PERI OPERATIVE
PROGRAMME
PÉRI-OPÉRATOIRE

The impact of multimodal prehabilitation in colorectal cancer patients on postoperative lean body mass

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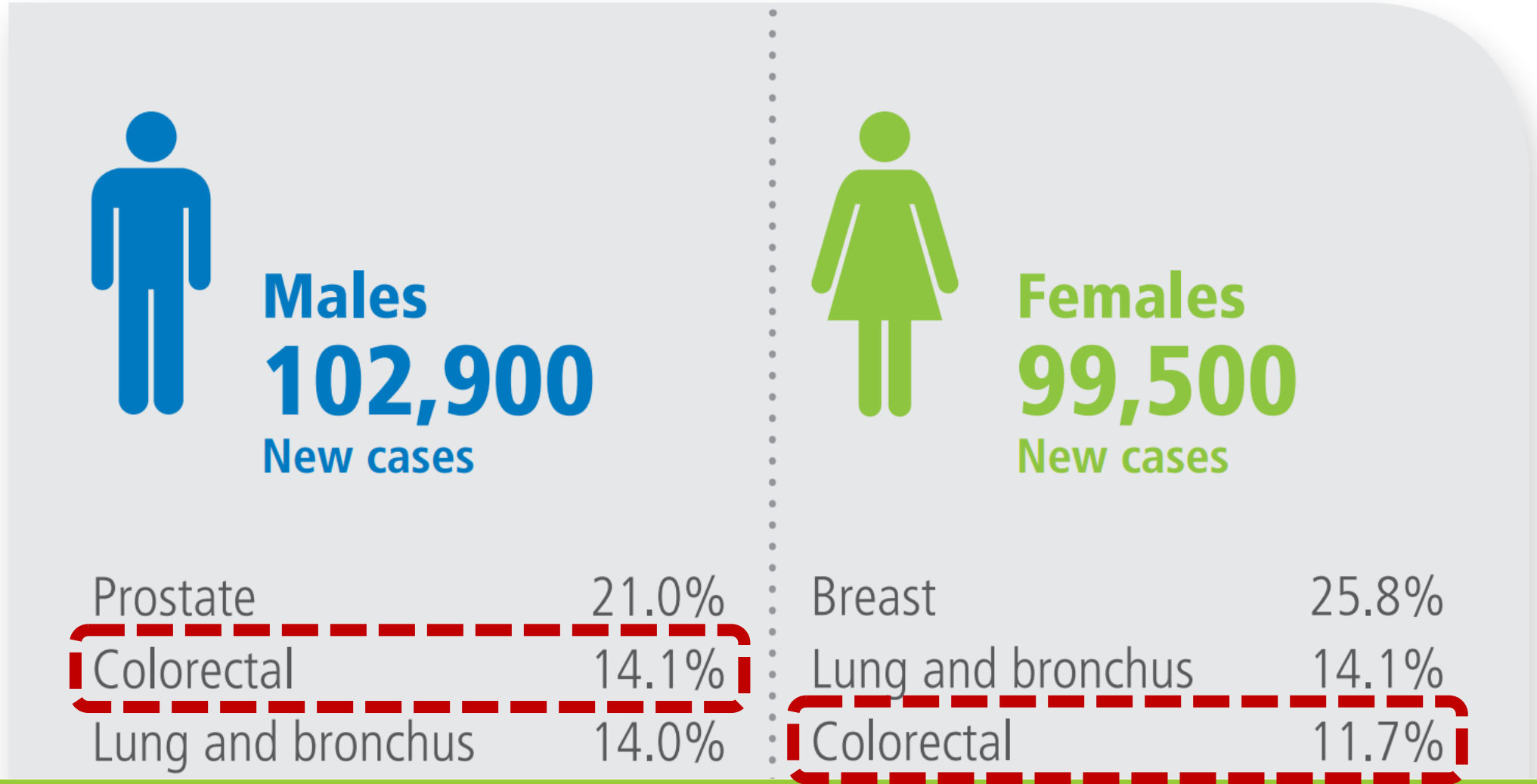
COMMITTEE MEMBER: DR. CELENA SCHEEDE-BERGDAHL

FIGURE 1.2 Percent distribution of estimated new cancer cases, by sex, Canada, 2016



Canadian Cancer Statistics 2016. (2016). Retrieved from cancer.ca/Canadian-Cancer-Statistics-2016-EN.pdf

Complications of Surgery

Postoperative complication rate of 21.1% to 30%

Associated Risk Factors	
Functional capacity	Age
Lean mass	Poor nutrition status
Muscle strength	Over- or underweight

Lucas, D. J. and T. M. Pawlik (2014). "Quality improvement in gastrointestinal surgical oncology with ACS National Surgical Quality Improvement Program." Surgery **155**(4): 593-601.
Ragg, J. L., D. A. Watters and G. D. Guest (2009). "Preoperative risk stratification for mortality and major morbidity in major colorectal surgery." Dis Colon Rectum **52**(7): 1296-1303.

