# Perioperative Medicine: An Overview

**Dr Noelle Healy[1†], Dr Pádraig Ó Scanaill[2], Dr Andrea Haren[3]**

[1]Specialist Anaesthesia Trainee, St Vincent's University Hospital, Dublin, Ireland
[2]Consultant in Anaesthesia and Perioperative Medicine, Mater Misericordiae University Hospital, Dublin, Ireland
[3]Consultant in Anaesthesia and Intensive Care Medicine, St Vincent's University Hospital, Dublin, Ireland

Edited by: Alison Jackson, Specialist Anaesthetist, Waikato Hospital, Hamilton, New Zealand

[†]Corresponding author email: noellehealy5@gmail.com

*Published 1 August 2023*

## KEY POINTS

- Perioperative medicine describes a spectrum of care that begins from the contemplation of surgery and continues until full recovery.
- The perioperative team may be composed of many different specialities and facilitates coordinated care from a variety of experts all aiming to optimise the patient's surgical journey.
- The patient is a core member of the perioperative medicine team and therefore should be involved in all decisions pertaining to their care through a process of shared decision making.
- Patient optimisation occurs through identification and management of comorbidities.
- Prehabilitation programmes aim to improve physical fitness, nutritional status and psychological well-being preoperatively.
- The routine use of objective risk-scoring tools can help identify patients with higher risk for postoperative morbidity and mortality, thereby allowing planning of perioperative management.

## INTRODUCTION

Perioperative medicine is an evolving field that focuses on optimising the care of surgical patients, from the contemplation of surgery until full recovery. Its successful implementation depends on collaboration between several hospital- and community-based disciplines. From within the hospital, this is often led by the anaesthesiologist, given their expertise in preoperative assessment.

The goals of perioperative medicine are to provide care that:

1. Identifies and optimises medical comorbidities before surgery
2. Adds value at each patient contact to reduce complications and hospital length of stay
3. Strives to target improved patient experience, satisfaction and outcome after surgery

## PATIENT ASSESSMENT AND THE PERIOPERATIVE TEAM

### Patient-Centred Care

Patients are central members of the perioperative team, and as such, any decisions made should best serve the individual patient. Shared decision making uses a patient-centred consultation, with the doctor bringing clinical expertise and the patient outlining their personal preferences and core values. It is an iterative process, starting when surgery is suggested and

*An online test is available for self-directed continuous medical education (CME). It is estimated to take 1 hour to complete. Please record time spent and report this to your accrediting body if you wish to claim CME points. A certificate will be awarded upon passing the test. Please refer to the accreditation policy here.*

**TAKE ONLINE TEST**

continuing at every step along the surgical journey. Of course, this concept is not unique to perioperative medicine but applies to all health care. Enabling patients to participate in decisions about their care is not only an ethical professional imperative but also a legal standard in some countries.[1] As an equal partner, patients feel involved and engaged in their care, which can lead to improved patient-reported outcomes, including less decisional regret.[2] Shared decision making should take place regardless of the level of education or health care literacy, and efforts must be made to ensure that the patient understands all facets of medical care being offered.[2] There are a variety of tools available to support both physicians and patients in this by the Centre for Perioperative Care (CPOC) in the United Kingdom, many of which are available on their website (https://cpoc.org.uk/).[3] Examples of resources available include the 'BRAN' decision aid, which prompts patients to consider the benefits, risks, alternatives to treatments and consider the prognosis with no treatment (do nothing) and the 'three talk model', which is designed to promote collaborative conversation and active listening in health care.[2,4]

