



Nephrolithiasis (Kidney Stone) Clinical Pathway

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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

- Standardize the approach to evaluation of pediatric patients presenting for suspected nephrolithiasis (kidney stones)
- Limit exposure to nephrotoxic medications in patients with abnormal serum creatinine level
- Ensure appropriate referral/consult to subspecialty services when indicated
- Appropriate use of radiographic studies

Why is Pathway Necessary?

- Increasing incidence of pediatric stone disease
- Shift to outpatient care, particularly in the Emergency Department
- Regional variability of use of CT scan as initial imaging modality despite published guidelines
- Establish a multidisciplinary team approach to stone disease management

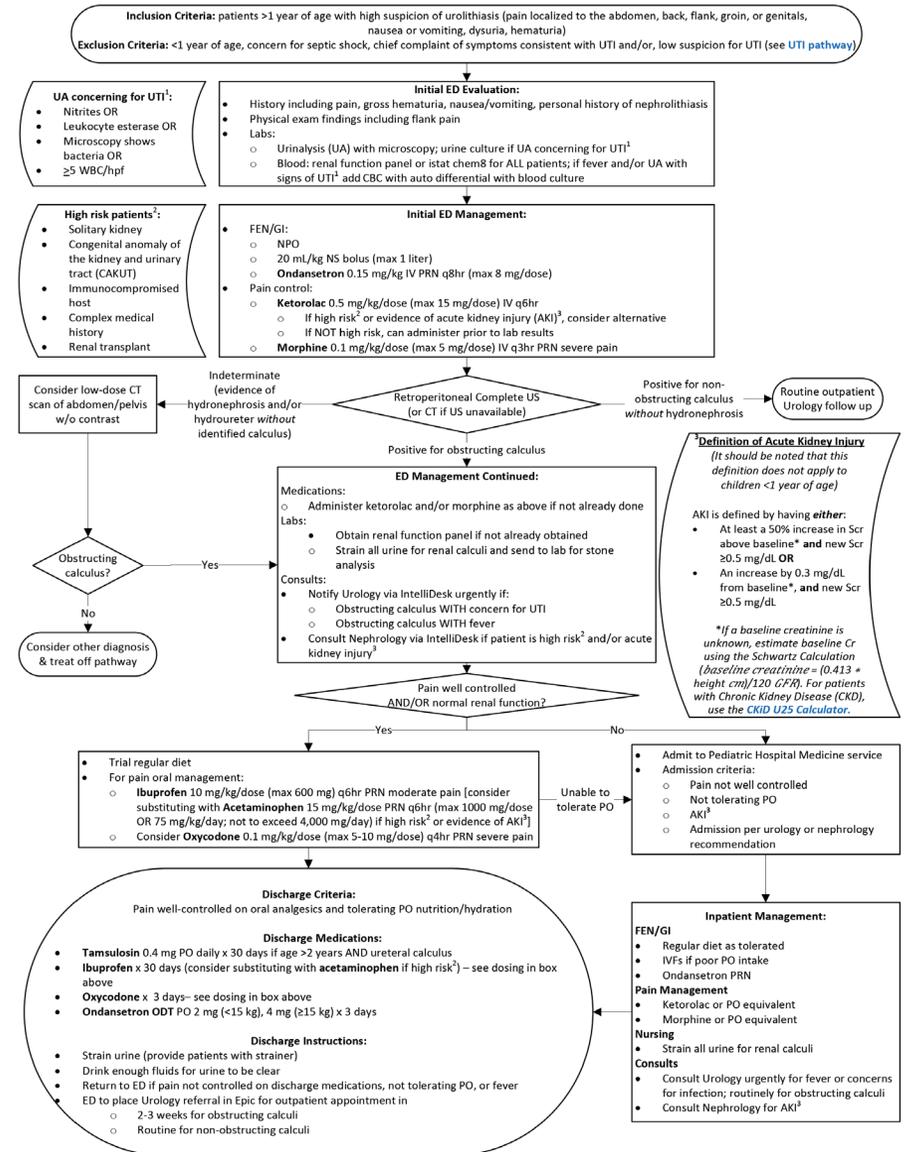
- **Population-based study of ED visits in South Carolina for nephrolithiasis (1997-2012):¹**
 - Doubling of risk for developing urinary stone disease with greatest increase between patients 15-19 years of age (Tasian et al. CJASN 11(3) 2016)
- **Kids' Inpatient Database of HCUP (1997-2012) and the HCUP National ED Sample (2006-2011):²**
 - Increase in medical care for pediatric urolithiasis in the ED setting by 9% (Kusumi et. Al. Ped Neph 2015)
 - Increase in hospital charges by 20% for treatment of pediatric urolithiasis
- **Cross-sectional study of children age 1-17 y.o. with diagnostic imaging for kidney stones (2003-2011):³**
 - Average of 63% had CT scan as initial study vs 24% with ultrasound (N.B. – Image Gently guidelines)

- Risk of recurrence for pediatric stone is 50% within 3 years of first symptomatic kidney stone, and the most at risk are adolescents and patients with prior history of kidney stone
- Medically complex patients can have several risk factors for kidney stone formation, particularly those with alternate forms of nutrition and those with immobility
- Assessment of a child with suspected stones is similar to an adult, but ultrasound is the preferred initial imaging study

CLINICAL PATHWAY: Suspected Nephrolithiasis

THIS PATHWAY
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This is the Nephrolithiasis Clinical Pathway.
We will be reviewing each component in the following slides.