Complications of Surgery

Focus on modifiable risk factors

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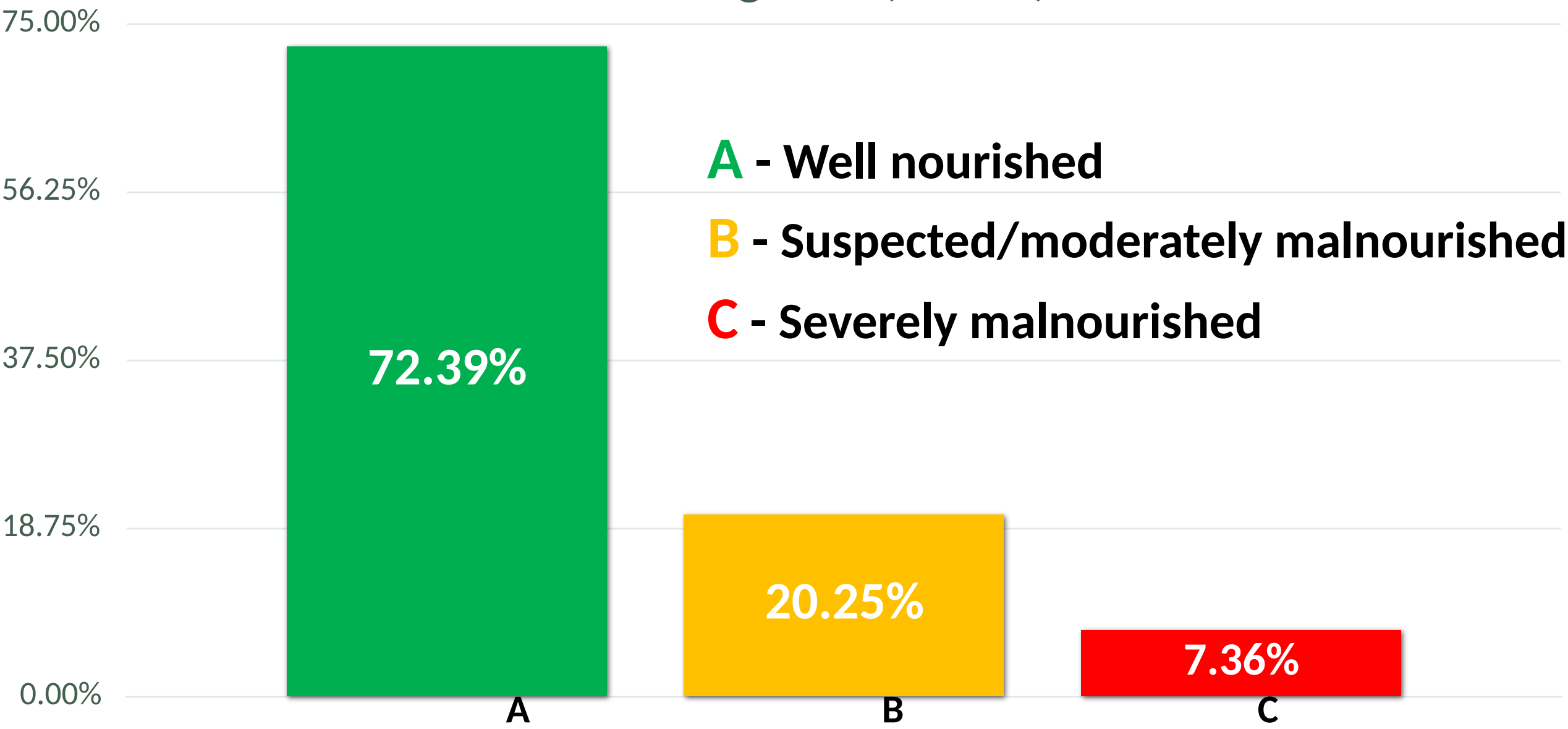
Patient Generated Subjective Global Assessment Categories (n=163)



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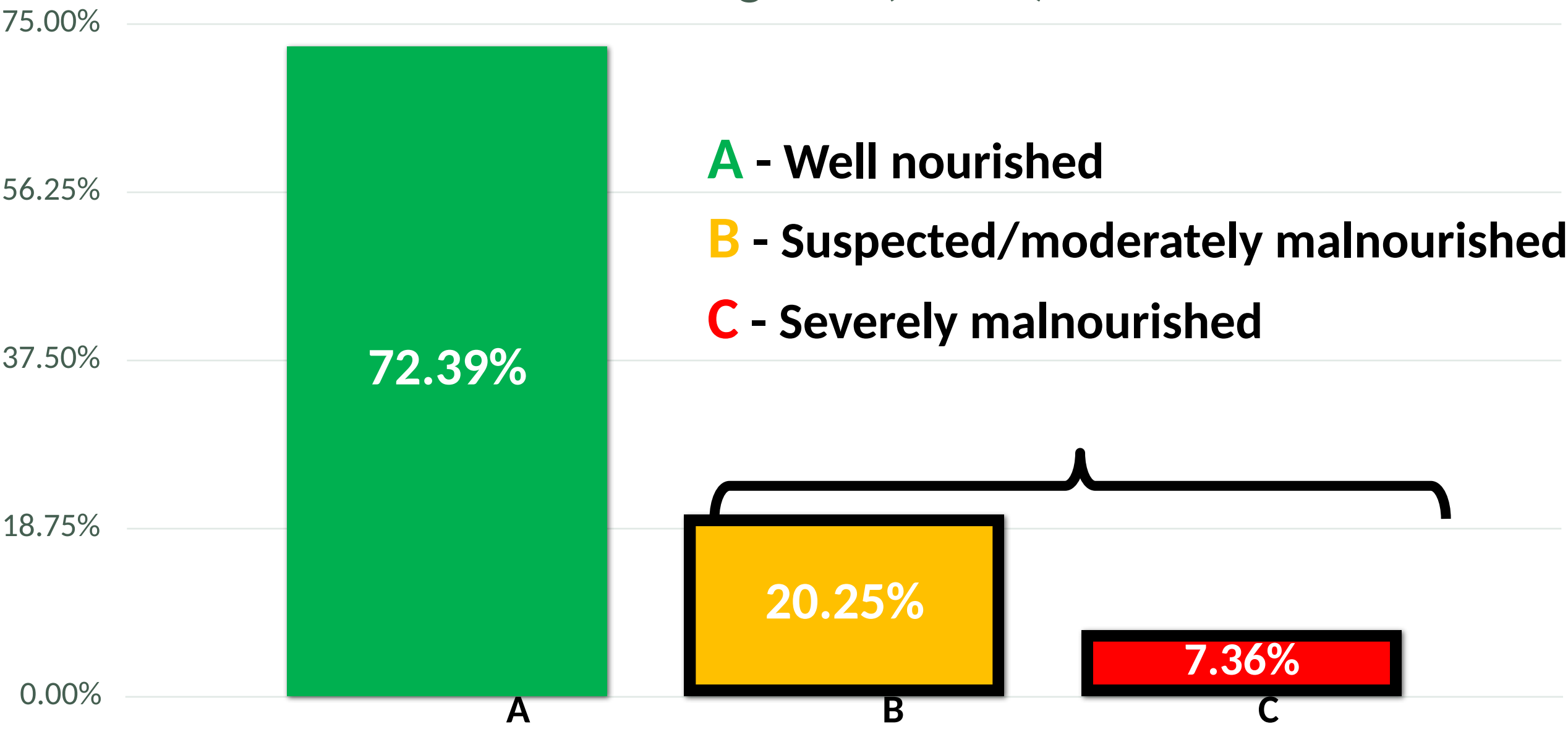

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Lean Body Mass By Nutritional Status at Baseline

