

# Evaluation and Management of Dehydration in Children

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## KEYWORDS

- Dehydration • Oral rehydration • Subcutaneous rehydration • Intravenous fluid
- Fluid bolus • Hyponatremia • Hypernatremia

## KEY POINTS

- The degree of pediatric dehydration may be difficult to clinically quantify.
- Dehydration may be treated with oral, subcutaneous, or intravenous fluids.
- Most children with mild to moderate dehydration can be successfully rehydrated with oral rehydration.
- When intravenous fluids are chosen for rehydration, isotonic solutions should be used to avoid iatrogenic hyponatremia.

## DIAGNOSIS

This article discusses evidence-based treatment of dehydration due to acute gastroenteritis in children. Many other common childhood illnesses, such as bronchiolitis, influenza, gingivostomatitis, and urinary tract infections, may cause dehydration as well. Although some of these other illnesses require specific therapy, the approach to associated dehydration is generally the same as presented in this article. Although diarrhea and dehydration are major causes of morbidity and mortality in low-income countries, this review focuses on treatment in high-income countries. Treatment considerations vary based on health care resources, incidence of preexisting poor nutrition, and common pathogens.

Children with dehydration are commonly divided into severity subgroups by percent of weight lost during the illness. Minimal or no dehydration is commonly defined as a loss of less than 3% of body weight, mild dehydration is a 3% to 5% loss, moderate dehydration is a 6% to 9% loss, and severe dehydration is a loss of 10% or more of the preillness weight, although severity subgroupings vary somewhat in different

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published guidelines (**Tables 1 and 2**). If a reliable preillness weight is available, the degree of dehydration can be calculated (**Equation 1**). A weight just prior to the illness, however, is not generally available and severity of dehydration must be estimated based on clinical signs and symptoms.

The formula for calculating fluid deficit is as follows:

$$\begin{aligned} \text{Fluid deficit (mL)} &= \% \text{ dehydration} \times \text{weight (kg)} \times 10 \\ \% \text{ dehydration determined clinically OR weight change} \\ &= \left( \frac{(\text{previous weight} - \text{current weight})}{\text{previous weight}} \right) \times 100 \end{aligned} \quad (1)$$

The ability to recognize dehydration has important clinical implications. Untreated dehydration may lead to electrolyte disturbances, acidosis, and end-organ damage due to hypoperfusion, including renal insufficiency and cardiovascular instability. An accurate assessment of the severity of dehydration, however, can be challenging. Historical features, including duration of illness, frequency and characterization of vomiting and diarrhea, urine output, preillness weight, and recent oral intake should be ascertained.<sup>1,2</sup> Guidelines recommend checking vital signs, general appearance, appearance of oral mucosa, and respiratory pattern.<sup>2</sup> Eyes should be examined for a sunken appearance and presence or absence of tears should be

<b>Symptom</b>	<b>Minimal Dehydration (&lt;3% Loss of Body Weight)</b>	<b>Mild–Moderate Dehydration (3%–9% Loss of Body Weight)</b>	<b>Severe Dehydration (≥10% Loss of Body Weight)</b>
Mental status	Normal	Normal, fatigued, restless or irritable	Apathetic, lethargic, unconscious
Heart rate	Normal	Normal–increased	Tachycardia (bradycardia possible if severe)
Breathing	Normal	Normal, fast	Deep
Pulse quality	Normal	Normal–decreased	Weak, thread, or difficult to palpate
Systolic blood pressure	Normal	Normal or low	Low
Anterior fontanelle	Normal	Sunken	Very sunken
Mucous membranes	Moist	Dry	Parched
Eyes	Normal	Slightly sunken	Deeply sunken
Tears	Present	Decreased	Absent
Skin fold elasticity	Pinch with instant recoil	Recoil in <2 s	Recoil in >2 s
Capillary refill	Normal	Prolonged	Prolonged, minimal
Extremities	Warm	Cool	Cold, mottled, cyanotic
Urinary output	Normal–decreased	Decreased	Minimal
Estimated fluid deficit	30–50 mL/kg	100 mL/kg	>100 mL/kg

Data from Colletti JE, Brown KM, Sharieff GQ, et al. The management of children with gastroenteritis and dehydration in the emergency department. *J Emerg Med* 2010;38(5):686–98; and Steiner MJ, DeWalt DA, Byerley JS. Is this child dehydrated? *JAMA* 2004;291(22):2746–54.

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