## Management of Comorbidities and Optimisation Before Surgery

In many parts of the world, patients presenting for surgery can have significant medical comorbidities. Twenty-five percent of patients recruited to a large, prospective observational cohort study of outcomes after elective surgery were American Society of Anesthesiologists (ASA) physical status 3 or 4, with a high prevalence of comorbidities documented.[5] Some of the conditions encountered may be chronic in nature, while others may be newly identified following a structured assessment before surgery. While the preoperative assessment clinic represents a valuable opportunity to complete a detailed assessment, attention is turning to opportunities to do this 'upstream' in the surgical pathway. Engaging the general practitioner and the surgical team in initiating health screening and investigations can help with the early identification of high-risk multimorbid (commonly understood to be the co-occurrence of 2 or more chronic conditions) patients.[6] For example, by incorporating relevant individualised patient data (eg, body mass index, smoking status, blood pressure, HbA1c, list of active medications, etc) into the hospital referral, patients may be triaged to receive additional support by the perioperative team while waiting for a surgical review.[2] Common comorbidities that should be optimised and carefully managed in the weeks prior to surgery include anaemia, smoking-related disease (eg, chronic obstructive pulmonary disease), obstructive sleep apnoea, diabetes, hypertension and cardiac diseases.[2] Whilst specific management of these conditions is outside of the scope of this tutorial, it should be noted that in each case there is an opportunity for assessment, refinement and potential 'marginal gains' in the lead up to surgery.

Marginal gains in perioperative medicine refer to the small improvements or optimisations that can be made in various aspects of care before, during and after surgery. These small changes can have a significant effect on patient-centred outcomes.[7] By focusing on these small improvements and making incremental changes, health care staff may enhance the quality of care and reduce the risk of adverse events in the perioperative period.[7] This can help to change the mindset of being on a 'waiting list' into that of being on a 'preparation list' for surgery.[2] Preparing for surgery creates a focus for the patient on actively engaging with health care, which in turn encourages the expansion of the perioperative team beyond just the surgeon and the anaesthesiologist.

## The Perioperative Team

Traditionally, anaesthesiologists have had a central role in delivering perioperative care. In a recent UK survey, most anaesthesiologists surveyed identified themselves as perioperative physicians.[8] In fact, perioperative medicine can be delivered by specialists in other disciplines. Any service that establishes effective workstreams among health care professionals, with a shared focus on patient outcomes, can participate in perioperative medicine delivery. As the patient progresses through the health care system, the clinical governance of care may shift between various specialists. This necessitates new ways of working, with clear channels of communication between team members and patients, as their needs change. In the United Kingdom, CPOC was established as a cross-specialty collaboration dedicated to the promotion and advancement of perioperative medicine. It is an alliance between patients and health care organisations, recognising the importance of the multidisciplinary composition of the team in the delivery of perioperative care. The perioperative period can be broken down into 3 phases: preoperative, intraoperative and postoperative. For clarity of flow in this tutorial, themes are explored in a linear manner organised into the preoperative and postoperative periods, but many of these concepts pertain to all three stages concurrently.

# PREOPERATIVE

## Bundled Care During the Patient Journey

The surgical journey is a continuous process rather than an isolated event. Best patient outcomes are associated with coordinated care, with a recent review of the effect of perioperative care on health economics concluding that such pathways can reduce hospital stay by an average of 2 days.[7] The benefits of making small cumulative changes can be seen in the well-established Enhanced Recovery After Surgery (ERAS) protocols, which are a bundle of best practice interventions that exemplify the previously discussed concept of marginal gains.[9] In the emergency setting, the role of coordinated perioperative pathways is supported by the progressive improvements in outcomes yielded by the National Emergency Laparotomy Audit[10]

and the National Hip Fracture Database[11] in the United Kingdom. Similar initiatives exist as examples of perioperative medicine in action in other jurisdictions worldwide.

## Functional Assessment

Surgery represents a significant physiological challenge that creates a surge in metabolic demand. Individuals with limited physiological reserve may be unable to cope with this demand. Patients with a poor functional capacity are at risk of increased complications, increased length of hospital stay and even death.[12] Quantifying physiological fitness before surgery is a key aspect of preoperative assessment. There are many ways to assess a patient's functional status, with advantages and limitations to each. Table 1 presents a summary of commonly used approaches.

