offer a scalable alternative, with early evidence that home-based delivery may be comparable to supervised care. Technology-enabled prehabilitation raises its own questions of access and equity, including digital literacy and connectivity, that determine whether it narrows or widens existing disparities. Prehabilitation timed to the neoadjuvant window is a biologically plausible, feasible, and low-risk strategy to improve preoperative fitness; its translation into routine esophagogastric cancer care now depends as much on delivery model, technology, and implementation as on defining optimal clinical content, and standardized, adequately powered trials are needed to confirm benefit.

KEYWORDS

Prehabilitation; Telemedicine; Mobile Health; Esophagectomy; Neoadjuvant Therapy; Health Services Accessibility

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1. Introduction

Esophageal and gastric cancers are among the most common and most lethal malignancies worldwide (Sung et al., 2021), and for patients with resectable disease, surgery – with or without perioperative oncological therapy – remains the only treatment offering a realistic chance of cure (Low et al., 2019; Mortensen et al., 2014). But esophagectomy and gastrectomy are extensive operations that impose a heavy physiological insult, and historically both carried high rates of postoperative morbidity and mortality. Pulmonary complications are the leading cause of poor short-term outcomes (Low et al., 2019; Mortensen et al., 2014). Even within mature Enhanced Recovery After Surgery (ERAS) pathways, complication rates after upper gastrointestinal resection remain substantial, underscoring the need for strategies that act before, and not only during and after, the operation (Low et al., 2019; Mortensen et al., 2014).

Prehabilitation refers to a process undertaken in the interval between diagnosis and treatment that aims to improve a patient's functional capacity and physiological reserve so that they can better withstand the stress of an impending intervention (Silver & Baima, 2013). It is not the same as postoperative rehabilitation, which only restores function after the decline has happened. Prehabilitation instead uses the preoperative period to build up fitness, nutrition and psychological readiness in advance (Carli & Scheede-Bergdahl, 2015; Silver & Baima, 2013). In most surgical contexts, however, that window is brief, and clinicians are reluctant to delay a cancer operation in order to deliver it (Carli et al., 2017; Kehlet, 2021).

Esophagogastric cancer is different. For most patients with locally advanced tumours, neoadjuvant chemotherapy or chemoradiotherapy now comes first, and surgery follows several weeks after that therapy ends (Low et al., 2019). That builds a defined, clinically mandated interval into the pathway. The catch is that the interval works against the patient too: neoadjuvant treatment itself erodes cardiorespiratory fitness and muscle mass and brings fatigue and a poorer quality of life, so many patients reach surgery less fit than they were at diagnosis (Allen et al., 2022; Ikeda et al., 2024). The neoadjuvant phase is thus two things at once: the main threat to a patient's reserve and the best chance to defend it. This review concerns prehabilitation delivered in that window before esophagogastric cancer surgery: its rationale, the evidence so far, and how it might be put into practice.

The concept behind prehabilitation is straightforward. Rather than waiting until after an operation to begin rehabilitation, the preoperative period is used to enhance a patient's functional capacity so that they enter surgery with greater reserve and are better able to withstand and recover from it. First articulated as a way to decrease treatment-related morbidity and to broaden the treatment options available to patients, prehabilitation has since evolved from single-modality exercise programs into structured, multimodal packages that address the several interacting deficits typical of surgical candidates (Carli et al., 2017; Silver & Baima, 2013). Its appeal in cancer surgery is particularly strong because the interval between diagnosis and operation is frequently occupied by neoadjuvant treatment, creating a ready-made window in which to intervene (Carli & Scheede-Bergdahl, 2015).

The stakes of getting perioperative care right in this disease are high. Esophagogastric cancers are frequently diagnosed at a locally advanced stage, the surgery required for cure is among the most physiologically taxing in elective practice, and the patients who need it are often older, nutritionally depleted and burdened by coexisting illness. Even in high-volume centres, postoperative morbidity – dominated by pulmonary complications – remains common and materially affects recovery, length of stay and the ability to complete adjuvant treatment. Against this background, any intervention that can improve a patient's condition before the operation, without displacing or delaying oncological therapy, warrants serious consideration, and it is this reasoning that has driven the rapid growth of interest in prehabilitation (Low et al., 2019).

Beyond the biological rationale, a practical question increasingly shapes whether prehabilitation reaches patients: how it is delivered. Supervised, hospital-based programmes are resource-intensive and geographically limiting, and the short neoadjuvant interval leaves little room for travel-dependent scheduling. This has driven interest in home-based and remotely supported models, in which digital health tools – smartphone applications, wearable activity and physiological sensors, and telehealth contact – enable monitoring, coaching and adherence support outside the clinic. Framing prehabilitation as a service-delivery and implementation problem, and not only a clinical one, brings questions of access, equity and technology-enabled scalability to the foreground, and it is through this lens that this review considers how multimodal prehabilitation can realistically be provided during the neoadjuvant window.

2. Materials and methods

This article is a narrative (non-systematic) review. The English-language literature was searched in PubMed/MEDLINE and Scopus using combinations of the terms "prehabilitation", "exercise", "inspiratory muscle training", "nutrition", "esophagectomy", "gastrectomy", "esophagogastric cancer", "neoadjuvant" and "Enhanced Recovery After Surgery". Randomized controlled trials, cohort and feasibility studies, systematic reviews and meta-analyses, and relevant ERAS Society guidelines were considered, and the reference lists of retrieved articles were screened for additional sources. Studies were selected for their relevance to the components, timing, feasibility and outcomes of prehabilitation in upper gastrointestinal cancer surgery; no formal quality appraisal or quantitative synthesis was performed, in keeping with the narrative format.

Because this review gives particular attention to how prehabilitation is delivered, the search was extended with terms including "telehealth", "telemedicine", "telerehabilitation", "mobile health", "wearable", "digital health" and "home-based", and sources addressing remote and technology-enabled delivery, access and implementation were included alongside the clinical literature. Priority was given to work concerning esophagogastric and other upper gastrointestinal cancer surgery, with evidence from adjacent surgical and oncological settings drawn upon where directly relevant and where setting-specific data were sparse. As a narrative review, the account is intended to be representative and interpretive rather than exhaustive, and the selection of sources reflects their relevance to the questions addressed rather than the outcome of a predefined systematic protocol.

