

# Enhanced Recovery After Surgery

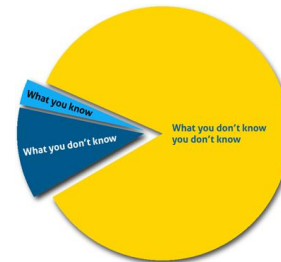
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## Prehabilitation: The New Normal

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## Sponsor Disclosure

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## Objectives

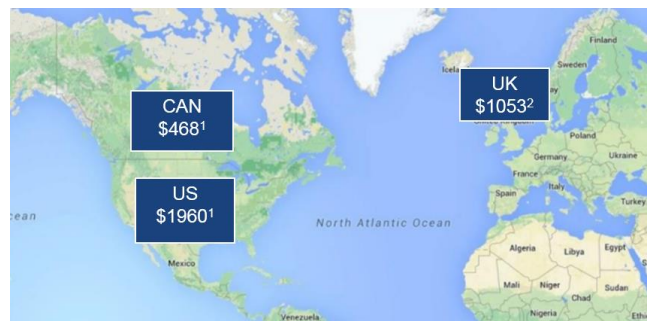
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- Understand the importance of Prehabilitation as a foundation for a strong Enhanced Recovery Program (ERP).
- Discuss various components of Prehabilitation, to include exercise, education, nutrition (immunonutrition and carbohydrate loading).
- Describe the implementation of an immunonutrition protocol within an ERP bundle.



## Cost per Hospital Day

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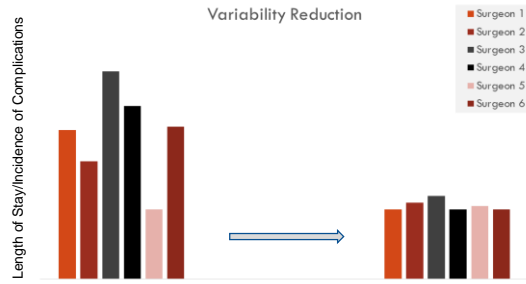


1. Lee, Ann Surg. 2014. 2. National Health Service. Personal Social Services Research Unit, Unit Costs of Health & Social Care 2011.

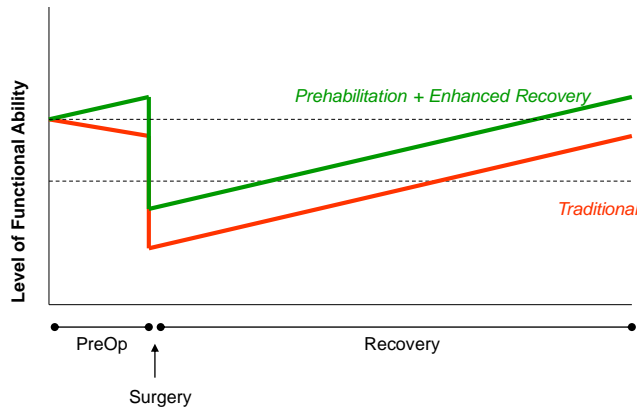


# Current Surgical Challenges

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Randomized clinical trial

## Randomized clinical trial of prehabilitation in colorectal surgery

F. Carli<sup>1</sup>, P. Charlebois<sup>2</sup>, B. Stein<sup>2</sup>, L. Feldman<sup>2</sup>, G. Zavorsky<sup>5</sup>, D. J. Kim<sup>3,4</sup>, S. Scott<sup>3,4</sup>  
and N. E. Mayo<sup>3,4</sup>

Departments of <sup>1</sup>Anesthesia and <sup>2</sup>Surgery and <sup>3</sup>Division of Clinical Epidemiology, McGill University Health Centre, <sup>4</sup>School of Physical and Occupational Therapy, McGill University, Montreal, Quebec, Canada, and <sup>5</sup>Department of Pharmacological and Physiological Science, Saint Louis University, Saint Louis, Missouri, USA

Correspondence to: Dr F. Carli, Department of Anesthesia, McGill University Health Centre, 1650 Cedar Avenue, Room D10-144, Montreal, Quebec, Canada H3G 1A4 (e-mail: franco.carli@mcgill.ca)