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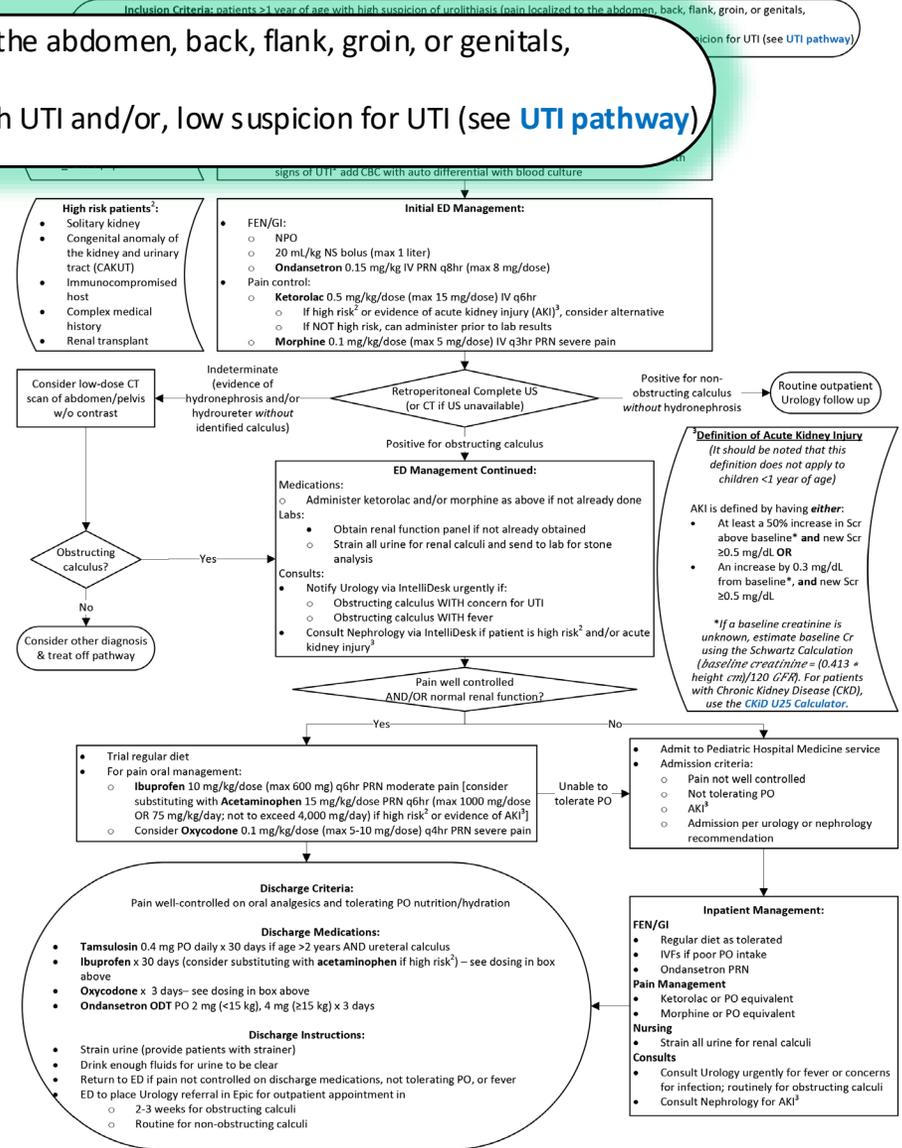
Inclusion Criteria: patients >1 year of age with high suspicion of urolithiasis (pain localized to the abdomen, back, flank, groin, or genitals, nausea or vomiting, dysuria, hematuria)

Exclusion Criteria: <1 year of age, concern for septic shock, chief complaint of symptoms consistent with UTI and/or, low suspicion for UTI (see **UTI pathway**)

Nephrolithiasis should be suspected in patients with urinary symptoms **AND** pain in flank, abdomen, back, groin, or genitals, with/without nausea or vomiting.

A personal history of nephrolithiasis should also raise the clinical suspicion.

Very young patients under 1 year old, those presenting with sepsis, and patients with high likelihood of UTI alone will be excluded from this pathway.



