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L'Unité d'évaluation des technologies et des modes d'intervention en santé (UETMIS) du Centre Universitaire de Santé McGill (CUSM)

Health Technology Assessment Unit (TAU) of the MUHC

Evaluating the value of a prehabilitation clinic for surgical patients at the MUHC: An update

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TAU Health Technology Assessment Update Report

Report no. 107

Report prepared for the Technology Assessment Unit (TAU) of the McGill University Health Centre (MUHC)

by

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Mission Statement

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Members of TAU's research staff and policy committee declare no conflicts of interest.

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- Tahereh Najafi Ghezeljeh, Research Associate, Centre for Outcomes Research and Evaluation, Research Institute of the McGill University Health Centre

REPORT REQUESTOR

This report was requested by Dr. Francesco Carli, Professor of Anesthesia, McGill University, on July 29, 2025, to update TAU's 2021 report on prehabilitation.

TYPES OF RECOMMENDATIONS ISSUED BY THE TAU COMMITTEE

Type of recommendation	Explanation
Approved	• Evidence for relevant decision criteria, including efficacy, safety, and cost, as well as context-specific factors such as feasibility, is sufficiently strong to justify a recommendation that the technology be accepted, used and funded through the institutional operating budget
Approved for evaluation	• There is a reasonable *probability* that relevant decision criteria, including efficacy, safety, and cost, as well as context-specific factors such as feasibility, are favorable but the evidence is not yet sufficiently strong to support a recommendation for permanent and routine approval. • The evidence is sufficiently strong to recommend a *temporary* approval in a restricted population for the purposes of evaluation, funded through the institutional operating budget.
Not approved	• There is insufficient evidence for the relevant decision criteria, including efficacy, safety, and cost; • The costs of any use of the technology (e.g. for research purposes) should not normally be covered by the institutional budget.

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TABLE OF CONTENTS

LIST OF TABLES

EXECUTIVE SUMMARY

BACKGROUND

- Prehabilitation is a proactive, preoperative intervention commonly integrated within Enhanced Recovery After Surgery (ERAS) pathways. It aims to improve patients' physical, nutritional, and psychological readiness for surgery, thereby enhancing resilience to surgical stress and reducing postoperative complications. Programs are typically multimodal, combining exercise, nutritional optimization, and psychological support.
- In 2021, the MUHC Technology Assessment Unit (TAU) conducted a Health Technology Assessment (HTA) on prehabilitation that included 48 systematic reviews. At that time, the evidence was mixed and of limited certainty, and funding through the MUHC operating budget was not approved.
- Since then, new evidence has emerged, alongside three years of real-world local implementation data and a local economic analysis from the MUHC Multimodal Prehabilitation Program. This program, which is currently philanthropically funded, is housed at the Montreal General Hospital (MGH) and serves approximately 200 surgical patients annually.
- This report presents an update to the 2021 TAU assessment, integrating new published evidence, local clinical and economic outcomes, and stakeholder perspectives.

EVALUATION QUESTIONS (Objectives of this report)

1. To evaluate recent evidence on the effectiveness of prehabilitation in improving postoperative outcomes and patient functioning;
2. To review local MUHC outcomes and experience, and
3. To document MUHC stakeholder perspectives on implementation and sustainability.

METHODS

We evaluated the evidence from a large network meta-analysis of 186 randomized trials (n=15,1684) examining the impact of prehabilitation on post-operative outcomes, and reviewed three sources of local MUHC evidence: (1) a stakeholder qualitative study, (2) a cost analysis, and (3) three years of implementation data from the prehabilitation clinic.

RESULTS

Evidence of effectiveness from the published literature:

- The most comprehensive evidence to date is derived from a 2025 BMJ systematic review and network meta-analysis of 186 randomized trials (n=15,1684). Unlike conventional pairwise meta-analyses that assess single components or pool heterogeneous interventions, network meta-analysis allows direct and indirect comparison of multiple prehabilitation components and their combinations, providing clearer insight into which elements are most effective for clinical practice or future trial design.
- Despite the low certainty of evidence (due to high risk of bias within studies, heterogeneity, and imprecision of estimates), this study demonstrated consistent directional benefits of multimodal prehabilitation compared with standard care.
- Multimodal programs were associated with fewer postoperative complications (OR 0.64; 95% CI: 0.45 to 0.92); improved quality of life (mean difference: 3.48 points on the Short-Form 36; 0.82 to 6.14); and improved walking capacity (mean difference: 43.4m; 5.96 to 80.91). Effects on length of stay (LOS) remain uncertain (mean difference: -0.53 days; -1.19 to 0.13).
- **Implication**: Multimodal prehabilitation appears to reduce postoperative complications, improve functional outcomes, and possibly reduce hospital stays, but confidence in the magnitude and consistency of these benefits is limited by persistent methodological weaknesses in the evidence base.

Evidence of effectiveness from local data:

- Since its launch in 2021, the MUHC Multimodal Prehabilitation Program has enrolled 646 high-risk surgical patients for preoperative support, demonstrating successful implementation and feasibility.
- While reported clinical outcomes (complications, LOS, physical functioning) are comparable to or better than external benchmarks, reliance on heterogeneous and non-comparable external control groups can result in substantial risk of confounding and selection bias, limiting causal interpretation. Therefore, these results are descriptive and should not be taken as definitive evidence of clinical effectiveness.
- Nonetheless, important implementation and improvement lessons can be drawn from this analysis:
    - Monitoring adherence to home-based exercise is challenging for over half of patients, suggesting a role for tele-prehabilitation tools to support engagement and tracking.

