



Evidence-Based Clinical Care Guideline

Acute Gastroenteritis (AGE)**In children aged 2 months through 5 years^a**

Original Publication Date: November 1999

Revision Publication Dates: April 2001

October 31, 2005

New search May, 2006 (see Development Process section)

Target Population

Inclusions: These guidelines are intended primarily for use in children aged 2 months through 5 years of age with signs and symptoms of acute gastroenteritis (diarrhea of recent onset not caused by chronic disease) with or without accompanying nausea, vomiting, fever, or abdominal pain.

Exclusions: These guidelines do **NOT** address all considerations needed to manage those with the following:

- toxic appearance or requiring intensive care
- episodes of diarrhea lasting longer than 7 days
- previously diagnosed disorders including immunodeficiency or those affecting major organ systems
- vomiting with no accompanying diarrhea
- AGE accompanying failure to thrive
- diarrhea and/or vomiting accompanied by chronic metabolic disorders (e.g. diabetes, PKU)
- diagnosis of hyponatremic or hypernatremic dehydration

Target Users

Include but are not limited to (in alphabetical order):

- Clinicians caring for inpatients

^a Please cite as: **Acute Gastroenteritis Guideline Team, Cincinnati Children's Hospital Medical Center:** Evidence-based clinical care guideline for medical management of acute gastroenteritis in children aged 2 months through 5 years, <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/gastro.htm>, Guideline 5, pages 1-15, October 31, 2005.

- Community-based caregivers (e.g. daycare, school personnel)
- Emergency Medicine physicians
- Patient Care staff, including:
 - dietitians
 - nurses
- Patients and families
- Primary care providers
- Residents

Introduction

References in parentheses () Evidence strengths in [] (See last page for definitions)

New evidence presented in this revision of the guideline:

- a) role of diarrheagenic *Escherichia coli*
- b) refined clinical measures for assessing dehydration
- c) note about evidence on use of ondansetron
- d) additional citations for the use of probiotics

Acute gastroenteritis (AGE) is a diarrheal disease of rapid onset, with or without accompanying symptoms and signs, such as nausea, vomiting, fever, or abdominal pain (King 2003 [S,E], Guerrant 2001 [S,E]). In the United States, approximately 1.5 million outpatient visits, 200,000 hospitalizations and 300 deaths are recorded each year for children with gastroenteritis. Approximately one-third of all hospitalizations for diarrhea in children younger than 5 years are due to rotavirus, with an associated direct cost of \$250 million annually (King 2003 [S,E]).

Because most patients included in this guideline will have self-limited viral or bacterial diarrhea, dehydration caused by the disease is the focus of treatment in this guideline. Based on the most current and best scientific information, the following recommendations are intended to help practitioners at all levels of experience refine their knowledge and select among the options for evaluation and management. A 20% drop in emergency department (ED) visits for AGE was documented for the three year period following community-wide application of the original version of this guideline (Perlstein 2002 [D]).

Challenges in the management of AGE include:

- diagnosing degree of dehydration
- prevention of AGE
- determining the practical role of probiotics in treating and preventing AGE.

In the target population, the objectives of this guideline are to:

- improve the use of appropriate clinical and laboratory assessment
- increase the use of oral rehydration and early progression to usual diet
- improve parental involvement in decision making around the management of AGE
- improve prevention of transmission of AGE
- decrease use of ED services for management of mild cases
- reduce the number of hospitalizations
- reduce the length of stay.

Etiology

Infectious agents are the most common causes of AGE. Viruses, primarily rotavirus species, are responsible for 70 to 80% of infectious diarrhea cases in the developed world. Various bacterial pathogens account for another 10 to 20% of cases; as many as 10% may be attributable to diarrheagenic *Escherichia coli* (Cohen 2005 [C]).

Parasitic organisms such as *Giardia* species cause fewer than 10% of cases. See Table 1 for etiologic agents. Incidence is affected by climate and season. Other factors that increase the risk of AGE in children include attendance at day care centers and impoverished living conditions with poor sanitation (Burkhart 1999 [S]).

Table 1: Etiologic Agents for Pediatric Infectious Gastroenteritis in the United States

Pathogens	Inflammatory Agents	Non-inflammatory Agents
Viruses 70-80%		<i>Rotavirus</i> <i>enteric adenovirus</i> <i>Norwalk Virus</i> <i>Calicivirus</i> <i>Astrovirus</i> <i>Parvovirus</i>
Bacteria 10-20%	<i>Salmonella</i> <i>Shigella</i> <i>Campylobacter jejuni</i> <i>Yersinia enterocolitica</i> <i>enterohemorrhagic E. coli</i> (includes O157:H7) <i>other diarrheagenic E. coli</i> (Cohen 2005 [C]) <i>*Clostridium difficile</i>	
Parasites 0-10%		<i>Giardia lamblia</i> <i>Cryptosporidium</i>

(Cohen 2005 [C], Northrup 1994 [S], Avery 1993 [S])
*In Cincinnati, other diarrheagenic *E. coli* are the largest percentage of bacterial pathogens.

Guideline Recommendations

Assessment and Diagnosis

Clinical Assessment

1. It is recommended that the history and physical examination be the primary basis for the diagnosis of AGE. See Figure and Appendix 1 (*Local Expert Consensus 2005 [E]*).

