LOW-RISK SPINAL FUSION

Algorithm 1: Preoperative

Pt undergoing or considering undergoing major spinal or chest wall deformity procedure (e.g., spinal fusion or magnetic growing rod insertion)

↓

Pre-Op Surgical Assessment
(1 - 4 months prior to surgery)
- Surgeon/PA, spine nurse, patient/family to attend
- Risk vs. benefit analysis
- Educate about steps prior to surgery and surgical procedure
- Discuss possible sub-specialty consults/evaluations

↓

Spine nurse conducts phone follow up with family to complete assessment
(RN Spine Pre-op care coordination call in Epic)

↓

Spine nurse communicates with appropriate care team members to determine appropriate consults/evaluations and scheduling of appointments

↓

Complete additional consults/evaluations as clinically indicated:
- Dermatology
- Nutrition
- Anesthesiology
- Others (if indicated)

↓

Pre-Admission (1-2 weeks prior to surgery)
- Pre-op labs:
  - Hemoglobin
  - Type and screen
  - MRSA (less than 13 years and/or pre-menarchal)
- Pre-op Imaging as indicated
- Determine surgical antibiotic prophylaxis (consult Epidemiology/Infection control physician for patients who are currently on antibiotics or prior surgical site infection)
- Patient/family education
- Spine nurse to complete Safe for Surgery Checklist and review with provider

↓

Day of Surgery
- Skin assessment
- Labs: Urine pregnancy test for 12 and older and/or post-menarchal, confirmatory Type and Screen
- Pre-op medications: Refer to Table 1 and Ortho IP Spinal Fusion Admission Orderset in Epic.

Inclusion Criteria
- Patients having spine surgery without other complex chronic conditions

Exclusion Criteria
- High-risk spinal fusion patients
- Non-ambulatory patients

! Assess for mental health concerns and refer to psychology if needed

Spine class is required for patient/family education
- If unable to attend, will get same information at pre-op visit

Algorithm 2: Postoperative

! If going to PICU, consult with orthopedic team to determine post-ICU disposition upon transfer to floor

Orthopedics/Anesthesia team hand off patient to the PACU

Orthopedic Team Clinical Management

- VTE prophylaxis for at risk patients in accordance with VTE Prevention Clinical Pathway. Discuss with surgeons need for enoxaparin if still at risk for VTE.
- Lung expansion protocol (q1 hour incentive spirometry while awake) *nursing to refer to protocol as needed
- Cold therapy as needed for pain
- **Post-op labs:**
  - Hemoglobin as clinically indicated
- **Post-op medications** as shown in Table 2 and the **Ortho IP Spinal Fusion Post-Op Orders**
- Dressing and incision care per the Surgical Site Infection (SSI) Spine Surgery Bundle
- Ensure adherence to activity and bowel regimen recommendations in green boxes to the right.

Patient Discharged (see criteria below)

- Follow up in 4-8 weeks post-op

Inclusion Criteria

- Patients having spine surgery without other complex chronic conditions

Exclusion Criteria

- High-risk spinal fusion patients
- Non-ambulatory patients

Activity:

Day of surgery- ALL patients:

- Sit on end of bed and/or get into chair with help from bedside nursing (*morning surgery patients)
- Elevate head of the bed up to 90° as tolerated
- Logroll every 2 hours and as needed.
- Physical therapy twice daily until patient is cleared

Postoperative day 1:

- Physical therapy to assist patient to dangle legs over edge of bed and/or get into chair
- Physical therapy to assess swift transferring to bedside chair and begin ambulation in afternoon

Postoperative day 2/3 until discharge:

- Ambulatory patients: Continue ambulation with physical therapist and practice stairs once cleared by PT.
- Patient to continue to practice ambulation 3-4 times per day with parents/caregivers or bedside nursing

Discharge Criteria:

- Stable respiratory status
- Tolerating oral intake
- Voiding
- Bowel movement not required prior to discharge
- Pain well controlled with oral medications and non-pharmacological approaches to pain control (i.e., cold therapy).
- Patient/parent/caregivers comfortable with discharge
- Cleared by physical therapy (TBD)
- Patient and/or parent/caregiver verbalize understanding of discharge teaching instructions

Bowel Regimen:

- See Table 3 for suggested medications for the Post-Operative Period
- Senna/Docusate twice a day
- Polyethylene glycol once a day
- Bisacodyl suppository starting post-op day 2
- Fleets enema PRN

TABLE OF CONTENTS

Algorithm 1. Pre-op

Algorithm 2. Post-op

Target Population

Clinical Management

- Pre-Hospital Management
- Pre-Operative Management
- Intra-Operative Management
- Post-Operative Management

Discharge Criteria

Follow-Up

Appendix A. Spine surgery patient algorithm for "Standard" Surgical Prophylaxis

Appendix B. Spine surgery patient algorithm for "Expanded" Surgical Prophylaxis

Table 1. Suggested Medications for the Pre-operative Period- "Standard Infection Risk"

Table 2. Suggested Medications for the Pre-operative Period - "Expanded Infection Risk"

Table 3. Suggested Medications for the Post-operative Period- All Patients

Parent | Caregiver Education

References

Clinical Improvement Team

TARGET POPULATION

Inclusion Criteria

- Patients having spine surgery without other complex chronic conditions

Exclusion Criteria

- High-risk spinal fusion patients
- Non-ambulatory patients

PRE-HOSPITAL MANAGEMENT

Assessment

- Evaluate the learning needs of the patient and caregivers prior to admission
  - Note: Evidence indicates a large portion of parents have limited literacy [Yin, 2009]. Parent health literacy may be linked to child health outcomes [Yin, 2009; DeWalt, 2009]
- Complete a psychosocial assessment prior to admission
  - Note: The psychosocial assessment should include evaluation of the family support system, plan for family post-surgery, school issues/concerns, guardianship, and resources
  - Nutrition assessment by registered dietician for patients with a body mass index (BMI) less than 10% for age or greater than 85% for age

- Complete sleep assessment prior to surgery by asking the following four questions:
  - Does your child pause in their breathing at night?
  - Does your child struggle to take a breath at night?
  - Does your child feel sleepy during the day?
  - Does your child snore more than half of the night?

