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Health

Mount Sinai Hospital
Joseph & Wolf Lebovic Health Complex



Patient Blood Management

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Disclosure

- Stipend received from ORBCON for the presentation
- On the 2021 ORBCON Transfusion Medicine Boot Camp for Nurses organizing committee
- No further commercial or service conflicts exist

Pre-Test Question 1

- What are the pillars of Patient Blood Management
 - Optimize Erythropoiesis
 - Minimize blood loss & bleeding
 - Harness & optimize physiological reserve of anemia
 - All of the above

Pre-Test Question 2

- How can we optimize erythropoiesis
 - Increase dietary iron
 - Oral iron supplements
 - IV Iron
 - All of the above

Pre-Test Question 3

- What are the roles of ONTraC coordinators
 - Direct Patient Care
 - Educator
 - Research / Quality Assurance
 - All of the above

Learning Objectives

- Identify the who, what, where, why of Patient Blood Management
- Identify the key pillars of Patient Blood Management
- Identify the potential interventions of treating pre-operative anemia
- Apply PBM techniques in developing treatment plans for 2 case studies
- Identify how PBM is applied in Ontario through the ONTraC program
- Identify the impact ONTraC has had on the surgical transfusion rates in Ontario

Patient Blood Management

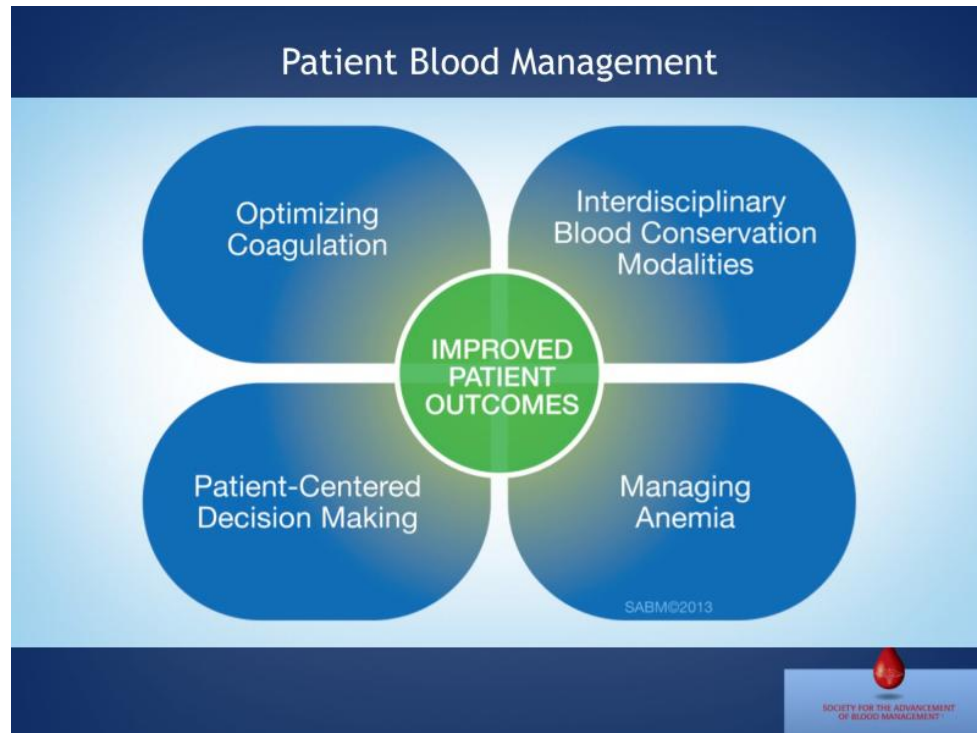
- Patient Blood Management
 - Patient centered, interdisciplinary approach to the timely application of evidence-based medical and surgical interventions designed to maintain patients own blood mass
- World Health Assembly
 - Endorsed PBM; based on the possibilities to strengthen and to preserve patients' own blood mass and to enable safe handling of donor blood
 - Request in 2010 to the World Health Organization to provide its member states with training on the safe and rational use of allogeneic blood products and implementation of transfusion alternatives
 - 2021 WHO published 'The urgent need to implement patient blood management: policy brief'

Patient Blood Management

- Is the timely multidisciplinary application of evidence-based medical and surgical concepts designed to maintain hemoglobin concentration, optimize hemostasis and minimize blood loss in an effort to improve patient outcome.
- Transfusion research over the past 25 years; including the idea that simply having a transfusion becomes a risk factor associated with poorer outcomes in terms of LOS in hospital as well as post-operative infections
 - Offers the opportunity to, enhance patient care, reduce costs, and conserve a valuable and scarce resource