3. The clinical problem: surgical stress, the fitness cliff and risk

Major upper gastrointestinal resection elicits a pronounced surgical stress response and a transient but substantial fall in physical function. Postoperative pulmonary complications are the most frequent and clinically important adverse events after esophagectomy, driven by factors including extensive thoracic and abdominal dissection, diaphragmatic disruption, impaired cough and prolonged immobilization (Low et al., 2019; Yamana et al., 2015). A patient's ability to tolerate this insult is closely related to their baseline cardiorespiratory fitness: objectively measured functional capacity, in particular variables derived from cardiopulmonary exercise testing (CPET) such as peak oxygen uptake and the anaerobic threshold, repeatedly stratifies risk before major intra-abdominal surgery, and poor preoperative fitness is associated with higher rates of complications (Moran et al., 2016). In the broader abdominal-surgery setting, structured preoperative physiotherapy can itself reduce respiratory complications, providing proof of principle for preoperative intervention (Boden et al., 2018).

Neoadjuvant therapy then deepens the problem. Chemotherapy and chemoradiotherapy reduce cardiorespiratory performance and deplete lean muscle mass (Allen et al., 2022; Ikeda et al., 2024), while pre-existing sarcopenia and frailty – common in this older, often nutritionally compromised population – are themselves predictors of worse surgical outcomes (Baimas-George et al., 2020). Patients face what is sometimes called a "fitness cliff": they decline during treatment and then have to absorb the shock of surgery. Prehabilitation aims to raise their physiological reserve before that point, or at least to blunt the neoadjuvant-related decline, so they reach the operating theatre in the best achievable condition (Kehlet, 2021; Silver & Baima, 2013).

Two features of this population make the preoperative decline especially consequential. First, sarcopenia – the loss of skeletal muscle mass and function – is common at diagnosis in esophagogastric cancer and is compounded by dysphagia, reduced intake and the catabolic effects of chemotherapy, so that muscle is being lost precisely when it is most needed to withstand surgery (Baimas-George et al., 2020). Second, functional reserve is not captured by age or routine bloodwork; objective testing, whether formal CPET or simpler field tests such as the six-minute walk, discriminates between patients who will and will not tolerate major resection more reliably than subjective assessment (Moran et al., 2016). Prehabilitation is therefore best understood not as generic fitness promotion but as a targeted attempt to move a measurable, risk-defining variable in the weeks before an unavoidable physiological insult.

The surgical stress response itself provides part of the rationale. Major resection triggers a neuroendocrine and inflammatory cascade – catabolic hormone release, systemic inflammation, insulin resistance and negative nitrogen balance – that accelerates the loss of muscle and functional capacity in the early postoperative period. A patient who enters this state with greater physiological reserve has more capacity to absorb it before reaching the threshold at which organ function is compromised, which is the conceptual basis for raising fitness beforehand rather than relying on postoperative rehabilitation alone. This is also why prehabilitation and enhanced-recovery pathways are complementary: the former widens the margin before surgery, the latter limits the insult and accelerates recovery afterward (Low et al., 2019; Mortensen et al., 2014).

Identifying who stands to gain most is part of the clinical problem. Patients with the lowest baseline fitness, established sarcopenia or frailty, and the greatest anticipated treatment toxicity have the most physiological ground to make up and, plausibly, the most to gain from intervention – yet they are also the least able to tolerate demanding programs and the most likely to struggle with attendance. This creates a tension between targeting prehabilitation at the highest-risk patients and the practical difficulty of delivering it to them, and it reinforces the argument that flexible, individualized and often home-based delivery is not a convenience but a prerequisite for reaching the patients in whom prehabilitation could matter most.

4. Components of multimodal prehabilitation

Contemporary prehabilitation is multimodal, typically combining structured exercise, respiratory muscle training, nutritional optimization and psychological support. The rationale for a combined approach is that the deficits seen in surgical candidates – reduced aerobic capacity, muscle wasting, undernutrition and distress – are interrelated, and addressing them in isolation is unlikely to maximize benefit (Bausys et al., 2023; Carli & Scheede-Bergdahl, 2015; Silver & Baima, 2013).

4.1. Aerobic and resistance exercise

Structured exercise is the cornerstone of most programs. Aerobic training aims to improve cardiorespiratory fitness and the anaerobic threshold, while resistance training targets muscle strength and lean mass. Feasibility studies have shown that patients awaiting elective gastrointestinal cancer surgery can engage in supervised or partially supervised exercise during the preoperative period (Valkenet et al., 2016), and structured preoperative exercise has been associated with measurable gains in cardiopulmonary fitness in cohort analyses (Huang et al., 2016). A randomized trial in esophagogastric cancer tested this directly: a program combining exercise and nutrition produced clinically relevant gains in functional walking capacity before surgery, compared with usual care (Minnella et al., 2018). More broadly, physical activity is increasingly recognized as a supportive intervention across the cancer continuum (Cemaga et al., 2026).

How exercise is prescribed matters as much as whether it is offered. Programs generally combine aerobic work, aimed at raising peak oxygen uptake and the anaerobic threshold, with progressive resistance training to preserve or rebuild lean mass, and the intensity, frequency and progression are individualized to baseline fitness and to the fluctuating tolerance imposed by concurrent chemotherapy. High-intensity interval formats can achieve meaningful physiological change in short periods, which is attractive given the limited window, but they demand closer monitoring; moderate continuous training is more easily self-directed. The practical question of supervision – hospital-based, remotely supervised, or independent – is not merely logistical, because supervision influences both safety and adherence, and it is the point at which delivery model and clinical content become inseparable.

4.2. Inspiratory muscle training

Because pulmonary complications dominate postoperative morbidity, inspiratory muscle training (IMT) – repeated breathing against an adjustable threshold load to strengthen the inspiratory muscles – has attracted particular attention. Early pilot and randomized work demonstrated that preoperative IMT is feasible in candidates for upper abdominal and esophageal surgery and improves respiratory muscle strength (Agrelli et al., 2012; Dettling et al., 2013; Dronkers et al., 2008; Guinan et al., 2019). Several trials have examined whether this translates into fewer pulmonary complications: a randomized study of a preoperative respiratory rehabilitation program reported a reduction in postoperative pulmonary complications after esophagectomy (Yamana et al., 2015), and different IMT regimens have been compared directly (van Adrichem et al., 2014). The multicentre PREPARE randomized trial, however, found that IMT before esophagectomy did not significantly reduce the overall rate of postoperative pneumonia, illustrating that single-modality respiratory training may be insufficient on its own and tempering earlier optimism (Valkenet et al., 2018). On balance, IMT is a cheap, low-risk component that reliably strengthens the inspiratory muscles. Its effect on pulmonary complications is likely but inconsistent.