Figure: History-Taking Tool for AGE

1.	# Episodes	Today	Yesterday	Day before Yest.
	vomiting			
	diarrhea			
2.	Urinated _____ times today.			
3.	Last urinated _____ hours ago.			

2. It is recommended that clinical assessment be initially performed for the presence and degree of dehydration (Steiner 2004 [M]). See Appendix 2 for physical parameters associated with degree of dehydration. See Table 2 and Table 3 for likelihood ratios of clinical signs.

Note 1: Prolonged capillary refill time, abnormal skin turgor, and absent tears are the best individual examination measures (Steiner 2004 [M]) (see Table 2, Table 3, and Appendix 2).

Note 2: Clinical diagnosis of dehydration has been shown to be imprecise and thus a general classification of a child’s dehydration status such as none, some (mild/moderate), or severe is suggested by the literature as a useful starting point in the management of the child at risk for dehydration (Steiner 2004 [M], King 2003 [S,E]).

Note 3: Acute body weight change is considered the gold standard measure of dehydration in a child but is often impractical for the initial assessment due to lack of an accurate pre-illness weight measurement (Gorelick 1997 [C], Duggan 1996 [C]).

Table 2: Likelihood Ratios (LR) for Clinical Signs^b

Presence of clinical sign	LR+ to rule-in $\geq 5\%$ dehydration (95% CI) ^c
Prolonged capillary refill	4.1 (1.7 to 9.8)
Abnormal skin turgor	2.5 (1.5 to 4.2)
Absent tears	2.3 (0.9 to 5.8)
Abnormal respiratory pattern	2.0 (1.5 to 2.7)
Poor overall appearance	1.9 (0.97 to 3.8)
Absence of clinical sign	LR- to rule-out $\geq 5\%$ dehydration (95% CI) ^c
Abnormally low urine output	0.27 (0.14 to 0.51)
Dry mucous membranes	0.41 (0.21 to 0.79)
Poor overall appearance	0.46 (0.34 to 0.61)
Sunken eyes	0.49 (0.38 to 0.63)
Absent tears	0.54 (0.26 to 1.13)
Prolonged capillary refill	0.57 (0.39 to 0.82)

(Steiner 2004 [M])

Table 3: Likelihood Ratios (LR) for Clusters of Clinical Signs^b

Presence of clinical sign	LR+ to rule-in $\geq 5\%$ dehydration (95% CI) ^c
At least 2 of the 4 following signs: <ul style="list-style-type: none"> capillary refill time dry mucous membranes absence of tears abnormal overall appearance 	6.1 (3.8 to 9.8) (Gorelick 1997 [C])
“Severe” rating from Appendix 2	3.4 (1.5 to 7.7)
“Mild to Mod” rating from Appendix 2	2.1 (0.9 to 4.8)

Laboratory Studies

3. It is recommended that laboratory tests **not** be routinely performed in children with signs and symptoms of AGE, including tests for specific pathogens, such as those for rotavirus, ova and parasites, bacteria, and fecal antigen tests for parasites (Northrup 1994 [S], Local Expert Consensus 2005 [E]).

Note: Serum electrolytes are sometimes useful in assessing children with moderate to severe dehydration and who require intravenous (IV) or nasogastric (NG) fluids. A normal bicarbonate concentration may be useful in ruling out dehydration (Steiner 2004 [M]).

^b Likelihood ratios quantify the change in probability of AGE when a given sign is present in a specific clinical case and depends upon a starting estimate of probability. For more information, see Appendix 3 for definition and use of LR.

^c 95% CI: 95% Confidence Interval expresses the uncertainty (precision) of a measured value; it is the range of values within which we can be 95% sure that the true value lies. A study with a larger sample size will generate more precise measurements, resulting in a narrower confidence interval.

Management Recommendations

Prevention of Dehydration

4. It is recommended that continued use of the child's preferred, usual, and age appropriate diet be encouraged to prevent or limit dehydration (Brown 1994 [M], Fayad 1993 [A], Alarcon 1992 [A]). Regular diets are generally more effective than restricted and progressive diets, and in numerous trials have consistently produced a reduction in the duration of diarrhea (Alarcon 1991 [A], Margolis 1990 [B], Placzek 1984 [B], Khin 1985 [C]).

Note 1: The historical BRAT diet (consisting of bananas, rice, applesauce, and toast) is unnecessarily restrictive, but may be offered as part of the child's usual diet (King 2003 [S,E]).

Note 2: Clear liquids are not recommended as a substitute for oral rehydration solutions (ORS) or regular diets in the prevention or therapy of dehydration (King 2003 [S,E]) (See Appendix 4).

Note 3: The vast majority of patients with AGE do not develop clinically important lactose intolerance. In selected patients with documented, persistent lactose intolerance, lactose-free formulas are recommended (Brown 1994 [M]).

Note 4: A meta-analysis of 16 studies found no significant clinical advantage to diluting milk or formula in the management of AGE (Brown 1994 [M]).

5. It is recommended that the vomiting child be offered frequent small feedings (every 10 to 60 minutes) of any tolerated foods or oral rehydration solutions (ORS) (Wan 1999 [A], Santosham 1985 [A]).
6. It is recommended that a child with recurrent vomiting but no signs of significant dehydration may be managed by frequent telephone follow up or by direct supervision in the office, emergency department, or in a hospital setting (see Appendix 1 for triage suggestions) (Local Expert Consensus 2005 [E]).