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- Laboratory evaluation and medical management can occur simultaneously
 - Of note, CBC and blood culture only indicated if patient febrile and/or UA with signs of UTI
- The mainstay of treatment is nausea, pain, and fluid management

Initial ED Evaluation:

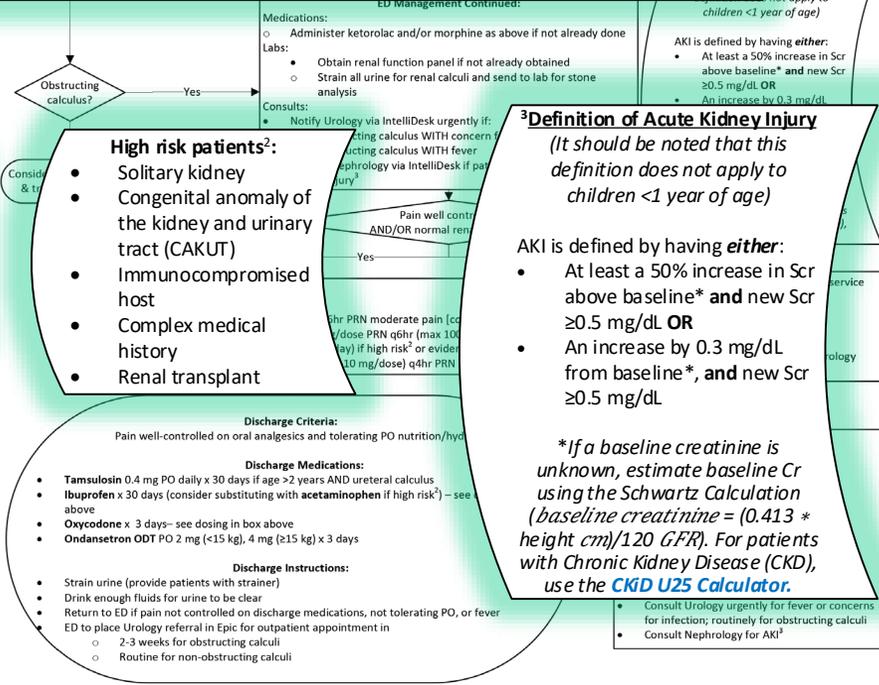
- History including pain, gross hematuria, nausea/vomiting, personal history of nephrolithiasis
- Physical exam findings including flank pain
- Labs:
 - Urinalysis (UA) with microscopy; urine culture if UA concerning for UTI¹
 - Blood: renal function panel or istat chem8 for ALL patients; if fever and/or UA with signs of UTI¹ add CBC with auto differential with blood culture

Initial ED Management:

- FEN/GI:
 - NPO
 - 20 mL/kg NS bolus (max 1 liter)
 - Ondansetron** 0.15 mg/kg IV PRN q8hr (max 8 mg/dose)
- Pain control:
 - Ketorolac** 0.5 mg/kg/dose (max 15 mg/dose) IV q6hr
 - If high risk² or evidence of acute kidney injury (AKI)³, consider alternative
 - If NOT high risk, can administer prior to lab results
 - Morphine** 0.1 mg/kg/dose (max 5 mg/dose) IV q3hr PRN severe pain

UA concerning for UTI¹:

- Nitrites OR
- Leukocyte esterase OR
- Microscopy shows bacteria OR
- ≥5 WBC/hpf



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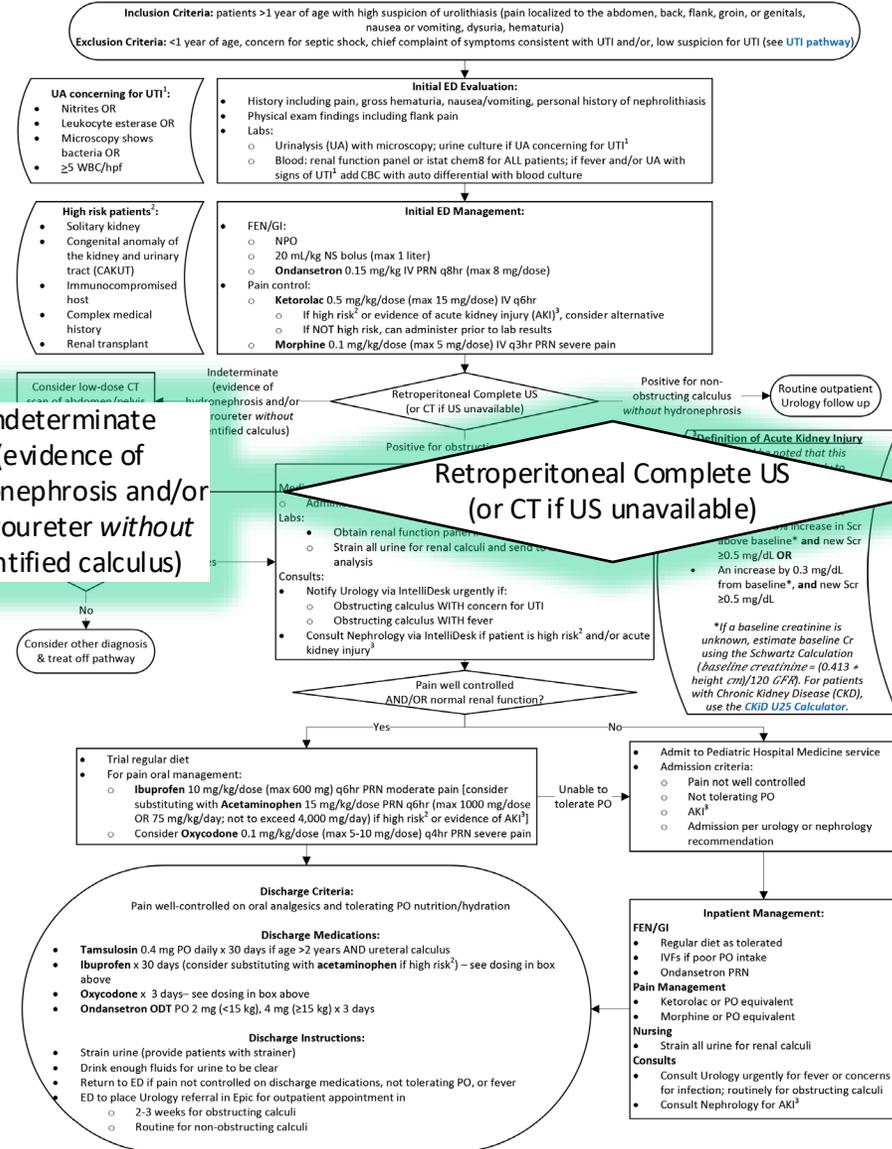


