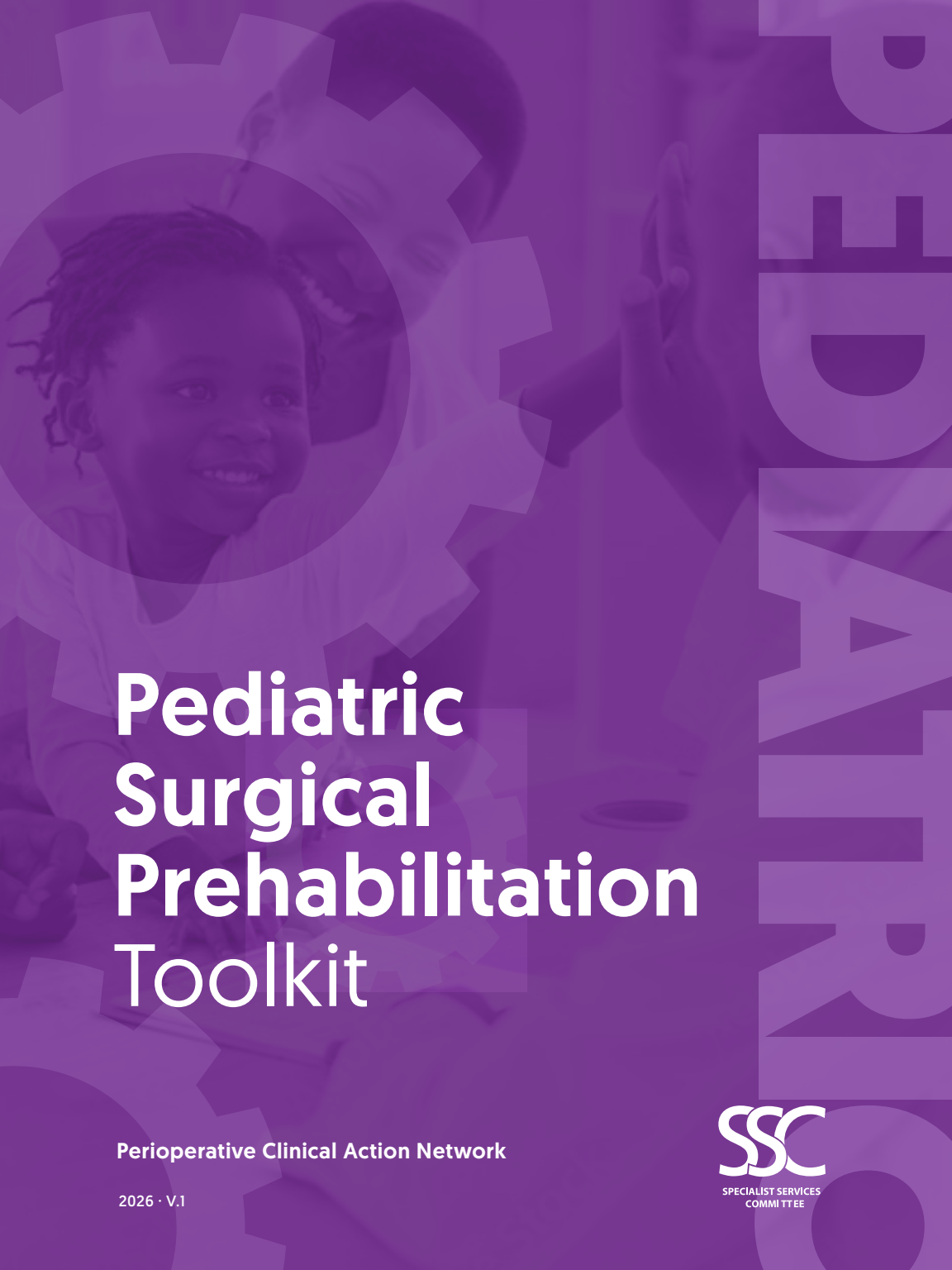




Pediatric Surgical Prehabilitation Toolkit

Perioperative Clinical Action Network

2026 · V.1

SSC
SPECIALIST SERVICES
COMMITTEE



Perioperative Clinical Action Network

For general inquiries, please contact the Portfolio Liaison,
Geoff Schierbeck at gschierbeck@doctorsofbc.ca

Website [PCAN]: www.sscbc.ca/pcan

Disclaimer

This work may be reproduced in whole or in part for study or training purposes subject to the inclusion of an acknowledgment of the source. It may not be reproduced for commercial usage or sale. Reproduction for purposes other than those indicated above, requires written permission from the Specialist Services Committee. Content within this publication was accurate at the time of publication. The information in this document does not replace clinical judgement.

Produced by: Perioperative Clinical Action Network

Version: 1

Date: August 2026

© PCAN, Specialist Services Committee, 2026

Funding for this project was provided by the Specialist Services Committee [SSC], one of four Joint Collaborative Committees (JCC) representing a partnership between Doctors of BC and the Government of BC

TABLE OF CONTENTS

Welcome	4
Acknowledgments	8
Cultural Considerations.....	10
Patient Activation and Shared Decision Making	15
Anemia and Iron Deficiency.....	22
Cardiac	28
Activities of Daily Living (ADLs) & Mobility	38
Nutrition	44
Pain Management	50
Respiratory	55
Social.....	65
Appendices.....	72
References.....	75

WELCOME



Welcome to the first BC Pediatric Surgical Prehabilitation Toolkit for children with medical complexity. This toolkit was created by the Perioperative Clinical Action Network [PCAN] in partnership with BC Children's Hospital alongside content experts across Canada.

Background

Following the success of the 2015-16 Enhanced Recovery After Surgery (ERAS) Collaborative, the Surgical Patient Optimization Collaborative (SPOC) launched in 2019 with 14 sites and expanded with another 13 sites in 2022, to include a total of 27 sites. The collaboratives provided system change strategies, funding support, and shared learning to interdisciplinary teams. Through SPOC 1.0 and 2.0, prehabilitation programs for adult surgical patients have been established in more than 50% of hospitals performing surgery in BC, demonstrating the benefits of prehabilitation to surgical patients, providers, and the healthcare system within the BC surgical landscape.

Prehabilitation is a potential vital strategy in pediatric surgical care as well, particularly for children with medical complexity who experience high rates of post-operative complications alongside increased utilisation of resources and need for family support. Despite this only a small number of pediatric medical centers across Canada offer pre-operative optimization services, with limited research compared to the adult population. Few guidelines exist for pediatricians and primary care providers looking to optimize their complex pediatric patients prior to surgery who, in the absence of standardized and well-established pediatric prehabilitation services, are left to manage the optimization of

these patients prior to surgery. Up to 2025, prehabilitation efforts have focused on the adult population, creating the need for a dedicated pediatric toolkit to support the prehabilitation of pediatric patients.

For children without significant co-occurring conditions, prehabilitation may simply focus on age-appropriate physical activity, nutrition, and psychological preparation to build resilience and reduce procedural anxiety.

For children with special healthcare needs or medical complexity, the process must be more intensive and highly individualized and family centered. These children often require stabilization of multiple chronic comorbidities involving input from specialists, primary care and allied health professionals to proactively mitigate perioperative risks. This comprehensive approach allows children “and their families” to participate in the decision-making about surgery as it is often the family making the decision. This approach supports safer outcomes, smoother recovery, and improved experiences for patients and families.

The Toolkit

The original Surgical Patient Optimization Toolkit was created in 2019 by the BC Surgical Optimization Working Group and validated across 15 provincial sites participating in the Surgical Patient Optimization Collaborative (SPOC). In 2024, the BC Prehabilitation Working Group reviewed and updated the adult toolkit, incorporating clinical context, actionable recommendations, and evidence-based screening tools. These updates reflected feedback from clinicians from inside and outside the province and input from subject matter experts, with a focus on strengthening the usability and practicality of the clinical pathways, while also integrating new components aligned with emerging best practices in prehabilitation.

Building on this foundation, the first Pediatric Surgical Prehabilitation Toolkit for children with medical complexity has now been developed. Informed by literature, clinical expertise, and frontline experience, this toolkit offers pediatric-specific pathways, recommendations, and resources to support pediatricians, primary care providers, anesthesiologists and other healthcare team members in preparing children with special health care needs and their families for surgery. It also provides a framework for providers looking to help guide their patients through the surgical journey through coordinated care and shared-care decision making.

The toolkit consists of seven clinical pillars and two over arching pillars for pediatric prehabilitation. These pillars highlight areas where targeted interventions can reduce perioperative risk, strengthen resilience, and improve outcomes for children and their families. It also provides a framework for providers looking to help guide their patients through the surgical journey via coordinated care and shared-care decision making.

Each pillar includes:

1. Introduction outlining perioperative risks in the pediatric population and the role of prehabilitation in reducing those risks.
2. Screening tool recommendations based on current pediatric evidence, adapted guidelines, and validated risk scores where available.
3. Visual algorithm illustrating potential workflows for assessing each component and identifying actionable prehabilitation goals.
4. Step-by-step guidance expanding on the algorithm with detailed considerations for pediatric patients.

References supporting each component can be found at the end of this toolkit.

Using the Toolkit

This toolkit includes recommendations that may be useful for healthcare providers looking to prehabilitate pediatric patients with special health care needs before surgery. This toolkit is not intended to dictate clinical practice. Rather, it provides guidance for clinicians to use at their discretion while considering the best interests and goals of the patient and family.

Search Strategy Methodology

A comprehensive literature search was conducted in Ovid Embase with the guidance of an experienced health professions education librarian. The strategy combined three core concepts: surgical prehabilitation, pediatrics, and one of the predefined topic pillars. Search terms for prehabilitation included variations such as preoperative optimization, surgical optimization, and peri-operative care. Results were narrowed using Embase's pediatrics filter, and then refined with terms specific to each pillar. Searches targeted titles, abstracts, and keywords, with search terms iteratively adjusted to yield between 50 and 400 articles per pillar (see Appendix 1 for full search strategy). In total, 1,066 articles were screened at the title and abstract level, and 98 were reviewed in full text by the pillar leads to ensure expert appraisal. Pillar leads also contributed additional relevant articles from their areas of expertise. Finally, a supplementary “snowball” approach was used, drawing on reference lists and other literature identified during toolkit development.

ACKNOWLEDGMENTS



The Pediatric Surgical Prehabilitation Toolkit has been developed by the Specialist Services Committee of Doctors of BC with the support and expertise of all members listed below.

The following individuals came together as working groups and a faculty of experts to create and refine the contents of this toolkit. We thank them for their contributions to BC healthcare.

Dr. Dynai Eilig

Orthopedic Surgeon,
Orthopedic Department,
BCCH

Catherine Jones

Registered Dietitian
Orthopedic Department,
BCCH

Dr. Tim Oberlander

Developmental
Pediatrician,
Complex Pain, BCCH

Dr. Ram Mishaal

Developmental
Pediatrician and Pediatric
Neurologist, Sunny Hill
Health Centre, BCCH

Dr. Esther Lee

Palliative Care Specialist,
Canuck Place Children's
Hospice, BCCH

Dr. Haley Fishman

Pediatric Respiriologist,
Respirology, BCCH

Dr. Gina Rempel

Neurodevelopmental
Pediatrician, Nutrition
Support and Complex
Care, Health Sciences
Centre Winnipeg

Dr. Giulia Pula

Pediatric Cardiologist,
BCCH

Dr. Nathan Katz

Orthopedic
Surgery Resident,
3rd year, UBC

Dr. Jennifer Balfour

Pediatrician, VIHA

Dr. Devin Peterson

Chief of Pediatric Surgery,
Orthopedic Surgery,
McMaster Children's
Hospital/Hamilton Health
Sciences

Dr. Victoria Buswell

Pediatric
Anesthesiologist, BCCH

**BCCH: BC Children's Hospital*

Dr. Caitlyn Hui

Pediatrician and Pediatric Infectious Diseases Specialist, Pediatric Medicine and Complex Care, The Hospital for Sick Children

Dr. Priya Sayal

Pediatrician, Holland Bloorview Kids Rehabilitation Hospital, Toronto

Dr. Hal Siden

Pediatrician, Palliative Medicine Canuck Place and BCCH

Dr Meera Rayer

Assistant Clinical Professor, Division of Hematology/Oncology/BMT, Department of Pediatrics, Faculty of Medicine, UBC

Kristine Tomczyk

Nurse Practitioner, Pediatrics, Orthopedic Surgery, McMaster Children's Hospital

Josie Lui

Occupational Therapist, Orthopedic Department, BCCH

Caitlyn Dunphy

Physiotherapist, Orthopedic Department, BCCH

Kaylyn Goossen

Social Worker, Orthopedic Department, BCCH

Kaitlin Avila

Nurse Clinician, Complex Care, BCCH

Jenn Waller

Operations Lead, Indigenous Health, BCCH

Bobbi Taylor

Parent Partner, Complex Care, BCCH

Sarah Pescitelli

Nurse Clinician, Orthopedic Department, BCCH

Chelsea Digney

Physiotherapist, Acute Med-Surg Unit, BCCH

Zoe Schwartz

Social Work Educator, BCCH

Chantel Canessa

Department Head, Nurse Practitioners, PHSA

Magalee Blumenkrans

Occupational Therapist, VCH

Emily Xu

Student - Researcher Queens University

Colleen Pawliuk

Librarian, BCCH

Geoff Schierbeck

DoBC Liaison, DoBC

Jenn Newell

Project Specialist, Specialist Services Committee

Kimberly Mckinley

Project Specialist, Specialist Services Committee

CULTURAL SAFETY, EQUITY AND FAMILY PARTNERSHIP IN PEDIATRIC PERIOPERATIVE CARE



Cultural safety is about creating an environment where children and families feel respected, understood, and safe in their health care journey.

It is defined by patients and families—not by providers. For many families, especially Indigenous families, experiences of health care are shaped by historical and ongoing harms. Recognizing this context is essential for safe and effective perioperative care.

This section is designed for providers at all levels, including those just beginning to learn about cultural safety. It emphasizes practical steps that directly improve patient outcomes and strengthen relationships with families.

1. Self-Identification and Trust

- Ask every patient/family if they identify as Indigenous [First Nations, Métis, Inuit]. This should always be voluntary and respectful.
- Explain why: “We ask so we can connect you with supports if you’d like them, and to ensure your care plan reflects what’s important to you.”
- Document self-identification clearly; it helps connect families to Indigenous Patient Navigators (IPNs), Elders, and community supports.

2. Partnership & Two-Eyed Seeing

Two-Eyed Seeing reminds us that the best care comes when different perspectives work together.

- ⦿ Providers bring clinical and surgical expertise.
- ⦿ Families bring lived knowledge of their child, culture, and what safety looks like.
- ⦿ When these perspectives meet with mutual respect, the result is stronger care, better decisions, and safer outcomes.

3. Patient and Family Autonomy

- ⦿ Autonomy is a cornerstone of cultural safety and clinical safety.
- ⦿ Families must always be asked for consent before involving additional services such as Social Work, IPN, or Spiritual Care.
- ⦿ This ensures families feel in control of who is part of their care and prevents unintentional harm or mistrust.
- ⦿ Provide families with tools for sharing what they want healthcare workers to know, for an example visit www.mybookletbc.com



4. Inclusive, Plain-Language Communication

- ⊗ Define acronyms and avoid jargon.
- ⊗ Use interpreters (including Indigenous languages) when needed.
- ⊗ Check understanding through teach-back.
- ⊗ Use strengths-based language: “care preferences” instead of “noncompliance.”
- ⊗ Check information sharing preferences with family, how do they want information shared and how much detail do they want. Written information in the form of handouts and e-mails can be useful when desired by families.