Patient Blood Management

- Puts the patient at the heart of decisions made around blood transfusions, promoting appropriate use of blood and blood components and the timely use of alternatives where available
- Represents an international initiative in best practice for transfusion medicine



3 Pillars of PBM

	1st Pillar Optimize erythropoiesis	2nd Pillar Minimize blood loss & bleeding	3rd Pillar Harness & optimize physiological reserve of anemia
Preoperative	<ul style="list-style-type: none"> • Detect anemia • Identify underlying disorder(s) causing anemia • Manage disorder(s) • Refer for further evaluation if necessary • Treat suboptimal iron stores/iron deficiency/anemia of chronic disease/iron-restricted erythropoiesis • Treat other hematinic deficiencies • Note: Anemia is a contraindication for elective surgery 	<ul style="list-style-type: none"> • Identify and manage bleeding risk • Minimizing iatrogenic blood loss • Procedure planning and rehearsal • Preoperative autologous blood donation (in selected cases or when patient choice) • Other 	<ul style="list-style-type: none"> • Assess/optimize patient's physiological reserve and risk factors • Compare estimated blood loss with patient-specific tolerable blood loss • Formulate patient-specific management plan using appropriate blood conservation modalities to minimize blood loss, optimize red cell mass, and manage anemia • Restrictive transfusion thresholds
Intraoperative	<ul style="list-style-type: none"> • Timing surgery with hematological optimization 	<ul style="list-style-type: none"> • Meticulous hemostasis and surgical techniques • Blood-sparing surgical techniques • Anesthetic blood conserving strategies • Autologous blood options • Pharmacological/hemostatic agents 	<ul style="list-style-type: none"> • Optimize cardiac output • Optimize ventilation and oxygenation • Restrictive transfusion thresholds
Postoperative	<ul style="list-style-type: none"> • Stimulate erythropoiesis • Be aware of drug interactions that can increase anemia 	<ul style="list-style-type: none"> • Vigilant monitoring and management of post-operative bleeding • Avoid secondary hemorrhage • Rapid warming/maintain normothermia (unless hypothermia specifically indicated) • Autologous blood salvage • Minimizing iatrogenic blood loss • Hemostasis/anticoagulation management • Prophylaxis of upper gastrointestinal hemorrhage • Avoid/treat infections promptly • Be aware of adverse effects of medication 	<ul style="list-style-type: none"> • Optimize anemia reserve • Maximize oxygen delivery • Minimize oxygen consumption • Avoid/treat infections promptly • Restrictive transfusion thresholds

- Optimizing the patient's own blood (e.g. pre-operative optimization of Hgb and erythropoiesis)
 - More than 40% of patients come to surgery anemic
- Minimizing surgical blood loss
- Optimizing the patient's physiological reserve in relation to anemia (including the use of restrictive transfusion triggers)

Patient Blood Management

- Impact

- Meta-analysis showed that a comprehensively implemented PBM program resulted in the reduction of allogenic blood transfusions by 39%
- Yearly savings identified in one study of over 2.5 million dollars but this value did not include the associated costs of a prolonged admission, or the treatment of postoperative complications associated with a blood transfusion

Patient Blood Management – Key Tools

INCREASING DIETARY IRON

Animal Sources = BEST!



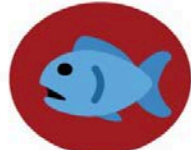
POULTRY



BEEF



SHELLFISH



SEAFOOD (TUNA,
SARDINES)

Plant Sources



BEANS,
LENTILS,
CHICKPEAS



NUTS



FORTIFIED
GRAINS,
BREADS,
CEREALS



VEGETABLES
(SPINACH,
TOMATOES,
POTATO)



TOFU

Pair with **VITAMIN C**
for better absorption!