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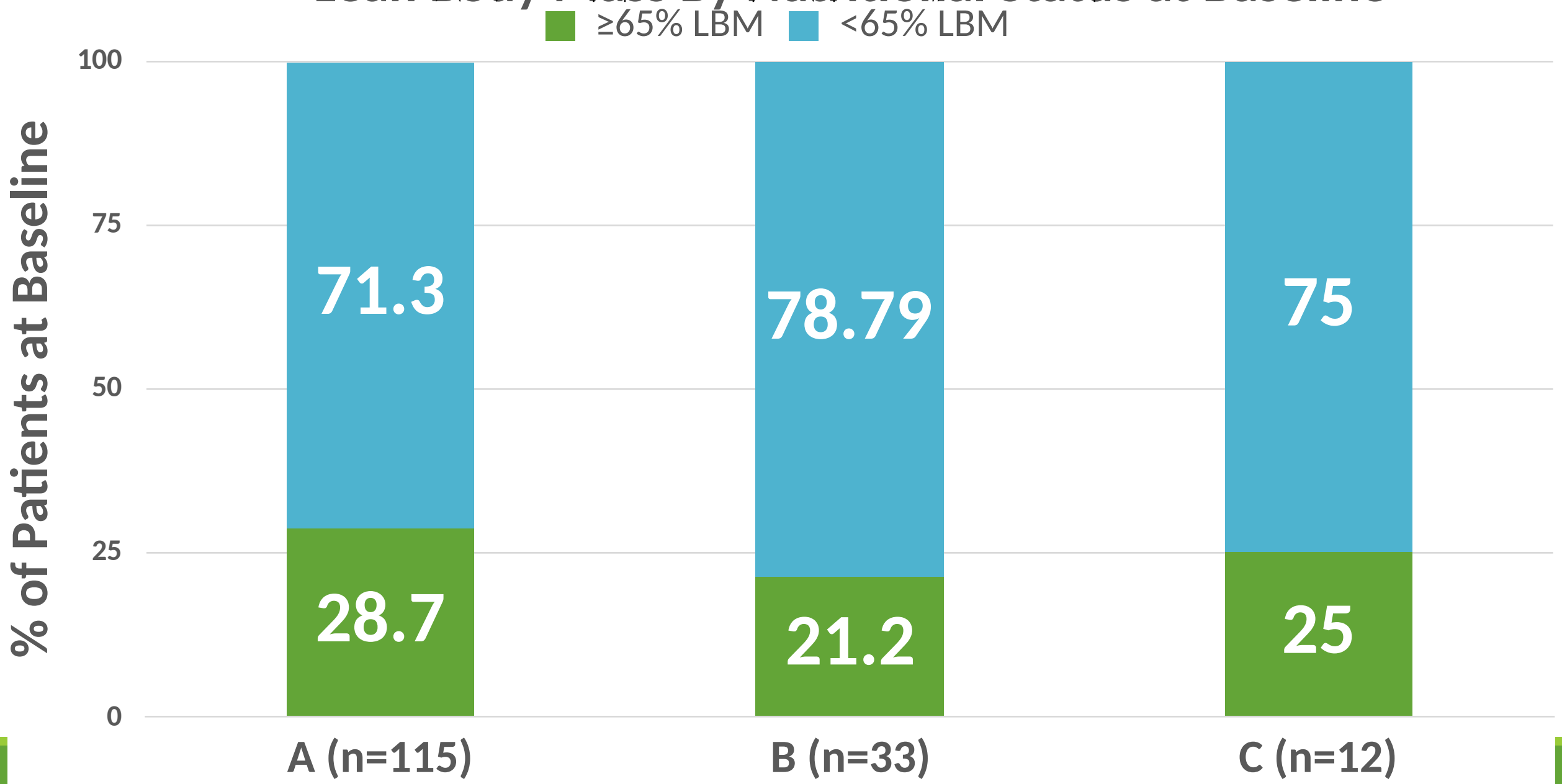

Functional Capacity By Nutritional Status at Baseline

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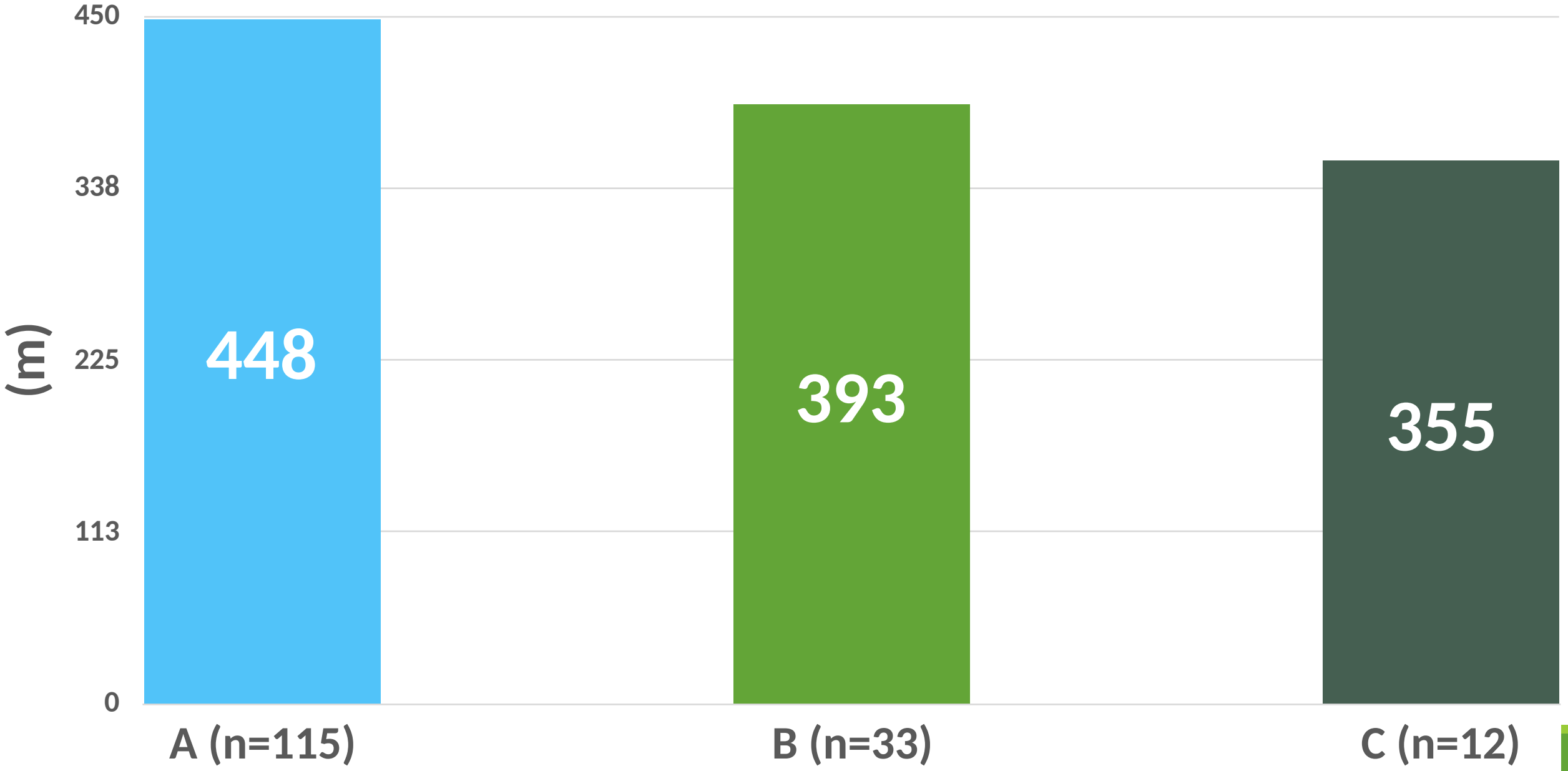
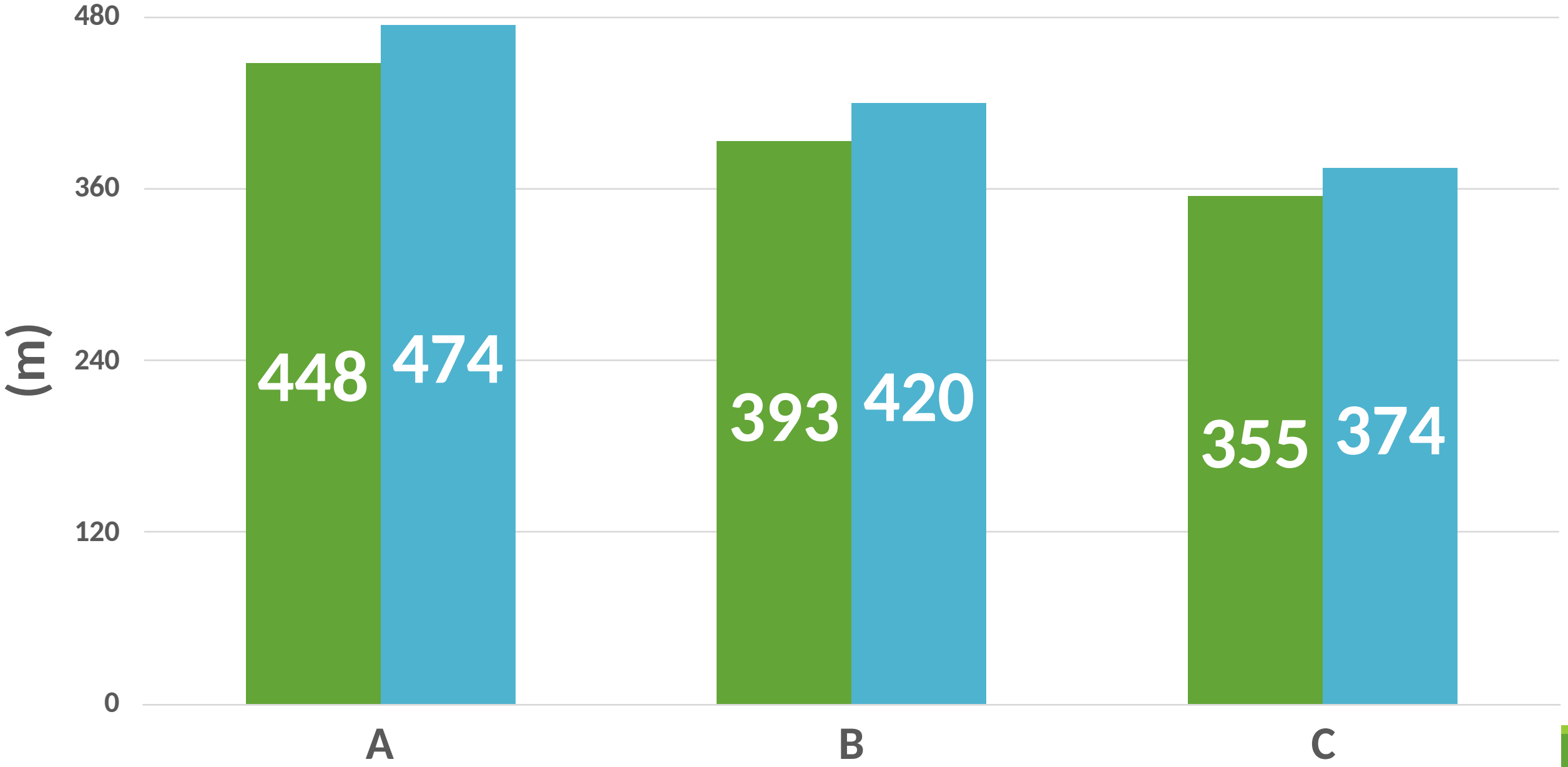


