Pediatric Burns

Brendan Campbell, MD, MPH
Samantha Pelow, APRN
Jen Tabak, RN, MSN

What is a Clinical Pathway?

An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.

Objectives of Pathway

- To decrease variability in the management of patients with burns
- To appropriately triage, diagnose and classify burns in the pediatric patient
- To provide appropriate burn care management for inpatients, including fluid resuscitation, dressing changes, and pain management
- To better delineate discharge criteria for admitted burn patients

Why is Pathway Necessary?

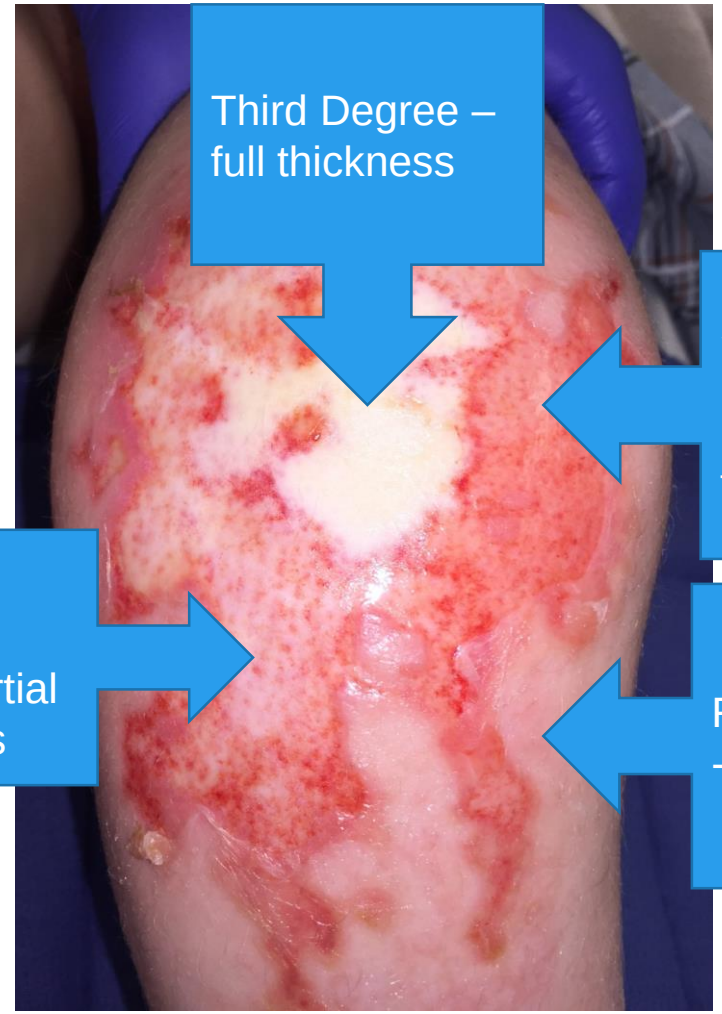
- Burn injury can range in severity from superficial and able to be treated at home, to a full partial thickness, to full thickness requiring higher levels of care and burn specialty centers.
- Currently at CCMC, no standardized approach exists for the management of the burned child from the ED, admission criteria, management while inpatient, discharge criteria and follow up recommendations

Standardization will help to:

- Set expectations for patients, families and providers
- Assure all burns are treated the same by all providers
- Delineate criteria for admission, transfer and safe discharge of patients with appropriate follow up

Definitions

Depth	Cause	Appearance	Sensation	Healing Time (days)
Superficial	Ultraviolet exposure Very short flash	Dry, red Blanches with pressure	Painful	3-6
Superficial partial thickness	Scald (spill or splash) Short flash	Blisters Moist, red, weeping Blanches with pressure	Painful to temperature and air	7-20
Deep partial thickness	Scald (spill) Flame Oil Grease	Blisters (easily unroofed) Wet or waxy dry Variable color (patchy to cheesy white to red) Does not blanch with pressure	Perceptive of pressure only	>21
Full thickness	Scald (immersion) Flame Steam Oil Grease Chemical Electrical	Waxy white to leathery gray to charred and black Dry and inelastic No blanching with pressure	Deep pressure only	Never (if >2% TBSA)



Burn Classifications

Table 2. Classification of Burn Severity.*

Criteria and Care	Minor Burn	Moderate Burn	Major Burn
Criteria			
TBSA	<10% in adults, <5% in children or elderly, <2% for full-thickness burn	10–20% in adults, 5–10% in children or elderly, 2–5% for full-thickness burn	>20% in adults, >10% in children and elderly, >5% for full-thickness burn
Other		Low-voltage burn, suspected inhalation injury, circumferential burn, concomitant medical problem predisposing to infection (e.g., diabetes, sickle cell disease)	High-voltage burn, chemical burn, any clinically significant burn to face, eyes, ears, genitalia, or major joints, clinically significant associated injuries (e.g., fracture, other major trauma)
Care	Outpatient management	Admission to a hospital with experience in managing burns	Referral to a burn center

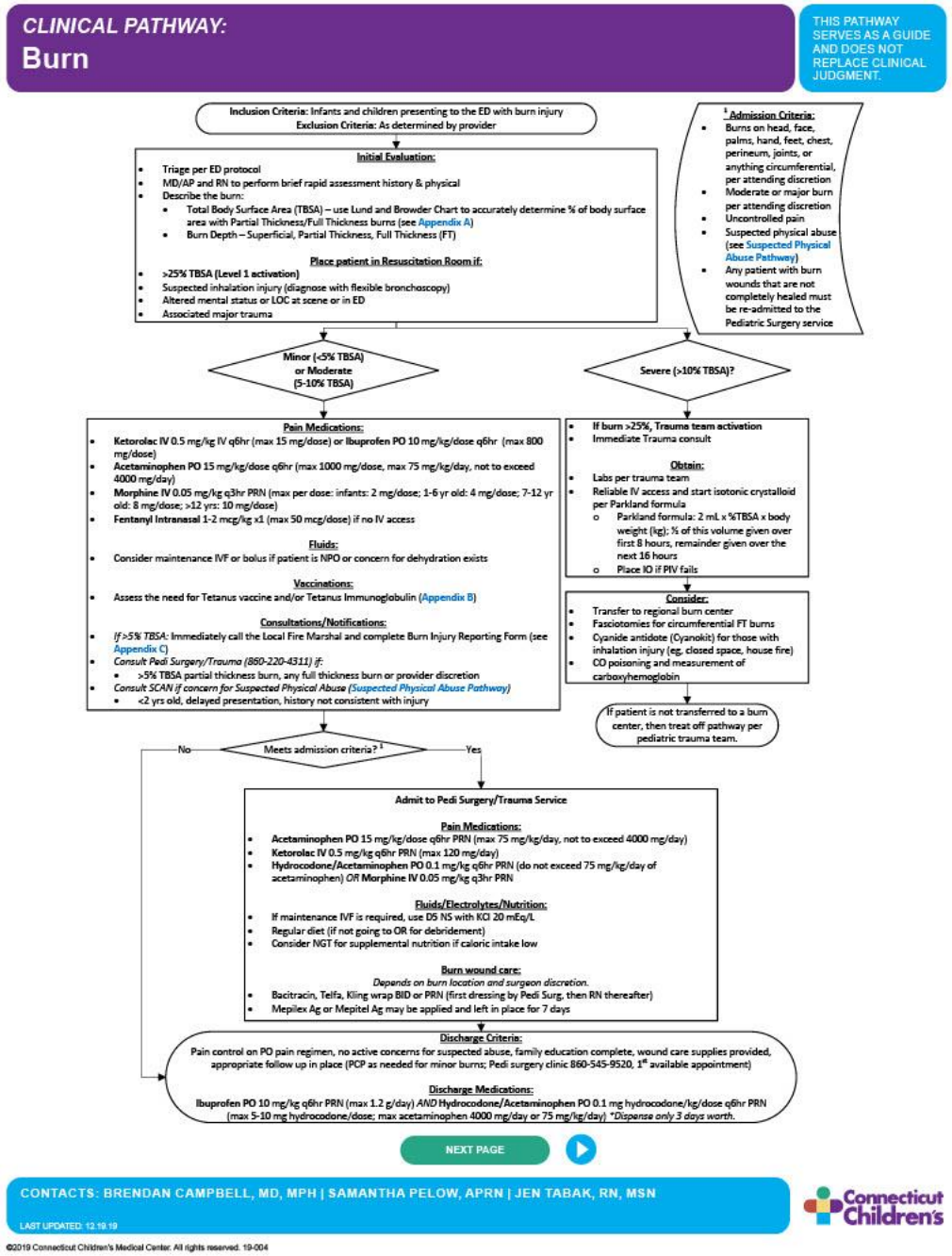
* TBSA denotes total body-surface area. Data are from the American Burn Association[37] and the American College of Surgeons.[38]

