

## Infants and Children: Management of Acute Gastroenteritis, Fourth Edition

**Summary** The Infants and Children, Management of Acute Gastroenteritis, clinical practice guideline, reflects what is currently regarded as a safe and appropriate approach to the acute management of gastroenteritis in infants and children.

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**Distributed to** Divisions of General Practice, Government Medical Officers, NSW Ambulance Service, Ministry of Health, Private Hospitals and Day Procedure Centres, Tertiary Education Institutes

**Audience** Emergency Departments;Nursing;Medical;Clinicians

## INFANTS AND CHILDREN: MANAGEMENT OF ACUTE GASTROENTERITIS

### PURPOSE

The *Infants and Children: Management of Acute Gastroenteritis, fourth edition* Clinical Practice Guideline has been revised to align with the [Standards for Paediatric Intravenous Fluids](#). This guideline provides direction to clinicians and is aimed at achieving the best possible paediatric care in all parts of the state. The Clinical Practice Guideline was prepared for the NSW Ministry of Health by an expert clinical reference group under the auspice of the state wide Paediatric Clinical Practice Guideline Steering Group.

### KEY PRINCIPLES

This guideline applies to all facilities where paediatric patients are managed. It requires the Chief Executives of all Local Health Districts and specialty health networks to have local guidelines / protocols based on the attached Clinical Practice Guideline in place in all hospitals and facilities required to assess or manage children with gastroenteritis.

The Clinical Practice Guideline reflects what is currently regarded as a safe and appropriate approach to the management of acute gastroenteritis in infants and children. However, as in any clinical situation there may be factors which cannot be covered by a single set of guidelines. This document should be used as a guide, rather than as a complete authoritative statement of procedures to be followed in respect of each individual presentation. **It does not replace the need for the application of clinical judgement to each individual presentation.**

### USE OF THE GUIDELINE

Chief Executives must ensure:

- Local protocols are developed based on the *Infants and Children: Management of Acute Gastroenteritis: fourth edition* Clinical Practice Guideline
- Local protocols are in place in all hospitals and facilities likely to be required to assess or manage paediatric patients with sore throat
- Ensure that all staff treating paediatric patients are educated in the use of the locally developed paediatric protocols.

Directors of Clinical Governance are required to inform relevant clinical staff treating paediatric patients of this new guideline.

### REVISION HISTORY

Version Approved	Approved by	Amendment notes
December 2014 (GL2014_024)	Deputy Secretary Population and Public Health	Fourth Edition – changes made to align with <a href="#">The Standards for Paediatric Intravenous Fluids</a> .
February 2010 (PD2010_009)	Deputy Director-General Population Health	Third Edition

October 2009 (PD2009_064)	Deputy Director-General Population Health	Second Edition
December 2004 (PD2005_238)	Director General	New Policy

## ATTACHMENT

1. *Infants and children: Management of Acute Gastroenteritis. fourth edition*, Clinical Practice Guideline.

# **INFANTS AND CHILDREN**



## **Management of Acute Gastroenteritis: fourth edition**

### **CLINICAL PRACTICE GUIDELINE**

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December 2014

A revision of this document is due in 2015

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## 1 INTRODUCTION

These Guidelines are aimed at achieving the best possible paediatric care in all parts of the State. The document should not be seen as a stringent set of rules to be applied without the clinical input and discretion of the managing professionals. Each patient should be individually evaluated and a decision made as to appropriate management in order to achieve the best clinical outcome.

The formal definition of clinical practice guidelines comes from the National Health and Medical Research Council:

*'Systematically developed statements to **assist** practitioner and patient decisions about appropriate health care for specific clinical circumstances.'* (National Health and Medical Research Council "A Guide to the Development, implementation and evaluation of Clinical Practice Guidelines", Endorsed 16 November 1998, available from [www.nhmrc.gov.au/publications/synopses/cp65syn.htm](http://www.nhmrc.gov.au/publications/synopses/cp65syn.htm))

It should be noted that this document reflects what is currently regarded as a safe and appropriate approach to care. However, as in any clinical situation there may be factors which cannot be covered by a single set of guidelines. This document should be used as a guide, rather than as a complete authoritative statement of procedures to be followed in respect of each individual presentation. It does not replace the need for the application of clinical judgment to each individual presentation.

The consideration and then exclusion of other differential diagnoses is important prior to using a disease specific clinical practice guideline.

This document represents basic clinical practice guidelines for the management of acute gastroenteritis in children and infants. Further information may be required in practice; suitable widely available resources are included as appendix 5.

Local health districts and specialty health networks are responsible for ensuring that local protocols based on these guidelines are developed. Local health districts and specialty health networks are also responsible for ensuring that all staff treating paediatric patients are educated in the use of the locally developed paediatric guidelines and protocols.

In the interests of patient care it is critical that contemporaneous, accurate and complete documentation is maintained during the course of patient management from arrival to discharge.

***Parental anxiety should not be discounted:***

***it is often of significance even if the child does not appear especially unwell.***

## 2 OVERVIEW

Gastroenteritis is a common paediatric condition. Appropriate management attempts to avoid dehydration, but when this occurs appropriate fluid management is essential. **For rehydration the enteral route is preferred**, but if intravenous fluids are used then low sodium containing fluids should not be used. For intravenous rehydration 0.9% sodium chloride + 5% glucose +/- 20mmols/L potassium chloride is recommended.

Oral rehydration solutions may be offered orally or administered via a nasogastric tube.

In cases of severe dehydration or clinical deterioration after admission or despite treatment, the Admitting Medical Officer in charge or consulting paediatrician should be notified and should personally review the patient as soon as possible. Where other medical staff act as a delegate for the Admitting Medical Officer, the hospital must have clear written protocols defining this arrangement as per local Clinical Emergency Response System (CERS) policy.