Whichever tool is used, the importance of applying a standardised method has been demonstrated by the METS trial,[12] a multicentre study in which an anaesthesiologist's subjective assessment of patient fitness correctly identified only 1 in 5 patients with low functional capacity (defined as a metabolic equivalent of task [MET] score of $<4$). Incorporating functional assessment into perioperative decision making has been successfully used to plan health care resource allocation.[13] A practical approach to functional assessment is the use of a validated questionnaire, followed by a targeted assessment for those identified as having reduced fitness.[2] The Duke Activity Status Index is a patient-reported measure of functional activity that has been shown to correlate well with perioperative outcomes.[12] If a deficit in functional reserve is identified preoperatively, evidence suggests that patient-specific preoperative training may improve performance and reduce the rates of complications, even in the high-risk patient cohort.[14]

## Risk Stratification

After health screening and pertinent investigations have been compiled, it is essential to effectively communicate the perioperative risk that comorbidities and the intended surgical procedure present to the patient. Various risk prediction models are currently available to support shared decision making, appropriate allocation of resources and create a universal language for medical teams. The use of standardised perioperative risk estimates also enables precise comparison of outcomes among patients across different institutions. Recently, biomarkers have been shown to assist in perioperative risk prediction together with a clinical assessment.[12] Table 2 outlines some common risk prediction models used in clinical practice. A commonly used risk prediction tool is the Surgical Outcome Risk Tool, which combines clinical judgment with an individualised, objective risk score and has been shown to be an accurate predictor of death within 30 days of inpatient surgery.[15]

## Frailty Assessment and the Older Person Undergoing Surgery

Frailty is a distinctive syndrome related to, but not exclusively associated with, aging. Patients with frailty demonstrate a decreased resilience across multiple body systems, which can lead to an increased vulnerability to external stressors and a slower or incomplete recovery following a physiological challenge. Multiple studies in the perioperative setting have identified frailty as an independent predictor of adverse outcomes.[16] A recent systematic review has shown the Rockwood Clinical Frailty Scale (CFS; Figure 1) to be a feasible and reliable predictor of adverse outcomes, including mortality and nonfavourable hospital discharge.[17]

Identification of preoperative frailty status should not solely be seen as a tool to characterise risk but rather represents an opportunity to develop an individualised care plan to mitigate this risk.[18] No single intervention has been shown to modify frailty; rather, the multidomain nature of the frailty syndrome requires a multidimensional treatment plan, which differs from the traditional systems-based approach often used in preoperative assessment.[18] CPOC has published guidelines to support embedding frailty assessment and interventions throughout the perioperative pathway.[19] Identification of comorbidities and geriatric syndromes (frailty, cognitive impairment and functional decline) plus early multidisciplinary input from medicine for the elderly specialists have been shown to improve outcomes for the older person undergoing surgery.[19]

## Nutrition

The stress response induced by surgery increases metabolic demand, and impaired nutritional reserves can impede patients' surgical recovery. Malnutrition is a modifiable risk factor that should be addressed prior to surgery.[20] The key steps in achieving this are screening, assessment and treatment of identified deficiencies. Examples of screening tools are outlined in Table 3.[20] Once screened as nutritionally at risk, the individual can undergo a more detailed assessment by a trained professional, which usually includes anthropometric measures (eg, skin-fold thickness and upper arm circumference) along with functional assessments (eg, hand-grip strength). Obesity is also a nutritional vulnerability that may be harder to characterise using these screening tools. There is emerging interest in the utility of radiologic evaluations to identify at-risk nutritional states such as sarcopenia (low muscle quantity and quality) and myosteatosis (fatty infiltration of muscle).[20] When malnutrition has been identified, targeted and individualised nutritional support should be offered both before and after surgery. Table 3 summarises some of the commonly encountered screening tools.