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Imaging Modality:

- Retroperitoneal/ renal bladder ultrasound (RBUS) – recommended by AUA as the 1st line study for children with suspected stones
- If indeterminate but high suspicion for stone OR US is unavailable, then consider low-dose CT scan



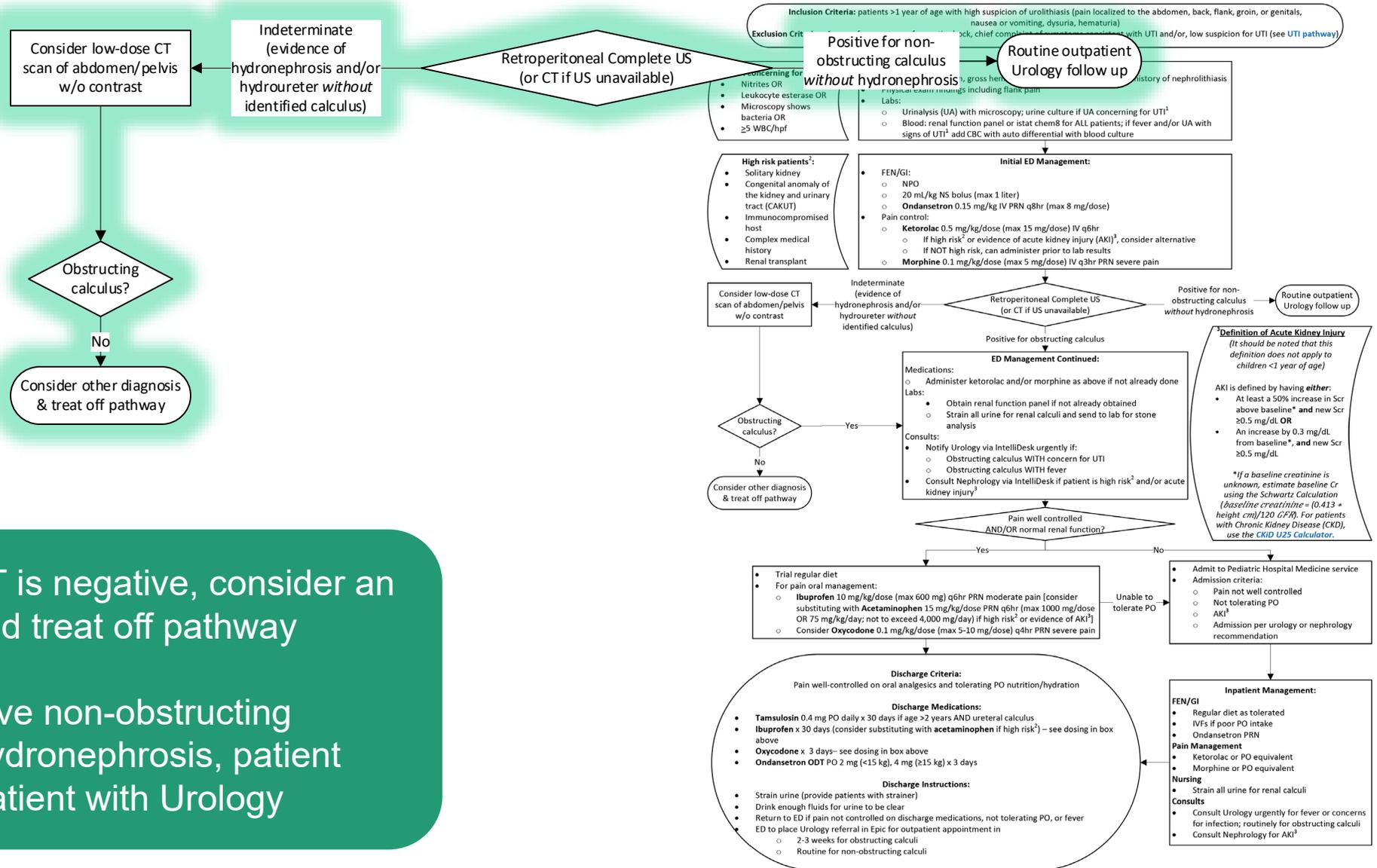
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- If the ultrasound or CT is negative, consider an alternate diagnosis and treat off pathway
- If the imaging is positive non-obstructing calculus WITHOUT hydronephrosis, patient should follow up outpatient with Urology

