Clinical Pathways

Acute Gastroenteritis (AGE) and Dehydration Pathway

Eric Hoppa, MD
Ilana Waynik, MD

Connecticut Children's

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 care of patients who present with gastroenteritis and dehydration
- Improve the classification of dehydration (mild, moderate, severe)
- Standardize use of ondansetron in appropriate patients
- Increase the use of oral rehydration therapy (ORT) when appropriate, and improve caregiver education on ORT administration
- Decrease time to regular diet
- Decrease unnecessary laboratory testing and treatments (e.g electrolytes, stool studies, antidiarrheal medications, antimicrobials)

Why is Pathway Necessary?

- In the United States, AGE accounts for 1.7 million Emergency Department Visits annually [1]
- According to the Centers for Disease Control (CDC), acute diarrhea accounts for 200,000 hospitalizations and approximately 300 deaths per year in the US[2]
  - 10% of all pediatric hospital admissions[3]
- AGE leads to significant utilization of inpatient resources, with estimated direct costs of >$200 million annually[11]

Why is Pathway Necessary (continued)?

- CDC published guidelines for management of AGE in 2003, and these were endorsed by the AAP in 2004

- However, a recent study[12] demonstrates continued varied resource use w/high percentage of patients receiving:
  - IVFs
  - CBC
  - Electrolytes

- Same study did show declines in rotavirus and stool cultures over time, and also a high variation in use of probiotics, antiemetics, and imaging

- Another recent study demonstrated that implementation of an evidence-based guideline for patients with gastroenteritis in a single center ED led to decreased frequency of IVFs, decreased LOS, and lower healthcare costs[13]…pathways work!

Gastroenteritis: Defined

- Vomiting
- Diarrhea
- Risk of Dehydration
- Inflammation
- Fever

Diarrhea is defined as at least 3 watery stools (taking the shape of the container) in 24 hours

The volume of fluid lost through stool can vary from 5mL/kg body weight/ day to > 200mL/kg/body weight/day

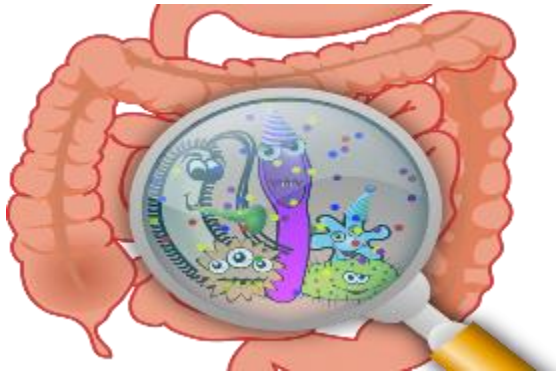
https://nutretumenteblog.wordpress.com/2014/09/25/gastroenteritis/

Gastroenteritis is defined as inflammation of the mucosa of the gastrointestinal tract causing a constellation of symptoms including abdominal pain, diarrhea, emesis and possibly dehydration.

Freedman, Stephen B., Samina Ali, Marta Oleszczuk, Serge Gouin, and Lisa Hartling. "Treatment of Acute Gastroenteritis in Children: An Overview of Systematic Reviews of Interventions Commonly Used in Developed Countries." Evid.-Based Child Health Evidence-Based Child Health: A Cochrane Review Journal 8.4 (2013): 1123-137. Web.

Gastroenteritis: Defined

- Dehydration and electrolyte losses associated with untreated diarrhea cause the primary morbidity of AGE.
- Diarrhea is caused by different infectious or inflammatory processes in the intestine that directly affect the enterocyte secretory and absorptive function.
- Enteritis has many viral, bacterial and parasitic cause.



https://nutretumenteblog.wordpress.com/2014/09/25/gastroenteritis/

Most commonly caused by viral pathogens

Freedman, Stephen B., Samina Ali, Marta Oleszczuk, Serge Gouin, and Lisa Hartling. "Treatment of Acute Gastroenteritis in Children: An Overview of Systematic Reviews of Interventions Commonly Used in Developed Countries." Evid.-Based Child Health Evidence-Based Child Health: A Cochrane Review Journal 8.4 (2013): 1123-137. Web.

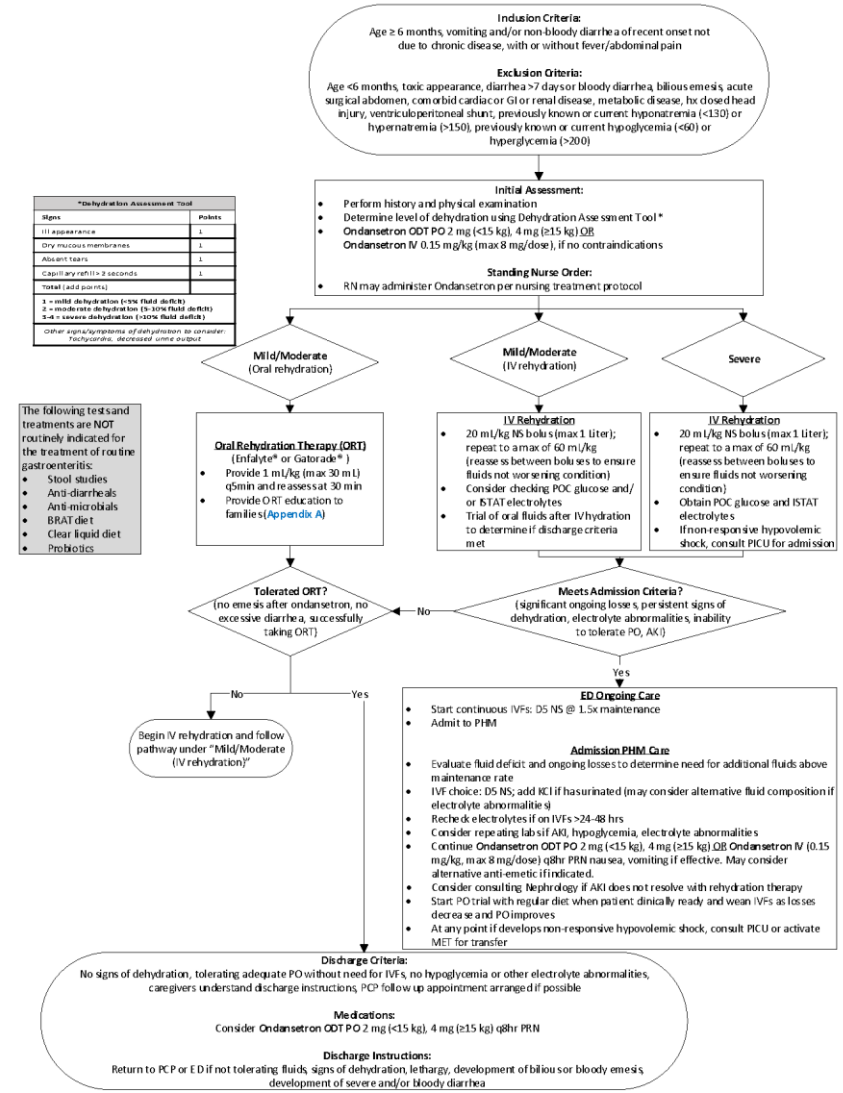
This is the Gastroenteritis and Dehydration Clinical Pathway.

We will be reviewing each component in the following slides.

CLINICAL PATHWAY:

Gastroenteritis and Dehydration

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



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Important questions to consider when taking the patient's history

- Emesis: number of times, last time, bilious/bloody, worse in the AM?
- Diarrhea: number of times, blood/mucus?
- Intake: type and amount of fluid
- Urination: number of times, last time, color/odor

CLINICAL PATHWAY:
Gastroenteritis and Dehydration

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Inclusion Criteria:
Age ≥ 6 months, vomiting and/or non-bloody diarrhea of recent onset not due to chronic disease, with or without fever/abdominal pain

Exclusion Criteria:
Age <6 months, toxic appearance, diarrhea >7 days or bloody diarrhea, bilious emesis, acute surgical abdomen, comorbid cardiac or GI or renal disease, metabolic disease, hx closed head injury, ventriculoperitoneal shunt, previously known or current hyponatremia (<130) or hypernatremia (>150), previously known or current hypoglycemia (<60) or hyperglycemia (>200)

Mild/Moderate (Oral rehydration)

Mild/Moderate (IV rehydration)

Severe

The following tests and

Initial Assessment:

- Perform history and physical examination
- Determine level of dehydration using Dehydration Assessment Tool *
- **Ondansetron ODT PO** 2 mg (<15 kg), 4 mg (≥15 kg) OR
  Ondansetron IV 0.15 mg/kg (max 8 mg/dose), if no contraindications

Standing Nurse Order:

- RN may administer Ondansetron per nursing treatment protocol

Begin IV rehydration and follow pathway under "Mild/Moderate (IV rehydration)"

- Admit to PHM

Admission PHM Care

- Evaluate fluid deficit and ongoing losses to determine need for additional fluids above maintenance rate
- IVF choice: D5 NS; add KCl if has urinated (may consider alternative fluid composition if electrolyte abnormalities)
- Recheck electrolytes if on IVFs >24-48 hrs
- Consider repeating labs if AKI, hypoglycemia, electrolyte abnormalities
- Continue **Ondansetron ODT PO** 2 mg (<15 kg), 4 mg (≥15 kg) OR **Ondansetron IV** (0.15 mg/kg, max 8 mg/dose) q8hr PRN nausea, vomiting if effective. May consider alternative anti-emetic if indicated.
- Consider consulting Nephrology if AKI does not resolve with rehydration therapy
- Start PO trial with regular diet when patient clinically ready and wean IVFs as losses decrease and PO improves
- At any point if develops non-responsive hypovolemic shock, consult PICU or activate MET for transfer

