

“Ensuring Children with Diarrhoea Receive the Best Possible Care”



**Evidence-Based Practice Guideline  
for the  
Management of Diarrhoea  
with or without Vomiting  
in Children**

13 July 2007

Adapted with permission from the “Guideline for the management of children presenting to hospital with diarrhoea, with or without vomiting” developed by the Paediatric Accident and Emergency Research Group, 2003.

'Health for Kids in the South East' is a Southern Health initiative funded by the Victorian Department of Human Services through the Hospital Admission Risk Program (HARP). This project aims to improve health outcomes for children and young people in the Southern Health catchment area by supporting evidence-based best practice and facilitating partnerships within and between acute and community health services

Electronic copies of this report can be obtained from the Health for Kids in the South East Internet site at:

<http://www.mihsr.monash.org/hfk/pdf/hfkgastroguideline.pdf>

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This guideline was adapted with permission from "Guideline for the management of children presenting to hospital with diarrhoea, with or without vomiting" developed by the Paediatric Accident and Emergency Research Group, 2003.

We thank the following people for their important contribution to the development of this guideline.

<b>Name</b>	<b>Role</b>	<b>Contribution</b>
Vijaya Sundararajan	Senior Epidemiologist Department of Human Services	Provision of Victorian Hospital data on croup presentations
Emily England John Wheeler	Metropolitan Ambulance Service (MAS)	Consultation in regard to MAS protocols
David Meldrum	Senior Medical Staff, Casey Hospital Emergency Department	Feedback on fluid management in children with severe dehydration

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### **Disclaimer**

This guideline is designed to assist clinicians by providing a framework of expected care based on the best available evidence at the time of publication. It should not replace clinical judgement in patient care

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## Summary of Recommendations

### Diagnosis, Assessment of Severity and Prognosis

**D** Diarrhoea is defined as a change in bowel habit for the individual child resulting in substantially more frequent and/or looser stools. Page 13

**D** The following differential diagnoses should be considered in a child who presents with diarrhoea: 14

<b>Clinical clue</b>	<b>Possible diagnosis</b>
<b><i>Gastroenteritis</i></b>	
Loose stools; rare blood; rare white blood cells; respiratory symptoms	Viral gastroenteritis
Loose/watery stools; variable blood; polymorphonuclear cells common; crampy abdominal pain; seizure ( <i>Shigella</i> )	Bacterial gastroenteritis /Food poisoning
Multi-system involvement, weight loss	Parasitic gastroenteritis
<b><i>Other - Acute Diarrhoea</i></b>	
Dysuria; frequency; burning on urination	Urinary tract infection
Loose stools; abdominal pain shifting to right lower quadrant; high fever if perforated	Acute appendicitis or peritonitis
Abdominal distension; bloody stool with mucous;	Intussusception
Anorexia; loose stools; taking antibiotics	Antibiotic toxicity
<b><i>Other - Chronic Diarrhoea</i></b>	
Anaemia; watery stools with blood	Milk allergy/intolerance
Poor growth; anaemia; profuse, bulk, pale, frothy stools	Gluten sensitivity (Coeliac disease)
Urgency; tenesmus; weight loss	Ulcerative colitis
Weight loss; perianal disease	Regional enteritis (Crohn's disease)
Respiratory infections; poor growth; fatty, bulky, foul smelling stools	Cystic fibrosis
Abdominal distension; lethargy; poor growth; green, watery, foul smelling stools	Hirschsprung's disease

<b>C</b>	The following clinical features should alert the clinician to look for causes other than acute infectious gastroenteritis for a child's diarrhoea with or without vomiting: <ul style="list-style-type: none"> <li>• Abdominal pain with tenderness with or without guarding</li> <li>• Pallor or jaundice or oligo/anuria</li> <li>• Blood in the stool</li> <li>• Shock</li> <li>• Bilious vomiting</li> </ul>	15
<b>A</b>	In children with diarrhoea, signs of dehydration are imprecise, making it difficult to accurately assess the severity of dehydration.	16
<b>A</b>	Capillary refill time, skin turgor and respiratory pattern are the most useful measures of dehydration. Assessment of severity of dehydration should be made on the basis of these measures, and other key measures, in combination.	16
<b>A</b>	Parental report of normal urine output decreases the likelihood of dehydration, however reported history of low urine output does not increase the likelihood of dehydration.	16
<b>D</b>	The following factors in the history of a child presenting with diarrhoea should alert the clinician to a high risk of dehydration: <ul style="list-style-type: none"> <li>• Infants &lt;6 months</li> <li>• More than 8 significant diarrhoeal stools in the last 24 hours.</li> <li>• More than 4 significant* vomits associated with diarrhoea in the last 24 hours.</li> <li>• Co-morbid conditions such as short gut or metabolic illnesses, and developmental delay.</li> <li>• Refusal of oral fluids</li> </ul> <p><i>*A 'significant' vomit is anything more than an effortless, small volume, possett.</i></p>	18
<b>C</b>	There is no evidence to support routine stool culture. The following clinical features are associated with an increased risk of bacterial gastroenteritis and hence a stool sample should be sent for culture: <ul style="list-style-type: none"> <li>• A history of blood with or without mucous in the stool</li> <li>• A combination of abrupt onset of diarrhoea with more than 4 stools per day and no vomiting pre diarrhoea</li> <li>• Temperature &gt; 40 degrees</li> <li>• 5 or more stools in the previous 24 hours</li> </ul>	20
<b>D</b>	<ul style="list-style-type: none"> <li>• Systemically unwell, severe or prolonged diarrhoea</li> <li>• A history suggestive of food poisoning</li> <li>• Recent history of travel abroad</li> </ul>	20
<b>D</b>	There is no evidence to support routine urinalysis in children with diarrhoea. Urinalysis may be warranted in children with diarrhoea and suspected urinary tract infection.	20

**D** There is no evidence to support routine analysis of electrolytes, urea/creatinine or bicarbonate. 22

The child who presents with diarrhoea with or without vomiting should have blood taken for urea/creatinine, electrolytes and bicarbonate in the following circumstances:

- Severe dehydration with circulatory compromise
- Moderate dehydration where there is concern that the child may be hypernatraemic
- Moderate dehydration where diagnosis is unclear or there are other co-morbid factors.
- When intravenous rehydration is required
- When there is a 12 hour or greater history of anuria

## Management

	Page
<b>A</b> Oral rehydration should be the standard treatment for children with mild-moderate dehydration secondary to gastroenteritis (see below for the type of ORS).	23
<b>D</b> Oral rehydration solution is more effective than water, diluted fruit juice, diluted soft drinks or diluted cordial in rehydrating children with diarrhoea.	23
<b>A</b> Reduced osmolarity ORS (with a sodium concentration of 75mmol/litre, and glucose concentration of 75mmol/litre) should be used for rehydration of children with acute gastroenteritis. Commercial solutions conforming to this include <b>Repalyte</b> , <b>O.R.S</b> , <b>Gastrolyte</b> , <b>Hydralyte</b> and <b>Pedialyte</b> .	24
<b>A</b> Rice based ORS do not significantly reduce stool output compared to glucose based ORS in children with non-cholera diarrhoea.	25
<b>D</b> Children with mild dehydration, or those children with diarrhoea at risk of dehydration should be given usual fluids at an increased rate. Avoid carbonated drinks or undiluted juice.	25
<b>D</b> Children at risk of dehydration should continue to receive increased volumes of usual fluids. Parents/carers should take particular care to maintain increased volumes of fluid intake if the child continues to have diarrhoea and vomiting.	25
<b>D</b> Children who have moderate dehydration secondary to acute gastroenteritis should be rehydrated with oral rehydration solution 20ml/kg/hr given in small amounts, for 4 hours.	25

D	In children with moderate dehydration, oral rehydration solution should be provided in aliquots of approximately 5ml/kg every 15 minutes, whenever this is practically possible <sup>**</sup> .	26
D	In children with moderate dehydration, nasogastric rehydration with ORS may be delivered either as intermittent boluses or continuously.	26
D	Additional volumes of ORS are not necessary to replace ongoing losses if the child is tolerating fluids and their clinical status is being reviewed frequently	26
D	If a child is unable or unwilling to accept oral fluids over approximately 1 hour, or their hydration status worsens over this period, use nasogastric rehydration	27
D	If a child is unable to accept nasogastric fluids (eg persistent vomiting), consider reducing the rate of nasogastric fluids or use intravenous rehydration	27
D	Children who have circulatory compromise ("shock") secondary to acute gastroenteritis should have their circulation restored by rapid IV infusion of normal saline with a 20ml/kg bolus. Experienced medical staff should be involved early.  A further bolus of 20ml/kg should be given if the circulation is still compromised 10-15 minutes after administration of initial bolus. If further boluses are required involve senior medical staff.	28
D	Once a child with severe dehydration has had their circulating fluid volume restored with IV fluid, they should receive continuing intravenous rehydration at 20ml/kg/hr for 4 hours and then be reviewed.	29
D	Once a child with severe dehydration has had their circulating fluid volume restored with IV fluid, and is receiving continuing intravenous rehydration they should be encouraged to also accept oral fluids as soon as possible.	29
D	The child with hypernatraemic dehydration ( $\text{Na} > 150\text{mmol/L}$ ) secondary to acute gastroenteritis should be rehydrated with ORS, giving their estimated deficit over at least 12 hours in discussion with senior medical staff.	29
D	Children with acute gastroenteritis with hypernatraemia should have their plasma biochemistry reassessed before discharge from hospital, and at least once every 4 hours while being rehydrated until sodium levels normalise.	29
D	The child with hyponatraemic dehydration ( $\text{Na} < 130\text{mmol/L}$ ) secondary to acute gastroenteritis should be rehydrated slowly with ORS, in discussion with senior medical staff.	30

D	Children with acute gastroenteritis hyponatraemia should have their plasma biochemistry reassessed before discharge from hospital, and at least once every 4 hours while being rehydrated until sodium levels normalise.	30
A	Breast feeding infants should continue to breast feed through the rehydration and maintenance phases of their acute gastroenteritis illness.	31
A	An age appropriate diet (including full strength lactose containing milk) should be restarted in non-breast fed children following initial rehydration with ORS (normally given over 4 hours).	31
D	Children who request food or report being hungry should not be denied food, even if they are receiving IV fluids. Give small portions of usual foods - avoiding foods high in sugar or fat.	31
D	Consider lactose intolerance in children with diarrhoea which continues longer than 7 days.	32
D	In children with post infectious lactose intolerance after acute diarrhoea <ul style="list-style-type: none"> <li>○ Breast feeding should continue unless buttock excoriation and failure to gain weight persist</li> <li>○ Formula feeding should be with lactose free formula for a period of three to four weeks, then usual formula.</li> </ul>	32
A	Loperamide is not recommended for the treatment of acute gastroenteritis in children	34
D	Anti-diarrhoeal medication should not be used in children with acute gastroenteritis.	34
A	Metoclopramide should not be prescribed for children with diarrhoea and vomiting as it does not reduce emesis and appears to increase the duration and/or severity of diarrhoea in children.	34
D	Anti-emetics should not usually be prescribed for children with diarrhoea and vomiting.	35
A	Probiotics are a useful adjunct to rehydration therapy in children with diarrhoea. However formulations of proven efficacy in these children (lactobacillus caseii GG or 'Biolactis') are not currently available in Australia. Other probiotics may be effective, however they cannot be recommended without further research.	36
D	Children with diarrhoea and fever may be treated with paracetamol to bring their temperature down and reduce irritability. Carefully consider and exclude other potential causes of fever, irritability and pain before giving paracetamol.	36

<b>D</b>	Antibiotics should not usually be prescribed for children with diarrhoea and vomiting.	37
<b>D</b>	In children with fever and bloody diarrhoea only consider antibiotics in consultation with a senior emergency physician or paediatrician.	37
<b>D</b>	<ul style="list-style-type: none"> <li>• Children with severe dehydration must receive immediate care in an acute medical facility.</li> <li>• Those children with moderate dehydration should be observed in a medical facility until adequately rehydrated, then discharged with appropriate advice and medical review arrangements.</li> <li>• Those children at high risk of dehydration on the basis of young age, high frequency of watery stools or vomits, should be given appropriate advice and have early medical review arranged.</li> <li>• Those children whose parents or carers are thought to be unable to manage the child's condition at home successfully should be admitted to hospital.</li> </ul>	38
<b>D</b>	Children with acute gastroenteritis should be weighed after 4 hours rehydration, before discharge, and at least once every 24 hours while the child is in hospital. Children who wear nappies should be bare weighed.	39
<b>D</b>	The management of children with acute gastroenteritis who have plasma abnormalities other than hyponatraemia or hypernatraemia should be decided in discussion with senior medical staff.	39
<b>D</b>	Children with diarrhoea which continues longer than 7 days should be reassessed by a medical practitioner to determine whether there are other causes.	39
<b>Patient Information</b>		
<b>D</b>	Parents/carers should be given an information sheet concerning the home management of diarrhoea with or without vomiting on discharge home.	Page 43

# 1. Introduction

These Guidelines were developed by the Health for Kids in the South East Gastroenteritis Guideline Development Group (GDG) at Southern Health in 2005. For the most part they were adapted (with permission) from the "Guideline for the management of children presenting to hospital with diarrhoea, with or without vomiting" developed in 2003 by the Paediatric Accident and Emergency Research Group (PAERG) based at the University of Nottingham in the United Kingdom.