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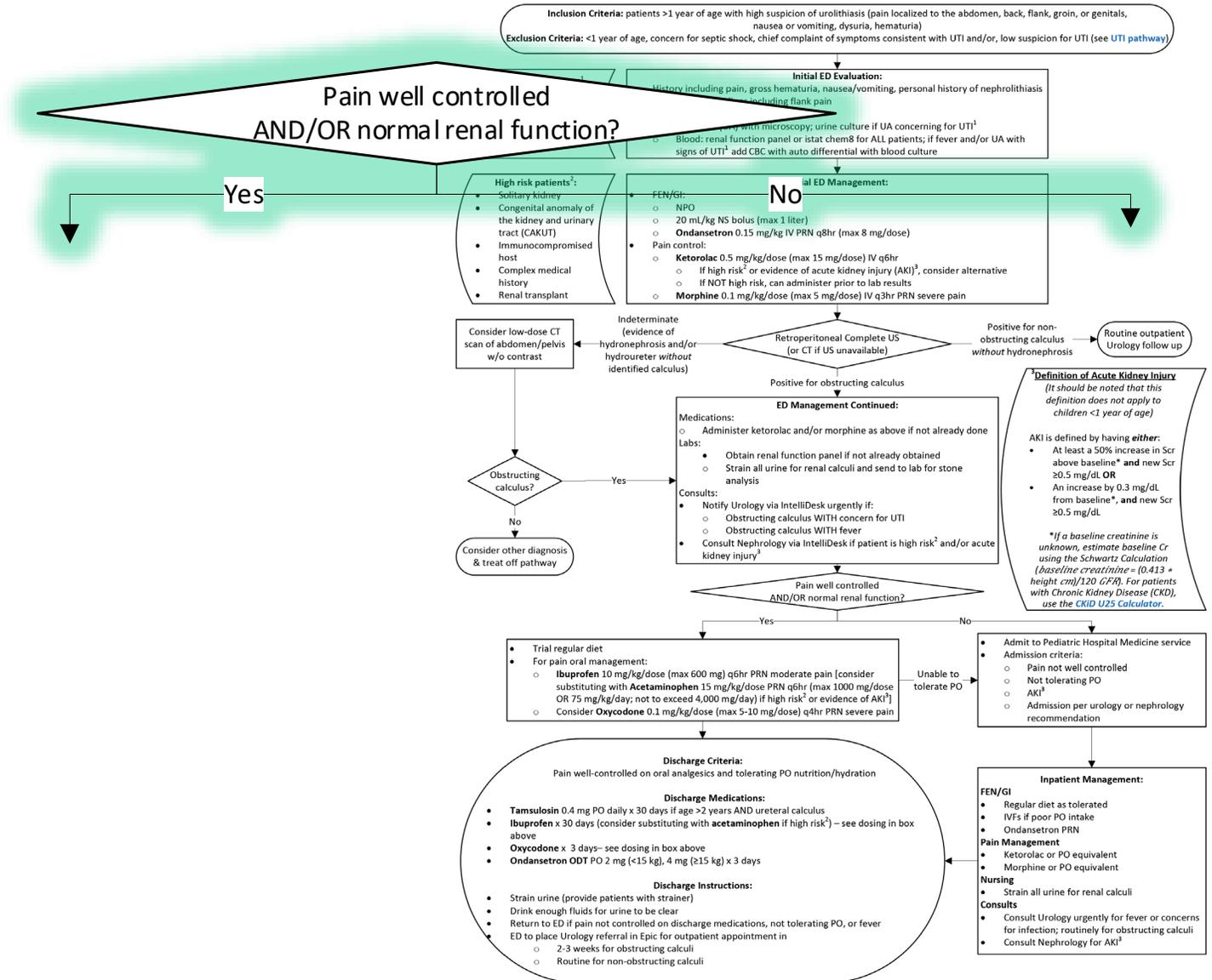
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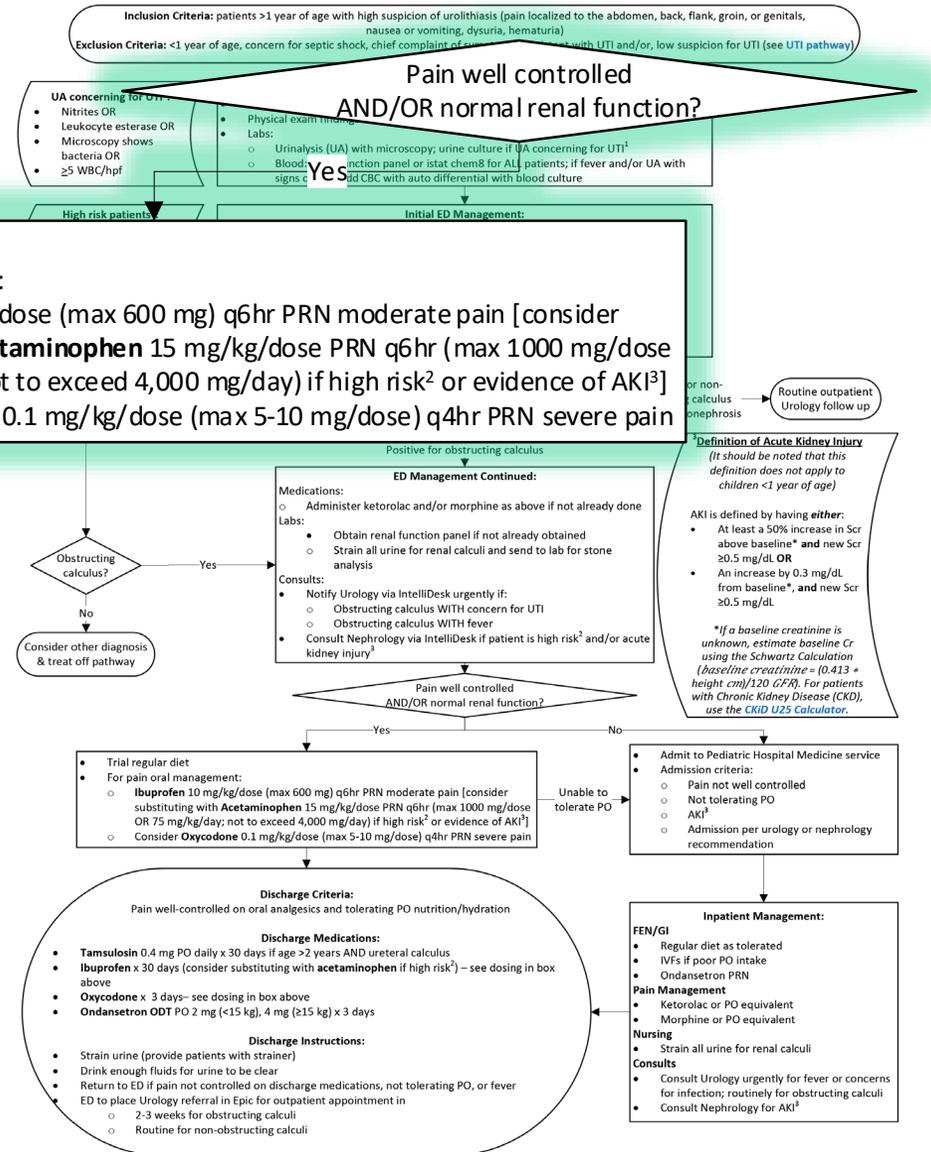
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• Next steps in care are dependent on whether or not pain is well controlled and whether or not there is normal renal function