For hospitals employing junior medical staff: The Admitting Medical Officer **MUST** be notified within an hour of the decision to admit the child. Details of the physical findings and proposed fluid therapy should be discussed. Hospitals should have an internal policy that defines roles if senior registrars act as a delegate for the AMO.

This Clinical Practice Guideline should be read in conjunction with other relevant Clinical Practice Guidelines (e.g. [Recognition of a Sick Baby or Child in the Emergency Department](#), and [Infants and Children: Acute Management of Abdominal Pain](#)). When dealing with children suspected of having gastroenteritis, it is essential that infection control measures be implemented to prevent cross contamination and spread.

### 2.1 Significant Changes From 2009 CPG Version

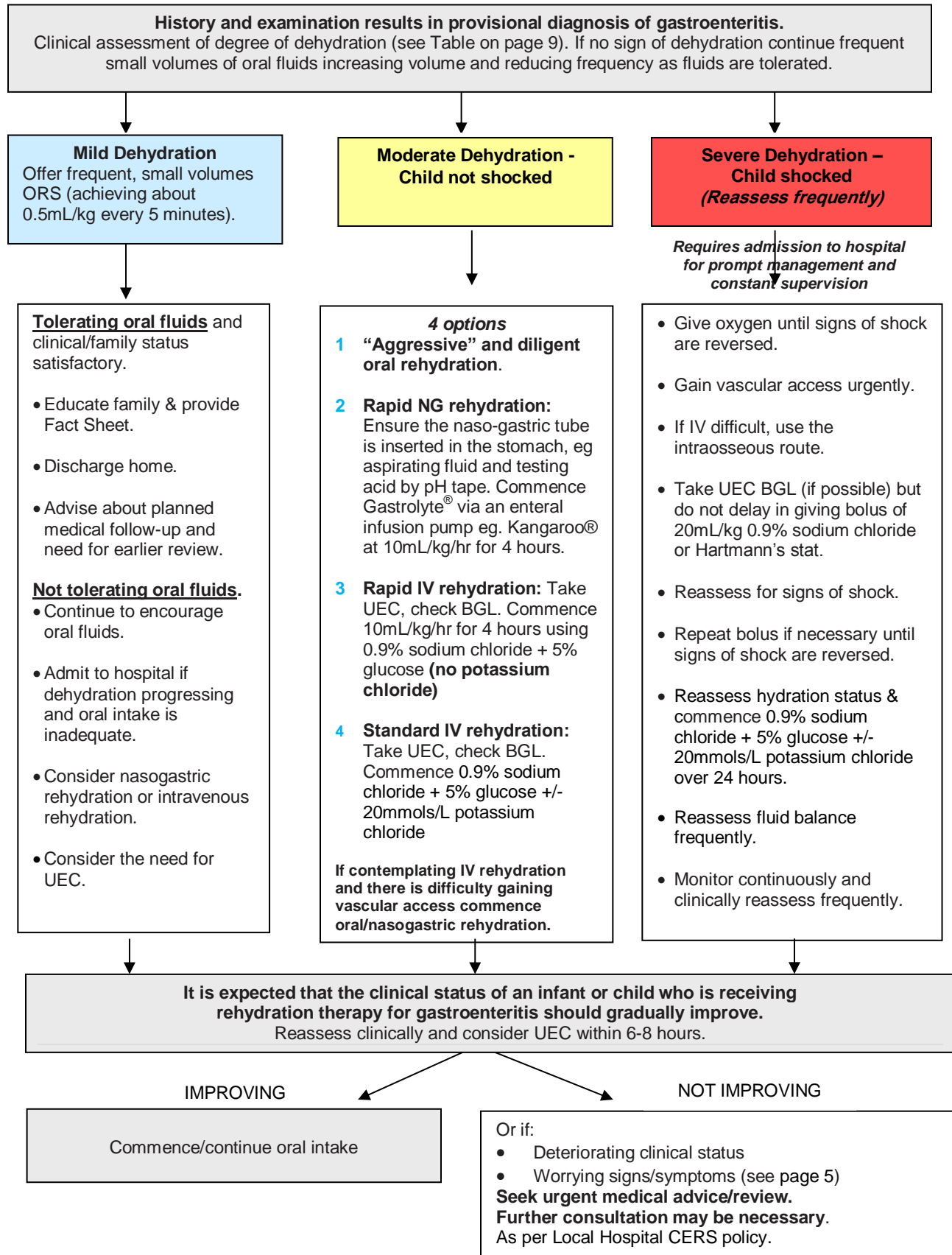
The **intravenous fluid recommendations** in the Clinical Practice Guideline, Infants and Children: Management of Acute Gastroenteritis **has been updated to be consistent with** [The Standards for Paediatric IV Fluids](#). Intended outcomes of the new standards regarding the content of IV Fluids for children and neonates include:

- Reducing the risk of hyponatraemia through increased sodium content and limiting the use of low sodium containing fluids
- Addressing glucose requirements of children and neonates through increased glucose content and
- Consistent inclusion of potassium chloride as early as considered safe and appropriate.