Basics of burn care

"A moist environment for the wound accelerates healing by preventing cellular dehydration and stimulating collagen synthesis and angiogenesis...."

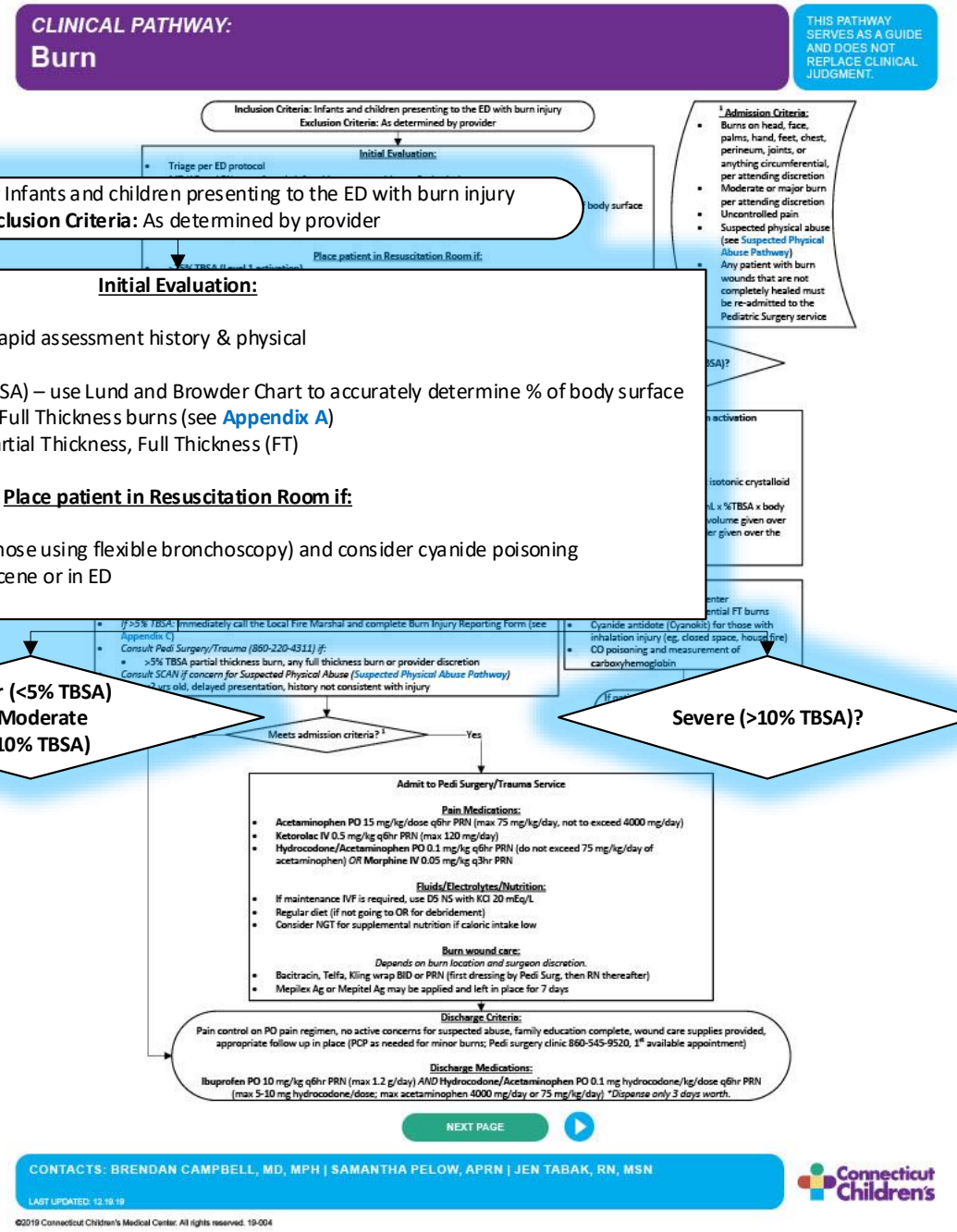
This is the Pediatric Burn Clinical Pathway.

We will be reviewing each component in the following slides.



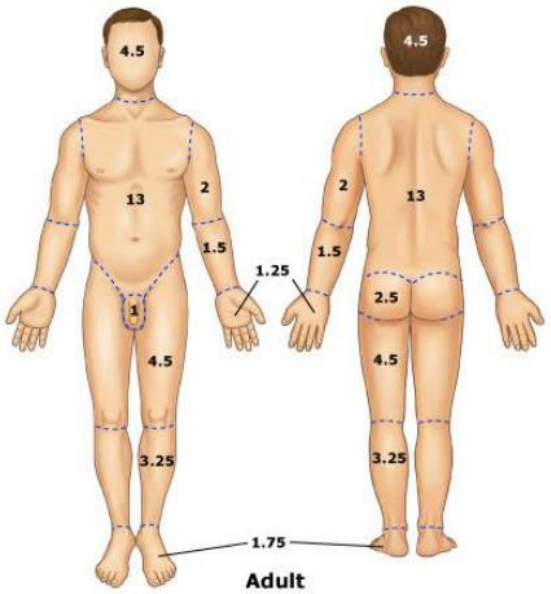
Initial care:

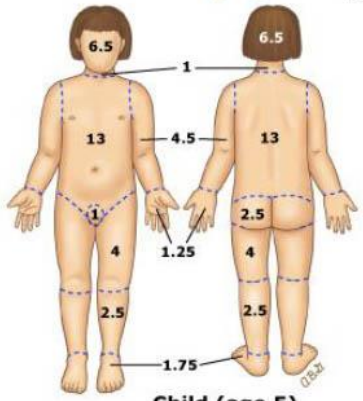
- Work up includes:
  - History and physical
  - Burn description (TBSA, burn depth)
  - Other exams should be considered based on presentation or mechanism
- ED classification of burn type (Minor, Moderate or Severe)
  - If severe page Pediatric Surgery if not already present in the event of trauma activation

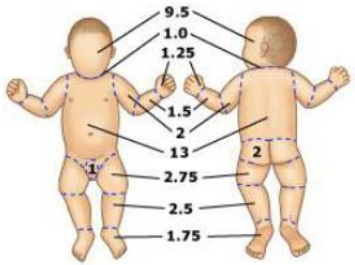


CLINICAL PATHWAY:
Burn
Appendix A: Lund and Browder Chart

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.







RETURN TO THE BEGINNING

CONTACTS: BRENDAN CAMPBELL, MD, MPH | SAMANTHA PELOW, APRN | JEN TABAK, RN, MSN

LAST UPDATED: 12.19.19

Connecticut Children's

Inclusion Criteria: Infants and children presenting to the ED with burn injury
Exclusion Criteria: As determined by provider

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Inclusion Criteria: Infants and children presenting to the ED with burn injury

Initial Evaluation:

- Triage per ED protocol
- MD/AP and RN to perform brief rapid assessment history & physical
- Describe the burn:
  - Total Body Surface Area (TBSA) – use Lund and Browder Chart to accurately determine % of body surface area with Partial Thickness/Full Thickness burns (see **Appendix A**)
  - Burn Depth – Superficial, Partial Thickness, Full Thickness (FT)

Place patient in Resuscitation Room if:

- **>25% TBSA (Level 1 activation)**
- Suspected inhalation injury (diagnose using flexible bronchoscopy) and consider cyanide poisoning
- Altered mental status or LOC at scene or in ED
- Associated major trauma

[1] Admission Criteria:
- Burns on head, face, palms, hand, feet, chest, perineum, joints, or anything circumferential, per attending discretion
- Moderate or major burn per attending discretion
- Uncontrolled pain
- Suspected physical abuse (see Suspected Physical Abuse Pathway)
- Any patient with burn wounds that are not completely healed must be re-admitted to the Pediatric Surgery service

% TBSA)?

team activation
nsult

- Morphine IV 0.05 mg/kg q3hr PRN (max per dose: infants: 2 mg/dose; 1-6 yr old: 4 mg/dose; 7-12 yr old: 8 mg/dose; >12 yrs: 10 mg/dose)
- Fentanyl Intranasal 1-2 mcg/kg x1 (max 50 mcg/dose) if no IV access

Fluids:
intenance IVF or bolus if patient is NPO or concern for dehydration exists

Vaccinations:
ed for Tetanus vaccine and/or Tetanus Immunoglobulin (Appendix B)

Consultations/Notifications:
- *If >5% TBSA:* Immediately call the Local Fire Marshal and complete Burn Injury Reporting Form (see Appendix C)
- *Consult Pedi Surgery/Trauma (860-220-4311) if:*
  - >5% TBSA partial thickness burn, any full thickness burn or provider discretion
- *Consult SCAN if concern for Suspected Physical Abuse (Suspected Physical Abuse Pathway)*
  - <2 yrs old, delayed presentation, history not consistent

Minor (<5% TBSA) or Moderate (5-10% TBSA)

Severe (>10% TBSA)?

- Reliable IV access and start isotonic crystalloid per Parkland formula
  - Parkland formula: 2 mL x %TBSA x body weight (kg): ½ of t
  - first 8 h
- Transfer to
- Fasciotomies for circ
- Cyanide antidote (Cyanokit) for
  inhalation injury (eg, closed space, house fire)
- CO poisoning and measurement of carboxyhemoglobin

If patient is not transferred to a burn center, then treat off pathway per pediatric trauma team.

No — Meets admission criteria? — Yes

to Pedi Surgery/Trauma Service

Pain Medications:
- **Acetaminophen PO** 15 mg/kg/dose q6hr PRN (max 75 mg/kg/day, not to exceed 4000 mg/day)
- **Ketorolac IV** 0.5 mg/kg q6hr PRN (max 120 mg/day)
- **Hydrocodone/Acetaminophen PO** 0.1 mg/kg q6hr PRN (do not exceed 75 mg/kg/day of acetaminophen) *OR* **Morphine IV** 0.05 mg/kg q3hr PRN

Fluids/Electrolytes/Nutrition:
- If maintenance IVF is required, use D5 NS with KCl 20 mEq/L
- Regular diet (if not going to OR for debridement)
- Consider NGT for supplemental nutrition if caloric intake low

Burn wound care:
Depends on burn location and surgeon discretion.
- Bacitracin, Telfa, Kling wrap BID or PRN (first dressing by Pedi Surg, then RN thereafter)
- Mepilex Ag or Mepitel Ag may be applied and left in place for 7 days

Discharge Criteria:
Pain control on PO pain regimen, no active concerns for suspected abuse, family education complete, wound care supplies provided, appropriate follow up in place (PCP as needed for minor burns; Pedi surgery clinic 860-545-9520, 1st available appointment)

Discharge Medications:
Ibuprofen PO 10 mg/kg q6hr PRN (max 1.2 g/day) *AND* **Hydrocodone/Acetaminophen PO** 0.1 mg hydrocodone/kg/dose q6hr PRN (max 5-10 mg hydrocodone/dose; max acetaminophen 4000 mg/day or 75 mg/kg/day) **Dispense only 3 days worth.*