Mechanistically, inspiratory muscle training loads the diaphragm and accessory muscles much as resistance training loads peripheral muscle, increasing maximal inspiratory pressure and, in principle, the capacity to generate an effective cough and to resist postoperative atelectasis. The inconsistency of its effect on clinical pneumonia rates likely reflects several factors: the short training period available, variable adherence to daily loading, differences in threshold-load progression, and the fact that pulmonary complications are multifactorial and not determined by inspiratory strength alone (Valkenet et al., 2018). IMT is nonetheless retained in most multimodal protocols because it is inexpensive, self-administered, carries essentially no risk, and reliably improves the physiological parameter it targets even where downstream clinical benefit is uncertain.

4.3. Nutritional optimization

Nutritional status is a recurring determinant of outcome in esophagogastric cancer, where dysphagia, anorexia and tumour- and treatment-related catabolism frequently cause weight loss and depletion of lean mass. ERAS Society guidance for both esophagectomy and gastrectomy emphasizes nutritional screening and targeted support, including protein and oral nutritional supplementation, as integral perioperative care (Low et al., 2019; Mortensen et al., 2014). Within prehabilitation, nutrition is rarely delivered alone: combined "walk-and-eat" interventions during neoadjuvant chemoradiotherapy, pairing physical activity with nutritional support, have been associated with better preservation of functional status and reduced treatment-related decline (Xu et al., 2015). Adequate protein intake is considered essential to enable the muscle-protein synthesis that exercise stimulates, making nutrition and exercise mutually dependent rather than parallel components.

In practice, nutritional prehabilitation begins with screening for weight loss and depletion of lean mass, followed by individualized targets for energy and protein intake, oral nutritional supplements where intake is inadequate, and specific strategies to manage dysphagia – texture modification, small frequent feeds and, in some cases, enteral access – so that a mechanical obstruction does not undermine the entire programme. Adequate protein provision is emphasized because exercise-stimulated muscle-protein synthesis cannot proceed without substrate, which is why nutrition and exercise are treated as mutually reinforcing rather than separate tracks (Low et al., 2019; Mortensen et al., 2014). Because appetite, taste and gastrointestinal tolerance fluctuate throughout chemotherapy, nutritional support is not a single prescription but a moving target that requires repeated review across the neoadjuvant interval.

4.4. Psychological support and behavioural optimization

Psychological interventions to reduce anxiety and distress, together with smoking cessation and reduction of alcohol intake, complete the multimodal package (Low et al., 2019; Silver & Baima, 2013). A cancer diagnosis and the prospect of major surgery are potent sources of psychological stress, and anxiety reduction is incorporated into trimodal programs both for its own value and because distress can undermine engagement with exercise and nutritional advice (Bausys et al., 2023). The value of embedding exercise-based prehabilitation within complex cancer-surgery pathways is also illustrated outside the upper gastrointestinal field, for example in major head and neck cancer surgery (Twomey et al., 2020).

The behavioural components deserve emphasis in their own right. Smoking cessation before major surgery reduces respiratory and wound complications, and the interval before esophagogastric resection is a recognized opportunity to intervene; reduction of alcohol intake similarly addresses a modifiable contributor to perioperative risk. These are, at their core, behaviour-change problems, and their success depends on engagement, motivation and support rather than on any physiological prescription – which is one reason that a cancer diagnosis, by concentrating a patient's attention on their health, has been described as a teachable moment. Distress, however, can work in the opposite direction, eroding the engagement on which every other component depends, so that psychological support underpins the multimodal package rather than sitting alongside it as an optional extra (Bausys et al., 2023).

5. The neoadjuvant window as the prehabilitation opportunity

The defining practical feature of esophagogastric cancer is that prehabilitation can be embedded within an interval that already exists in the care pathway. For locally advanced disease, neoadjuvant therapy is followed by surgery after a planned delay; esophagectomy is typically performed several weeks after the end of neoadjuvant treatment – commonly within about four to eight weeks, depending on the regimen and recovery from toxicity (Low et al., 2019). The neoadjuvant treatment phase itself spans additional weeks to months. Together these provide a realistic training period without requiring any deliberate postponement of oncological treatment – a key advantage over surgical settings in which prehabilitation competes with the imperative to operate promptly (Carli & Scheede-Bergdahl, 2015; Kehlet, 2021).

A growing body of work has tested prehabilitation delivered concurrently with neoadjuvant therapy rather than only in the short gap before surgery. A pilot randomized clinical trial of multimodal prehabilitation during neoadjuvant treatment before esophagogastric resection reported better preserved cardiorespiratory fitness and grip strength and improved quality of life relative to control (Allen et al., 2022). A subsequent randomized feasibility trial in esophageal cancer that directly compared supervised hospital-based with unsupervised home-based exercise during concurrent neoadjuvant chemotherapy found both approaches feasible, with comparable maintenance of cardiorespiratory fitness and similar gains in functional measures, supporting home-based delivery as a realistic option in this setting (St-Pierre et al., 2024). The safety and feasibility of preoperative exercise during neoadjuvant treatment have been demonstrated specifically in gastro-oesophageal junction adenocarcinoma (Christensen et al., 2019), and exercise-based prehabilitation delivered after neoadjuvant therapy has likewise proved feasible and well tolerated (Argudo et al., 2021). A systematic review focused on prehabilitation during neoadjuvant therapy concluded that it is safe and may enhance tolerance of treatment and reduce postoperative complications, while highlighting variable adherence (Ikeda et al., 2024). Combined nutritional and walking interventions delivered during chemoradiotherapy reinforce that the neoadjuvant window is the period in which intervention may do most to counteract treatment-related decline (Xu et al., 2015).

This framing of the neoadjuvant interval as a teachable moment has practical implications for how prehabilitation should be organized. Because the window is defined by oncological treatment rather than by the convenience of the prehabilitation service, engagement has to be secured quickly, at a time when patients are absorbing a new diagnosis and beginning toxic therapy, and it has to be sustained through the fatigue and gastrointestinal effects that chemotherapy imposes. Delivery that requires repeated travel to a specialist centre competes directly with this burden, whereas approaches that meet patients where they are – at home, with remote support – may better preserve participation across the interval (St-Pierre et al., 2024). The window is therefore both the central opportunity of esophagogastric prehabilitation and the source of its principal delivery challenge.