**Complete review of this clinical practice guideline is due September 2015.**



### 3 ALGORITHM



#### 4 CLINICAL ASSESSMENT OF DEHYDRATION AND INITIAL TREATMENT

**Table 1: No single symptom or clinical sign reliably predicts the degree of dehydration**

Description of dehydration	Dehydration (% of Body Weight)	Signs and Symptoms	Replacement Fluid Route	Replacement Fluid Type
<b>No Clinical Signs of Dehydration</b>		Reduced urine output Thirst No physical signs	Oral	In order of preference <ul style="list-style-type: none"> <li>• Frequent breastfeeds where appropriate/possible</li> <li>• Oral Rehydration Solution (see page 10)</li> <li>• 1/5 strength clear fluids i.e.: 4 parts water and 1 part juice/lemonade (<b>if ORS refused</b>)</li> </ul>
<b>Mild</b>	3%	Reduced urine output Thirst Dry mucous membranes Mild Tachycardia	Oral	In order of preference <ul style="list-style-type: none"> <li>• Frequent breastfeeds where possible/appropriate may be supplemented with an ORS</li> <li>• Oral Rehydration Solution (see page 10)</li> </ul>
			Nasogastric	Oral Rehydration Solution e.g. Gastrolyte® (see pages 10 - 12)
			Intravenous - Rapid	0.9% sodium chloride + 5% glucose ( <b>no potassium chloride</b> )
			Intravenous - Standard	0.9% sodium chloride + 5% glucose +/- 20mmols/L potassium chloride
<b>Moderate</b>	5%	Dry mucous membranes Tachycardia Abnormal respiratory pattern Lethargy Reduced skin turgor Sunken eyes	Nasogastric	Oral Rehydration Solution e.g. Gastrolyte® (see pages 10 -12)
			Intravenous - Rapid	0.9% sodium chloride + 5% glucose ( <b>no potassium chloride</b> )
			Intravenous - Standard	0.9% sodium chloride + 5% glucose +/-20mmols/L potassium chloride
<b>Severe</b>	10%	Above signs Poor Perfusion - <i>Mottled, cool limbs/Slow capillary refill/Altered consciousness</i> Shock - <i>thready peripheral pulses with marked tachycardia and other signs of poor perfusion stated above</i>	Intravenous or intraosseous 20mL/kg stat and reassess fluid needs	For resuscitation use either:  0.9% sodium chloride OR Hartmann's solution Reassess the child after each bolus.  Ongoing fluid replacement should be: 0.9% sodium chloride + 5% glucose +/-20mmols/L potassium chloride

## 5 GASTROENTERITIS IN INFANCY AND CHILDHOOD

- This common acute intestinal communicable infection causes vomiting, diarrhoea and fever. It is usually viral, but sometimes bacterial or parasitic. Community outbreaks are sporadic and seasonal.
- A small proportion of those affected will suffer severe dehydration and electrolyte disturbance. Untreated or poorly treated dehydration may progress to shock and death. There are also risks from over-hydration and/or inappropriate electrolyte replacement, including death from cerebral oedema.
- Some other serious illnesses are sometimes incorrectly diagnosed as gastroenteritis. Warning signs of other diagnoses must be recognised and investigated (see page 8).

### 5.1 Suggested hospital requirements for management of children with gastroenteritis

- Twenty-four hour availability of nurses and medical practitioners experienced in the management of sick children.
- Access to 24 hour standard biochemistry for inpatient management. This may include point of care testing.
- Availability of standard resuscitation intravenous fluids, including 0.9% sodium chloride (without added glucose). Note Hartmann's solution (without added glucose) is an alternative.
- Availability of recommended rehydration intravenous fluids - 0.9% sodium chloride + 5% glucose +/- 20mmols/L potassium chloride.
- Intravenous paediatric giving sets with burettes, appropriate infusion pumps.
- Appropriate Oral Rehydration Solutions such as Gastrolyte<sup>®</sup>, Gastrolyte-R<sup>®</sup>, Repalyte<sup>®</sup>, Hydralyte<sup>®</sup>
- Appropriate giving sets and enteral infusion pumps (e.g. Kangaroo<sup>®</sup> pump).
- In neonatal practice 0.45% sodium chloride + 10% glucose will be used. In these situations low sodium content products (0.225%, 0.22% and 0.18% sodium chloride) should be stored separately, either in a locked cupboard (similar to vials of potassium) or in a dedicated maternity/neonatal unit.

### 5.2 Availability of assistance when treating severely ill children

- The treatment of children with severe dehydration should be discussed with a paediatrician and consideration be given to transfer to a facility with a paediatric intensive care unit.
- For advice regarding the management of seriously ill children or to arrange their transfer to any of the children's hospitals contact NETS NSW (Newborn and paediatric Emergency Transport Service Hotline number: **1300 36 2500**). Calls to NETS are voice recorded and form part of the NETS medical record for the patient.

### 5.3 Principles of Fluid Management

- Infants and children with gastroenteritis require additional fluids to prevent dehydration, or for rehydration.

- The **enteral route is preferred** for rehydration of children with mild or moderate dehydration. This is done with an Oral Rehydration Solution (an ORS) either by mouth or via nasogastric tube.
- Suitable fluids should be offered, for oral rehydration
  - Babies who are breastfed should receive small frequent breastfeeds to ensure normal urine output. This may be supplemented with an ORS.
  - For all other children, offer an ORS. Those requiring mixing must follow the manufacturer's instructions. *Do not add flavouring or sweet drinks to an ORS.*
  - If an ORS is unavailable, or refused, dilute juice/lemonade (mixed as 1 part juice/lemonade with 4 parts water) can be used **only if a child does not have any clinical signs of dehydration**. *These are less desirable fluid options.*
  - Do not use “sports drinks” as they are not an appropriate rehydration fluid for children with gastroenteritis.
  - Do not use low-calorie or diet drinks.
- Suitable volumes should be offered: try to give about 0.5mL/kg every 5 minutes.
- Achieving successful oral rehydration demands constant attention and persistence, usually by parents.
- The principles and practice of oral replacement therapy are described on page 10.
- Intravenous rehydration is often a reasonable alternative for moderate dehydration (see Table 1 on page 9) and is essential where severe dehydration and/or shock are present.
- Children receiving fluid rehydration require regular timely reassessment of hydration status.
- The principles and practice of intravenous replacement therapy are described on page 14.

**NB - Careful calculations of fluid volume and rate are required regardless of route of administration.**

## 5.4 Medications

There are no indications for using anti-motility or anti-diarrhoeal agents in the management of acute gastroenteritis in infants or children.