The PAERG guideline was determined by the Health for Kids in the South East Gastroenteritis Guideline Development Group to be a relevant, recent, high quality evidence-based clinical practice guideline. Rather than duplicate the enormous body of work already carried out, the GDG asked for and received permission from Dr Kate Armon of PAERG to adapt their guideline for use at Southern Health.

The PAERG guideline was intended for use by clinicians in emergency departments and acute paediatric assessment units. In this adaptation the scope of the guideline has been expanded to include management of diarrhoea by general practitioners and on inpatient wards. This has necessitated some additional content. Changes have also been made to align consensus recommendations with local practice and to adapt recommendations for local use. Modified and/or new sections are in comic sans font for easy recognition.

It is intended that the Southern Health adaptation of these guidelines be updated every 2 years, to reflect changes in the best available evidence and any relevant local changes. This adaptation will therefore be due for review in July 2007.

## 1.1 Statement of intent

It is the aim of this guideline

- To provide clinicians with recommendations for the management of children aged 3 months and older presenting with diarrhoea with or without vomiting.
- To promote consistency of care of patients with similar clinical problems in general practice and hospital settings.
- To promote the use of oral rehydration which is the appropriate treatment for the majority of children who present with gastroenteritis.

It is important to remember that guidelines are only one tool used to improve patient care. Clinical acumen and judgement must always be used in conjunction with the guideline. Research is a continuum and it may be necessary to alter practice in light of new evidence before the guideline has been up-dated. It is also important for all clinicians to

remember that all guidelines must be used in association with individual patient needs and preferences.

The key recommendations of this **guideline** are intended to direct the clinician to the most appropriate management of patients based on the best evidence available from the literature.

Recommendations have also been included based on a multidisciplinary consensus opinion to provide guidance in clinically important areas where evidence is lacking. The guideline is transparent about which recommendations are evidence based and which are based on consensus opinion.

## 1.2 Scope of the guideline

- This policy is for the child presenting to **either an emergency department or a general practice** with acute diarrhoea (<7 days) with or without vomiting.
- Children presenting with vomiting alone or chronic diarrhoea (>7 days) are not considered.
- This algorithm is intended for use when a child is first seen. Further management decisions over the next 6-12 hours and indications for review and discharge are also given.

Key areas covered:

- Symptoms and signs that may alert the clinician to diagnoses other than infectious gastroenteritis
- Assessment of the degree of dehydration
- Indications for laboratory investigations
- Management of rehydration and indications for oral, **nasogastric** and intravenous routes
- Management of hypernatraemia and **lactose intolerance**
- **Infection control**
- Indications for admission and discharge

### Guideline Exclusions

- Children less than three months old
- Children with chronic diarrhoea

Table 1: Key to evidence statements and grades of recommendation

## KEY TO EVIDENCE STATEMENTS AND GRADES OF RECOMMENDATIONS

### LEVELS OF EVIDENCE

1 <sup>++</sup>	High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1 <sup>+</sup>	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias
2 <sup>++</sup>	High quality systematic reviews of case-control or cohort studies or high quality case-control or cohort studies with a very low risk of confounding, bias, or change and a moderate probability that the relationship is causal
2 <sup>+</sup>	Well conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal
2	Case-control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal
3	Non-analytical studies e.g. case reports, case series
4	Expert opinion

### GRADES OF RECOMMENDATIONS

Note: The grade of recommendation relates to the strength of the evidence on which the recommendation is based. It does not reflect the clinical importance of the recommendation.

<b>A</b>	At least one meta-analyses, systematic review or RCT rated as 1 <sup>++</sup> , and directly applicable to the target population, and demonstrating overall consistency of results
	Or a body of evidence consisting principally of studies rated as 1 <sup>+</sup> , directly applicable to the target population, and demonstrating overall consistency of results
<b>B</b>	A body of evidence including studies rated as 2 <sup>++</sup> , directly applicable to the target population, and demonstrating overall consistency of results;
	Or extrapolated evidence from studies rated as 1 <sup>++</sup> or 1 <sup>+</sup>
<b>C</b>	A body of evidence including studies rated as 2 <sup>+</sup> , directly applicable to the target population and demonstrating overall consistency of results;
	Or extrapolated evidence from studies rated as 2 <sup>++</sup>
<b>D</b>	Evidence level 3 or 4;
	Or extrapolated evidence from studies rated as 2 <sup>+</sup>

## 2. Diagnosis, Assessment of Severity and Investigations

### 2.1 Definition of diarrhoea

Diarrhoea is present when there is an increase in the frequency, volume or liquidity of the stool relative to the usual habit of the individual. There is no research specifically addressing the definition of diarrhoea. There is a great variability in stool patterns amongst normal infants. Most papers accept a working definition of diarrhoea as follows:

#### *RECOMMENDATION*

**D** Diarrhoea is defined as a change in bowel habit for the individual child resulting in substantially more frequent and/or looser stools.

### 2.2 Differential diagnoses

Once a child has attended a **medical facility** with a presenting complaint of diarrhoea, with or without vomiting, we need to know the possible differential diagnoses and the likelihood of these. Unfortunately there are very little data available to help with this clinical question.

Conway<sup>14</sup> performed a prospective hospital cohort study. The aim of this study was to document the paediatric population admitted with gastroenteritis to a sub-regional infectious disease unit. Patients initially thought to have acute gastroenteritis and subsequently given other diagnoses were included. 1,148 children were enrolled of whom 59 (5%) were found to have other diagnoses, which included infections other than in the GI tract, pyloric stenosis, feeding problems and cows milk protein intolerance. This is by no means a comprehensive list as the aim of the study was not to identify end diagnoses in children with diarrhoea.

3

In the absence of **good quality** published evidence a list of differential diagnoses was sent to the Guideline Development Group and consensus agreement was achieved on **the list found in table 1**.

**RECOMMENDATION**

**D** The following differential diagnoses should be considered in a child who presents with diarrhoea:

**Table 2. Clues to alternative diagnoses in children with diarrhoea**

<b>Clinical clue</b>	<b>Possible diagnosis</b>
<b><i>Gastroenteritis</i></b>	
Loose stools; rare blood; rare white blood cells; respiratory symptoms	Viral gastroenteritis
Loose/watery stools; variable blood; polymorphonuclear cells common; crampy abdominal pain; seizure ( <i>Shigella</i> )	Bacterial gastroenteritis /Food poisoning
Multi-system involvement, weight loss	Parasitic gastroenteritis
<b><i>Other - Acute Diarrhoea</i></b>	
Dysuria; frequency; burning on urination	Urinary tract infection
Loose stools; abdominal pain shifting to right lower quadrant; high fever if perforated	Acute appendicitis or peritonitis
Abdominal distension; bloody stool with mucous;	Intussusception
Anorexia; loose stools; taking antibiotics	Antibiotic toxicity
<b><i>Other - Chronic Diarrhoea</i></b>	
Anaemia; watery stools with blood	Milk allergy/intolerance
Poor growth; anaemia; profuse, bulk, pale, frothy stools	Gluten sensitivity (Coeliac disease)
Urgency; tenesmus; weight loss	Ulcerative colitis
Weight loss; perianal disease	Regional enteritis (Crohn's disease)
Respiratory infections; poor growth; fatty, bulky, foul smelling stools	Cystic fibrosis
Abdominal distension; lethargy; poor growth; green, watery, foul smelling stools	Hirschsprung's disease

### 2.2.1 Symptoms and signs which should alert the clinician to diagnoses other than gastroenteritis

As described above the list of differential diagnoses for children presenting with diarrhoea with or without vomiting is long and varied. There are some symptoms and signs which may be helpful in alerting the clinician to more serious diagnoses such as HUS (haemolytic uraemic syndrome).

Macdonald and Beattie<sup>16</sup> carried out a retrospective review of children with intussusception over a 10 year period. Population incidence was found to be about 1 per 1000 in the first year of life. There were 110 children in whom 32% had diarrhoea at first presentation, 26% were shocked or dehydrated, 83% were vomiting (27% bilious), and 32% had bloody stool. The peak age of diagnosis was 5 months with 80% under 1. Only 42% were diagnosed correctly within 3 hours of admission.

2+

Milford<sup>17</sup> reported on the clinical and epidemiological aspects of HUS in the British Isles (1987-1989), finding cases through the British Paediatric Surveillance Unit and other sources. The overall incidence in children aged 0-15 years was 0.91/100,000. The peak incidence was in the age group 1-2 years at 3.3/100,000/year. 298 children were reported over the three-year surveillance. A prodrome of diarrhoea was present in 273 (95%) of cases and in 199 it was bloody. Diagnostic features on presentation were pallor in 92%, jaundice in 35% and oligo/anuria in 38%.

2+

Many children with diarrhoea have associated abdominal pain, a few of these children will have surgical causes for their symptoms. This sub-group of children are often difficult to differentiate and present the clinician with a diagnostic dilemma. Reynolds<sup>18</sup> looked retrospectively at children presenting with abdominal pain to the A&E department. 371 children were identified over 4 seasonally diverse months. The final diagnoses were medical in 64.4%, surgical in 6.5% and nonspecific in 29.1%. Guarding and abdominal tenderness were the two signs most strongly associated with a surgical diagnosis. The paper does not state how many children had associated diarrhoea but does say that diarrhoea was not significantly associated with surgical causes of abdominal pain.

2+

#### RECOMMENDATION

**C** The following clinical features should alert the clinician to look for causes other than acute infectious gastroenteritis for a child's diarrhoea with or without vomiting:

- Abdominal pain with tenderness with or without guarding
- Pallor or jaundice or oligo/anuria
- Blood in the stool
- Shock
- Bilious vomiting

## 2.3 Assessment of severity of dehydration

Dehydration occurs when a child or infant is losing and not replacing water and electrolytes. Infants and children with diarrhoea with or without vomiting who are not drinking adequately can become dehydrated very quickly and the consequences can be serious if dehydration is not promptly addressed.

### 2.3.1 Weight loss

The severity of dehydration is most accurately assessed in terms of weight loss as a percentage of total body weight (prior to the dehydrating episode). An accurate weight immediately pre-illness is rarely available in the clinical situation, but if it is (for example a recent weight in the parent held record) dehydration can be estimated with some accuracy.

### 2.3.2 Clinical indicators

In a systematic review<sup>68</sup> of the accuracy of symptoms, signs and basic laboratory tests for assessment of severity of dehydration in children aged between 1 month and 5 years, capillary refill time, skin turgor and respiratory pattern were found to be the most useful measures of dehydration. This review also found that while parental report of normal urine output decreased the likelihood of dehydration, history of low urine output did not increase the likelihood of dehydration. The reviewers found that there is a lack of high quality literature evaluating clinical indicators of dehydration in children and the tests of dehydration are imprecise. They note that combinations of measures, rather than single measures improve diagnostic accuracy.

1+

#### RECOMMENDATION

- A** In children with diarrhoea, signs of dehydration are imprecise, making it difficult to accurately assess the severity of dehydration.
- A** Capillary refill time, skin turgor and respiratory pattern are the most useful measures of dehydration. Assessment of severity of dehydration should be made on the basis of these measures, and other key measures, in combination.
- A** Parental report of normal urine output decreases the likelihood of dehydration, however reported history of low urine output does not increase the likelihood of dehydration.

### 2.3.3 Risk of dehydration

If a child is at high risk of becoming dehydrated, even though they are not dehydrated at the time of being seen, they need to be managed differently to the child who is *less* likely to become dehydrated. The following factors were noted in the literature to increase the risk:

#### 2.3.3.1 Age of the child

From first principles it seems reasonable that the young infant would be at higher risk of dehydration than the older child. They have increased insensible losses due to their surface area:volume ratio, they have an inherent tendency to more severe vomiting and diarrhoea, and their prime source of nutrition is milk which has a high osmotic load. This theory is born out by studies in India and Brazil. Bhattacharya<sup>45</sup> found a non significant trend towards the younger age groups (<12 months) being at more risk. Fuch<sup>44</sup> found a definite association, with young infants (<9 months and especially 2-3 months) at greatest risk of dehydrating diarrhoea.

2+

#### 2.3.3.2 Severity of symptoms

It seems reasonable to assume that the severity of the symptoms would affect risk of dehydration. Bhattacharya<sup>45</sup> in Calcutta performed a prospective case-control study. 379 infants <2 years old were enrolled on presentation with diarrhoea of <24 hours (defined as >3 loose stools in 24 hours). They were interviewed and assessed independently. The infants were then categorised as moderate/severe dehydration (cases) versus mild dehydration (controls), and risk factors compared. The most significant were withdrawal of breast feeding around the time of the illness and not giving extra fluids. Additional factors were age <12 months, stool frequency >8/day, vomits >2/day, vibrios in stool and malnutrition. Faruque<sup>45</sup> had very similar results in an almost identical trial design of 1,013 infants 1-35 months in Bangladesh. They found the same risk factors for dehydration as Bhattacharya<sup>45</sup> (age <6 months, stool >11 per day, history of vomiting) and in addition lack of maternal education.