The length and predictability of this window vary with the oncological regimen, and this variability is itself clinically relevant. Longer neoadjuvant schedules offer more time to build fitness but also more time in which untreated decline can accumulate, while shorter intervals compress the opportunity for meaningful physiological change; in both cases the weeks immediately before surgery, once neoadjuvant toxicity has begun to settle, are a natural point to intensify training and to reassess readiness. Planning prehabilitation around the specific treatment timeline – rather than applying a fixed programme duration – is therefore part of tailoring the intervention to the individual, and it is another reason that delivery models able to adjust intensity and setting over time are valuable.

6. Current evidence and clinical outcomes

The most consistent and reproducible effect of prehabilitation in this setting is improvement in preoperative physical fitness. Across randomized and cohort studies, programs incorporating exercise improve functional walking capacity, CPET-derived variables and respiratory muscle strength before surgery (Allen et al., 2022; Huang et al., 2016; Minnella et al., 2018). These are clinically meaningful intermediate endpoints, given the established relationship between preoperative fitness and surgical risk (Moran et al., 2016).

Evidence for harder clinical outcomes is more mixed. Inspiratory muscle training and respiratory-focused prehabilitation have been associated with reductions in postoperative pulmonary complications in several trials (Yamana et al., 2015), although the negative pneumonia result of the multicentre PREPARE trial demonstrates that the effect is not universal and may depend on program intensity, adherence and the surgical approach (Valkenet et al., 2018). Multimodal programs have been tested against clinical endpoints, not just fitness. A multicentre randomized trial of home-based trimodal prehabilitation in gastric cancer – including patients receiving neoadjuvant chemotherapy – reported a significant reduction in the proportion of patients with postoperative complications at 90 days and improved quality of life relative to standard care (Bausys et al., 2023). A respiratory-prehabilitation-augmented ERAS protocol for elective gastrectomy (Swaminathan et al., 2020) and a multimodal program before totally minimally invasive esophagectomy (Janssen et al., 2022), the latter linked to fewer early postoperative complications. A propensity-matched analysis found better post-operative outcomes in oesophageal cancer surgery (Halliday et al., 2021). Nonetheless, effects on overall complication rates, length of hospital stay and mortality remain inconsistent, and successive systematic reviews conclude that benefits for physical fitness are reasonably consistent whereas effects on hard clinical outcomes are not yet established (Bolger et al., 2019; Ikeda et al., 2024). This heterogeneity is unsurprising: studies differ markedly in components, intensity, duration, degree of supervision and outcome definitions, the neoadjuvant interval is short and variable, and many trials are small and underpowered for clinical endpoints (Kehlet, 2021). Improvements in quality of life and the preservation of physical function during neoadjuvant therapy are additional reported benefits that may be valuable to patients independent of any effect on complication rates (Allen et al., 2022; Xu et al., 2015).

Two further points recur across this literature. The first is adherence, which is consistently identified as the pivotal determinant of whether any program achieves its physiological aim; heterogeneous and often incomplete adherence is a plausible explanation for the gap between reliable improvements in fitness and inconsistent effects on clinical endpoints (Ikeda et al., 2024). The second is that the intermediate endpoints that prehabilitation reliably improves – functional capacity, respiratory muscle strength, and quality of life during a gruelling treatment phase – may matter to patients independently of whether complication rates change, a value that trials powered only for surgical outcomes can miss (Allen et al., 2022; Xu et al., 2015). Taken together, the evidence supports prehabilitation as a low-risk intervention with a robust effect on preoperative fitness and a probable but unproven effect on postoperative morbidity, for which the key uncertainties now concern optimal content, adequate dosing, and reliable delivery rather than basic plausibility.

The multimodal trials that have reported clinical benefit are instructive about what an adequate program may require. Home-based trimodal prehabilitation in gastric cancer that reduced 90-day complications combined exercise, nutrition and psychological support and ran through the neoadjuvant period rather than only in the final preoperative days (Bausys et al., 2023); programs delivered before totally minimally invasive esophagectomy and within respiratory-augmented enhanced-recovery pathways likewise embedded several components rather than relying on one (Janssen et al., 2022; Swaminathan et al., 2020). The recurring implication is that benefit, where seen, tends to accompany programs that are multimodal, of adequate duration, and integrated into the treatment pathway, which is consistent with the biological argument that the deficits being addressed are interrelated. Isolated, brief or single-component interventions, by contrast, more often move fitness without shifting clinical outcomes.

The distinction between statistical significance and clinical importance is worth keeping in view when interpreting this literature. Several trials are small and were designed to detect differences in fitness rather than in complications, so a neutral result for a clinical endpoint often reflects limited statistical power as much as a genuine absence of effect; conversely, a statistically significant change in a walk-test distance is not automatically clinically decisive. The most defensible reading is that prehabilitation dependably improves the physiological variables that predict surgical risk, that some adequately constructed multimodal programs have additionally reduced complications, and that the field's central task is now to determine which programs, delivered how, convert improved fitness into better clinical outcomes for which patients.

Table 1 summarizes the principal studies discussed above, spanning single-modality and multimodal programs; supervised, home-based and technology-enabled delivery; and individual trials as well as systematic reviews.

Table 1. Summary of key studies on prehabilitation in esophagogastric (and directly relevant) cancer surgery.