Discharge Criteria:
No signs of dehydration, tolerating adequate PO without need for IVFs, no hypoglycemia or other electrolyte abnormalities, caregivers understand discharge instructions, PCP follow up appointment arranged if possible

Medications:
Consider **Ondansetron ODT PO** 2 mg (<15 kg), 4 mg (≥15 kg) q8hr PRN

Discharge Instructions:
Return to PCP or ED if not tolerating fluids, signs of dehydration, lethargy, development of bilious or bloody emesis, development of severe and/or bloody diarrhea

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Important questions to consider when taking the patient's history

- Exposure: ill contacts, new foods, farm animals, foreign travel
- Pain: location, quality, radiation, duration
- Pre-illness Weight: sensitive indicator of dehydration
- Underlying medical condition: cardiac, GI, renal, metabolic, endocrine (DM), immunodeficiency, hx of abdominal surgeries

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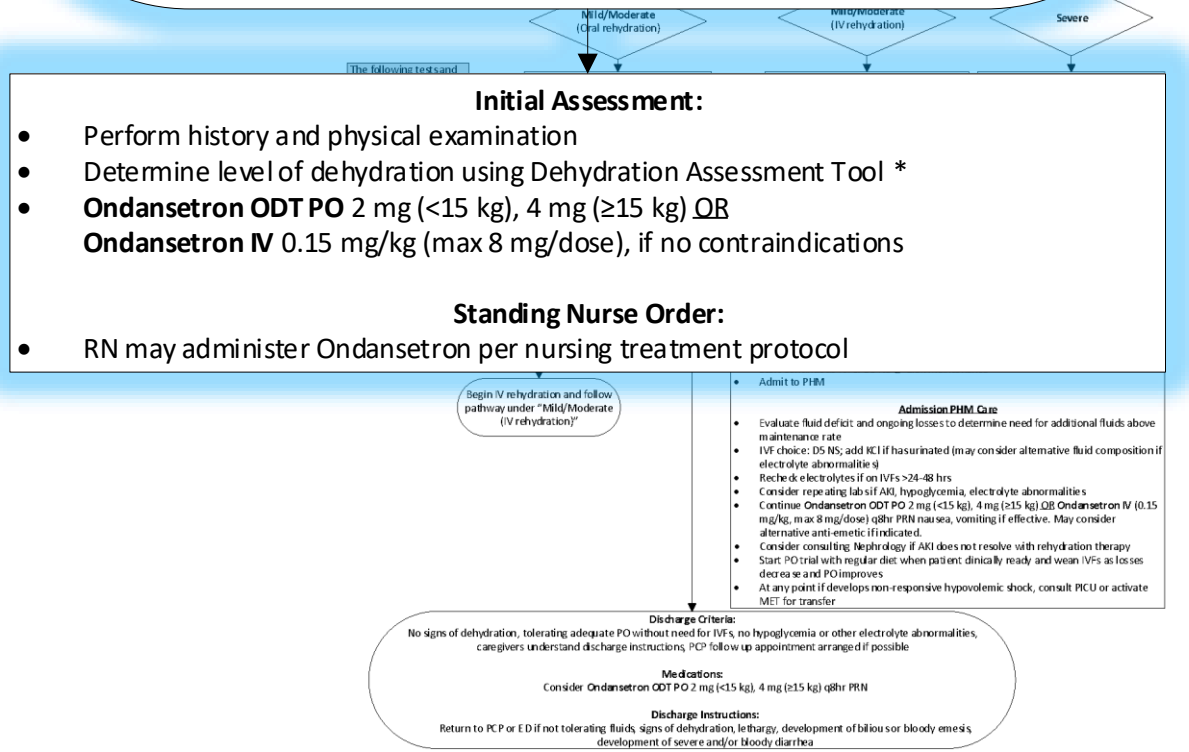

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Hydration Status

Physical exam findings and vital signs are used to determine a patient's level of dehydration.

TABLE 1. Symptoms associated with dehydration

Symptom	Minimal or no dehydration (<3% loss of body weight)	Mild to moderate dehydration (3%–9% loss of body weight)	Severe dehydration (>9% loss of body weight)
Mental status	Well; alert	Normal, fatigued or restless, irritable	Apathetic, lethargic, unconscious
Thirst	Drinks normally; might refuse liquids	Thirsty; eager to drink	Drinks poorly; unable to drink
Heart rate	Normal	Normal to increased	Tachycardia, with bradycardia in most severe cases
Quality of pulses	Normal	Normal to decreased	Weak, thready, or impalpable
Breathing	Normal	Normal; fast	Deep
Eyes	Normal	Slightly sunken	Deeply sunken
Tears	Present	Decreased	Absent
Mouth and tongue	Moist	Dry	Parched
Skin fold	Instant recoil	Recoil in <2 seconds	Recoil in >2 seconds
Capillary refill	Normal	Prolonged	Prolonged; minimal
Extremities	Warm	Cool	Cold; mottled; cyanotic
Urine output	Normal to decreased	Decreased	Minimal

Sources: Adapted from Duggan C, Santosham M, Glass RI. The management of acute diarrhea in children: oral rehydration, maintenance, and nutritional therapy. MMWR 1992;41(No. RR-16):1–20; and World Health Organization. The treatment of diarrhoea: a manual for physicians and other senior health workers. Geneva, Switzerland: World Health Organization, 1995. Available at http://www.who.int/child-adolescent-health/New_Publications/CHILD_HEALTH/WHO.CDR.95.3.htm.

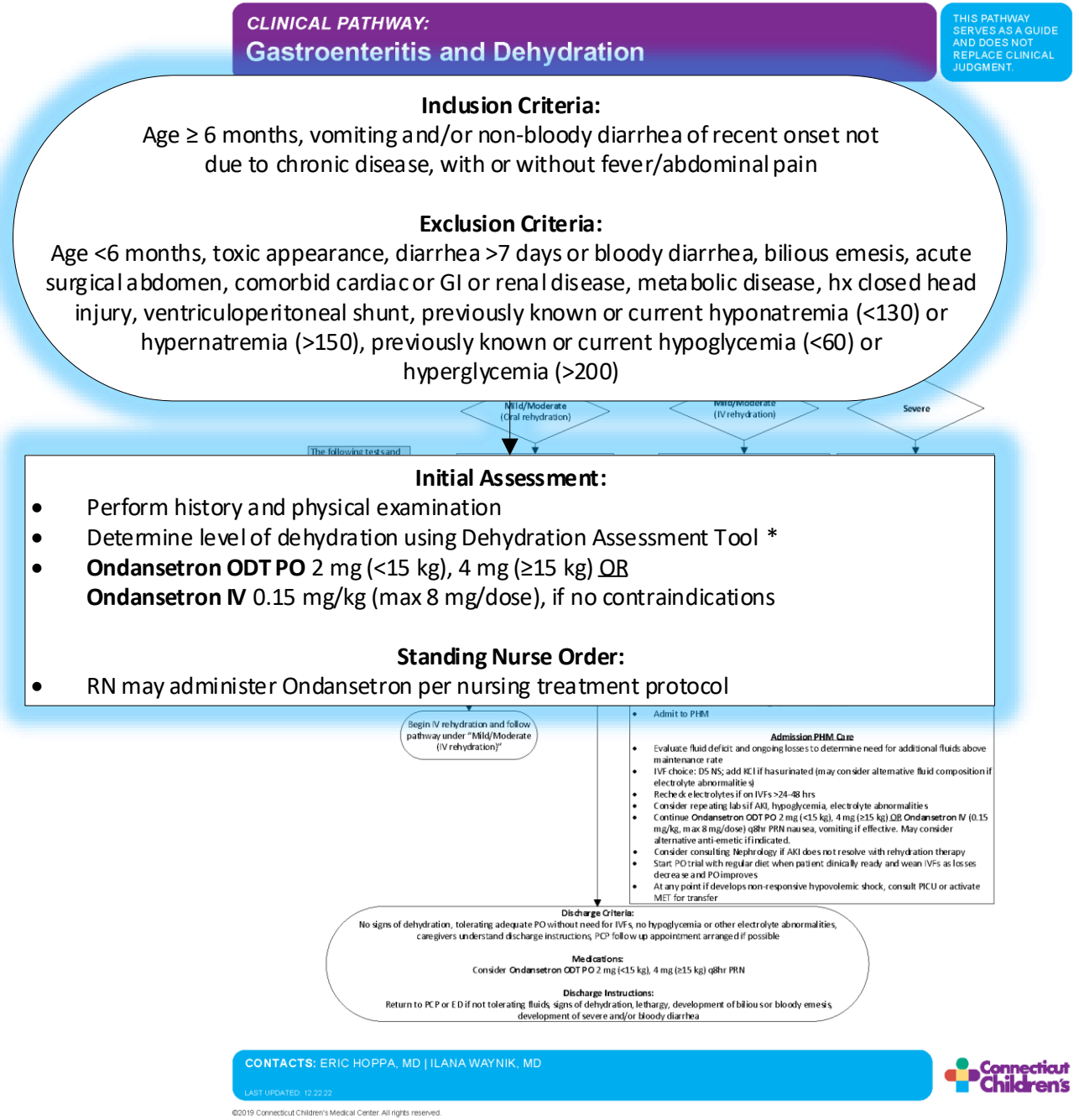
http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5216a1.htm#tab1

Physical Exam Considerations:

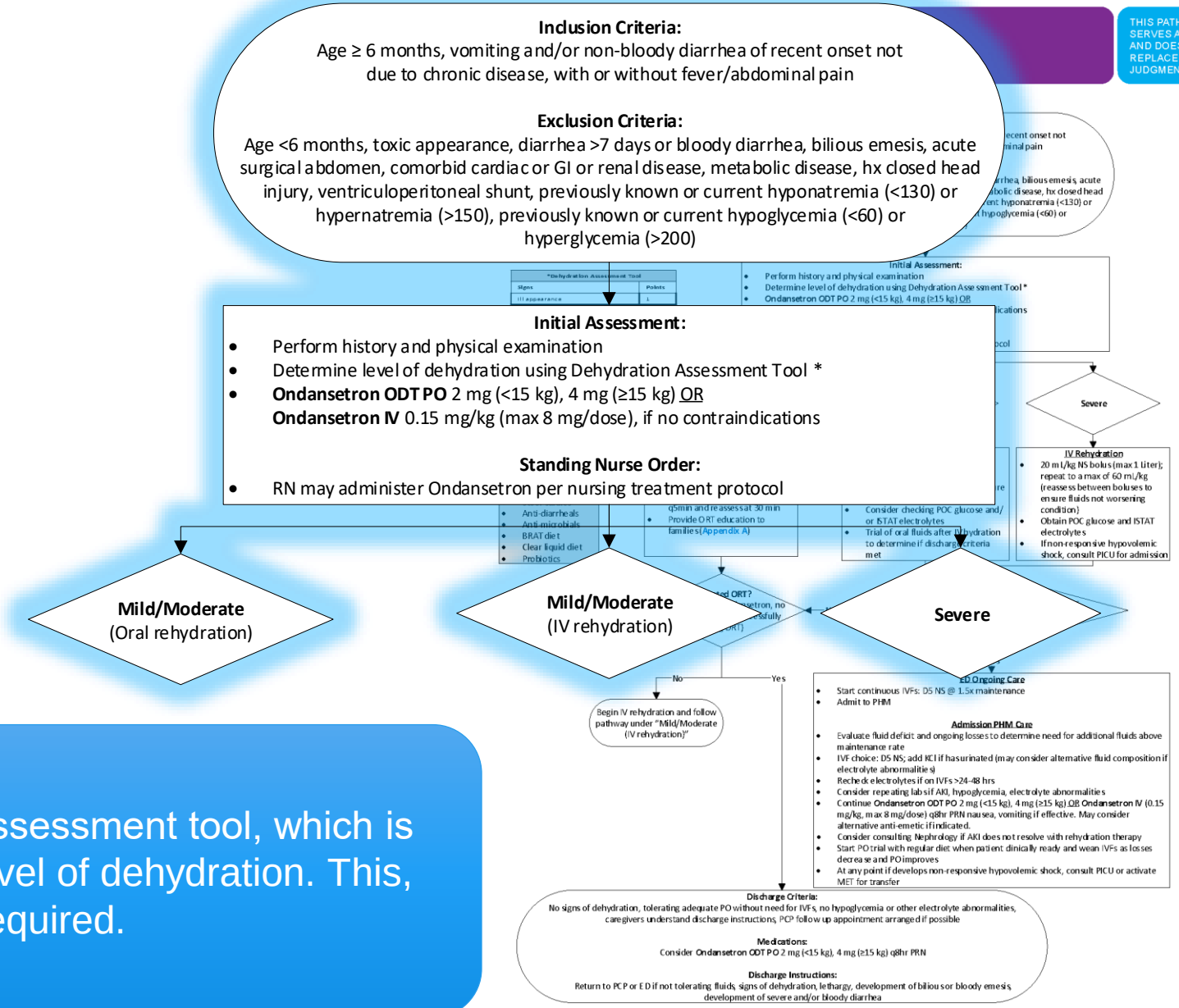
- See prior slide for complete list of possible PE findings for AGE as well as how to estimate percent dehydration

Signs there may be something other than typical viral AGE

- Respiratory status (tachypnea, Kussmaul respirations)
- Abdominal tenderness, rebound, or guarding
- Concerns for increased ICP (focal neurologic exam, papilledema)



*Dehydration Assessment Tool	
Signs	**Points**
Ill appearance	1
Dry mucous membranes	1
Absent tears	1
Capillary refill > 2 seconds	1
Total (add points)	
1 = mild dehydration (<5% fluid deficit) **2 = moderate dehydration (5-10% fluid deficit)** **3-4 = severe dehydration (>10% fluid deficit)**	
Other signs/symptoms of dehydration to consider: Tachycardia, decreased urine output	



CT Children's utilizes the Dehydration Assessment tool, which is designed to help determine a patients level of dehydration. This, in turn, guides the level of intervention required.

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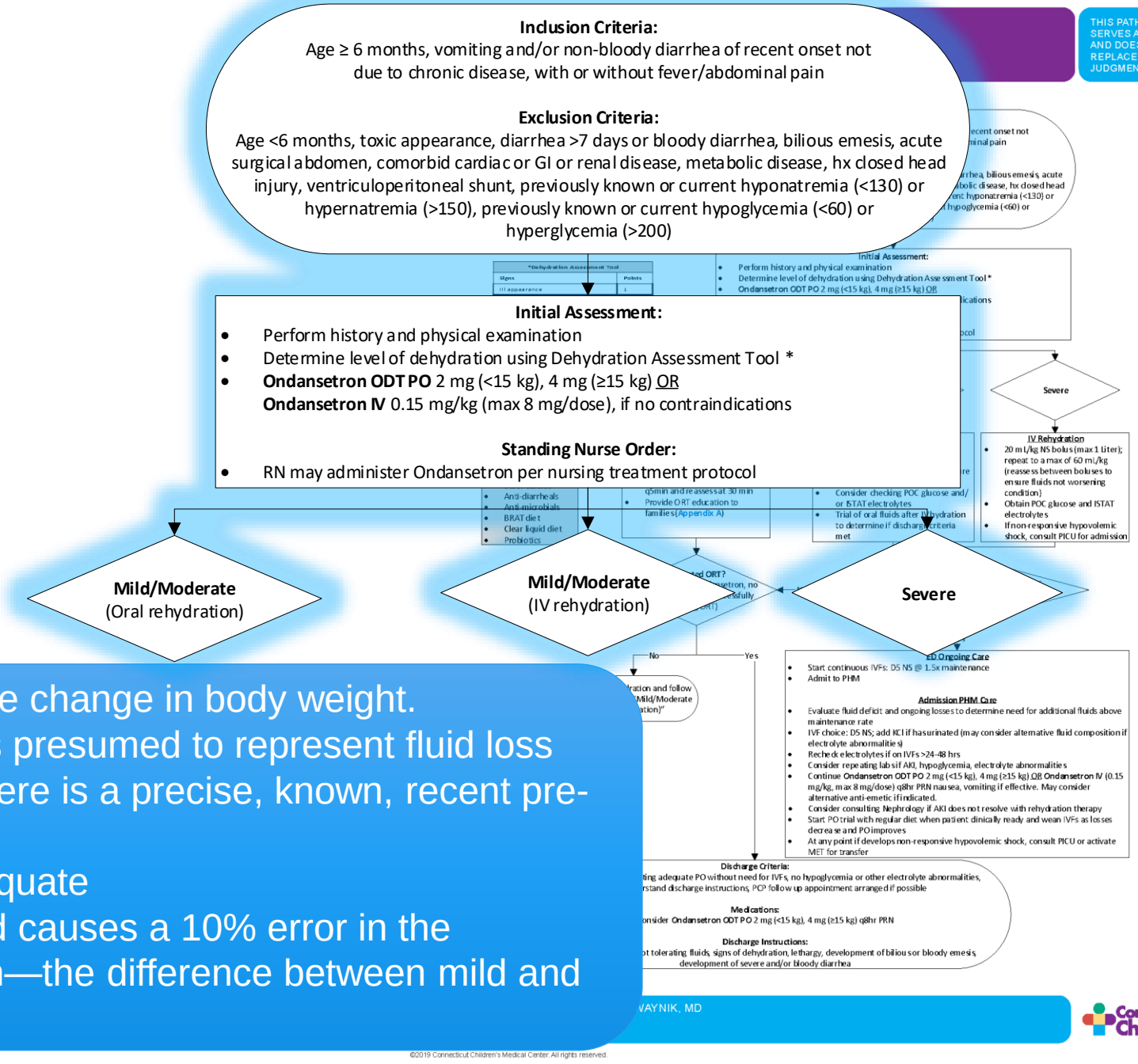