### Interventions

Biking/Exercise Program vs. Walking/Deep Breathing

### Findings

Walkers did better than bikers

Compliance was terrible



Carli. British J of Surgery. 2010

## Impact of a trimodal prehabilitation program on functional recovery after colorectal cancer surgery: a pilot study

Chao Li · Francesco Carli · Lawrence Lee · Patrick Charlebois · Barry Stein ·  
Alexander S. Liberman · Pepa Kaneva · Berson Augustin · Mingkwan Wongyingsinn ·  
Ann Gamsa · Do Jun Kim · Melina C. Vassiliou · Liane S. Feldman

### Interventions

Nutrition, anxiety reduction, exercise

### Findings

Functional recovery better at 1 & 2 mo vs. controls

LOS and surgical outcomes similar



Chao. Surg Endoscopy. 2013

# Prehab Literature Summary

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- Exercise
  - ▣ Moderate exercise (3x/wk, for 2-3wks) provides measurable improvements in postoperative ambulation and subjective well-being
- Anxiety reduction
  - ▣ Preoperative interventions MAY identify patients at risk for pain/anxiety
- Incentive spirometry (IS)
  - ▣ Pre-op IS and/or deep breathing exercises x2wks improve lung max inspiratory pressure, and prevent post-op declines in lung function
- Smoking cessation
  - ▣ Pulmonary complications decrease at 8wks, wound healing improvements at 3wks
- Immunonutrition



# Different Types of Nutrition

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## □ Standard Nutrition

- ▣ Benefit derived primarily from protein and calories
- ▣ Addresses malnutrition by improving nutritional status
- ▣ ≥ 2-4 weeks duration required

## □ Surgical Immunonutrition

- ▣ Benefit is not derived primarily from protein and calories
- ▣ Additive ingredients modulate immune, vascular and inflammatory responses.
- ▣ Meets distinct nutritional requirements of the surgery and trauma patient to improve recovery
- ▣ Shorter term (5-10 day perioperative period) duration



Kabata P et al. Supp Care Canc 2014;pub on line. Ekinci O et al. NCP 2016; pub on line. Alito Aprelino M and de Aguiar-Nascimento JE. Nutr Journal 2016;15:34. Drover JW et al. JACS 2011;212(3):385-399. Zhu X et al. Ann Surg 2014;259(1):171-8. Braga M et al. Surg 2002;132:805-14. Hess JR and Greenberg NA. NCP 2012;27(2):281-94. Morris CR et al. NCP 2017;32(1):305-475.

## A Brief Word about CHO Loading

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- CHO drink morning of surgery reduces insulin resistance
- Preop CHO beneficial to all patients undergoing major surgery (ESPEN Grade 0)
  - Colorectal, urology, pancreatic, hip/knee
  - Supports reduced LOS when used in combination with other ERP protocols
  - OK with DM 2, bowel prep
- What is a “carbohydrate drink”?



Weimann A et al. *Clin Nutr* 2017;36:623-650.

## “Eat Well Before Surgery”

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OR



## Questions Questions Questions

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- Are calories and protein enough?
- Does it matter if you're well nourished?
- When to start
- What to give
- What to do postop
- Isn't food just part of hotel management?



## Nutritional Loading

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- Preoperative malnutrition leads to prolonged length of stay and increased risk of infection
  - Carbohydrate loading as part of ERP improves outcomes
  - Immunonutrition improves outcomes greater than standard caloric supplements
  - Supplementing malnourished patients perioperatively reduces risk
    - How does a clinician determine nutritional status?



## Nutritional Loading

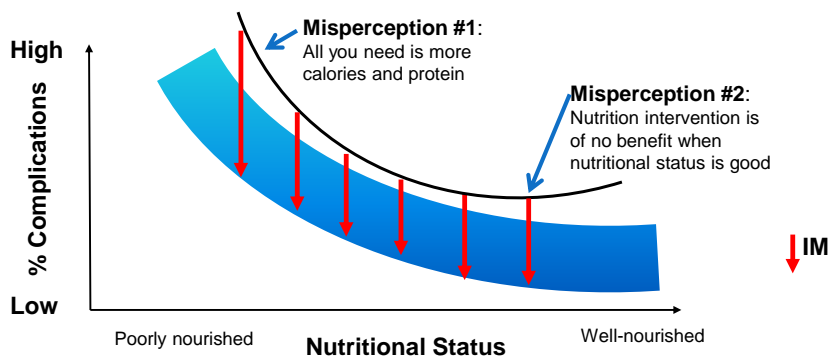
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  - Supplementing malnourished patients perioperatively reduces risk
    - How does a clinician determine nutritional status?
- Well nourished patients benefit from preoperative immunonutrition as well