5. Trauma- and Violence-Informed Care

- ⊗ Ask: “What does feeling safe look like for you here?”
- ⊗ Explain procedures before touching; maintain privacy and dignity.
- ⊗ Be aware that past health care experiences or systemic racism may affect trust.

6. Identity, Kinship & Consent

- ⊗ Clarify who the decision-makers are. This may include extended family, guardians, or Elders, if the family wishes.
- ⊗ Always use correct names and pronouns.
- ⊗ Where sex-based thresholds apply clinically, specify that these are based on sex assigned at birth, while respecting gender identity.

7. Ceremony & Cultural Items

- ⊗ Offer time and space for ceremony (smudging, prayer, songs) per hospital policy and oxygen safety requirements.
- ⊗ Discuss hair removal ahead of time when needed; offer to preserve or return hair.
- ⊗ Handle sacred items with respect and ensure they are returned to the family.

8. Equity of Access & Logistics

- ⊗ Anticipate travel, lodging, and financial barriers, particularly for rural or remote families.
- ⊗ Engage supports (SW, IPN) only with family consent and as early as possible, to avoid last-minute crises.
- ⊗ Allow sufficient time for any screening tests, for example bloodwork, to be completed. If screening tests are anticipated, consider ordering in advance so families have ample time to coordinate.
- ⊗ Anticipate needs for families to be safely discharged home such as equipment needs.

9. Pain, Sensory & Environment

- ⊗ Pain expression varies across cultures and neurotypes.
- ⊗ Invite families to share how their child shows pain or distress.
- ⊗ Provide sensory accommodations (quiet space, lighting, visiting flexibility) when possible.
- ⊗ Ensure understanding of available pain management options.

10. Tools & Data

- ⚙ Risk scores and biomarkers may not capture all populations; combine results with family input and clinical judgment.
- ⚙ Respect Indigenous data sovereignty where Indigenous data are used.
- ⚙ Document neutrally: “preferences,” “declined today,” “care plan.”

Quality Outcomes to Monitor

- ⚙ Fewer day-of-surgery cancellations related to consent or logistics.
- ⚙ Reduced length of stay or complications linked to communication gaps.
- ⚙ Positive family feedback: “We felt culturally safe,” “Our voices were heard in planning.”



PATIENT ACTIVATION AND SHARED DECISION MAKING

PATIENT ACTIVATION AND SHARED DECISION MAKING



Some children who require surgery are at higher risk of complications and benefit from a comprehensive and collaborative approach with the family in making decisions about the surgery.

Children with Special Health Care Needs [CSHCN] are those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally.

A subset of CSHCN are Children with Medical Complexity [CMC].

Children with Medical Complexity are defined as children who have the following:

- 1. Needs:** CMC are characterized by substantial family-identified health care service needs such as medical care, specialized therapy, and educational needs. The service needs have a significant impact on the family unit, specifically time devoted to direct care, frequent provider visits, care coordination, and financial burden.
- 2. Chronic condition[s]:** CMC have 1 or more chronic clinical condition[s], either diagnosed or unknown, that are severe and/or associated with medical fragility (eg, high morbidity and mortality rates). The condition and/or its sequelae should be expected to be potentially lifelong, although some children may improve with optimal care or with time.

-
- 3. Functional limitations:** Functioning is typically classified by using key dimensions of body structure and function, performance of activities, and participation in communal life. For CMC, the limitations are typically severe and may require assistance from technology such as a tracheostomy tube, feeding tube, and/or a wheelchair.
 - 4. Health care use:** CMC typically have high projected utilization of health resources that may include frequent or prolonged hospitalization, multiple surgeries, or the ongoing involvement of multiple subspecialty services and providers.

CMC patients live with frailty and fragility. This leads to a state of health vulnerability with an increased risk of morbidity and mortality especially those with serious illness that is life-threatening or life-limiting.

CMC and other children who have a history of and/or have high risk of post-operative complications require a comprehensive assessment and interdisciplinary team discussions, to ensure the family has enough information to make an informed decision on surgery. Decision may be to 1. go ahead with surgery, or 2. delay the surgery until the child's health is improved, or 3. have enough information and understanding to inquire about non-surgical management, second opinion or other surgical options.

The Patient Activation Process outlined in this toolkit is initiated when the surgical team determines that a patient requires surgery. The following guidelines may be utilized in pre-operative health optimization for any child with special health care needs that require surgical intervention.

Please apply the following pathway to all children requiring major surgery. Major surgery is defined as a high risk procedure with high complication potential and prolonged recovery.

Components of Major Surgery



Invasiveness: Major surgeries are extensive procedures involving body cavities, removal of organs, or structural alterations to anatomy.



Anesthesia: Almost always requires general anesthesia.



Risk Level: Carries significant potential risk for infection, blood loss, cardiovascular injury, pain and danger to the patient's life. The risk is partly due to the complexity of the operation itself and partly due to patient factors.



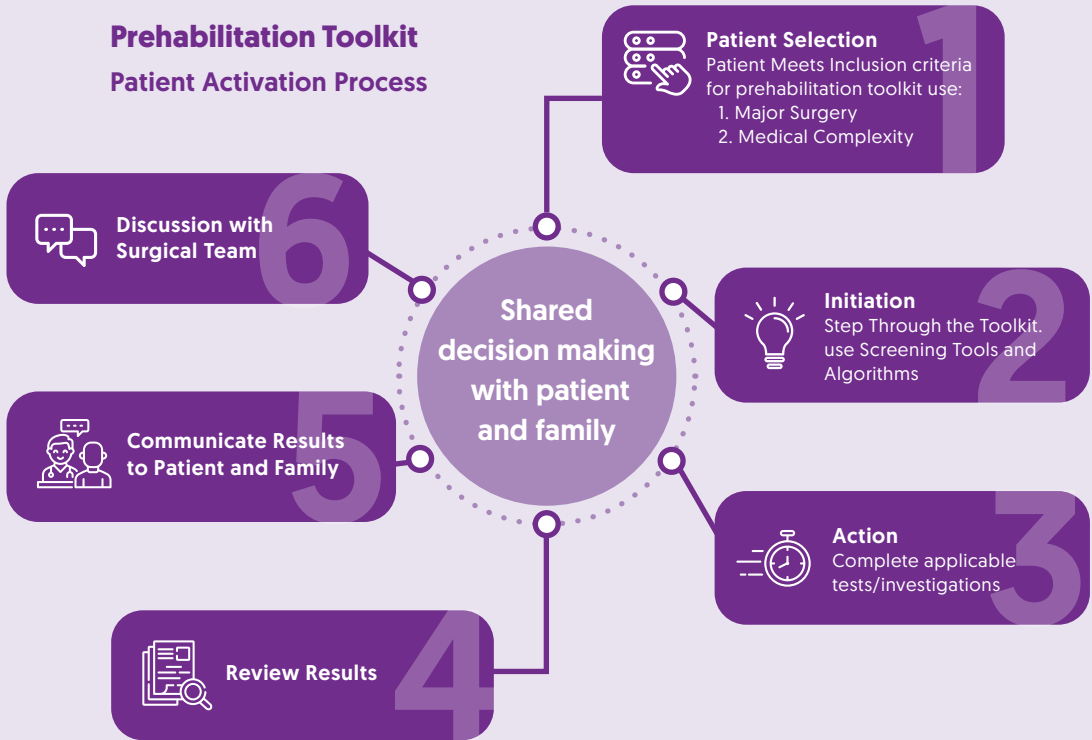
Hospital Setting: Performed in a hospital and requires post operative inpatient stay and care.



Recovery: Involves longer recovery periods, longer hospital stay.

Prehabilitation Toolkit

Patient Activation Process



Patient Activation Process

Step 1 – Pre-activation and Patient Selection

The family or surgeon, or hospital/community provider discussion re: goals of care and appropriateness of surgery.

- Review surgical indications – Review criteria for Major Surgery.
- Discuss goals of care with family involving necessary health care team members as per family's preference.

Giving this handout to family

- [Patient Family Decision Making guide](#)



Step 2 – Initiation

- ⊗ Patient chart review for screening of medical history, quality of life and functioning.
- ⊗ Communicate with community healthcare team as applicable.
- ⊗ Outpatient visit for comprehensive health assessment.
- ⊗ Confirm the family understands the risks/benefits of surgery.
- ⊗ Review the toolkit pillars:
 - Anemia
 - Cardiac
 - ADLs & Mobility
 - Nutrition
 - Pain Management
 - Respiratory
 - Social

Step 3 – Action

- ⊗ Based on the health assessment findings, highlight areas of the child's health and well-being that require health optimization prior to pursuing surgery (if any).
- ⊗ Make referrals as required for optimization (example dietitian referral for malnutrition), relevant tests and appointments and involve recommended services.

Section 4 – Review Results

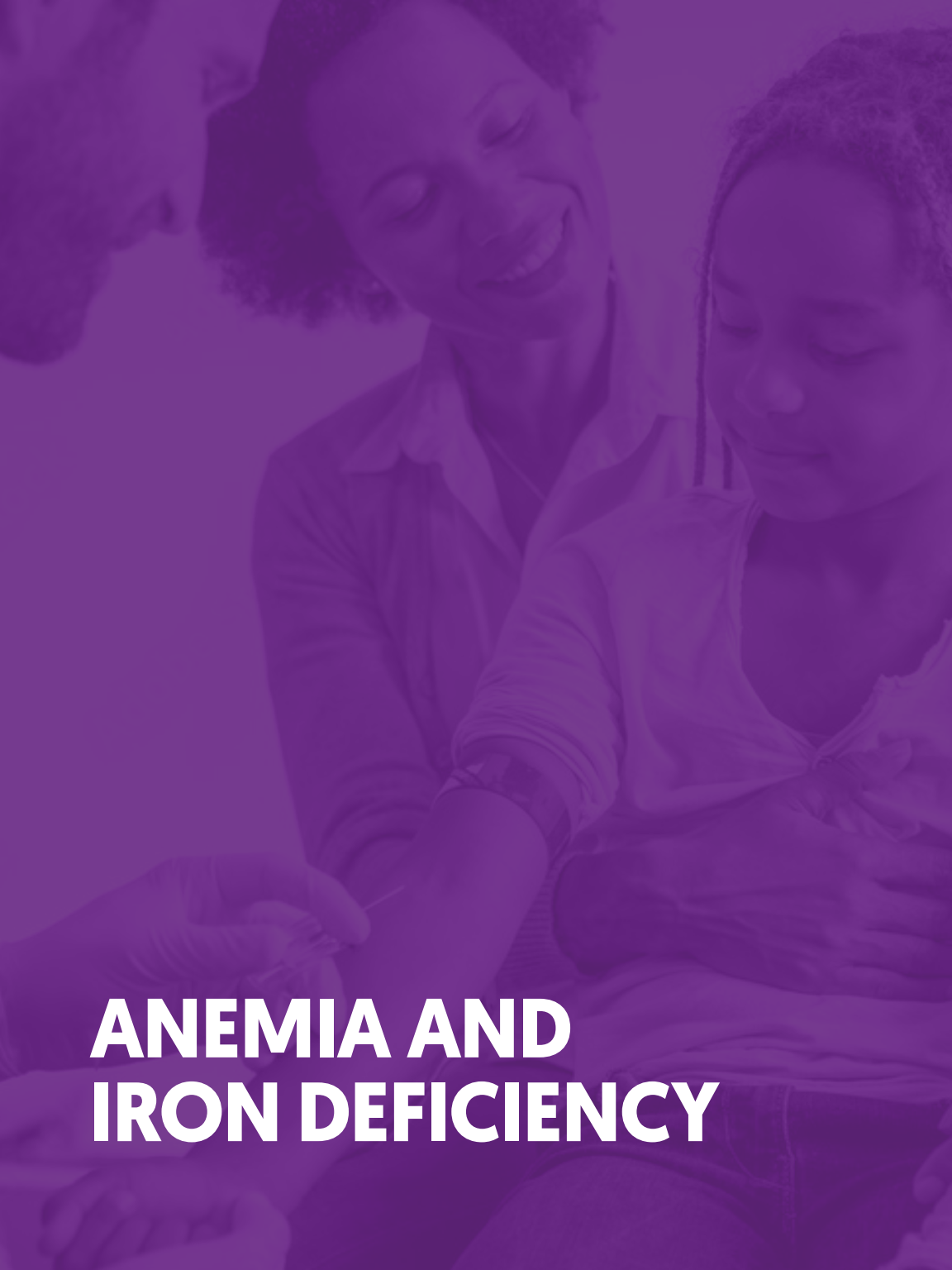
- ⊗ Follow up on tests, referrals and appointments made.
- ⊗ Review patient chart, analyze and summarize results.
- ⊗ All results should be taken under consideration and an action list should be made, one that provides overall and consistent requirements for presurgical optimization.

Step 5 – Shared decision making; communicate results to patient and family

- ⚙ Based on the comprehensive health history, test results, medical interventions, and review of goals of care, a collaborative decision between the patient and family.
- ⚙ If results are not within expected range: Act on test results, recommendations, allied health guidance, and actively follow the toolkit's instructions.

Step 6–Discuss with Surgical team

- ⚙ Reflect results and discuss further process with the surgical team.
- ⚙ Review further required pre-operative optimization.
- ⚙ Consider advising the surgical team if more time is required to further optimize the patient's health.
- ⚙ Follow up with patient and family to discuss best agreed upon treatment protocol.
- ⚙ Outcome discussion should include a timeline and follow up plans including how to support the patient and family especially if surgery is not advised. Consider serious illness conversation with the involvement of palliative care. A multidisciplinary meeting may be helpful - invite the community team, indigenous patient navigator, other key supports for family as needed.

A photograph of a woman with curly hair smiling as a healthcare professional in a white glove draws blood from her arm. A young girl with braids stands next to her, looking down at the procedure. The entire image is overlaid with a semi-transparent purple filter.

ANEMIA AND IRON DEFICIENCY

ANEMIA AND IRON DEFICIENCY



Pre-operative anemia is a modifiable risk factor that can significantly impact surgical outcomes in pediatric patients. It has been associated with increased postoperative morbidity, mortality, transfusion requirements, surgical site infections, adverse neurodevelopmental outcomes and longer hospital stays, including in otherwise healthy children.

Anemia prevalence is high across pediatric populations globally, with iron deficiency being the most common cause. Identifying and treating anemia and iron deficiency pre-operatively can improve recovery, reduce transfusion needs, and enhance long-term health outcomes.



Cultural Safety Considerations

Shared decision-making for transfusion: Include cultural/religious considerations (e.g., Jehovah's Witnesses).

Nutrition: Acknowledge traditional foodways; address cost/food security.

Education: Provide plain-language iron therapy handouts; use interpreters when needed and utilize teach-back method.

Reframe: “Low socioeconomic status” as “structural barriers to nutrition/health access.”

Screening

Routine screening with CBC, ferritin and reticulocytes should occur in the following groups at least 4-6 weeks before elective surgery [provide requisition at time of surgical decision].

- ⚙ Patients undergoing procedures with moderate to major bleeding risk [$>20\%$ of total blood volume or $>10\%$ risk of transfusion].
- ⚙ Children with risk factors for anemia ([see Appendix 2](#)) or bleeding (*Pediatrics Bleeding Questionnaire*).