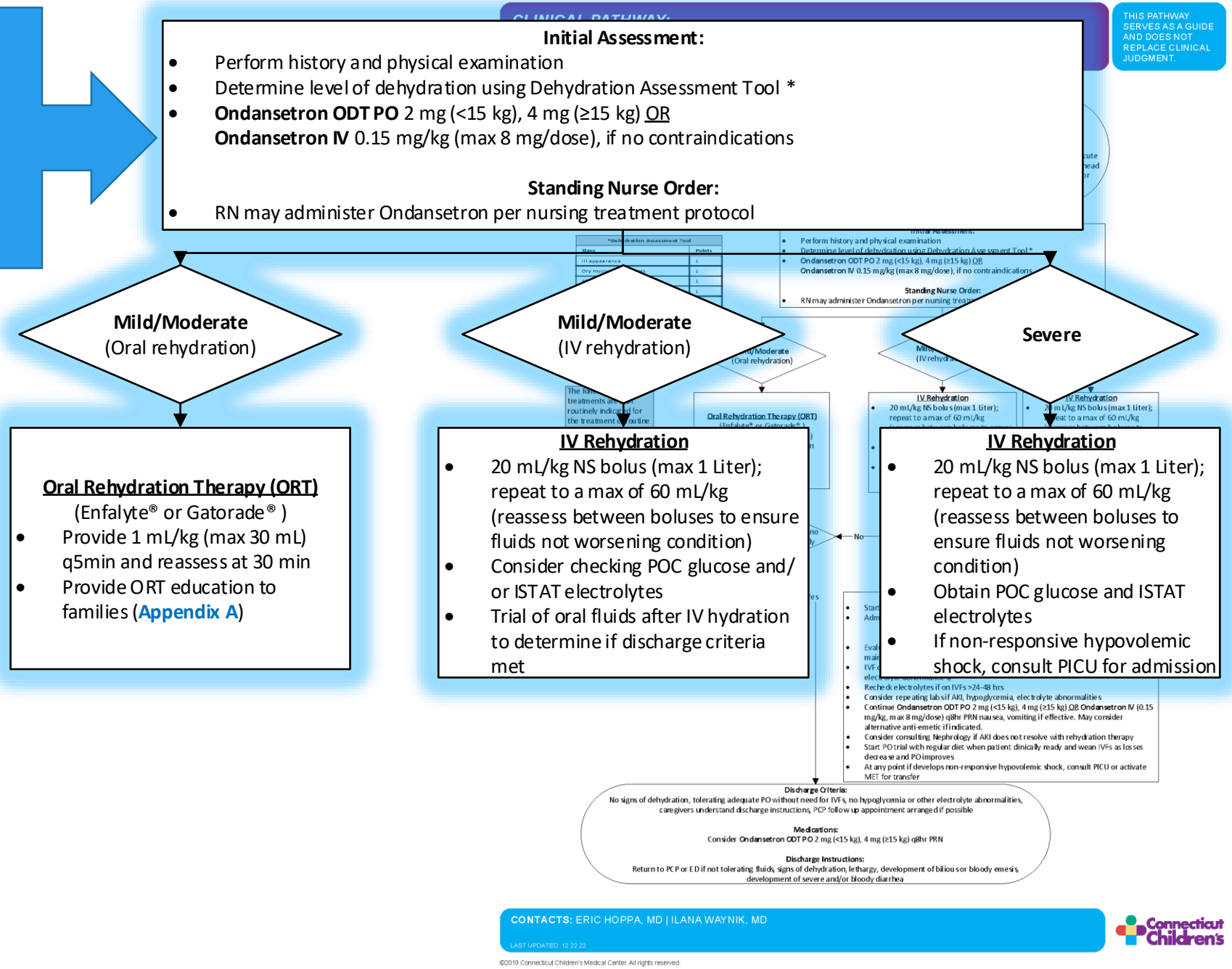
Another measure of dehydration is acute change in body weight.

- All short term weight loss >1%/day is presumed to represent fluid loss

However, only use this method when there is a precise, known, recent pre-illness weight

- Parental estimates are usually inadequate
- Consider a 1-kg error in a 10-kg child causes a 10% error in the calculated percentage of dehydration—the difference between mild and severe dehydration

Ondansetron administration prior to ORT can reduce the use of IV rehydration [11]



Enteral Rehydration (oral and nasogastric or gastrostomy tube)

Enteral Rehydration = Oral Rehydration Therapy (ORT)

Enteral vs Intravenous Rehydration Therapy for Children With Gastroenteritis

A Meta-analysis of Randomized Controlled Trials

Bob K. Fonseca, FRACP, MMed; Anna Holdgate, FACEM, MMed; Jonathan C. Craig, FRACP, PhD

Arch Pediatr Adolesc Med, 2004

"Combining data from all studies in this review, enteral therapy failed in 4.0% of children who were dehydrated with gastroenteritis. This is similar to data from the study by Gavin et al and from other multicenter trials and supports the recommendation from the American Academy of Pediatrics that "almost all children who have vomiting and dehydration can be treated with oral rehydration therapy."

ORT Principles

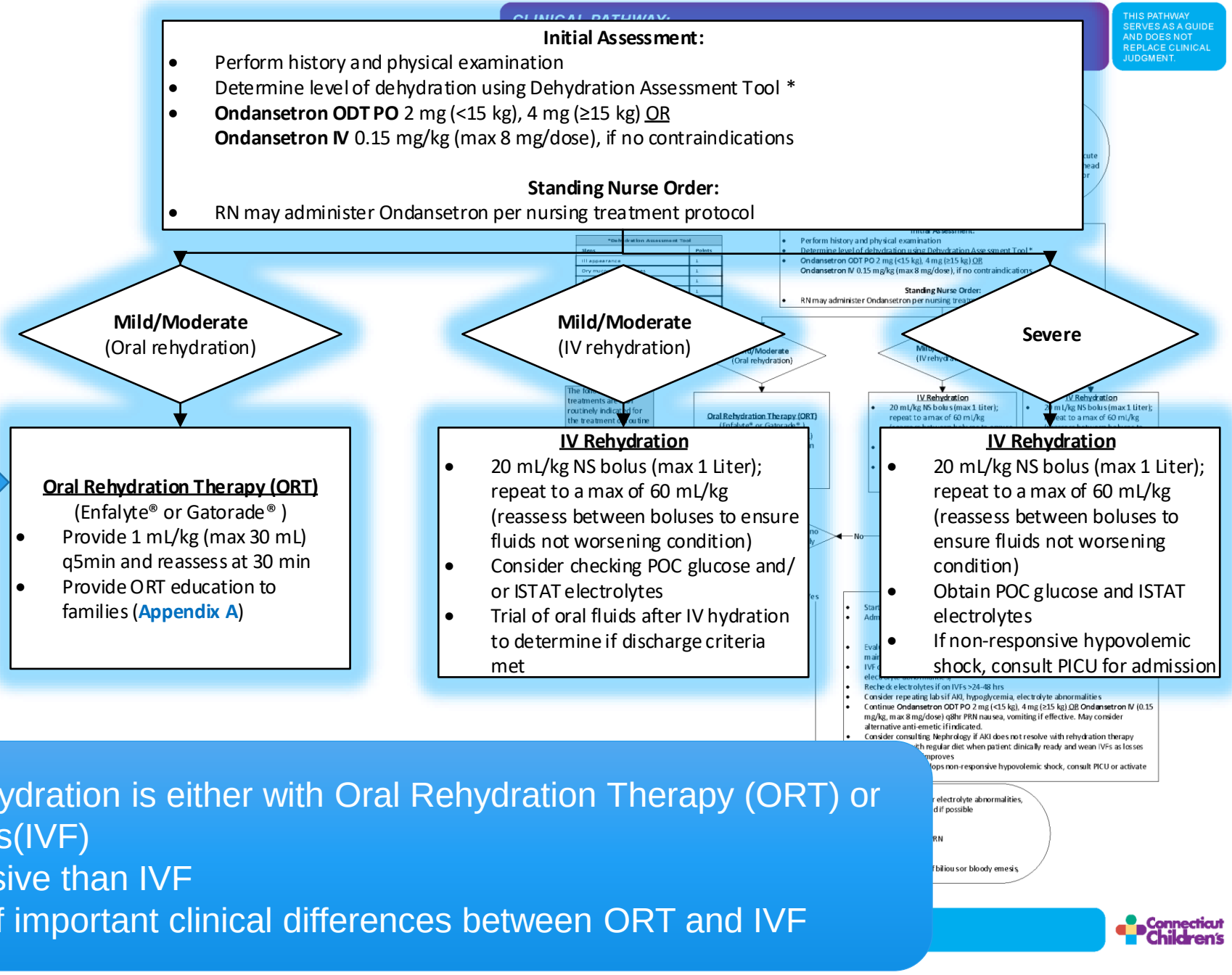
Gut rest is not indicated in AGE

- Only 4% of patients fail ORT and require IV fluids
  - Usually in children with a paralytic ileus or intractable vomiting
- Breast fed infants should continue to breast feed
- Diet should be advanced as soon as tolerated
  - As soon as the dehydration is corrected
  - Formula fed infants should continue their usual formula Lactose free or Soy formulas are not indicated
    - Formula dilution is not necessary
- Patient should resume a normal home diet
  - BRAT diet not recommended

ORT Principles

- ORT relies on Na-Glucose coupled transport in the gut
- Limitations to ORT:
  - Intractable vomiting
  - Stool output >10mL/kg –lower success rate
  - Carbohydrate malabsorption – the dramatic increase in stool output after intake of fluids containing simple sugars (glucose)
- ORT is contraindicated with obstruction, ileus, intussusception, bloody diarrhea
- May consider nasogastric tube or utilize gastrostomy tube (if patient already has the latter)

ORT is the preferred first choice for children with AGE and mild-to-moderate dehydration



Treatment of Dehydration is either with Oral Rehydration Therapy (ORT) or Intravenous Fluids(IVF)

- ORT less invasive than IVF
- No evidence of important clinical differences between ORT and IVF

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Initial Assessment:

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  Ondansetron IV 0.15 mg/kg (max 8 mg/dose), if no contraindications

Standing Nurse Order:

- RN may administer Ondansetron per nursing treatment protocol

Mild/Moderate
(Oral rehydration)

Mild/Moderate
(IV rehydration)

Severe

Initial rehydration is performed rapidly.