## The Role of Immunonutrition (IM) in Major Elective Surgery Is Not About Calories and Protein

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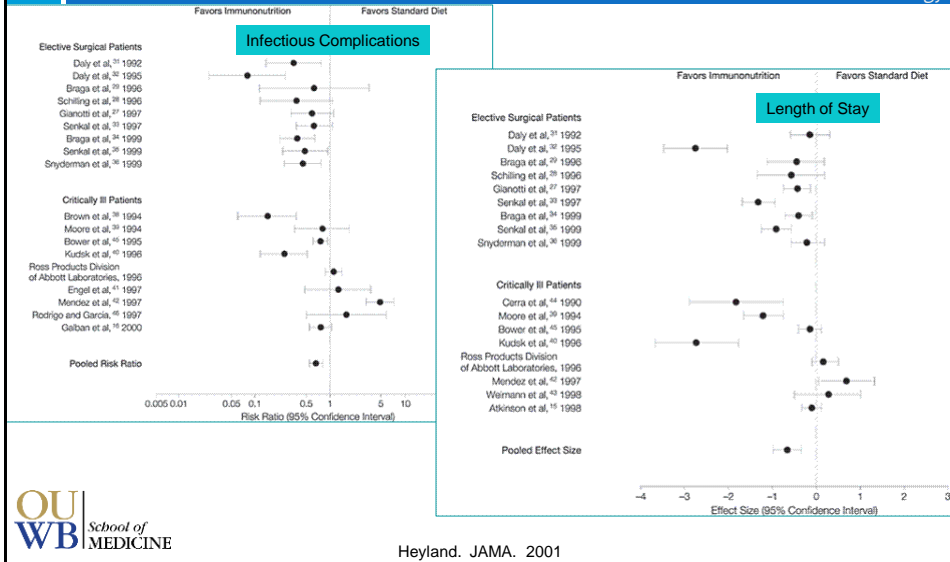


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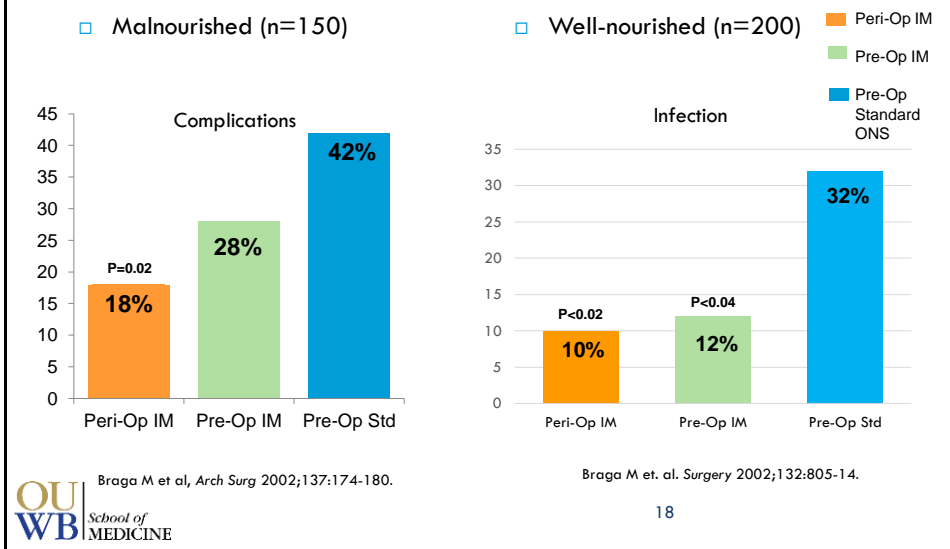
# Immunonutrition

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# Two Landmark RCTs- GI Cancer Surgery

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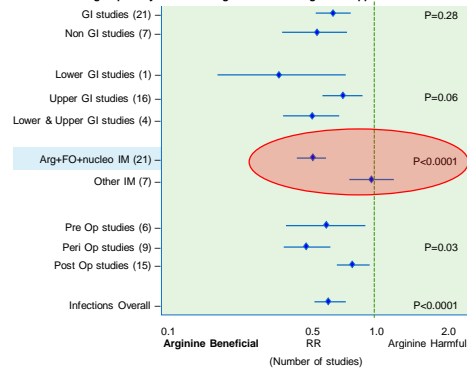