Education

- Patients over 11 years: should attend a pre-operative spine class
- Patients less than 11 years of age: should receive 1:1 pre-operative teaching
- Patients unable to attend a spine class: should receive 1:1 pre-operative teaching
  - Note: caregivers should receive education along with the patient
- It is suggested that patients and caregivers receive a tour of the hospital prior to surgery

Nutrition

- Encourage a well-balanced diet during the pre-operative period
  - Note: Adequate pre-operative nutrition has been associated with improved healing and decreased infection [Hatlen, 2010]
- Nil per os (NPO) guidelines according to anesthesia guidelines
  - Note: The American Society of Anesthesiologists recommends a minimum fasting period of eight hours for solids, 6 hours for nonhuman milk/formula and a minimum of two hours fasting from clear liquids before arrival time [Practice guidelines for pre-operative fasting, 2011]

Treatments

Preadmission pre-operative skin assessment

- Parents instructed not to shave or use depilatory on the patient's back for at least a week prior to surgery
- Assessment of acne, tattoos and piercings

Preadmission pre-operative skin care the night before surgery

- Patient to shower the night before surgery
- After drying off from the shower, patient to use one packet (= 2 cloths) of 2% chlorhexidine gluconate cloths to wipe their entire surgical site; do not rinse with water; allow to air dry
  - Posterior surgery: base of neck, entire back from top of shoulders to upper buttocks, including sides
  - Anterior surgery: from midline chest around under the arm to the spine. Should wipe in the direction of the curve. Wipe under right arm for right-sided curve, and under left arm for left-sided curve. Spine nurses will inform family of proper location to wipe at pre-op appointment.
- Put on clean pajamas and place clean sheets on the patient's bed

Pre-operative cleanse by pre-op nurse with 2% chlorhexidine gluconate (CHG) antiseptic cloth the morning of the surgery

- Use one packet (= 2 cloths) to wipe the entire back from top of shoulders to upper buttocks, including sides, completely wetting the skin; discard cloths
- Allow skin to completely air dry – do not rinse
- Note: The use of a 2% chlorhexidine gluconate-coated cloth or 4% CHG soap with a standardized, timed process before hospital admission is an effective infection prevention strategy for reducing the risk of post-operative surgical site infections (SSIs) [Edmiston, 2010]

PRE-OPERATIVE MANAGEMENT

Assessment | Radiographs

- Posterior/Anterior (PA) and lateral standing radiographs in standard EOS prior to surgery
  - Scoliosis patients: PA standing bending radiographs,
  - Kyphosis patients: lateral bolster radiographs of the thoracic spine
  - Other radiographs as clinically indicated
  - MRI as clinically indicated

Assessment | Laboratory

- **Nasal culture** for methicillin-resistant *Staphylococcus aureus* (MRSA) within 30 days prior to surgery for patients less than 13 years and/or pre-menarchal
  - Note: Pre-operative testing and treatment of patients positive for MRSA has been shown to decrease the incidence of post-operative infections [Epstein, 2011]
- **Urine analysis** (UA) with microscopy obtained if clinically indicated
- Evaluation of Need for Pre-Admission Urinalysis and/or Culture

Spine Nurses preop screening call questions:

1. Do you have history of urinary tract infections (UTI's)?
   a. Answer no – no follow up needed
   b. Answer yes – educate parent/caregiver
      i. Note any signs/symptoms of UTI 1-2 weeks before surgery
      ii. If any frequency, burning, or foul-smelling urine call PCP to evaluate for UTI. PCP will treat if positive findings. Notify spine nurses if symptomatic and taking to PCP.

Preop visit (typically the week before surgery)

1. If answered yes to the above, spine nurse to follow up with parent/caregiver to ensure the patient saw PCP and no current symptoms.
2. If current symptoms send patient to PCP and/or obtain a UA based on provider recommendations
   a. If UA obtained review results with PCP and ortho provider
      - Note: Pre-operative bacteriuria may increase post-operative complications [Hatlen, 2010]

- **Urine pregnancy test** for all females 12 years and older and/or postmenarchal
- **Day of pre-op visit: Hgb and Type and screen** to determine if antigens are present
- Day of surgery: If 72 hours or less confirmatory type and screen. If greater than 72 hours obtain type and screen.

Assessment | Other Tests

- Pulmonary function tests (PFTs) for patients with a thoracic scoliosis curve greater than 70°, kyphosis greater than 70°
- If history of uncontrolled asthma, need pulmonary consult who will then order PFT's.

Assessment | History of Skin Infections

- Assess any history of acne, eczema, rashes, tattoos, piercings, pressure sores
  - If presence of significant acne on back, patient should consult with PCP or dermatologist.
  - Any changes or infections in the past 3 months
  - Any history of wound infection following previous spine surgery
  - If yes needs an infectious disease consult preop

Assessment | Weight and nutrition

- Concerns about weight or nutrition
- History of consult with GI or nutritionist
- Evaluate BMI < 10 % or greater than 85% need nutrition consult; > 95 % need expanded prophylaxis

Assessment | Other specialists involved in care

- Ensure other specialists aware and obtain surgical clearance if clinically indicated.
- Family history of clotting or bleeding disorders. If positive for genetic history of clotting or bleeding disorder, discuss with anesthesiologist and/or hematology for further recommendations.

Medications

- Please refer to **Table 1. Suggested Medications for the Pre-operative Period- "Standard Infection Risk"** or **Table 2. Suggested Medications for the Pre-operative Period - "Expanded Infection Risk"**
- Refer to the Order set in Epic: **Ortho IP Spinal Fusion Admission Orders**.