Study	Design	Population	Intervention	Key finding
Minnella et al. (2018)	RCT	Esophagogastric cancer	Exercise + nutrition	Clinically relevant improvement in preoperative functional walking capacity vs usual care
Allen et al. (2022)	Pilot RCT	Esophagogastric cancer (during neoadjuvant therapy)	Multimodal (exercise, nutrition, psychological)	Better preserved cardiorespiratory fitness and grip strength; improved quality of life vs control
Yamana et al. (2015)	RCT	Esophagectomy	Preoperative respiratory rehabilitation	Reduction in postoperative pulmonary complications
Valkenet et al. (2018); PREPARE	Multicentre RCT	Esophagectomy	Preoperative inspiratory muscle training	No significant reduction in postoperative pneumonia
St-Pierre et al. (2024)	RCT (feasibility)	Esophageal cancer (concurrent neoadjuvant)	Supervised vs home-based exercise	Both feasible; comparable maintenance of cardiorespiratory fitness
Bausys et al. (2023)	RCT	Gastric cancer (incl. neoadjuvant)	Home-based trimodal prehabilitation	Fewer patients with postoperative complications at 90 days (RR 0.40); improved quality of life
Piraux et al. (2020)	Feasibility study	Esophagogastric cancer	Internet-based tele-prehabilitation (aerobic, resistance, IMT)	Feasible, safe and well accepted; preliminary functional gains
Ikeda et al. (2024)	Systematic review	Esophageal / GEJ cancer (neoadjuvant)	Prehabilitation during neoadjuvant therapy	Safe; may improve treatment tolerance and reduce complications; adherence variable
Bolger et al. (2019)	Systematic review	Esophagogastric cancer	Perioperative prehabilitation / rehabilitation	Positive effects reported, but study designs heterogeneous
Tay et al. (2024)	Systematic review	Cancer (technology-enabled prehabilitation)	Wearables, apps, teleprehabilitation, virtual reality	Technology-based prehabilitation broadly feasible; effectiveness depends on design

RCT, randomized controlled trial; CPET, cardiopulmonary exercise testing; IMT, inspiratory muscle training; GEJ, gastro-oesophageal junction. Studies are ordered as discussed in the text and findings are summarized qualitatively.

7. A practical framework for the neoadjuvant window

In practice the approach is simple to state. Assess the patient early, train through the neoadjuvant phase, then reassess before surgery. Baseline assessment ideally includes an objective measure of functional capacity (CPET where available, or the six-minute walk test as a more accessible alternative), nutritional screening, evaluation of frailty and sarcopenia, and measurement of respiratory muscle strength (Moran et al., 2016). A multimodal program is then delivered across the neoadjuvant interval and intensified, where tolerated, in the weeks immediately before surgery, with content individualized to baseline status and to the toxicity of concurrent therapy. The components summarized in Table 1 reflect modalities and broad targets reported in the cited literature and are intended as a practical template rather than a rigid prescription; specific parameters should be tailored to the patient and to local resources, and home-based delivery considered where supervised programs are impractical (Allen et al., 2022; Bausys et al., 2023; Minnella et al., 2018; St-Pierre et al., 2024).

The logic of this framework is deliberately pragmatic rather than prescriptive. Baseline assessment establishes not only eligibility but a set of measurable targets – fitness, respiratory muscle strength, nutritional status, frailty – against which progress and preoperative readiness can be judged, and reassessment before surgery converts prehabilitation from an open-ended activity into a bounded intervention with a defined endpoint. Between these two points, the content is titrated to the individual: intensified when treatment is tolerated well, scaled back during periods of toxicity, and shifted toward home-based or remotely supported delivery when attendance at a centre is not feasible. The components in Table 1 should therefore be read as a menu to be combined and dosed according to the patient, the tumour, the treatment schedule and the resources of the service, not as a fixed protocol to be applied uniformly.

8. Implementation, access, and technology-enabled delivery

Several obstacles temper routine adoption. The preoperative interval, although longer than in non-neoadjuvant surgery, is still finite and variable, and the imperative to proceed to resection once neoadjuvant therapy is complete constrains how much conditioning can be achieved (Low et al., 2019). Patients are frequently undergoing chemotherapy concurrently, with associated fatigue, nausea and myelosuppression that can limit exercise tolerance and engagement. Supervised hospital-based programs demand staff, space and patient travel, generating practical and financial barriers and the risk of "intervention-based inequalities" whereby only patients with the resources to participate derive benefit; home-based and technology-supported delivery, shown to be feasible and potentially comparable in effect to supervised training, offers one route to wider and more equitable access (St-Pierre et al., 2024; Valkenet et al., 2016). Embedding prehabilitation within existing multidisciplinary ERAS pathways, rather than treating it as a separate undertaking, is likely to improve uptake and coordination with surgical scheduling (Low et al., 2019; Mortensen et al., 2014).

These barriers are not distributed evenly. Access to supervised prehabilitation is shaped by distance from specialist centres, socioeconomic resources, and competing demands during an already burdensome treatment period, so that the patients who might benefit most can be the least able to attend. Home-based delivery is one response: a randomized trial in gastric cancer found a home-based programme feasible and clinically useful (Bausys et al., 2023), and technology can extend this further, using applications and wearable sensors to prescribe and monitor activity, guide inspiratory muscle training, track nutritional intake, and maintain remote contact between patient and team. Such tools also generate objective adherence and physiological data that intermittent clinic visits capture poorly. At the same time, technology-enabled delivery carries its own equity considerations – digital literacy, device and connectivity access, and language – that determine whether digital prehabilitation narrows or widens existing gaps. Realistic implementation therefore depends less on proving that any single component works in isolation and more on matching the mode of delivery to the patient, the health system, and the resources available.

Technology-enabled delivery has moved from improvisation to a small but growing evidence base. Telehealth and internet-based platforms have been used to deliver multimodal prehabilitation remotely, and a systematic review of technology in cancer prehabilitation identified sixteen studies spanning wearables, mobile applications, teleprehabilitation and virtual reality, concluding that technology-based programs are broadly feasible while their effectiveness depends on intervention design and the specific technology employed (Tay et al., 2024). Directly relevant to the present setting, a tele-prehabilitation program delivering aerobic, resistance and inspiratory muscle training over an internet-based platform proved feasible, safe and well accepted in patients with esophagogastric cancer awaiting surgery, demonstrating that the full multimodal package can in principle be supported remotely in exactly the population considered here (Piraux et al., 2020).

Different technologies address different parts of the problem. Wearable activity and physiological sensors provide objective, continuous data on activity and adherence that clinic visits capture only intermittently, and have been combined with clinician-issued exercise prescriptions to support preoperative training (Finley et al., 2021); their weakness is that objective monitoring does not by itself guarantee compliance. Videoconferencing preserves a degree of supervision and the coaching relationship that supervised programs rely on, and can mitigate the adherence problems seen with unsupervised tools, at the cost of scheduled contact time (Tay et al., 2024). Applications can deliver and progress structured exercise, guide inspiratory muscle training, prompt nutritional intake and house educational material, consolidating the multimodal package into a single interface. The practical implication is that no single technology is sufficient; the sensible unit of design is a combination matched to the components being delivered and to the degree of supervision each requires.