Pineapple
Strawberries
Oranges

Peppers
Tomatoes
Mango

Dark leafy greens
Kiwi
Cantaloupe

- Optimizing one's own blood supply through:
 - Dietary iron



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Patient Blood Management – Key Tools

Table 1:
Selected Oral Iron Products

Generic name	Tablet size	Elemental iron provided per tablet	Number of tablets per day to provide 60 mg elemental iron 3 times per day
Ferrous sulfate	324 mg/324 mg	65 mg	3
Ferrous gluconate	300 mg	34 mg	6
	240 mg	27 mg	7
Ferrous fumarate	324 mg	106 mg	2
	200 mg	66 mg	3

- Optimizing one's own blood supply through:
 - Oral iron
 - Preferred oral iron – ferrous fumarate 300mg / once a day

Patient Blood Management – Key Tools

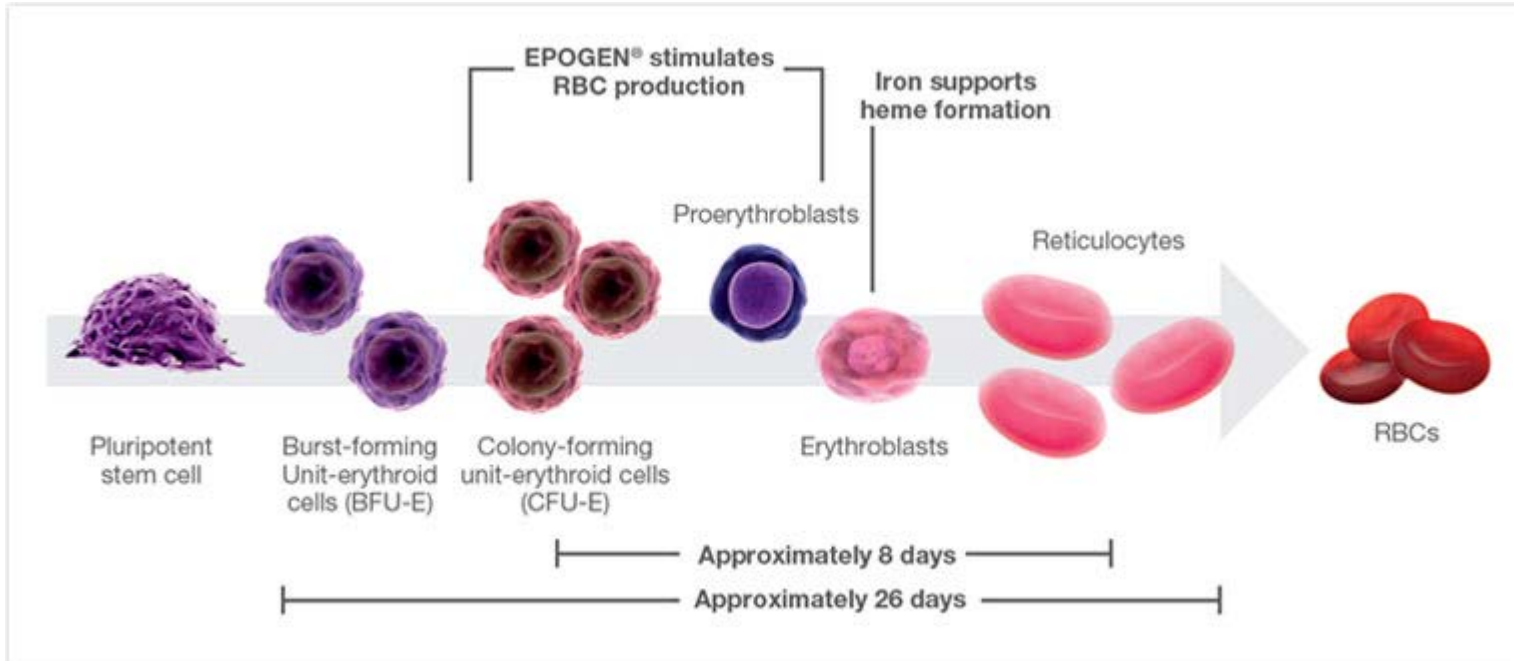
IV Iron Options

Compound	Brand Name	Recommended amount per dose	Infusion Time	Availability
Low Molecular Weight Iron Dextran	INFeD®	100mg following uneventful 25mg test dose	2-6 hrs (+test dose)	US, Europe
Ferric Gluconate Complex	Ferrlecit®	125mg	12.5mg/min	US, Europe, Canada
Iron Sucrose	Venofer®	200-300mg	100mg/30min	US, Europe, Canada
Ferumoxytol	Feraheme®	510mg	15 min	US, Europe
Ferric Carboxymaltose	Injectafer®	750mg	15 min	US, Europe
	Ferinject®	1000mg	15 min	
Iron Isomaltoside	Monofer®	≤1000mg	>15 min	US, Europe, Canada
	Monoferic®	>1000mg (max 20mg/kg)	≥ 30 minutes	