Many antiemetic medications have a risk of significant side effects, like dystonic reactions and sedation, and should be avoided [e.g. promethazine, prochlorperazine]. Medications such as 5HT-3 receptor antagonists, e.g. ondansetron, may have some clinical benefit. Experienced clinicians choosing to use that medication generally should limit the use to a single dose.

Pro-biotics and Zinc may have some clinical benefits in the management of gastroenteritis, and may be available in some commercially available products such as yoghurts. These can be given to children when a normal diet is reintroduced.

Antibiotics are rarely required in gastroenteritis, even when bacterial in aetiology. If unsure, consult a paediatrician or paediatric infectious disease specialist.

Rotavirus vaccines are available and have a significant benefit in the prevention of gastroenteritis in young infants. Additional information is available at the [National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases website](#).

## 5.5 Differential Diagnoses

Always keep in mind the possibility that the diagnosis of gastroenteritis could be incorrect. *Gastroenteritis consists of the triad of vomiting, diarrhoea and fever.* **Be cautious of evaluating the child with vomiting alone.** The following list is not exclusive. Consider also:

- Acute appendicitis
- Strangulated hernia
- Intussusception or other causes of bowel obstruction
- Urinary tract infection
- Meningitis and other types of sepsis
- Any cause of raised intracranial pressure
- Diabetic ketoacidosis
- Inborn errors of metabolism
- Inflammatory bowel disease
- Haemolytic uraemic syndrome.

Always consider another diagnosis if there is:

- Abdominal distension
- Bile-stained vomiting
- Fever  $>39^{\circ}\text{C}$
- Blood in vomitus or stool
- Severe abdominal pain
- Vomiting in the absence of diarrhoea
- Headache.

***Beware!***  
***The very young infant and the malnourished child are more likely to suffer severe disease, or to have another diagnosis.***

Table 1 on page 5 gives an overview of dehydration definition, signs and symptoms, along with initial enteral or parenteral fluid therapy. The flow chart on page 4 outlines a treatment overview and highlights decision points in regard to the initial management of an infant or child with gastroenteritis.

## 6 ENTERAL REHYDRATION THERAPY

Most children with gastroenteritis and mild-moderate dehydration can be successfully rehydrated with oral rehydration solutions either by mouth or nasogastric tube.

### 6.1 Oral Rehydration Solutions

Oral rehydration solutions (ORSs) are specifically designed fluids that contain an appropriate amount of sodium, glucose and other electrolytes and are of the appropriate osmolality, to maximise water absorption from the gut. They use the principle of glucose-

facilitated sodium transport whereby glucose enhances sodium and secondarily water transport across the mucosa of the upper intestine. The sodium and glucose concentrations and the osmolality are of vital importance.

The World Health Organisation (WHO) recommends an ORS that has a sodium concentration of 90mmol/L. In developed countries with non-cholera diarrhoea, it is generally thought that 90mmol/L is a little high, as non-cholera gastroenteritis does not result in the same sodium losses that are seen in cholera. Many different ORSs with varying sodium concentrations have been developed. It has been shown that water absorption across the lumen of the human intestine is maximal using solutions with a sodium concentration of 60mmol/L<sup>1</sup> (such as Gastrolyte<sup>®</sup>) and this is the concentration recommended by the European Society of Paediatric Gastroenterology and Nutrition.<sup>2</sup> However some children who are not particularly dehydrated will refuse to drink such an ORS because of its salty taste. ORSs with slightly less sodium such as Hydralyte<sup>®</sup> may be more palatable, particularly as this comes in an iceblock form. ORSs with similar compositions to Hydralyte<sup>®</sup> are safe and effective. These hypo-osmolar solutions (such as Gastrolyte<sup>®</sup> and Hydralyte<sup>®</sup>) are more effective at promoting water absorption than isotonic or hypertonic solutions.<sup>3,4,5</sup>

The composition of various ORSs and other fluids is shown in Tables 2 and 3. Fruit juices and soft drinks are inappropriate because of the minimal sodium content and the excessive glucose content and hence excessive osmolality, which will worsen diarrhoea. Although diluting juices and soft drinks reduces glucose concentration, the fluid has insufficient sodium to act as a rehydration fluid.

Sports drinks have varying sodium and carbohydrate levels, and are considered inappropriate as rehydration solutions.

**Table 2: Composition of Oral Rehydration Solutions**

Comparisons of ORSs					
	Sodium	Carbohydrate			Osmolality
	(mmol/L)		(mmol/L)	(%)	(mOsm/L)
WHO	90	G	111	(2%)	331
Gastrolyte <sup>®</sup>	60	G	90	(2%)	240
Gastrolyte-R <sup>®</sup>	60	RSS	6g/L	(2.5%)	226
Repalyte <sup>®</sup>	60	G	90	(2%)	240
Terry White/Chem-mart <sup>®</sup>	60	G	90	(2%)	240
Hydralyte <sup>®</sup>	45	G	90	(2.5%)	240

G = glucose, RSS = rice syrup solids

**Table 3: Composition of Oral Fluids**

Comparisons of Oral Fluids			
	Sodium	Carbohydrate	Osmolality
	(mmol/L)	(mmol/L)	(mOsm/L)
Apple Juice	3	690	730
Soft drinks	~2	~700	~750
Sports drinks	~20	~255	~330

## 6.2 Method of giving oral fluids

It is important to give small amounts of fluid frequently, for example 0.5mL/kg every five minutes. The fluid can be measured in a syringe and given to the child either by syringe, teaspoon or cup. The child is far more likely to tolerate these small amounts of fluid than if he/she drinks a large amount at once. Obviously if the child tolerates this fluid the

parent can gradually increase the volume and decrease the frequency of the fluid offered. Success can be optimised in the Emergency Department setting by giving the parents a documentation chart (see Appendix 5) to record the fluid given and any vomits, diarrhoea or urine passed.