Rehydration

7. It is recommended that dehydration be treated with ORS, if tolerated and if intake exceeds losses, for a period of 4 to 6 hours or until an adequate degree of rehydration is achieved (Gavin 1996 [M], Gore 1992 [M], Cohen 1995 [A], Molina 1995 [A], Fayad 1993 [A], Santosham 1985 [A], Santosham 1982 [A], Atherly-John 2002 [B], Nager 2002 [B], Listernick 1986 [B], Tamer 1985 [C], King 2003 [S,E], Holliday 1996 [S,E]).

8. It is recommended,
- when unable to replace the estimated fluid deficit and keep up with the on-going losses using oral feedings alone, and/or
 - for severely dehydrated children with obtunded mental status,
- that IV fluids or NG ORS be given for a period of 4 to 6 hours or until an adequate degree of rehydration is achieved. It is appropriate to involve the family in the decision regarding the method of fluid replacement (*Cohen 1995 [A], Mackenzie 1991 [A], Santosham 1982 [A], Nager 2002 [B], Vesikari 1987 [B], Listerick 1986 [B], Tamer 1985 [C], King 2003 [S,E]*).
12. It is recommended that antimicrobial therapies be used only for selected children with AGE who present with special risks or evidence of a serious bacterial infection (SBI) (*Barbara 2000 [C]*) (see Appendix 5).

Note: *Giardia lamblia* and *Cryptosporidium* are common causes of persistent diarrhea and, if found, treatment is available with metronidazole or nitazoxanide (*AAP 2003 [O]*).

Oral Feeding Following Rehydration

9. It is recommended that refeeding of the usual diet be started at the earliest opportunity after an adequate degree of rehydration is achieved (*Cohen 1995 [A], Fayad 1993 [A], Santosham 1982 [A], Fox 1990 [B], Hjelt 1989 [B], Gazala 1988 [B], Walker-Smith 1997 [S,E]*).

Note 1: Following rehydration therapy in the child with mild to moderate dehydration, regular diets may be supplemented with oral rehydration solutions containing at least 45mEq Na⁺/L, and targeted to deliver 10ml/kg for each stool or emesis (*Cohen 1995 [A]*) (see Appendix 4).

Note 2: It is advisable to reassess hydration status by phone or in the office when a child refuses ORS. Refusal may indicate an absence of salt craving, and, as such, the absence or resolution of dehydration (*Local Expert Consensus 2005 [E]*).

On-going IV or NG Fluids following Rehydration

10. It is recommended that maintenance IV fluids or NG ORS be given:
- when unable to replace the estimated fluid deficit and keep up with the on-going losses using oral feedings alone, and/or
 - to severely dehydrated children with obtunded mental status,
- and after discussion with family regarding choice of IV or NG (*Cohen 1995 [A], Mackenzie 1991 [A], Santosham 1982 [A], Nager 2002 [B], Vesikari 1987 [B], Listerick 1986 [B], Tamer 1985 [C]*).

Other Therapy

11. It is recommended that anti-diarrheal agents or antiemetics **not** be used in the routine management of children with AGE (*King 2003 [S,E]*).

Note: Ondansetron may decrease vomiting and hospitalization rates in those patients who require IV or NG fluids (*Reeves 2002 [A], Ramsook 2002 [B]*).

13. It is recommended that probiotics be considered as adjunctive therapy, as they have been shown to reduce the duration of diarrhea (*Allen 2004 [M]*). Family preference may be central to the decision to use probiotics. Parameters influencing the family's decision may include cost, degree of potential benefit, availability and unverified effectiveness of commercial products.

Note 1: A Cochrane meta-analysis of 23 randomized controlled trials found mild therapeutic benefit from probiotics that was generally reproducible regardless of organism, quality of study design, or outcome measure (*Allen 2004 [M]*). The following organisms/combinations showed benefit in one or more study (in alphabetical order):

- *Enterococcus LAB strain SF68*
- *Lactobacillus acidophilus* and *Lactobacillus bifidus*
- *Lactobacillus acidophilus LB strain* (killed)
- *Lactobacillus casei strain GG*
- *Lactobacillus reuteri*

Note 2: Probiotics may be more effective for rotavirus diarrhea, compared to all-cause diarrhea (*Allen 2004 [M]*).

Note 3: The microorganisms used to culture yogurt, *Streptococcus thermophilus* and *Lactobacillus bulgaricus*, are not considered probiotics because they do not survive the acidity of the stomach to colonize the intestines. One study of malnourished infants found that yogurt, compared to milk was not effective in reducing the duration of diarrhea (*Allen 2004 [M], Bhatnagar 1998 [B]*).

Inpatient Management Considerations

14. It is recommended that those patients who are treated in the hospital setting and who are eligible for the AGE guideline be placed as Short Stay patients with a discharge goal of 23 hours or less (*Browne 1996 [C], McConnochie 1999 [D]*).

15. It is recommended that for children receiving care in a hospital setting, prompt discharge be considered when the following levels of recovery are reached:
- sufficient rehydration achieved as indicated by weight gain and/or clinical status;
 - IV or NG fluids not required;
 - oral intake equals or exceeds losses;
 - adequate family teaching has occurred; and
 - medical follow up is available via telephone or office visit

(Local Expert Consensus 2005 [E]).