- Optimizing one's own blood supply through:
 - IV Iron
 - Monoferric (Iron Isomaltoside)
 - Venofer (Iron Sucrose)



Patient Blood Management – Key Tools



- Optimizing one's own blood supply
 - Erythropoietin – Stimulating Agents
 - Epoetin Alfa (Epogen)

Patient Blood Management – Key Tools

- Minimizing surgical blood loss
 - Tranexamic Acid
 - Stabilize formed clots and reduce active bleeding
 - Numerous research studies have reported favorable safety and efficacy in ortho cases
 - Both topical and IV routes show efficacy
- Optimizing the patient's physiological reserve in relation to anemia
 - Restrictive transfusion triggers
 - Strong RCT evidence suggests the safety of restrictive transfusion triggers. As a consequence, an Hgb transfusion trigger of <70g/l may be recommended for most high risk patients

Case Study – Gynecology

- Pt is a 36 year old P0G0 female experiencing heavy menses and is scheduled for a total abdominal myomectomy in 6 weeks.
- Her bloodwork shows: Hgb – 72 / Ferritin – 4 / Transferrin Saturation 0.03
- Her PMHx is negative for IBD, Thalassemia, Sickle Cell Disease and Cancer, her weight is 65kg.
- Current Medication – Vitamin C, Calcium, Tranexamic Acid

Case Study – Gynecology

- Ganzoni Formula

- Total Iron Dose = Actual body weight in Kilos x (target Hgb – Actual Hgb/10)x2.4 + Iron Stores (500)
 - $65(130-72)/10 \times 2.4 + 500 = 1,404.8 / 300$ (Venofer Dose) = 4.6

- Recommendations

- Increase Dietary Iron
- Add Oral Iron (preferred iron salts i.e. Ferrous Fumarate 300mg / day); counseled to take at a different time than the calcium but at the same time as the vitamin C
- IV Iron
 - Venofer 300mg x 4 OR
 - Monoferric 1000mg x 1 + Venofer 300mg x 1

Case Study – orthopedic

- Pt is 65 year old male to be scheduled for a total knee arthroplasty – revision on their left knee in 3 weeks
- Bloodwork shows: Hgb 112 / Ferritin 12 / Transferrin Saturation 0.15
- His PMHx is positive for IBD (Crohn's Disease), and negative for Thalassemia, Sickle Cell Disease and Cancer, his weight is 80kg

Case Study – orthopedic

- Ganzoni Formula

- Total Iron Dose = Actual body weight in Kilos x (target Hgb – Actual Hgb/10)x2.4 + Iron Stores (500)
- $80(130 - 112) / 10 \times 2.4 + 500 = 845.6 / 300 = 2.8$

- Recommendation

- Venofer 300mg x 2 OR
- Monoferric 500mg x 1 + Venofer 300mg x 1
- Choose not to suggest oral iron because of the short optimization window as well as the potential intolerability related to his IBD

ONTraC

- Ontario Nurse Transfusion Coordinators (ONTraC)
 - Started in 2002 by Dr. John Freedman
 - The ONTraC leadership, including Dr. Freedman, are based out of St. Michael's Hospital
 - Currently there are 31 Registered Nurses across 25 centers throughout the province; with both adult and pediatric focuses



Ontario Transfusion Coordinator (ONTraC) Program

25 Locations; 14 in the Greater Toronto Area (GTA)



ONTraC – Role

- Direct Patient Care
 - Assessing a patients eligibility for blood management strategies
 - Coordinator and implementing blood management strategies
 - Evaluating the success of the strategies and following the patient throughout the course of their admission
- Educator
 - Providing patient blood management education to patients and families, as well as risks of blood transfusion
 - Promoting patient blood management, by interacting with health care providers
- Research / Quality assurance
 - Data Collection
 - Submission and analysis of blood utilization for the hospital
 - Involvement with committees to improve blood management strategies within the hospital