| Functional Assessment Tool | Method | Advantages | Disadvantages |
|---|---|---|---|
| Duke Activity Status Index (DASI) | The patient reports their ability to perform each of 12 different activities | Inexpensive and widely available. Does not require specific equipment or training to perform<br>Can be performed at bedside or by patient on their own<br>Standardisation improves consistency across interviews<br>Correlates with objectively measured exercise capacity | Subjective: patients may not accurately self-report their performance |
| Cardiopulmonary Exercise Test (CPET) | The patient is guided through graded exercise intensity (usually on an ergometric bike) with continuous measurement of physiological parameters | Poor performance correlates with increased risk of poor postoperative outcomes<br>Objective investigation<br>Identifies the cause of exercise limitation thereby facilitating targeted optimisation | Requires specialised training and equipment<br>Not available in all centres<br>Some measurements are dependent on individual patient motivation<br>Some comorbidities may preclude patient participation, eg, unstable angina |
| Six Minute Walk Test (6MWT) | The patient is asked to walk as far as possible within a 6-minute time frame, over a 30-m stretch of level ground | Minimal equipment needed: $SpO_2$ probe, stopwatch, blood pressure cuff and level ground<br>Low scores correlate well with risk of adverse postoperative outcomes<br>Easy to interpret and complete, can be performed easily | Feasibility may be limited by those with gait or musculoskeletal difficulties due to need for turning<br>Can be affected by patient motivation to complete task |
| Timed Up and Go (TUAG) | The patient starts seated in a chair: the time taken to stand up from seated, walk to a 3-m mark and then return to seated position is recorded | Easy to perform in the clinical setting<br>Inexpensive | Applicable to older or frailer patients<br>Ability to perform can be limited by cognitive function<br>No consensus on cutoff point for identifying patients at high risk for postoperative complication |
| Five Sit to Stand Test (5STS) | The patient is asked to stand from a seated position 5 times, as quickly as possible | Easy to perform assessment of lower limb strength and falls risk in elderly patients with multiple comorbidities<br>Low cost | Not yet widely validated in the surgical context |

**Table 1.** Nonexhaustive Summary of Functional Assessments That Can Be Incorporated Into Preoperative Evaluation

| Risk Prediction Model | Components | Advantages | Disadvantages |
|---|---|---|---|
| P-POSSUM | 18 variables (12 preoperative and 6 intraoperative) | Comprehensive, includes patient and surgical factors<br>Generates an estimated morbidity risk | Cannot fully complete preoperatively<br>Risk of interinterpreter variability and subjectivity<br>Tends to overestimate risk in low-risk patients<br>18 variables makes it a complex system and may impede use |
| SORT | 6 preoperative variables | Easy to use<br>All variables are available in preoperative setting | Use in emergency surgical patients has not yet been validated<br>Not designed for use in cardiac or neurosurgical patients<br>Prone to subjectivity due to use of ASA-PS<br>No morbidity risk scoring |
| ACS-NSQIP | 21 preoperative variables | Very comprehensive<br>Predicts risk of 14 outcomes within 30 days of surgery<br>Can be used preoperatively | Time consuming due to number of variables included<br>Only validated in specific surgical subtypes and for specific postoperative outcome, in private sector of United States healthcare system |

**Table 2.** Commonly Encountered Risk Prediction Models. ACS-NSQIP, American College of Surgeons National Surgical Quality Improvement Project; ASA-PS, American Society of Anaesthesiologists Physical Status; P-POSSUM, Portsmouth Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity; SORT, Surgical Outcome Risk Tool