Prehabilitation and Optimization Recommendations

- ⚙ If anemia or iron deficiency is identified, initiate workup and treatment.
- ⚙ Anemia should be evaluated and treated before proceeding with major scheduled surgery.
- ⚙ Diagnostic thresholds for anemia vary with age/gender; refer to local references.
- ⚙ Ferritin and iron deficiency:
 - <12 ug/L = diagnostic iron deficiency
 - $12-20$ ug/L = possible iron deficiency
 - >20 ug/L normal iron stores in pre-pubertal children
 - Toddlers frequently have intercurrent viral illnesses - may falsely elevate ferritin

Patient Education

Inform families:

- ⊗ Risks of untreated anemia: fatigue, infection, poor surgical outcomes, developmental impacts
- ⊗ Measures to reduce transfusion perioperatively: iron therapy, tranexamic acid, intraoperative cell salvage
- ⊗ Goal for shared decision-making: especially patients with religious or cultural considerations [e.g., Jehovah's Witnesses]

Adolescents included in **assent discussions** if appropriate.

Consider Delaying Surgery

Consider postponing **non-urgent scheduled surgery** if anemia and:

- ⊗ High anticipated blood loss surgery
 - ⊗ Anemia not yet evaluated or treated
 - ⊗ Workup incomplete for anemia of unknown causes
-

Investigate Possible Causes

- ⊗ Nutritional: iron, folate, vitamin B12 deficiency
 - ⊗ Chronic inflammation/disease: malignancy, chronic kidney disease
 - ⊗ Hemoglobinopathy: thalassemia, sickle cell
 - ⊗ Bone marrow disorders
 - ⊗ Blood loss
 - ⊗ Hemolytic anemia
 - ⊗ Miscellaneous (parasitic infections, enzyme deficits, membranopathies, etc.)
-

Referral to Hematology, Nephrology, or General Pediatrics

- ⊗ Suspected or known hemoglobinopathy
 - ⊗ Refractory or unexplained anemia
 - ⊗ Suspected or known bleeding disorders
 - ⊗ Anemia associated with renal disease
-

Treat Iron Deficiency

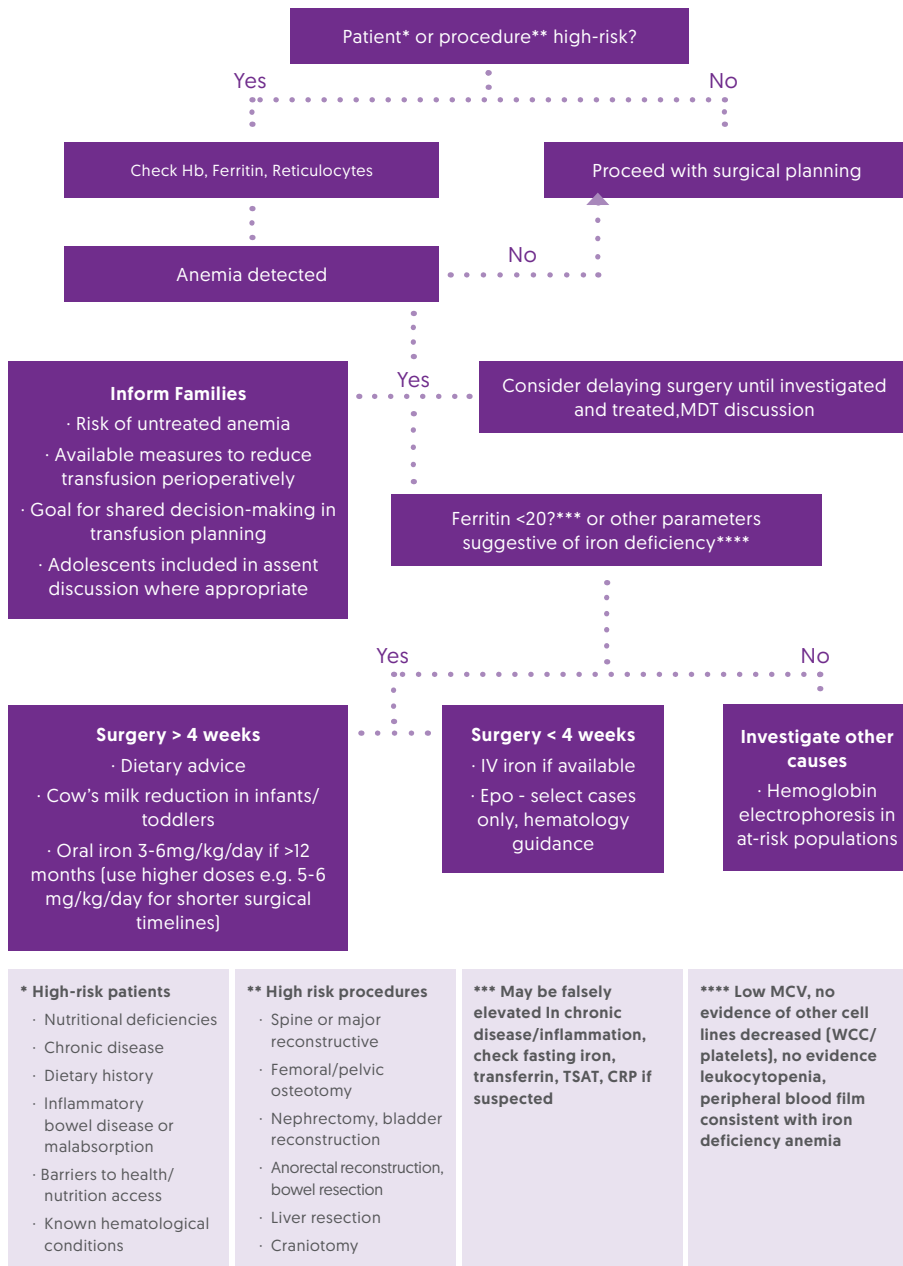
- ⚙ Increase dietary iron
- ⚙ Modify cow's milk consumption in infants and toddlers:
 - Avoid < 9-12 months
 - Reduce < 750ml/day for toddlers
- ⚙ Oral iron:
 - First-line if >4 weeks before surgery
 - Children >12 months: 3–6 mg/kg/day elemental iron in divided doses
 - Consider lower-dose regimens if concerns regarding tolerance of oral iron (recognizing that it will potentially take longer for the hemoglobin level to increase)
 - Vitamin C can enhance absorption
 - Dosing recommendations at:
[BC Guidelines: Pediatric Iron Doses](#)
- ⚙ IV iron:
 - If surgery <4 weeks away, oral iron intolerance, severe anemia, or some GI disorders/malabsorption
 - Iron sucrose or ferric derisomaltose common options
 - Arrange via community pediatrician if available or at a future hospitalization
- ⚙ Erythropoietin (Epo) in select cases: children unable to receive transfusions, chronic anemia - only in consultation with hematology

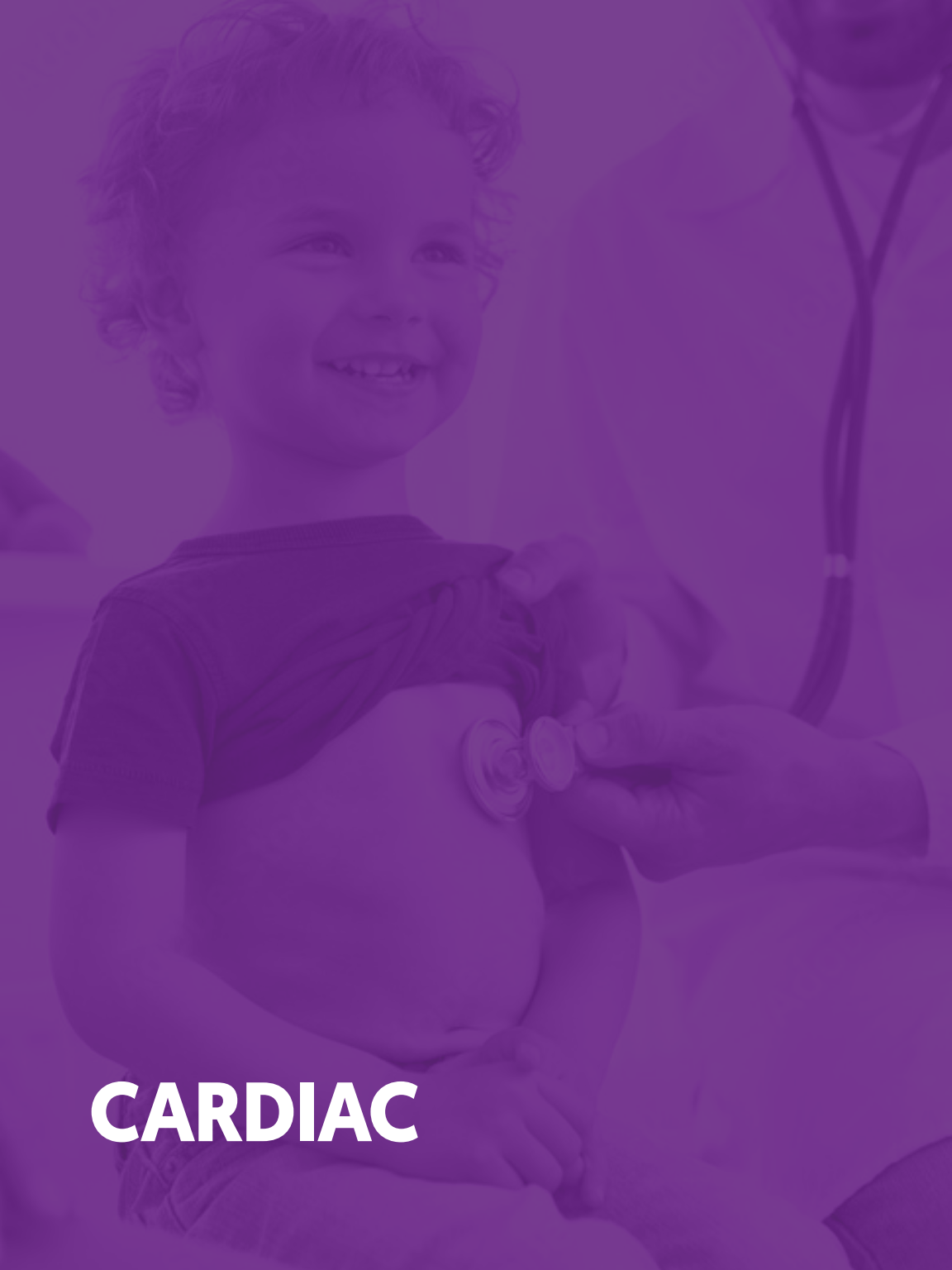


Monitoring and Maintenance

- ⚙ Recheck CBC after 2–4 weeks. If hemoglobin is correcting by 4 weeks, continue oral iron and check CBC and ferritin again at three months
 - ⚙ Monitor for clinical improvement
 - ⚙ Ensure family understands need for continued iron-rich diet or supplements postoperatively
-

Anemia screening and optimization pathway





CARDIAC

CARDIAC



Children with medical complexity are at markedly increased risk for perioperative cardiac complications due to underlying physiological vulnerabilities, comorbidities, and limited reserve*.

This risk is compounded in congenital heart disease (CHD), which frequently coexists with extracardiac anomalies in approximately 30% of patients.

Optimizing outcomes requires careful evaluation of three central domains: **ventricular function, pulmonary hypertension, and rhythm disturbances**. Cardiac symptoms in these populations are often subtle or under-recognized,

**Limited cardiovascular reserve refers to a reduced ability to augment cardiac output or tolerate perioperative stressors without decompensation, due to impaired ventricular function, pulmonary hypertension, fixed preload or afterload physiology, or limited chronotropic or rhythm adaptability. Patients may appear stable at baseline but decompensate rapidly under stress.*



Cultural Safety Recommendations

Hair removal: If skin preparation requires hair removal, ask the family beforehand whether they wish it kept or returned.

Plan: Arrange early for remote/rural families' travel/lodging.

Access: Anticipate travel and accommodation needs for remote/rural families at the point of referral, before urgency timelines are compromised.

Language: Where language barriers exist, use qualified interpreter services for routine symptom review and consent, including discussion of referral urgency and perioperative risk.

Decision-making: Recognize that families differ in how decisions are made; inquire about their preferences and align consent and care discussions accordingly.

as baseline disability can mask typical manifestations or lead to misattribution to respiratory or nutritional causes. Validated pediatric perioperative risk assessment tools remain limited. Preoperative evaluation should include detailed history-taking for clinical red flags, with symptom burden quantified using classification systems: the [MODIFIED Ross classification](#) → for infants and young children and the [NYHA functional class](#) → for older children and adolescents. Ancillary testing—including chest radiography and BNP/NT-proBNP—supports diagnosis and monitoring of decompensation, though results may be influenced by age, renal function, or comorbid neuromuscular or respiratory disease.



Longitudinal surveillance — integrating serial clinical assessment, biomarkers, and imaging— provides greater predictive accuracy than isolated evaluations, ensuring that **high-risk children are appropriately stratified and optimally managed perioperatively.**

Screening Tools

Heart Failure Severity Scores

- ❁ **[NYU Pediatric Heart Failure Index \(PHFI\)](#)**: validated tool for quantifying pediatric HF severity



The Table below describes the classes in the NYHA Functional Classification

CLASS	PATIENT SYMPTOMS
I	No limitations of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation or shortness of breath
II	Slight limitation of physical activity. Comfortable at rest. Ordinary physical activity results in fatigue, palpitation, shortness of breath or chest pain
III	Marked limitation of physical activity. Comfortable at rest. Less than ordinary activity causes fatigue, palpitation, shortness of breath or chest pain.
IV	Symptoms of heart failure at rest. Any physical activity causes further discomfort.

Adapted from Dolgin M, Association NYH, Fox AC, Gorlin R, Levin RI, New York Heart Association. Criteria Committee.

Nomenclature and criteria for diagnosis of disease of the heart and great vessels 9th. ed. Boston, MA: Lippincott Williams and Wilkins; March 1, 1994.

Original source: Criteria committee, New York Heart Association, Inc. Diseases of the Heart and Blood Vessels. Nomenclature and Criteria for diagnosis, 6th edition Boston, Little Brown and Co. 1964, p 114.

©1994 American Heart Association, Inc.

- **Functional status scales:** modified Ross classification (infants/young children), NYHA classification (adolescents)



Classification of symptomatic severity in pediatric heart failure

CLASS OF SYMPTOMS	SYMPTOMS NOTED ON HISTORY
I	Asymptomatic
II	Infants: mild tachypnea or diaphoresis with feeding; no growth failure Older Children: dyspnea on moderate exertion
III	Infants: marked tachypnea or diaphoresis with feeding; growth failure Older Children: dyspnea on mild or minimum exertion
IV	Tachypnea, diaphoresis or respiratory distress at rest

Infants refers to age 0-1 year. Older children refers to age 1-10 years.

Ross RD. The Ross classification for heart failure in children after 25 years: a review and an age-stratified revision. *Pediatr Cardiol.* 2012 Dec;33(8):1295-300. doi: 10.1007/s00246-012-0306-8. Epub 2012 Apr 5. PMID: 22476605.