2+

Fuchs<sup>46</sup> in a case control study in Brazil found that those who were formula fed, or who had been recently weaned from the breast were at highest risk of developing moderate to severe dehydration, independent of confounding variables.

2+

Unfortunately risk factors for dehydration have not been looked at in developed countries where rotavirus is more common and malnutrition rare, the above findings may not be directly applicable to **Australia**. In particular vomiting >2 times/day does not seem to equate with a high risk of dehydration in our clinical practice. In the UK and **Australia** rotavirus is very common<sup>69</sup> and often causes frequent vomiting as the first sign of illness, without necessarily increasing the risk of dehydration. Since there is no evidence available from *either* country the following recommendations were made based on the Delphi consensus.

**RECOMMENDATION**

- D** The following factors in the history of a child presenting with diarrhoea should alert the clinician to a high risk of dehydration:
- Infants <6 months
  - More than 8 significant diarrhoeal stools in the last 24 hours.
  - More than 4 significant\* vomits associated with diarrhoea in the last 24 hours.
  - Co-morbid conditions such as short gut or metabolic illnesses, and developmental delay.
  - Refusal of oral fluids

\*A 'significant' vomit is anything more than an effortless, small volume, posset.

**Table 3. Assessment of Severity of Dehydration**

<b>None-Minimal</b> <5% lost body weight	<b>Moderate</b> 5-10% lost body weight	<b>Severe</b> >10% lost body weight
<ul style="list-style-type: none"> <li>• Normal capillary refill time</li> <li>• Skin fold retracts immediately</li> <li>• Normal respiratory pattern</li> <li>• Normal conscious state</li> <li>• Normal drinking</li> <li>• Normal urine output</li> </ul>	<ul style="list-style-type: none"> <li>• Delayed capillary refill (3-4 seconds)</li> <li>• Skin fold retracts slowly (1-2 seconds)</li> <li>• Increased respiratory rate<sup>1</sup></li> <li>• Restless, irritable</li> <li>• Drinks eagerly, increased thirst</li> <li>• Tachycardia</li> </ul>	<ul style="list-style-type: none"> <li>• Very delayed capillary refill (&gt;4 seconds), mottled skin</li> <li>• Skin fold retracts very slowly (&gt;2 seconds)</li> <li>• Deep, acidotic breathing</li> <li>• Lethargic, unconscious</li> <li>• Unable to drink</li> <li>• Deeply sunken eyes</li> <li>• Hypotension</li> </ul>

If patient has signs or symptoms across categories, always treat according to their most severe features

## 2.4 Investigations

### 2.4.1 Stool culture

#### 2.4.1.1 Diagnosis & treatment

Once a diagnosis of acute gastroenteritis has been made clinically, the question of the aetiology of the infection arises. For the individual, it would be important to know what is causing the symptoms if treatment of the infection could eliminate them. As we shall discuss later, treatment is rarely necessary and therefore stool culture for this reason alone is not productive.

#### 2.4.1.2 Prognosis

Some might argue that we would have a clearer idea of the prognosis if we knew the aetiology. With respect to acute risk of dehydration this does not seem to be the case.

The risk of dehydration was the same for all aetiological agents except

| 2<sup>+</sup>

cholera in both Faruque<sup>47</sup> and Bhattacharya's studies<sup>45</sup>. Fortunately in **Australia** cholera is only seen rarely in children who have travelled abroad. With respect to predicting which infections are likely to become chronic, it may be useful to know the pathogen. However when a child presents acutely it is unnecessary to make this distinction.

A history of travelling must be taken seriously. There are case series which describe children with malnutrition and severe chronic diarrhoea treated in UK hospitals following an extended trip abroad but none which specifically address whether a stool sample should be sent in children presenting with acute diarrhoea following a trip abroad.

#### *2.4.1.3 Implications of aetiology for Public Health*

From a public health point of view it is clearly important to know which organisms in the community are causing infections, and more specifically whether there is any evidence of outbreaks of disease. With respect to food poisoning (shigella, salmonella, campylobacter) it is important that the source of any outbreak is traced and dealt with. The Victorian Department of Human Services (DHS) recommends that stool culture is useful when the clinician suspects that the diarrhoea might be part of an outbreak, i.e. when multiple members of the family have diarrhoea, or when a contaminated food source is the suspected cause, as well as when clinically indicated by blood in the stool, etc.

Thus it is clear from the public health point of view that some stool samples should be sent for culture. However if all patients with a short spell of diarrhoea had a stool sample sent to the laboratory for culture the lab would be overwhelmed. It therefore seems reasonable to try to limit stool specimens sent to those likely to have important (bacterial or parasitic) infections.

#### *2.4.1.4 Important historical features*

DeWitt<sup>49</sup> looked at the value of various features of history and examination and stool screening tests in predicting whether diarrhoea was caused by a bacterial agent. They studied 200 children less than 4 years old presenting to a primary care centre in the USA with diarrhoea of less than 10 days. The best predictor on clinical grounds alone of bacterial infection was a cluster of 3 historical variables- abrupt onset of diarrhoea, more than 4 stools per day and no vomiting before the onset of diarrhoea. This cluster had a sensitivity of 86% a specificity of 60%, PPV of 27% and NPV of 96%.

Diarrhoea which is frankly bloody is more likely to be caused by invasive bacteria than viruses. Finkelstein<sup>50</sup> found that in 1,035 infants under 1 year of life with diarrhoea (of which 108 (10.4%) had a bacterial cause), 5 or more stools in the previous 24 hours had the highest sensitivity (67%) as a single predictor. Temperature >40 degrees had the highest positive predictive value. Combinations of temperature >39°C and >10 stools per day or blood in the stool with >10 stools/day were useful with positive predictive values of 64% and 63% respectively.

Conway<sup>14</sup> looked at 1148 children <16 years with diarrhoea, in whom 153 (13%) had bacterial, protozoal or mixed pathogen aetiology. They found that the bacterial group had a statistically significant higher stool frequency of >7 per day, but the difference was of little use to the clinician (36% in bacterial group and 26% in rotavirus group, no figures given to calculate sensitivity etc). They also found that the stool more frequently contained blood or mucous (25% in the bacterial group compared with 2.8% in the viral group). | 4

In Milford's study of HUS<sup>17</sup>, 199 children (73%) had a prodrome of bloody diarrhoea, with 178 of these growing colliforms in the stool. | 2+

### RECOMMENDATION

There is no evidence to support routine stool culture. The following clinical features are associated with an increased risk of bacterial gastroenteritis and hence a stool sample should be sent for culture:

- C**
  - A history of blood with or without mucous in the stool
  - A combination of abrupt onset of diarrhoea with more than 4 stools per day and no vomiting pre diarrhoea
  - Temperature > 40 degrees
- D**
  - 5 or more stools in the previous 24 hours
  - Systemically unwell, severe or prolonged diarrhoea
  - A history suggestive of food poisoning
  - Recent history of travel abroad

### 2.4.2 Urine Analysis

No studies were identified which addressed when urine should be collected from children with diarrhoea for urinalysis. It is very difficult to collect a clean urine sample in children with diarrhoea. In the absence of evidence a consensus recommendation was made by the GDG.

### RECOMMENDATION

- D** There is no evidence to support routine urinalysis in children with diarrhoea. Urinalysis may be warranted in children with diarrhoea and suspected urinary tract infection.

### 2.4.3 Biochemistry

No studies were identified that specifically investigated when to measure plasma electrolytes. Most episodes of dehydration caused by diarrhoea in developed countries are isonatremic. Even when there is derangement of electrolytes in the serum, this is due to relative losses of salt and water. It is clear from several hospital cohort studies that derangement of electrolytes in acute gastroenteritis in developed countries is now rare.

A study by Elliot<sup>73</sup> at the Royal Alexandra Hospital for Children in Sydney | 2+

examined the medical records of 164 children presenting with acute gastroenteritis. Of these children 134 (82%) had a recorded analysis of plasma electrolytes, and minimal disturbance of electrolytes was found. Seven children (5.2%) were hyponatraemic (sodium <130 mmol/L) and none were hypernatraemic (sodium >150 mmol/L). Four (3%) were hyperkalaemic (potassium >5.5 mmol/L) and none were hypokalaemic (potassium <3.5 mmol/L). Twenty-eight children (21%) had metabolic acidosis (bicarbonate <15mmol/L).

Table 4 summarises three recent UK papers looking at hospital cohorts of children with gastroenteritis. Approximately 1% of these admissions had hypernatraemia. None of these studies reported hypokalaemia or hyponatraemia, which are commonly found in patients dehydrated with cholera.

**Table 4: Frequency of deranged electrolytes in acute gastroenteritis in developed countries.**

	<i>Jenkins<sup>55</sup> Cohort of GE in South Wales, 1987/8, children &lt;16years</i>	<i>Conway<sup>14</sup> Cohort of GE in Leeds, 1986/7, Children &lt;16years</i>	<i>Ellis<sup>56</sup> Cohort of GE in Manchester, 1982 (Infectious Disease Unit) Infants &lt;2years</i>
No. of cases	215	1148	447
No. (%) moderate-severe dehydration (5-10%)	15 (7%)	12 (1%)	63 (14%)
No. in whom electrolytes were measured	76 (35%)	1119 (97%)	NR
Hypernatraemia (as defined in each study in mmol/l)	Na >145 2 (<1%)	Na >149 8 (<1%)	Na >150 5 (1%)
Urea (mmol/l)	Urea >6 17 (8%)	Urea >7 86 (7%)	Urea >6 8 (1.8%)
Bicarbonate <15mmol/l	13 (6%)	NR	3 (<1%)

NR= Not reported.

Another study by Klein<sup>33</sup> from America studied 221 children admitted with gastroenteritis and treated with IV fluids all of whom had electrolytes tested. 87% of sodiums tested were normal, 12% were abnormal and 1% were in the critical range quoted as <115 or >160. Potassium, 88% normal, 10% abnormal and 2% in the critical range quoted as <3 or >6.5. Unfortunately the paper doesn't state whether any of the children with results in the critical range were symptomatic, or whether the results changed clinical management. Abnormal results due to sampling errors were not considered.

2+

Other studies have tried to evaluate the usefulness of laboratory tests in assessing dehydration. Bonadio<sup>34</sup> evaluated 50 children with dehydration and found that blood urea did not correlate with the degree of clinical dehydration. This study used clinicians estimation of dehydration rather than rehydrated weight. The former is known to be difficult to estimate and inaccurate and may have affected the interpretation of the results. Vega<sup>35</sup> studied 97 children and found that urea correlated significantly with severe dehydration (assessed by rehydrated weight) but not with mild or moderate dehydration. A combination of clinical assessment and bicarbonate had high sensitivity but low specificity for assessing dehydration. Yilmaz<sup>36</sup> studied 168 children and found using multiple linear regression that urea and bicarbonate correlated with dehydration. The studies by Klein, Bonadio, Vega and Yilmaz all studied children admitted to hospital who received IV fluids for dehydration secondary to gastroenteritis. None of the papers specifically address whether this was the indicated treatment for the level of dehydration. 53 children in the study by Yilmaz were admitted and treated with IV fluids for mild dehydration only. So it seems that electrolytes when tested are rarely abnormal and there is conflicting evidence surrounding how useful laboratory investigations are in determining the level of dehydration. No evidence being higher than 2<sup>+</sup>. All of these studies have looked at children receiving IV fluids in hospital. Less children are now treated this way as there is grade 1 evidence supporting the use of ORS in children with dehydration secondary to gastroenteritis. There are no studies specifically addressing the need for laboratory investigations in children rehydrated orally.

2<sup>+</sup>

#### RECOMMENDATION

**D** There is no evidence to support routine analysis of electrolytes, urea/creatinine or bicarbonate.

The child who presents with diarrhoea with or without vomiting should have blood taken for urea/creatinine, electrolytes and bicarbonate in the following circumstances:

- Severe dehydration with circulatory compromise
- Moderate dehydration *where there is concern that the child may be hypernatraemic*
- Moderate dehydration where diagnosis is unclear or there are other co-morbid factors.
- When intravenous rehydration is required
- When there is a 12 hour or greater history of anuria

## 3. Management

### 3.1 Rehydration

The overriding principles of the management of gastroenteritis are rehydration and prevention of dehydration.

#### 3.1.1 Oral rehydration solution

The Western world has lagged behind the developing world in using ORS despite there being good evidence that children with mild to moderate dehydration can be safely rehydrated with these solutions. Mackenzie<sup>24</sup> and Sharifi<sup>30</sup> conducted two of the biggest studies addressing this question. In the former study, 111 children were randomised to either ORS (containing 50mmol Na) given over 6 hours or IV therapy given over 12 hours. ORS failed in only 2 children (a failure rate of 3.8%). ORS was found to be as good as IV rehydration when judged by biochemical parameters and there was no significant difference in the stool output between the two groups. The second study by Sharifi compared 470 children randomised to ORS or IV therapy. Two different ORS were used in this study. Solution A with a sodium content of 80mmol and osmolarity of 270 was given until signs of dehydration had disappeared followed by solution B with 40 mmol sodium and an osmolarity of 270 which was used for maintenance. The aim of this study was to compare the two therapies in severe dehydration but in fact the mean weight gain in the study group at discharge was 8.9% and 7.2% in the control group. The results showed that nearly 99% of children in the oral group were successfully treated with ORS. Duration of diarrhoea in hospital was found to be significantly less in the oral group. Other similar studies have come to the same conclusion (Tamer<sup>87</sup>; Vesikari<sup>32</sup>). A meta-analysis by Gavin<sup>25</sup> also addresses this question but includes both studies comparing ORS and IV therapy and those comparing different strength ORSs. Randomised trials with oral and IV arms were felt to be the most appropriate trials to answer this particular question and so were studied separately to make a recommendation.