4. In US children, will a rotavirus immunization program be cost-effective?

Education

16. It is recommended that return to school/daycare be discussed in the context of the following parameters:

- consideration for controlling disease transmission
 - no vomiting for 24 hours
 - stools are able to be adequately contained
 - assurance that daycare/school adheres to appropriate handwashing policies
- temperature less than 38.0° C (100.4° F)

(Local Expert Consensus 2005 [E]).

17. It is recommended that risk factors and preventive activities be discussed with parents, including:

- continue breastfeeding (*Wan 1999 [A], Khin 1985 [C]*) and
- handwashing.

Health Topics on CCHMC's website ^d:

- [Gastroenteritis](#)
- [Acute Diarrhea](#)
- [Vomiting](#)

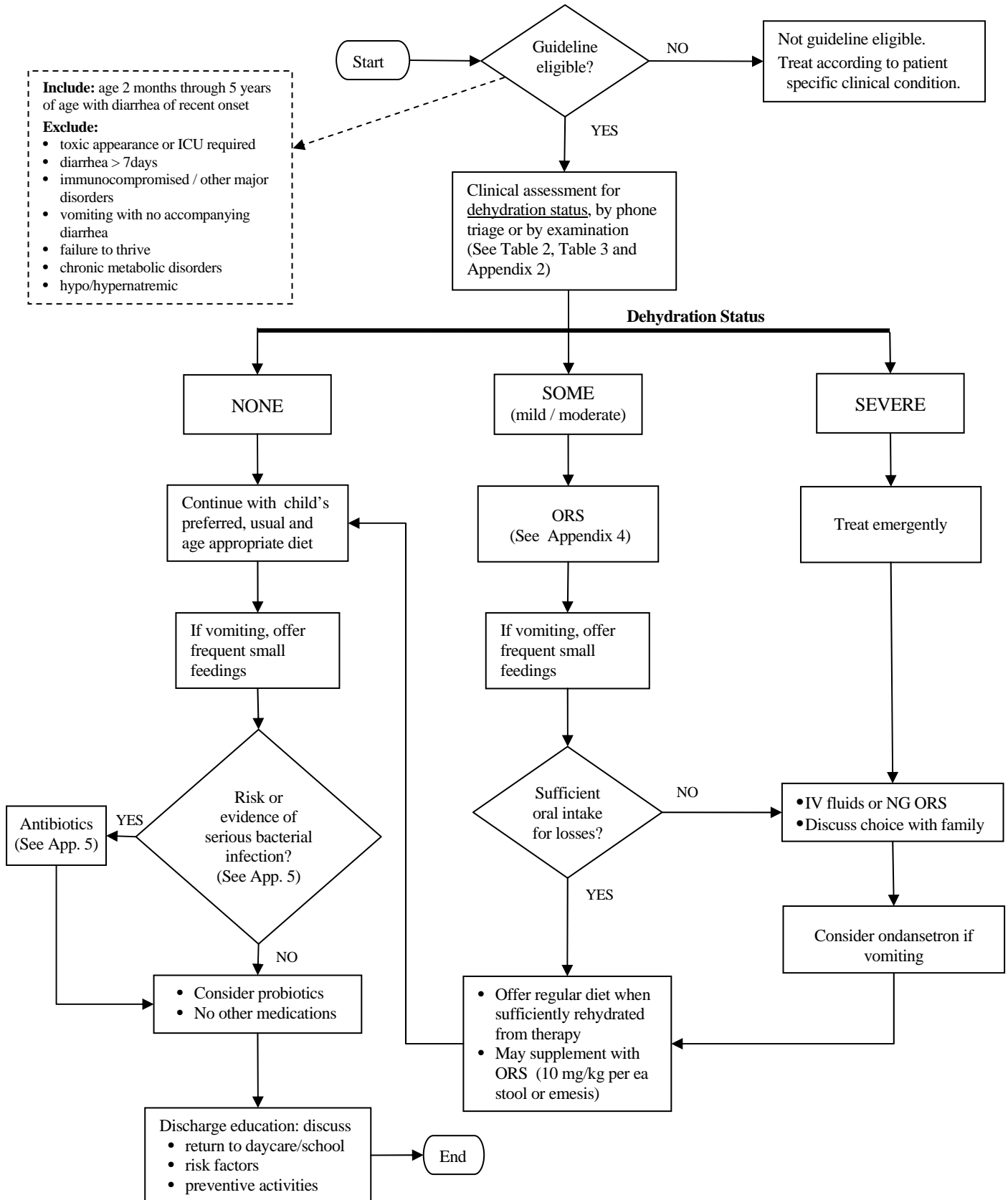
Future Research Agenda

1. In children with AGE, is ondansetron treatment, compared to placebo, cost effective?
2. In children with AGE, what is the ideal dosing protocol for probiotics, compared to placebo, in reducing the duration of symptoms?
3. Among young children attending daycare, is the use of prophylactic probiotics, compared to placebo, effective in reducing incidence of AGE?