Antibiotics

- Please refer to Spine Surgery Patient Algorithm for "Standard" Surgical Prophylaxis for guidance on antibiotic ordering patients with AIS.
- Please refer to Spine Surgery Patient Algorithm for "Expanded" Surgical Prophylaxis for AIS patients with BMI greater or equal to 95%; or non AIS patients.

Pain Medications

- For patients who can swallow pills, give acetaminophen tablet on arrival to the pre-op area
- For patients who can't swallow pills, give acetaminophen oral solution, chewable tablets, or IV acetaminophen will be given in the OR

INTRA-OPERATIVE CLINICAL MANAGEMENT

- All patients will have a specialized Spine Anesthesiologist for their surgery
- All patients will have the following lines placed: at least 2 large bore peripheral IVs, and arterial line, Clinical need for central venous catheter will be determined by anesthesiologist on the day of surgery.

Medications

- Limit use of volatile anesthetic, terminate use as soon as possible
- Antibiotics-
  - Please refer to Spine Surgery Patient Algorithm for "Standard" Surgical Prophylaxis and to Spine Surgery Patient Algorithm for "Expanded" Surgical Prophylaxis
    - Vancomycin infusion should be started after the arterial line is established
    - Other antibiotics should be administered after the patient is flipped prone
    - Redose antibiotics for blood loss and/or elapsed time per Appendix A.
- Intrathecal morphine
    - 7.5 mcg/kg (maximum dose 500 mcg)
    - If patient has documented obstructive sleep apnea (OSA), decrease dose to 5 mcg/kg (maximum dose 350 mcg)
- Total intravenous anesthetic (TIVA) with propofol (75-200 mcg/kg/min) and remifentanil (0.05-0.3 mcg/kg/min) infusions

- Ketamine infusion 0.1-0.4 mg/kg/hr
- Tranexamic Acid: 10 mg/kg bolus over 30 minutes (maximum 1 gram), then 5 mg/kg/hr
- Ketorolac 0.5 mg/kg (maximum 30 mg) at end of surgery, if approved by surgeons
- Acetaminophen re-dose (15 mg/kg) at 6 hours after initial acetaminophen dose
- Transfusion Management
    - Hemoglobin goal is > 8-9 or hematocrit > 24-27%
    - FFP, platelets, cryoprecipitate- guide use based on thromboelastogram

POST-OPERATIVE MANAGEMENT

Assessment | Monitoring

- Vital signs and neurovascular assessment every 4 hours for 24 hours, then every 8 hours until discharge.
- Continuous pulse oximetry if patient requires supplemental oxygen or is on patient-controlled analgesia
- Record output from indwelling catheter every 4 hours for the first 24 hours and then every 8 hours until discontinued
- Discontinue urinary catheter as soon as the patient can ambulate to the bathroom (post-op day 1 or 2)

Laboratory

- Hemoglobin monitoring (Blood bank has requested that hemoglobin be monitored. Approximate conversion from hemoglobin to hematocrit is multiplication by 3. Hgb 7 = Hct 21%, Hgb 8 = Hct 24%, etc.)
    - POD #1: All patients have hemoglobin checked
    - POD #2: Only check hemoglobin if the hemoglobin from POD #1 is < 10
    - POD #3: Only check hemoglobin if the hemoglobin from POD #2 is < 9
- Decision to transfuse should be based on clinical symptoms and hemoglobin
    - Persistent tachycardia not due to pain
    - Oxygen requirement despite aggressive pulmonary toilet
    - Symptoms of hypotension on standing

Medications

- Please refer to **Table 3. Suggested Medications for the Post-operative Period - All patients** and refer to the Order set in Epic: **Ortho IP Spinal Fusion Post-Op Orders** or **Ortho IP Spinal Fusion PICU Post-op**.

Antibiotics

- Continue antibiotic prophylaxis **for 24 hours** post-operatively. Please refer to Spine Surgery Patient Algorithm for "Standard" Surgical Prophylaxis for guidance on antibiotic ordering patients with AIS.
- Continue antibiotic prophylaxis **for 24 hours** post-operatively. Please refer to Spine Surgery Patient Algorithm for "Expanded" Surgical Prophylaxis for AIS patients with BMI greater or equal to 95%; or non AIS patients.

Pain Medication – confirm with Anesthesia

- Patient-Controlled Analgesia (PCA) (Morphine or Dilaudid)
    - No basal rate should be ordered due to intrathecal morphine given in OR. Only demand those ordered.

- Discontinue PCA after patient has tolerated 2 doses of oral pain medications on post-op day 1
- See Patient-controlled Analgesia (PCA) Set-up, Administration, and Documentation

- Acetaminophen
  - Every 4 hours for 48 hours, then every 4 hours PRN
- Oxycodone
  - Every 4 hours for 48 hours, then every 4 hours PRN
  - First post-op dose to begin first post-op day at 0900 if patient has received IT morphine otherwise consult provider for start time ("*Start PRN dose 4 hours after scheduled dose*.")
- Ketorolac/Ibuprofen
  - Ketorolac IV scheduled every 6 hours beginning 0900 on the first post-operative day for 48 hours (total of 8 doses), then ibuprofen every 6 hours PRN until discharge
  - Do not give Ketorolac or ibuprofen to patients with underlying kidney disease.
- Diazepam
  - Oral every 6 hours as needed for spasms. Use lowest effective dose

Bowel Regimen

- Senna/Docusate tablets or senna oral syrup twice a day started post-op day 1
- Polyethylene glycol once a day started post-op day 1
- Bisacodyl (Magic Bullet) suppository on post-op day 2 then QD as needed
- Fleets enema every day PRN if no results with suppository

Other Medications

- Nalbuphine every 3 hours as needed for pruritis
- Ondansetron every 6 hours for 24 hours (IV), then every 6 hours PRN nausea (Oral)
- Scopolamine patch every 72 hours, for patients 12 years of age and older
- Famotidine once or twice daily until patient is tolerating food intake/PO