Functional Capacity By SGA Status: Baseline vs Preop

Carli, F. (2017). Database of preoperative colorectal patients (unpublished data), Montreal General Hospital.



One Month Post-Op

Study	n	Measure	Outcome
Christensen et al.	32	Fatigue (Visual analog scale)	33% had increased fatigue compared to baseline

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Lawrence, V. A., et al. (2004). "Functional independence after major abdominal surgery in the elderly." J Am Coll Surg **199**(5): 762-772.

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		Time up and go	60% below baseline
		Grip strength	68% below baseline
		Functional reach	61% below baseline

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		Time up and go	60% below baseline
		Grip strength	68% below baseline
		Functional reach	61% below baseline
Jensen et al.	385	Body composition (DXA/BIA)	Total/lean/fat mass all decreased
		Fatigue (vertical numerical rating scale)	30% reported high fatigue
		Grip strength	37% below baseline

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Jensen et al. (2011). "Postoperative changes in fatigue, physical function and body composition:" Colorectal Dis **13**(5): 588-593.
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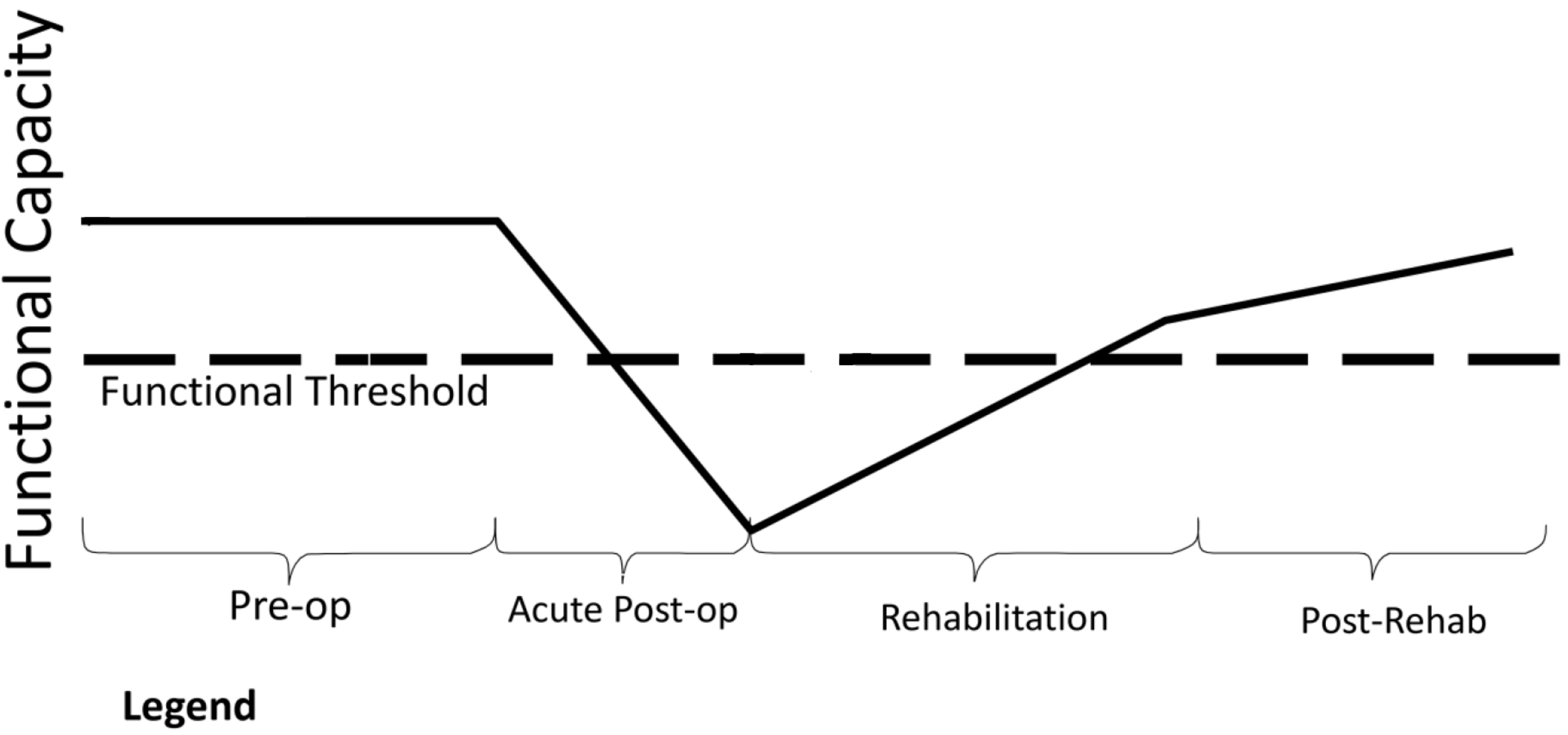