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#### RECOMMENDATION

**A** Oral rehydration should be the standard treatment for children with mild-moderate dehydration secondary to gastroenteritis (see below for the type of ORS).

No studies were identified which compared ORS with other clear fluids in regard to effectiveness of fluid replacement. Water, fruit juices, cordial and soft drinks are generally low in sodium and potassium and high in sugar, making them less effective than ORS in replacing the lost electrolytes and fluid in dehydrated children.

#### RECOMMENDATION

**D** Oral rehydration solution is more effective than water, diluted fruit juice, diluted soft drinks or diluted cordial in rehydrating children with diarrhoea.

ORS is the preferred fluid for rehydrating children with dehydration however it may not be well tolerated by all children. The table below lists suitable alternatives for children who are refusing ORS.

Fluid	Dilution
Unsweetened fruit juice	1 part juice with 4 parts water
Cordial (not low calorie or diet)	1 part cordial with 10 parts water
Sugar solution	1 teaspoon sugar in cup of water
Hydralyte icypoles	

### 3.1.1.1 Composition of ORS

In the 1970's the WHO adopted a glucose-electrolyte solution for the treatment of diarrhoea that contained 90mmol/l of sodium. Since then there have been many controlled trials looking at the ideal concentration of electrolytes and carbohydrate in ORS and in particular the incidence of hyper and hyponatraemia with the different solutions. In developing countries where cholera is more common, rapid losses of sodium and potassium are documented. In developed countries diarrhoea tends to be isotonic, and therefore replacement of large quantities of sodium is not so imperative, and indeed may be harmful.

Hahn<sup>26</sup> conducted a Cochrane systematic review on reduced osmolarity oral rehydration solution for treating diarrhoea caused by acute gastroenteritis in children. They conclude that reduced osmolarity ORS in children with mild to moderate diarrhoea is associated with fewer unscheduled IV infusions, lower stool output and less vomiting. Importantly they did not document an increased incidence of hyponatraemia with reduced osmolarity ORS. Within this review the osmolarity of the reduced ORSs varied from 250mmol/l to 270mmol/l. Standard WHO ORS has an osmolarity of 311mmol/l. Two studies with osmolarities up to 331mmol/l were included. A randomised double blind multi-centre trial including 676 children by the CHOICE Study Group was one of the studies included in the systematic review. This study compared reduced ORS with a sodium concentration of 75mmol/litre, and glucose concentration of 75mmol/litre with standard WHO ORS. They found a significant reduction in unscheduled use of IV infusions in the reduced ORS group but no difference in stool output or vomiting. These studies demonstrate that reduced osmolarity ORS compared to standard WHO ORS has a beneficial effect by decreasing the number of children who require IV fluids because of failed rehydration. Debate remains as to the exact optimum concentration of reduced ORS and further studies are needed to resolve this.

1+

### RECOMMENDATION

**A** Reduced osmolarity ORS (with a sodium concentration of 75mmol/litre, and glucose concentration of 75mmol/litre) should be used for rehydration of children with acute gastroenteritis. Commercial solutions conforming to this include Repalyte, O.R.S, Gastrolyte, Hydralyte and Pedialyte.

Many papers have been published looking at the different types of carbohydrate to be used in ORS, in particular rice based ORS to reduce the severity and duration of diarrhoea. A Cochrane systematic review by Fontaine<sup>27</sup> demonstrated that rice based ORS are effective in reducing stool output in children and adults with cholera diarrhoea but not in those with non-cholera diarrhoea. A meta-analysis by Gore<sup>28</sup> using many of the same studies came to the same conclusion.

1+

#### RECOMMENDATION

**A** Rice based ORS do not significantly reduce stool output compared to glucose based ORS in children with non-cholera diarrhoea.

### 3.1.2 Children at risk of dehydration, or with mild dehydration

Children at risk of dehydration, or with mild dehydration should receive increased volumes of usual fluids. Appropriate fluids include breast milk, ORS, unsweetened fruit juice diluted 1 part in 4, or cordial diluted 1 part in 10. Fizzy drinks should be avoided.

**D** Children with mild dehydration, or those children with diarrhoea at risk of dehydration should be given usual fluids at an increased rate. Avoid carbonated drinks or undiluted juice.

There are no trials concerning the replacement of losses in children at risk of dehydration. The GDG agreed that children at risk of dehydration should continue to receive increased volumes of usual fluids, and that this was especially important if the child continued to have diarrhoea and vomiting.

#### RECOMMENDATION

**D** Children at risk of dehydration should continue to receive increased volumes of usual fluids. Parents/carers should take particular care to maintain increased volumes of fluid intake if the child continues to have diarrhoea and vomiting.

### 3.1.3 Children with moderate dehydration

There is no evidence specifically addressing how quickly fluid deficits should be replaced and when to review once ORS has been started in children with moderate dehydration. Review articles and other guidelines<sup>29</sup> state that ORS should be used for rehydration and be given over a period of 3-4 hours. In light of the absence of evidence a consensus recommendation was developed.

#### RECOMMENDATION

**D** Children who have moderate dehydration secondary to acute gastroenteritis should be rehydrated with oral rehydration solution 20ml/kg/hr given in small amounts, for 4 hours.

\*The literature discusses the correct administration of ORS and recommends 5ml aliquots every 1-2 minutes - however this may not always be practical. If this is well tolerated with no vomiting the size of the aliquots may be increased with decreasing frequency.

*RECOMMENDATION*

**D** In children with moderate dehydration, oral rehydration solution should be provided in aliquots of approximately 5ml/kg every 15 minutes, whenever this is practically possible\*\*.

\*\*Whenever practically possible implies that the child's carer is willing and able to carry this out under supervision. Where this is not the case rehydrate by nasogastric tube (preferred) or IVI.

There is no evidence to determine whether intermittent bolus or continuous nasogastric rehydration is more effective.

*RECOMMENDATION*

**D** In children with moderate dehydration, nasogastric rehydration with ORS may be delivered either as intermittent boluses or continuously.

The manufacturers recommend that ORS should be made up immediately prior to feeding and any solution remaining an hour after reconstitution should be discarded. They note that the solution may be used for up to 24 hours if stored in a refrigerator immediately after reconstitution.

*3.1.3.1 Replacement of ongoing losses*

There is no convincing research evidence to suggest that ongoing losses should be replaced with additional ORS for each loose stool or substantial vomit. In the absence of evidence, the GDG agreed that additional volumes are not necessary if the child is tolerating oral fluids and their clinical status is being reviewed frequently.

*RECOMMENDATION*

**D** Additional volumes of ORS are not necessary to replace ongoing losses if the child is tolerating fluids and their clinical status is being reviewed frequently

*3.1.3.2 Duration of trial of oral fluids*

There is no evidence available to determine the appropriate duration of a trial of oral fluids. In the absence of evidence, the consensus of the GDG was that if a child with moderate dehydration was unable or unwilling to accept oral rehydration over a period of approximately 1 hour (either in the hospital or community setting), or their hydration status was worsening, other forms of

rehydration should be used. Nasogastric rehydration is the preferred next option.

#### RECOMMENDATION

**D** If a child is unable or unwilling to accept oral fluids over approximately 1 hour, or their hydration status worsens over this period, use nasogastric rehydration

There is evidence from RCTs<sup>24, 31</sup> that in moderate dehydration, nasogastric rehydration using ORS is as effective as intravenous rehydration. Children receiving ORS had significantly less vomiting and diarrhoea and improved weight gain at discharge compared to patients receiving intravenous fluids. There is limited evidence from 1 RCT<sup>30</sup> that this may also be true in patients with severe dehydration.

1+

In a child with moderate dehydration, intravenous fluids are indicated only if the child is unable to tolerate nasogastric rehydration OR nasogastric rehydration fails i.e. persistent vomiting or worsening dehydration. There is no evidence to determine how long to trial nasogastric fluids before moving to intravenous rehydration.

#### RECOMMENDATION

**D** If a child is unable to accept nasogastric fluids (eg persistent vomiting), consider reducing the rate of nasogastric fluids or use intravenous rehydration

### 3.1.4 Children with severe dehydration

Few studies assessing the efficacy of ORS include children with severe dehydration. The exception being the study by Sharifi<sup>30</sup>. This was a randomised controlled trial to compare oral and IV rehydration in children with severe dehydration. 64% of the oral group and 65% of the IV group were felt to have severe dehydration with signs of shock at presentation. The paper states that severe dehydration is equivalent to 10% or more weight loss. The mean weight gain in the oral group was 8.9% and 7.2% in the IV group suggesting most children were at the upper end of moderate dehydration rather than severe. Despite this only 1 child in the oral group went on to need IV fluids and the study group generally did better with significantly less vomiting, diarrhoea and improved weight gain at discharge. Most studies either exclude children with severe dehydration (Mackenzie<sup>24</sup>) or treat with IV fluids until signs of shock have disappeared and the child is able to tolerate oral fluids then randomise (CHOICE Study 2001<sup>31</sup>). The results from Sharifi's study are encouraging but it is not possible to make a recommendation regarding the use of ORS in severe dehydration based on this study alone in view of the problems noted above. There are unlikely to be further studies in the developed world on the use of ORS in severe dehydration due to the small number of children who present and the ethical dilemmas in undertaking this type of study when signs of shock are present.

1+

Many of the panellists made comments about the controversy that surrounds the use of colloid and crystalloid. There is no literature on the particular issue of crystalloid versus colloid in the resuscitation of infants and children with diarrhoea. In studies in adults crystalloid is known to be as effective for rapid restoration of circulating fluid volume. Until we have more evidence for children, (and this is likely to have to come from a developing country as the numbers of children presenting in shock with diarrhoea are so small in the UK and Australia), we will have to use the current literature which does not include a randomised controlled trial on crystalloid versus colloid. No studies report the use of colloid in diarrhoea. The child with dehydrating diarrhoea is different from a child with shock secondary to trauma or sepsis. The dehydrated child has lost water and salts from all body compartments. In severe dehydration the final compartment to decompensate is the intravascular one. The child will have a high haematocrit and will not have lost any plasma proteins. It thus seems reasonable from a theoretical point of view to restore what has been lost, namely water and salts.

It is argued that if crystalloids are used they diffuse more readily into the interstitial and intracellular compartments. As these compartments are depleted in dehydrating diarrhoea, this seems a theoretically good thing, as long as further fluid is given to maintain intravascular volume.

#### RECOMMENDATION

**D** Children who have circulatory compromise ("shock") secondary to acute gastroenteritis should have their circulation restored by rapid IV infusion of normal saline with a 20ml/kg bolus. Experienced medical staff should be involved early.

A further bolus of 20ml/kg should be given if the circulation is still compromised 10-15 minutes after administration of initial bolus. If further boluses are required involve senior medical staff.

#### 3.1.4.1 NG versus IV rehydration following restoration of circulating fluid volume

No studies have specifically looked at whether children treated with IV fluids for severe dehydration do better with nasogastric or ongoing IV fluids once the circulating volume has been restored.

There are studies though where children have been randomised to different types of ORS following IV fluid resuscitation for severe dehydration (CHOICE Study 2001<sup>31</sup>). In this study 56/675 presented with severe dehydration and following resuscitation were randomised to reduced ORS or WHO ORS. Overall 12% needed unscheduled IV fluids. It is not possible to tell from the data whether this group represents a higher than average proportion of children who initially presented with severe dehydration. Since there is good evidence that children with moderate dehydration should be treated with ORS it seems sensible that once the circulating volume has been restored ORS should be introduced.

There is no evidence to guide the clinician in deciding how fast the deficit should be replaced in children who require IV fluids. There are no studies comparing different rehydration times in children requiring IV fluid resuscitation. There are many studies comparing oral and IV rehydration, within these studies IV fluids are given over a variable period. Vesikari<sup>32</sup> compared oral and IV rehydration over 12 hours and gave 2/3 of the deficit over the first 6 hours and the remaining 1/3 over the next 6 hours. A similar study by Mackenzie<sup>24</sup> comparing oral and IV fluids rehydrated children over 24 hours. The *GDG* developed this consensus recommendation.

#### RECOMMENDATION

- D** Once a child with severe dehydration has had their circulating fluid volume restored with IV fluid, they should receive continuing intravenous rehydration at 10ml/kg/hr and be reviewed hourly.
- D** Once a child with severe dehydration has had their circulating fluid volume restored with IV fluid, and is receiving continuing intravenous rehydration they should be encouraged to also accept oral fluids as soon as possible.