NEXT PAGE

CONTACTS: BRENDAN CAMPBELL, MD, MPH | SAMANTHA PELOW, APRN | JEN TABAK, RN, MSN

LAST UPDATED: 12.19.19

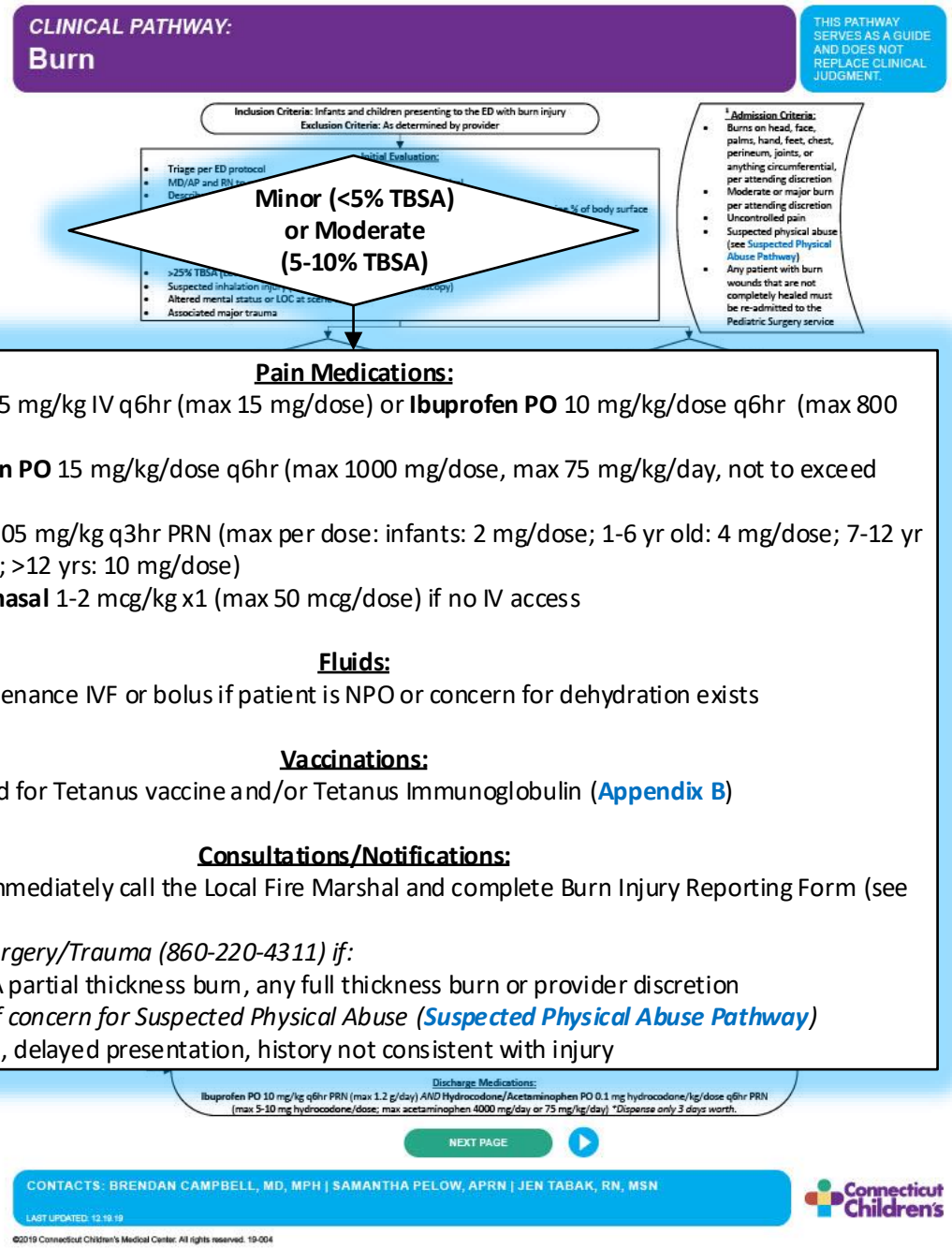
Connecticut Children's

[4]Modified Lund-Browder Chart

Initial Care:

Minor (less than 5% TBSA)
Moderate (5-10% TBSA)

- Establish IV to administer pain medications/fluids
- Consult Pediatric Surgery
- Consider SCAN consult if there is concern for suspected child abuse
- Establish admission criteria



CLINICAL PATHWAY:
Burn
Appendix B: Tetanus Vaccine and IG Considerations

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

- If the patient has completed primary Tetanus series, is up to date on Tetanus vaccination, and received a dose in the past 5 years, no tetanus prophylaxis is indicated.
- If the patient is up to date on Tetanus vaccine but has not completed DTaP series (4 vaccines in total), provide a dose of DTaP if the minimum interval has occurred. Need to Tetanus Immunoglobulin (TIG) should be assessed below:
  - If the patient received at least 3 doses of a Tetanus-containing vaccine, no TIG is needed.
  - If the patient has received fewer than 3 doses of a Tetanus-containing vaccine, TIG is needed.

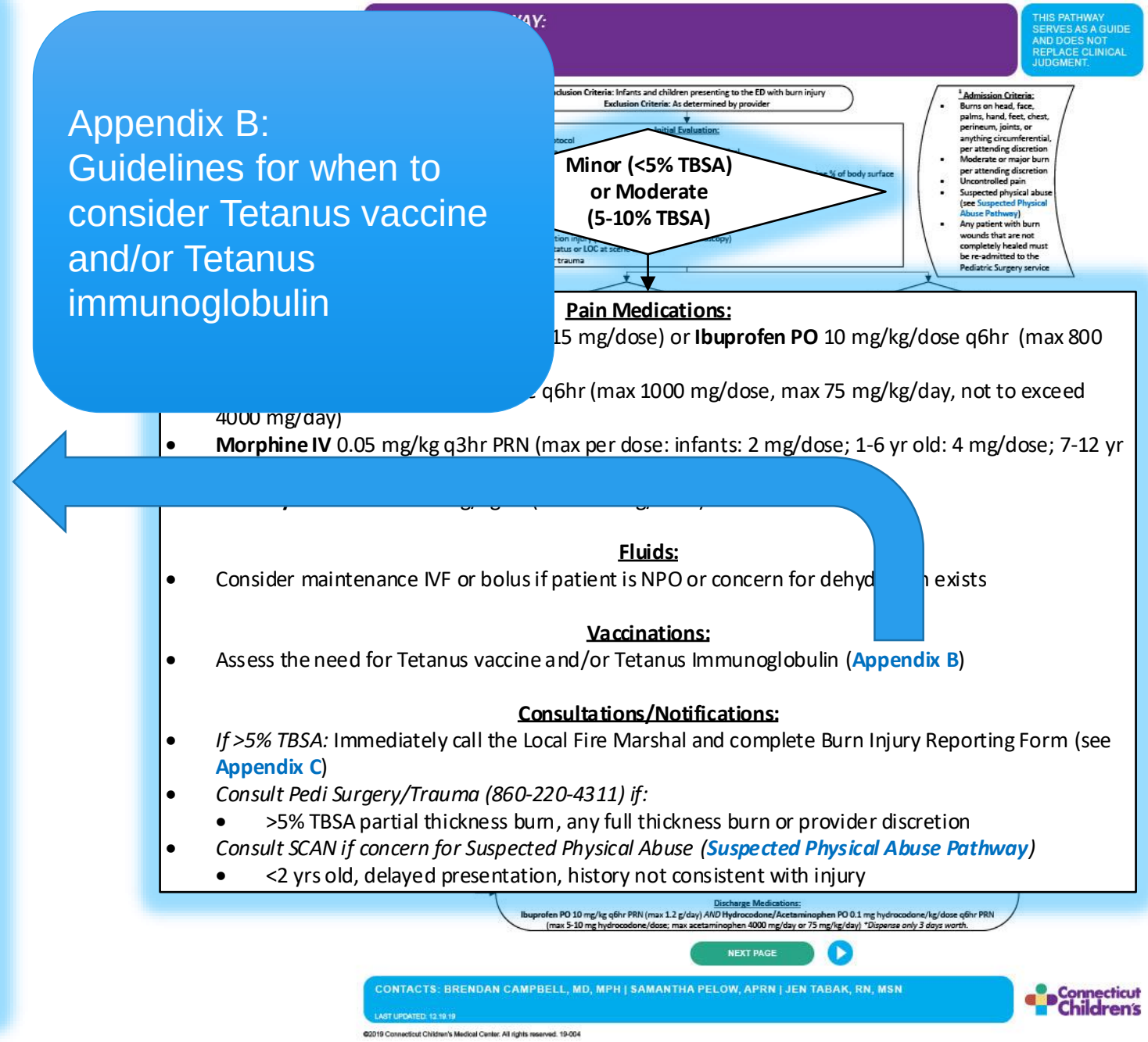
RETURN TO THE BEGINNING

CONTACTS: BRENDAN CAMPBELL, MD, MPH | SAMANTHA PELOW, APRN | JEN TABAK, RN, MSN

LAST UPDATED: 12.19.19

Connecticut Children's

Appendix B: Guidelines for when to consider Tetanus vaccine and/or Tetanus immunoglobulin