## Sub-analyses of Arginine-Supplemented (Immunonutrition) Formulas on Infection

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- Same benefit shown for GI surgery vs. non GI surgery
- Same benefit shown for Upper and Lower GI surgeries
- **Only Arg-n3-nucleotide formula showed statistically significant benefit when compared with other arginine supplemented (IM) formulas ( $p < 0.0001$ )**
- Peri-operative use showed greatest benefit ( $p = 0.03$ )

Figure 4. Results of Subgroup Analyses examining the Effect of Arginine Supplemented Diets on Infection



Drover et al. *J Am Coll Surg* 2011;212(3):385-399.

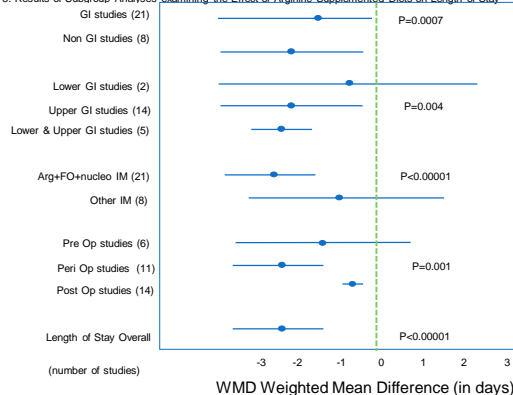


## Sub-analyses of Arginine Supplemented Diets on LOS

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- Significantly more benefit shown for:
  - ▣ Non GI surgery ( $p = 0.0007$ )
  - ▣ Upper GI Surgery ( $p = 0.004$ )
  - ▣ Use of an IM formula containing arg-n3-nucleotides ( $p < 0.0001$ )
  - ▣ Peri-operative use ( $p = 0.001$ )

Figure 5. Results of Subgroup Analyses examining the Effect of Arginine Supplemented Diets on Length of Stay

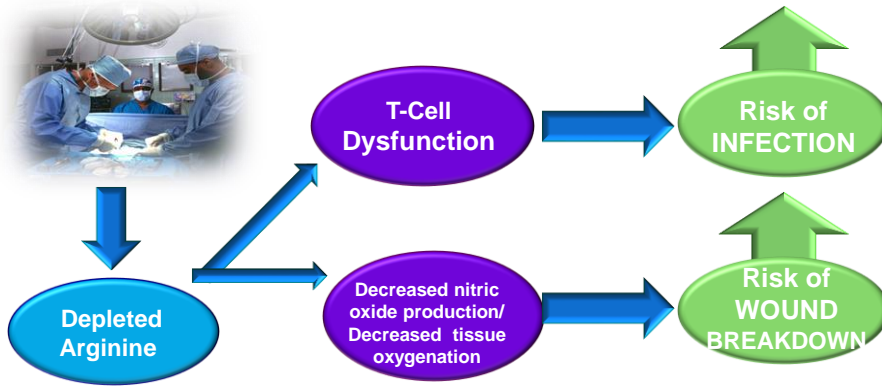


Drover et al. *J Am Coll Surgeons* 2011;212(3):385-399.



## The Role of Arginine/Arginase

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Popovich PJ et al. *J of Nutr* 2006;137:1681S-1686S. McClave et al. *JPEN* 2009;33:277-316. Zhu X et al. *Ann Surg* 2014;259(1):171-178.

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## Food Sources of Arginine

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- Normal diet contains 3-5 g/d
- Supplemental amount needed
  - ~4% of total calories
    - ~18 g for 70 kg pt
- Reliability from a compliance perspective x 5 days peri-op??