Arrhythmia and Risk Stratification

- **Electrocardiogram (ECG):** Screening for rhythm abnormalities, conduction disturbances, repolarization abnormalities, conduction disease, arrhythmias, or repolarization abnormalities (eg, QTc prolongation (> 460 ms in prepubertal patients, > 470 ms for postpubertal females, and > 450 ms for postpubertal males)

Imaging

- Chest X-ray [CXR]:
 - Assessment of pulmonary vasculature, pulmonary venous congestion, redistribution, pulmonary edema, pleural effusions
 - Cardiomegaly should prompt review for additional clinical features and consideration of echocardiography
 - Evaluation of lung disease (e.g., chronic aspiration, scoliosis-related restriction)
- Echocardiography: assess cardiac structure and function

Biomarkers

- ⚙ BNP/NT-proBNP: elevated levels associated with adverse perioperative outcomes

Functional/Exercise Capacity

- ⚙ 6-Minute Walk Test (6MWT)*: validated prognostic marker in pediatric pulmonary hypertension (age >5 years)
- ⚙ Cardiopulmonary exercise testing (CPET)*: useful in older children/adolescents for objective assessment of exercise capacity and risk stratification

** ordered, interpreted, and integrated into perioperative planning under cardiology supervision*

Prehabilitation and Optimization Recommendations

Goals of preoperative assessment are to optimize the following

1. Risk Identification & Planning

- ⚙ Identify high-risk patients
- ⚙ Anticipate need for post-operative ICU monitoring, advanced support (ECMO, mechanical ventilation), and risk of pulmonary hypertensive crisis

2. Cardiovascular Optimization

- ⚙ Review and optimize cardiac medications (heart failure therapy, pulmonary vasodilators, antiarrhythmics, anticoagulation)
- ⚙ Stabilize rhythm disturbances and ensure availability of monitoring, pacing, or defibrillator support if needed

3. Respiratory Optimization

- ⚙ Maximize baseline respiratory status: treat active infections, optimize airway clearance, adjust ventilatory support as needed
- ⚙ Identify and manage underlying lung disease (restrictive or obstructive physiology, aspiration risk, recurrent pneumonia)

4. Consider Recommending Dietician Involvement

- ⚙ Improve nutritional status
 - *Preoperative malnutrition in children—especially those with CHD—predicts higher mortality, infections, prolonged ventilation, and longer ICU/hospital stay; short, structured prehab (≈2 weeks) improves growth and shortens MV and ICU/hospital LOS.
- ⚙ Correct electrolyte abnormalities (K^+ , Mg^{2+} , Ca^{2+}) to reduce arrhythmia risk

5. Infection Prevention

- ⚙ Consider indications for perioperative infection prophylaxis (antibiotics, RSV prophylaxis if applicable, vaccination status)

6. Multidisciplinary Coordination

- ⚙ Coordinate care with cardiology, anesthesia, critical care, respirology, surgery, and nutrition
- ⚙ Establish perioperative anticoagulation strategy in high-risk patients
- ⚙ Plan post-operative monitoring, escalation thresholds, and contingency pathways

7. Psychosocial Preparation

- ⚙ Provide anticipatory guidance, psychosocial support, and family preparation for the perioperative course

**When to refer
to Cardiology**

**1. Known Cardiac Disease (perioperative risk
classification as per ACS–NSQIP)**

- ⚙ High/major risk disease → always refer
- ⚙ Minor risk disease → refer if:
 - ⚙ Consider consulting cardiology to determine whether an assessment is required if the last cardiac evaluation was >6 months prior
 - ⚙ Any new symptoms or red flags
 - ⚙ Otherwise unexplained Clinical Deterioration / Escalating Therapy Requirements

Table 1. ACS-NSQIP Classification of Congenital HD Based on Residual Lesion Burden and Functional Status

Congenital HD classification	Definition and criteria
Minor	Cardiac condition with or without medication and maintenance (eg, atrial septal defect, small to moderate ventricular septal defect without symptoms) Repair of congenital HD with normal cardiovascular function and no medication
Major	Repair of congenital HD with residual hemodynamic abnormality with or without medications (eg, tetralogy of Fallot with free pulmonary regurgitation, hypoplastic left heart syndrome including stage 1 palliation)
Severe	Uncorrected cyanotic congenital HD Patients with documented pulmonary hypertension Patients with ventricular dysfunction requiring medication Listed for heart transplantation

ACS-NSQIP indicates the American College of Surgeons National Surgical Quality Improvement Program; and HD heart disease.

Reprinted from Faraoni et al 10 with permission. Copyright- © 2016 Elsevier.

2. Clinical Red Flags Suggesting Cardiovascular Disease

History

- ⊗ **Respiratory:** eg, persistent tachypnea at rest, increased work of breathing, orthopnea, unexplained desaturations or cyanosis, recurrent wheeze/pneumonias
- ⊗ **Activity intolerance:** eg, decline in functional capacity from baseline, early fatigue with play/therapy, exertional pallor or cyanosis
- ⊗ **Feeding/growth:** eg, tachypnea or diaphoresis with feeds, poor weight gain despite adequate intake, unexplained cachexia, or rapid weight gain suggestive of fluid retention
- ⊗ **Other warning symptoms:** eg, palpitations, dizziness, non-vasovagal syncope [especially exertional], irregular pulse, or inappropriate tachy/bradycardia

Physical Exam

- ⊗ Hepatomegaly, edema, ascites, jugular venous distension
- ⊗ Abnormal Cardiovascular Examination: eg. Pathologic murmurs, loud/single S2, or gallop rhythm

ECG

- ⊗ Chamber hypertrophy / strain patterns
- ⊗ Rhythm abnormalities
- ⊗ Depolarization/conduction abnormalities: eg. WPW, second or third degree AV block
- ⊗ Frequent ectopy or symptomatic arrhythmias

**except benign early repolarization in adolescents*

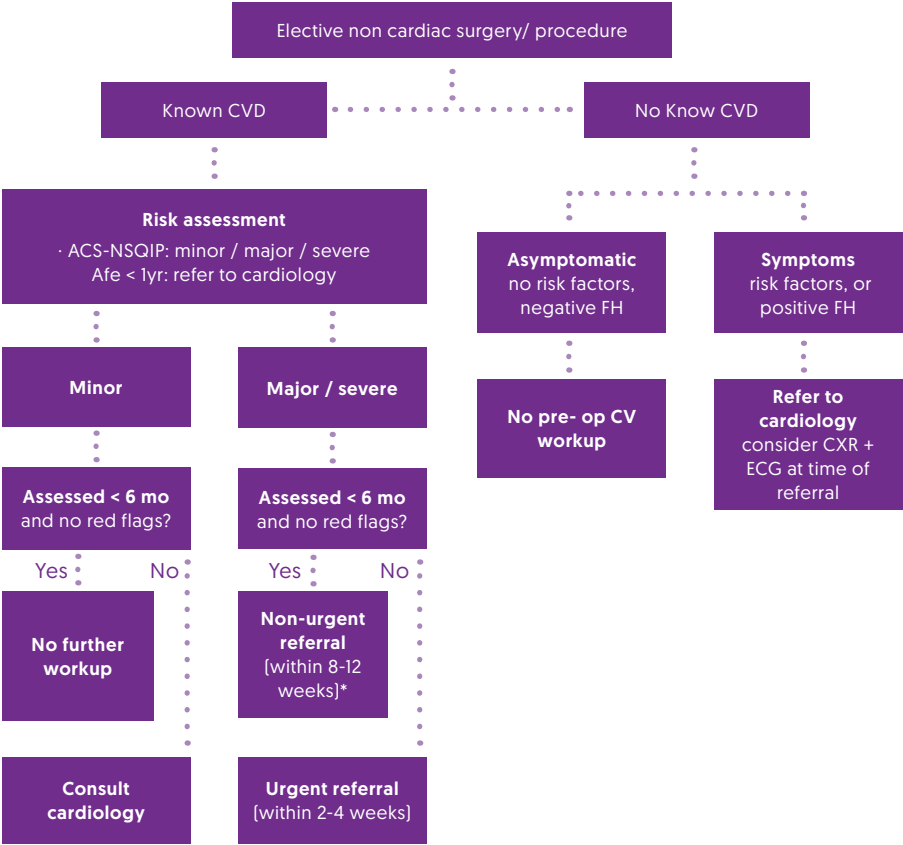
3. Associated comorbidities with potential influence on cardiac status

- ⚙ Current diagnosis of pulmonary hypertension
- ⚙ Syndromic/genetic associations at risk for cardiovascular involvement (eg, trisomy 21, Turner, Noonan, Williams, 22q11 deletion, elastinopathies, connective tissue disorders, neuromuscular disease such as Duchenne muscular dystrophy)

4. Family history

(eg, sudden cardiac or unexplained death in young, known cardiomyopathy, channelopathies, ICD or pacemaker placement at a young age)

Perioperative Cardiac Risk Stratification and Referral Algorithm for Medically Complex Pediatric Patients



**consider timing of planned surgery*

A young child with short brown hair is sitting on a white tricycle. The child is wearing a white long-sleeved shirt and dark shorts. They are looking down at the handlebars. The background is a playroom with various toys, including a large wooden toy chest and some plastic containers. The entire image is covered with a semi-transparent purple overlay.

ACTIVITIES OF DAILY LIVING (ADLS) & MOBILITY

ACTIVITIES OF DAILY LIVING (ADLS) & MOBILITY



Early assessment and home set-up is essential to ensure a timely and safe discharge home.

Major surgeries can change a patient's mobility and how they manage their ADLs temporarily or permanently. Physiotherapists [PTs] focus on improving physical movement and mobility while occupational therapists [OTs] focus on helping people perform daily tasks. Both OTs and PTs consider environmental and personal factors to enable patients to participate in meaningful activities. PTs and OTs emphasize including the families' expertise in managing the child's mobility, transfers, and ADLs. Research has shown that prehab education and PT/OT involvement maximized effectiveness of orthopaedic interventions. Children and families living with complex care needs are usually connected with a community based therapy team. Encourage patients to reach out to their team prior to surgery, to share information about the surgery, and to help them with pre-operative planning and return to baseline function after discharge. If a care coordinator is involved in the patient's care, they can also assist with community connections.



Cultural Safety Recommendations

Highlight: Family expertise in transfers/positioning.

Assess: Home/cultural environment [e.g., ceremony spaces, sacred regalia storage].

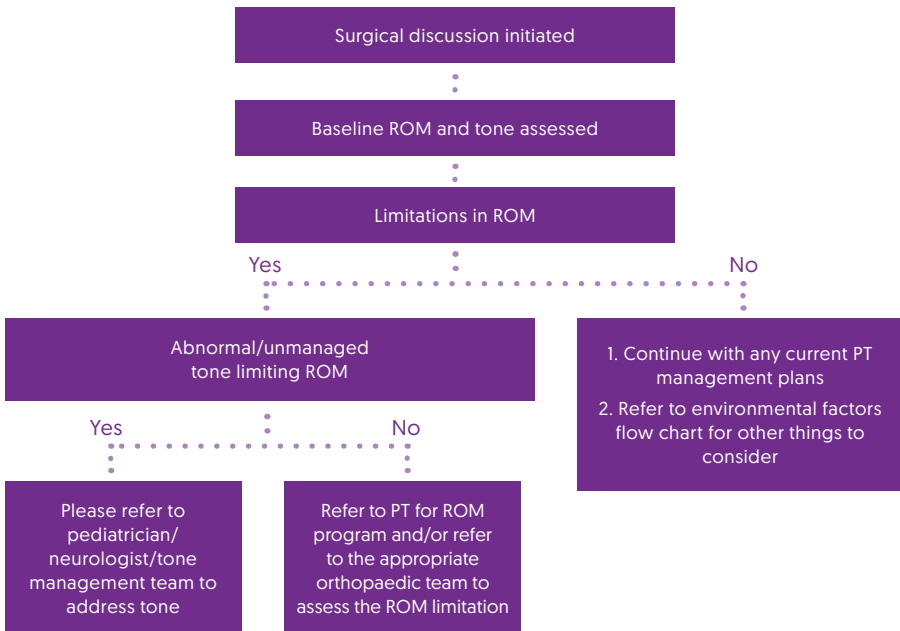
Language: Use plain language and provide demonstrations.

Visuals: Consider handouts with visuals for equipment changes or transfer updates.

Personal Factors

- ⚙ Assessing joint mobility is essential when planning for any major orthopedic procedure.
- ⚙ Range of motion in the joints above and below the surgical site directly influences post-operative positioning, mobility, and functional outcomes.
- ⚙ Limited ROM may affect the ability to sit, stand, transfer, ambulate, or use mobility equipment, depending on the surgical region.
- ⚙ Soft-tissue contractures or fixed deformities can complicate post-operative care, reduce independence with ADLs, and restrict necessary movement patterns.
- ⚙ Tone management is important, as unmanaged tone can limit functional ranges needed for positioning, splinting, and early rehabilitation.
- ⚙ Early identification of these factors supports proactive planning, optimized equipment needs, and improved functional recovery.

Mobility and ROM



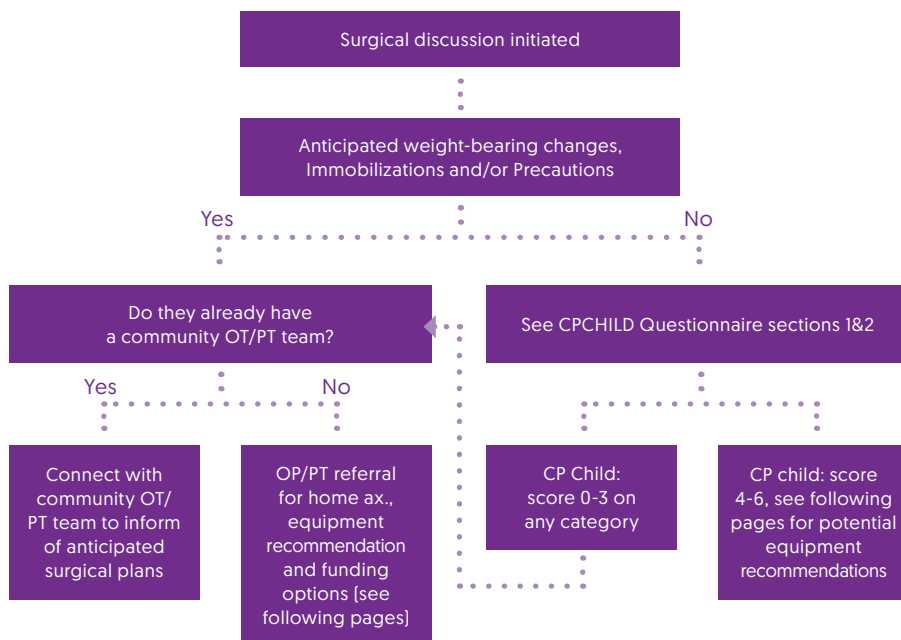
Environmental Factors

- The [CPCCHILD™ questionnaire](#) is a reliable and validated tool for capturing caregivers' perspectives on the health, comfort, well-being, and caregiving demands of children with severe developmental disabilities.



- Sections 1 & 2 focus specifically on ADLs and mobility. These can provide insight into areas that a patient and family currently find difficult managing pre-operatively and may become even more difficult after a major orthopedic procedure.

Environment and Equipment



Immobilization/ precautions: Adherence with post-operative activity orders is crucial to ensure proper healing and recovery from surgery

- ⦿ Potential to be casted or splinted full-time post-operative
- ⦿ Joint range of motion may be limited or restricted
- ⦿ Post-operative weight bearing orders of affected limb(s) can range from full to none, and are typically in place for a minimum of 6-8 weeks

Home Assessment: Managing at home can look different after surgery, these are things to consider:

- ⦿ Access in and out of home [i.e. are there stairs?], and access to bedroom and washroom [i.e. is there option in place for a minimum of 6-8 weeks to relocate on one floor?]
- ⦿ Can new equipment fit and be used in the space?
- ⦿ Can family safely use the current equipment with new precautions?