A small amount given every 5 minutes

Oral Rehydration Therapy (ORT)
(Enfalyte® or Gatorade®)

- Provide 1 mL/kg (max 30 mL) q5min and reassess at 30 min
- Provide ORT education to families (**Appendix A**)

IV Rehydration

- 20 mL/kg NS bolus (max 1 Liter); repeat to a max of 60 mL/kg (reassess between boluses to ensure fluids not worsening condition)
- Consider checking POC glucose and/or ISTAT electrolytes
- Trial of oral fluids after IV hydration to determine if discharge criteria met

IV Rehydration

- 20 mL/kg NS bolus (max 1 Liter); repeat to a max of 60 mL/kg (reassess between boluses to ensure fluids not worsening condition)
- Obtain POC glucose and ISTAT electrolytes
- If non-responsive hypovolemic shock, consult PICU for admission

Remember breastfed babies should continue to breast feed at all times, even during the initial rehydration phase.

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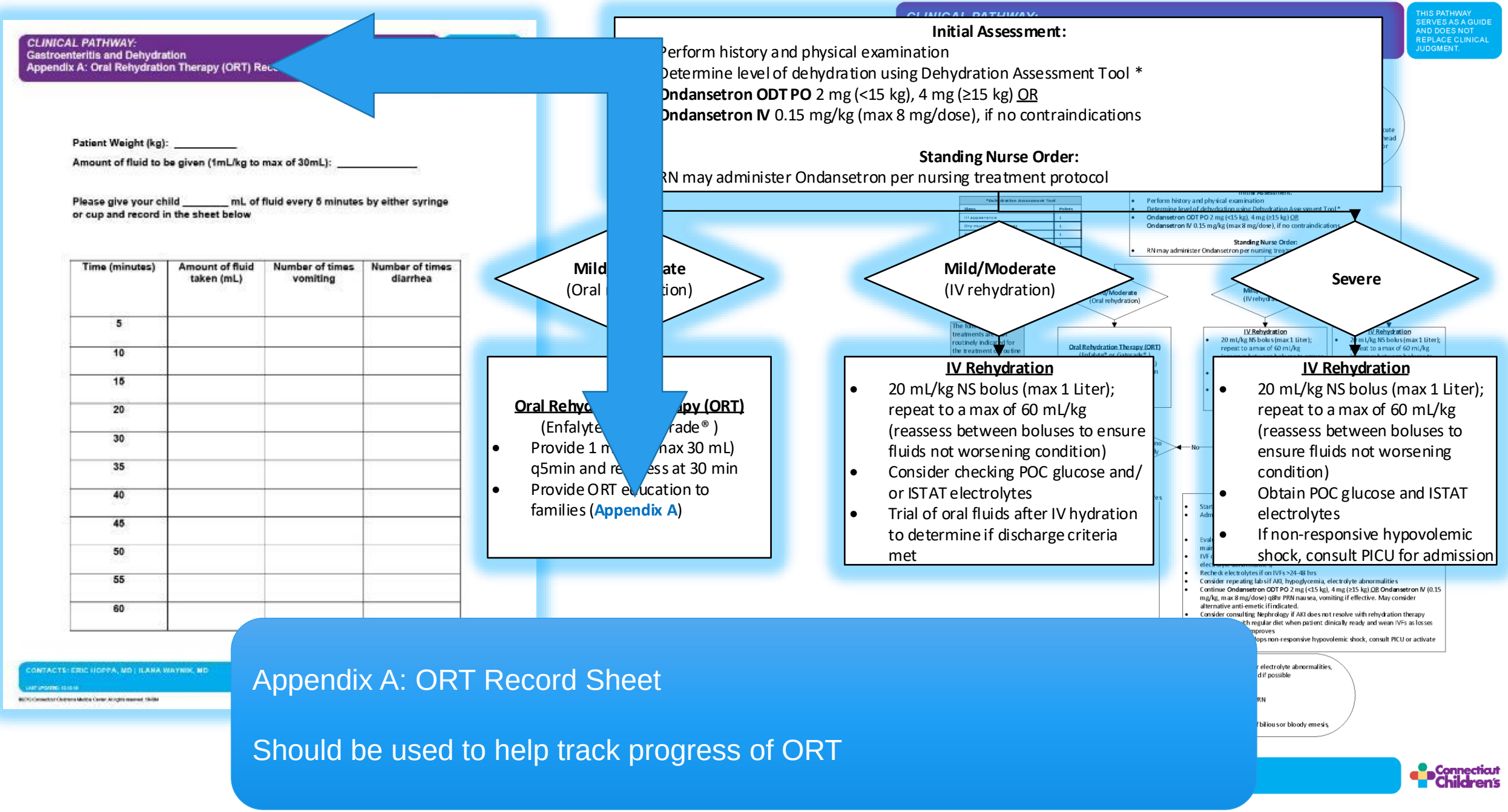
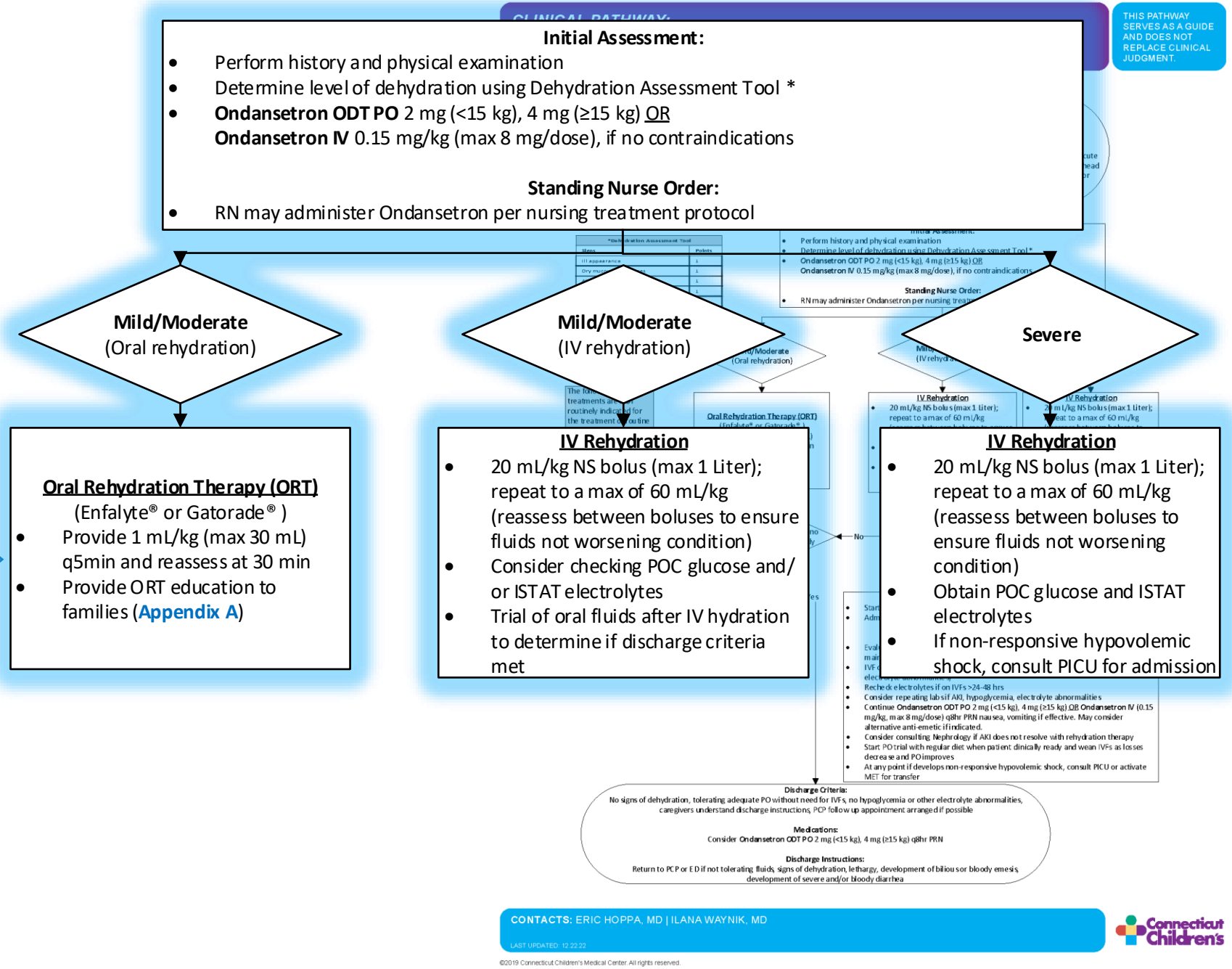