Activity

Day of surgery- ALL patients:

- Sit on end of bed and/or get into chair with help from bedside nursing (*morning surgery patients)
- Elevate head of the bed up to 90° as tolerated
- Logroll every 2 hours and as needed.
- Physical therapy twice daily until patient is cleared

Post-operative Day 1

- Physical therapy to assist patient to dangle legs over edge of bed and/or get into chair
- Physical therapy to assess swift transferring to bedside chair and begin ambulation in afternoon

Post-operative Day 2&3 to Discharge

- Ambulatory patients: Continue ambulation with physical therapist and practice stairs once cleared by PT.
- Patient to continue to practice ambulation 3-4 times per day with parents/caregivers or bedside nursing

Nutrition

- Regular diet on post-op day 1 is ordered but should only have clear liquids or bland foods (such as crackers, toast, smoothie) as tolerated on the day of surgery.
- Provide a light diet for breakfast on postoperative day 1 and then advance to regular diet as tolerated
- A well-balanced, high fiber diet with small frequent meals and increased caloric intake should be provided to encourage healing.

Treatments

VTE prevention

- Patients at risk for Venous Thromboembolism (VTE) receive prophylaxis in accordance with the VTE guideline
- All spine patients receive SCD's post-op

Cold therapy

- As needed to decrease pain
- Cold therapy is provided to patients for comfort and not necessarily to manage swelling or drainage
- If the patient does not tolerate cold therapy, it does not need to be used
- Family to take cold therapy unit home upon discharge

Foley catheter

- Discontinue when the patient is able to ambulate to the bathroom (post-op day 1 or day 2)

Incentive spirometry (14cc/kg)

- 10 times per hour while awake
- If not able to consistently achieve 14cc/kg on incentive spirometer, EZ pap treatments should be implemented per lung expansion protocol

Dressing care

- Please refer to the Surgical Site Infection (SSI): Spine Surgery Target Zero Bundle
- Please consult plastic surgeons for wound care and activity orders if plastics surgery did the wound closure
- Reinforce dressings if saturated until first dressing change
- Dressing options (3)
  - Prineo w/Mepilex and Tegaderm
    - Remove mepilex and tegaderm on POD3 (if discharged POD2, caregivers remove at home on POD3).
      - Do not replace mepilex prior to discharge unless incision is draining.
      - Leave prineo intact upon discharge
    - Parents to remove Prineo 3 weeks after day of surgery
  - Zipline
    - Remove mepilex and tegaderm on POD3 (if discharged POD2, caregivers remove at home on POD3).
      - Do not replace mepilex prior to discharge unless incision is draining.
      - Leave Zipline intact upon discharge
    - Caregiver may remove zipline 3 weeks after discharge by applying baby oil along the whole length of the zipline, which will allow for gentle separation from the skin.
- If patient has Prevena Wound Vac

  - This is left on for 7 days after surgery. It is removed at home by the family or by an RN in the clinic. The wound vac is disposable.
  - The family should be sent home with the black charging plug, or the wound vac will run out of battery. Family should be instructed on how to troubleshoot the wound vac prior to discharge.
  - When removing the wound vac, care should be taken to leave the Zip surgical closure on the incision.
- The prineo or zipline is allowed to get wet in the shower
- No tub baths, no hot tubs, no swimming in lakes or oceans until your surgeon says it's OK
- Assess for clinical signs and symptoms of surgical site infection and, if present, report to surgical team
- Discharge teaching includes hand hygiene, dressing/wound care and showering.

DISCHARGE CRITERIA

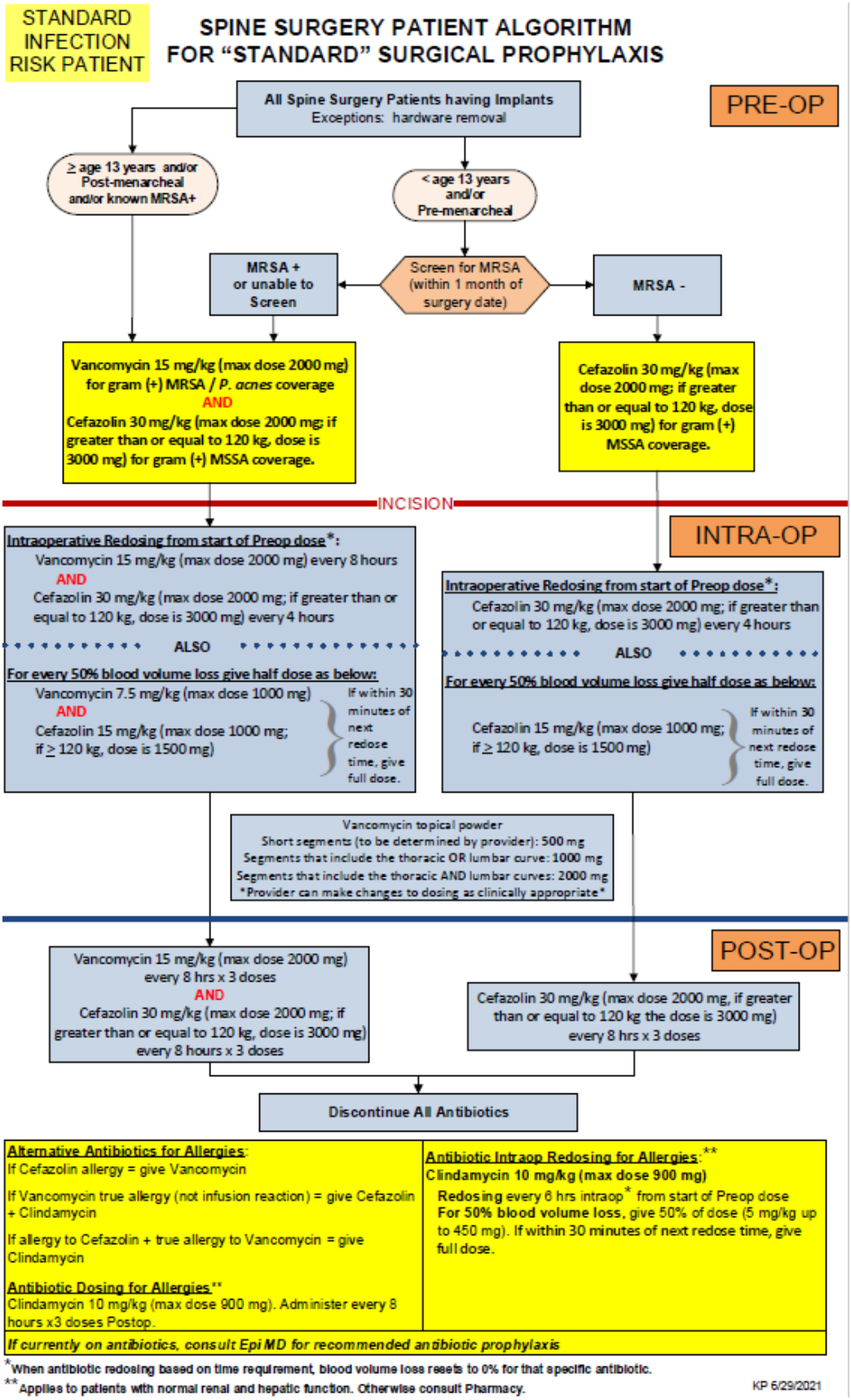
Patient should not be discharged until the following criteria have been met:

- Off oxygen as clinically indicated
- Tolerating oral intake
- Voiding
- Bowel movement (BM) not required prior to discharge if NOT symptomatic (nausea, vomiting, distention)
- Pain well controlled with oral medications
- Cleared by PT
- Patient or caregiver can verbalize understanding of discharge teaching instruction

FOLLOW-UP

- Follow up by nurse telehealth visit or phone call (if telehealth not available) within 2 weeks of discharge
- Follow-up visits with provider occur at 4 to 8 weeks post-operatively and annually from the surgical date until discharged from care by the provider.
  - Visits can be virtual or in-person per provider discretion
- Additional visit may be advised per provider discretion

APPENDIX A. SPINE SURGERY PATIENT ALGORITHM FOR "STANDARD" SURGICAL PROPHYLAXIS



APPENDIX B. SPINE SURGERY PATIENT ALGORITHM FOR "EXPANDED" SURGICAL PROPHYLAXIS

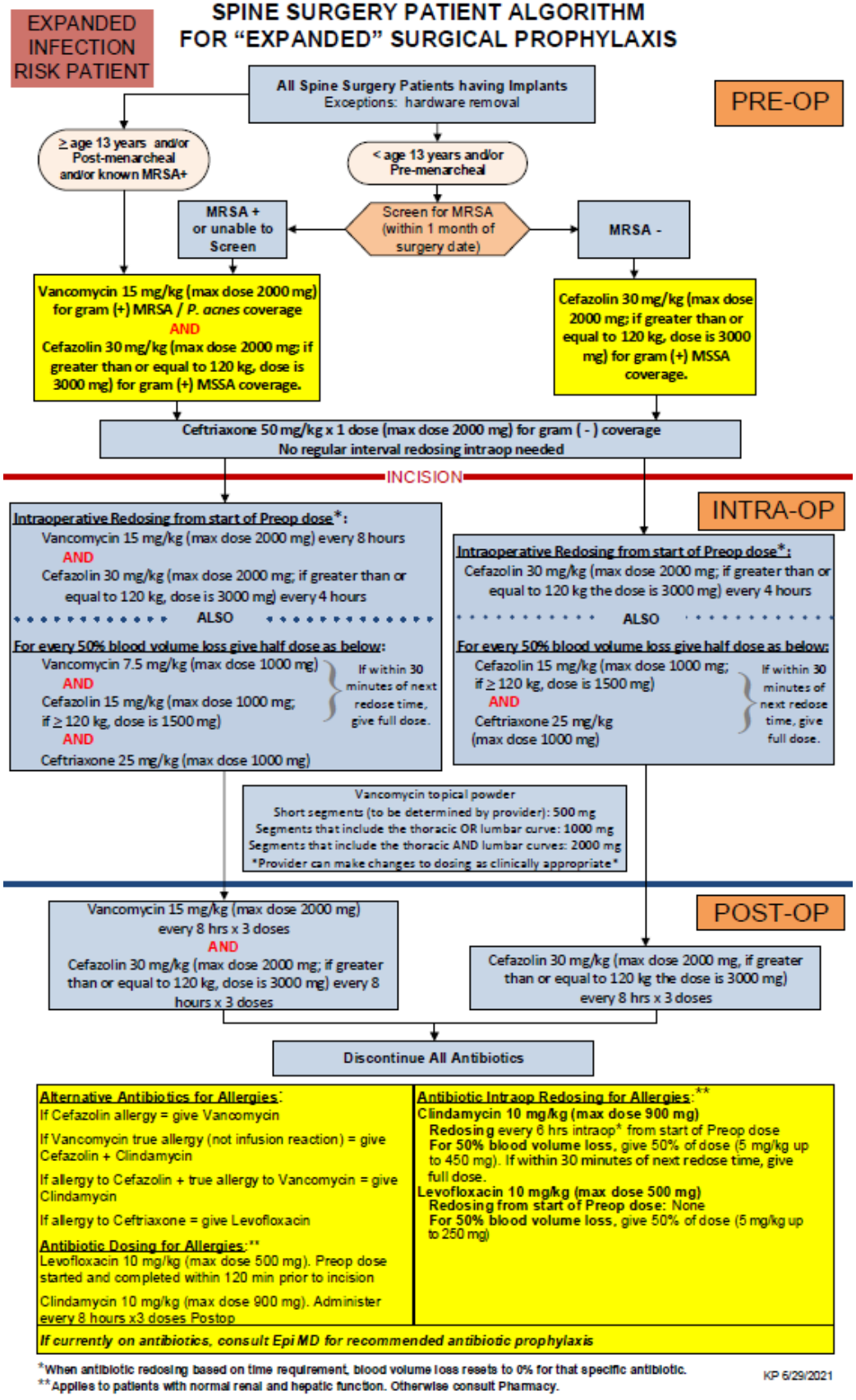


Table 1. Suggested Medications for the Pre-operative Period- "Standard Infection Risk"