Funding: Funding can take a long time to apply for, to be approved and then received. Some short-term equipment rentals can be organized if there are no external funding.

- ⦿ Does your patient have funding [i.e. AHP, extended health benefits, etc.]?
- ⦿ Do the parents know how to access funding?
- ⦿ Do you need a letter of justification for equipment?
- ⦿ Are charity resources available?
- ⦿ Consider referral to social work as well if complex social issues present

Equipment: Mobility and ADL equipment may be needed temporarily after surgery or permanently needed depending on your patients' needs/baseline function.

Please see below for some equipment ideas.

Potential recommendations and consideration for pre-operative

This is not an exhaustive list, and will require PT/OT to thoroughly assess.

Home assessment/ community access	Transfers / toileting transfers
Access · Consider stairlift or ramp · Relocating bedroom on main floor · Considering room space for potential equipment · If rental property, start conversation with landlord Transportation · Handydart application · Special Needs Transport (SNT) · Wheelchair accessible taxi vs. wheelchair accessible van · Car transfers practice · Car seat assessment	Teach and support parents/caregivers how to perform manual transfer while maintaining new postoperative precautions Equipment · Power lift · Free standing ceiling lift · Ceiling track lift · Slings - different for toileting vs transfer to wheelchair · Consider sliding board if NWB with no precautions · Tilt commode · Hospital bed
ADLs (dressing, hygiene, bathing, etc.)	Positioning
· Hospital bed · Sponge bathing until cleared for showers from surgeon · Tub transfer bench · Shower chair · Ceiling track lift · Shower tilt commode · Over toilet commode vs. bedside commode	· Wheelchair modification - contact your seating therapist/team to prepare for post-operative modifications Potential post-operative requirements (Pre-operative teaching beneficial): · Splints · Casts · Orthotics · Pressure injury prevention · Pressure relief measures · Positioning for secretion management Assessment potential postop rehab needs



NUTRITION

NUTRITION



Malnutrition is a well known risk factor for post-operative complications such as surgical site infections and development of pressure sores.

This in turn results in longer hospital stays and higher healthcare costs. Preventing nutrition related complications requires early identification of malnutrition via screening and comprehensive assessment. Addressing malnutrition requires a multidisciplinary team that must include the primary care provider, pediatrician and dietitian where appropriate.



Cultural Safety Recommendations

Address: Traditional foods/seasonal availability; coordinate with food security supports where needed.

Tube-feeding: Document ceremony/fasting accommodations where safe.

Follow-up: Ensure follow-up is accessible for rural/remote families.

Screening Tools



CP Feeding and Nutrition Screening Tool

[CP Feeding and Nutrition Screening Tool](#) is designed to be filled out by caregivers and has been validated in children with Cerebral Palsy.

Final screening questions for identifying children and young people with cerebral palsy who may have feeding difficulties and/or undernutrition

Question	Possible response	Scoring
Do you think your child is underweight?	Yes	1
	No	0
	Unsure	1
Does your child have problems gaining weight?	Yes	1
	No	0
	Unsure	1
Rate, on a scale from 0-10, whether you think your child has any problems eating compared to other children of his/her age	10cm long VAS with numbers at each centimetre	≥7 on the VAS = score 1
Rate, on a scale from 0-10, whether you think your child has any problems drinking compared to other children of his/her age	10cm long VAS with numbers at each centimetre	≥7 on the VAS = score 1
Total score of >3 = refer for further assessment of feeding/swallowing and nutritional status		

VAS, visual analogue scale.

Pediatric Nutrition Screening Tool (PNST)

[Pediatric Nutrition Screening Tool \(PNST\)](#) designed to be administered by health care professionals. Validated in pediatric inpatients.



Nutrition Screening Questions

- 1 Has the child unintentionally lost weight lately? ☐ Yes ☐ No
- 2 Has the child had poor weight gain over the last few months? ☐ Yes ☐ No
- 3 Has the child been eating/feeding less in the last few weeks? ☐ Yes ☐ No
- 4 Is the child obviously underweight? ☐ Yes ☐ No

Perform or refer for Nutrition Assessment for positive screen

Assessment

If screening is positive, recommend performing [Subjective Global Nutrition Assessment \[SGNA\]](#) as the gold standard for identification of malnutrition.



Some possible clinical indicators of malnutrition include:

- ⊗ Weight loss or lack of weight gain
- ⊗ Weight for age < z score -2 [<3rd percentile]
- ⊗ Tricep skin fold [TSF] <10th percentile for age: or Eyeball TSF: <1cm for females, <0.5cm for males of any age
- ⊗ Mid upper arm circumference <10th percentile for age
- ⊗ For children with cerebral palsy: plotting less than 20th percentile weight for age on the Brooks 2011 [CP growth charts](#) stratified by sex, age, GMFCS, and tube feeding status



Laboratory markers

Consider baseline nutritional labs such as CBC, iron stores, CRP, total protein, albumin, liver and renal function, vitamin D, calcium, magnesium and phosphate.

For J-tube fed children consider testing B12, zinc, copper, selenium as absorption may be reduced.

Prehabilitation and Optimization Recommendations

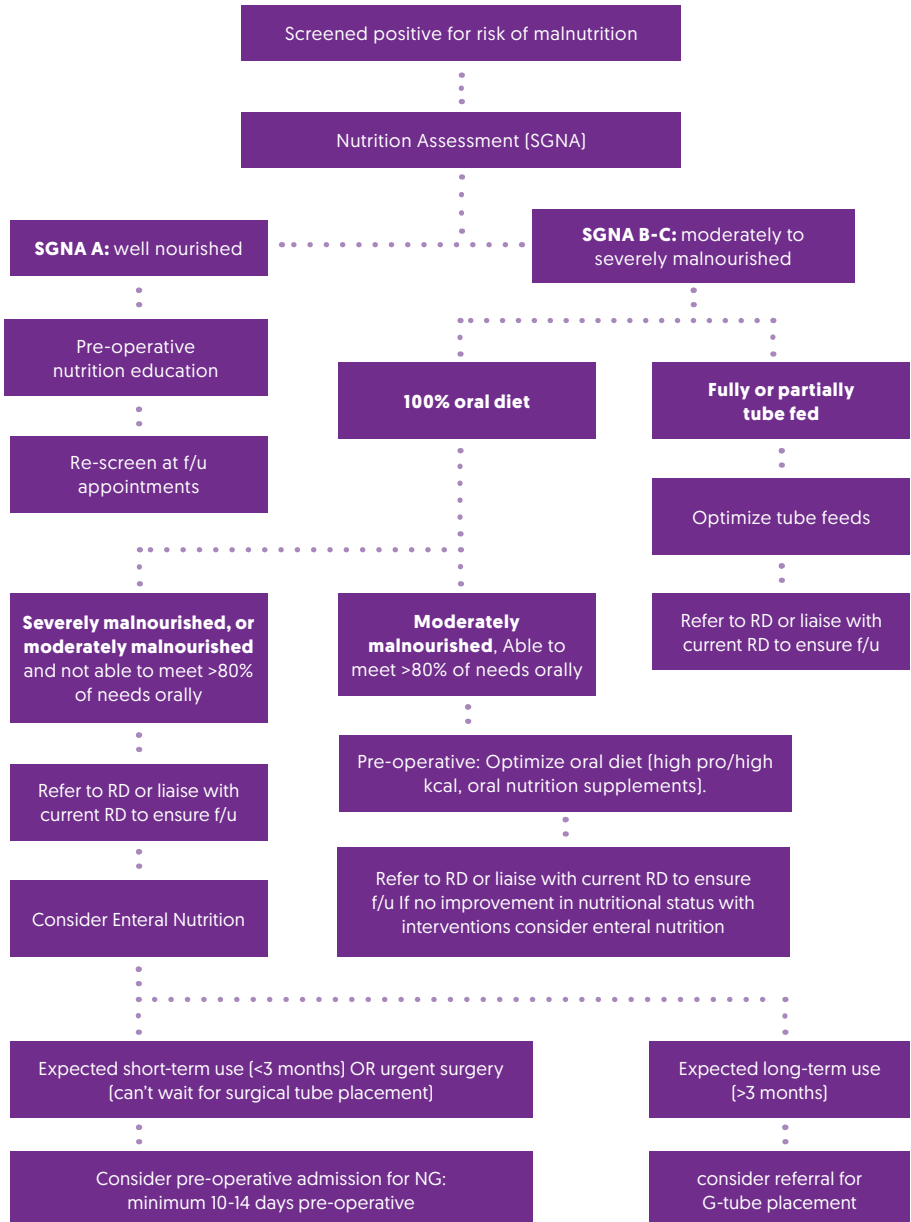
Orally fed

- ⚙ High protein/ high energy diet: ensure diet recommendations are culturally appropriate, consider food availability (for example seasonal foods) and incorporate traditional foods. Connect with food security supports as needed
 - ⚙ Oral nutritional supplements
 - ⚙ Ensure adequacy in micronutrients such as calcium and Vitamin D. Supplement as needed
 - ⚙ Consider enteral nutrition (G-tube vs. NG tube depending on surgical urgency)
 - ⚙ Referral to Dietitian with training in Pediatrics or liaise with current RD
-

Tube fed

- ⚙ Optimize enteral nutrition: ensure adequacy of calories and protein. Malnourished patients may need a 10-20% increase in calories and up to 2-3g/kg of protein
 - ⚙ Incorporate patient/ family values (for example fasting times or cultural dietary needs) into tube feeding plan where safe
 - ⚙ Ensure adequacy in micronutrients such as calcium and Vitamin D. Supplement as needed
 - ⚙ Referral to Dietitian with training in Pediatrics or liaise with current RD
-

Nutrition Screening and Optimization



A young girl with dark hair and bangs is shown in profile, drinking from a small white cup. The image is overlaid with a solid purple gradient, which is darker on the left and lighter on the right. The text 'PAIN MANAGEMENT' is written in white, bold, sans-serif capital letters at the bottom left.

PAIN MANAGEMENT

PAIN MANAGEMENT



Approaches to improving pain care in children and youth with neurodevelopmental disabilities.

Pain is commonly experienced by hospitalized children and youth with neurodevelopmental disabilities (NDD). It is often under-recognized and undertreated, with an incidence of up to 70-80% experiencing pain. In a pediatric rehabilitation setting many children experience daily pain related to care, repositioning, dressing and transfers. Early recognition and treatment promotes wound healing, reduces hospital stays and improves functional outcomes.



Cultural Safety Recommendations

Recognize: Diverse pain expression; invite caregiver/patient cues.

Offer: Culturally meaningful non-pharm options (songs, stories, medicines if safe).

Pain: Apply validated pain scales; note limitations in some populations.

Language: Interpreter for side-effects and safe storage teaching of medications.

Special considerations for managing pain in children with neurodevelopmental disabilities

- ⚙ Appropriate pain assessment and management is essential for post operative rehabilitation, return to usual activities of daily living, and quality of life.
- ⚙ Post operative pain management begins in the prehabilitation period with systematic assessment and management of baseline/everyday pain (i.e., what is typically used to assess and manage the child's everyday pain).
- ⚙ In children and youth with significant neurologic impairment or developmental disability (e.g., cerebral palsy, autism), pain expression can be highly individual and distress behaviours may be confused with other emotional states (happiness, sadness, etc.).
- ⚙ Engaging experienced caregivers in the perioperative setting is essential for evaluating pain and the impact of pain treatment.
- ⚙ Atypical ways of expressing pain must not lead to the false belief that a child or youth with motor, social, or language impairment does not experience pain.
- ⚙ Consider referral to Child Life Specialist for pre-op and post-op coping.

Assessment of pain in a Prehab setting is to determine if further workup and care is needed prior to surgery. We recognize pain in children with an NDD is difficult and for the most part we defer to the parent or caregiver.

Pediatric Pre-Surgical Pain Screening Tool

This is a pathway derived from the PIUO (Pain and Irritability of Unknown Origin) project. (Siden & Oberlander)

1. How often has your child experienced pain in the last two weeks?

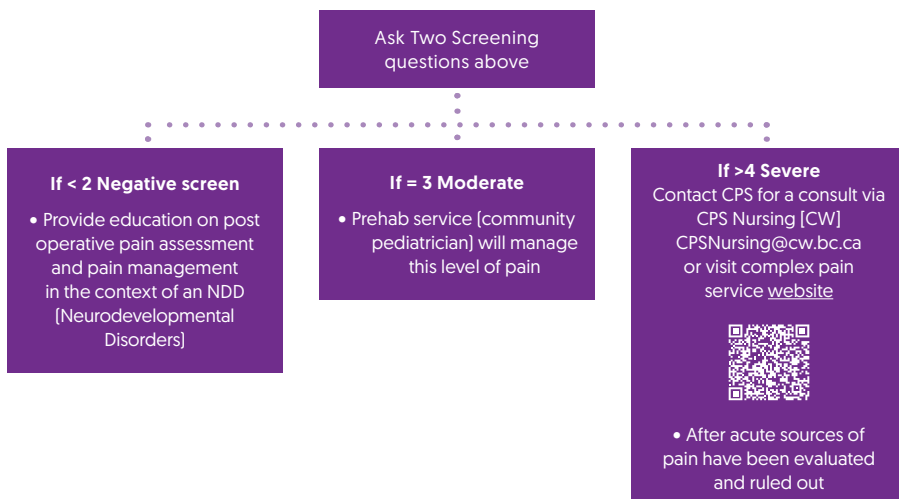
- ☐ [0] Never
- ☐ [1] Some days
- ☐ [2] Most days
- ☐ [3] Every day

2. Thinking about the last time your child had pain how much did they have?

- ☐ [1] A little
- ☐ [2] Between a little and a lot
- ☐ [3] A lot

Scoring Key

Question #1	Question #2	Scoring	Definition
Never	Not applicable	0	Pain free
Some days	A little	2	Low
Some days	Between a little and a lot	3	Moderate
Most days	A little	4	High
Some days	A lot		
Most days	Between a little and a lot		
Every day	A little		
Most days	A lot	5–6	Severe
Every day	Between a little and a lot		
Every day	A lot		





RESPIRATORY

RESPIRATORY

Children with neuromuscular disease [NMD], cerebral palsy, neurodegenerative syndromes and chest wall deformities are at an increased risk of peri-operative respiratory adverse events [PRAEs], the most common being pneumonia and respiratory failure.

The higher rate of PRAEs in children with medical complexities is associated with an increased prevalence of sleep disordered breathing, impaired airway clearance, reduced pulmonary reserve and chest wall compliance. These are further exacerbated by immobility and pain in the post-operative period. The potential need for supplemental oxygen, non-invasive [NIV] or invasive ventilation [IV], reintubation and/or airway support can result in prolonged hospital stays and worse patient outcomes.

Patients identified as high risk via the presence of red flags on clinical history and/or objective tools should be referred to respiratory medicine for further evaluation.



Cultural Safety Recommendations

Coordinate: Smudging/ ceremony with oxygen safety policy.

Access: When recommending sleep studies, note access issues; offer oximetry/CO2 monitoring alternatives.

Teaching: Airway clearance teaching with interpreter + teach-back + visual aids; plan for equipment loaner.

3 key areas to screen for pre-operatively include

Sleep Disordered Breathing (SDB)

Overview

SDB refers to a range of conditions that result in abnormal breathing during sleep and include obstructive sleep apnea (OSA), central sleep apnea, and hypoventilation. Most common is OSA which is characterized by recurring episodes of complete and/or partial obstruction of the upper airway during sleep, resulting in intermittent hypoxemia, hypercapnia, arousals and sleep fragmentation.