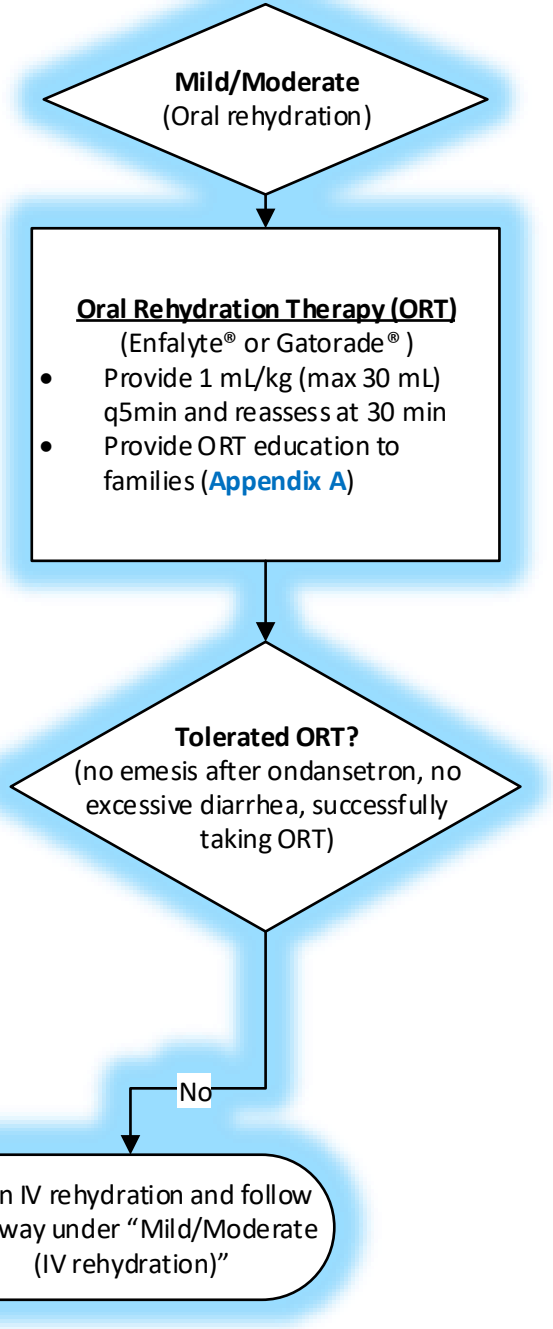
Appendix A: ORT Record Sheet

Should be used to help track progress of ORT

- Replace fluid deficit
  - 50-100mL of ORT/kg body weight during 2-4 hours
- 1mL/kg (max 30mL) every 5 minutes
- Reassess after 30 minutes



Patients with Mild/Moderate dehydration who either have a contraindication to ORT or who fail ORT should receive IV rehydration



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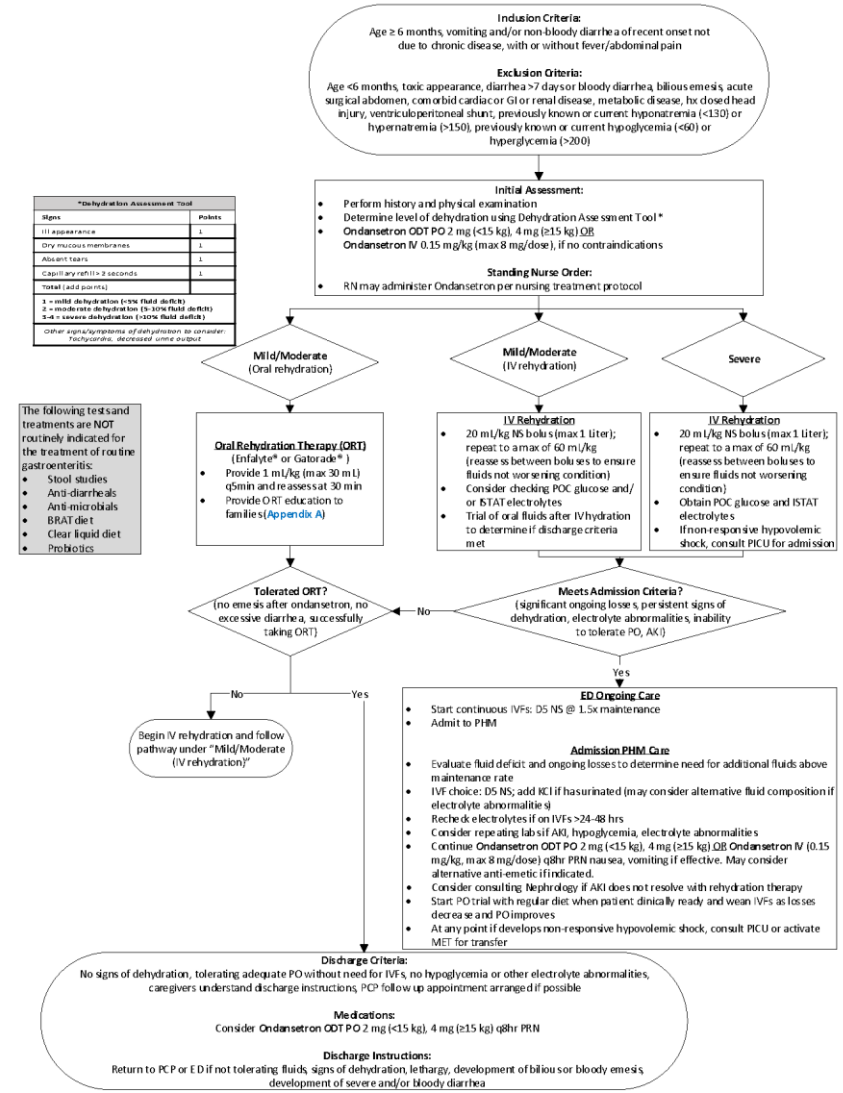

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Standing Nurse Order:

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Mild/Moderate (Oral rehydration)

Mild/Moderate (IV rehydration)

Severe

The following tests and treatments are **NOT** routinely indicated for the treatment of routine gastroenteritis:

- Stool studies
- Anti-diarrheals
- Anti-microbials
- BRAT diet
- Clear liquid diet
- Probiotics

Oral Rehydration Therapy (ORT)
(Enfalyte® or Gatorade®)

- Provide 1 mL/kg (max 30 mL) q5min and reassess at 30 min
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IV Rehydration

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- Obtain POC glucose and ISTAT electrolytes
- If non-responsive hypovolemic shock, consult PICU for admission

As a reminder, certain tests and treatments are NOT routinely indicated and should be avoided (see next slide)

Discharge Criteria:
No signs of dehydration, tolerating adequate PO without need for IVFs, no hypoglycemia or other electrolyte abnormalities, caregivers understand discharge instructions, PCP follow up appointment arranged if possible

Medications:
Consider **Ondansetron ODT PO** 2 mg (<15 kg), 4 mg (≥15 kg) q8hr PRN

Discharge Instructions:
Return to PCP or ED if not tolerating fluids, signs of dehydration, lethargy, development of biliousor bloody emesis, development of severe and/or bloody diarrhea

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Not Routinely Recommended Tests and Tx

- Stool studies are not indicated for routine AGE [2,3]
  - Consider in children who are immunocompromised, appear toxic, or have a history of foreign travel
- Antidiarrheal agents are not recommended for infants and children[2,3]
- Antimicrobials are not indicated for routine AGE and may make symptoms worse [2,3]
- Probiotics unlikely to improve symptoms and should not be routinely prescribed for AGE [14,15]
  - RCTs probiotics vs placebo in ED patients with AGE
  - No difference in clinical outcomes

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IV Rehydration

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- Obtain POC glucose and ISTAT electrolytes
- If non-responsive hypovolemic shock, consult PICU for admission

Lab work in general is not necessary, however, blood glucose and electrolytes should be drawn when there is concern for severe dehydration (see next slide)

Electrolyte Abnormalities in AGE

Clinical Pearls:

- ❖ Results of serum electrolytes are often normal or mildly abnormal in mild/moderate dehydration. These are expected to correct with dehydration, and repeating electrolytes, if drawn at admission, does not often add to care
- ❖ POC glucose can be useful to determine if hypoglycemia is contributing to a patient's presentation

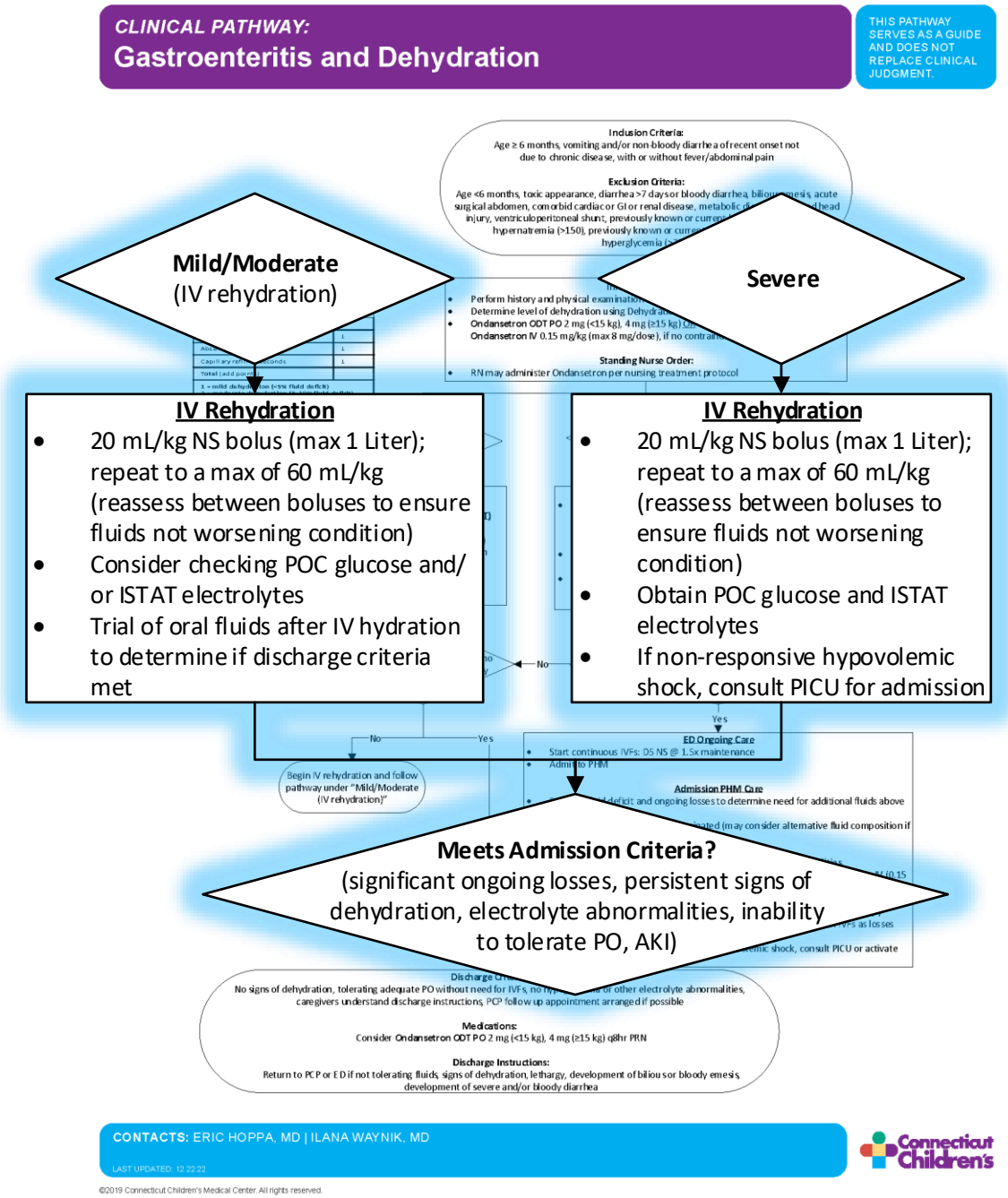
Other Notes about Electrolytes:

- Serum bicarbonate is one of the most sensitive tests to help determine the degree of dehydration
  - A value of less than 17 mEq/L on presentation indicates moderate to severe dehydration
- Blood Urea Nitrogen and Creatinine help evaluate for Acute Kidney Injury (AKI)
  - If signs of AKI do not resolve with rehydration, consult Nephrology
- Potassium values may be low or high
  - Typically low with diarrhea
  - Worsening hypovolemia can cause metabolic acidosis and an extracellular shift
- Sodium values may be high or low
  - Depends on the cause of dehydration

IV Rehydration

Goal is to restore intravascular volume.

- Normal saline is fluid of choice for rehyhdration
- Give 20mL/kg (max 1 L) over 30 minutes.
- May repeat to max of 60 mL/kg



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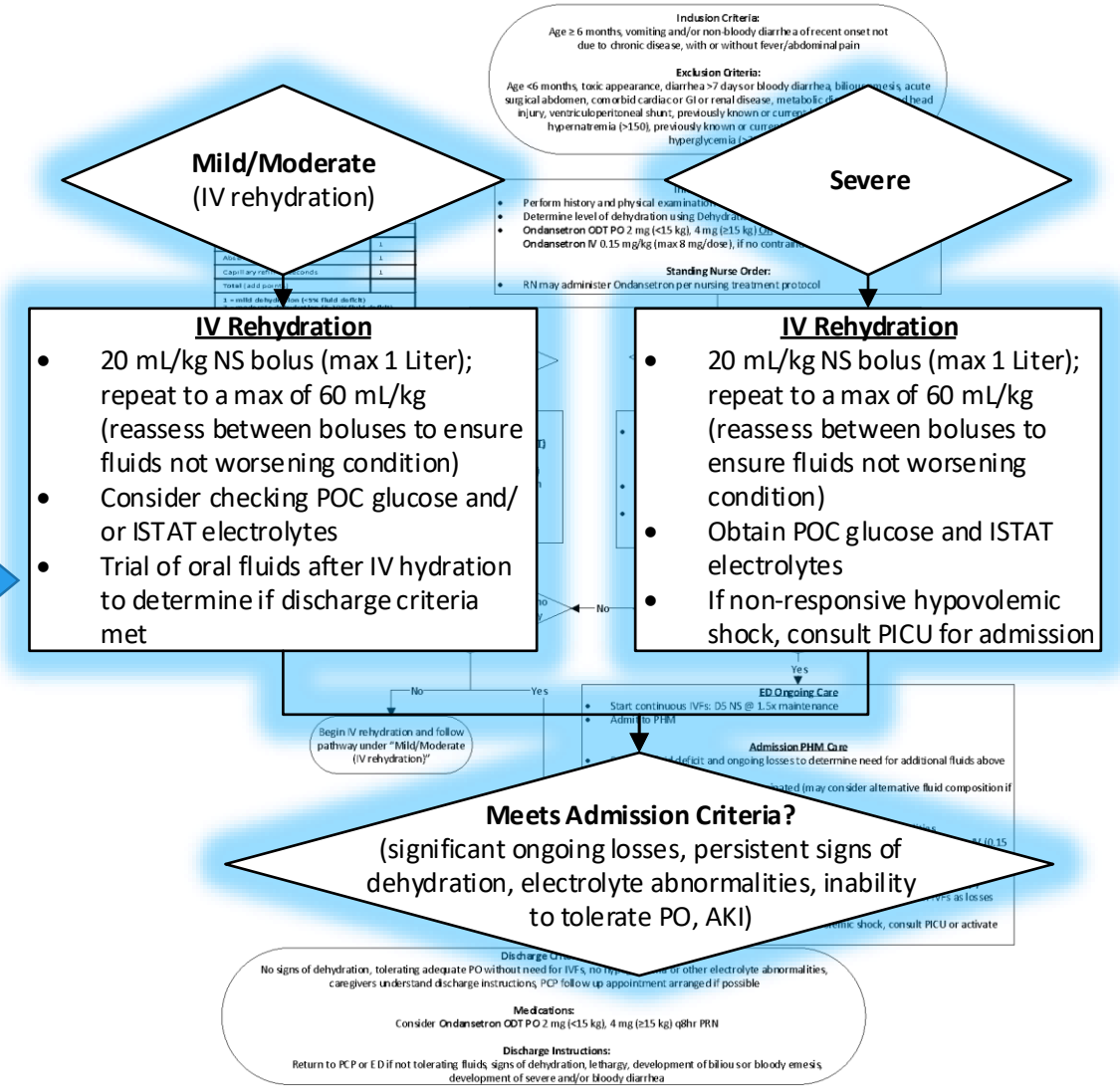
Transition to oral rehydration/maintenance as soon as you are able to.

A lack of response to fluid administration should raise concern of an alternative diagnosis, such as septic shock, cardiac disease, metabolic disorder, or neurologic disorder.



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Admission Criteria

- Significant dehydration
- Electrolyte abnormalities/persistent hypoglycemia
- Significant ongoing losses
- Inability to tolerate PO
- Caregivers unable to provide care at home

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Gastroenteritis and Dehydration

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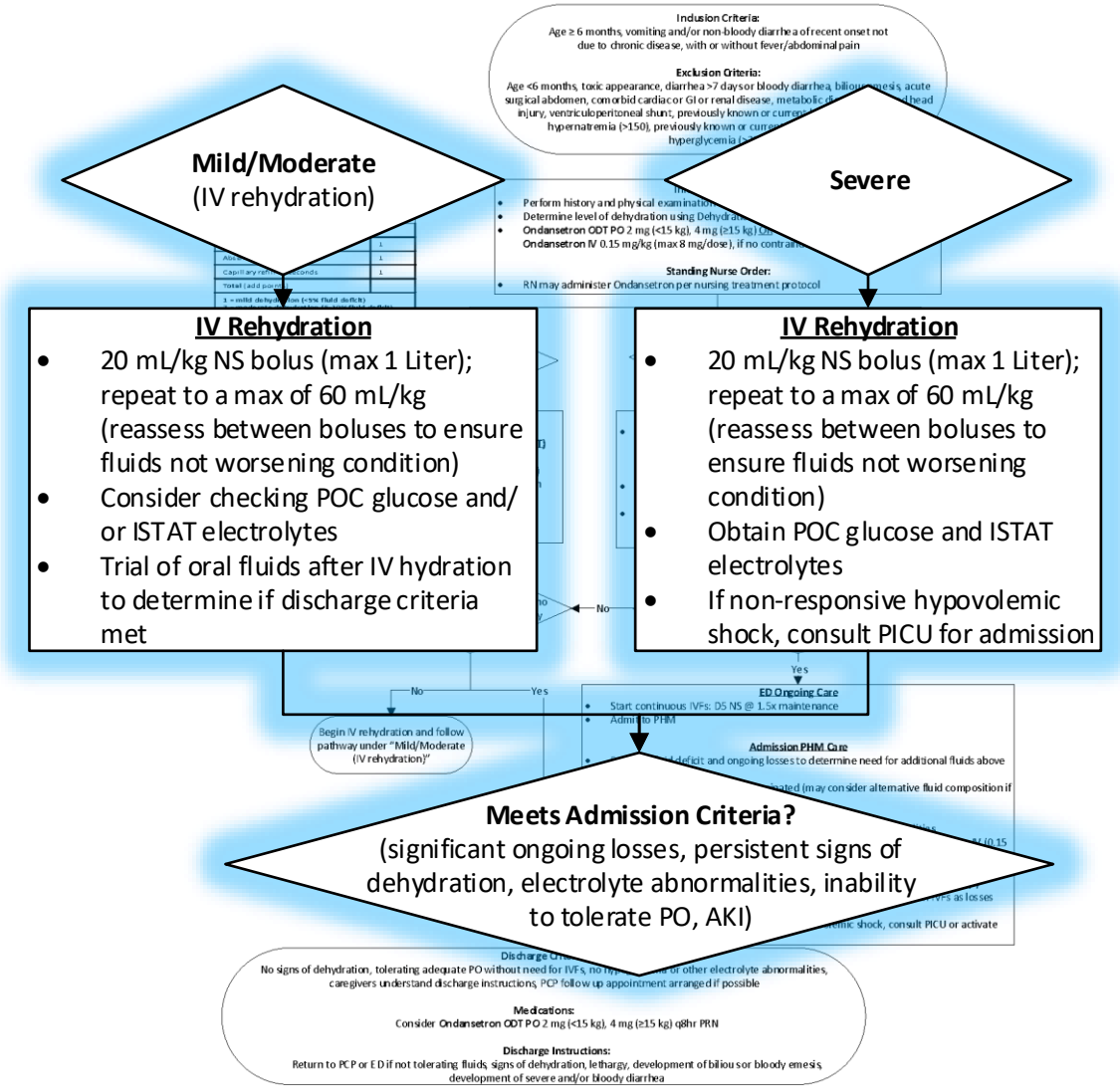