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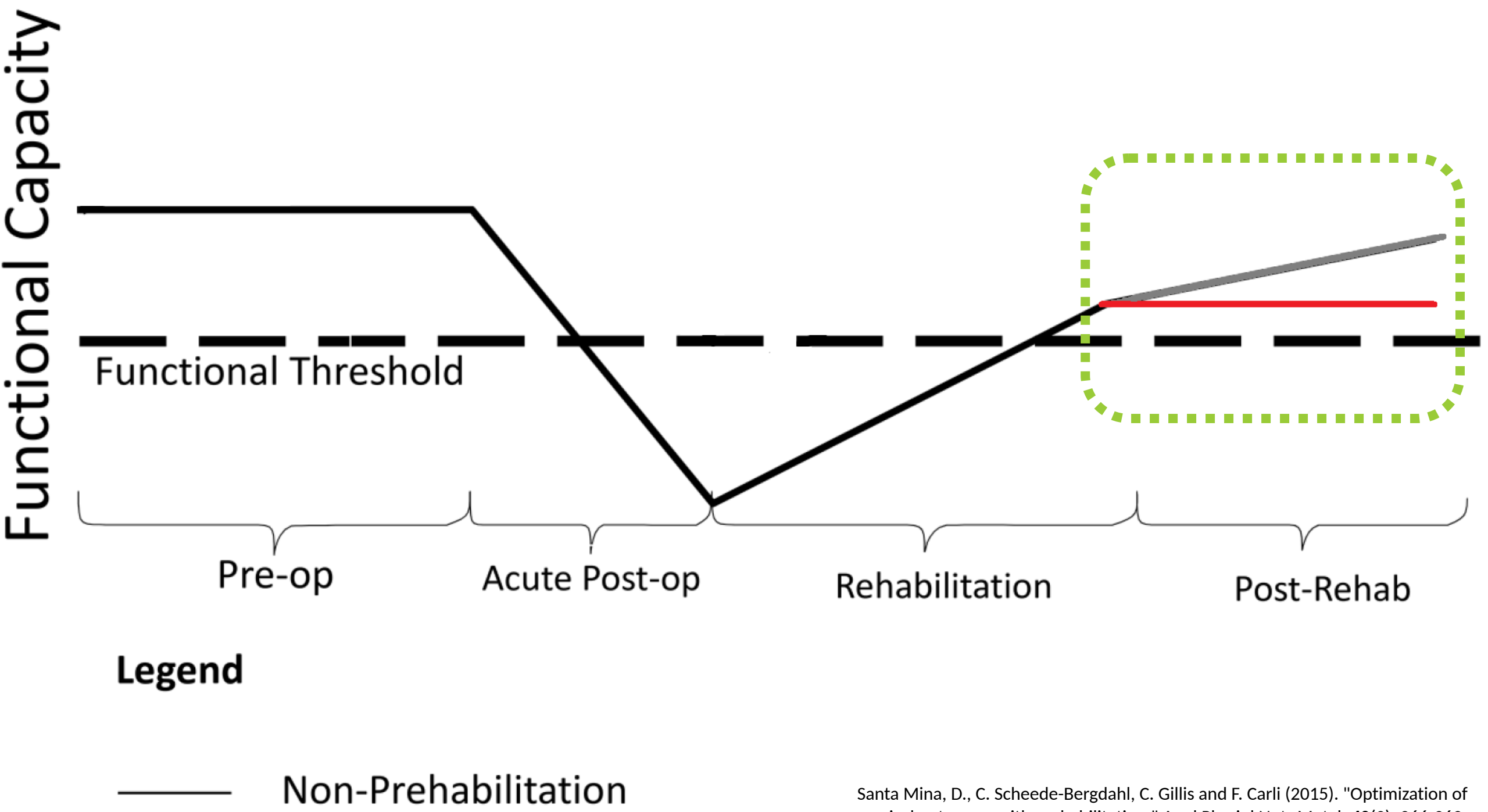