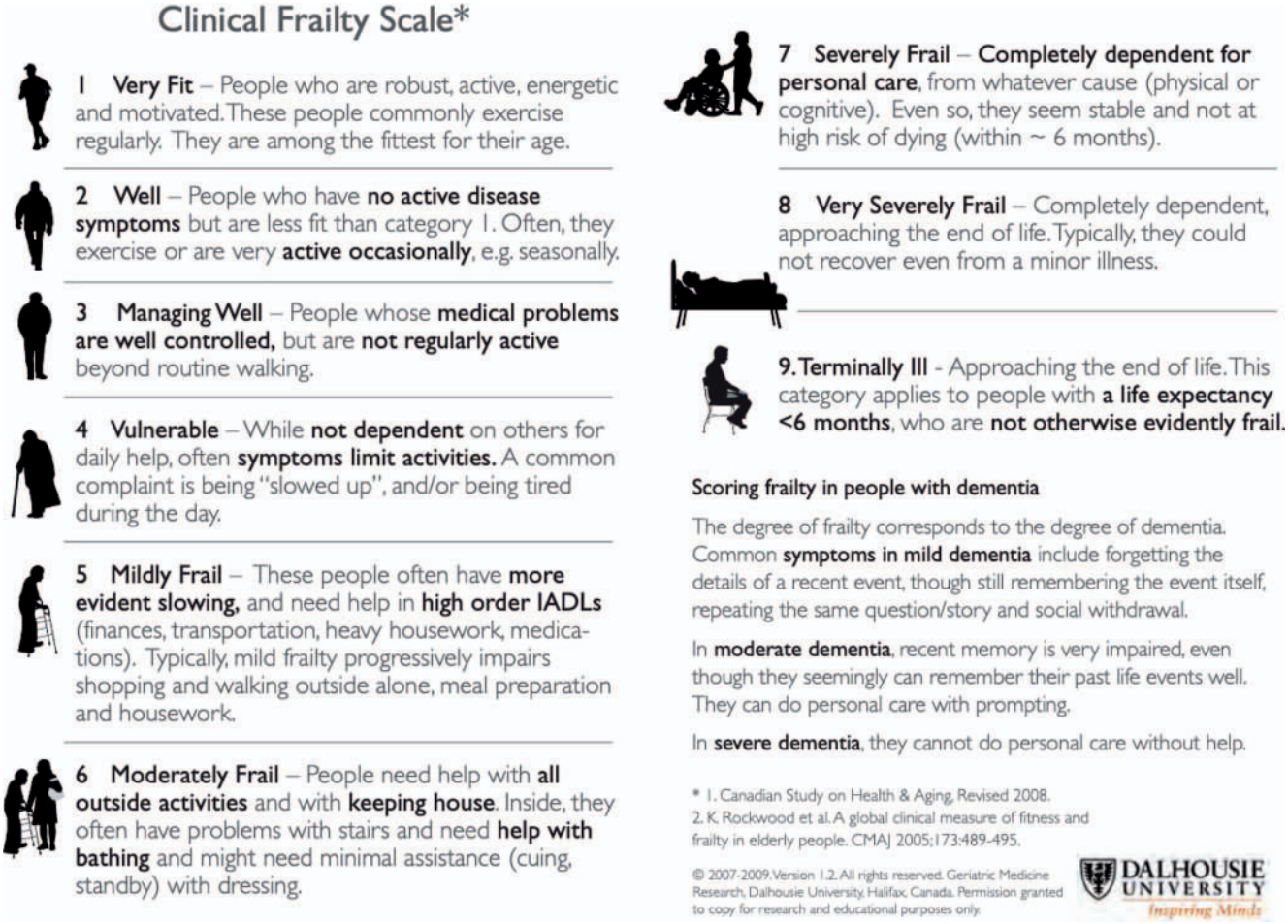


**Figure 1.** Clinical Frailty Scale (CFS). Taken from https://www.bgs.org.uk. The Rockwood CFS is a commonly used frailty assessment tool. Clinical judgment is required to appropriately evaluate a person's function. The text provided beside each graphic gives a guide as to specific questions to ask to gauge an individual's independence or otherwise in their activities of daily living.

## Prehabilitation

The perioperative period is a 'teachable moment' to motivate lifestyle changes: promoting physical activity, smoking cessation, reducing alcohol consumption and optimising nutritional status.[2] Prehabilitation describes multimodal strategies aimed at improving physical fitness, nutritional status and psychological well-being before surgery.[21] The underpinning principle of prehabilitation is that increasing functional reserve may allow the individual to meet the physiological and psychological demands of surgery (Figure 2).

A number of holistic prehabilitation models are being trialled in the United Kingdom, with encouraging results. 'Surgery schools' are education initiatives that involve group learning, in which patients and their families are instructed on how to prepare for surgery.[2] Discussions involve how best to physically and psychologically prepare for surgery and what to expect during the hospital stay. Outside of formal programmes, all clinicians should be competent to deliver universal exercise advice to patients. Resources such as Moving Medicine have been developed to help integrate physical activity conversations and prescriptions into routine health care interactions.[22] In addition, the COVID-19 pandemic necessitated a rapid pivot to digital or remote prehabilitation modalities, which may offer a scalable method of implementing such optimisation programmes.