Medication	Indication	Dose	Frequency	Route	Maximum Dose	Comments
ANTIBOITCS						
Cefazolin	Pre-operative antibiotic prophylaxis for MSSA	30 mg/kg	ONCE Intra-op: re-dose every 4 hours or 50% of dose with one-half blood volume loss	IV	2,000 mg (if greater than or equal to 120 kg, dose is 3,000 mg)	Complete infusion within 60 minutes before surgical incision
Vancomycin	Pre-operative antibiotic prophylaxis for beta-lactam allergy, MRSA positive, *P. acnes* coverage also for age > 13 years and/or post-menarchal	15 mg/kg	ONCE Intra-op: re-dose every 8 hours or 50% of dose with one-half blood volume loss	IV	2,000 mg	Pre-op dose completed within 60 minutes of incision. Patients with documented Red Mans Syndrome should receive diphenhydramine pre-medication and 120 minute infusion of vancomycin
Clindamycin	Pre-operative antibiotic prophylaxis for patients allergic to vancomycin	10 mg/kg	ONCE Intra-op: re-dose every 6 hours or 50% of the dose with one-half blood volume loss	IV	900 mg	Complete infusion within 60 minutes of surgical incision
Topical Vancomycin Powder	For topical use only in the OR	Short segments 500 mg Segments that include the thoracic OR lumbar curve: 1000 mg Segments that include the thoracic AND lumbar curve: 2000 mg	ONCE	Topical	2,000 mg	
PRE-MEDICATIONS						
Diphenhydramine	Vancomycin pre-medication for patients with documented Red Mans Syndrome	1 mg/kg	ONCE	IV	50 mg	
PAIN MEDICATIONS						
Acetaminophen	Pre-operative pain medication	10-15 mg/kg	ONCE	PO	650 mg	For patients who cannot swallow pills give IV acetaminophen 15 mg/kg (max dose 650 mg)

Table 2. Suggested Medications for the Pre-operative Period - "Expanded Infection Risk"

Medication	Indication	Dose	Frequency	Route	Maximum Dose	Comments
ANTIBOITCS						
Cefazolin	Pre-operative antibiotic prophylaxis for MSSA	30 mg/kg	ONCE Intra-op: re-dose every 4 hours or 50% of dose with one-half blood volume loss	IV	2,000 mg (if greater than or equal to 120 kg, dose is 3,000 mg)	Complete infusion within 60 minutes before surgical incision
Vancomycin	Pre-operative antibiotic prophylaxis for beta-lactam allergy, MRSA positive, *P. acnes* coverage also for age > 13 years and/or post-menarchal	15 mg/kg	ONCE Intra-op: re-dose every 8 hours or 50% of dose with one-half blood volume loss	IV	2,000 mg	Pre-op dose completed within 60 minutes of incision. Patients with documented Red Mans Syndrome should receive diphenhydramine pre-medication and 120 minute infusion of vancomycin
Ceftriaxone	Pre-operative antibiotic prophylaxis for gram negative coverage	50 mg/kg	ONCE Intra-op: No regular interval redosing needed, 50% of the dose with one-half blood volume loss	IV	2,000 mg	
Clindamycin	Pre-operative antibiotic prophylaxis for patients allergic to vancomycin	10 mg/kg	ONCE Intra-op: re-dose every 6 hours or 50% of the dose with one-half blood volume loss	IV	900 mg	Complete infusion within 60 minutes of surgical incision
Levofloxacin	Pre-operative antibiotic prophylaxis for patient allergic to ceftriaxone	10 mg/kg	ONCE Intra-op: No regular interval redosing needed, 50% of the dose with one-half blood volume loss	IV	500 mg	Preop dose started and completed within 120 min prior to incision
Topical Vancomycin Powder	For topical use only in the OR	Short segments: 500 mg Segments that include the thoracic OR lumbar curve: 1000 mg Segments that include the thoracic AND lumbar curve: 2000 mg	ONCE	Topical	2,000 mg	
PRE-MEDICATIONS						
Diphenhydramine	Vancomycin pre-medication for patients with documented Red Mans Syndrome	1 mg/kg	ONCE	IV	50 mg	
PAIN MEDICATIONS						
Acetaminophen	Pre-operative pain medication	10 to 15 mg/kg	ONCE	PO	650 mg	For patients who cannot swallow pills give IV acetaminophen 15 mg/kg (max dose 650 mg)