  - Nearly one-quarter of referred patients decline participation, underscoring the need for better surgeon and patient education, earlier engagement, and involvement of families and caregivers.
  - Efficiency could be improved by simplifying screening tools and questionnaires to reduce patient burden and evaluation time.
  - Further optimization includes developing procedure-specific prehabilitation pathways (e.g., enhanced respiratory physiotherapy for lung surgery) and formally evaluating cost-effectiveness to support long-term sustainability and value-based care.
- **Implication**: While the effectiveness results from this local data analysis should be interpreted with caution due to high risk of bias, overall, the program demonstrates feasibility and potential value. There is a need to optimize patient and clinician engagement, develop better screening tools and procedure-specific pathways to maximize impact and ensure sustainability.

Local Stakeholder Perspective:

- Qualitative interviews (n=61) with patients, clinicians, and administrators highlight broad consensus that prehabilitation at the MUHC should be patient-centred, **integrated with ERAS**, and **focused on high-risk patients** with modifiable risk factors to support value-based care.
- Exercise and nutrition were identified as core components, and key enablers included early screening, clear referral pathways, surgeon engagement, interdisciplinary communication, and digital tools.
- Stakeholders emphasized measuring both process (adherence, implementation quality and cost) and outcome (clinical and patient-reported outcomes) measures.

Local Economic Evidence:

- <u>Research study (Propensity-score matched microcosting analysis)</u>
  - A 2025 cost analysis comparing 142 high-risk lung cancer surgery patients receiving prehabilitation to 142 control patients at the MUHC reported a net annual savings of $721,901 ($5,084 per patient). This estimate was driven by reductions in hospital stays and readmissions in the prehabilitation group compared to standard care, after accounting for program operating costs (only staff salaries) of ~$55,000.

- Real operating costs
    - Actual operating cost estimates, necessary for operational planning to safely deliver prehabilitation services to 200 new patients annually at our hospital, are projected to be $350,000, which includes protected multidisciplinary staff time, care coordination, follow-up visits of new and current patients, and essential non-patient facing activities.

CONCLUSIONS

- **Clinical value:** Multimodal prehabilitation consistently shows potential to reduce postoperative complications and improve functional outcomes, though published evidence remains low certainty.
- **Local impact**: Local MUHC experience over three years demonstrates that prehabilitation is feasible, acceptable to patients and clinicians, and aligned with institutional priorities for ERAS and value-based care. Descriptive outcome data suggest performance comparable to or better than external benchmarks, but methodological limitations, such as reliance on external comparators, mean these findings should be interpreted as supportive but not definitive evidence of effectiveness.
- **Economic case**: A local economic evaluation shows prehabilitation is cost-saving in high-risk lung cancer surgery patients.
- **Strategic opportunity**: Taken together, the convergence of updated evidence, local MUHC data that supports feasibility and stakeholder acceptability, and local economic findings that demonstrate cost savings for the hospital, suggests that multimodal prehabilitation represents a valuable, patient-centred intervention for **selected surgical populations** at the MUHC.

RECOMMENDATIONS

Funding of prehabilitation through the hospital operating budget is justified and approved, with defined scope, targeted population, and ongoing evaluation requirements.

This recommendation is based on the following:

- The best available evidence, although of low-certainty, consistently shows that multimodal prehabilitation may reduce postoperative complications and improve functional outcomes, without safety risks.
- A local economic analysis found that prehabilitation in high-risk lung cancer surgery patients resulted in net annual savings of $721,901 or $5,084 per patient in this subgroup, driven by reduced healthcare utilization costs.
- Local implementation aligns with stakeholder consensus that **prehabilitation should be targeted to high-risk patients with modifiable risk factors**, where the likelihood of benefit and cost avoidance is greatest. This mitigates the risk of inefficient resource use and dilution of effect.
- The current program is integrated with ERAS, supports institutional priorities related to quality, patient experience, and resource stewardship, and has demonstrated feasibility and stakeholder buy-in.

Continued implementation of this program should ensure:

1. The program remains targeted to high-risk surgical patients (e.g., frailty, poor functional capacity, malnutrition, high predicted complication risk), with clear inclusion and discharge criteria.
2. Increased awareness of the program among clinicians and patients to improve its impact.
3. Improved data collection support to facilitate ongoing evaluation and accountability, with need for routine collection of:
    a. Complications, ICU admissions, LOS, and readmissions
    b. Program uptake and adherence
    c. Cost and resource utilization
    d. Patient-reported experience and outcomes
4. Cost analysis beyond lung cancer surgery patients to determine the cost impact in other surgical populations.