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After initial rehydration, patients are started on IVF at 1.5x maintenance

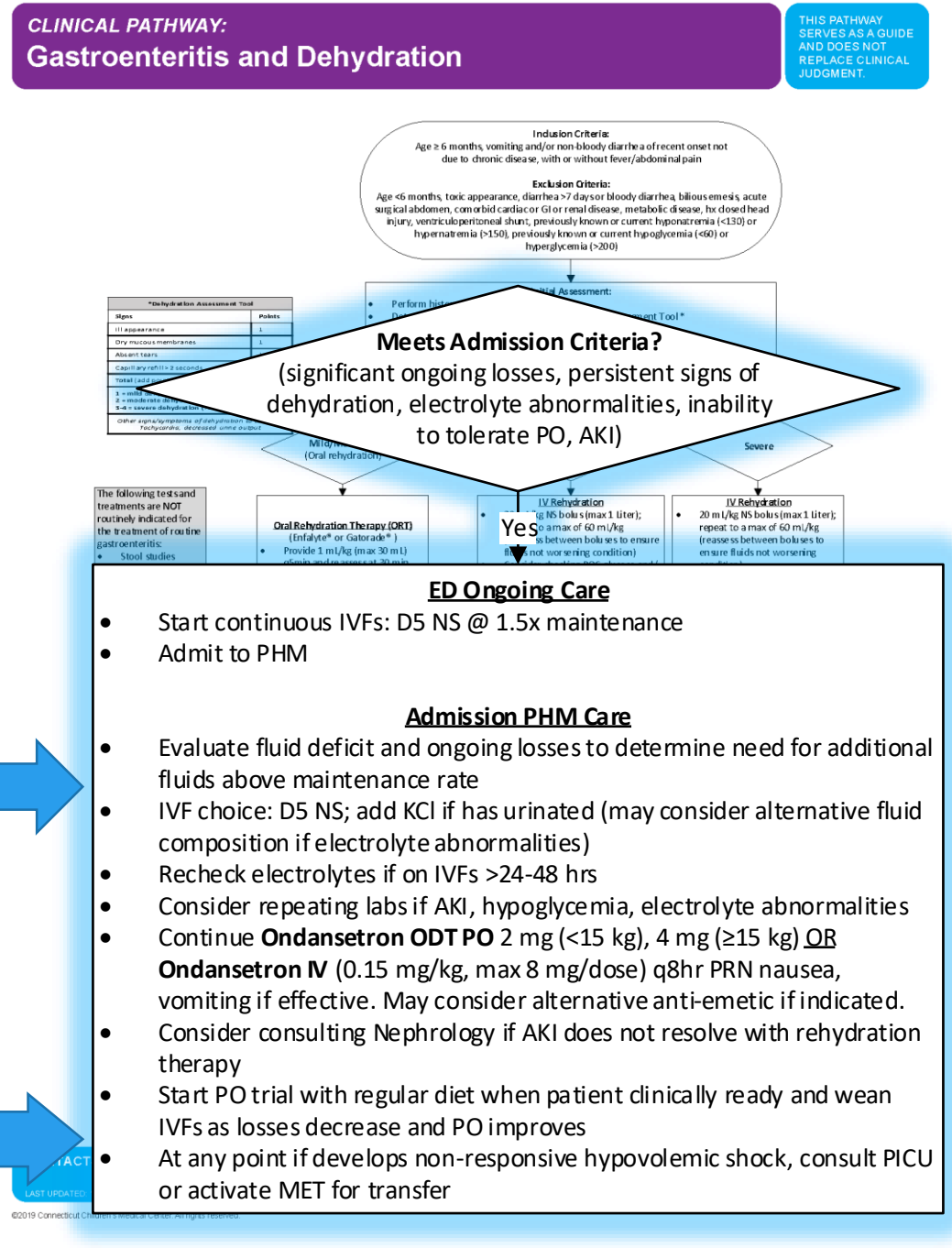
- D5NS will be started in the ED
- After admission may add KCl after the patient urinates.

Again continue to monitor fluid deficit and ongoing losses.

May repeat labs or not depending on the results of the original labs.

Consider Nephrology consult if AKI does not resolve as expected

PO trial should begin as soon as a patient is clinically improved.



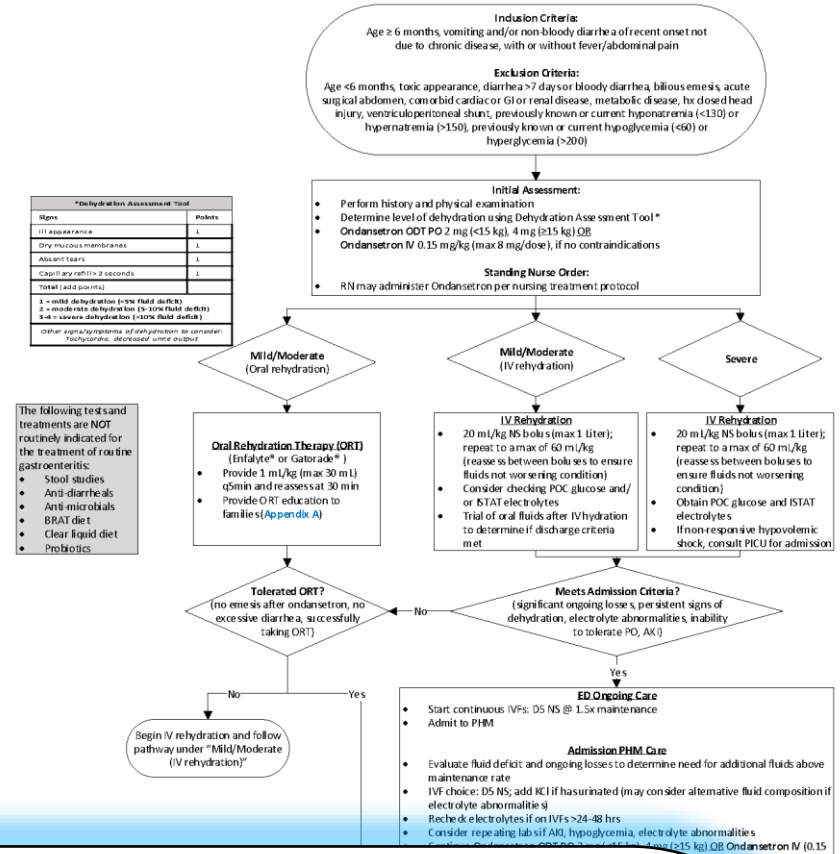
CLINICAL PATHWAY:
Gastroenteritis and Dehydration

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

Patients are ready for discharge once they are tolerating adequate PO without evidence of dehydration.

May consider giving ondansetron prescription.

Provide family with guidelines for signs and symptoms to watch out for



Discharge Criteria:
No signs of dehydration, tolerating adequate PO without need for IVFs, no hypoglycemia or other electrolyte abnormalities, caregivers understand discharge instructions, PCP follow up appointment arranged if possible

Medications:
Consider **Ondansetron ODT PO** 2 mg (<15 kg), 4 mg (≥15 kg) q8hr PRN

Discharge Instructions:
Return to PCP or ED if not tolerating fluids, signs of dehydration, lethargy, development of bilious or bloody emesis, development of severe and/or bloody diarrhea

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Review of Key Points

- ORT indicated for most cases of mild-to-moderate dehydration
- IV fluid rehydration is indicated if ORT fails, or with severe dehydration
  - Normal saline is used for rehydration
  - D5 NS (+/- KCl) is used for maintenance
- Ondansetron should be given with vomiting
- Electrolytes are only checked if concern for severe dehydration; may consider POC glucose
- Patients should resume their home diet as soon as possible
  - There is no indication for bowel rest with routine AGE
  - Breastfed infants should continue to breastfeed throughout treatment
- Tests and treatments **NOT** routinely indicated for the treatment AGE include stool studies, anti-diarrheals, anti-microbials, BRAT diet, clear liquid diet, probiotics

Quality Metrics

- Percentage of eligible patients with pathway order set utilization
- Percentage of patients discharged home from the ED (treated and released)
- Percentage of patients receiving ondansetron (Zofran)
- Average time from ED arrival to initial Zofran administration (minutes)
- Percentage of patients receiving IV fluid rehydration
- Percentage of patients receiving IV rehydration with documented dehydration classification: mild/mod/severe (using Dehydration Assessment tool)
- Length of Stay in ED (hours) and inpatient/observation (days)
- Percentage of patients with repeat electrolyte testing
- Returns to ED within 48 hours
- Percentage of admitted patients who get chem 7 or chem 10 on floors (not ED)
- Percentage of admitted patients who have hypernatremia (Na > 145)
- Percentage of readmission within 48 hours (admitted patients)

Pathway Contacts

- Eric Hoppa, MD
  - Pediatric Emergency Medicine
- Ilana Waynik, MD
  - Pediatric Hospital 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.