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Traditional Approach

Rehabilitation

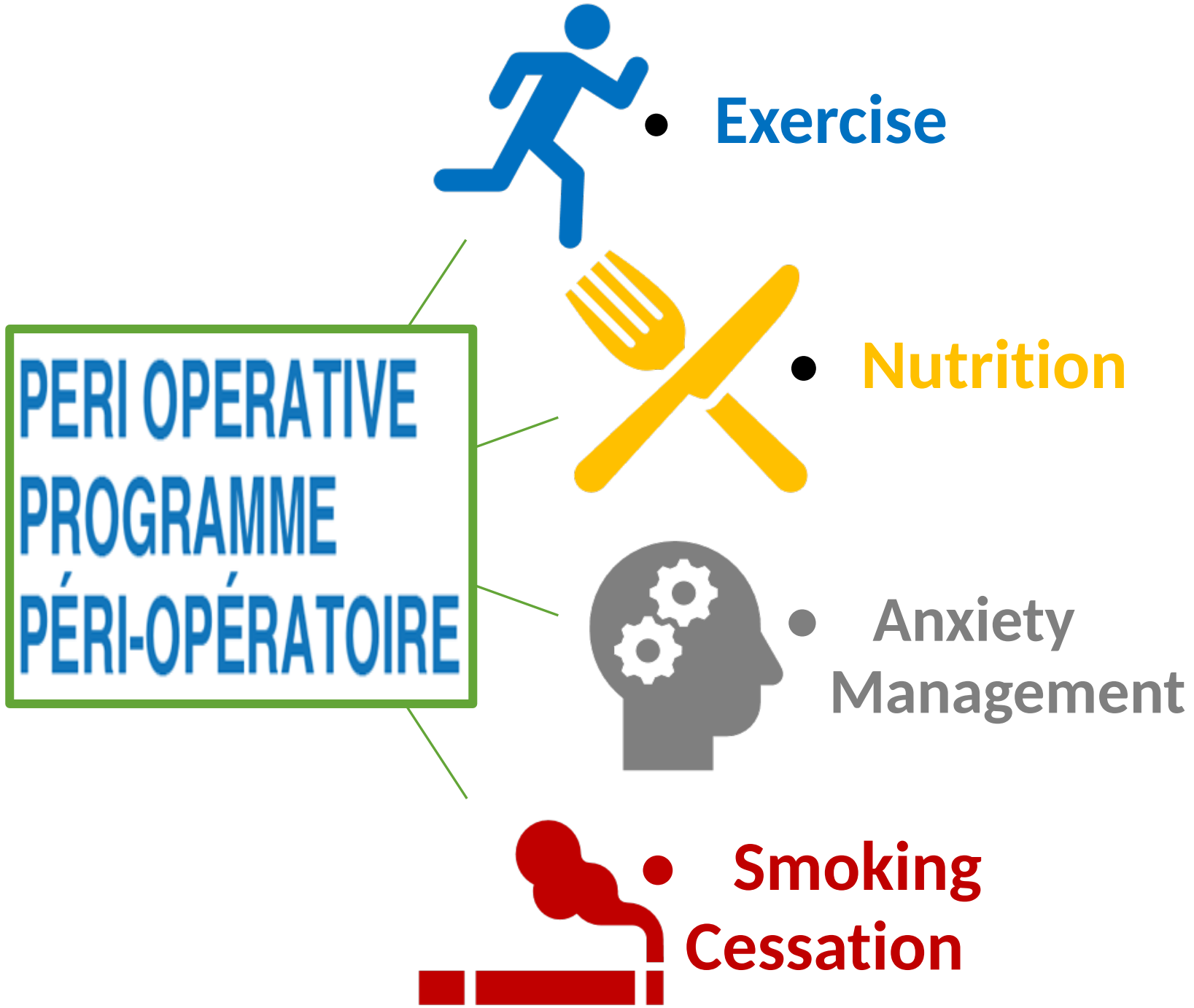
- Efforts at accelerating recovery have focused on the **post**operative period
- An inopportune time to alter nutrition and exercise
  - Patients are fatigued
  - Worried about exacerbating recovery
  - Stress/anxiety over additional treatments
- New approach: **Pre**habilitation before surgery

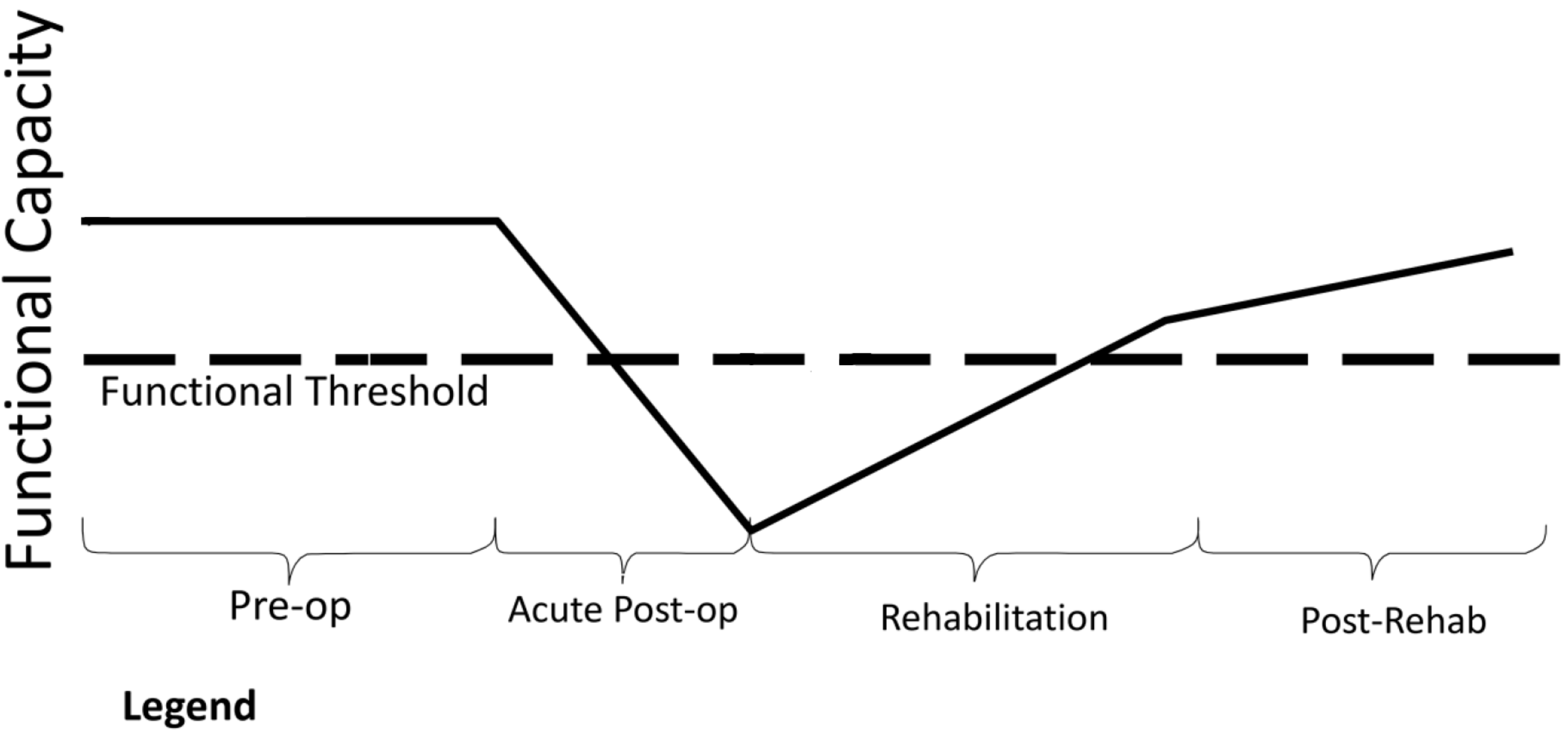
What Is Prehabilitation?

The process of augmenting a patient's functional capacity to **optimize physiologic reserves** so that they might withstand the stressor of inactivity associated with a surgical insult.

Carli, F. and G. S. Zavorsky (2005). "Optimizing functional exercise capacity in the elderly surgical population." Curr Opin Clin Nutr Metab Care **8**(1): 23-32.