^d CCHMC Health Topic website:

www.cincinnatichildrens.org/health/info

Algorithm for evaluation and management for Acute Gastroenteritis (AGE) in children aged 2 months through 5 years



Appendix 1 Model of form for phone triage for child with AGE

Name:				Phone:		
Date:				Phone:		
Time:		Age:		Other:		
Call Taken By:						
Phone Triage for Acute Gastroenteritis in child 2 mo. to 5 years of age						
<p>Note: The decision to see a child in the office or the Emergency Department (ED) depends on condition and Physician availability. If referred for ED evaluation it is recommended that the family not be given expectations for specific care in the ED until completion of a physical evaluation providing some estimate of the child's state of hydration. Management options can then be decided on and, when possible, following consultation between the ED and the patient's primary care provider; these options can be discussed with the family.</p>						
Any single criteria below is a possible indication for physical evaluation of child in office, or emergency department (ED)					Office	ED
		Age	Duration			
1. No urine observed		< 1 year old	> 8 Hours	X	X	
		1 year or older	> 12 Hours	X	X	
2. Bilious emesis suspect				X	X	
3. Bilious emesis >1 time						X
4. Bloody emesis suspect				X	X	
5. Bloody emesis >1 time						X
6. Bloody stools suspect				X	X	
7. Bloody stools >1 time						X
8. Lethargy				X	X	
9. Inconsolable				X	X	
10. Unarousable						X
11. Unclear history				X	X	
12. Parental preference				X	X	
13. <u>OTHER:</u>						
<u>Disposition:</u>						

Appendix 2 Physical parameters associated with degree of dehydration

Parameter	Normal to Mild (<6%)	Mild to Moderate (6 to 9%)	Severe (>9%)
MUCOUS MEMBRANES	Slightly dry	Dry	Dry
EXTREMITIES	Warm, good refill	Delayed refill	Mottled, poor refill
TEARS	Normal	Normal to absent	Absent
MENTAL STATUS	Normal	Normal to listless	Normal to coma
Blood pressure	Normal	Normal	Normal/decrease
Pulse "quality"	Normal	Normal/ decrease	Moderate decrease
Heart rate	Normal	Increased	Increase or decrease
Skin turgor	Normal	Decreased	Decreased
Fontanel	Normal	Sunken	Sunken
Eyes	Normal	Sunken	Deeply sunken
Urine output	Slight decrease	< 1ml/kg/hr	<< 1ml/kg/hr
Thirst	Slight increase	Moderate increase	May be unresponsive

1. Acute body weight change
 - a) Acute body weight change is considered the gold standard measure of dehydration in a child but is often impractical for the initial assessment due to lack of an accurate pre-illness weight measurement
 - b) A weight loss of less than 3 to 5% can be difficult to discern clinically.
 - c) Determining weight gain following rehydration is often the only way to assess the degree of actual dehydration that existed at onset of therapies.
2. Clinical diagnosis of dehydration has been shown to be imprecise and thus a general classification of a child's dehydration status such as none, some (mild/moderate) or severe is suggested by the literature as a useful starting point in the management of the child at risk for dehydration (*Steiner 2004 [M], King 2003 [S,E]*).
3. Any two of the first four parameters in this table predict dehydration of >5%, with an LR of 6.1(*Gorelick 1997 [C]*).
4. As a single sign, delayed capillary refill has the highest predictive value with a LR of 4.1.
5. Absence of specific signs has high predictive value for no dehydration
 - absence of abnormally low urine output: LR = 0.16 (*Porter 2003 [C]*)
0.27 (*Gorelick 1997 [C]*)
 - absence of dry mucous membranes 0.41 (*Steiner 2004 [M]*)
 - absence of sunken eyes: 0.49 (*Steiner 2004 [M]*)

**Appendix 3 Definition of LIKELIHOOD RATIOS (LR)
in the context of evaluating signs and symptoms for the diagnosis of dehydration**

A **likelihood ratio (LR)** is:

the likelihood of the presence of the sign or symptom in the child **WITH** dehydration, divided by the likelihood of the presence of the sign or symptom in the child **WITHOUT** dehydration.

An **LR value**:

- greater than 10 is very helpful in increasing diagnostic certainty
the presence of sign or symptom is 10 times more likely to be present in a child with dehydration than in a child without dehydration
- of 1 is not helpful
the presence of sign or symptom is just as likely to be present in child with dehydration as in a child without dehydration
- less than 0.2 is very helpful in ruling out the condition
the presence of sign or symptom is one-fifth as likely to be present in a child with dehydration as in a child without dehydration