SOMMAIRE

CONTEXTE

- La préhabilitation est une intervention préopératoire proactive souvent intégrée aux protocoles de rétablissement amélioré après chirurgie (ERAS). Elle vise à améliorer la préparation physique, nutritionnelle et psychologique des patients à la chirurgie, renforçant ainsi leur résilience au stress chirurgical et réduisant les complications postopératoires. Les programmes sont généralement multimodaux et combinent exercice physique, optimisation nutritionnelle et soutien psychologique.
- En 2021, l'Unité d'évaluation des technologies et des modes d'intervention en santé (UETMIS-TAU) du CUSM a mené une évaluation des technologies de la santé (ETMIS) sur la préhabilitation, incluant 48 revues systématiques. À ce moment-là, les données probantes étaient mitigées et d'un degré de certitude limité, et le financement via le budget opérationnel du CUSM n'a pas été approuvé.
- Depuis, de nouvelles données probantes ont émergé, ainsi que trois années de données de mise en œuvre locales et une analyse économique locale du programme de préhabilitation multimodale du CUSM. Ce programme, actuellement financé par des dons, est hébergé à l'Hôpital général de Montréal (HGM) et dessert environ 200 patients opérés par année.
- Ce rapport présente une mise à jour de l'évaluation TAU de 2021, intégrant de nouvelles données publiées, les résultats cliniques et économiques locaux et les points de vue des parties prenantes.

QUESTIONS D'ÉVALUATION (Objectifs du présent rapport)

1. Évaluer les données probantes récentes sur l'efficacité de la préhabilitation pour améliorer les résultats postopératoires et le fonctionnement des patients;
2. Examiner les résultats et l'expérience du CUSM;
3. Documenter les points de vue des parties prenantes du CUSM sur la mise en œuvre et la pérennité du programme.

MÉTHODES

Nous avons évalué les données probantes d'une vaste méta-analyse en réseau de 186 essais randomisés (n=15 1684) examinant l'impact de la préhabilitation sur les résultats postopératoires. Nous avons également examiné trois sources de données probantes locales du CUSM : (1) une étude qualitative auprès des parties prenantes, (2) une

analyse des coûts et (3) trois années de données de mise en œuvre de la clinique de préhabilitation.

RÉSULTATS

Preuves d'efficacité issues de la littérature :

- Les preuves les plus complètes à ce jour proviennent d'une revue systématique et d'une méta-analyse en réseau publiées en 2025 dans le BMJ, portant sur 186 essais randomisés (n = 15 1684). Contrairement aux méta-analyses classiques qui évaluent des composantes isolées ou regroupent des interventions hétérogènes, la méta-analyse en réseau permet une comparaison directe et indirecte de multiples composantes de préhabilitation et de leurs combinaisons, offrant ainsi une vision plus claire des éléments les plus efficaces pour la pratique clinique ou la conception d'essais futurs.
- Malgré le faible niveau de preuve (dû au risque élevé de biais au sein des études, à l'hétérogénéité et à l'imprécision des estimations), cette étude a démontré des bénéfices constants de la préhabilitation multimodale par rapport aux soins standards.
- Les programmes multimodaux étaient associés à une diminution des complications postopératoires (OR : 0,64 ; IC à 95 % : 0,45 à 0,92) et à une amélioration de la qualité de vie (différence moyenne : 3,48 points sur le questionnaire SF-36 ; IC à 95 % : 0,82 à 6,14); et une amélioration de la capacité de marche (différence moyenne : 43,4 m ; IC à 95 % : 5,96 à 80,91). Les effets sur la durée d'hospitalisation restent incertains (différence moyenne : -0,53 jour ; IC à 95 % : -1,19 à 0,13).
- **Conclusion** : La préhabilitation multimodale semble réduire les complications postopératoires, améliorer les résultats fonctionnels et potentiellement réduire la durée d'hospitalisation. Toutefois, la fiabilité et la constance de ces bénéfices sont limitées par des faiblesses méthodologiques persistantes dans les études.

Preuves d'efficacité issues des données locales :

- Depuis son lancement en 2021, le programme de préhabilitation multimodale du CUSM a recruté 646 patients à haut risque chirurgical pour un soutien préopératoire, démontrant ainsi sa mise en œuvre réussie et sa faisabilité.
- Bien que les résultats cliniques rapportés (complications, durée d'hospitalisation, fonction physique) soient comparables ou supérieurs aux normes externes, le recours à des groupes témoins externes hétérogènes et non comparables peut entraîner un risque important de confusion et de biais de sélection, limitant ainsi

l'interprétation causale. Par conséquent, ces résultats sont descriptifs et ne doivent pas être considérés comme une preuve définitive d'efficacité clinique.

- Néanmoins, cette analyse permet de tirer d'importantes leçons en matière de mise en œuvre et d'amélioration :
    - Le suivi de l'observance des exercices à domicile s'avère difficile pour plus de la moitié des patients, ce qui suggère l'utilité des outils de télépréhabilitation pour favoriser l'engagement et le suivi.
    - Près du quart des patients orientés vers le programme refusent d'y participer, ce qui souligne la nécessité d'une meilleure formation des chirurgiens et des patients, d'une prise en charge plus précoce et de la participation des familles et des aidants naturels.
    - L'efficacité pourrait être améliorée en simplifiant les outils de dépistage et les questionnaires afin de réduire la charge pesant sur le patient et le temps d'évaluation.
    - L'optimisation pourrait également passer par l'élaboration de parcours de préhabilitation spécifiques à chaque intervention (par exemple, une kinésithérapie respiratoire renforcée pour la chirurgie pulmonaire) et par une évaluation formelle du rapport coût-efficacité afin de garantir la pérennité du programme et des soins axés sur la valeur.
- **Conclusion** : Bien que les résultats d'efficacité issus de cette analyse de données locales doivent être interprétés avec prudence en raison d'un risque élevé de biais, le programme démontre globalement sa faisabilité et son intérêt potentiel. Il est nécessaire d'optimiser l'implication des patients et des cliniciens, de développer de meilleurs outils de dépistage et des parcours spécifiques à chaque intervention afin de maximiser l'impact et d'assurer la pérennité du programme.