CLINICAL PATHWAY:
Burn
Appendix C: Burn Injury Reporting Form

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

State of Connecticut
Department of Administrative Services
Office of Education and Data Management

Burn Injury Reporting Form

www.ct.gov/dcs | phone 860.713.5522 | 860-920-3093

To Report Burn Injuries:

1. ***Immediately*** call the Local Fire Marshal in whose jurisdiction the injury occurred.
2. Tell the Fire Marshal you are reporting a burn injury and give the following information:

A. Victim's name, address and date of birth	D. Area(s) of body injured	G. Apparent cause of burn injury
B. Address when burn injury occurred	E. Degree of burns and percent of body burned	H. Name and address of reporting facility
C. Date and time of injury	F. Injury severity	I. Attending physician

3. Complete the Burn Injury Reporting Form ***within 48 hours*** of the incident. This is a fillable-form in PDF. Please complete the form electronically and email to: **oedm@ct.gov** with the subject line: Burn Injury Report. You may also print and mail the form to: **Office of Education and Data Management, DAS, 450 Columbus Blvd., Suite 1306, Hartford, CT 06103.**

Victim's Name_____ DOB_____ Gender ☐ Male ☐ Female
Last, First, MI mm/dd/yy

Victim's Address_____ Victim's Phone_____ ☐ Check if incident has received prior treatment (transfer patient)
Number, Street, City, State, Zip

Address Where Burn Occurred_____ County_____
Number, Street, City, State, Zip

Date of Injury_____ Time of Injury_____ hours Percent Burned____% Degree(s) of Burn ☐1st ☐2nd ☐3rd ☐Inhalation Burn

Area(s) of Body Injured (Put and "X" by all that apply)

____ Face, Head	____ Leg
____ Neck, Shoulder	____ Foot
____ Chest, Abdomen	____ Arm
____ Back, Buttocks	____ Hand
____ Groin, Genitals	____ Internal (including trachea and larynx)

Injury Severity (Put an "X" in the appropriate box)
☐Moderate (treated and released)
☐Serious (hospitalized)
☐Life Threatening (death is imminent and/or probable)
☐Dead on Arrival

Apparent Cause of Burn Injury (Put and "X" in the appropriate box)
☐Chemical - Contact or exposure to reactive, caustic, corrosive or irritating substance
☐Contact with Hot Object - Woodstove, stovepipe, furnace, iron, steam pipe, exhaust pipe, etc.
☐Cooking - Stove, oven, hotplate, barbecue, hot grease
☐Electrical - Electrocution, electrical equipment and flash burns
☐Explosive - Gun powder, TNT, dynamite
☐Fireworks - Sparklers, firecrackers, rockets, smoke bombs, etc.
☐Flammable Liquids - Ignition of flammable/combustible liquids such as gasoline, kerosene, diesel fuel, jet fuel, lighter fluid, etc.
☐Gas/Vapor Explosion - ignition of flammable gases or the explosion of flammable liquid vapors
☐Hot Liquid - Hot water, coffee, tea, hot food, hot tar, melted plastic, etc.
☐Other Open Flame - Welding, matches, lighter, torch, etc.
☐Outside Fires - Grass and brush, forest, bonfires, dump, trash and refuse fires, etc.
☐Radiation - Burns caused by contact or exposure to any radioactive materials
☐Steam - caused by escaping steam from radiators, boilers, pipes, etc.
☐Structure Fire - any uncontained burning within a structure, including smoking accidents, trash fires, etc.
☐Sunburn - Exposure to ultraviolet light, including sun lamps
☐Vehicle Fire - Car, truck, plane, boat, tractor, lawnmower, etc., carburetor and engine fires, etc.

Name of Reporting Facility _____ Date of Report _____
mm/dd/yy

Address of Reporting Facility _____
Number, Street, City, State, Zip

Name of Attending Physician _____ Name of Person Completing Report _____
Last, First, MI Last, First, MI