A further, less obvious contribution of digital delivery is to the behavioural and monitoring dimensions that determine adherence. Automated reminders, self-monitoring displays and remote feedback can support the day-to-day engagement on which exercise, nutrition and smoking or alcohol change all depend, and the adherence and physiological data these systems generate allow the clinical team to identify and respond to disengagement in near real time rather than at the next scheduled visit. This continuous, low-intensity contact is difficult to reproduce in a purely hospital-based model constrained by clinic capacity, and it is one of the clearer respects in which technology does not merely replicate supervised care remotely but changes what is feasible.

The strongest argument for technology in this setting is access. Specialist prehabilitation is concentrated in tertiary centres, and rural and regional patients face travel burdens that can make in-person programs impractical during an already demanding treatment period; telehealth has been proposed and implemented specifically to extend specialist prehabilitation support to such patients and to reduce the resulting health inequities (Waterland et al., 2021). Yet the same technologies that widen access for some can exclude others. Digital literacy, availability of suitable devices and reliable connectivity, and language are not evenly distributed, and are often least available to the older, socioeconomically disadvantaged patients who carry the highest surgical risk. Whether digitally enabled prehabilitation narrows or widens existing disparities is therefore not a property of the technology but of how carefully it is designed, offered and supported, and it is a question that belongs as much to health-services and social research as to clinical trials.

Implementation also has an economic dimension that will shape adoption. Supervised, centre-based prehabilitation carries real costs in staff time, space and equipment, which constrain how widely it can be offered; home-based and digitally supported models shift part of this burden but introduce their own costs of platforms, devices and remote monitoring, and their value depends on whether reductions in complications, length of stay or treatment interruption offset that investment. Health systems considering prehabilitation as routine care will need economic evaluations conducted alongside clinical trials, together with attention to reimbursement, governance of patient-generated data, and integration with existing cancer pathways. These are not peripheral concerns: whether an intervention of proven physiological benefit actually reaches patients is determined as much by how it is financed and organized as by its clinical efficacy.

9. Limitations of the evidence and future directions

The current evidence base, though expanding, has important limitations. Many trials are small feasibility or pilot studies; programs are heterogeneous in composition, intensity and duration; outcome definitions vary; and adherence is inconsistently reported. As a result, while improvements in intermediate fitness outcomes are well supported, conclusions about effects on postoperative complications, length of stay and survival remain provisional (Ikeda et al., 2024; Kehlet, 2021; Valkenet et al., 2018). Priorities for future research include adequately powered randomized trials with standardized, clearly described interventions and core outcome sets; clarification of which components and what "dose" are most effective within the constraints of the neoadjuvant interval; evaluation of home-based and digitally supported models that could broaden access; and identification of the patients – for example those who are frail, sarcopenic or have low baseline CPET values – most likely to benefit (Allen et al., 2022; Carli et al., 2017). As a narrative review, the present article is itself subject to selection and interpretation bias and does not provide a quantitative estimate of effect; it is intended to frame the rationale and practical considerations rather than to grade the strength of evidence.

The evidence on technology-enabled delivery is at an even earlier stage than the clinical evidence for prehabilitation itself. Most digital and tele-prehabilitation studies are small feasibility or pilot investigations rather than adequately powered randomized trials, outcome measures are inconsistent, and comparative data establishing whether remote delivery matches supervised programs for physiological and clinical endpoints remain limited (Tay et al., 2024). Priorities for future work therefore include standardization of program content and reporting, agreement on core outcome sets that capture both intermediate fitness measures and patient-important endpoints, adequately powered trials of specific delivery models – including head-to-head comparisons of supervised, home-based and digitally supported prehabilitation – and formal evaluation of cost-effectiveness and equity of access, without which technology-enabled prehabilitation cannot responsibly be scaled. Embedding implementation and health-services perspectives alongside clinical ones will be essential if prehabilitation is to reach the patients who stand to benefit most.

10. Summary and conclusions

In esophagogastric cancer surgery, the neoadjuvant window is both the principal threat to a patient's physiological reserve and the most natural opportunity to defend it. Multimodal prehabilitation delivered during this interval – combining aerobic and resistance exercise, inspiratory muscle training, nutritional optimization and psychological support – reliably improves preoperative functional capacity and respiratory muscle strength and is feasible, low-risk and increasingly deliverable in home-based formats. Its effect on hard clinical outcomes is biologically plausible but not yet firmly established, owing to heterogeneous and underpowered studies. Prehabilitation timed to the neoadjuvant window is therefore a rational and low-cost adjunct to modern enhanced-recovery care that warrants integration into multidisciplinary pathways and rigorous, standardized evaluation.

Framed as a delivery and implementation challenge, prehabilitation also intersects with broader questions of equitable access and the role of digital health in extending specialist care beyond the hospital. How technology-enabled, home-based models perform against supervised programmes, and for whom, is a priority for future work as much as the choice of exercise regimen or nutritional protocol.