Point de vue des parties prenantes locaux :

- Des entretiens qualitatifs (n=61) menés auprès de patients, de cliniciens et d'administrateurs ont mis en évidence un large consensus : la préhabilitation au CUSM devrait **être axée sur le patient, intégrée au protocole ERAS et ciblée sur les patients à haut risque** présentant des facteurs de risque modifiables, afin de favoriser des soins fondés sur la valeur.
- L'exercice physique et la nutrition ont été identifiés comme des composantes essentielles, et parmi les principaux facteurs de réussite figurent le dépistage précoce, des parcours de soins clairs, l'implication des chirurgiens, la communication interdisciplinaire et les outils numériques.

- Les intervenants ont insisté sur l'importance de mesurer à la fois les indicateurs de processus (adhésion, qualité de la mise en œuvre et coûts) et les indicateurs de résultats (résultats cliniques et résultats rapportés par les patients).

Données économiques locales :

Étude de recherche (analyse de microcoûts par appariement sur score de propension)

- Une analyse des coûts de 2025 comparant 142 patients atteints d'un cancer du poumon à haut risque et ayant reçu la préhabilitation à 142 patients témoins au CUSM a révélé des économies annuelles nettes de 721 901 $ (5 084 $ par patient). Cette estimation s'explique par la réduction des hospitalisations et des réadmissions dans le groupe de préhabilitation par rapport aux soins standards, après prise en compte des coûts de fonctionnement du programme (salaires du personnel uniquement) d'environ 55 000 $.

Coûts de fonctionnement réels

- Les estimations des coûts de fonctionnement réels, nécessaires à la planification opérationnelle pour offrir en toute sécurité des services de préhabilitation à 200 nouveaux patients par année dans notre hôpital, sont estimées à 350 000 $. Ce montant comprend le temps protégé du personnel multidisciplinaire, la coordination des soins, les visites de suivi des nouveaux patients et des patients actuels, ainsi que les activités essentielles ne nécessitant pas de contact direct avec les patients.

CONCLUSIONS

- **Valeur clinique** : La préhabilitation multimodale démontre systématiquement son potentiel à réduire les complications postopératoires et à améliorer les résultats fonctionnels, bien que les données publiées demeurent de faible certitude.
- **Impact local** : L'expérience locale du CUSM sur trois ans démontre que la préhabilitation est faisable, acceptable pour les patients et les cliniciens, et conforme aux priorités institutionnelles en matière de protocoles de soins améliorés et de soins axés sur la valeur. Les données descriptives suggèrent une performance comparable ou supérieure aux normes externes, mais les limites méthodologiques, comme le recours à des comparateurs externes, signifient que ces résultats ne doivent pas être interprétés comme des preuves d'efficacité définitives.
- **Analyse économique** : Une évaluation économique locale démontre que la préhabilitation permet de réaliser des économies pour l'hôpital chez les patients à haut risque de cancer du poumon subissant une chirurgie.

- **Opportunité stratégique** : La convergence des données probantes actualisées, des données locales du CUSM qui appuient la faisabilité et l'acceptabilité par les parties prenantes, et des résultats économiques locaux qui démontrent des économies pour l'hôpital, suggère que la préhabilitation multimodale représente une intervention précieuse et axée sur le patient pour certaines populations chirurgicales du CUSM.

RECOMMANDATIONS

Le financement de la préhabilitation par le biais du budget de fonctionnement de l'hôpital est justifié et approuvé, avec un périmètre d'intervention défini, une population cible précise et des exigences d'évaluation continue.

Cette recommandation repose sur les éléments suivants :

- Les meilleures données probantes disponibles, bien que de faible certitude, démontrent de façon constante que la préhabilitation multimodale peut réduire les complications postopératoires et améliorer les résultats fonctionnels, sans risque pour la sécurité.
- Une analyse économique locale a révélé que la préhabilitation chez les patients à haut risque opérés d'un cancer du poumon a permis de réaliser des économies annuelles nettes de 721 901 $ (soit 5 084 $ par patient dans ce sous-groupe), grâce à la réduction des coûts liés à l'utilisation des soins de santé.
- La mise en œuvre locale est conforme au consensus des parties prenantes selon lequel la **préhabilitation devrait cibler les patients à haut risque présentant des facteurs de risque modifiables,** chez lesquels la probabilité de bénéfices et d'économies est la plus élevée. Cela atténue le risque d'utilisation inefficace des ressources et de dilution de l'effet.
- Le programme actuel est intégré au protocole ERAS, soutient les priorités institutionnelles liées à la qualité, à l'expérience patient et à la gestion des ressources, et a démontré sa faisabilité et l'adhésion des parties prenantes.