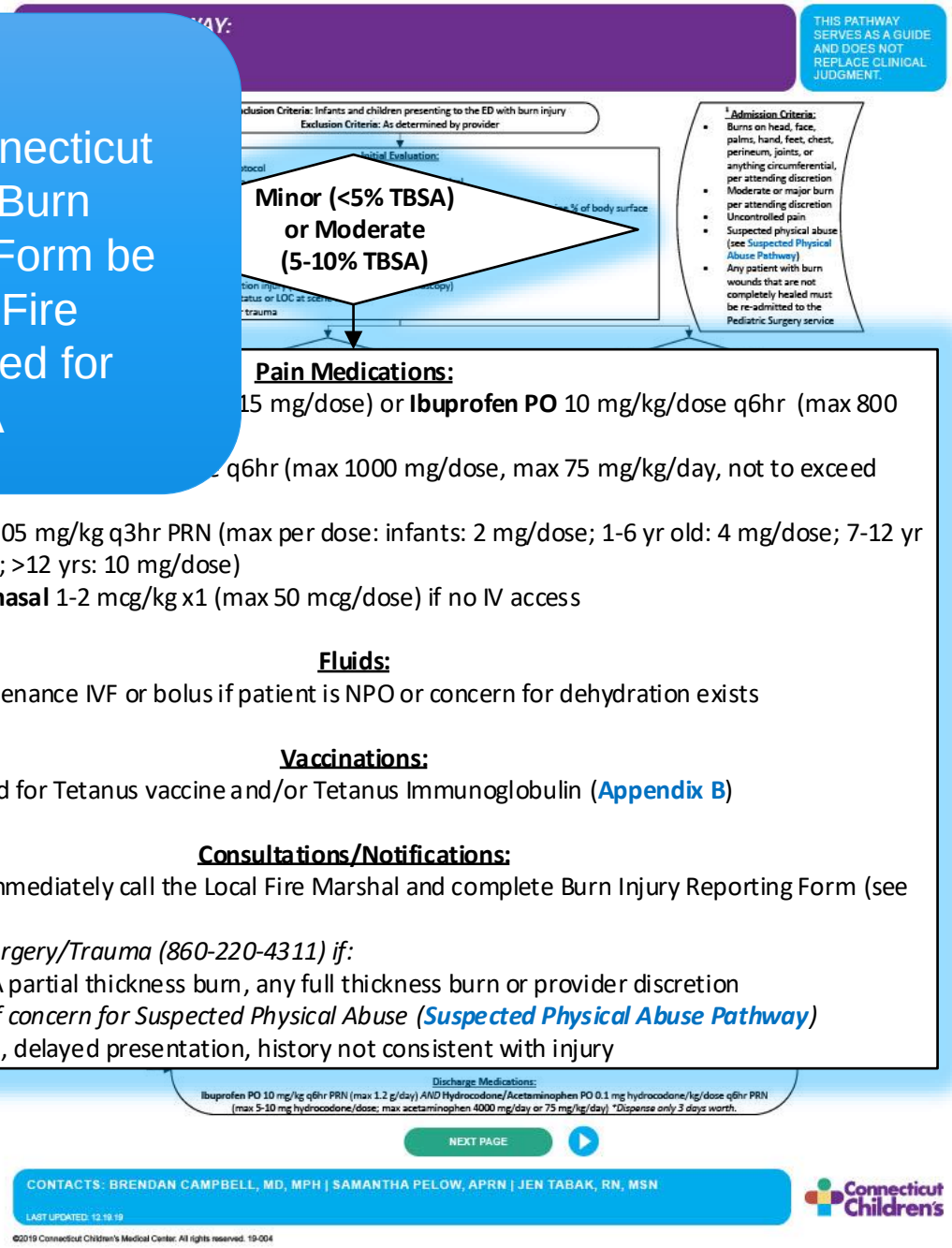
RETURN TO THE BEGINNING

CONTACTS: BRENDAN CAMPBELL, MD, MPH | SAMANTHA PELOW, APRN | JEN TABAK, RN, MSN

LAST UPDATED: 12.19.19

Connecticut Children's

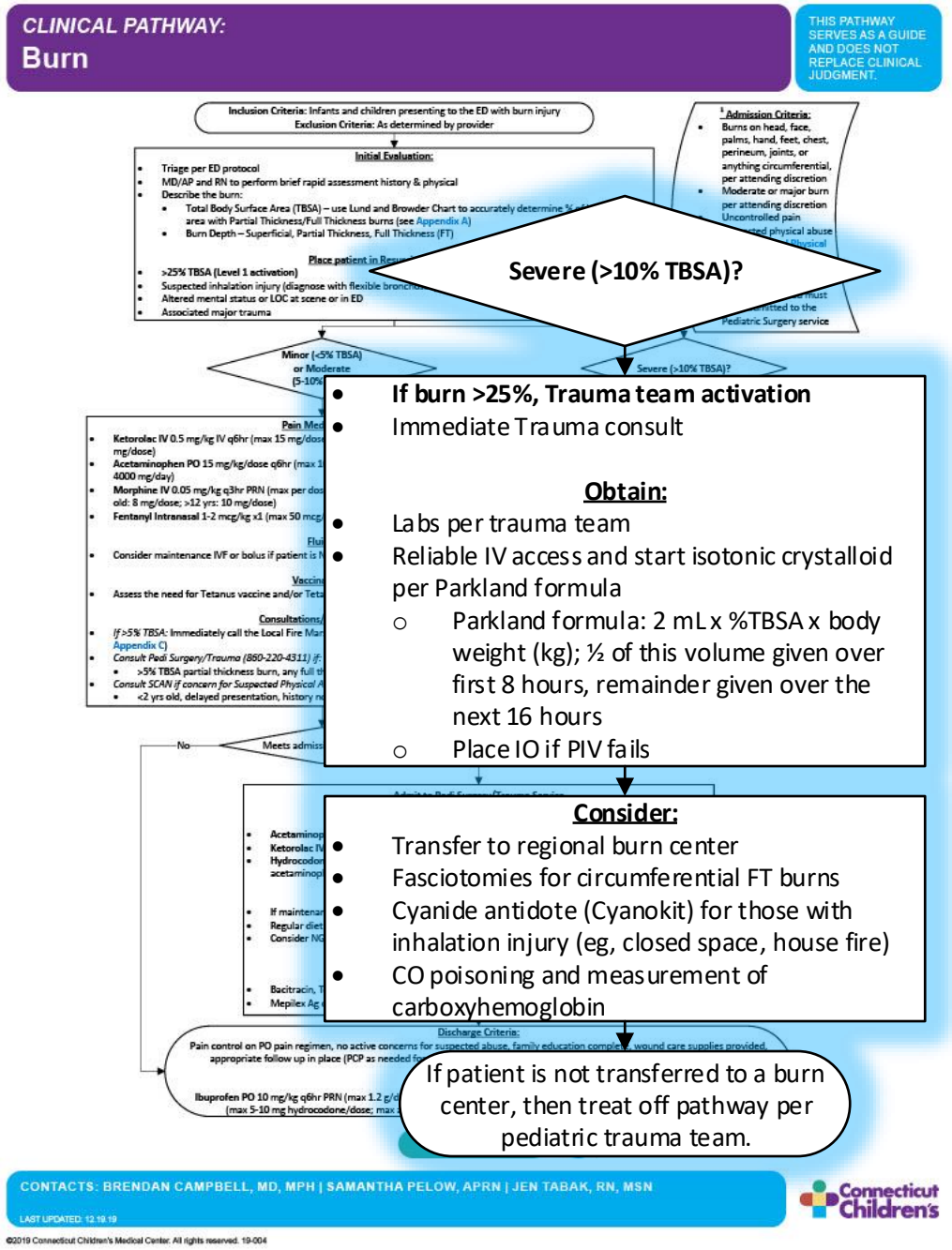
Appendix C:
The State of Connecticut requires that the Burn Injury Reporting Form be filled out and the Fire Marshall be notified for burns >5% TBSA



Initial Care:

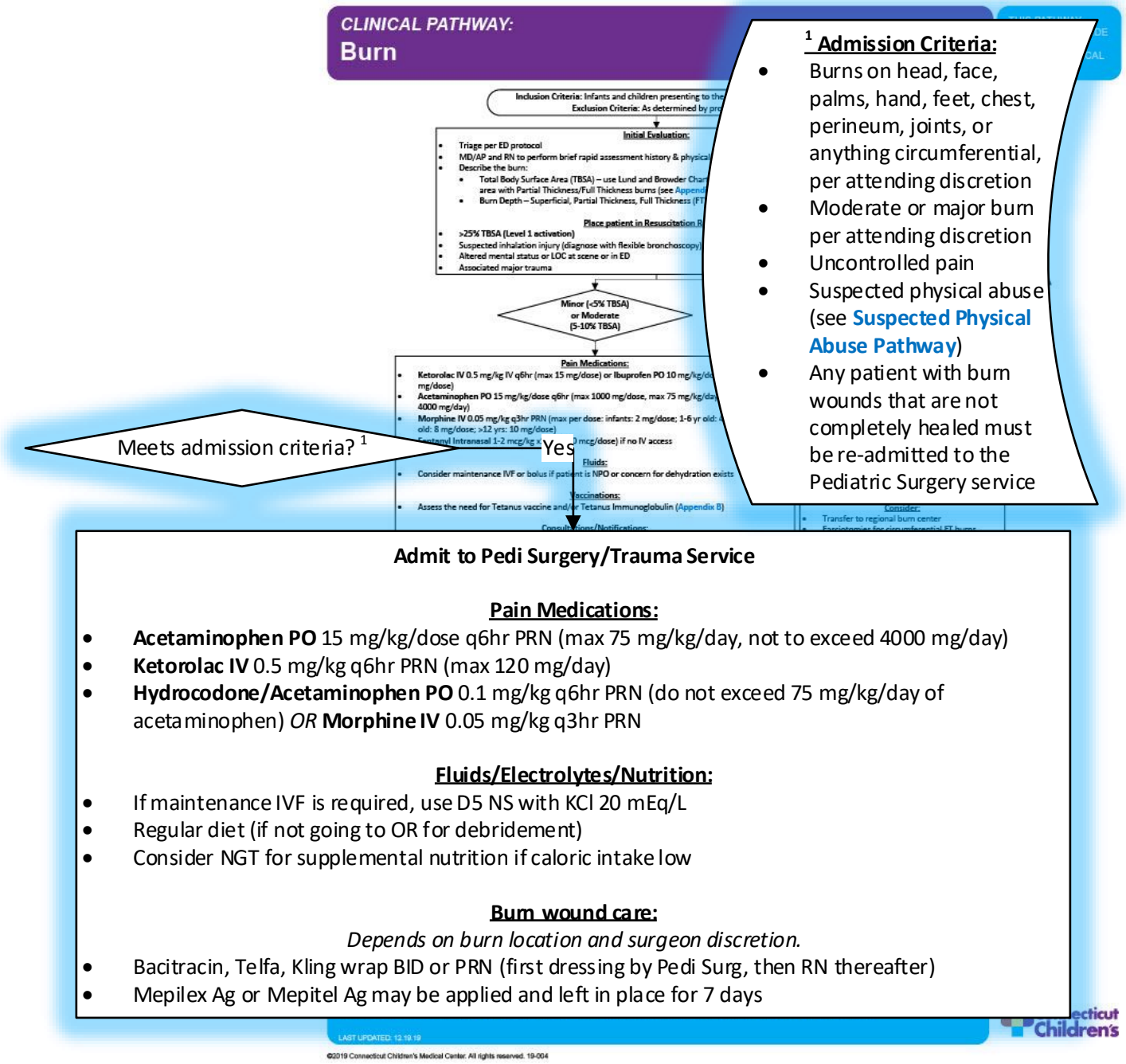
Major burns (>10% TBSA)

- Immediate trauma consult
- If > 25% must be a trauma activation
- Establish and IV, start IVF and obtain labs under direction of the trauma team



Admission to Pedi Surgery/Trauma Service?

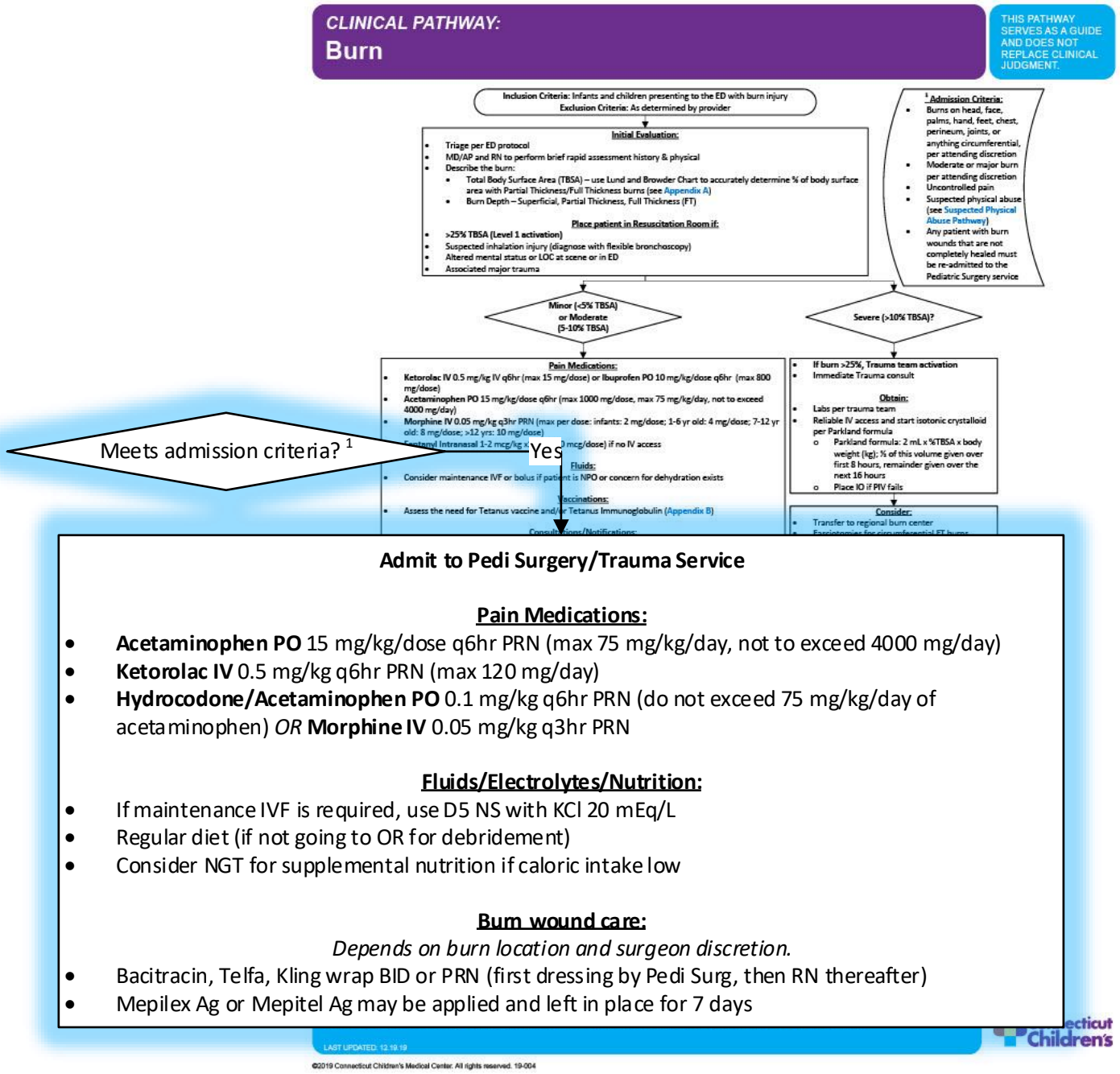
- Burns on the head, face, palms, hands, feet, chest, perineum, joints or anything circumferential
- Greater than 5% TBSA
- Uncontrolled pain
- Suspected abuse