Components of Multimodal Prehab





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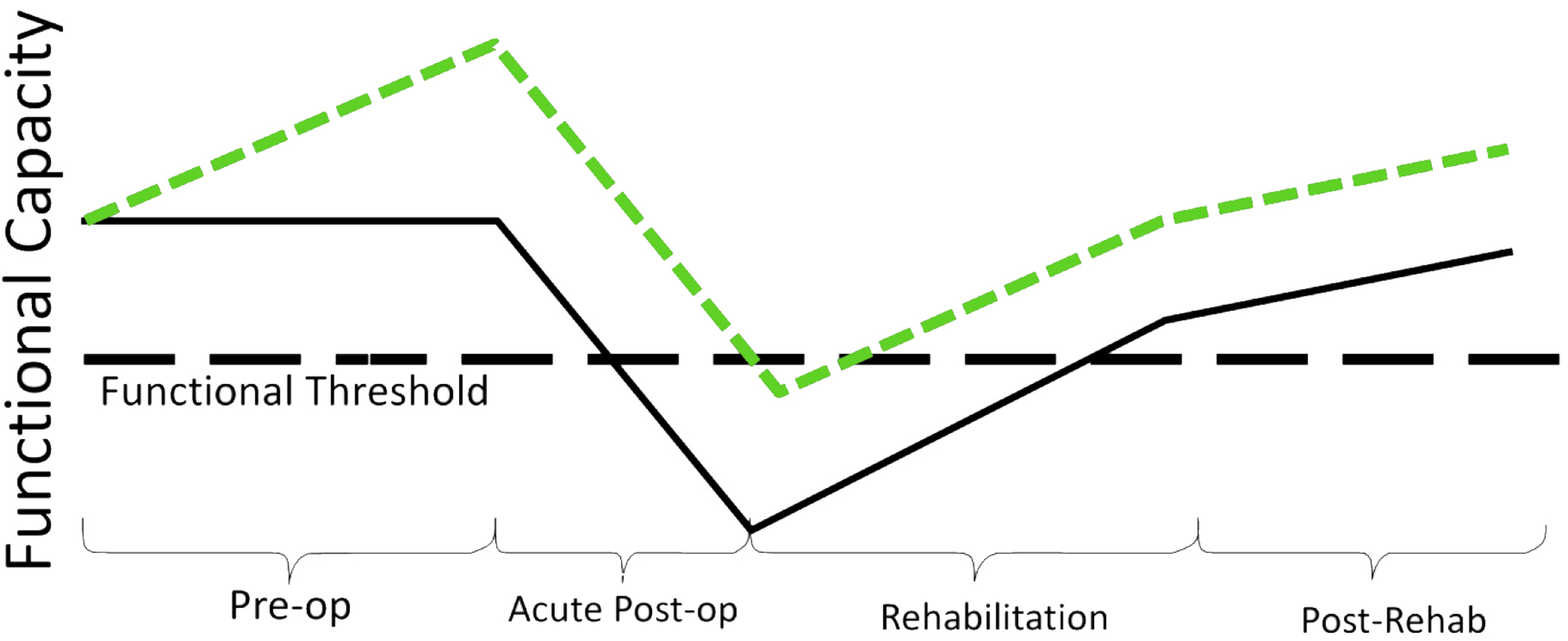


Legend

Prehabilitation

Non-Prehabilitation

Santa Mina, D., C. Scheede-Bergdahl, C. Gillis and F. Carli (2015). "Optimization of surgical outcomes with prehabilitation." Appl Physiol Nutr Metab **40**(9): 966-969.

The Importance of Lean Mass

Low lean body mass in CRC patients is correlated with:

- Increased postoperative complications
- Slowed recovery of bowel functions
- Extended hospital stays
- Higher re-admission rates and costs
- Higher levels of fatigue
- Reduced quality of life

Braunschweig, C., et al. (2000). "Impact of declines in nutritional status on outcomes in adult patients hospitalized for more than 7 days." J Am Diet Assoc **100**(11): 1316-1322; quiz 1323-1314.
Garth, A. K., et al. (2010). "Nutritional status, nutrition practices and post-operative complications in patients with gastrointestinal cancer." J Hum Nutr Diet **23**(4): 393-401.

The PREHAB Study

Study Design: International multicenter, prospective, randomized controlled trial (n=708). Our center is responsible for n=100.

Study Population: Adult (≥18) patients undergoing elective surgery for colorectal cancer at the Montréal General Hospital

The PREHAB Study

Intervention:

- **Intervention group**: Receives 4 weeks prehabilitation
- **Control group**: Receiving no prehabilitation
- **Both groups:** 8 weeks rehabilitation post-op (Enhanced Recovery After Surgery (ERAS) guidelines, which is standard care)

Study Questions & Objectives

1. **What is the effect of a multimodal prehab program on lean mass accrual? Is the intervention providing a big enough stimulus to slow the loss of lean mass loss compared to control (standard care)?**
2. **Are patients consuming enough protein in the postoperative period? Is there a carry-over effect in the intervention group? Is more intensive dietary counseling needed in the post-op window?**

Study Schedule

INTERVENTION GROUP

	Weeks Pre-Op				Operation	Weeks Post-Op	
Week	-4	-3	-2	-1	0	+4	+8
Schedule	Test Day			Test Day		Test Day	Test Day
	Exercise	Exercise	Exercise	Exercise			
	← ← Ongoing: Exercise/diet, protein supplement, smoking cessation → →						

CONTROL GROUP

	Weeks Pre-Op				Operation	Weeks Post-Op	
Week	-4	-3	-2	-1	0	+4	+8
Schedule	Test Day			Test Day		Test Day	Test Day
	← ← Ongoing: Exercise/diet, smoking cessation → →						

Exercise Intervention

	CONTROL	INTERVENTION
Exercise	• Standard care • Unsupervised at home exercise like walks, stretching • Practice some deep breathing occasionally	• Supervised high intensity training (HIT) and resistance training 3x/week • At home training 4x/week • 60 minutes of low to moderate intensity exercise

Exercise Intervention

Exercise Dose (FITT)