It is important to educate the parents that seeing a doctor will not cure their child of his/her vomiting and diarrhoea. Small, frequent amounts of fluid will hopefully minimise the vomiting, but will not reduce the diarrhoea. The aim is for the input to exceed the output by enough to rehydrate and then maintain hydration. **Occasional vomiting alone should not be considered as failure of oral rehydration therapy.**

### 6.3 Discharge criteria

Children with gastroenteritis can be discharged, even if they still have some vomiting, if the following discharge criteria are met:

- ✓ Diagnosis of gastroenteritis
- ✓ Child is rehydrated or only mildly dehydrated
- ✓ Gastrointestinal losses not profuse
- ✓ Child has passed urine in ED or within the last 4 hours
- ✓ Parent has demonstrated the ability to give an ORS appropriately
- ✓ Clinical staff confident parent will take child to GP for review within 48hrs and represent for medical review if child's condition deteriorates.

## 7 NASOGASTRIC REHYDRATION

If a child with gastroenteritis and dehydration does not fulfil the discharge criteria, they will need to be admitted for ongoing management. Increasing numbers of hospitals in developed countries are using an ORS via continuous nasogastric (NG) infusion<sup>8,9</sup>. This has been shown to be as effective as intravenous rehydration<sup>8-15</sup>, less expensive<sup>8,15</sup> and reduces lengths of hospital stay<sup>8</sup> when compared with standard intravenous rehydration. It is usually unnecessary to perform UEC for children being rehydrated with nasogastric ORS.

Nasogastric rehydration is where an ORS is infused continuously via a nasogastric tube with a pump such as a Kangaroo<sup>®</sup> pump. **Choose an ORS with a sodium concentration of 60mmol/L such as Gastrolyte<sup>®</sup>, as this is the optimal concentration and taste is not an issue when using an NG tube.** Hydralyte<sup>®</sup> has only 45 mmol/L of sodium, and *is not* the preferred nasogastric solution (but when given orally often has better compliance due to taste). Nasogastric rehydration is often successful even in children with frequent vomiting. Staff need to be competent in placing nasogastric tubes in children and babies and follow local protocols and training/accreditation procedures. Facilities need to be equipped to deliver NG rehydration in regards to equipment and education before this form of rehydration should be introduced.

**Do not use nasogastric** rehydration if child has:

- An ileus (check for bowel sounds)
- Significantly reduced level of consciousness.

**Do not use “rapid”** nasogastric rehydration if child:

- Is younger than 6 months old
- Has a medical condition which increases the risk of fluid overload.

Different regimens are used for continuous nasogastric rehydration. One simple method is described below:

- Perform observations – respiratory rate(RR), heart rate(HR), capillary refill (CR), blood pressure(BP), temperature(T), and assessment of mental state before commencing, then repeat RR, HR, CR, BP at least hourly. Record on age appropriate Standard Paediatric Observation Chart and escalate if required as per local CERS
- Establish NG access
- Give 10mL/kg/hour of Gastrolyte<sup>®</sup> for four hours for all mild-moderately dehydrated children, **after which the infusion is ceased**
- Do not take blood for UEC and BGL as a routine.
- After completion the child is then re-examined by the medical officer and a re-trial of oral fluids is commenced.

After 1-2 hours of completing rehydration the child is reassessed and if he/she fulfils the discharge criteria (page 13), may be discharged with appropriate advice and follow up.

If the child does not tolerate NG rehydration, (Note 1 or 2 small vomits does not necessarily mean NG rehydration has failed), IV rehydration will probably need to be commenced. **This should be over 24 hours i.e. do not give rapid IV rehydration after the child has already received “rapid” NG rehydration** (see page 16 for calculation).

Some clinicians may choose to use a slower NG infusion rate, either initially or over a longer period of time; similar to the standard IV rehydration rate (see page 16).

If the child tolerated the NG rehydration but fails the subsequent trial of oral fluids, the child will usually need to stay in hospital. If further fluid in addition to that taken orally is required after reassessment, this can be given via the nasogastric tube. **A second administration of “rapid” NG rehydration should not be given** (see page 16 for calculation). At this point UEC and BGL should be checked to ensure that an electrolyte abnormality is not the cause for failure of rehydration.

NG rehydration is most suitable for infants and young children. From a practical view point, older children would be more suitable to be rehydrated orally or intravenously.

## 8 INTRAVENOUS FLUID THERAPY

### 8.1 Introductory notes

When IV fluid therapy is commenced, the first decision is whether the child is severely dehydrated and needs resuscitation (see below).

- When resuscitation fluid (a bolus) has been given for shock, and the signs of shock corrected, then the next phase of treatment is to provide standard IV rehydration.
- If a bolus has not been needed, the next phase of treatment is to provide either rapid IV rehydration or standard IV rehydration.
- In this guideline, 0.9% sodium chloride + 5% glucose is considered to be an isotonic solution, as the glucose is rapidly metabolised after infusion.



- Whenever an IV cannula is inserted for the provision of IV fluids, blood should be withdrawn and sent for UEC and BGL.
- Children with gastroenteritis and dehydration are at risk of hypoglycaemia; any fluid used for rehydration should contain some glucose. For hypoglycaemic children (i.e. BGL <2.6 mmol/L), treat with **2mL/kg** of 10% glucose and recheck BGL within 20-30 minutes. Check urinalysis for ketones. Most healthy children who have ketonuria and hypoglycaemia in this situation will be due to starvation. Consult a paediatrician and discuss any need for further investigations.
- For standard IV rehydration therapy (**not** rapid IV rehydration – see below) use 0.9% sodium chloride + 5% glucose +/- 20mmols/L potassium chloride.
- **DO NOT USE ANY FLUID CONTAINING LESS SODIUM THAN 0.9% SODIUM CHLORIDE FOR REHYDRATION OR REPLACEMENT FLUIDS.**