- Medications:
  - Pain management depending on severity

- Fluids/Electrolytes/Nutrition:
  - Use D5 NS with KCl 20 mEq/L for maintenance fluid, if needed
  - Have a low threshold to place Nasogastric tube if intake is poor
    - Proper nutrition is essential for wound healing

- Wound Care: either,
  - Bacitracin (copious amounts), Telfa, Kling wrap BID
  - Aquacel Ag done at 24 hours and every 3 days at bedside
  - Mepilex/Mepitel Ag



Discharge Criteria:

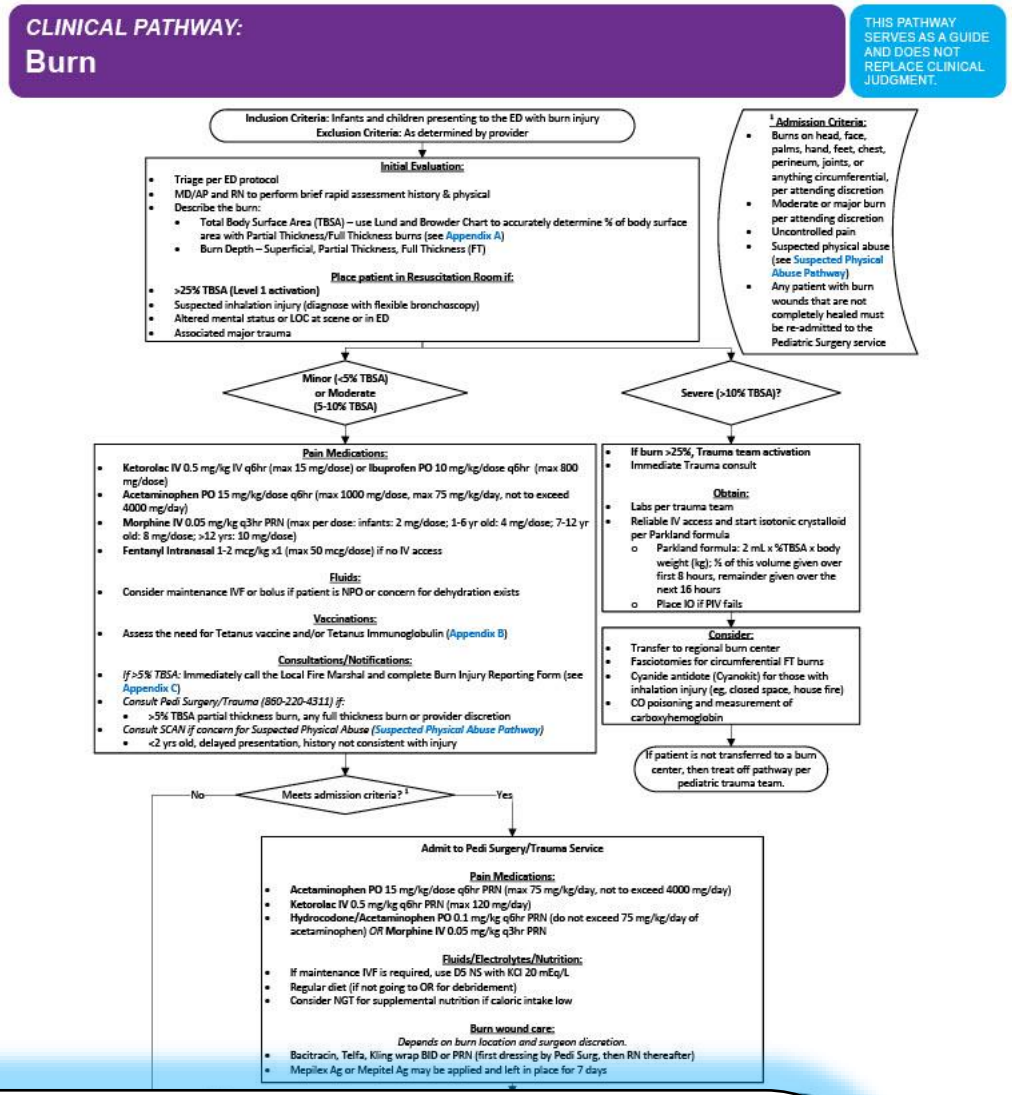
- Less than 5% TBSA

OR

- pain controlled on oral regimen
- no concerns for NAT
- family education complete
- wound care supplies ordered
- follow-up appointment in place (PCP vs Pediatric surgery clinic)

Medications on discharge:

- Ibuprofen AND Hydrocodone/Acetaminophen
  - Dispense only a 3 day supply of hydrocodone/acetaminophen



Discharge Criteria:

Pain control on PO pain regimen, no active concerns for suspected abuse, family education complete, wound care supplies provided, appropriate follow up in place (PCP as needed for minor burns; Pedi surgery clinic 860-545-9520, 1st available appointment)

Discharge Medications:

Ibuprofen PO 10 mg/kg q6hr PRN (max 1.2 g/day) *AND* **Hydrocodone/Acetaminophen** PO 0.1 mg hydrocodone/kg/dose q6hr PRN (max 5-10 mg hydrocodone/dose; max acetaminophen 4000 mg/day or 75 mg/kg/day) **Dispense only 3 days worth.*

Connecticut Children's

Review of Key Points

- Triage and classification of the burn done by the ED to determine severity
- Trauma consult if >5% TBSA; trauma activation for major burns
- Admission orders becoming standardized for admitted burn patients
- Discharge criteria and instructions should be the same for any burn.

Quality Metrics

- Percent utilization of order set (admitted patients only)
- Percentage of patients treated and released from the ED
- Percentage of patients admitted to MS6
- Percentage of eligible patients with notification to Fire Marshal for burn >5% TBSA
- Percentage of patients transferred to a burn center
- LOS for admitted patients (days)

References

- Jeschke MG, Herndon DN. Burns in children: standard and new treatments. Lancet. 2014 Mar;383(9923):1168-78.
- Burn classification. Children's Hospital of Philadelphia, 2017, Philadelphia, PA.
- Modified Lund-Browder Chart. UpToDate, 2018.

Pathway Contacts

- Brendan Campbell, MD, MPH,
  - Department of Pediatric Surgery and Trauma
- Samantha Pelow, APRN,
  - Department of Pediatric Surgery and Trauma
- Jen Tabak, RN, MSN,
  - Trauma Program Coordinator

Thank You!

About Connecticut Children's Clinical Pathways Program

The Clinical Pathways Program at Connecticut Children's aims to improve the quality of care our patients receive, across both ambulatory and acute care settings. We have implemented a standardized process for clinical pathway development and maintenance to ensure meaningful improvements to patient care as well as systematic continual improvement. Development of a clinical pathway includes a multidisciplinary team, which may include doctors, advanced practitioners, nurses, pharmacists, other specialists, and even patients/families. Each clinical pathway has a flow algorithm, an educational module for end-user education, associated order set(s) in the electronic medical record, and quality metrics that are evaluated regularly to measure the pathway's effectiveness. Additionally, clinical pathways are reviewed annually and updated to ensure alignment with the most up to date evidence. These pathways serve as a guide for providers and do not replace clinical judgment.