La poursuite de la mise en œuvre de ce programme devrait garantir :

- Que le programme reste ciblé sur les patients chirurgicaux à haut risque (par exemple, fragilité, faible capacité fonctionnelle, malnutrition, risque élevé de complications prévisibles), avec des critères d'inclusion et de sortie clairement définis.
- Une meilleure sensibilisation au programme auprès des cliniciens et des patients afin d'en améliorer l'impact.
- Un soutien accru à la collecte de données pour faciliter l'évaluation continue et la responsabilisation, avec la nécessité de recueillir systématiquement les informations suivantes :
    - Complications, admissions en soins intensifs, durée de séjour et réadmissions
    - Adhésion au programme
    - Coûts et utilisation des ressources
    - Expérience et résultats rapportés par les patients
- Une analyse des coûts au-delà des patients opérés d'un cancer du poumon afin de déterminer l'impact financier sur d'autres populations chirurgicales.

LIST OF ABBREVIATIONS

ACS NSQIP	American College of Surgeons National Surgical Quality Improvement Program
ASA	American Society of Anesthesiology
CI	Confidence Interval
ERAS	Enhanced Recovery After Surgery
HTA	Health Technology Assessment
LOS	Length of Stay
MGH	Montreal General Hospital
MUHC	McGill University Health Centre
OR	Odds Ratio
TAU	MUHC Technology Assessment Unit

UPDATED EVIDENCE ON PREHABILITATION FOR REDUCING POSTOPERATIVE COMPLICATIONS

1. BACKGROUND

Prehabilitation is a pre-operative intervention commonly integrated into hospital ERAS (Enhanced Recovery After Surgery) programs, and aims to prepare the patient to better withstand surgical stress by improving their physical, nutritional and mental health.[1] It often involves a multimodal approach including exercise, nutrition, and psychological support to improve surgical resilience.

1.1 Context for this evaluation

- In 2021, the Health Technology Assessment Unit (TAU) of the MUHC conducted a comprehensive evaluation of prehabilitation, which included 48 systematic reviews assessing impact on post-operative outcomes.[2] The evidence at the time was mixed and of limited certainty, and funding through the MUHC operating budget was not approved by the TAU Policy Committee.
- At the MUHC, the prehabilitation clinic is located at the Montreal General Hospital and is philanthropically funded. The clinic serves approximately 200 surgical patients per year.
- It is staffed by a multidisciplinary team including a physician (1.0 FTE), registered nurse/clinical lead (1.0 FTE), kinesiologist (0.6 FTE), physiotherapist (0.4 FTE), dietician (0.5 FTE), administrative assistant (1.0 FTE), and volunteer wellness specialists supporting stress management and behaviour change.
- This report updates the 2021 TAU Health Technology Assessment on prehabilitation, incorporating new evidence and three years of real-world implementation data from the MUHC Multimodal Prehabilitation Program.

2. OBJECTIVES

The objectives are to assess:

1. The effectiveness of prehabilitation in improving postoperative outcomes,
2. Local MUHC outcomes and experience, and
3. Stakeholder perspectives on implementation and sustainability.

3. METHODS

3.1 Literature review

We synthesized the evidence from one large network meta-analysis that included 186 RCTs (n=15,1684) published between 1993 and 2023, which examined the impact of individual and combined prehabilitation components (exercise, nutrition, cognitive, and psychosocial) on key outcomes including postoperative complications, length of stay, health related quality of life, and physical recovery in adult patients undergoing surgery.

3.2 MUHC experience

We reviewed the following studies evaluating the MUHC prehabilitation clinic: (1) a qualitative study of local stakeholder feedback on the prehabilitation program, (2) a budget-impact analysis of the program, and (3) a local quality improvement study summarizing three years of data on the patient population and outcomes of the prehabilitation clinic at the MUHC, obtained from Dr. Franco Carli.

4. UPDATED EVIDENCE ON CLINICAL EFFECTIVENESS FROM THE LITERATURE

4.1 Systematic review and network meta-analysis (McIsaac et al. 2025, BMJ)

Advantage of a network meta-analysis:

- This review incorporated a network meta-analysis, which differs from traditional pairwise meta-analyses that estimate the effect of a single intervention relative to a control group in a head-to-head comparison. [3]
- Network meta-analysis is particularly useful for multicomponent interventions like prehabilitation because it allows simultaneous direct and indirect comparison of individual and combined prehabilitation components, addressing the limitations of traditional meta-analyses that either isolate single components or pool heterogeneous interventions.
- This approach helps identify which components, or combinations, are most likely to be effective, reducing uncertainty for clinical practice integration and providing clearer guidance for designing future prehabilitation programs and trials.

4.1.1 Findings

- This comprehensive review of 186 RCTs (n=15,1684 patients) found that, compared to usual care, multimodal prehabilitation (exercise + nutrition + psychological support) was associated with:
    - A reduced risk of postoperative complications (OR 0.64; 95% CI: 0.45 to 0.92); very low certainty of evidence from 13 trials. This indicates that multimodal prehabilitation **may** reduce postoperative complications.
    - An improved quality of life (mean difference: 3.48 points on the Short-Form 36 (95% CI: 0.82 to 6.14)); very low certainty of evidence from 8 trials. This indicates that multimodal prehabilitation **may** improve health-related quality of life.
    - An improved walking capacity (mean difference: 43.4m on the 6-minute walk test (95% CI: 5.96 to 80.91)); very low certainty of evidence from 10 trials. This indicates that multimodal prehabilitation **may** improve walking capacity.
    - A shorter length of stay (mean difference: -0.53 days (-1.19 to 0.13); moderate certainty of evidence from 15 trials. The confidence intervals that cross the null indicate the impact of multimodal prehabilitation on length of stay remains **uncertain.**
- Component network meta-analysis comparing individual components identified exercise (aerobic and resistance) as the individual component most likely to improve all critical outcomes and nutritional optimization as the individual component likely to improve complications and length of stay.