#### 3.1.5 Hypernatraemic dehydration (sodium >150mmol/L)

It is acknowledged that ORS is quicker in the correction of dehydration and acidosis and safer than IV therapy. Moreover the use of oral rehydration therapy (ORT) appears to reduce the risk of seizure during correction of hypernatraemic dehydration, Pizarro<sup>37</sup> reported no seizures among 35 infants with hypernatraemic dehydration whose deficit was replaced with WHO-ORT over 12 hours. An earlier study by Pizarro 1983<sup>38</sup> of 61 infants with hypernatraemic dehydration found 5 patients had overt convulsions following oral rehydration over 6 hours. Both of these studies used ORS with sodium concentrations of 90 mmol. 3

In the largest randomised controlled trial of IV versus ORT Sharifi<sup>30</sup> randomly assigned 470 children aged 1 to 18 months (without malnutrition) admitted to hospital in Tehran with severe acute gastroenteritis to receive either ORS (administered initially by nasogastric tube) or IV fluid. Of the 34 hypernatraemic patients in the ORT group, 2(6%) developed generalised seizures compared with 6 of 24 (25%) in the intravenous group. 1<sup>+</sup>

The *GDG* agreed that in order to avoid potentially causing convulsions or seizures, it is important to rehydrate a child with hypernatraemic dehydration slowly.

#### RECOMMENDATION

- D** The child with hypernatraemic dehydration (Na >150mmol/L) secondary to acute gastroenteritis should be rehydrated with ORS, giving their estimated deficit over at least 12 hours in discussion with senior medical staff.

There is no evidence to determine how often a child with acute gastroenteritis who has hypernatraemia should have their plasma biochemistry reassessed. The GDG agreed to the following recommendation:

#### RECOMMENDATION

- D** Children with acute gastroenteritis with hypernatraemia should have their plasma biochemistry reassessed before discharge from hospital, and at least once every 4 hours while being rehydrated until sodium levels normalise.

#### 3.1.6 Hyponatraemic dehydration (sodium < 130mmol/L)

No studies were identified which compared different rehydration protocols for children with hyponatraemic dehydration.

In the absence of evidence, the GDG agreed that children with hyponatraemic dehydration should be rehydrated slowly with ORS. Senior medical staff should be contacted and special care taken to observe the child frequently.

- D** The child with hyponatraemic dehydration (Na < 130mmol/L) secondary to acute gastroenteritis should be rehydrated slowly with ORS, in discussion with senior medical staff.

There is no evidence to determine how often a child with acute gastroenteritis who has hyponatraemia should have their plasma biochemistry reassessed. The GDG agreed to the following recommendation:

#### RECOMMENDATION

- D** Children with acute gastroenteritis hyponatraemia should have their plasma biochemistry reassessed before discharge from hospital, and at least once every 4 hours while being rehydrated until sodium levels normalise.

### 3.2 Feeding

Historically children were starved for the period of rehydration (often over 24 hours) and were then regraded onto increasing strengths of milk feed following gastroenteritis. This was not based on any evidence, but thought to reduce the incidence of lactose intolerance.

Evidence exists to support the early introduction of age appropriate diets in children who are weaned, Sandhu<sup>39</sup>. In this study all children were rehydrated over 4 hours with ORS. They were then randomised to early feeding (normal diet) or late feeding (ORS for a further 20 hours followed by diet). They concluded that early feeding including full strength lactose containing milk did not lead to a worsening or prolongation of diarrhoea or increased lactose intolerance.

1+

Good evidence exists to show that children who are breast fed should continue breast feeding throughout the rehydration and maintenance phases of their therapy. In so doing they reduce the risk of dehydration, pass smaller volumes of stool and recover quicker<sup>40</sup>.

1+

So the above 2 trials suggest that children who are breast fed should continue to breast feed through their illness and that weaned children should continue full strength milk and normal diet following rehydration.

Brown<sup>41</sup> performed a meta-analysis on the use of non-human milks in gastroenteritis and concluded that the vast majority (over 80%) of young children with acute diarrhoea can be successfully managed with continued feeding of undiluted non-human milks. The results of this meta-analysis are difficult to interpret as many different diets were compared and many studies were performed using different rehydration regimes to those in use now (intravenous as opposed to oral). However, individual papers from the meta-analysis were reviewed and 1 was found to be relevant to refeeding in non-breast fed babies<sup>42</sup>. The aim of this study was to compare rapid refeeding with standard cows milk formula, a low lactose formula, a soya based formula and gradual introduction of full strength feeds. Two hundred babies were enrolled; the average age was 4.9 months. Although the group receiving a low lactose formula showed better early weight gain in hospital there was no difference in the overall duration of the diarrhoea or time to discharge compared to the group receiving full strength milk. It is of note in this study that of the 18 treatment failures 4 occurred in those rehydrated orally and 14 in those rehydrated by the IV route.

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While there is no evidence to determine whether a child receiving IV fluids should eat, the GDG agreed that a child who was hungry should not be denied food and that any child who requested food should be given small portions of usual foods, avoiding those foods which are high in sugar and/or fat.

#### RECOMMENDATION

- A** Breast feeding infants should continue to breast feed through the rehydration and maintenance phases of their acute gastroenteritis illness.
- A** An age appropriate diet (including full strength lactose containing milk) should be restarted in non-breast fed children following initial rehydration with ORS (normally given over 4 hours).
- D** Children who request food or report being hungry should not be denied food, even if they are receiving IV fluids. Give small portions of usual foods - avoiding foods high in sugar or fat.

### 3.3 Lactose Intolerance

There is very little evidence available on which to base recommendations for the diagnosis and management of lactose-intolerance secondary to acute gastroenteritis. Some authors suggest that whilst post-infectious lactose intolerance used to be common in infants <6 months of age, its incidence has substantially decreased, and it is now rare<sup>77, 85</sup>.

No trials were found which examined the accuracy of diagnostic techniques, such as Clinitest or hydrogen breath tests, against a suitable gold standard in children with lactose intolerance after acute gastroenteritis. A small number of methodologically weak trials were found which compared hydrogen breath tests to Clinitest or clinical signs<sup>78-84</sup>. These trials produced varying results and suggested that hydrogen breath tests are potentially unreliable, particularly in young infants.

The diagnosis of lactose intolerance in children with diarrhoea as a result of acute gastroenteritis is complicated by the underlying illness. In these children the increased speed of passage of foods through the digestive tract, with or without lactose intolerance, may result in excretion of undigested sugars. Tests such as Clinitest are not specific for lactose, and will return a positive test in the presence of any reducing sugar (glucose, lactose, fructose, galactose, maltose and pentoses).

In the absence of adequate evidence, the GDG agreed that lactose intolerance should be considered in children with diarrhoea lasting seven days or longer.

#### RECOMMENDATION

**D** Consider lactose intolerance in children with diarrhoea which continues longer than 7 days.

It is not clear what intervention is appropriate for children with lactose intolerance after acute diarrhoea. No controlled trials were identified which examined the effectiveness of lactose free formula or diet, compared to lactose containing formula or diet.

In the absence of adequate evidence, and in line with recommended practice at the Royal Children's Hospital<sup>77</sup> the GDG agreed to the following recommendation:

#### RECOMMENDATION

**D** In children with post infectious lactose intolerance after acute diarrhoea

- Breast feeding should continue unless buttock excoriation and failure to gain weight persist
- Formula feeding should be with lactose free formula for a period of three to four weeks, then usual formula.

### 3.4 Medication

#### 3.4.1 Anti-diarrhoeal/ anti-motility agents

Despite level 1 evidence supporting the use of ORS in gastroenteritis many parents and indeed health professionals still perceive successful treatment as resolution of diarrhoea. Ongoing diarrhoea in an otherwise well child can cause disruption to the family with child care problems and time off work. This along with many other reasons led to interest in the use of anti-diarrhoeal medication in acute infectious diarrhoea. The anti-diarrhoeal effects of loperamide have been most extensively studied and are described below.

Motala<sup>51</sup> conducted a case control study to evaluate the efficacy of high dose loperamide in acute dehydrating diarrhoeal disease. 60 male infants 6 weeks to 1 year were recruited (30 cases and 30 controls). 2 children in the loperamide group 4 and 8 months respectively developed an ileus and severe vomiting both thought to be secondary to loperamide, these cases were excluded from the subsequent analysis. 4 infants all less than 4 months developed mild drowsiness after 3-5 doses of loperamide. A significant reduction in the daily stool output was noted in the loperamide group (52 to 26 gm/kg body weight on day1) but it wasn't apparent whether this was clinically significant. This difference was not apparent when a sub-group analysis was carried out on those affected by rotavirus (7 cases and 8 controls) though the numbers were small.

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A randomised double blind placebo trial by Bowie<sup>52</sup> studied 200 children admitted to hospital with mild to moderate dehydration. They were randomly assigned to placebo or high dose loperamide 0.8mg/kg/day and the effect on length of hospital stay examined. No significance difference was found between the 2 groups in terms of aetiology or duration of diarrhoea, duration of hospital stay ( $p>0.05$ ), or treatment failures.

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Another randomised double blind placebo trial by Hendricks<sup>53</sup> studied the effects of 0.4 and 0.8mg/kg/day of loperamide on children admitted with diarrhoea. Weight gain by day 3 was noted in 58% of children who had received 0.8mg loperamide, 51% of children who had received 0.4mg loperamide and 36% of those who had received placebo. The differences were significant. The primary outcome measure in this study was not clearly stated. There were also a number of patients who didn't open their bowels for 24 hours following hospital admission - 32% in the 0.8mg loperamide group, 30% in the 0.4mg group and 17% in the placebo group. This may be evidence for the efficacy of loperamide or could indicate that children randomised to the trial did not have a true diagnosis of diarrhoea. A definition for diarrhoea is not given in this study. The recovery of children receiving 0.8mg loperamide was hastened by 24 hours.

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So it can be seen that results are contradictory and benefits where demonstrated are small and may not be clinically apparent. One study also demonstrated high levels of serious side effects. In view of this loperamide cannot be recommended.

**RECOMMENDATION**

- A** Loperamide is not recommended for the treatment of acute gastroenteritis in children

As discussed above most of the work on anti-diarrhoeal agents in children has been carried out using loperamide. In addition the *GDG* agreed that no anti-diarrhoeal agents should be used in children with gastroenteritis as they have not been shown to be effective in reducing diarrhoea and have potentially serious side effects.

**RECOMMENDATION**

- D** Anti-diarrhoeal medication should not be used in children with acute gastroenteritis.

**3.4.2 Anti-emetic agents**

Three RCTs were identified which investigated the effectiveness of anti-emetic agents in children with acute gastroenteritis<sup>70, 71, 72</sup>. All 3 of these studies were funded by Glaxo-Wellcome who produce ondansetron, the drug being evaluated, 1 also evaluated metoclopramide<sup>70</sup>. The study by Cubeddu et al<sup>70</sup>, included a total of 36 patients, randomised to either ondansetron, metoclopramide or placebo. In this study metoclopramide did not significantly reduce emesis. The mean number of emetic episodes over 24 hours from administration was 5 episodes in the placebo group and 2 in the ondansetron group (p=0.048). However, both ondansetron and metoclopramide resulted in significantly more episodes of diarrhoea over the first 24 hours compared with placebo. Reeves et al<sup>71</sup> randomised 107 patients aged 1 month to 22 years to receive either ondansetron or placebo. Patients receiving ondansetron were more likely to cease vomiting (70% compared with 51%, p=0.04). There were no differences between the groups in admission rate, duration of diarrhoeal symptoms, median number of diarrhoea episodes or length of hospital stay. Ramsook et al<sup>72</sup> randomised 145 children aged between 6 months and 12 years to ondansetron or placebo. The median number of vomiting episodes after administration was 0 in both groups. Patients in the ondansetron group were more likely to cease vomiting in the emergency department but there was no difference between the groups in the rate of cessation of vomiting over the 24 hour period from administration. A smaller proportion of patients receiving ondansetron required IV fluids (8% vs 23%, p=0.15) however patients in the ondansetron group had significantly more diarrhoeal episodes over the 48 hours following admission (4.7 vs 1.4, p=0.002 for first two hours and 3.0 vs 1.0, p=0.015 over following 24 hours).

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**RECOMMENDATION**

- A** Metoclopramide should not be prescribed for children with diarrhoea and vomiting as it does not reduce emesis and appears to increase the duration and/or severity of diarrhoea in children.

The *GDG* agreed that there is not enough evidence available to determine the effectiveness or safety of ondansetron in children with acute gastroenteritis. There is conflicting evidence about reduction in emesis, and no evidence that it reduces admissions or length of hospital stay. It should be noted that ondansetron is not licensed for use in children in Australia other than in the context of emetogenic chemotherapy and radiotherapy, or prevention of postoperative nausea and vomiting.

In the absence of evidence to evaluate the effectiveness or safety of other anti-emetics in children with diarrhoea and vomiting, the *GDG* agreed that they should not be routinely used.

#### RECOMMENDATION

**D** Anti-emetics should not usually be prescribed for children with diarrhoea and vomiting.

#### 3.4.3 Use of probiotics

A probiotic is a live microbial food additive that may be beneficial to health. The use of probiotics in children with acute infectious diarrhoea has been explored for some years now.