Red Flags on History

- ⚙ **Night-time symptoms:** snoring, apneas, gasping breaths, nocturnal diaphoresis, enuresis, restless sleep, frequent nocturnal awakenings, paradoxical or labored breathing, mouth breathing, hyperextension of the neck during sleep
- ⚙ **Daytime symptoms:** excessive daytime sleepiness, learning difficulties, inattention and hyperactivity, poor concentration, behavioral and mood disorders, morning headaches

Screening Tool

Pediatric Sleep Questionnaire (PSQ)



[Official PSQ | Pediatric Sleep Questionnaire](#)
[distributed by Mapi Research Trust | ePROVIDE](#)

Prehabilitation and Optimization

Recommendation

Referral for Diagnostic Testing

- ⚙ Consider referral to Respiratory (Sleep) Medicine for consideration of polysomnography (sleep study)
- ⚙ If limited access to polysomnography, consider screening assessment with overnight oximetry and continuous carbon dioxide monitoring (either with end-tidal or transcutaneous carbon dioxide) or capillary blood gas

Additional Pre-Operative Recommendations

- ⚙ Patients with known sleep apnea should be evaluated by Anesthesiology.
 - ⚙ Patients established on respiratory technology should be evaluated by Respiratory Medicine, or Home Tracheostomy and Ventilation (HTV) Clinic if followed at BCCH, to ensure therapy is optimized and establish a personalized peri-operative care plan, including extubation guidelines and post-operative admission location.
 - ⚙ Limit use of opiates/respiratory depressants in favor of local analgesia if possible.
-

Secretion and Aspiration Management

Overview

Sialorrhea refers to drooling of saliva which can be attributed to a lack of coordinated control of the oropharyngeal musculature, lack of awareness of oral incompetence, impaired sensation to the lower lip or a functional and/or structural inability to close the mouth. Sialorrhea can manifest anteriorly, as spillage of saliva over the lower lips and chin, or posteriorly, with pooling of secretions through the oropharynx into the hypopharynx with an increased risk of aspiration.

Red Flags on History

- ⚙ Presence of anterior drooling or trouble managing upper airway secretions
- ⚙ Pooling of secretions in the posterior oropharynx
- ⚙ Need for frequent suctioning
- ⚙ Presence of coughing, sputtering, emesis, or choking when eating or drinking
- ⚙ History of recurrent aspiration pneumonia
- ⚙ Frequent respiratory symptoms (daily wet cough, phlegm, wheeze)

Screening Tool

Drooling Severity and Frequency Scale



Drooling - Severity	Score
1. Dry (never drools)	1
2. Mild (wet lips only)	2
3. Moderate (wet lips and chin)	3
4. Severe (wet clothes)	4
5. Profuse (wet clothing, hands, trays, objects within reach)	5

Drooling - Frequency	Score
6. Never drools	1
7. Occasionally drools	2
8. Frequently drools	3
9. Constantly drools	4

Taken from: Thomas-Stonell and Greenberg

The Drooling Score equals the sum of the Severity and Frequency sub-scores.

Prehabilitation and Optimization Recommendation

Referral for Diagnostic Testing

- Consider a referral to an Occupational Therapist or Speech Language Pathologist for swallowing/feeding assessment and trial of behavioral and non-medical interventions.
- Chest X-Ray to screen for chronic inflammatory changes (ie.opacity/atelectasis/bronchial dilatation).

Additional Pre-Operative Recommendations

- ⚙ Consider providing home suction unit for nasal/oral suctioning.
- ⚙ Consider trial of anti-cholinergic medication (ie. atropine, glycopyrrolate).
- ⚙ If inadequate response to anticholinergic medication or intolerant of side effects, consideration may be given to salivary botox or surgical intervention. Depending on the institution, this may require a consultation to Otolaryngology or Interventional Radiology.

Airway Clearance

Overview

A weak cough associated with respiratory muscle weakness can lead to mucous retention, resulting in atelectasis, infection, and chronic inflammation. Supportive airway clearance techniques can prevent these sequelae by removing secretions from the lungs and airways.

Red Flags on History

- ⚙ Description or observation of ineffective or weak cough
- ⚙ Admission for a respiratory illness in the past year
- ⚙ Treatment with 2 or more courses of antibiotics for chest infections in the past year
- ⚙ Previous/recurrent respiratory failure with acute viral infections or surgery necessitating hospital or ICU admission

Diagnostic Tools

❁ Spirometry

- Spirometry should be obtained in cooperative patients (age > 6 years)
- Guidelines in children with NMD suggest increased risk for PRAEs if forced vital capacity (FVC) <60% predicted

❁ Peak Cough Flow (PCF)

- In patients with NMD >12 years, PCF <270 L/min is considered ineffective and predisposes to extubation failure
- PCF <5th percentile for age in patients < 12 years suggests impaired cough

❁ Maximal Inspiratory Pressure (MIP)/ Maximal Expiratory Pressure (MEP)

- MEP <60 cmH₂O may require initiation of assisted coughing technique

Prehabilitation and Optimization Recommendation

Referral for Diagnostic Testing

- ❁ Consider referral to a Physiotherapist or Respiratory Therapist (depending on your institution and local expertise) for assessment and education of targeted airway clearance therapy
- ❁ Consider referral to Respiratory Medicine for assessment and evaluation for augmentative cough techniques (ie. breath stacking, lung volume recruitment, mechanical insufflation-exsufflation)
- ❁ Consideration may be given to agents that alter viscosity of secretions (ie. nebulized saline)

Additional Pre-Operative Recommendation:

- ⚙ Patients on NIV and using augmentative cough therapy should be evaluated by Respiratory Medicine, or HTV Clinic if followed at BCCH, to ensure therapy is optimized and establish a personalized peri-operative care plan.
-

Immunizations

Respiratory Syncytial Virus (RSV) Prophylaxis

Should be administered to eligible high-risk infants and young children to reduce RSV-related hospitalizations. Please refer to up-to-date [Child Health BC RSV Immunoprophylaxis Guidelines](#).

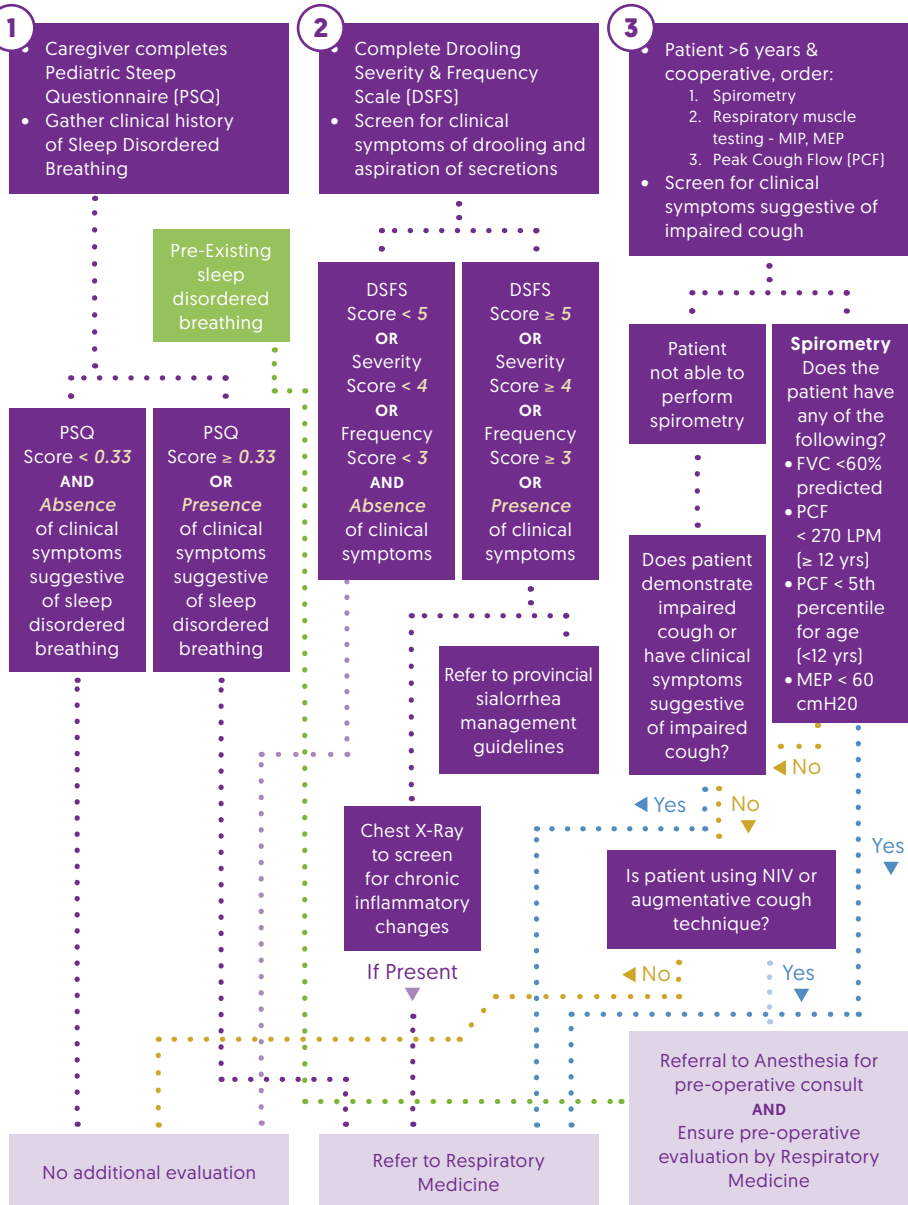


Pneumococcal Conjugate Vaccine-20 Valent (PCV20)

Should be administered to eligible infants and children at increased risk for pneumococcal infection. Please refer to up-to-date [BC Immunization Program Guidelines](#).



Pre-operative Respiratory Screening for Children with Medical Complexity





SOCIAL

SOCIAL

Emerging evidence highlights the significant impact of external, non-medical factors on surgical outcomes, particularly in pediatric populations.

Studies consistently link poorer outcomes to the [Social Vulnerability Index](#) and other social determinants of health. These include a patient's support system, family dynamics, living environment, geographic isolation, race, financial strain, and language barriers.

Early identification of these factors through pre-screening can inform more comprehensive treatment planning and facilitate access to essential perioperative and postoperative resources. Importantly, addressing the social and cultural needs of both the child and their family is a critical step in reducing traumatic stress and promoting better recovery throughout the surgical care continuum.



Cultural Safety Recommendations

Recognize: Diverse kinship structures in consent.

Anticipate: Travel, lodging, employment/leave, caregiver burnout; connect early to supports.

Document: Highlight strengths (“family priorities,” “supports in place”)—avoid stigmatizing language.

Cultural Safety

Name anti-racism and Indigenous-specific racism to promote cultural safety and to challenge self-biases. Pair this with actionable supports such as: Indigenous health, interpreters, Elder support, and/or family identified cultural community members.

Screening Goals

- ⚙️ Arrange supports and resource allocation pre-operatively
- ⚙️ Ensure mental health supports are arranged throughout and after the operative journey
- ⚙️ Establish who is the medical decision maker and support network, recognizing diverse kinship structures
- ⚙️ Establish Indigenous supports throughout the operative journey

Structure

Screening

- ⚙️ Screening questions to determine if they need social work involvement

Screening Tool

Screening questions

Are there concerns around?

- ✿ **Transportation:** for pre/post operative appointments, funding for safe transport for equipment.
- ✿ **Household Finances:** does the family require crisis funding to support caregivers to be off work for their child's recovery?
- ✿ **Employment:** does the family require a letter of support for their employer to grant time off work? Applications for employment insurance to supplement income to time off.
- ✿ **Accommodation:** during hospitalization and community-based housing
- ✿ **Post-operative community and social support:** with decreased mobility and extended recovery time postoperatively, does the family have additional support to prevent caregiver burnout?
- ✿ **Wellbeing of child and caregivers:** is there a preexisting mental health challenge? Will additional stress of a surgery increase anxiety to the point where treatment is recommended? Are there substance use concerns? Is cultural or spiritual care required?
- ✿ **Safety/care capacity in the home environment:** Is there already a heavy care burden on the family? Are there other children or high needs family members in the home? Are there child protection concerns? Is the home environment physically, psychologically, and socially safe?
- ✿ **Barriers getting to appointments or managing care plan:** is there a language barrier? Are there caregiver learning difficulties?

Please refer to social worker for support in any of these domains.

Intervention

- ⊗ Organizational support (social worker, child life specialist, Indigenous patient navigator, etc.)
- ⊗ Community support (governmental funding for home nursing and equipment, transportation, etc.)
- ⊗ Charity supports
- ⊗ Private support (savings, insurance, friends/family/community, etc.)

Outcomes

- ⊗ Family/patient agree with care plan and goals
- ⊗ Post-operative supports confirmed
- ⊗ Family and professionals report
- ⊗ Documenting and highlighting strengths of the family, avoiding stigmatizing language

Frameworks

A. ASCD Child's Circle of Support — Aboriginal Supported Child Development., n.d.

ASCD Practice Guidelines Framework Child's Circle of Support



Adapted from "Trinity's Ecological Model of Support"
By Laranna Androsoff (ASCD Working Group-Parent Representative)

B. Pediatric Medical Traumatic Stress A Comprehensive Guide., n.d.

Traumatic Stress in Ill or Injured Children

AFTER THE ABC'S CONSIDER THE DEF'S

D

Distress

- Assess and manage pain.
- Ask about fears and worries.
- Consider grief and loss.

E

Emotional Support

- Who and what does the patient need now?
- Barriers to mobilizing existing supports?

F

Family

- Assess parents' or siblings' and others' distress.
- Gauge family stressors and resources.
- Address other needs (beyond medical.)

APPENDICES



Appendix 1 Search Strategy

#	Query	Results from 29 Jul 2025
1	preoperative exercise/	3,352
2	[prehabilitation or preoperative optimi#ation or surgical optimi#ation or preoperative screening or peri-operative care or perioperative care or preoperative intervention\$.tw,kf.	19,665
3	1 or 2	20,438
4	limit 3 to children - focussed	1,797
5	limit 4 to "remove clinical trial [clinicaltrials.gov] records"	1,716
6	frailty score/ or frailty/	40,851
7	[fragility or frail* or fragile].tw,kf.	141,598
8	6 or 7	146,141
9	5 and 8 5 and 8	33
10	occupational therapy/ or equipment/ or mobility/	460,276
11	[occupational therapy or mobility or equipment or wheelchair* or powerchair* or AFO* or cerebral palsy or "continuity of care" or transitional care].tw,kf.	559,166
12	10 or 11	982,168
13	5 and 12	85
14	Anxiety/ or Anxious/	359,937
16	14 or 15	799,033
17	5 and 16	108
18	[neuromuscular or respiratory or respirolog*].tw,kf.	995,453
19	5 and 18	172
20	Anemia/ or Hematology/	363,505
21	[an?emi* or h?ematol* or iron deficiency].tw,kf.	612,505
22	20 or 21	770,274

23	5 and 22	91
24	Nutrition/ or Malnutrition/ or Obesity/	826,255
25	[nutrition* or nutrient or malnutrition or obesity or BMI or diet or anthropometric measurements or feeding or nutrition screening or nutrition support or nutrition* deficiencies].tw,kf.	2,143,369
26	24 or 25	2,347,396
27	5 and 26	205
28	Social/ or Social support/ or "social determinants of health"/ or exp social status/	429,701
29	["social determinants of health" or socioeconomic status or income or transportation or social support or caregiver or family support or psychosocial or health disparities or insurance or "barriers to discharge" or single-parent household or social vulnerability or child life services].tw,kf.	902,363
30	28 or 29	1,117,900
31	5 and 30	107
32	Cardiac/ or Cardiology/	111,947
33	[cardiac or cardiology or cardioresp* or cardiovasc* or cardiothorac* or heart or troponin* or murmur or wall abnormality or echocardiogram].tw,kf.	2,949,984
34	32 or 33	2,980,163
35	5 and 34	470
36	[fetal or p?ediatric or congenital or teen or teenager or adolescent or "young adult"].tw,kf.	1,754,483
37	35 and 36	373

Appendix 2

Table 1: Risk Factors for Iron Deficiency in Children and Adolescents

Guidelines & Protocols Advisory Committee. [2023, November 2]. Iron deficiency – Diagnosis and management. Province of British Columbia. Retrieved September 7, 2025. <https://www2.gov.bc.ca/gov/content/health/practitioner-professional-resources/bc-guidelines/iron-deficiency#iron-deficiency>.