Table 3. Suggested Medications for the Post-operative Period- All Patients

Medication	Indication	Dose	Frequency	Route	Maximum Dose	Comments
ANTIBIOTICS						
Cefazolin	Post-operative antibiotic prophylaxis for MSSA	30 mg/kg/dose	Every 8 hours x 24 hours post-op (3 doses)	IV	2,000 mg (if greater than or equal to 120 kg, dose is 3,000 mg)	
Vancomycin	Post-operative antibiotic prophylaxis for beta-lactam allergy, MRSA positive, *P. acnes* coverage also for age > 13 years and/or postmenarchal	15 mg/kg/dose	Every 8 hours x 24 hours post-op (3 doses)	IV	2,000 mg	Patients with documented Red Mans Syndrome should receive diphenhydramine pre-medication and 120 minute infusion of vancomycin
Clindamycin	Post-operative antibiotic prophylaxis for patients allergic to vancomycin	10 mg/kg/dose	Every 8 hours x 24 hours post-op (3 doses)	IV	900 mg	
PAIN MEDICATIONS						
Acetaminophen	Mild pain	10 to 15 mg/kg/dose	Every 4 hours x 48 hours, then every 4 hours prn	Oral	650 mg	Tablet or suspension
Oxycodone	Moderate to severe pain	0.1 to 0.15 mg/kg/dose	Every 4 hours x 48 hours, then every 4 hours prn	Oral	10 mg/dose	Tablet or solution. Start on post-op day 1 at 0900. Use conservative dosing for patients with OSA (start on the low end of the dosing range)
Ketorolac	• Post-operative, around-the-clock analgesia	0.5 mg/kg/dose	Every 6 hours x 48 hours, then ibuprofen every 6 hours prn pain	IV	30 mg/dose	Maximum duration: 48 hours. Start on post-op day 1 at 0900. Do not use in patients with underlying kidney disease
Ibuprofen	• Mild to moderate pain • Adjunct for more severe pain	10 mg/kg/dose	Every 6 hours prn	Oral	800 mg/dose	Tablet or suspension. Start 6 hours after last ketorolac dose. Do not use in patients with underlying kidney disease
Diazepam	Muscle spasms	0.05 to 0.1 mg/kg/dose	Every 6 hours prn	Oral	4 mg/dose	Tablet or solution
OTHER						
Nalbuphine	Opioid related pruritis	0.05 mg/kg/dose	Every 3 hours prn	IV	5 mg	
ANTIEMETICS						

Ondansetron	Post-operative nausea/vomiting (PONV)	0.1 mg/kg	Every 6 hours x 24 hours, then q6h prn	Oral/IV	4 mg/dose	May be given undiluted over 2 to 5 minutes when used as a single dose for prevention of PONV
Scopolamine patch	Post-operative nausea/vomiting (PONV)	1 patch	Every 72 hours	Transdermal	1 patch	For patients 12 years and older
ACID BLOCKERS						
Famotidine	Stress ulcer prophylaxis	<3 months: 0.5 mg/kg every 24 hours 3 months and older: 0.5 mg/kg every 12 hours	Start post-op day 1	PO	20 mg/dose	Discontinue after patient starts tolerating PO
LAXATIVES						
Bisacodyl (Magic Bullet)	Constipation	2 to <12 years: 5 mg 12 years and older: 10 mg	Once daily	Rectally	10 mg/dose	Give on post-op day 2, then QD PRN
Fleets enema	Constipation	2 to <4 years: 33 mL 4 to <10 years: 66 mL 10 years and older: 133 mL	Once daily prn	Rectally	2 to <4 years: 33 mL/dose 4 to <10 years: 66 mL/dose 10 years and older: 133 mL/dose	Start post-op day 2. May repeat x1 if needed.
Senna-docusate (8.6-50mg/tablet)	Constipation	2 to <6 years: ½ tablet 6 to <12 years: 1 tablet 12 years and older: 2 tablets	Twice daily	Oral	2 to <6 years: 1 tablet twice daily 6 to <12 years: 2 tablets twice daily 12 years and older: 4 tablets twice daily	Start on post-op day 1
Sennosides 8.8mg/5ml syrup	Constipation	2 to <6 years: 4.4 mg (2.5 mL) 6 to <12 years: 8.8 mg (5 mL) 12 years and older: 17.6 mg (10 mL)	Twice daily	Oral	2 to <6 years: 6.6 mg (3.75 mL) twice daily 6 to <12 years: 13.2 (7.5 mL) mg twice daily 12 years and older: 26.4 mg (15 ml) twice daily	Start on post-op day 1
Polyethylene glycol 3350 oral powder	Constipation	0.5-1.5 g/kg/dose Standard dosing: 4.25 g, 8.5 g, 17 g	Once daily	Oral	17 g	Start on post-op day 1

CAREGIVER EDUCATION MATERIALS

See the Spine Program book given to the patient at the pre-operative visit.

REFERENCES

Health Literacy

1. Yin HS, Johnson M, Mendelsohn AL, Abrams MA, Sanders LM, Dreyer BP. The health literacy of parents in the United States: a nationally representative study. Pediatrics 2009; 124 Suppl 3:S289-98.
2. DeWalt DA, Hink A. Health literacy and child health outcomes: a systematic review of the literature. Pediatrics 2009; 124 Suppl 3 :S265-74.

Pre-operative, Intra-operative, and post-operative measures

1. Hatlen T, Song K, Shurtleff D, Duguay S. Contributory factors to postoperative spinal fusion complications for children with myelomeningocele. Spine 2010; 35:1294-9.
2. Practice guideline for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: an updated report by the American Society of Anesthesiologists Committee on Standards and Practice Parameters. Anesthesiology 2011; 114:495-511.
3. Edmiston CE, Okoli O, Graham MB, Sinski S, Seabrook GR. Evidence for using chlorhexidine gluconate preoperative cleansing to reduce the risk of surgical site infection. AORN J 2010; 92:509-518.
4. Epstein NE. Preoperative, intraoperative, postoperative measures to further reduce spinal infections. Surg Neurol Int 2011; 2:17.