Niel<sup>54</sup> conducted a meta-analysis level of evidence 1+ on the use of lactobacillus therapy for acute infectious diarrhoea in children. 9 studies met the inclusion criteria. Children receiving lactobacillus had a shorter duration of diarrhoea reduced by 0.7 days and less frequent diarrhoea on day 2 reduced by 1.6 stools. The authors make the comment that although the results seem consistent between the studies the definition of diarrhoea and its severity differed markedly between the studies, as did the strain of lactobacillus and dose used. Many of the studies were funded by pharmaceutical and food agencies. 361 children were studied in total, there was no difference in the number of adverse reactions noted in each group. The results suggest that treatment with lactobacillus will reduce the length of diarrhoea by 17 hours but the direct and indirect cost benefits of this have not been addressed.

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Adverse reactions have been noted in the elderly population treated with lactobacillus. It may well be that bigger studies are needed to identify any potential problems in children.

Allen<sup>67</sup> recently published a *Cochrane* systematic review assessing the use of probiotics for treating infectious diarrhoea which included 23 RCTs. Children treated with probiotics were less likely to have diarrhoea lasting 3 days or more (RR=0.71, 95%CI (0.62, 0.80) (n=1008)), and diarrhoea lasting 4 days or more (RR=0.46, 95%CI (0.37, 0.58) (n=895)). Four of the studies (including a total of 231 children) investigated the use of probiotics in children who had rotavirus diarrhoea. In these studies, children treated with probiotics had a mean reduction in duration of diarrhoea of 38.1 hours (95%CI 8.1, 68.1) compared with

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children treated with rehydration therapy only. No adverse events attributable to the probiotics were reported.

The review concluded that probiotics appeared to be a useful adjunct to rehydration therapy in treating acute infectious diarrhoea in both children and adults and noted that further studies are required to determine the optimum probiotics regime. The four studies which all showed benefit of probiotics in children with rotavirus gastroenteritis used either lactobacillus caseii or lactobacillus caseii GG.

The four studies all of which showed benefit of probiotics in children with rotavirus gastroenteritis, used either lactobacillus caseii GG or a product called 'Biolactis'. Neither of these products are currently available in Australia.

#### RECOMMENDATION

**A** Probiotics are a useful adjunct to rehydration therapy in children with diarrhoea. However formulations of proven efficacy in these children (lactobacillus caseii GG or 'Biolactis') are not currently available in Australia. Other probiotics may be effective, however they cannot be recommended without further research.

#### 3.4.4 Paracetamol and anti-pyretics

There is no evidence to determine whether children with diarrhoea should receive paracetamol or other anti-pyretics to reduce fever and irritability. The GDG noted that some clinicians are concerned that paracetamol may potentially mask clinically important symptoms. Equally, other clinicians believe that reducing fever can lead to increased appetite, decreased irritability and, therefore, potentially better outcomes.

In the absence of evidence the GDG agreed that paracetamol may be useful in children with diarrhoea, but that clinicians must carefully consider and exclude other potential causes of fever, irritability and pain before giving paracetamol.

#### RECOMMENDATION

**D** Children with diarrhoea and fever may be treated with paracetamol to bring their temperature down and reduce irritability. Carefully consider and exclude other potential causes of fever, irritability and pain before giving paracetamol.

### 3.4.5 Antibiotics

Viruses are by far the most common cause of acute diarrhoea in children, and therefore most children with acute diarrhoea do not require treatment with antibiotics.

#### *RECOMMENDATION*

**D** Antibiotics should not usually be prescribed for children with diarrhoea and vomiting.

In current practice, children with fever and bloody diarrhoea are sometimes given antibiotics before infection with a bacterial pathogen is confirmed. No evidence was identified to determine whether this is more effective than delaying prescription of antibiotics until after a pathogen is identified.

The decision as to when to provide antibiotics to children with bloody diarrhoea and fever is complex. Even in children with severe diarrhoea the benefits of antibiotic treatment must be carefully weighed against the risks, including possible side effects, the potential problem of emerging antibiotic-resistance, and concerns that elimination of normal flora may lead to development of super-infections. Choosing an appropriate antibiotic is also more difficult when the pathogen has not been identified. Even if a bacterial pathogen is isolated, antibiotics are generally not indicated.

Antibiotic therapy may be detrimental in O157:H7 *Escherichia coli* diarrhoea which causes bloody diarrhoea and has been seen in Australian outbreaks.

In the absence of evidence the GDG agreed that in children with fever and bloody diarrhoea the decision to give antibiotics before a bacterial pathogen is identified should only be made in consultation with a senior emergency physician or paediatrician.

#### *RECOMMENDATION*

**D** In children with fever and bloody diarrhoea only consider antibiotics in consultation with a senior emergency physician or paediatrician.

### 3.5 Level of care required

There is no evidence from the literature on which to make clear recommendations about how to determine the level of care a child with gastroenteritis requires. There are many factors, both medical and non-medical, which may influence a decision to send a child to hospital, or to admit a child who has presented to hospital. Some of these influences have been studied.

Fitzgerald<sup>43</sup> found that for the same severity of acute gastroenteritis, children with mothers reporting higher levels of psychological distress were more likely to be admitted. These mothers were also likely to have poor social resources. These factors influencing admission are less easy to define, but are equally important and should be incorporated into a guideline. Work in America has found that supply of beds, type of medical facility available (teaching or district general) and distance from the hospital has a profound effect on hospitalization rates in children. In this study children with gastroenteritis had a 15% higher chance of admission when living in an area with a bed supply of 4/1000 compared with 1.9/1000, Goodman<sup>44</sup>.

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It was the consensus of the *GDG* that a child with severe dehydration must receive immediate care in an acute medical facility. Children with moderate dehydration and those at high risk of developing dehydration will need to be watched carefully. Those moderately dehydrated should be observed frequently by medical staff until they are fully rehydrated, and those at risk of dehydration may need to be observed for a period to ensure that they remain well hydrated. (No evidence from the literature).

In cases where there is diagnostic uncertainty, children may need admission for investigation or observation of the progress of their illness.

#### RECOMMENDATION

- D**
- Children with severe dehydration must receive immediate care in an acute medical facility.
  - Those children with moderate dehydration should be observed in a medical facility until adequately rehydrated, then discharged with appropriate advice and medical review arrangements.
  - Those children at high risk of dehydration on the basis of young age, high frequency of watery stools or vomits, should be given appropriate advice and have early medical review arranged.
  - Those children whose parents or carers are thought to be unable to manage the child's condition at home successfully should be admitted to hospital.

## 3.6 Response to treatment

### 3.6.1 Weight

There is no evidence to determine how often a child with acute gastroenteritis should be weighed to assess the effectiveness of rehydration. In the absence of evidence the GDG agreed to the following recommendation:

#### RECOMMENDATION

- D** Children with acute gastroenteritis should be weighed after 4 hours rehydration, before discharge, and at least once every 24 hours while the child is in hospital. Children who wear nappies should be bare weighed.

### 3.6.2 Biochemistry

Assessment of plasma biochemistry is not necessary in most children with acute gastroenteritis. There is no evidence to determine how often a child with acute gastroenteritis who has abnormal plasma biochemistry other than hypernatraemia or hyponatraemia on initial assessment should have plasma biochemistry reassessed. The management of patients who have other plasma abnormalities, including assessment of plasma biochemistry should be decided in discussion with senior medical staff.

#### RECOMMENDATION

- D** The management of children with acute gastroenteritis who have plasma abnormalities other than hyponatraemia or hypernatraemia should be decided in discussion with senior medical staff.

Recommendations for reassessment of plasma sodium levels in children with hypernatraemia and hyponatraemia are found in sections 3.1.5 and 3.1.6 respectively.

### 3.6.3 Continuing Diarrhoea

This guideline applies to children with acute diarrhoea. If diarrhoea continues longer than 7 days, the child should be reassessed by a medical practitioner to determine whether there are other causes (see Table 2 on page 13).

#### RECOMMENDATION

- D** Children with diarrhoea which continues longer than 7 days should be reassessed by a medical practitioner to determine whether there are other causes.

### **3.6.4 Return to childcare or school**

Regulations 13 and 14 of the Health (Infectious Diseases) Regulations 2001 – Schedule 6 (as quoted at <http://www.health.vic.gov.au/ideas/>) require children with diarrhoea to be excluded from schools and children's service centres until diarrhoea has ceased.

## 4. Infection Control

In consultation with colleagues and consumers, the GDG developed several clinical questions regarding infection control in relation to children with diarrhoea.

Topics of these questions included:

- Mechanisms of transmission
- Requirements for notification of infection
- Transmission precautions
- Management and cleaning of contaminated surfaces, linen and equipment
- Isolation precautions, management of visitors

Most of these topics are not addressed in the research literature but are subject to a range of standards developed by departments of the Australian Federal and Victorian State governments. These standards differ between hospital and community settings and are regularly updated by the appropriate authorities.

A number of professional bodies have synthesised these materials into guidelines for use by health professionals. Rather than duplicate this information, the GDG decided that it was more appropriate to refer readers to sources of information relevant to their context.

### 4.1 Infection Control Standards

#### 4.1.1 Australian Federal Government

The Department of Health and Ageing, have produced "Infection control guidelines for the prevention of transmission of infectious diseases in the health care setting"<sup>76</sup>. These guidelines provide recommendations on appropriate work practices to improve infection control, along with overviews on management for a wide variety of infectious diseases.

The guidelines provide a framework for infection control but are not detailed enough to answer the clinical questions posed.

#### 4.1.2 Victorian State Government

The Department of Human Services, Infectious Diseases Epidemiology & Surveillance website (<http://www.health.vic.gov.au/ideas/>) provides various guidelines, standards and legislation for the investigation, control and prevention of infectious diseases in a range of settings. This website also provides standards and processes for notifying cases of infectious diseases.

This material is relevant to clinicians in both hospital and community settings in Victoria, and the guidance on when and how to notify is particularly relevant. The website does not provide the practical information required to answer the majority of the clinical questions raised.

#### **4.1.3 Royal Australian College of General Practitioners**

Standards for infection control relevant to *General Practices* can be found in the publication produced by the Royal Australian College of General Practitioners, National Practice Management and Services Committee:

Demediuk N. (ed), 2000, *Sterilisation/Disinfection Guidelines for General Practice*, 3rd edition, RACGP.

#### **4.1.4 Southern Health**

The Southern Health standards for infection control for patients with diarrhoea can be found in the *Southern Health Infection Control and Epidemiology Manual*, and particularly in the chapters on *Gastroenteritis and Enteric Pathogens*, and *Standard and Additional Precautions*.

The most recent editions of these publications are available on the Southern Health Intranet, the editions current at time of publication of this guideline reproduced in Annex 8.

## 5. Patient Information

No evidence was found concerning the interests of other people, namely parents, carers and the children themselves in the management of acute gastroenteritis. It would be interesting to know what their views are about the use of oral rehydration therapy, intravenous infusions, nasogastric tubes and care in hospital or at home. No evidence on which to base a statement is currently available.

At a basic level, however, parents or carers should always be discharged with written information concerning the home management of diarrhoea with or without vomiting.

The information sheet developed by the *GDG* in consultation with the Health for Kids Consumer Group is shown in Annex 2.

### *RECOMMENDATION*

**D** Parents/carers should be given an information sheet concerning the home management of diarrhoea with or without vomiting on discharge home.

## 6. Outcomes and Audit

There are many different frameworks for developing outcome and audit measures. For the purpose of evaluating the implementation of this guideline we defined two types of measures; process and outcome. Process measures assess the success of the implementation process and the degree of implementation achieved. Outcome measures assess whether the implementation has improved clinical practice and patient outcomes.

### Process measures

#### *Implementation process*

- Proportion of target groups that received the interventions outlined in the implementation and dissemination plan. This information will be collected by attendance sheets and other similar documentation.

#### *Degree of implementation*

- Proportion of eligible patients on clinical paths and proportion of clinical paths completed correctly. This information will be collected by audit of patient records

### Outcome measures

#### *Clinical practice*

Members of the GDG, in consultation with their colleagues, reviewed the guideline recommendations for diagnosis and management of children with diarrhoea to identify any recommendations that would require changes in practice. They decided that as none of the recommendations would require a substantial change from existing clinical practice, the evaluation should focus on patient outcomes.

#### *Patient outcomes*

To develop a set of outcome measures we reviewed the original aims of the guideline development. These aims included reducing emergency department presentations, reducing hospital admissions, reducing length of stay in hospital and reducing the representation rate

In light of this, the GDG agreed that the following measures should be assessed for children with diarrhoea, with or without vomiting, prior to and post implementation of the guideline through a clinical path:

- Number of presentations to ED, number of admissions and number of representations to ED within seven days
- Proportion of presentations to ED admitted and proportion of presentations to ED representing within seven days
- Length of stay

These data are routinely collected at Southern Health.