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If pain well controlled and normal renal function:

- Trial a regular diet
- Ensure oral pain management is adequate

If patient tolerates these interventions, can proceed to discharge home

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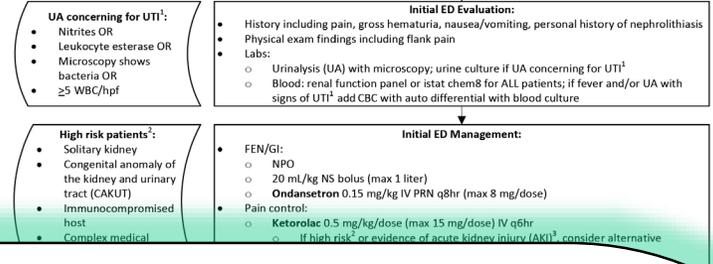
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Exclusion Criteria: <1 year of age, concern for septic shock, chief complaint of symptoms consistent with UTI and/or, low suspicion for UTI (see UTI pathway)



- Discharge criteria, discharge medications, and discharge instructions are included in the clinical pathway
- Patient should be instructed to strain their urine and drink fluids.
- Providers to place a referral to urology for outpatient follow up via Epic

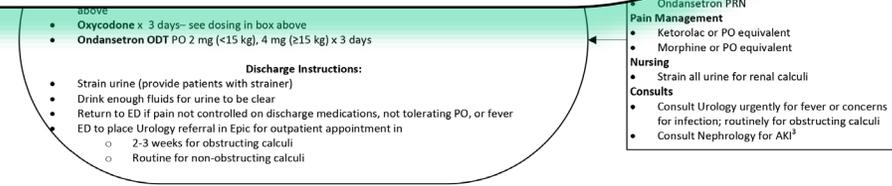
Discharge Criteria:
Pain well-controlled on oral analgesics and tolerating PO nutrition/hydration