***“Keep your patient safe: If a child or neonate is prescribed IV Fluids not recommended in the NSW Standards for Paediatric IV Fluids then please clarify reason”***

When ordering IV fluids it must be written in full such as:  
“0.9% sodium chloride + 5% glucose”  
Alternatives like dextrose & abbreviations like NaCl, N/S & N/2 **must not be used.**

## 8.2 Resuscitation

- Where severe dehydration is accompanied by shock or imminent shock, bolus administration of intravenous fluids for resuscitation is required. Commence with intraosseous infusion if IV access cannot be established. If neither is possible commence nasogastric rehydration while awaiting assistance. These administration routes do not negate the need for an IV line.
- Percentage of 0.9% sodium chloride 20 mL/kg or Hartmann’s solution, 20 mL/kg, should be given **IV/IO** over 5-10 minutes. These fluids should NOT contain glucose or potassium chloride.
- For hypoglycaemic children (i.e. BGL <2.6 mmol/L), treat with 2mLs/kg of 10% glucose and recheck BGL within 20-30 minutes.
- Check serum electrolytes.
- Repeat boluses of 10-20 mL/kg until signs of shock are reversed.
- After signs of shock are reversed, proceed to **standard rehydration** (see page 16).

## 8.3 Rapid Intravenous (IV) Rehydration

- Rapid rehydration refers to the correction of dehydration over a relatively short time e.g. 4 hours, with the expectation that the child may subsequently be able to be discharged from hospital if tolerating oral fluids. This method has been shown to be safe and effective.<sup>16</sup> **THE IV FLUIDS MUST NOT BE CONTINUED AT THE RAPID RATE BEYOND 4 HOURS.**
- All children should be given a trial of oral fluids during or after rapid IV rehydration has finished. IV fluids should only be recommenced after careful reassessment of the child

and if the child still has signs of dehydration, or there are significant ongoing losses. These should be given at standard rehydration rates only (i.e. rapid IV rehydration should NOT be repeated).

- The advice on rapid IV rehydration in this guideline applies only to those children with gastroenteritis.
- Do **NOT** use rapid rehydration if:
  - The patient is less than 6 months old
  - The patient is severely dehydrated (10%) or shocked
  - The patient has an altered level of consciousness
  - The serum sodium, if known, is <130 mmol/L or >149 mmol/L.
- Establish IV access. Send blood for UEC and BGL. Also check the BGL by bedside meter as this is good clinical practice. Results should be available and checked within 1 hour. If laboratory access to this turnaround is not available then do not use rapid IV rehydration.
- Perform observations – respiratory rate(RR), heart rate(HR), capillary refill(CR), blood pressure(BP), temperature(T), and assessment of mental state before commencing, then repeat RR, HR, CR, BP at least hourly. Record on Standard Paediatric Observation Chart and escalate if required.
- Commence 0.9% sodium chloride + 5% glucose (**no potassium chloride**) at 10 mL/kg/hr and continue for 4 hours.
- **Percentage of 0.45% sodium chloride + 5% glucose and potassium chloride MUST NOT be used for rapid or standard IV rehydration.**
- After 4 hours, flush and cap IV cannula and oral fluids should be offered. The treating doctor should re-examine the child. Small amounts of oral fluids may be commenced earlier, during IV rehydration, if appropriate. Intravenous fluids should only be recommenced if on review the child still has signs of dehydration, or if there are significant ongoing losses.
- If the rapid rehydration has been completed late at night, and the child has no signs of dehydration, the child may safely be allowed to sleep with the IV capped, with a trial of oral fluids to commence when the child wakes.
- It is expected that the clinical status (e.g. heart rate, perfusion and mental state) of the child receiving rapid rehydration for gastroenteritis should gradually improve. Failure to improve, any deterioration or development of unexpected signs or symptoms should lead to a medical reassessment, reconsideration of the diagnosis and management, and discussion with a Paediatrician.

#### 8.4 Standard Intravenous (IV) Rehydration

- Standard rehydration refers to the provision of maintenance fluids, and the correction of dehydration, usually over 24 hours.
- When the IV cannula is inserted, send blood for UEC and BGL. It is important to check UEC results within an hour.
- Use 0.9% sodium chloride + 5% glucose +/- 20mmols/L potassium chloride.

**DO NOT USE ANY FLUID CONTAINING 0.45% (OR LESS) SODIUM CHLORIDE**

- **For Neonates (< 28 days) use:**
  - 0.45% sodium chloride + 10% glucose +/- 20mmols/L potassium chloride  
OR
  - 0.9% sodium chloride + 10% glucose +/- 20mmols/L potassium chloride for occasional use in dehydrated neonates under expert supervision.
- Calculate the total volume of IV fluids likely to be needed for the next 24 hours, being maintenance and deficit. Do not include fluids already given for resuscitation. If resuscitation has been required, reassess dehydration state **now** and calculate fluid requirement from **now**. Note that this calculation is a “starting point” which will be reviewed according to progress, including assessment of general appearance, heart rate, urine output, ongoing losses (vomiting, diarrhoea), or fever, at intervals of not more than 6 hours.
- The majority of children will not require rehydration for more than a 5% deficit in the first 24 hours.
- The volumes for rehydration and maintenance are calculated separately, as the basis for calculation of each is different.
- For **rehydration**:  $Wt \text{ (in kg)} \times \% \text{ dehydration} \times 10 = \text{mL deficit needed for rehydration}$ . For example, a 9 kg child estimated to be 5% dehydrated, rehydration volume is  $9 \times 5 \times 10 = 450 \text{ mL}$ . (see Table 1 on page 5 for a guide to assessing dehydration)
- For **maintenance**: Calculate volume according to the child’s weight, as in the following table:

Body Weight	Fluid requirement mL/ day	Fluid requirement mL/ hour
First 10 kg	100 mL/kg	4 mL/kg/hr
Second 10 kg	+ 50 mL/kg	+ 2 mL/kg/hr
Subsequent kg	+ 20 mL/kg	+ 1 mL/kg/hr

E.g. A child weighing 25 kg has a maintenance fluid requirement for 24 hours of:

$$(10 \times 100) + (10 \times 50) + (5 \times 20) = 1600 \text{ mL per 24 hours.}$$

Note:

- Maintenance fluids for infants less than 6-9 months is 120mL/kg
- There are alternative methods for calculating maintenance fluid requirements. (see Appendix 8 for an example)
- Add the two volumes (rehydration and maintenance) together. Calculate the rate to give the total volume over 24 hours.
- Formal review by a Medical Officer within 6-8 hours is generally required. Assess hydration status. Check patient physically, including mental state.
- Take note of parental observations or concerns.
- Rapid improvement over 2-4 hours is the “norm”. Onset of any new symptoms e.g. drowsiness, headache, abdominal pain, demand urgent review. Atypical behaviour of the patient should raise the question of an alternate diagnosis.

- Repeat UEC if the child still appears unwell, if the electrolytes were markedly abnormal initially, or if the child was seriously unwell initially. Repeat UEC should also be planned for the child who continues on IV fluids. Any child remaining on intravenous fluids should have UEC performed at least every 24hrs but may be required more frequently if clinically indicated.
- Include potassium ~3 mmol/kg/24hrs when urine is passed, if initial serum potassium was normal (up to 5 mmol/kg/24hrs if marked hypokalaemia is present). Use of standard IV Fluid bags with added potassium chloride (500mL or 1000mL) should be used – see [Standards for Paediatric IV Fluids](#).

### 8.5 Hypernatraemia (serum sodium >149 mmol/L)

**Do not follow the Acute Gastroenteritis Guideline for fluid administration. Early consultation with a Paediatrician is essential.**

- Hypernatraemic dehydration is uncommon, but potentially more dangerous than when serum sodium is initially normal or slightly low. There is a greater likelihood of cerebral oedema, seizures and brain damage.
- Clinically the degree of dehydration may be underestimated.
- If shock is present, resuscitate with a fluid bolus of 20 mL/kg, using 0.9% sodium chloride or Hartmann's solution.
- Continuing rehydration should proceed slowly (usually over at least 48 hours) using 0.9% sodium chloride + 5% glucose +/- 20mmols/L potassium chloride.

### 8.6 Hyponatraemia (serum sodium <135 mmol/L)

- **Do not use any fluid containing less sodium than 0.9% sodium chloride.**
- If there is severe hyponatraemia (serum sodium <130 mmol/L), ensure that the IV fluid being given is 0.9% sodium chloride + 5% glucose, and discuss **urgently** with a Paediatrician.

## 9 INVESTIGATIONS AND OBSERVATIONS

- Generally children being enterally rehydrated do not require blood tests.
- If nasogastric rehydration is required beyond 4 hours of rapid nasogastric rehydration, check UEC and BGL. Medical reassessment of the patient, including hydration status, is required.
- All children with severe dehydration or with intravenous therapy, need UEC, BGL.
- Consider blood culture and FBC if the child has a temperature >39°C.
- Generally urine culture is not required but urinalysis is helpful.
- It is generally unnecessary to send stool for microscopy, culture & sensitivities (MC&S) or viral studies. In some circumstances (e.g. bloody diarrhoea, history of travel, and community outbreak of gastroenteritis) it may be appropriate to undertake these tests.
- Infants and children who are severely dehydrated require constant observation and monitoring, including, where possible, cardiac monitoring, pulse oximetry, frequent blood pressure measurement and urine output measurement.

- Every child being treated in hospital for gastroenteritis, whether or not having intravenous therapy, requires observation of, and recording of, standard observations (e.g. pulse, respiration, temperature etc.) on a regular basis (not less than 4 hourly).
- Children needing IV fluid therapy require UEC and BGL check at initial assessment. If initial UEC was markedly abnormal, or if the child's condition has not started to improve, or if the child was severely dehydrated recheck UEC at 6-8 hours. Results should be checked within two hours.
- If there is failure to improve, deterioration or development of new signs, there should be discussion with the Admitting Medical Officer.
- A daily lightly clothed weight can be a useful clinical parameter in the assessment of progress after admission, as well as a retrospective guide to the accuracy of the initial assessment of dehydration.

## 10 REINTRODUCTION OF DIET

Children who are not dehydrated should continue to be fed an age appropriate diet. Children who require rehydration should recommence age appropriate diets as soon as vomiting settles. This should be within the first 12-24 hours. Formula fed infants should recommence full strength formula.

Refer to Gastroenteritis Fact Sheet jointly developed by the Children's Hospital Westmead, the Sydney Children's Hospital and the John Hunter Children's Hospital:

[The Gastroenteritis Fact Sheet](#) is available for written advice for parents.

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## 11 APPENDICES

### 11.1 Appendix 1 – References

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### 11.3 Appendix 3 – Glossary

Admitting Medical Officer	Most senior medical officer under whom the child is admitted to hospital
BGL	Blood Glucose Level
CERS	Clinical Emergency Response System <a href="#">See PD2013_049</a>
FBC	Full Blood Count
Hartmann's solution	Isotonic intravenous solution (see 'Composition' table Appendix 4)
ORS	Oral Rehydration Solution
UEC	Urea, Electrolytes, and Creatinine. Ideally this should include measurement of serum sodium, potassium, chloride, bicarbonate, urea and creatinine. It is recognised that not all local laboratories offer all of these parameters 24 hours. It is essential that the serum sodium be measured on any child who is receiving intravenous rehydration therapy.
MC&S	Microscopy, culture & sensitivities