4.1.2 Risk of bias & evidence quality

- Of the 186 randomized trials included, the authors report that only 23% were low risk of bias, 36% moderate, and 41% high risk of bias based on the Cochrane Risk of Bias tool.
- The overall certainty of evidence across outcomes was very low, largely due to within-study bias, imprecision, and incoherence (disagreement between direct and indirect evidence) among included trials.
- **Implication:**
    - The systematic review highlights consistent directional effects favouring prehabilitation but acknowledges low overall certainty of evidence because of included trials' methodological limitations. Therefore, the low certainty evidence suggests that multimodal prehabilitation may improve

severe complications, health-related quality of life, and physical recovery, but impact on length of stay remains uncertain.

4.2 Overall conclusion from published evidence

- **Effectiveness**:
  - The systematic review and network meta-analysis by McIsaac et al. (BMJ 2025) provides the most comprehensive synthesis to date and demonstrates consistent directional effects favouring multimodal prehabilitation compared with standard care. Across a large body of randomized evidence, multimodal programs were associated with a lower risk of postoperative complications, improvements in quality of life and walking capacity, and a possible reduction in length of stay, although the latter remains uncertain due to wide confidence intervals.
  - Importantly, component analyses suggest that exercise (aerobic and resistance) and nutritional optimization are the components most likely to drive benefit.
- **Certainty of evidence:**
  - Despite promising findings, confidence in these results is substantially weakened by methodological limitations of the underlying trials, including a high proportion of studies at moderate to high risk of bias, heterogeneity of interventions and populations, and imprecision in effect estimates.
  - As a result, the certainty of evidence for all critical outcomes was rated low to very low, indicating that true effects may differ meaningfully from reported estimates.
- **Implication**: The available evidence suggests that multimodal prehabilitation is promising and may improve selected postoperative outcomes, particularly reducing postoperative complications and enhancing preoperative functional capacity. However, the overall certainty of evidence remains very low, limiting confidence in the magnitude and consistency of these effects.

5. LOCAL EVIDENCE ON EFFECTIVENSS

5.1 Results from the MUHC Multimodal Prehabilitation Program (2021-2025)

5.1.1 Program overview

- The MUHC launched a Multimodal Prehabilitation Program at the Montreal General Hospital in 2021, building on its leadership in ERAS and prehabilitation research. The program provides individualized preoperative support, i.e. exercise training, nutritional supplementation, anxiety management, and medical optimization.
- This descriptive quality improvement study, based on local data collected between October 2021 and March 2025, reports preliminary outcomes of the impact of the program over three years of implementation.

5.1.2 Limitations of this analysis

- As there was no local control group, these analyses rely heavily on comparisons with external control groups drawn from the published literature, national benchmarks, and historical cohorts, which may not be fully comparable to the local patient population in terms of case mix, baseline risk, care pathways, and organizational context.
- The selection and justification of these comparators are not consistently described, and outcome definitions and time horizons vary across sources, limiting coherence and interpretability.
- In addition, observed differences may be influenced by confounding, selection bias (e.g., comparisons between prehabilitation completers and non-completers), and secular improvements in perioperative care rather than the prehabilitation program itself.
- **As such, these findings should be interpreted as descriptive and hypothesis-generating, supporting feasibility and contextual benchmarking rather than causal inference regarding program effectiveness.**

5.1.3 Population and Methods

- 646 adult surgery patients were enrolled in the prehabilitation program over the three-year period; 443 underwent surgery by June 2025.

- Eligible patients were candidates for major elective surgery: thoracic (34%), upper and lower gastrointestinal (27%), abdominal hernia (15%), gynecology (9%), and others (15%).
- Cancer patients comprised 60% of participants, of whom 40% received neoadjuvant therapy and 30% had stage III or IV cancer.
- Enrolled patients had a high prevalence of modifiable risk factors: frailty (30%), malnutrition risk (77% cancer), low functional status (59%), and comorbidities (80%).

5.1.4 Clinical and Functional Outcomes

Table 1 reports various outcomes, including LOS, complications and patient experience, monitored over three years of implementation. Overall, descriptive findings suggest outcomes comparable to or better than external benchmarks, but reliance on external comparators limits causal interpretation of these findings.

Table 1. Clinical and Patient Experience Outcomes: MUHC Prehabilitation Program

Outcome Domain	Population / Subgroup	Local Findings	Comparator / Reference
Length of Stay (LOS)	Cancer surgery patients	50% discharged within 3 days	ACS NSQIP prediction: 36% discharged ≤3 days
	Lung and colorectal cancer surgery patients	Median LOS: 3 days	Descriptive (no direct comparator)
	ASA III–IV patients admitted to ERAS wards (since 2023)	70% discharged within 3 days	Descriptive (internal trend)
Overall Complications	Cancer surgery patients	36% experienced ≥1 complication	Descriptive
	Non-cancer surgery patients	38% experienced ≥1 complication	Descriptive
Medical Complications	Cancer surgery patients	21% medical complications	Lower than reported in literature (JAMA Surgery 2023)[4]
Serious Complications	High-risk patients (n=256)	14% (cancer) vs. 18% (non-cancer)	Within ranges reported in literature
Readmissions	High-risk patients (n=256)	12% (cancer) vs. 5% (non-cancer)	Within predicted ranges reported in literature
Functional Recovery	Prehabilitation participants	Significant preoperative improvements vs. baseline: body composition (p=0.026), anxiety (p=0.002), quality of life (p=0.012)	Pre-intervention baseline
Patient Experience	Prehabilitation participants	Patients reported feeling physically and psychologically better prepared for surgery	Descriptive (number not reported)