Discharge Medications:

- Tamsulosin 0.4 mg PO daily x 30 days if age >2 years AND ureteral calculus
- Ibuprofen x 30 days (consider substituting with acetaminophen if high risk²) – see dosing in box above
- Oxycodone x 3 days– see dosing in box above
- Ondansetron ODT PO 2 mg (<15 kg), 4 mg (≥15 kg) x 3 days

Discharge Instructions:

- Strain urine (provide patients with strainer)
- Drink enough fluids for urine to be clear
- Return to ED if pain not controlled on discharge medications, not tolerating PO, or fever
- ED to place Urology referral in Epic for outpatient appointment in
 - 2-3 weeks for obstructing calculi
 - Routine for non-obstructing calculi



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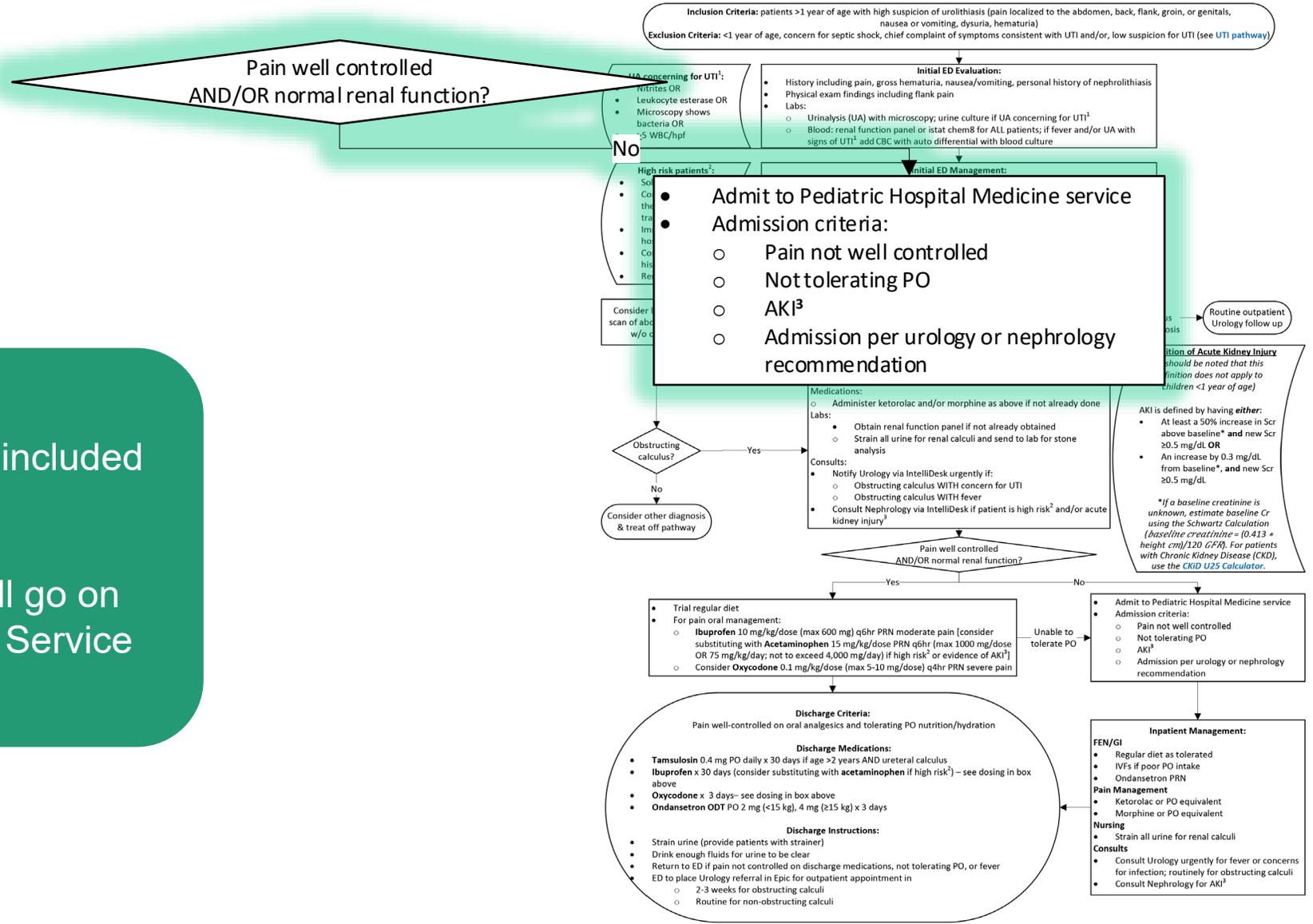
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- Inpatient admission criteria are included in the pathway
- Patients requiring admission will go on the Pediatric Hospital Medicine Service