# POSTOPERATIVE

## Enhanced Recovery Protocols

The central goals of the immediate postoperative period are encapsulated in the acronym 'DREAM', which aims to have a patient DRinking, EAting, and Mobilising within 24 hours of surgery. The Perioperative Quality Improvement Project (PQIP) in the United Kingdom has made 100% compliance with this target a national goal.[23] The aim of having a patient 'DREAMing' forms part of ERAS protocols, which have been shown to reduce length of stay, complications and mortality across a range of

| Nutritional Screening Tool | Components |
|---|---|
| Malnutrition Universal Screening Tool (MUST) | Combines BMI, unintended weight loss, reported or at risk of poor oral intake |
| Preoperative Nutrition Score (PONS) | Step 1 combines BMI, unintended weight loss plus poor oral intake. If patient has any 1 of these 3, undergoes step 2: biochemical evaluation (vitamin D and albumin) |
| Nutritional Risk Score 2002 (NRS 2002) | Combines BMI, unintended weight loss, poor oral intake PLUS whether patient is in intensive care |
| Subjective Global Assessment (SGA) | Four parameters: weight loss, anorexia, loss of subcutaneous fat, muscle mass |

**Table 3.** Examples of Nutritional Screening Tools. BMI, body mass index

surgical specialties.[9] In many cases, compliance with the postoperative elements is more difficult to achieve, despite being most strongly associated with optimal recovery.[24] Fidelity to the postoperative components of these protocols enables better outcomes for both patients and hospital processes.

## Critical Care and Enhanced Care Wards

Intraoperative mortality is rare, but the postoperative period is a time of ongoing risk. In fact, postoperative mortality has been estimated to be the third biggest contributor to deaths globally.[25] Postoperative morbidity is also a major global health concern. At a population level, the occurrence of even 1 single postoperative complication affects notably on long-term survival.[26] While the rate of postoperative complications at different institutions is relatively constant, the effect on survival following a complication varies significantly, with a nearly 3-fold difference in mortality between the best-performing and worst-performing hospitals.[27] This phenomenon has been termed *failure to rescue* and is thought to reflect variation in processes of care rather than patient-specific factors. Optimising these processes of care is a key focus of perioperative medicine.

It has been established that there is a high-risk cohort of patients who represent a minority (10%) of the surgical population but comprise a majority (80%) of perioperative mortality.[28] Postoperative critical care is one potential pathway to modify adverse outcomes, particularly in this high-risk group. An evolving field of interest is the utilisation of enhanced care wards. These areas should be considered as separate from, rather than a substitute for, critical care beds. Suggested admission criteria include those with a calculated perioperative mortality of >1% (using an objective risk prediction tool), a defined length of stay (eg, 12-24 hours) or those with specific care (eg, management of epidural) or monitoring needs (eg, special circulations like free flap monitoring).[29]