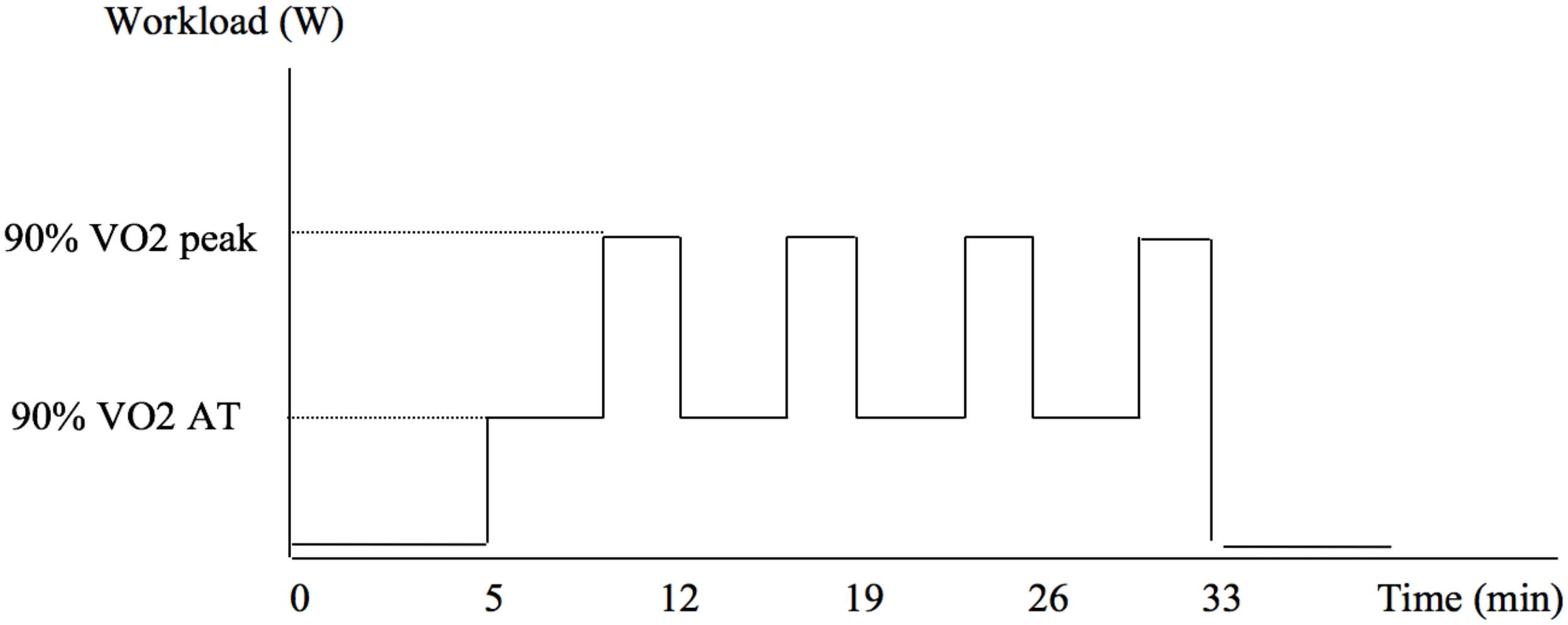
- **F**requency – how often is the exercise performed
- **I**ntensity – how hard you exercise
- **T**ime – total duration
- **T**ype – the kind of exercise undertaken

Exercise Intervention

Participants will undergo a cardiopulmonary exercise test (CPET) and the exercise intensity will be individualized based on the CPET values.

- HIT = High-intensity interval training
- Performed for 28 minutes total on cycle ergometer
  - 4 intervals of moderate intensity (4 minutes @ x>90% of VO2peak)
  - 4 intervals of high intensity (3 minutes @ 90% of VO2 anaerobic threshold)
- Rate Perceived Exertion (RPE) of 15-17 on Borg scale of 6-20

Exercise Intervention



Exercise Intervention

Resistance training based on 1 repetition maximum (1RM) estimation

- 2 sets of 10 repetitions of 6 exercises:
  - **Leg press** – performed on NuStep with resistance on
  - **Chest press** – on a flat bench with dumbbells
  - **Abdominal crunch** – seated or, if possible, supine on the floor
  - **Lat pull down** – using resistance bands attached to elevated hook
  - **Low row** – seated, with resistance bands
  - **Step up** – performed on 18.5 cm platform

Exercise Intervention

- **Volume will be progressively increased week over week**
  - In week 1 using 65% of calculated 1RM (baseline)
  - In week 2 using 70% of calculated 1RM (baseline)
  - In week 3 using 65% of calculated 1RM (at 3 weeks)
  - In week 4 using 70% of calculated 1RM (at 3 weeks)
- **Progress will be tracked via total volume per week**
  - Volume load = sets * repetitions * weight used

In-Hospital Training

High Intensity
Individualized
Interval Training

Protein
Supplementation

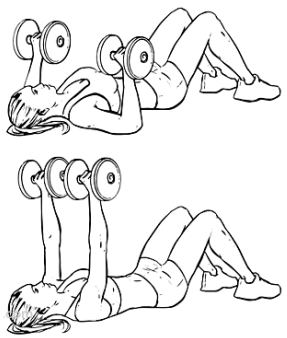
1
Cycling

2
Resistance

3
Protein

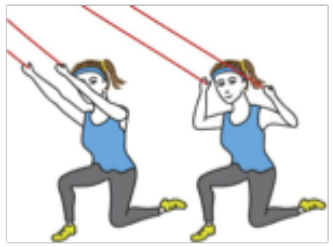
Resistance and Strength Training

Leg Press (NuStep)



Chest Press

Abdominal Crunch



Lat Pull Down

Low Row

Step Up

Nutrition Intervention

	CONTROL	INTERVENTION
DIET	• Try to eat well throughout the day • Follow the recommendations given to you by your dietitian	• Increase protein to 1.5-1.8 g/kg/day • Consume protein before bed • Balance out protein intake between meals • Consume protein drink within 30 minutes of in-hospital workouts • Provide whey protein isolate supplement as needed

Nutrition Intervention

- **Nutritional status will be tracked using the PG-SGA**
  - Four screenings at -4, -1, +4, and +8
  - Appropriate nutritional advise will be given regardless of group
- **Intake will be tracked using 3-day food diaries and 24-hour recall**
  - Four 3-day food diaries at -4, -1, +4, and +8
  - Three 24-hour recalls take postoperatively at +1, +2, and 3+ weeks

Lean Mass Assessment

- **Body composition assessment via DXA scan at -4, -1, +4, and +8**
- **Standardized testing procedures**
  - Same or similar clothing
  - In the morning after overnight fast, if possible.
  - No exercise prior
  - Hydrated (but not over- or dehydrated)
  - No recent major dietary changes in the 3 days prior
  - Same equipment, software, technician, and body position

CONTROL & INTERVENTION

Psychological Coping	Patients receive 1.5 hours of instruction in the first session and more sessions during the 4 weeks of prehabilitation if necessary. The goal is to provide anxiety reduction and avoid depression.
Smoking Cessation	Intensive counseling and nicotine replacement therapy (NRT) will be offered to all patients during the 4 weeks prior to the surgery.

Statistical Analysis

The sample size calculation is based on the primary outcome of differences in lean body mass. An α of 0.05, β of 0.2, and power of 0.80 (two-sided test) will be used with an expected dropout rate of 10%. Sample size needed would be 36 participants, 18 per group.

A one-way repeated measures ANOVA will be used to determine the effect of treatment on lean body mass and protein intake differences between groups. Statistical significance is defined as $p < 0.05$.

Significance

Results will provide data that may be useful to examine if current PREHAB approaches are resulting in sufficient lean mass accretion and preservation.

Additionally, we can examine patient protein intake post-op to see if future approaches may need to be altered to increase odds of favorable outcomes.