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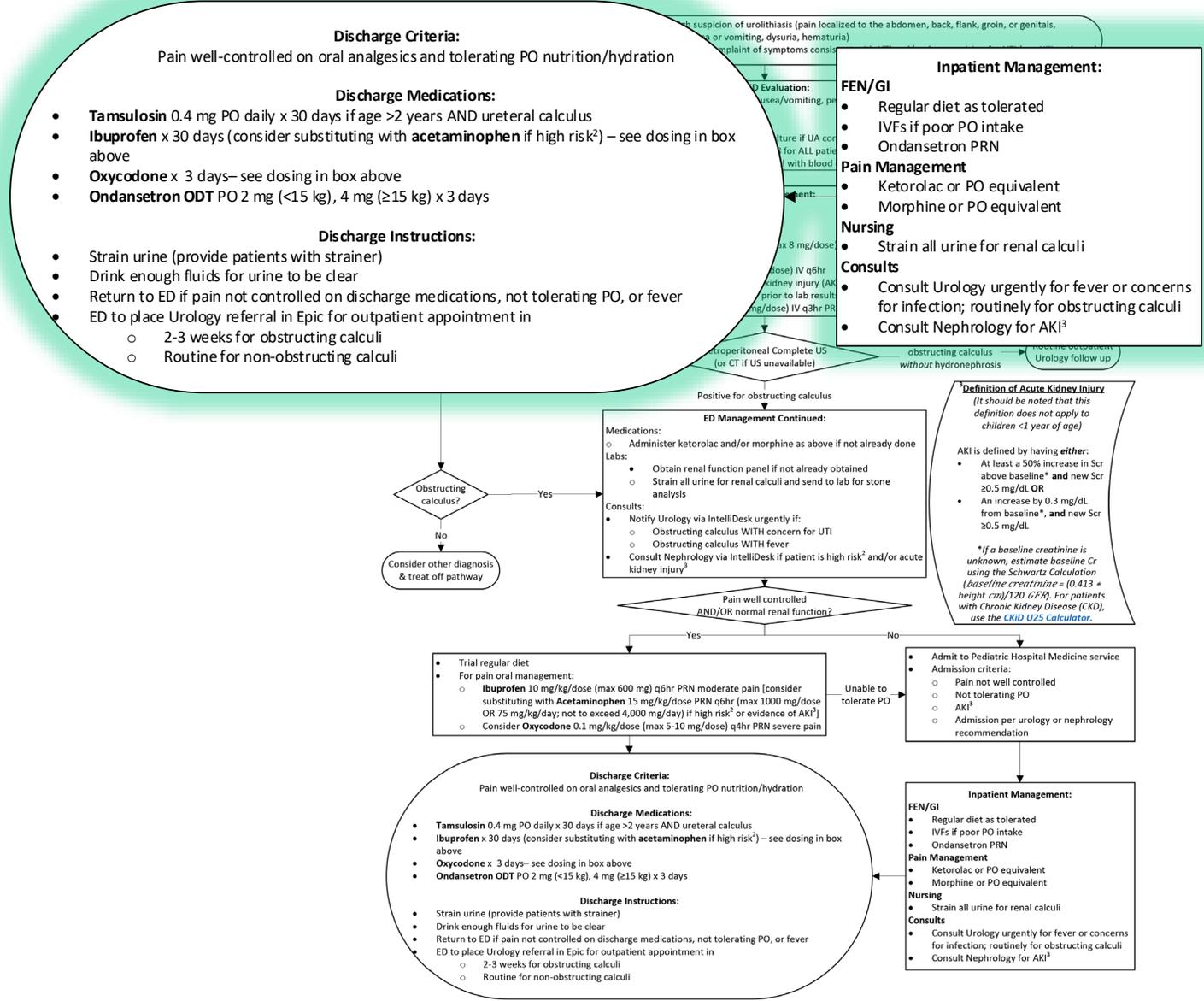
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- Inpatient management may include IVFs, antiemetics, and IV pain medication depending on patient's reason(s) for admission
- All urine must be strained for renal stone analysis
- Indications for if and when to consult Urology and/or Nephrology are clearly indicated
- Once patient is meeting discharge criteria, utilize the discharge medications and discharge instructions included in the clinical pathway



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Review of Key Points

- Acute care and management of nephrolithiasis typically occur in the Emergency Department
- Consideration for the complexity of patient's underlying chronic disorders is important in the evaluation and management of acute nephrolithiasis
- Initial imaging should begin with renal bladder ultrasound in most cases
- Obtain timely consultation Nephrology and Urology as indicated

- Percentage of patients seen in the ED who require admission
- Percentage of patients who have serum Cr performed
- Number of patients who undergo CT scan for stone evaluation in the ED
- Percentage of patients returning to the ED within 48 hours after discharge
- Percent of patients who received tamsulosin for treatment of confirmed stone
- Length of stay (LOS) in the ED for stone event

Pathway Contacts



- Leonela Villegas, MD, MSCE
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- Courtney Rowe, MD
 - Connecticut Children's Division of Urology
- Eric Hoppa, MD
 - Connecticut Children's Division of Emergency Medicine

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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.