Food	Amount	Arg (g)
Peanuts	1 cup	4.7
Tuna, canned	1 cup	2.5
Salmon	6 oz	2.3
Shrimp	3 oz	1.9
Chicken	3 oz	1.8
Egg	1	1.0
Tofu, firm	½ cup	0.9

USDA National Nutrient Database

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## Society Guideline Recommendations for Surgical Immunonutrition

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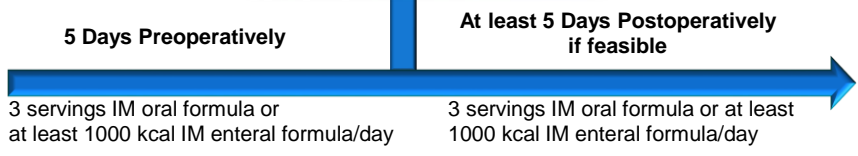
	Society of Critical Care Medicine/ American Society of Enteral and Parenteral Nutrition- Critical Care	European Society of Enteral and Parenteral Nutrition- Surgery	American Society of Enteral and Parenteral Nutrition- Cancer
<b>Population</b>	Surgical and trauma patients (SICU)	Malnourished pts undergoing major surgery for cancer	Malnourished pts undergoing major surgery for cancer
<b>Guideline (not expert consensus)</b>	Immune-modulating formulas ( <u>arginine</u> and other agents including EPA, DHA, glutamine, nucleic acid) used <u>perioperatively</u>	Perioperative substrates (arginine, n3 and nucleotides)	Diets containing arginine, nucleic acid and EFA

1. McClave et al. *JPEN* 2016;40(2):159-211. 2. Weimann A et al. *Clin Nutr* 2017;36:623-650. 3. August DA et al. *JPEN* 2009;33:472-500.



## Surgical Immunonutrition Protocol

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Waitzberg DL et al. *World J Surg* 2006;30:1592-1604. Marik P and Zaloga G. *JPEN* 2010; 34(4):378-386. McClave et al. *JPEN* 2016;40(2):159-211. August DA et al. *JPEN* 2009;33:472-500. Drover et al. *J Am Coll Surg* 2011;212(3):385-399.

IM= Immunonutrition Formula containing arginine-n3 fatty acid-nucleotides



## ERP with IM vs. Traditional Care: THA

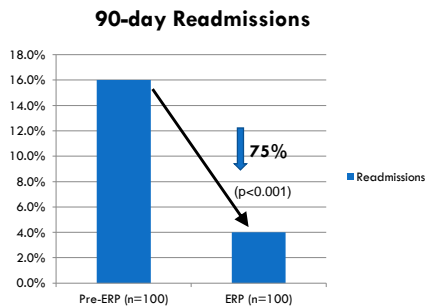
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Variable	Control Group		ACERTO Group		
	Mean	Median	Mean	Median	
LOS	6 days		3 days		p<0.01
CRP (mg/L)					
Preop	10.2	8	10.1	8	p=0.96
Postop Day 2	80.6	79	66.5	66	p<0.01

\*The IM intervention contained supplemental L-arginine, fish oil, and nucleotides

## ERP with IM vs Traditional Care: Ventral Hernia

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\*The IM intervention contained supplemental L-arginine, fish oil, and nucleotides

- A 75% reduction in 90-day readmission was associated with the ERP bundle, including evidence-based IM\*.
- Other associated outcomes were:
  - Reduced LOS
  - More rapid diet advancement and time to flatus and bowel movement
  - Shorter time to oral narcotics

## ERP with IM vs without IM: Cystectomy

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- Infection rate measured in terms of antibiotic use
- Rate was 39% lower in the group receiving ERP protocols including IM\*

Antibiotic Use	IM	ONS
90 days	14%	53%
		$p=0.027$
		<i>Adapted from Table 1</i>

\*The IM intervention contained supplemental L-arginine, fish oil, and nucleotides

Hamilton-Reeves JM et al. *Euro Urol* 2016;69(3):389-392.



## Strong for Surgery®

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- Started as public health campaign in Washington, with initial focus on colo-rectal surgery
- Now initiative of ACS
  - Interactive tools to help optimize patients prior to surgery
    - Pre-Surgical Checklists
      - Optimizing Nutrition- Utilizes Preoperative Arginine-supp IM, evidence based
      - Smoking Cessation
      - Medications
      - Blood sugar control
    - An 23% lower risk of prolonged LOS was shown in the nutrition check-listed group receiving IM. (RR 0.77;95%CI,0.58-1.01  $p=0.05$ )
  - [www.facs.org/quality-programs/strong-for-surgery](http://www.facs.org/quality-programs/strong-for-surgery)

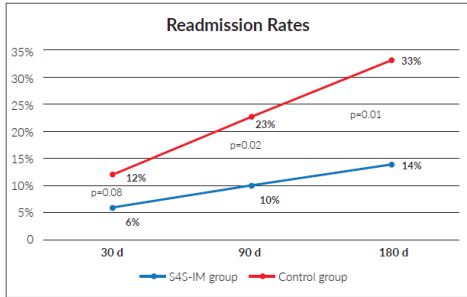


Thornblade. Dis Colon Rect. 2017

Strong for Surgery® is a registered trademark of the American College of Surgeons