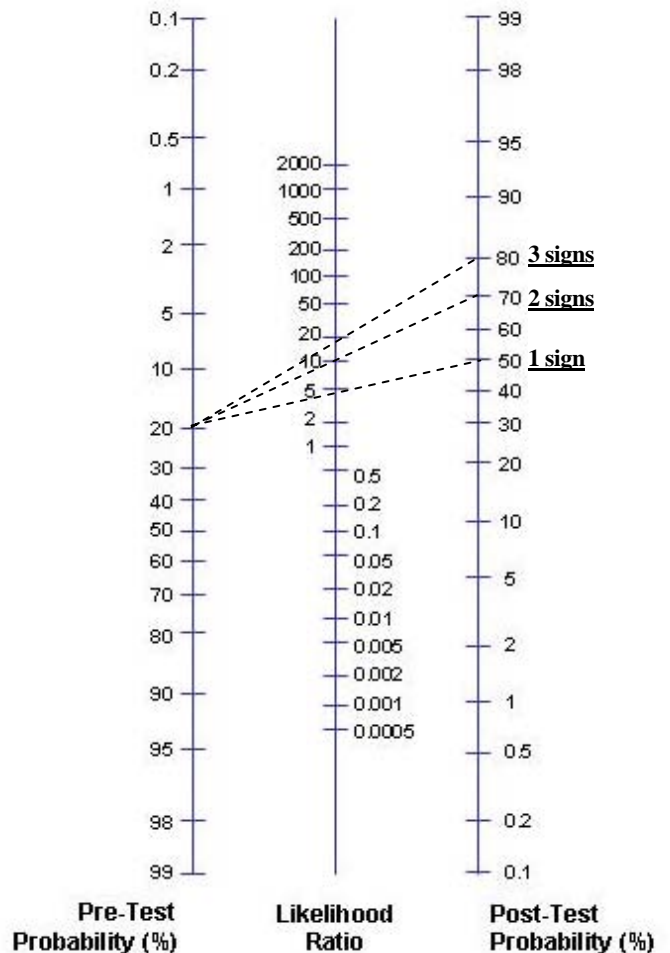
For more information on LRs see: <http://www.cebm.utoronto.ca/glossary/lrs.htm#top>

Probability Worksheet for your own use

1. Based on _____ (**Prior Factors Considered**), my estimate of the **pre-test probability** is _____% that this child is dehydrated.
2. The sign or symptom I found, _____, has an **LR** of _____.
3. Using the nomogram, I calculate that the **post-test probability** is _____% that this child is dehydrated.
4. Repeat steps 1 to 3, as desired, for each additional sign or symptom observed (shortcut: multiply LRs before starting).
5. The final **post-test probability** is _____% that this child is dehydrated.

Probability Worksheet EXAMPLE

1. Based on this child’s chief complaint for this visit, my uncalculated, but professional estimate of the **pre-test probability is 20%** that this child is dehydrated. “Pre-test” is defined as: “before I have had a chance to examine the child.”
2. The sign or symptom I found, prolonged capillary refill has an **LR of 4.1**.
3. Using the nomogram, I calculate that the **post-test probability is 50%** that this child is dehydrated.
4. Repeating steps 1 to 3, for each additional sign or symptom observed (shortcut: multiply LRs before starting), I find abnormal skin turgor (LR = 2.5), and poor overall appearance (LR = 1.9). (4.1 X 2.5 X 1.9 = 19.5 = LR for the 3 signs together).
5. With no other significant findings, the final **post-test probability is 80%** that this child is dehydrated.



Appendix 4 Oral Rehydration Solutions

Manufacturer/ Brand Name	Product Description	CHO gm	Na ⁺ mEq/liter	K ⁺ mEq/liter	Osmolarity mOsmol/liter	CHO:Na ratio mmol/liter: mmol/liter
Solutions appropriate for oral rehydration therapy (locally available products listed in order of generally increasing cost per oz)						
Generic CVS Kroger/Comfort Walgreen's	<ul style="list-style-type: none"> liquid, in liter or 8 oz sizes (single or 4-pk) freezer pops, 2.1 oz, 16 per box* 7 assorted flavors, varies by product 	25	45	20	Flavored 270	3.1 : 1
Ross Pedialyte®	<ul style="list-style-type: none"> liquid, in liter or 8 oz sizes (4-pk) freezer pops, 2.1 oz, 16 per box* 8 assorted flavors, varies by product 				Unflavored 250	
Gerber / LiquiLytes®	<ul style="list-style-type: none"> powdered mix, 6 oz reconstituted, 6 pkgs liquid, 8 oz, 4-pack fruit punch, apple or unflavored 	22	~270			
ReVital Blue's Clues®	<ul style="list-style-type: none"> liquid, 8 oz, 6-pack (Squeezers) freezer pops, 2.1 oz, 16 per box* gelatin (Jell Cups), 5 oz, 4-pack 5 assorted flavors, varies by product 	25	~270			
WHO-ORS**	• standard ORS packet	20	90	20	330	1.2 : 1
WHO-ORS**	• hypo-osmolar ORS packet	15	60	30	224	1.4 : 1
Solutions not appropriate for rehydration***						
Cola		126	2	0.1	750	1944 : 1
Apple juice		125	3	32	730	1278 : 1
Chicken broth		0	250	8	500	0 : 1
Gatorade®, sports drink		59	20	3	330	62.5 : 1

*Labeled for children 1 year of age or older.