Age Group	Risk Factors
All ages	- Increased requirements due to growth - Low socioeconomic status - Lack of balanced diet (including ethnic groups with high-fibre, phytate-rich diets, e.g., some Asian populations) - Celiac disease - Bleeding from any source (e.g., frequent nosebleeds, gastrointestinal disease, short gut syndrome, cow's milk protein colitis)
Infants < 6 months	- Maternal iron deficiency - Prematurity or low birth weight (low blood volume at birth, phlebotomy) - Feeding with inappropriate milk substitutes other than breastmilk or commercial infant formula - History of fetal–maternal haemorrhage - History of twin-to-twin transfusion
Toddlers 6-36 months	- Prematurity - Exclusive breastfeeding beyond 6 months - Cow's milk before 9 months - Excessive cow's milk intake (>750 mL/day) - Bottle use beyond 12–15 months - Picky eating (insufficient intake/diversity of solid foods) - Obesity
Children 3-12 years	- Risk factors generally the same as those listed under All ages (growth, dietary insufficiency, chronic illness, bleeding, celiac disease, socioeconomic status) - No unique pediatric risk factors identified beyond those groups.
Adolescents	- Menorrhagia - Disordered eating - Vegetarian diet - Extreme physical exercise/endurance athletics - Low body weight

REFERENCES



Patient Activation References

Benini, F., Antonello, L. M., & Duci, M. [2023]. Frailty in Pediatrics: Definition and Care Needs. In M. Lima & M. C. Mondardini [Eds], *Frailty in Children: From the Perioperative Management to the Multidisciplinary Approach* [pp. 3–10]. Springer International Publishing.

Berry, J. [2019]. *Perioperative Planning Makes All the Difference for High-Risk Pediatric Surgery*. Engaging Patients. <http://www.engagingpatients.org/2019-sherman-award-winner/perioperative-planning-makes-difference-high-risk-pediatric-surgery/>

Boston Children's Hospital & Courageous Parents Network. [2023]. *Scoliosis and Spine / Spinal Surgery: Facts and Decision-Making*. Courageous Parents Network. <https://courageousparentsnetwork.org/guides/decision-making-around-spinal-fusion-surgery>

Camardelli, M. S., Campmany, L., Hammermuller, E., & Arighi, P. [2025]. Complexity of healthcare needs of children and adolescents with complex chronic illnesses and primary caregiver burden. *Archivos Argentinos de Pediatria*, 123[4]. <https://doi.org/10.5546/aap.2024-10348.eng>

Cohen, E., Kuo, D. Z., Agrawal, R., Berry, J. G., Bhagat, S. K. M., Simon, T. D., & Srivastava, R. [2011]. Children With Medical Complexity: An Emerging Population for Clinical and Research Initiatives. *Pediatrics*, 127[3], 529–538. <https://doi.org/10.1542/peds.2010-0910>

Giordano, M., Casavant, D., Flores Cano, J. C., Rempel, G., Dorste, A., Graham, R. J., Quates, S. K., Belthur, M. V., Bastianelli, L. C., Sewell, T. B., Zamkoff, J., Mauskar, S., Mariani, J., Trost, M. J., Simpson, B., Stringfellow, I., & Berry, J. G. [2024]. Perioperative Health Interventions in Children With Chronic Neuromuscular Conditions Undergoing Major Musculoskeletal Surgery: A Scoping Review. *Hospital pediatrics*, 14[6], e281–e291. <https://doi.org/10.1542/hpeds.2021-006187>

Gordon, J. B., Colby, H. H., Bartelt, T., Jablonski, D., Krauthoefer, M. L., & Havens, P. [2007]. A tertiary care-primary care partnership model for medically complex and fragile children and youth with special health care needs. *Archives of pediatrics & adolescent medicine*, 161[10], 937–944. <https://doi.org/10.1001/archpedi.161.10.937>

International Committee on Perioperative Care for Children with Medical Complexity Deciding on and Preparing for Major Musculoskeletal Surgery in Children with Medical Complexity. [n.d.]. Rise Articulate. https://rise.articulate.com/share/qdoHwtIAWoBdt7-o5e7CPT_s7ULGlnAH#/

International Committee on Perioperative Care for Children with Medical Complexity Pre-Op Checklist for Orthopaedic Surgery in Children with Medical Complexity. [n.d.]. Rise Articulate. https://rise.articulate.com/share/qdoHwtIAWoBdt7-o5e7CPT_s7ULGlnAH#/

Mariani, J. [2025]. *Boston Complex Care Surgery Preparation Team 2025, unpublished*. Boston Children's Hospital. <chrome-extension://efaidnbmnnnibpcajpgclefindmkaj/https://www.childrenshospital.org/sites/default/files/2022-04/complex-care-surgery-preparation-team.pdf>

Mason, S. L., Sebesta, M. R., Snow, S., Frino, J., Gyr, B., Nageswaran, S., Auriemma, J. R., & Haberman, C. [2022]. Multidisciplinary Approach to Optimize the Health of Children with Medical Complexity Undergoing Orthopaedic Surgery. *Journal of the Pediatric Orthopaedic Society of North America*, 4[4], 490. <https://doi.org/10.55275/JPOSNA-2022-490>

McPherson, M., Arango, P., Fox, H., Lauver, C., McManus, M., Newacheck, P. W., Perrin, J. M., Shonkoff, J. P., & Strickland, B. [1998]. A new definition of children with special health care needs. *Pediatrics*, 102[1 Pt 1], 137–140. <https://doi.org/10.1542/peds.102.1.137>

Whitney, D., Hurvitz, E., Ryan, J., Devlin, M., Caird, M., French, Z., Ellenberg, E., & Peterson, M. [2018]. Noncommunicable disease and multimorbidity in young adults with cerebral palsy. *Clinical Epidemiology*, Volume 10, 511–519. <https://doi.org/10.2147/CLEP.S159405>

Anemia and Iron Deficiency References

Ademuyiwa, A., Bode, C., Adekola, O., Desalu, I., Elebute, O., & Kushimo, O. [2016]. Routine hemoglobin electrophoresis for pediatric surgery day case in at-risk populations: Suggested algorithm for screening using clinical risk factors. *Nigerian Journal of Clinical Practice*, 19[3], 349. <https://doi.org/10.4103/1119-3077.179272>

Anadio, J., Lane, A., Tarango, C., Sturm, P., & Palumbo, J. S. [2015]. Assessing Bleeding Risk in Pediatric Patients Undergoing Major Spinal Surgery. *Blood*, 126[23], 3518–3518. <https://doi.org/10.1182/blood.V126.23.3518.3518>

Cholette, J. M., Faraoni, D., Goobie, S. M., Ferraris, V., & Hassan, N. [2018]. Patient Blood Management in Pediatric Cardiac Surgery: A Review. *Anesthesia & Analgesia*, 127[4], 1002–1016. <https://doi.org/10.1213/ANE.0000000000002504>

CPOC. Guideline for Management of Anaemia in the Perioperative Pathway. London: CPOC, 2025. ISBN: 978-1-900936-38-5. Version 2.1. Retrieved from: <https://cpoc.org.uk/guidelines-and-resources/guidelines/anaemia-perioperative-pathway>

Guidelines & Protocols Advisory Committee. [2023, November 2]. *Iron deficiency – Diagnosis and management*. Province of British Columbia. Retrieved September 7, 2025 www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/iron-deficiency-appendix-d.pdf

Pasricha SR, Hayes E, Kalumba K, Biggs BA. Effect of daily iron supplementation on health in children aged 4–23 months: a systematic review and meta-analysis of randomised controlled trials. *Lancet Glob Health*. 2013 Aug;l[2]:e77–E86. <https://www2.gov.bc.ca/gov/content/health/practitioner-professional-resources/bc-guidelines/iron-deficiency#iron-deficiency>

Tan, G. M., Murto, K., Downey, L. A., Wilder, M. S., & Goobie, S. M. [2023]. Error traps in Pediatric Patient Blood Management in the Perioperative Period. *Pediatric Anesthesia*, 33[8], 609–619. <https://doi.org/10.1111/pan.14683>

Queen's University, Kingston General Hospital. [2016, July 22]. *Bleeding questionnaires*. Queen's University. Retrieved September 7, 2025, from <https://www.path.queensu.ca/labs/lillicrap/bq.htm>.

Cardiac References

Connolly D, Rutkowski M, Auslender M, Artman M. The New York University Pediatric Heart Failure Index: a new method of quantifying chronic heart failure severity in children. *J Pediatr*. 2001 May;138(5):644-8.

Davies RA, Ladouceur VB, Green MS, Joza J, Juurlink DN, Krahn AD, McMurtry MS, Roberts JD, Roston TM, Sanatani S, Steinberg C, MacIntyre C. The 2023 Canadian Cardiovascular Society Clinical Practice Update on Management of the Patient With a Prolonged QT Interval. *Can J Cardiol*. 2023 Oct;39(10):1285-1301.

Faraoni D, Zou X, DiNardo JA, Nasr VG. Integration of the intrinsic surgical risk with patient comorbidities and severity of congenital cardiac disease does not improve risk stratification in children undergoing noncardiac surgery. *Anesth Analg*. 2020.

Groh WJ, Bhakta D, Tomaselli GF, Aleong RG, Teixeira RA, Amato A, Asirvatham SJ, Cha YM, Corrado D, Duboc D, Goldberger ZD, Horie M, Hornyak JE, Jefferies JL, Käb S, Kalman JM, Kertes NJ, Lakdawala NK, Lambiase PD, Lubitz SA, McMillan HJ, McNally EM, Milone M, Namboodiri

Kantor PF, Loughheed J, Dancea A, McGillion M, Barbosa N, Chan C, Dillenburg R, Atallah J, Buchholz H, Chant-Gambacort C, Conway J, Gardin L, George K, Greenway S, Human DG, Jeewa A, Price JF, Ross RD, Roche SL, Ryerson L, Soni R, Wilson J, Wong K; Children's Heart Failure Study Group. Presentation, diagnosis, and medical management of heart failure in children: Canadian Cardiovascular Society guidelines. *Can J Cardiol*. 2013 Dec;29(12):1535-52.

Nasr VG, Markham LW, Clay M, DiNardo JA, Faraoni D, Gottlieb-Sen D, Miller-Hance WC, Pike NA, Rotman C; American Heart Association Council on Lifelong Congenital Heart Disease and Heart Health in the Young and Council on Cardiovascular Radiology and Intervention. Perioperative Considerations for Pediatric Patients With Congenital Heart Disease Presenting for Noncardiac Procedures: A Scientific Statement From the American Heart Association. *Circ Cardiovasc Qual Outcomes*. 2023 Jan;16(1):e000113.

N, Nazarian S, Patton KK, Russo V, Sacher F, Santangeli P, Shen WK, Sobral Filho DC, Stambler BS, Stöllberger C, Wahbi K, Wehrens XHT, Weiner MM, Wheeler MT, Zeppenfeld K. 2022 HRS expert consensus statement on evaluation and management of arrhythmic risk in neuromuscular disorders. *Heart Rhythm*. 2022 Oct;19(10):e61-e120.

Parker DM, Stabler ME, MacKenzie TA, Zimmerman MS, Shi X, Everett AD, Bucholz EM, Brown JR. Population-Based Estimates of the Prevalence of Children With Congenital Heart Disease and Associated Comorbidities in the United States. *Circ Cardiovasc Qual Outcomes*. 2024 Sep;17(9):e010657.

Ramamoorthy C, Haberkern CM, Bhananker SM, Domino KB, Posner KL, Campos JS, Morray JP. Anesthesia-related cardiac arrest in children with heart disease: data from the Pediatric Perioperative Cardiac Arrest (POCA) Registry. *Anesth Analg*. 2010;110:1376-1382.

Sedra F, Shafafy R, Sadek AR, Aftab S, Montgomery A, Nadarajah R. Perioperative Optimization of Patients With Neuromuscular Disorders Undergoing Scoliosis Corrective Surgery: A Multidisciplinary Team Approach. *Global Spine J*. 2021 Mar;31(2):240-248.

Taylor D, Habre W. Risk associated with anesthesia for noncardiac surgery in children with congenital heart disease. *Paediatr Anaesth*. 2019;29:426–434.

Yamamoto T, Schindler E. Anaesthesia management for non-cardiac surgery in children with congenital heart disease. *Anaesthesiol Intensive Ther*. 2016;48:305–313.

Zuk M, Migdal A, Jagiellowicz-Kowalska D, Mazurkiewicz K, Sadel-Wieczorek A, Brzezinska-Rajszys G. Six-Minute Walk Test in Evaluation of Children with Pulmonary Arterial Hypertension. *Pediatr Cardiol*. 2017 Apr;38(4):754-761.

Activities of Daily Living (ADLs) & Mobility References

Al Shami, A. [2024]. A comprehensive review of rehabilitation strategies post-orthopedic intervention in pediatric cerebral palsy. *Journal of Musculoskeletal Surgery and Research*, 9, 42–48. https://doi.org/10.25259/JMSR_204_2024

Bailes, A. F., Greve, K., Long, J., Kurowski, B. G., Vargus-Adams, J., Aronow, B., & Mitelpunkt, A. [2021]. Describing the Delivery of Evidence-Based Physical Therapy Intervention to Individuals With Cerebral Palsy. *Pediatric physical therapy : the official publication of the Section on Pediatrics of the American Physical Therapy Association*, 33(2), 65–72. <https://doi.org/10.1097/PEP.0000000000000783>

Brady, M. A., Carrington, H., & Theologis, T. [2021]. Prehabilitation in Pediatric Orthopaedic Surgery Reduces Hospital Length of Stay. *Clinical Audit*, Volume 13, 1–7. <https://doi.org/10.2147/CA.S296690>

DiFazio, R.L., Vessey, J.A., Miller, P.E., Snyder, B.D. and Shore, B.J. [2022], Health-related quality of life and caregiver burden after hip reconstruction and spinal fusion in children with spastic cerebral palsy. *Dev Med Child Neurol*, 64: 80-87. <https://doi.org/10.1111/dmcn.14994>

Gannotti, M., Frumberg, D. [2020]. Clinical Therapy Services for Adults with Cerebral Palsy. In: Miller, F., Bachrach, S., Lennon, N., O'Neil, M. (eds) *Cerebral Palsy*. Springer, Cham. https://doi.org/10.1007/978-3-319-50592-3_158-1

Keys, M., & Lewis, C. [2019]. An Interdisciplinary Approach for Treating Children with Cerebral Palsy. *Journal of Interprofessional Practice and Collaboration*, 1(1). Retrieved from <https://repository.ulm.edu/ojhp/vol1/iss1/7>

Sick Kids Hospital. [2024]. CPCHILD® Caregiver Priorities & Child Health Index of Life with Disabilities [Questionnaire]. *Sick Kids Hospital*. <https://lab.research.sickkids.ca/pscoreprogram/cpchild/>

Trabacca, A., Vespino, T., Di Liddo, A., & Russo, L. [2016]. Multidisciplinary rehabilitation for patients with cerebral palsy: improving long-term care. *Journal of multidisciplinary healthcare*, 9, 455–462. <https://doi.org/10.2147/JMDH.S88782>

Nutrition

Bell, K. L., Benfer, K. A., Ware, R. S., Patrao, T. A., Garvey, J. J., Haddow, R., Boyd, R. N., Davies, P. S. W., Arvedson, J. C., & Weir, K. A. [2020]. The Pediatric Subjective Global Nutrition Assessment Classifies More Children With Cerebral Palsy as Malnourished Compared With Anthropometry. *Journal of the Academy of Nutrition and Dietetics*, 120(11), 1893–1901. <https://doi.org/10.1016/j.jand.2020.04.012>

Bell, K. L., Benfer, K. A., Ware, R. S., Patrao, T. A., Garvey, J. J., Arvedson, J. C., Boyd, R. N., Davies, P. S. W., & Weir, K. A. [2019]. Development and validation of a screening tool for feeding/swallowing difficulties and undernutrition in children with cerebral palsy. *Developmental Medicine & Child Neurology*, 61(10), 1175–1181.