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REFERENCES

1. Agrelli, T. F., de Carvalho Ramos, M., Guglielminetti, R., Silva, A. A., & Crema, E. (2012). Preoperative ambulatory inspiratory muscle training in patients undergoing esophagectomy: A pilot study. *International Surgery, 97*(3), 198–202.
2. Allen, S. K., Brown, V., White, D., King, D., Hunt, J., Wainwright, J., Emery, A., Hodge, E., Kehinde, A., Prabhu, P., Rockall, T. A., Preston, S. R., & Sultan, J. (2022). Multimodal prehabilitation during neoadjuvant therapy prior to esophagogastric cancer resection: Effect on cardiopulmonary exercise test performance, muscle mass and quality of life—A pilot randomized clinical trial. *Annals of Surgical Oncology, 29*(3), 1839–1850. https://doi.org/10.1245/s10434-021-11002-0
3. Argudo, N., Rodó-Pin, A., Martínez-Llorens, J., Marco, E., Visa, L., Messaggi-Sartor, M., Balañá-Corberó, A., Ramón, J. M., Rodríguez-Chiaradía, D. A., Grande, L., & Pera, M. (2021). Feasibility, tolerability, and effects of exercise-based prehabilitation after neoadjuvant therapy in esophagogastric cancer patients undergoing surgery: An interventional pilot study. *Diseases of the Esophagus, 34*, doaa086. https://doi.org/10.1093/dote/doaa086
4. Baimas-George, M., Watson, M., Elhage, S., Parala-Metz, A., Vrochides, D., & Davis, B. R. (2020). Prehabilitation in frail surgical patients: A systematic review. *World Journal of Surgery, 44*(11), 3668–3678. https://doi.org/10.1007/s00268-020-05658-0
5. Bausys, A., Luksta, M., Anglickiene, G., Maneikiene, V. V., Kryzauskas, M., Rybakovas, A., Dulskas, A., Kuliavas, J., Stratilatovas, E., Macijauskiene, L., Simbelyte, T., Celutkiene, J., Jamontaite, I. E., Cirtautas, A., Lenickiene, S., Petrauskiene, D., Cikanaviciute, E., Gaveliene, E., Klimaviciute, G., . . . Strupas, K. (2023). Effect of home-based prehabilitation on postoperative complications after surgery for gastric cancer: Randomized clinical trial. *British Journal of Surgery, 110*(12), 1800–1807. https://doi.org/10.1093/bjs/znad312
6. Boden, I., Skinner, E. H., Browning, L., Reeve, J., Anderson, L., Hill, C., Robertson, I. K., Story, D., & Denehy, L. (2018). Preoperative physiotherapy for the prevention of respiratory complications after upper abdominal surgery: Pragmatic, double-blinded, multicentre randomised controlled trial. *BMJ, 360*, j5916. https://doi.org/10.1136/bmj.j5916
7. Bolger, J. C., Loughney, L., Tully, R., Cunningham, M., Keogh, S., McCaffrey, N., Hickey, W., & Robb, W. B. (2019). Perioperative prehabilitation and rehabilitation in esophagogastric malignancies: A systematic review. *Diseases of the Esophagus, 32*(9), doz058. https://doi.org/10.1093/dote/doz058
8. Carli, F., & Scheede-Bergdahl, C. (2015). Prehabilitation to enhance perioperative care. *Anesthesiology Clinics, 33*(1), 17–33.
9. Carli, F., Silver, J. K., Feldman, L. S., McKee, A., Gilman, S., Gillis, C., Scheede-Bergdahl, C., Gamsa, A., Stout, N., & Hirsch, B. (2017). Surgical prehabilitation in patients with cancer: State-of-the-science and recommendations for future research from a panel of subject matter experts. *Physical Medicine and Rehabilitation Clinics of North America, 28*(1), 49–64.
10. Cemaga, R., Hebda, P., Czapliński, M., Szplit, E., Patalong, M., Pustuła, P., et al. (2026). The role of physical activity in the prevention and management of various cancers. *Journal of Education, Health and Sport, 88*, 68346. https://doi.org/10.12775/JEHS.2026.88.68346
11. Christensen, J. F., Simonsen, C., Banck-Petersen, A., Thorsen-Streit, S., Herrstedt, A., Djurhuus, S. S., Egeland, C., Mortensen, C. E., Kofoed, S. C., Kristensen, T. S., Garbyal, R. S., Pedersen, B. K., Svendsen, L. B., Højman, P., & de Heer, P. (2019). Safety and feasibility of preoperative exercise training during neoadjuvant treatment before surgery for adenocarcinoma of the gastro-oesophageal junction. *BJS Open, 3*, 74–84. https://doi.org/10.1002/bjs5.50110
12. Dettling, D. S., van der Schaaf, M., Blom, R. L., Nollet, F., Busch, O. R., & van Berge Henegouwen, M. I. (2013). Feasibility and effectiveness of pre-operative inspiratory muscle training in patients undergoing oesophagectomy: A pilot study. *Physiotherapy Research International, 18*(1), 16–26. https://doi.org/10.1002/pri.1524
13. Dronkers, J., Veldman, A., Hoberg, E., van der Waal, C., & van Meeteren, N. (2008). Prevention of pulmonary complications after upper abdominal surgery by preoperative intensive inspiratory muscle training: A randomized controlled pilot study. *Clinical Rehabilitation, 22*(2), 134–142. https://doi.org/10.1177/0269215507081574
14. Finley, D. J., Stevens, C. J., Emond, J. A., Batsis, J. A., Fay, K. A., Darabos, C., Sacks, O. A., Cook, S. B., & Lyons, K. D. (2021). Potential effectiveness of a surgeon-delivered exercise prescription and an activity tracker on pre-operative exercise adherence and aerobic capacity of lung cancer patients. *Surgical Oncology, 37*, 101525. https://doi.org/10.1016/j.suronc.2021.101525
15. Guinan, E. M., Forde, C., O'Neill, L., Gannon, J., Doyle, S. L., Valkenet, K., Trappenburg, J. C. A., van Hillegersberg, R., Ravi, N., Hussey, J. M., & Reynolds, J. V. (2019). Effect of preoperative inspiratory muscle training on physical functioning following esophagectomy. *Diseases of the Esophagus, 32*(2), doy091. https://doi.org/10.1093/dote/doy091
16. Halliday, L. J., Doganay, E., Wynter-Blyth, V. A., Hanna, G. B., & Moorthy, K. (2021). The impact of prehabilitation on post-operative outcomes in oesophageal cancer surgery: A propensity score matched comparison. *Journal of Gastrointestinal Surgery, 25*, 2733–2741. https://doi.org/10.1007/s11605-020-04881-3