## 7. Dissemination and Implementation of the Guideline

Who	<b>Inform</b> Raise awareness of the guideline and clinical path through multiple strategies that will inform a wide range of staff	<b>Educate</b> Provide information at a variety of forums to outline the content of the guideline and clinical path how and why they were developed.	<b>Motivate</b> Work with staff to provide ongoing support and a feedback mechanism throughout the implementation of the guideline and clinical path
<b>General</b>	<ul style="list-style-type: none"> <li>Place Guideline on Southern Health Internet and Intranet</li> <li>Email all relevant staff about the availability of the guideline</li> <li>Distribute copies of guideline to key staff and place in Emergency Departments, wards, staff rooms</li> <li>Use posters in departments to inform and remind staff of guidelines etc</li> <li>Put notice in Purple Peril about availability of guideline</li> <li>Put notice on payslips about availability of the guideline</li> </ul>	<ul style="list-style-type: none"> <li>Include as part of orientation for new staff</li> <li>Emergency department education sessions re guideline and clinical path</li> <li>Provide "hands on" training for medical, nursing and allied health staff.</li> </ul>	<ul style="list-style-type: none"> <li>Regular meetings with different groups to discuss benefits/challenges of guideline and clinical path</li> <li>Regular updates about progress in implementation and resulting improvements</li> <li>Use GDG members to motivate staff to use documents</li> </ul>
<b>Program Management</b>		<ul style="list-style-type: none"> <li>Meeting with Children's Program and Emergency Dept management about guideline and clinical path</li> </ul>	
<b>Medical</b>	<ul style="list-style-type: none"> <li>Put notices in Senior Medical Staff pigeon holes about the availability of guideline and implementation of clinical path</li> </ul>	<ul style="list-style-type: none"> <li>Discussion at Senior Medical Staff meeting of guideline and clinical path</li> <li>Discussion with those responsible for physician training about guideline and clinical path</li> <li>Junior Medical Staff education about guideline and clinical path</li> </ul>	<ul style="list-style-type: none"> <li>One-on-one meetings with key clinicians and opinion leaders to encourage them to motivate others</li> </ul>
<b>Nursing</b>		<ul style="list-style-type: none"> <li>Meeting with Nurse Unit Managers and nurse educators about guideline and clinical path</li> <li>Nurse in-services regarding guideline and clinical path</li> </ul>	<ul style="list-style-type: none"> <li>Involve Nurse Educators and Clinical Nurse Specialists in ongoing education</li> <li>One-on-one meetings with Nurse Unit Managers to encourage them to motivate their staff.</li> </ul>
<b>Allied Health</b>		<ul style="list-style-type: none"> <li>Meet with paediatric Allied Health about guideline and clinical path</li> </ul>	
<b>Ward Clerks</b>		<ul style="list-style-type: none"> <li>Meet with Ward Clerks to explain Clinical Path and how it is used</li> </ul>	<ul style="list-style-type: none"> <li>Work with the Ward Clerks to keep them informed and motivated throughout the implementation</li> </ul>
<b>General Practitioners</b>	<ul style="list-style-type: none"> <li>An implementation plan to address the specific needs of General Practitioners is being developed by the GP Liaison Officer as a separate strategy to the acute implementation plan</li> </ul>		

## 8. Guideline Development Group

### 8.1 Southern Health Gastroenteritis Guideline Adaptation

This adaptation of the PAERG Guidelines was undertaken by the Health for Kids in the South East Gastroenteritis Guideline Development Group at Southern Health. Sandy Foster (Clinical Scholar in EBP) and Fiona Wilkinson (Senior Project Officer) co-ordinated the process and Tari Turner (Senior Project Officer) was responsible for identifying and appraising the evidence, and drafting the guidelines.

Members of the Guideline Development Group represented all clinical areas at Southern Health relevant to the care of children with croup, GPs and consumers.

Members of the group were:

Name	Role
Liam Tjia	Emergency Medicine Fellow - Monash Medical Centre
Colleen Bayly	Consumer Representative
Kerry Breckon	Infectious Control Consultant
Paul Ferrier	Bed Access Coordinator - Monash Medical Centre
Sally Forbes	Paediatric Nurse - Monash Medical Centre
Peter Francis	Emergency Medicine Specialist - Monash Medical Centre
Claire Harris	Project Manager - Health for Kids in the South East
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Danielle Mazza	GP Liaison Officer - Health for Kids in the South East
Sue O'Sullivan	Paediatric Nurse - Dandenong and Casey Hospitals
Pam Rosengarten	Emergency Department Director - Monash Medical Centre
Jodie Sparke	Consumer Representative
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Declarations of interest were made by all members of the Guideline Development Group, no conflicts of interest were identified.

#### 8.1.1 Acknowledgements

We thank the following people for their important contribution to the development of this guideline.

Name	Role	Contribution
Vijaya	Senior Epidemiologist	Provision of Victorian Hospital
Sundararajan	Department of Human Services	data on croup presentations
Emily England	Metropolitan Ambulance Service	Consultation in regard to MAS
John Wheeler	(MAS)	protocols
David Meldrum	Senior Medical Staff, Casey Hospital	Feedback on fluid management in
	Emergency Department	children with severe dehydration

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### Conflict of interest

The views or interests of the charity funding the development of this guideline have not influenced the final recommendations. Members of the development group have not expressed any conflict of interest with the development of the guideline.

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Children Nationwide Medical Research Fund

Appraised by the Quality of Practice Committee Royal College of Paediatricians and Child Health

### 8.3 PAERG Delphi panellists

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Carter E (Paed. Cons.),  
Charlton C P J (Paed. Cons.  
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Cutts J (Paed. Nurse),  
Devane S (Paed. Cons.),  
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Ehrhardt P (Paed. Cons.),  
Gleeson E (A&E SpR),  
Green C (Paed. Cons.),  
Hewertson J (Paed. Cons.),  
Hodges S (Paed. Cons.),  
Huynh H (Paed. SpR.),  
Jefferson I (Paed. Cons.),  
Jenkins H (Paed. Cons. (Gastro)),

Kershaw C (Paed. Cons.),  
Laurent S (Paed. Cons.),  
Lewis H M (Paed. Cons.),  
Marcovitch H (Paed. Cons.),  
McGovern M C (Paed. SpR.),  
McGraw M E (Paed. Cons.),  
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Mirfattahi M M B (Paed. Cons.),  
Puntis J (Paed. Cons. (Gastro)),  
Rutter N (Paed. Cons.),  
Sajjanhar T (Paed. Cons. (A&E)),  
Smith R (Paed. Cons.),  
Smith S (Paed. Cons. (A&E)),  
Stephens S (Paed. SpR.),  
Sullivan C (Paed. Cons.),  
Thomas S (Paed. SpR.),  
Wells L (Paed. SpR.).

Key: Paed. = Paediatric,  
Cons. = Consultant,  
SpR = Specialist Registrar,  
A&E = Accident and Emergency,  
Gastro = Gastroenterology

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# Annex 1

## MANAGEMENT OF CHILD WITH DIARRHOEA, WITH OR WITHOUT VOMITING IN HOSPITAL

### INITIAL ASSESSMENT

- Exclude non-gastroenteritis causes of diarrhoea:
  - Acute: e.g. urinary tract infection, acute appendicitis, peritonitis, intussusception, antibiotic toxicity, sepsis
  - Chronic: e.g. milk allergy/intolerance, gluten sensitivity, ulcerative colitis, Crohn's disease, cystic fibrosis, Hirschsprung's disease

### ASSESSMENT OF SEVERITY OF DEHYDRATION

None or Minimal	Moderate	Severe
<ul style="list-style-type: none"> <li>Normal capillary refill time (1-2 seconds)</li> <li>Skin pinch retracts immediately</li> <li>Normal respiratory pattern</li> <li>Normal conscious state</li> <li>Normal drinking</li> <li>Normal urine output</li> </ul> <p><i>These signs correspond to &lt;5% lost body weight</i></p>	<ul style="list-style-type: none"> <li>Delayed capillary refill (3-4 seconds)</li> <li>Skin pinch retracts slowly (1-2 seconds)</li> <li>Increased respiratory rate<sup>#</sup></li> <li>Restless, irritable</li> <li>Tachycardia<sup>#</sup></li> <li>Drinks eagerly, increased thirst</li> </ul> <p><i>These signs correspond to 5-10% lost body weight</i></p>	<ul style="list-style-type: none"> <li>Very delayed capillary refill (&gt;4 seconds), mottled skin</li> <li>Skin pinch retracts very slowly (&gt;2 seconds)</li> <li>Deep, acidotic breathing</li> <li>Lethargic, unconscious</li> <li>Deeply sunken eyes</li> <li>Unable to drink</li> <li>Hypotensive</li> </ul> <p><i>These signs correspond to &gt;10% lost body weight</i></p>

N.B. If patient has signs or symptoms across categories, always treat according to their most severe features.

Take special care and consult appropriate specialist clinicians if the child:

- Is less than 6 months old
- Has had more than 8 significant diarrhoeal stools or more than 4 significant vomits in the last 24 hours
- Has co-morbid conditions such as short gut, developmental delay or metabolic illnesses

### INITIAL TREATMENT

<p><b>Increase frequency and volume of usual drinks</b></p> <ul style="list-style-type: none"> <li>Weigh child</li> <li>Give parent advice about:                             <ol style="list-style-type: none"> <li>Appropriate fluids, such as: breast milk, ORS<sup>*</sup>, formula, unsweetened fruit juice diluted 1:4, or cordial diluted 1:10</li> </ol> </li> <li>Avoiding soft drinks and undiluted fruit juice</li> <li>Using cup, bottle, spoon, dropper, syringe or icy-pole as child prefers</li> <li>Allowing normal foods</li> <li>Give parent handout</li> <li>Discharge or, if reason not to discharge (e.g. criteria to take special care as above), provide appropriate oral fluids and reassess within 1 hour</li> </ul>	<p><b>Rehydrate with Oral Rehydration Solution (ORS)<sup>*</sup></b></p> <ul style="list-style-type: none"> <li>Weigh child and start fluid balance chart</li> <li>Give ORS 10-20 ml/kg/hr for 1 hour                             <ul style="list-style-type: none"> <li>Give small amounts - 5mls/kg/15 minutes whenever possible</li> <li>Use cup, bottle, spoon, dropper, syringe or icy-pole as child prefers</li> </ul> </li> <li>Give parent handout</li> <li>Reassess after 1 hour</li> </ul>	<p><b>Rehydrate with intravenous (IV) fluids</b></p> <ul style="list-style-type: none"> <li>Weigh child and start fluid balance chart</li> <li>Take blood for urgent assessment of glucose, urea, creatinine, electrolytes and bicarbonate when inserting IV cannula</li> <li>Give bolus of normal saline 20ml/kg IV</li> <li>Notify senior clinician</li> <li>Reassess 10-15 minutes after bolus</li> </ul>
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### RESPONSE TO INITIAL TREATMENT

TOLERATING ORAL FLUIDS	NOT TOLERATING ORAL FLUIDS	RESPONDING	NOT RESPONDING
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### CONTINUING TREATMENT

<ul style="list-style-type: none"> <li>Continue oral fluids 10-20 ml/kg/hr for up to 3 hours</li> <li>Reassess hourly</li> <li>Allow normal foods</li> </ul>	<ul style="list-style-type: none"> <li>Insert nasogastric tube (NGT)</li> <li>Give ORS<sup>*</sup> via NGT 20 ml/kg/hr for up to 4 hours</li> <li>If persistent vomiting consider reducing rate of NG fluids or change to IV normal saline 20ml/kg/hr</li> <li>Reassess hourly</li> <li>Offer oral fluids</li> <li>Allow normal foods</li> </ul>	<ul style="list-style-type: none"> <li>Continue IV rehydration with normal saline 10ml/kg/hr</li> <li>Reassess hourly</li> <li>Offer oral fluids</li> <li>Allow normal foods</li> </ul>	<ul style="list-style-type: none"> <li>Give further bolus of normal saline 20ml/kg IV</li> <li>Discuss with senior clinician or High Dependency Unit/Intensive Care Unit and arrange transfer</li> </ul>
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### RESPONSE TO CONTINUED TREATMENT

<p><b>RESPONDING</b></p> <ul style="list-style-type: none"> <li>Continue rehydration until no or minimal signs of dehydration</li> <li>Ensure child is tolerating oral fluids</li> <li>Provide patient information, including reasons to return</li> <li>Fax or post letter to GP</li> <li>Discharge</li> </ul>	<p><b>NOT RESPONDING</b></p> <ul style="list-style-type: none"> <li>Consider in consultation with senior clinician</li> <li>Reconsider diagnosis</li> <li>Continue to rehydrate - use nasogastric/intravenous fluids</li> </ul>
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## MANAGEMENT OF CHILD WITH DIARRHOEA, WITH OR WITHOUT VOMITING IN GENERAL PRACTICE

### INITIAL ASSESSMENT

This guideline should not be followed when:

- The child is unconscious or <3 months old
- The cause of diarrhoea is something other than gastroenteritis such as:
  - Acute causes e.g. urinary tract infection, acute appendicitis, peritonitis, intussusception, antibiotic toxicity
  - Chronic causes e.g. milk allergy/intolerance, gluten sensitivity, ulcerative colitis, regional enteritis, cystic fibrosis, Hirschsprung's disease