CLINICAL IMPROVEMENT TEAM MEMBERS

Sumeet Garg, MD | Orthopedic Surgery
Mark Erickson, MD | Orthopedic Surgery
Anna Lewis, RN | Clinical Nurse II
Elise Benefield, RN | Clinical Nurse IV
Suzanne Evans, RN | Clinical Nurse IV
Christine Baumgartner, PharmD, BCPPS | Clinical Pharmacist Specialist
Abby Kim, PharmD, BCOP | Manager of Clinical Pharmacy Services
Rashad Booker, MD | Orthopedic Surgery
LeAnne Minshall, RN | Clinical Nurse II
Kathryn Klane, RN | Clinical Nurse II
Skylar Simpson, RN | Clinical Nurse III
Oren Kupfer, MD | Pulmonary Medicine
Lynn Katz | Clinical Social Worker II
Kylie Fernandez | Orthopedics
Lori Karol, MD | Orthopedics
Michael (Ryan) Ballard, PA | Orthopedics
Molly Buerk, PA | Orthopedics
Niccole Culligan | Operating Room
Heidi Manzanares | Operating Room
Shannon Horner | Operating Room
Brian Shaw, MD | CSH Surgeon in Chief
Grant Young, MD | Anesthesiology
David Nash | Pharmacy
Ceryl Fueconcillo-Ubungen | Clinical Education Specialist
Rebecca Clippinger, RN | Clinical Nurse II
Thanh Nguyen, MD | Anesthesiology
Kaitlin Widmer, MD | Hospital Medicine
James Thomas, MD | Anesthesiology
Liz Ficco | Clinical Pathway Coordinator

APPROVED BY

Clinical Pathways and Measures Review Committee – May 24, 2021
Pharmacy & Therapeutics Committee – June 2021

MANUAL/DEPARTMENT	Clinical Pathways/Quality
ORIGINATION DATE	February 2, 2012
LAST DATE OF REVIEW OR REVISION	June 15, 2021
COLORADO SPRINGS REVIEW BY	 Michael DiStefano, MD Chief Medical Officer, Colorado Springs
APPROVED BY	 Lalit Bajaj, MD, MPH Medical Director, Clinical Effectiveness

REVIEW/REVISION SCHEDULE

Scheduled for full review on June 15, 2025

Children's Hospital Colorado • Anschutz Medical Campus • 13123 East 16th Avenue • Aurora, CO 80045 • 720-777-1234 • childrenscolorado.org

Discrimination is Against the Law. Children's Hospital Colorado complies with applicable Federal civil rights laws and does not discriminate on the basis of race, color, national origin, age, disability, or sex. Children's Hospital Colorado does not exclude people or treat them differently because of race, color, national origin, age, disability, or sex.

Children's Hospital Colorado provides free aids and services to people with disabilities to communicate effectively with us, such as: Qualified sign language interpreters, written information in other formats (large print, audio, accessible electronic formats, other formats). Children's Hospital Colorado provides free language services to people whose primary language is not English, such as: Qualified interpreters, information written in other languages.

If you need these services, contact the Medical Interpreters Department at 720.777.9800.

If you believe that Children's Hospital Colorado has failed to provide these services or discriminated in another way on the basis of race, color, national origin, age, disability, or sex, you can file a grievance with: Corporate Compliance Officer, 13123 E 16th Avenue, B450, Aurora, Colorado 80045, Phone: 720.777.1234, Fax: 720.777.7257, corporate.compliance@childrenscolorado.org. You can file a grievance in person or by mail, fax, or email. If you need help filing a grievance, the Corporate Compliance Officer is available to help you.

You can also file a civil rights complaint with the U.S. Department of Health and Human Services, Office for Civil Rights, electronically through the Office for Civil Rights Complaint Portal, available at ocrportal.hhs.gov/ocr/portal/lobby.jsf, or by mail or phone at: U.S. Department of Health and Human Services 200 Independence Avenue, SW Room 509F, HHH Building Washington, D.C. 20201 1-800-368-1019, 800-537-7697 (TDD) Complaint forms are available at www.hhs.gov/ocr/office/file/index.html.

Children's Hospital Colorado complies with applicable Federal civil rights laws and does not discriminate on the basis of race, color, national origin, age, disability, or sex.

ATENCIÓN: si habla español, tiene a su disposición servicios gratuitos de asistencia lingüística. Llame al 1-720-777-9800.

CHÚ Ý: Nếu bạn nói Tiếng Việt, có các dịch vụ hỗ trợ ngôn ngữ miễn phí dành cho bạn. Gọi số 1-720-777-9800.

주의: 한국어를 사용하시는 경우, 언어 지원 서비스를 무료로 이용하실 수 있습니다. 1-720-777-9800 번으로 전화해 주십시오

注意：如果您使用繁體中文，您可以免費獲得語言援助服務。請致電1-720-777-9800。

ВНИМАНИЕ: Если вы говорите на русском языке, то вам доступны бесплатные услуги перевода. Звоните 1-720-777-9800.

ማስታወሻ: የሚናገሩት ቋንቋ አማርኛ ከሆነ የትርጉም እርዳታ ድርጅቶች፣ በነጻ ሊያግዝዎት ተዘጋጀተዋል፡ ወደ ሚከተለው ቁጥር ይደውሉ 1-720-777-9800 (መስማት ለተሳናቸው.

ملحوظة: إذا كنت تتحدث اذكر اللغة، فإن خدمات المساعدة اللغوية تتوافر لك بالمجان. اتصل برقم 1-720-777-9800 (رقم)

ACHTUNG: Wenn Sie Deutsch sprechen, stehen Ihnen kostenlos sprachliche Hilfsdienstleistungen zur Verfügung. Rufnummer: 1-720-777-9800.

ATTENTION : Si vous parlez français, des services d'aide linguistique vous sont proposés gratuitement. Appelez le 1-720-777-9800.

ध्यान दनु होस्तपाइले नेपाल बोल्नहन्छ भन तपाइको निम्त भाषा सहायता सवाहरू नःशल्क रूपमा उपलब्ध छ । फोन गनु होसर् 1-720-777-9800 ।

PAUNAWA: Kung nagsasalita ka ng Tagalog, maaari kang gumamit ng mga serbisyo ng tulong sa wika nang walang bayad. Tumawag sa 1-720-777-9800.

注意事項：日本語を話される場合、無料の言語支援をご利用いただけます。1-720-777-9800 まで、お電話にてご連絡ください。

Nti: Ọ bụrụ na asụ Ibo, asụsụ aka ọasụ n'efu, defu, aka. Call 1-720-777-9800.