Outcomes in program completers	Completed prehabilitation (n=148) vs. dropouts (n=103)	Completers had fewer complications and shorter LOS	Participants vs. dropouts
Disease-Specific Comparative Analysis	Propensity-score matched lung cancer patients	Lower complication rates (46% vs 65%; p=0.01), ICU admissions (2.7% vs 8.2%, p=0.04), and readmissions (6% vs 14%, p=0.21)	147 PS-matched historical controls[5]

5.1.5 Challenges and Areas for Improvement

Several challenges and opportunities for improvement became apparent over the implementation period:

- Home-based adherence tracking remains difficult: Digital tools (e.g., tele-prehabilitation) could be explored to improve compliance.
- 24% of referred patients decline participation: Improved education and engagement strategies for both patients and clinicians are needed.
- Burden of screening tools could be reduced to improve efficiency.
- Procedure-specific pathways (e.g., intensive respiratory physiotherapy for lung surgery) might further improve efficiency of the program.
- Sustainability and cost-effectiveness assessment is essential to support long-term program viability.

5.2 Conclusion from local effectiveness studies

- While the effectiveness results should be interpreted as contextual and not as definitive evidence of clinical effectiveness due to high risk of bias, overall, the program demonstrates feasibility and potential value.
- There is a need to optimize patient and clinician engagement, develop better screening tools and procedure-specific pathways, and ascertain cost-effectiveness of the program to maximize impact and ensure sustainable integration into routine care.

6. LOCAL ECONOMIC EVIDENCE: COST AT THE MUHC

6.1 Cost evaluation in high-risk lung cancer surgery (Ghezeljeh et al. 2025; in press)

A local cost analysis assessed the economic impact of multimodal prehabilitation in high-risk lung cancer surgery patients, using a propensity score–matched cohort (142 prehabilitation vs. 142 controls) of patients who underwent surgery at the MUHC between 2018 and 2024.[6]

6.1.1 Key Findings

- **Clinic operating cost:**
  - Using a bottom-up microcosting approach based on observed resource utilization for 142 patients, program operating costs were calculated at the patient level using visit frequency, session duration, and discipline-specific hourly rates, yielding a total cost of $54,979 per year ($387 per patient).
- **60-day post-operative costs to the hospital:**
  - Healthcare utilization costs (nursing costs in OR and ICU, laboratory tests, medications, ICU admissions, LOS) from surgery to 60 days post operation were compared between patients who received prehabilitation and the control group. The prehabilitation group had fewer overall complications (44.6% vs. 64.7%, p=0.001); fewer ICU admissions (2.1% vs. 8.4%, p=0.03); shorter hospital LOS (median 3 vs. 4 days, p=0.05); and fewer readmissions (6.3% vs. 13.3%, p=0.04).
  - These resulted in total costs of $2.08M in the prehabilitation group vs. $3.07M for the controls.
- **Cost impact of prehabilitation:**
  - Using a per-diem cost analysis, differences between the two groups in index hospitalization LOS and readmissions LOS were translated into cost differences by using a fixed mean unit cost of hospitalization per day of $1,872.
  - Assuming clinic operating costs of $54,979 per year, reductions in LOS due to prehabilitation would result in a net savings of $721,901 (95% CI: ($552,365 to $916,320) annually, equivalent to $5,084 saved per patient.

6.2 Conclusion from economic evidence

- This retrospective analysis of MUHC data found that multimodal prehabilitation is cost-saving for high-risk lung cancer surgery patients, highlighting its potential as a cost-effective intervention in perioperative care.
- The main limitation of this analysis is that it is a bottom-up, patient-level costing analysis, which accounts only for direct observed costs, and does not include protected staff time, coordination, follow-up care and clinical operational costs, thus limiting extrapolation to the actual program operating costs.

6.3 Estimated MUHC Operation Costs of the Prehabilitation Program

- A top-down program-level costing approach that accounts for protected multidisciplinary staff time (formally funded allocation of staff effort dedicated to the prehabilitation program for both direct patient care and essential non–patient-facing activities including care coordination and follow-up visits for existing patients) required to deliver and sustain the service for approximately 200 new patients would yield an estimated total cost of $350,000 per year.

7. MUHC STAKEHOLODER PERSPECTIVE

7.1 Qualitative study of stakeholder perspectives (Gillis et al. 2025)

This qualitative study included 61 interviews with MUHC stakeholders (10 patients; 45 healthcare professionals including perioperative care physicians, nurses, dieticians and physiotherapists; and 6 hospital administrators), conducted between June 2022 and December 2023.[7] It reported on the following local stakeholder insights:

7.1.1 Mission of prehabilitation at the MUHC:

- Stakeholders agreed that prehabilitation should be patient-centred and integrated with ERAS and surgical services to not duplicate existing preoperative services.