**WHO = World Health Organization

***Inappropriate and non-physiologic fluids are given for comparison only.

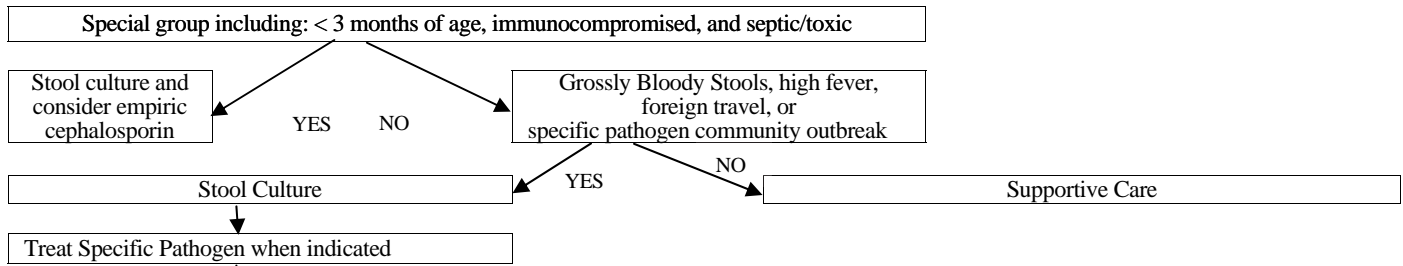
Adapted from (Kleinman 2004 [S]).

- An effective rehydration solution:
 - is hypotonic (osmolarity <~310 mOsm/liter),
 - has enough sodium to replace loss,
 - adequately replaces potassium and HCO₃ (as bicarbonate or citrate), and
 - takes advantage of equimolar Na:glucose co-transport which is 1:1 and linear until about a concentration of 100 mmol/liter.
- For non-cholera diarrhea, glucose:sodium ratios about 3 mmol/liter : 1 mmol/liter are effective in maintaining hydration.
- In 2004, the World Health Organization (WHO) introduced a hypo-osmolar formulation ORS packet for non-cholera diarrhea. This formulation reduces stool volume, vomiting and need for IV therapy, and has also been shown to be safe and effective for children with cholera (CHOICE Study Group 2001 [A]). The WHO standard formula was originally developed to treat any acute gastroenteritis, including cholera in all age groups. WHO-ORS packets are not readily available in the U.S.
- ORS products not available at pharmacies in the Cincinnati area may be obtained as noted below:
 - CeraLyte® 50, CeraLyte® 70 and CeraLyte® 90**, manufactured by Cera Products, Inc., are rice-based solutions with osmolarities of <225, 235 and 260 mOsmol/liter, respectively. They may be purchased on the internet. All are available in lemon and unflavored powdered formulations; CeraLyte 50 is also available in a powder in berry flavor and a ready-to-drink form in lemon flavor. Cereal based solutions are as effective as, but more expensive than, glucose-based ORS plus early refeeding.
 - Rehydralyte®**, manufactured by Ross, is a glucose-based solution with an osmolarity of 300 mOsmol/liter, and is higher in sodium content. It may be used for rehydration but not for maintenance therapy, except when excessive stool losses of sodium are found. It is available for purchase on the internet.
 - WHO-ORS** (also known as **WHO-ORT**) packets are available from Jianis Brothers, 2533 Southwest Boulevard Kansas City, MO 64108-2395; (816) 421-2880, with a minimum order of 125 packets. They may be readily available over the counter to travelers in most developing countries.

(Kleinman 2004 [S])

Appendix 5

A decision tool for helping decide when to obtain stool cultures and when a child may benefit from antimicrobial therapies. Consider otherwise obtaining cultures on all children with significant fever.



Organism (in alphabetical order)	Indications for Antibiotic Use	Preferred Agent	Alternative Agent(s)	Comments
<i>Aeromonas</i>	<ul style="list-style-type: none"> persistence of diarrhea 	<ul style="list-style-type: none"> TMP-SMX 	<ul style="list-style-type: none"> ciprofloxacin ^e chloramphenicol aminoglycosides 	<ul style="list-style-type: none"> self-limiting condition
<i>Campylobacter</i>	<ul style="list-style-type: none"> persistence of diarrhea 	<ul style="list-style-type: none"> erythromycin azithromycin ciprofloxacin ^e 	<ul style="list-style-type: none"> tetracycline / doxycycline ^f 	<ul style="list-style-type: none"> early treatment can shorten duration and prevent relapse self-limiting condition
<i>Clostridium difficile</i>	<ul style="list-style-type: none"> persistence of diarrhea after discontinuing antibiotics 	<ul style="list-style-type: none"> metronidazole 		<ul style="list-style-type: none"> Discourage vancomycin due to promotion of vancomycin resistant organisms (AAP 2003 [O]).
enterohemorrhagic <i>E. coli</i> (O157:H7)	antibiotics are contraindicated	None	None	Antibiotics increase likelihood of hemolytic uremic syndrome and are contraindicated (Wong 2000 [C]).
<i>Salmonella</i>	<ul style="list-style-type: none"> bacteremia invasive disease those with risk factor(s) for invasive disease, including: <ul style="list-style-type: none"> > age <3 months > functional or anatomical asplenia > malignancy > AIDS > chronic gastrointestinal tract disease > hemoglobinopathy > immunosuppressive therapy 	<ul style="list-style-type: none"> cefotaxime ceftriaxone 	<ul style="list-style-type: none"> ampicillin TMP-SMX ciprofloxacin ^e chloramphenicol 	<ul style="list-style-type: none"> treatment plan is based on susceptibility testing
<i>Shigella</i>	<ul style="list-style-type: none"> disease control persistence of diarrhea severe disease 	<ul style="list-style-type: none"> cefotaxime ceftriaxone ciprofloxacin ^e 	<ul style="list-style-type: none"> azithromycin 	<ul style="list-style-type: none"> self-limiting condition treatment is based on local susceptibilities <ul style="list-style-type: none"> > See below for discussion about CCHMC rates of resistance ^g. > In the U.S., about 50% of these organisms are resistant to ampicillin and TMP-SMX (AAP 2003 [O]).
<i>Vibrio cholerae</i> (cholera)	<ul style="list-style-type: none"> persistence of diarrhea to decrease fluid requirements disease control 	<ul style="list-style-type: none"> tetracycline / doxycycline ^f 	<ul style="list-style-type: none"> TMP-SMX erythromycin ciprofloxacin ^e 	
<i>Yersinia</i>	<ul style="list-style-type: none"> bacteremia invasive disease immunoincompetent host 	<ul style="list-style-type: none"> TMP-SMX tetracycline / doxycycline ^f 	<ul style="list-style-type: none"> ciprofloxacin ^e aminoglycosides cefotaxime 	