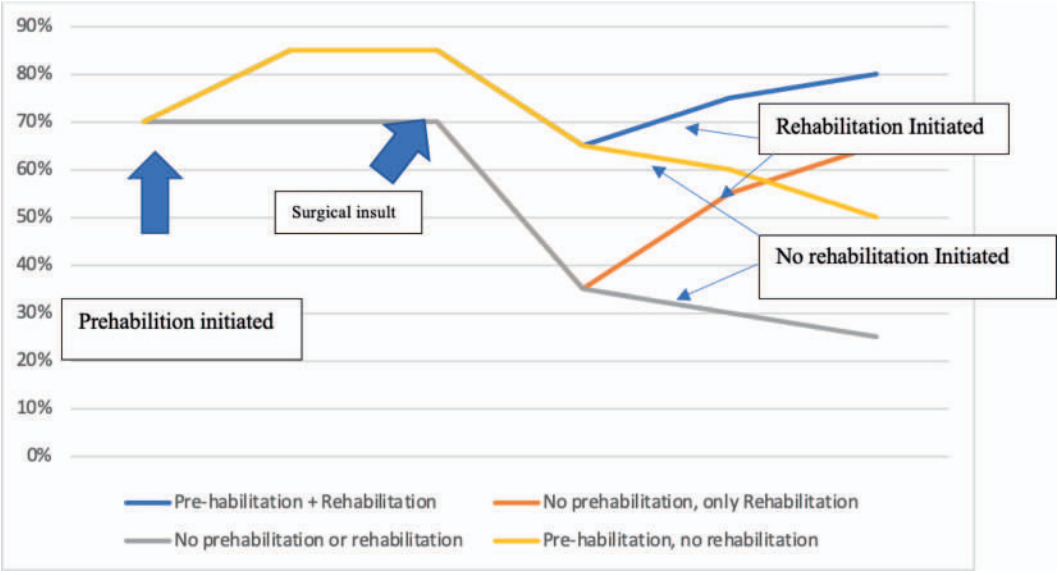


**Figure 2.** Graphical representation of the role that prehabilitation can have for patients following surgery compared with an index of baseline functional status. Used with permission. Further resources are available at https://www.macmillan.org.uk/.

## Discharge Planning and Rehabilitation

Effective postoperative care is often rooted in the preoperative setting. A patient who is motivated and psychologically prepared is essential for enabling early rehabilitation. Adequate support and early discharge planning should be organised prior to admission, and potential obstacles to safe and timely discharge can be anticipated and addressed.[30]


## SUMMARY

In this tutorial, we aim to introduce the reader to some of the major themes in perioperative medicine. Many of the concepts outlined apply across many health care settings and medical conditions; however, cohering these themes together around the time of surgery is central to delivering high-quality perioperative care. This is a broad field, which relies on many different specialties and is evolving rapidly as its own subspeciality. Successful patient care requires orchestrated, cohesive and coordinated buy-in from all stakeholders involved in perioperative medicine. When implemented properly, this has been shown to improve clinical outcomes, lower health care costs and increase patient satisfaction. Working to embed these principles of perioperative medicine into routine practice is therefore an important goal for all health care systems globally.