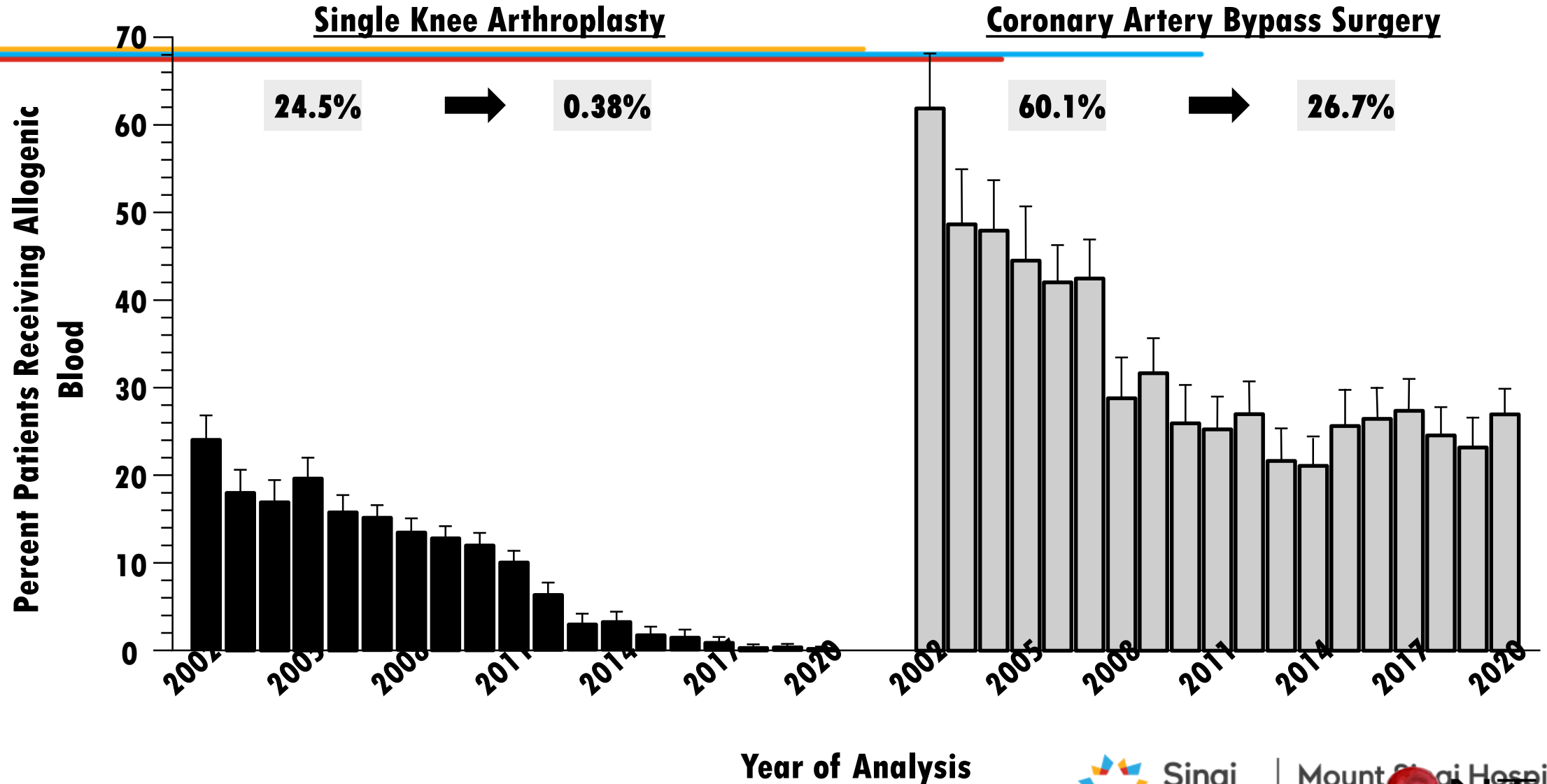
ONTraC – Research

- Yearly Data Collection
 - Targeted Procedures:
 - A total of 60 targeted procedures collected consecutively (not a requirement for the coordinator to consult)
 - Data Collection period February till 60 surgeries obtained
 - Specific Procedures:
 - TKA + THA
 - CABG (not collected at Mount Sinai Hospital)
 - Benign gynecological procedures (open – myomectomy, hysterectomy)
 - Non Targeted
 - Collected for the full calendar year
 - Data collected starts after the targeted procedures for TKA, THA, open myomectomy, and open hysterectomy
 - Include any surgical patient that is assessed by the coordinator; regardless of procedure