Brooks J, Day S, Day S, Shavelle R, Strauss D. Low weight, morbidity, and mortality in children with cerebral palsy: new clinical growth charts. *Pediatrics*. 2011 Aug;128(2):e299-307. DOI: 10.1542/peds.2010-2801. PMID: 21768315.

Canada, N.L., Mullins, L., Pearo, B. and Spoeede, E. [2016], Optimizing Perioperative Nutrition in Pediatric Populations. *Nutrition in Clinical Practice*, 31: 49-58. <https://doi.org/10.1177/0884533615622639>

Canadian Malnutrition Task Force & Canadian Nutrition Society. [2024]. *Subjective Global Nutrition Assessment Form (SGNA)* [Questionnaire]. chrome-extension://efaidnbmninnibpcapjcgclcfndmkaj/[https://nutritioncareinCanada.ca/sites/default/uploads/files/Pediatrics/Subjective_Global_Nutrition_Assessment%20Form\(SGNA\).pdf](https://nutritioncareinCanada.ca/sites/default/uploads/files/Pediatrics/Subjective_Global_Nutrition_Assessment%20Form(SGNA).pdf)

Evans, D.C., Martindale, R.G., Kiraly, L.N. and Jones, C.M. [2014], Nutrition Optimization Prior to Surgery. *Nutrition in Clinical Practice*, 29: 10-21. <https://doi.org/10.1177/0884533613517006>

Fehlings, D., Switzer, L., Agarwal, P., Wong, C., Sochett, E., Stevenson, R., ... & Thorogood, L. [2012]. Informing evidence- based clinical practice guidelines for children with cerebral palsy at risk of osteoporosis: A systematic review. *Developmental Medicine & Child Neurology*, 54(2), 106-116.

Gambra-Arzo, M., Alonso-Cadenas, J.A., Jiménez-Legido, M., López-Giménez, M.R., Martín-Rivada, Á., de los Ángeles Martínez-Ibeas, M., Cañedo-Villarroya, E. and Pedrón-Giner, C. [2020], Nutrition Risk in Hospitalized Pediatric Patients: Higher Complication Rate and Higher Costs Related to Malnutrition. *Nutrition in Clinical Practice*, 35: 157-163. <https://doi.org/10.1002/ncp.10316>

Jadi, J., Hyder, S., Rodriguez Ormaza, N. P., Twer, E., Phillips, M., Akinkuotu, A., & Reid, T. D. [2023]. Evaluation of Complications and Weight Outcomes in Pediatric Cerebral Palsy Patients With Gastrostomy Tubes. *The American surgeon*, 89(4), 632–640. <https://doi.org/10.1177/00031348211034753>

Jie, B., Jiang, Z. M., Nolan, M. T., Zhu, S. N., Yu, K., & Kondrup, J. [2012]. Impact of preoperative nutritional support on clinical outcome in abdominal surgical patients at nutritional risk. *Nutrition [Burbank, Los Angeles County, Calif.]*, 28(10), 1022–1027. <https://doi.org/10.1016/j.nut.2012.01.017>

Martins DS, Piper HG. Nutrition considerations in pediatric surgical patients. *Nut Clin Pract*. 2022; 37: 510-520. doi:10.1002/ncp.10855

Minhas, S. V., Chow, I., & Otsuka, N. Y. [2016]. The Effect of Body Mass Index on Postoperative Morbidity After Orthopaedic Surgery in Children With Cerebral Palsy. *Journal of pediatric orthopedics*, 36[5], 505–510. <https://doi.org/10.1097/BPO.0000000000000475>

Peng, T., Zhao, Y., Fu, C., Huang, S., Zhou, H., Li, J., Tang, H., He, L., & Xu, K. [2022]. A study of validity and reliability for Subjective Global Nutritional Assessment in outpatient children with cerebral palsy. *Nutritional neuroscience*, 25[12], 2570–2576. <https://doi.org/10.1080/1028415X.2021.1990463>

Raval, M. V., Brockel, M. A., Kolaček, S., Simpson, K. E., Spoede, E., Starr, K. N. P., & Wulf, K. L. [2023]. Key Strategies for Optimizing Pediatric Perioperative Nutrition-Insight from a Multidisciplinary Expert Panel. *Nutrients*, 15[5], 1270. <https://doi.org/10.3390/nut15051270>

Romano, C., Van Winckel, M., Hulst, J., Broekaert, I., Bronsky, J., Dall'Oglio, L., Mis, N. F., Hojsak, I., Orel, R., Papadopoulou, A., Schaeppi, M., Thapar, N., Wilschanski, M., Sullivan, P., & Gottrand, F. [2019]. European Society for Pediatric Gastroenterology, Hepatology and Nutrition guidelines for the evaluation and treatment of gastrointestinal and nutritional complications in children with neurological impairment. *Journal of Pediatric Gastroenterology and Nutrition*, 68[3], 438–453. <https://doi.org/10.1097/MPG.0000000000002186>

Roye, D. P., Jr, & Roye, B. D. [2019]. Gross Motor Function Classification System Specific Growth Charts-Utility as a Risk Stratification Tool for Surgical Site Infection Following Spine Surgery. *Journal of pediatric orthopedics*, 39[4], e298–e302. <https://doi.org/10.1097/BPO.0000000000001285>

Weimann, A., Braga, M., Carli, F., Higashiguchi, T., Hübner, M., Klek, S., Laviano, A., Ljungqvist, O., Lobo, D. N., Martindale, R., Waitzberg, D. L., Bischoff, S. C., & Singer, P. [2017]. ESPEN practical guideline: Clinical nutrition in surgery. *Clinical Nutrition*, 36[1], 1187–1196.

White M, Lawson K, Ramsey R, et al. Simple Nutrition Screening Tool for Pediatric Inpatients. *JPEN J Parenter Enteral Nutr* 2016;40[3]:392-8.

Pain Management

Breau LM, McGrath PJ, Camfield CS, Finley GA. Psychometric properties of the non-communicating children's pain checklist-revised. *Pain*. 2002 Sep 1;99(1-2):349-57. https://pediatric-pain.ca/wp-content/uploads/2013/04/NCCPCR_200901.pdf

Burkitt, Chantel, et al. "Pain and Symptom Management in Neurodevelopmental Disorders: Sensory and Nociceptive Function/Pain and Symptom Management." *Neurodevelopmental Pediatrics: Genetic and Environmental Influences* (2023): 697-711.

Hauer J, Houtrow AJ. Pain assessment and treatment in children with significant impairment of the central nervous system. *Pediatrics*. 2017 Jun 1;139(6):e20171002.

Hunt A, Goldman A, Seers K, Crichton N, Mastroyannopoulou K, Moffat V, Oulton K, Brady M. Clinical validation of the pediatric pain profile. *Developmental medicine and child neurology*. 2004 Jan;46[1]:9-18. https://pppprofile.org.uk/wp-content/uploads/2018/11/history_and_baseline_assessments.pdf

Noyek, Samantha, et al. "A systematic review of self and observer assessment of pain and related functioning in youth with brain-based developmental disabilities." *Pain* 165.3 (2024): 523-536.

Raiter A, Merbler A, Burkitt CC, Symons FJ, Oberlander TF. Pain in individuals with intellectual disabilities. *Clinical pain management: a practical guide*. 2022 Mar 9:439-49.

Respiratory

Amin, R., MacLusky, I., Zielinski, D., Adderley, R., Carnevale, F., Chiang, J., Côté, A., Daniels, C., Daigneault, P., Harrison, C., Katz, S., Keilty, K., Majaesic, C., Moraes, T. J., Price, A., Radhakrishnan, D., Rapoport, A., Spier, S., Thavagnanam, S., ... Canadian Thoracic Society. [2017]. Pediatric home mechanical ventilation: A Canadian Thoracic Society clinical practice guideline executive summary. *Canadian Journal of Respiratory, Critical Care, and Sleep Medicine*, 1(1), 7–36. <https://doi.org/10.1080/24745332.2017.1300463>

Antolovich, G., Cooper, M., Johnson, M., Lundine, K., Yang, Y., Frayman, K., Vandeleur, M., Sutherland, I., Peachey, D., Gadish, T., Turner, B., & Harvey, A. [2022]. Perioperative Care of Children with Severe Neurological Impairment and Neuromuscular Scoliosis—A Practical Pathway to Optimize Perioperative Health and Guide Decision Making. *Journal of Clinical Medicine*, 11(22), 6769. <https://doi.org/10.3390/jcm11226769>

Chiang, J., & Amin, R. [2017]. Respiratory Care Considerations for Children with Medical Complexity. *Children (Basel)*, 4(5), 41. <https://doi.org/10.3390/children4050041>

Cooper, M. S., Blackmore, A. M., Gibson, N., Chang, A., Culloton, L., Depiazzi, J., Gains, J., Jaffe, A., Kong, W., Langdon, K., Marpole, R., Moshovis, L., Pavleski, K., & Wilson, A. C. [2021]. *Respiratory Health in Cerebral Palsy* [AACPD Care Pathways]. <https://www.aacpdm.org/publications/care-pathways/respiratory-health-in-cerebral-palsy>

Huerta, J., Taleu, H., Norton, R., Gries, H., Yun, P., & Lam, D. [2022]. Use of the Snoring, Trouble Breathing, Un-Refreshed questionnaire to predict perioperative respiratory adverse events in children. *Journal of Clinical Sleep Medicine*, 18(3), 695–701. <https://doi.org/10.5664/jcsm.9582>

Khan, A., Frazer-Green, L., Amin, R., Wolfe, L., Faulkner, G., Casey, K., Sharma, G., Selim, B., Zielinski, D., Aboussouan, L. S., McKim, D., & Gay, P. [2023]. Respiratory Management of Patients With Neuromuscular Weakness: An American College of Chest Physicians Clinical Practice Guideline and Expert Panel Report. *Chest*, 164(2), 394. <https://doi.org/10.1016/j.chest.2023.03.011>

Kiekkas, P., Stefanopoulos, N., Bakalis, N., Kefaliakos, A., & Konstantinou, E. [2016]. Perioperative Adverse Respiratory Events in Overweight/Obese Children: Systematic Review. *Journal of PeriAnesthesia Nursing*, 31(1), 11–22. <https://doi.org/10.1016/j.jopan.2014.11.018>

Naume, M. M., Hoei-Hansen, C. E., Born, A. P., Brekke, G., Høj, A., Nielsen, M. R., Borgwardt, L., Vissing, J., Dirks, J., Rye, A. K. S., Møller, M. H., Andersen, T. B., & Ørngreen, M. C. [2024]. A Prospective Study on the Feasibility and Effect of an Optimized Perioperative Care Protocol in Pediatric Neuromuscular Scoliosis Surgery. *Journal of Clinical Medicine*, 13(24), 7848. <https://doi.org/10.3390/jcm13247848>

St-Laurent, A., Zysman-Colman, Z., & Zielinski, D. [2022]. Respiratory prehabilitation in pediatric anesthesia in children with muscular and neurologic disease. *Pediatric Anesthesia*, 32(2), 228–236. <https://doi.org/10.1111/pan.14359>

Tait, A., Voepel-Lewis, T., Christensen, R., & O'Brien, L. [2013]. The STBUR questionnaire for predicting perioperative respiratory adverse events in children at risk for sleep-disordered breathing. *Paediatric Anaesthesiology*, 23(6), 510–516.

Terry, K. L., Disabato, J., & Krajicek, M. [n.d.]. Snoring, Trouble Breathing, *Un-Refreshed (STBUR) Screening Questionnaire to Reduce Perioperative Respiratory Adverse Events in Pediatric Surgical Patients: A Quality Improvement Project*.

Thomas-Stonell, N., & Greenberg, J. [1988]. Three treatment approaches and clinical factors in the reduction of drooling. *Dysphagia*, 3[2], 73-78.

Social

ASCD Child's Circle of Support — *Aboriginal Supported Child Development*. [n.d.]. www.ascdp.bc.ca. <https://www.ascdp.bc.ca/professionals/ascd-child-s-circle-of-support>

Barnard, J. G., Albright, K., Morrato, E. H., Nowels, C. T., Benefield, E. M., Hadley-Miller, N. A., Kempe, A., & Erickson, M. A. [2013]. Pediatric spinal fusion surgery and the transition to home-based care: provider expectations and carer experiences. *Health & Social Care in the Community*, n/a-n/a. <https://doi.org/10.1111/hsc.12049>

Nieri, C. A., Davies, C., Luttrell, J. B., & Sheyn, A. [2023]. Associations Between Social Vulnerability Indicators and Pediatric Tonsillectomy Outcomes. *The Laryngoscope*, 134[2], 954–962. <https://doi.org/10.1002/lary.30836>

Pediatric Medical Traumatic Stress A Comprehensive Guide. [n.d.]. https://www.nctsn.org/sites/default/files/resources//pediatric_toolkit_for_health_care_providers.pdf

Perez, N. P., Ahmad, H., Alemayehu, H., Newman, E. A., & Reyes-Ferral, C. [2021]. The Impact of Social Determinants of Health on the Overall Wellbeing of Children: A Review for the Pediatric Surgeon. *Journal of Pediatric Surgery*, 57[4]. <https://doi.org/10.1016/j.jpedsurg.2021.10.018>

Richard, H. M., Nguyen, D. C., Birch, J. G., Roland, S. D., Samchukov, M. K., & Cherkashin, A. M. [2015]. Clinical Implications of Psychosocial Factors on Pediatric External Fixation Treatment and Recommendations. *Clinical Orthopaedics and Related Research*®, 473[10], 3154–3162. <https://doi.org/10.1007/s11999-015-4276-z>

Yap, A., Laverde, R., Thompson, A., Ozgediz, D., Ehie, O., Mpody, C., & Vu, L. [2023]. Social vulnerability index (SVI) and poor postoperative outcomes in children undergoing surgery in California. *The American Journal of Surgery*, 225[1], 122–128. <https://doi.org/10.1016/j.amjsurg.2022.09.030>



Specialist Services Committee

115 - 1665 West Broadway
Vancouver BC V6J 5A4

604.638.4852
sscbc@doctorsofbc.ca

www.sscbc.ca