## Effects of arginine-based immunonutrition on inpatient total costs and hospitalization outcomes for patients undergoing colorectal surgery

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Adapted from Table 4

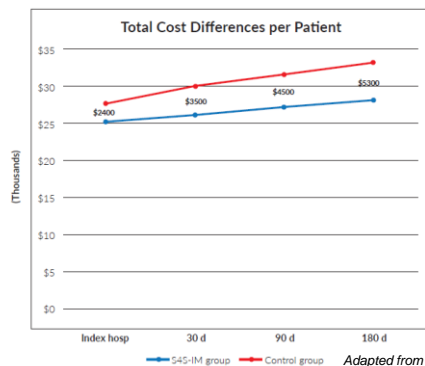
- n= 722 colorectal surgery patients
- Strong for Surgery® (S4S) study group- Nutrition check-listed and provided with evidence-based preop IM
- Clinical Outcomes
  - Readmission decreased 50-58% (p<0.05)
  - Decreased risk of SSI (0% vs 2.65%; p=0.04)
  - Decreased risk of thromboembolism (1.32% vs. 4.96%p=0.05)



Banerjee et al. Nutr 2017; pub on-line  
Strong for Surgery® is a registered trademark of the American College of Surgeons

## Effects of arginine-based immunonutrition on inpatient total costs and hospitalization outcomes for patients undergoing colorectal surgery

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Adapted from Table 2

- From Index Hospitalization to 180 days post-discharge, mean cost of care was \$5300 less for the Strong for Surgery® (S4S)-IM group vs. control group.



Banerjee et al. Nutr 2017; pub on-line  
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## ASER Nutrition Recommendations

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- American Society of Enhanced Recovery (ASER) <http://aserhq.org/>
  1. Reduce the preoperative starvation period
  2. Carbohydrate loading may be given 12 hrs prior to surgery and up to two hours before anesthesia
  3. Immunonutrition containing supplemental arginine, n-3 fatty acids (EPA & DHA) and nucleotides found beneficial when given 5-7 days preoperatively and 5-10 days postoperatively



ASER. Enhanced Recovery Implementation Guide. Sept 2016

## Beaumont Recommendations\*

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- ERP patients provided with an immunonutrition drink (arginine, n-3 fatty acids and nucleotides)
  - ▣ 3 times daily for the 5 days before their surgery
- Patients provided with a maltodextrin based drink
  - ▣ 2 hours before their scheduled surgical arrival time

\* colorectal & cystectomy





# PreOperative Education

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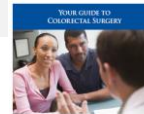
## STARR\* Clinic Appointments

60-90 minutes  
History & physical  
Labs drawn  
Pre-op orders placed  
Antibiotics  
DOS labs  
Fluids  
Gabapentin  
Lidocaine

Consults as needed:  
Stoma nurse  
Anesthesia pain service  
Cardiology/Pulmonology  
Anesthesiologist  
Education brochure reviewed  
Pre-operative supplies given  
Tour offered

## Education Brochure

- Written at 6th - 8th grade reading level
- Interactive
- Includes images
- Easy to print and edit
- Focus on expectation management
- Pain
- Exercise/Inc Spirometry
- Ambulation
- Nutrition



Beaumont Anesthesiology and the Anesthesiologists at Beaumont Anesthesiology are pleased to provide you with this brochure. It is designed to help you understand the process of surgery and anesthesia. We hope you find it helpful and informative. Please contact us if you have any questions. Thank you for choosing Beaumont Anesthesiology.