(AAP 2003 [O])

^e Ciprofloxacin is not recommended for children less than 18 years of age, except in circumstances when potential risks are less than the potential benefits (AAP 2003 [O]).

^f Tetracycline / doxycycline are not generally used in children < 8 years of age.

^g At CCHMC: In 2004, 18 of 18 outpatient isolates were resistant to ampicillin and 13 of 18 outpatient isolates were resistant to TMP-SMX (CCHMC 2004 [O]). In 2002, 26 of 40 outpatient isolates were resistant to ampicillin and 0 of 40 outpatient isolates were resistant to TMP-SMX (CCHMC 2002 [O]).

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Development Process

The process by which this guideline was developed is documented in the [Guideline Development Process Manual](#); a Team Binder maintains minutes and other relevant development materials. The recommendations contained in this guideline were formulated by an interdisciplinary working group which performed systematic and critical literature reviews, using the grading scale that follows, and examined current local clinical practices.

To select evidence for critical appraisal by the group for the update of this guideline, the Medline, EmBase and the Cochrane databases were

CCHMC Evidence Grading Scale			
M	Meta-analysis or Systematic Review	O	Other evidence
A	Randomized controlled trial: large sample	E	Expert opinion or consensus
B	Randomized controlled trial: small sample	F	Basic Laboratory Research
C	Prospective trial or large case series	L	Legal requirement
D	Retrospective analysis	Q	Decision analysis
S	Review article	X	No evidence

searched for dates of January, 2000 to March, 2003 to generate an unrefined, "combined evidence" database using a search strategy focused on answering clinical questions relevant to AGE and employing a combination of Boolean searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on words in the title, abstract, and indexing terms. The citations were reduced by: eliminating duplicates, review articles, non-English articles, and adult articles. The resulting abstracts were reviewed by a methodologist to eliminate low quality and irrelevant citations. During the course of the guideline development, additional clinical questions were generated and subjected to the search process, and some relevant review articles were identified. December, 1999 was the last date for which literature was reviewed for the previous version of this guideline. The details of that review strategy are not documented. However, all previous citations were reviewed for appropriateness to this revision.

A search using the above criteria was conducted for dates of January, 2004 through May, 2006. Thirty-three relevant articles were selected as potential future citations for the guideline. However, none of these references were determined to require changes to the 2005 version of the recommendations.

Appropriate companion documents have been developed to assist in the effective dissemination and implementation of the guideline. Experience with the implementation of earlier publications of this guideline has provided learnings which have been incorporated into this revision (*Perlstein 2002 [D]*).

Once the guideline has been in place for three years, the development team reconvenes to explore the continued validity of the guideline. This phase can be initiated at any point that evidence indicates a critical change is needed.

Recommendations have been formulated by a consensus process directed by best evidence, patient and family preference and clinical expertise. During formulation of these recommendations, the team members have remained cognizant of controversies and disagreements over the management of these patients. They have tried to resolve controversial issues by consensus where possible and, when not possible, to offer optional approaches to care in the form of information that includes best supporting evidence of efficacy for alternative choices.

The guidelines have been reviewed and approved by clinical experts not involved in the development process, senior management, Risk Management & Corporate Compliance, other appropriate hospital

committees, and other individuals as appropriate to their intended purposes.

The guideline was developed without external funding. All Team Members and Clinical Effectiveness support staff listed have declared whether they have any conflict of interest and none were identified.

Copies of this EBCG are available online and may be distributed by any organization for the global purpose of improving child health outcomes. Website address:

<http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/default.htm> Examples of approved uses of the EBCG include the following:

- copies may be provided to anyone involved in the organization's process for developing and implementing evidence-based care guidelines;
- hyperlinks to the CCHMC website may be placed on the organization's website;
- the EBCG may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
- copies may be provided to patients and the clinicians who manage their care.

Notification of CCHMC at HPCEInfo@cchmc.org for any EBCG adopted, adapted, implemented or hyperlinked by the organization is appreciated.

NOTE: These recommendations result from review of literature and practices current at the time of their formulations. This protocol does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the guidelines to meet the specific and unique requirements of individual patients. Adherence to this pathway is voluntary. The physician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.

For more information about these guidelines, their supporting evidences and the guideline development process, contact the Health Policy & Clinical Effectiveness office at: 513-636-2501 or HPCEInfo@cchmc.org.

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Note: When using the electronic version of this document, “_____” refers to journal articles that have a hyperlink to the abstract.

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