## 11.4 Appendix 4 – Intravenous Therapy (IVT) Composition

	Osmolality mOsm/L	Na <sup>+</sup> mmol/L	Cl <sup>-</sup> mmol/L	Glucose g/L	K <sup>+</sup> mmol/L
0.9% Sodium Chloride	300	150	150	-	-
Hartmann's Solution	274	129	109	-	5
0.45% Sodium Chloride & 5% Glucose	292	76	76	25	-
0.9% Sodium Chloride & 5% Glucose	448	150	150	25	-

## 11.5 Appendix 5 – Parent Oral Rehydration Documentation Form

### Oral Fluids for your Child with Gastroenteritis

Please give your child:

1. Frequent Breast Feeds if you are breast feeding or
2. An Oral Rehydration Solution

**Dilute juice (e.g. 1 part Apple Juice to 4 parts water) is not as effective but sometimes may be used if your child is Not dehydrated**

Your child's weight is \_\_\_\_\_kg.

Your child should drink about \_\_\_\_\_ mL every 5 minutes ( $\frac{1}{2}$  mL/kg) or 1 Hydralyte<sup>®</sup> iceblock (62.5mL) every \_\_\_\_\_ minutes




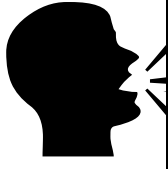


Use the 10 mL syringe to measure the fluid unless using Hydralyte<sup>®</sup> iceblock.

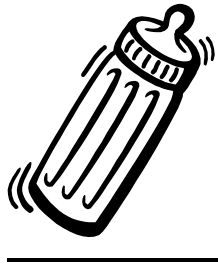
Give the fluid to your child in a syringe, teaspoon, bottle or cup.

(One Hydralyte<sup>®</sup> iceblock = 62.5 mL)

Place patient identification sticker here

Please record every time you give your child fluid and every time your child vomits, passes urine or has diarrhoea :

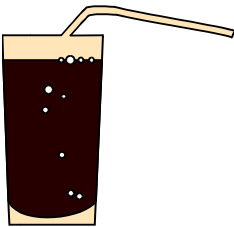
	TIME	FLUID TYPE	VOLUME	VOMIT	DIARRHOEA	URINE
						
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
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**ORAL FLUIDS for**  
**YOUR CHILD with GASTROENTERITIS**



The nurse who assessed your sick child has placed you into an appropriate category for urgency to see the doctor. It is most likely that your child has gastroenteritis and needs fluid treatment. Here in hospital we use oral fluids while you are waiting to see a doctor.



If you have been giving your child fluids at home, you are probably here because you feel this has been unsuccessful. The way we give oral fluids here may be slightly different and is often successful. The other side of this sheet explains exactly how much fluid and how often we want you to give it to your child.

When your child sees the doctor a decision will be made as to whether you can go home, or whether your child needs a small tube through the nose into the stomach or a drip to provide extra fluid for a few hours. Sometimes this is all it takes to make your child feel a lot better and you will then be able to go home. If this doesn't improve your child, he or she may need to be admitted to hospital for further treatment.



## 11.6 Appendix 6 – Parent Information

[A Gastroenteritis Fact Sheet](#) jointly developed by John Hunter Children's Hospital, Sydney Children's Hospital, and Children's Hospital Westmead, is available.

**Disclaimer: The fact sheet referred to is for educational purposes only. Parents should consult with their doctor or other health professional to ensure the information is right for their child.**



## 11.7 Appendix 7 – Resources

Fuller details may be necessary in practice, especially for the management of children with moderate or severe dehydration. Possible sources include:

- NSW Health Department CIAP website, Managing Young Children and Infants with Gastroenteritis in Hospitals at: <http://www.ciap.health.nsw.gov.au>
- The Children's Hospital Westmead Handbook, 2004 (Sections 7 - Fluid Therapy, and Section 16 - Gastroenterology), available as a book from the [Children's Hospital at Westmead](#)
- [Gastroenteritis Fact Sheet](#) jointly developed by the John Hunter Children's Hospital, and Sydney Children's Hospitals Network, or at [www.kaleidoscope.org.au](http://www.kaleidoscope.org.au)
- [Standards for Paediatric Intravenous Fluids: NSW Health, 2015](#)

## 11.8 Appendix 8 – Alternative Calculation for Maintenance Fluids

**Calculate the maintenance fluid requirement, for 24 hours, by age:**

- Infants up to 9 months: 120-140mL/kg/24hrs
- Children 9-24 months: 90-100mL/kg/24hrs
- Children 2-4 years: 70-90mL/kg/24hrs
- Children 4-8 years: 60-70mL/kg/24hrs
- Older children: 50-60mL/kg/24hrs

## 11.9 Appendix 9 – Working Party Members

### **Dr Christopher Webber (Chair)**

Paediatric Emergency Physician and Consultant Paediatrician  
Emergency Department  
Sydney Children's Hospitals Network, Randwick

### **Dr Matthew Chu**

Director of Emergency Medicine  
Canterbury Hospital

### **Dr Steven Doherty (to March 2007)**

Emergency Physician,  
Emergency Department  
Tamworth Hospital

### **Dr Patrick Moore**

Staff Specialist Paediatrician  
Fairfield Hospital

### **Dr Kristen Neville**

Paediatric Endocrinologist  
Sydney Children's Hospitals Network, Randwick

### **Dr Susan Phin**

Paediatric Emergency Physician  
Emergency Department  
Sydney Children's Hospitals Network, Westmead

### **Ms Rhonda Winskill**

Clinical Nurse Consultant, Paediatrics  
Hunter New England Area Health Service

### **Ms Leanne Crittenden**

Coordinator,  
Northern Children's Healthcare Network

### **Ms Mary Crum**

Senior Analyst  
NSW Kids and Families

### **Ms Jane Cichero (since April 2014)**

Paediatric Guideline Coordinator  
NSW Kids and Families