- The mission of prehabilitation should align with the needs of a tertiary care centre, focusing on high-risk patients with modifiable risk factors (e.g., reduced physical function or malnutrition).
- To that end, clear inclusion and discharge criteria were viewed as essential to avoid dilution of benefit and inefficient use of limited acute-care resources, thereby supporting **value-based healthcare**, i.e. delivering a high-quality patient experience while optimizing resource use.

7.1.2 Core components and enablers:

- **Exercise and nutrition** were identified as the two essential and equally important components of prehabilitation, with psychosocial support enabling adherence.
- Critical enablers included early systematic screening to identify patients at risk for poor surgical outcomes, clear referral pathways, strong surgeon buy-in, interdisciplinary communication, and the use of digital tools for screening and data collection.

7.1.3 Outcomes that matter to stakeholders:

- Stakeholders valued a broad outcome framework, combining traditional clinical outcomes (complications, length of stay), process indicators (adherence, penetration, implementation cost), and patient-reported experience and outcomes.
- Patients prioritized feeling supported and informed, while clinicians and administrators emphasized readiness for discharge and reduced resource burden.

7.1.4 Implementation enablers:

- Success depends on early patient identification and referral, streamlined communication across teams, and improving awareness of the program for staff and patients.

8. KEY TAKEAWAYS AND CONCLUSIONS

8.1 Key takeaways

- **Updated evidence suggests prehabilitation shows consistent, though low-certainty, clinical benefit.**

Recent evidence from a large network meta-analysis of 187 randomized controlled trials shows consistent directional benefits of multimodal prehabilitation (exercise, nutrition, and psychological support), particularly reductions in postoperative complications and improvements in functional capacity and quality of life. Confidence in these effects remains limited by very low certainty of evidence due to within-study bias and imprecision of effect estimates.

- **Local MUHC data support feasibility and potential value.** Three years of real-world implementation data demonstrate successful delivery to a high-risk population, favourable outcomes compared with external benchmarks, and positive patient experience. While absence of a local control group and reliance on heterogeneous external comparators limit causal interpretation of effectiveness data, valuable lessons for implementation and improvement were extracted.
- **Economic findings are encouraging for high-risk lung cancer patients.** A local propensity score–matched cost analysis suggests that multimodal prehabilitation may be cost-saving in high-risk lung cancer surgery, driven by fewer complications, ICU admissions, and readmissions.
- **Stakeholders emphasize targeted, value-based implementation.** Local stakeholders (patients, clinicians, and administrators) strongly support prehabilitation when it is patient-centred, integrated with ERAS, and targeted to high-risk patients with modifiable risk factors. Clear referral criteria, early identification, strong interdisciplinary communication, and patient/clinician buy-in were identified as critical to sustainability.
- **Exercise and nutrition appear to be the core active components.** The component network meta-analysis as well as local stakeholder feedback identified exercise and nutritional optimization as the components most likely to drive benefit, supporting a focused, risk-targeted approach rather than broadly applied, resource-intensive programs.

8.2 Overall conclusion

- **Clinical value:** Multimodal prehabilitation consistently shows potential to reduce postoperative complications and improve functional outcomes, though published evidence remains low certainty.
- **Local impact**: Local MUHC experience over three years demonstrates that prehabilitation is feasible, acceptable to patients and clinicians, and aligned with institutional priorities for ERAS and value-based care. Descriptive outcome data

suggest performance comparable to or better than external benchmarks, but methodological limitations, such as reliance on external comparators, mean these findings should be interpreted as supportive but not definitive evidence of effectiveness.

- **Economic case**: Local economic evaluation shows prehabilitation is cost-saving in high-risk lung cancer surgery patients.
- **Strategic opportunity**: Taken together, the convergence of updated evidence, local MUHC data that supports feasibility and stakeholder acceptability, and local economic findings that demonstrate cost savings for the hospital, suggests that multimodal prehabilitation represents a valuable, patient-centred intervention for selected surgical populations at the MUHC.

9. RECOMMENDATIONS

Funding through the hospital operating budget is justified, with defined scope, targeted population, and ongoing evaluation requirements.

- This recommendation is based on the following:
  - The best available evidence, although of low-certainty, consistently shows that multimodal prehabilitation may reduce postoperative complications and improve functional outcomes, without safety risks.
  - A local economic analysis found that prehabilitation in high-risk lung cancer surgery patients resulted in net annual savings of $721,901 or $5,084 per patient in this subgroup, driven by reduced healthcare utilization costs.
  - Local implementation aligns with stakeholder consensus that **prehabilitation should be targeted to high-risk patients with modifiable risk factors**, where the likelihood of benefit and cost avoidance is greatest. This mitigates the risk of inefficient resource use and dilution of effect.
  - The current program is integrated with ERAS, supports institutional priorities related to quality, patient experience, and resource stewardship, and has demonstrated feasibility and stakeholder buy-in.
- Continued implementation of this program should ensure:
  - The program remains targeted to high-risk surgical patients (e.g., frailty, poor functional capacity, malnutrition, high predicted complication risk), with clear inclusion and discharge criteria.

- Increased awareness of the program among clinicians and patients to improve its impact.
- Improved data collection support to facilitate ongoing evaluation and accountability, with need for routine collection of:
  - Complications, ICU admissions, LOS, and readmissions
  - Program uptake and adherence
  - Cost and resource utilization
  - Patient-reported experience and outcomes
- Cost analysis beyond lung cancer surgery patients to determine the cost impact in other surgical populations.

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