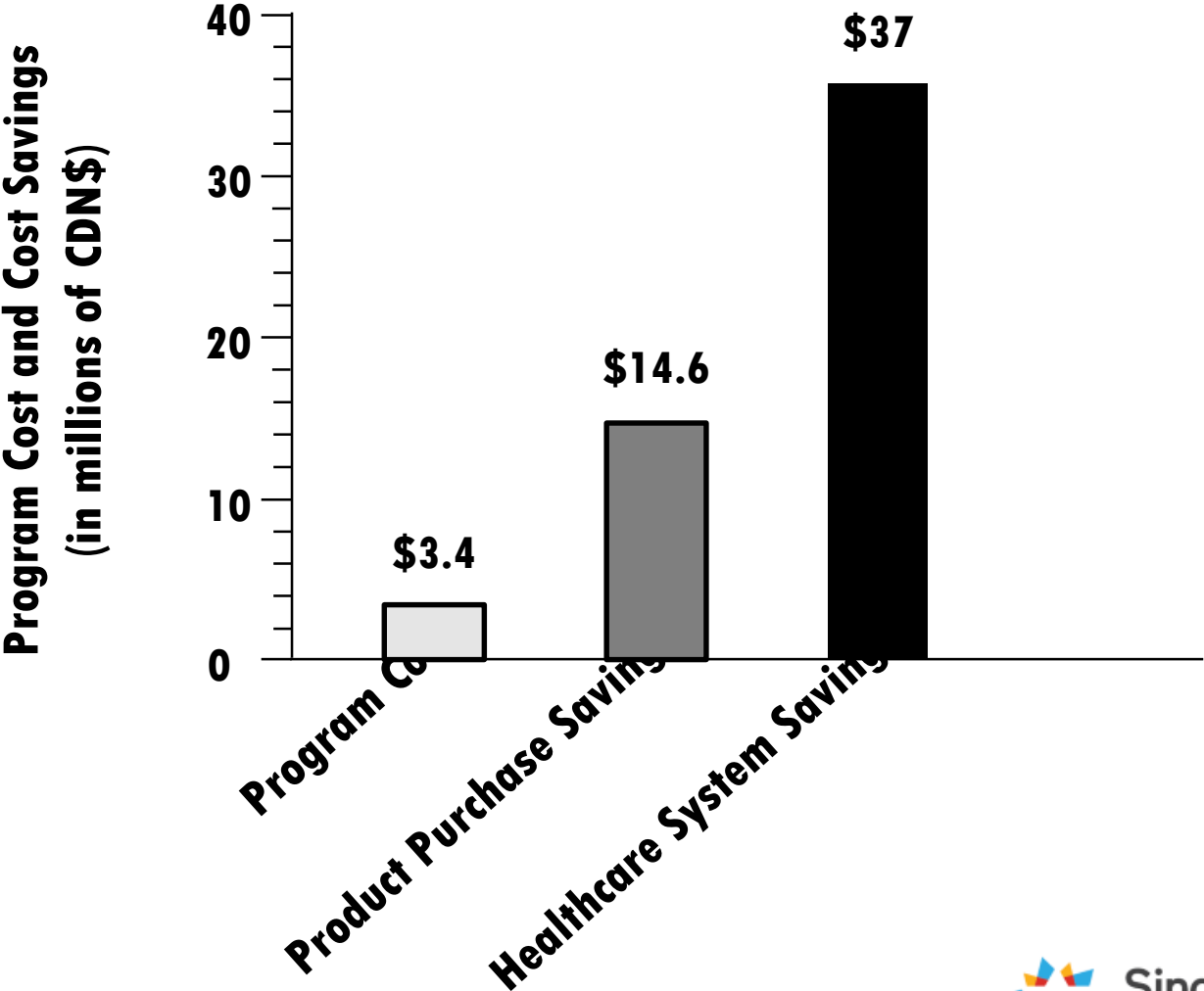
Impact of Preoperative Hemoglobin Concentration (Hb) on Transfusion

Pre-Op Hb	Percent Transfused (2019)				
	Knee	CABG	CABG+Valve	Valves	Gyne
Hb < 100 g/L	33.3%		52.8%	66.7%	33.3%
Hb < 110 g/L	20.0%	61.1%	85.7%	80.0%	21.2%
Hb < 120 g/L	4.0%	57.8%	76.2%	71.1%	13.8%
Hb < 130 g/L	2.0%	51.8%	66.7%	59.2%	11.0%
Hb > 130 g/L	0.6%	12.0%	42.9%	16.8%	3.7%
Hb > 140 g/L	0%	12.8%	35.4%	13.9%	0%

Mean Provincial Transfusion Rates: 2002 to 2020



Annual Cost Savings Compared to Baseline for Coronary Artery Bypass Surgery and Hip and Knee Arthroplasty Combined



Post Test Questions

Questions



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Key Resources – Patient Blood Management

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