## REFERENCES


1. Montgomery (Appellant) vs Lanarkshire Health Board (Respondent) (Scotland) [2015] UKSC 11. https://www.supremecourt.uk/cases/uksc-2013-0136.html
2. Centre for Perioperative Care. Preoperative Assessment and Optimisation for Adult Surgery including consideration of COVID-19 and its implications. 2021. Accessed January 25, 2023. https://www.cpoc.org.uk/preoperative-assessment-and-optimisation-adult-surgery
3. Centre for Perioperative Care. 2022. Accessed June 6, 2023. https://cpoc.org.uk/
4. Elwyn G, Durand MA, Song J, et al. A three-talk model for shared decision making: multistage consultation process. *BMJ*. 2017;359:j4891.
5. International Surgical Outcomes Study Group. Global outcomes after elective surgery: prospective cohort study in 27 low-, middle- and high-income countries. *Br J Anaesth*. 2016;117(5):601-609.
6. Johnston M, Crilly M, Black C, et al. Defining and measuring multimorbidity: a systematic review of systematic reviews. *Eur J Public Health*. 2019;29(1):182-189.
7. Centre for Perioperative Care. Impact of perioperative care on healthcare resource use: rapid research review. 2020. Accessed January 23, 2023. https://cpoc.org.uk/sites/cpoc/files/documents/2020-09/Impact%20of%20perioperative%20care%20-%20rapid%20review%20FINAL%20-%2009092020MW.pdf
8. Partridge JSL, Rogerson A, Joughin AL, et al. The emerging specialty of perioperative medicine: a UK survey of the attitudes and behaviours of anaesthetists. *Periop Med*. 2020;9(1):3.
9. Ljungqvist O, Young-Fadok T, Demartines N. The history of Enhanced Recovery After Surgery and the ERAS Society. *J Laparoendosc Adv Surg Tech A*. 2017;27(9):860-862.
10. National Emergency Laparotomy Audit. Accessed June 6, 2023. https://www.nela.org.uk
11. National Hip Fracture Database. Accessed June 6, 2023. https://nhfd.co.uk
12. Wijeysundera DN, Pearse RM, Shulman MA, et al. Assessment of functional capacity before major non-cardiac surgery: an international, prospective cohort study. *Lancet*. 2018;391(10140):2631-2640.
13. Swart M, Carlisle JB, Goddard J. Using predicted 30-day mortality to plan postoperative colorectal surgery care: a cohort study. *Br J Anaesth*. 2017;118(1):100-104.
14. Barberan-Garcia A, Ubré M, Roca J, et al. Personalised prehabilitation in high-risk patients undergoing elective major abdominal surgery: a randomized blinded controlled trial. *Ann Surg*. 2018;267(1):50-56.
15. Wong DJN, Harris S, Sahni A, et al. Developing and validating subjective and objective risk-assessment measures for predicting mortality after major surgery: an international prospective cohort study. *PLoS Med*. 2020;17(10):e1003253.
16. Lin HS, Watts JN, Peel NM, et al. Frailty and post-operative outcomes in older surgical patients: a systematic review. *BMC Geriatr*. 2016;16(1):157.
17. Aucoin SD, Hao M, Sohi R, et al. Accuracy and feasibility of clinically applied frailty instruments before surgery: a systematic review and meta-analysis. *Anesthesiology*. 2020;133(1):78-95.
18. Dhesi J, Lees N, Partridge J. Frailty in the perioperative setting. *Clin Med (Lond)*. 2019;19(6):485-489.
19. Centre for Perioperative Care and British Geriatrics Society, Guideline for perioperative care for people living with frailty undergoing elective and emergency surgery. Accessed June 6, 2023. https://www.cpoc.org.uk/sites/cpoc/files/documents/2021-09/CPOC-BGS-Frailty-Guideline-2021.pdf
20. Lobo D, Gianotti L, Adiamah A, et al. Perioperative nutrition: recommendations from the ESPEN expert group. *Clin Nutr*. 2020;39:3211-3277.

21. McIsaac D, Gill M, Boland L, et al. Prehabilitation in adult patients undergoing surgery: an umbrella review of systematic reviews. *Br J Anaesth*. 2022;128(2):244-257.
22. Moving Medicine. Accessed June 6, 2023. https://movingmedicine.ac.uk
23. Perioperative Quality Improvement Project (PQIP). 2022. Accessed June 6, 2023. https://pqip.org.uk/
24. Aarts MA, Rotstein OD, Pearsall EA, et al. Postoperative ERAS interventions have the greatest impact on optimal recovery: experience with implementation of ERAS across multiple hospitals. *Ann Surg*. 2018;267(6):992-997.
25. Nepogodiev D, Martin J, Biccard B, et al. Global burden of postoperative death. *Lancet*. 2019;393(10170):401.
26. Moonesinghe SR, Harris S, Mythen MG, et al. Survival after postoperative morbidity: a longitudinal observational cohort study. *Br J Anaesth*. 2014;113(6):977-984.
27. Khuri SF, Henderson WG, DePalma RG, et al. Determinants of long-term survival after major surgery and the adverse effect of postoperative complications. *Ann Surg*. 2005;242(3):326-341.
28. National Confidential Enquiry Into Patient Outcome and Death. Knowing the risk: a review of the peri-operative care of surgical patients. 2011. https://www.ncepod.org.uk/2011poc.html
29. The Faculty of Intensive Care Medicine. Enhanced care: guidance on service development in the hospital setting. 2020. Accessed March 19, 2023. www.ficm.ac.uk/sites/ficm/files/documents/2021-10/enhanced_care_guidance_final_-_may_2020-.pdf
30. Bougeard A, Watkins B. Transitions of care in the perioperative period – a review. *Clin Med (Lond)*. 2019;19(6):446-449.