17. Huang, G. H., Ismail, H., Murnane, A., Kim, P., & Riedel, B. (2016). Structured exercise program prior to major cancer surgery improves cardiopulmonary fitness: A retrospective cohort study. *Supportive Care in Cancer, 24*(5), 2277–2285.
18. Ikeda, T., Toyama, S., Harada, T., Noma, K., Hamada, M., & Kitagawa, T. (2024). Effectiveness of prehabilitation during neoadjuvant therapy for patients with esophageal or gastroesophageal junction cancer: A systematic review. *Esophagus, 21*(3), 283–297. https://doi.org/10.1007/s10388-024-01049-9
19. Janssen, T. H. J. B., Fransen, L. F. C., Heesakkers, F. F. B. M., Dolmans-Zwartjes, A. C. P., Moorthy, K., Nieuwenhuijzen, G. A. P., & Luyer, M. D. P. (2022). Effect of a multimodal prehabilitation program on postoperative recovery and morbidity in patients undergoing a totally minimally invasive esophagectomy. *Diseases of the Esophagus, 35*(7), doab082. https://doi.org/10.1093/dote/doab082
20. Kehlet, H. (2021). Prehabilitation in surgery—Need for new strategies? *European Journal of Surgical Oncology, 47*(5), 929–930.
21. Low, D. E., Allum, W., De Manzoni, G., Ferri, L., Immanuel, A., Kuppusamy, M., Law, S., Lindblad, M., Maynard, N., Neal, J., Pramesh, C. S., Scott, M., Mark Smithers, B., Addor, V., & Ljungqvist, O. (2019). Guidelines for perioperative care in esophagectomy: Enhanced Recovery After Surgery (ERAS) Society recommendations. *World Journal of Surgery, 43*(2), 299–330. https://doi.org/10.1007/s00268-018-4786-4
22. Minnella, E. M., Awasthi, R., Loiselle, S. E., Agnihotram, R. V., Ferri, L. E., & Carli, F. (2018). Effect of exercise and nutrition prehabilitation on functional capacity in esophagogastric cancer surgery: A randomized clinical trial. *JAMA Surgery, 153*(12), 1081–1089. https://doi.org/10.1001/jamasurg.2018.1645
23. Moran, J., Wilson, F., Guinan, E., McCormick, P., Hussey, J., & Moriarty, J. (2016). Role of cardiopulmonary exercise testing as a risk-assessment method in patients undergoing intra-abdominal surgery: A systematic review. *British Journal of Anaesthesia, 116*(2), 177–191.
24. Mortensen, K., Nilsson, M., Slim, K., Schäfer, M., Mariette, C., Braga, M., Carli, F., Demartines, N., Griffin, S. M., & Lassen, K. (2014). Consensus guidelines for enhanced recovery after gastrectomy: Enhanced Recovery After Surgery (ERAS) Society recommendations. *British Journal of Surgery, 101*(10), 1209–1229. https://doi.org/10.1002/bjs.9582
25. Piraux, E., Caty, G., Reychler, G., Forget, P., & Deswysen, Y. (2020). Feasibility and preliminary effectiveness of a tele-prehabilitation program in esophagogastric cancer patients. *Journal of Clinical Medicine, 9*(7), 2176. https://doi.org/10.3390/jcm9072176
26. Silver, J. K., & Baima, J. (2013). Cancer prehabilitation: An opportunity to decrease treatment-related morbidity, increase cancer treatment options, and improve physical and psychological health outcomes. *American Journal of Physical Medicine & Rehabilitation, 92*(8), 715–727. https://doi.org/10.1097/PHM.0b013e31829b4afe
27. St-Pierre, J., Coca-Martinez, M., Drummond, K., Minnella, E., Ramanakumar, A. V., Ferri, L., Carli, F., & Scheede-Bergdahl, C. (2024). Multimodal prehabilitation to enhance functional capacity of patients with esophageal cancer during concurrent neoadjuvant chemotherapies—A randomized feasibility trial. *Diseases of the Esophagus, 37*(12), doae087. https://doi.org/10.1093/dote/doae087
28. Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021). Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians, 71*(3), 209–249. https://doi.org/10.3322/caac.21660
29. Swaminathan, N., Kundra, P., Ravi, R., & Kate, V. (2020). ERAS protocol with respiratory prehabilitation versus conventional perioperative protocol in elective gastrectomy—A randomized controlled trial. *International Journal of Surgery, 81*, 149–157. https://doi.org/10.1016/j.ijsu.2020.07.027
30. Tay, S. S., Zhang, F., & Neo, E. J. R. (2024). The use of technology in cancer prehabilitation: A systematic review. *Frontiers in Oncology, 14*, 1321493. https://doi.org/10.3389/fonc.2024.1321493
31. Twomey, R., Culos-Reed, S. N., & Dort, J. C. (2020). Exercise prehabilitation—Supporting recovery from major head and neck cancer surgery. *JAMA Otolaryngology–Head & Neck Surgery, 146*(8), 689–690. https://doi.org/10.1001/jamaoto.2020.1346
32. Valkenet, K., Trappenburg, J. C. A., Schippers, C. C., Wanders, L., Lemmens, L., Backx, F. J. G., & van Hillegersberg, R. (2016). Feasibility of exercise training in cancer patients scheduled for elective gastrointestinal surgery. *Digestive Surgery, 33*(5), 439–447. https://doi.org/10.1159/000445958
33. Valkenet, K., Trappenburg, J. C. A., Ruurda, J. P., Guinan, E. M., Reynolds, J. V., Nafteux, P., Fontaine, M., Rodrigo, H. E., van der Peet, D. L., Hania, S. W., Sosef, M. N., Willms, J., Rosman, C., Pieters, H., Scheepers, J. J. G., Faber, T., Kouwenhoven, E. A., Tinselboer, M., Räsänen, J., . . . Backx, F. J. G. (2018). Multicentre randomized clinical trial of inspiratory muscle training versus usual care before surgery for oesophageal cancer. *British Journal of Surgery, 105*(5), 502–511. https://doi.org/10.1002/bjs.10803
34. van Adrichem, E. J., Meulenbroek, R. L., Plukker, J. T., Groen, H., & van Weert, E. (2014). Comparison of two preoperative inspiratory muscle training programs to prevent pulmonary complications in patients undergoing esophagectomy: A randomized controlled pilot study. *Annals of Surgical Oncology, 21*, 2353–2360. https://doi.org/10.1245/s10434-014-3612-y

35. Waterland, J. L., Chahal, R., Ismail, H., Sinton, C., Riedel, B., Francis, J. J., & Denehy, L. (2021). Implementing a telehealth prehabilitation education session for patients preparing for major cancer surgery. *BMC Health Services Research, 21*, 443. https://doi.org/10.1186/s12913-021-06437-w
36. Xu, Y. J., Cheng, J. C., Lee, J. M., Huang, P. M., Huang, G. H., & Chen, C. C. (2015). A walk-and-eat intervention improves outcomes for patients with esophageal cancer undergoing neoadjuvant chemoradiotherapy. *The Oncologist, 20*(10), 1216–1222. https://doi.org/10.1634/theoncologist.2015-0178
37. Yamana, I., Takeno, S., Hashimoto, T., Maki, K., Shibata, R., Shiwaku, H., Shimaoka, H., Shiota, E., & Yamashita, Y. (2015). Randomized controlled study to evaluate the efficacy of a preoperative respiratory rehabilitation program to prevent postoperative pulmonary complications after esophagectomy. *Digestive Surgery, 32*(5), 331–337. https://doi.org/10.1159/000434758