Beaumont

\*STARR = Surgical Testing and Teaching for an Accelerated Recovery



# The Beaumont Goodie Bag

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- ❑ Immunonutrition drink containing arginine, n-3 fatty acids and nucleotides
- ❑ Maltodextrin based drink
- ❑ Incentive spirometer
- ❑ Brochure



## Beaumont Outcomes- Length of Stay

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### ERAS Colorectal

Discharge Month	Cases	Mean LOS (Obs)
Aug 2014 - Jul 2015	415	6.18
Aug 2015 - Oct 2016	240	4.87
Aug 2015 - Dec 2016	270	4.76

### ERAS Cystectomy

Discharge Month	Cases	Mean LOS (Obs)
Oct 2014 - Sept 2015	24	8.29
Nov 2015 - Oct 2016	12	6.67
Nov 2015 - Dec 2016	13	6.54



## Patient Empowerment

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Question	Prehabilitation Class Participant (Mean)	Non-Prehabilitation Participant (Mean)	P-Value
I feel I was adequately prepared for my colorectal surgery	91.4	80.5	0.001
I feel I can actively participate in my own recovery	91.2	82.3	0.001
I feel my expectations for surgery were adequately met	90.6	82.3	0.005
I feel encouraged and enabled about my recovery	93.7	81.4	0.003
I feel I was physically/mentally prepared for my surgery	88.3	81.0	<0.001
I feel I was involved in the decision making about my surgical care	89.9	81.2	0.007
I understood the health information provided to me about my surgery	91.3	82.3	<0.001
I feel I had the access to the information I needed about my surgery	91.0	81.8	<0.001
I feel prepared to care for my own health after my surgery	89.1	81.1	0.001



Soto. ASER Abstracts. 2017

## Satisfaction: HCAHPS\* Scores

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STTAR Clinic Patients- ERAS Colorectal		
Question/Domain	% Top Box	%tile Rank
Overall Rating of Hospital	78.9%	79
<b>Nurse Communication</b>	82.2%	68
Nurses treat with courtesy/respect	93.1%	93
Nurses listen carefully to you	77.6%	52
Nurses explain in way you understand	75.9%	47
<b>Doctor Communication</b>	86.2%	84
Doctors treat with courtesy/respect	93.1%	91
Doctors listen carefully to you	86.2%	88
Doctors explain in way you understand	79.3%	68

STTAR Clinic Patients- ERAS Cystectomy		
Question/Domain	% Top Box	%tile Rank
Overall Rating of Hospital	100.0%	99
<b>Nurse Communication</b>	100.0%	99
Nurses treat with courtesy/respect	100.0%	99
Nurses listen carefully to you	100.0%	99
Nurses explain in way you understand	100.0%	99
<b>Doctor Communication</b>	100.0%	99
Doctors treat with courtesy/respect	100.0%	99
Doctors listen carefully to you	100.0%	99
Doctors explain in way you understand	100.0%	99

Baseline overall percentile 66%



\*Hospital Consumer Assessment of Healthcare Providers and Systems

## Who Should Pay?

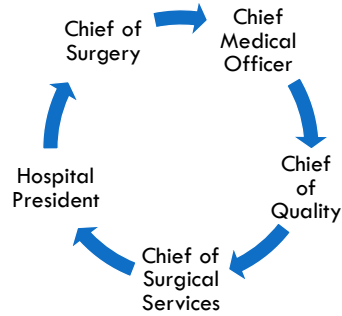
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- Patient?
- Anesthesia?
- Surgeon?
- Hospital?



# Ye Olde Runaround

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- Home
- About
- Grant Programs
- Past Recipients
- Community Impact

## Grants Overview

- [Request for Proposal](#)
- [Investigator Initiated Research Program](#)
- › [Physician Investigator Research Award Program](#)
- [Community Health Matching Grant Program](#)
- [Proposal Development Award](#)
- [Student Award Program](#)

## Physician Investigator Research Award

This program supports Michigan physicians who seek to improve the quality, cost or access to health care for residents through pilot studies, feasibility studies or small research projects.

It offers up to \$10,000 in funding.

We encourage potential grantees to submit a [concept paper \(PDF\)](#) to [foundation@bcbsm.com](mailto:foundation@bcbsm.com) for feedback before submitting a full proposal.

### Eligibility

Applicants must be physicians based in Michigan.

Blue Cross Blue Shield of Michigan employees and their immediate family members are ineligible. Employees of any BCBSM affiliate and their immediate family members also are ineligible.

### Deadline



## Summary

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- Preoperative education and prehabilitation improve outcomes, patient satisfaction and feelings of empowerment
- Providing surgical immunonutrition (arginine, n-3 fatty acids and nucleotides) is an evidence-based means of improving outcomes
- Immunonutrition, as part of a broader ERP, supports shortened LOS, reduce risk of readmission, fewer infections and a lower cost of care.



# Thank You

# Questions?

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