### ASSESSMENT OF SEVERITY OF DEHYDRATION

<u>None or Minimal</u>	<u>Moderate</u>	<u>Severe</u>
<ul style="list-style-type: none"> <li>• Normal capillary refill time</li> <li>• Skin pinch retracts immediately</li> <li>• Normal respiratory pattern</li> <li>• Normal conscious state</li> <li>• Normal drinking</li> <li>• Normal urine output</li> </ul> <p><i>These signs correspond to &lt;5% lost body weight</i></p>	<ul style="list-style-type: none"> <li>• Delayed capillary refill (3-4 seconds)</li> <li>• Skin pinch retracts slowly (1-2 seconds)</li> <li>• Increased respiratory rate<sup>1</sup></li> <li>• Restless, irritable</li> <li>• Drinks eagerly, increased thirst</li> <li>• Tachycardia<sup>1</sup></li> </ul> <p><i>These signs correspond to 5-10% lost body weight</i></p>	<ul style="list-style-type: none"> <li>• Very delayed capillary refill (&gt;4 seconds), mottled skin</li> <li>• Skin pinch retracts very slowly (&gt;2 seconds)</li> <li>• Deep, acidotic breathing</li> <li>• Lethargic, unconscious</li> <li>• Unable to drink</li> <li>• Deeply sunken eyes</li> <li>• Hypotension</li> </ul> <p><i>These signs correspond to &gt;10% lost body weight</i></p>

**N.B. If patient has signs or symptoms across categories, always treat according to their most severe features**

**Take special care if the child:**

- Is less than 6 months old
- Has had more than 8 significant diarrhoeal stools or more than 4 significant vomits in the last 24 hours
- Has co-morbid conditions such as short gut, developmental delay or metabolic illnesses

### INITIAL TREATMENT

	IF CHILD <u>NOT</u> TOLERATING ORAL FLUIDS → SEND TO HOSPITAL	SEND TO HOSPITAL
<p><b>Increase frequency and volume of usual drinks while child has diarrhoea.</b> This can occur in the surgery if facilities are available for monitoring, or at the patient's home if the GP considers circumstances suitable</p> <p>→ Best practice is to weigh the child and document fluid intake and output</p> <ul style="list-style-type: none"> <li>• Give appropriate fluids, such as: breast milk, ORS, unsweetened fruit juice diluted 1:4, or cordial diluted 1:10                             <ul style="list-style-type: none"> <li>◦ Use cup, bottle, spoon, dropper, syringe or icy-pole as child prefers</li> <li>◦ Avoid soft drinks, sports drinks and undiluted fruit juice or cordial</li> <li>◦ Allow normal foods if child hungry</li> </ul> </li> <li>• Give parent written information</li> </ul> <p><b>Reassess in person or by phone as required</b></p>	<p><b>IF CHILD TOLERATING ORAL FLUIDS</b> Rehydrate with Oral Rehydration Solution (ORS)<sup>2</sup>. This can occur in the surgery if facilities are available for monitoring, or at the patient's home if the GP considers circumstances suitable</p> <p>→ Best practice is to weigh the child and document fluid intake and output</p> <ul style="list-style-type: none"> <li>• Give 10-20 ml/kg ORS over 1 hour                             <ul style="list-style-type: none"> <li>◦ Give frequent small amounts eg 5mls/kg every 15 minutes whenever practical</li> <li>◦ Use cup, bottle, spoon, dropper, syringe or icy-pole as child prefers</li> </ul> </li> <li>• Give parent written information</li> </ul> <p><b>Reassess after 1 hour.</b> If the child is tolerating oral fluids then rehydration should continue for a further 3 hours with hourly reassessment</p>	

### RESPONSE TO TREATMENT

RESPONDING	NOT RESPONDING → SEND TO HOSPITAL
<p>Children who are tolerating oral fluids may be sent home if the parent/carer can provide adequate supervision, is able to continue to provide frequent small volume drinks, and understands when to return to medical care.</p>	<ul style="list-style-type: none"> <li>• Reconsider diagnosis</li> <li>• Continue to rehydrate</li> <li>• Consult with a Paediatrician or Emergency Physician</li> </ul>

<sup>1</sup>Normal parameters for paediatric vital signs are on page 57 <sup>2</sup>Oral Rehydration Solution (eg Repalyte, Gastrolyte, Pedalyte, Hydralyte)

## Annex 2 Patient Information

### Medical & nursing care for your child

Medical & nursing care for children with diarrhoea focuses on making sure your child drinks enough

- Your child will be checked for dehydration
- Drinks will be offered to your child. Drinks are the best treatment for dehydration
- Most children will get better if they drink enough
- If your child refuses to drink and continues to vomit, then a nasogastric tube may be inserted through their nose to their stomach. The tube helps get fluid into their stomach.
- If your child continues to vomit with the nasogastric tube, an IV drip may be used
- Your child will be regularly reviewed and sent home when their dehydration has improved, even if they still have diarrhoea or vomiting
- Only a very small number of children who go to hospital are admitted to the ward

**Did you know?**  
If you don't already have a GP you can find a child friendly GP on the web: [www.healthforkids.net.au](http://www.healthforkids.net.au)

### Important points to remember:

- Diarrhoea and vomiting can mostly be managed at home
- Give lots of drinks to make sure your child doesn't become dehydrated.
- Wash your hands after touching your child (especially toileting or changing nappies) and before touching any food. This stops the infection spreading.
- Do not allow other members of the family to share cups, plates, cutlery etc.
- Try to keep your child away from other children until the diarrhoea has stopped.
- Don't send your child to care, kindergarten, or school until the diarrhoea has stopped.

These websites have more information on diarrhoea and other illnesses:

<http://www.betterhealth.vic.gov.au/>

[www.rch.org.au/kidsinfo/](http://www.rch.org.au/kidsinfo/)

**Southern Health**

Disclaimer:

This health information is for general education purposes only. It should not be used in place of medical advice. Please consult with your doctor and/or other health care professionals to ensure a personalised and appropriate health care is taken for your child.

## Information for Parents of Children with Diarrhoea with or without Vomiting



### Diarrhoea and vomiting

Diarrhoea and vomiting are very common in children and are usually caused by an infection.

- Diarrhoea is a runny, watery bowel action, and usually lasts 2-3 days but can last up to 10 days
- Vomiting usually settles quickly, lasting a day or two.

Your child may also have:

- Tummy pain
- A high temperature
- Nausea

### Dehydration

The main worry for children with diarrhoea and vomiting is that they might become dehydrated.

Dehydration happens when children lose more water, sugar and salts through diarrhoea and vomiting than they take in from food and drinks.

**Did you know?**  
Babies under 6 months of age have a higher risk of dehydration.

Signs that your child might be dehydrated:

- More sleepy than usual
- Dry lips, tongue, or mouth
- Cold hands and feet
- Sunken eyes
- Not passing urine (Dry nappies)
- Pale

### What should I do at home?

Diarrhoea and vomiting can mostly be managed at home – the most important thing is to give lots of drink to make sure your child doesn't become dehydrated.

- Continue breastfeeding. Give smaller feeds more frequently
- If bottle feeding continue normal strength formula.
- Give regular drinks: see table for amounts → (a small amount every 10 – 15 minutes)
- Continue to give drinks even if diarrhoea or vomiting continues or gets worse
- Do not give any drugs to stop the diarrhoea and vomiting, as these can be harmful.
- Offer normal foods, but don't worry if your child doesn't feel like eating.

**Did you know?**  
Any normal foods are fine – you won't 'feed the bug'

These drinks are good:

- Cordial (not low calorie)  
½ cup cordial to ½ cup water
- Fruit juice (not sweetened)  
1 cup juice to 4 cups water
- Solutions that have been designed to treat dehydration. These are called 'oral rehydration solutions', some brands are:
  - **Rephalyte, O.R.S, Gastrolyte, Hydralyte, and Pedialyte.**
  - **Hydralyte** by-poles are also good; they are available from the chemist or supermarket.

**Did you know?**  
You don't have to use half-strength formula for bottle-fed children. Full strength is fine.

### How much drink should I give my child?

Child's weight	Over 15 minutes?	Over 1 hour?
< 10 kg	2 tablespoons	½ - 1 cup
10-20 kg	¼ - ½ cup	1 - 2 cups
20-30 kg	¼ - ½ cup	2 - 2½ cups
30-40 kg	¼ - 1 cup	2½ - 3 cups
40-50 kg	About 1 cup	3-4 cups

If your child wants to drink more than this, that's OK. Give small quantities each time. Large drinks might make your child vomit more.

### When should I take my child to a doctor?

Take your child to a GP:

- If you are concerned
- If your child:
  - Refuses to drink and continues to have diarrhoea or vomiting
  - Continues to drink, but vomits often and seems unable to keep any fluids down.
  - Has not been to the toilet or has not had a wet nappy for 12 hours
  - Is dehydrated
  - Has a bad stomach ache
  - Has mucus or blood in the diarrhoea
  - Is lethargic, restless or irritable

Take your child to the Emergency Department if your child has these symptoms and:

- An appointment with a GP is not available in the next few hours and you are concerned

If your GP is concerned that your child is severely dehydrated they may send you to the Emergency Department.

## How much fluid do I give my child?

What is your child's weight?	How much drink in 15 minutes?		How much drink in 1 hour?	
		How much is that?		How much is that?
About:				
5 kg	25 mls	Just over 1 tablespoon	100 mls	Just under $\frac{1}{2}$ a cup
7 kg	35 mls	About 2 tablespoons	140 mls	Just over $\frac{1}{2}$ a cup
10 kg	50 mls	Just under $\frac{1}{4}$ of a cup	200 mls	Almost 1 cup
12 kg	60 mls	$\frac{1}{4}$ of a cup	240 mls	About 1 cup
15 kg	75 mls	Just over $\frac{1}{4}$ of a cup	300 mls	Just over 1 cup
20 kg	100 mls	Just under $\frac{1}{2}$ a cup	400 mls	1 and $\frac{1}{2}$ cups
25 kg	125 mls	$\frac{1}{2}$ a cup	500 mls	2 cups
30 kg	150 mls	Just over $\frac{1}{2}$ a cup	600 mls	2 and $\frac{1}{2}$ cups
35 kg	175 mls	$\frac{3}{4}$ of a cup	700 mls	Almost 3 cups
40 kg	200 mls	Almost 1 cup	800 mls	Just over 3 cups
45 kg	225 mls	About 1 cup	900 mls	3 and $\frac{1}{2}$ cups
50 kg	250 mls	1 cup	1000 mls	1 litre

If your child wants to drink more than this amount, that's OK. Just make sure you give it in small quantities. Large drinks might make your child vomit more.

Don't worry if your child continues to vomit - this is normal for children with gastro. Just keep giving your child more fluid, in small amounts often.

If you are concerned that your child is vomiting up more fluid than they are drinking, even though you keep trying to give them more fluid, get advice from a doctor or nurse.

## Annex 3 Normal Parameters for Paediatric Vital Signs

	Neonate	Infant (6 months)	Toddler (2 yrs)	Pre-school	School-age (7 yrs)	Adolescent (15yrs)
<b>Heart Rate</b> (awake) (beats/min)	100-180	100-160	80-150	70-110	65-110	60-90
<b>Heart Rate</b> (asleep) (beats/min)	80-160	80-160	70-120	60-90	60-90	50-90
<b>Respiratory Rate</b> (breaths/min)	30-80	30-60	24-40	22-34	18-30	12-20
<b>Systolic BP</b> (5-95%) (mmHg)	60-90	87-105	95-105	95-110	97-112	112-128
<b>Diastolic BP</b> (5-95%) (mmHg)	20-60	50-66	50-66	50-78	57-80	66-80
<b>Temperature</b> (°C)	36.5-37.5	36.5-37.5	36.0-37.2	36.0-37.2	36.0-37.2	36.0-37.2

## Annex 4 Acronyms and Abbreviations

A&E	Accident and emergency
ABG	Arterial blood gas
DHS	Department of Human Services
ED	Emergency department
GDG	Guideline Development Group
GE	Gastroenteritis
GP	General practitioner
HUS	Haemolytic-uraemic syndrome
IV	Intravenous
IVI	Intravenous infusion
NG	Nasogastric
NGT	Nasogastric tube
ORS	Oral rehydration solution
ORT	Oral rehydration therapy
PAERG	Paediatric Accident and Emergency Research Group
RCT	Randomised controlled trial

## Annex 5 PAERG Guideline Development Process

A multi-disciplinary group was convened to advise on the development of the guideline and met regularly throughout the process. The group consisted of Dr Kate Armon (clinical research fellow), Dr Maria Atkinson (clinical research fellow), Professor Terence Stephenson (Professor of Child Health and Honorary Consultant Paediatrician), Dr Roderick Macfaul (DGH Paediatrician), Ursula Werneke (statistician), Dr Stephanie Smith (Paediatric A&E Consultant), Pippa Ecclestone (nurse researcher). A GP and parent representatives were also consulted.

### Details Of Guideline Development

The guideline development process is based on the methodology suggested by the Scottish Intercollegiate Guideline Network<sup>12</sup> and the 'AGREE' criteria used to appraise guidelines provided in the Royal College of Paediatrics Standards for development of clinical guidelines<sup>13</sup>. The literature was appraised by following recommendations for grading provided in a recent report by SIGN<sup>12</sup>. A modified Delphi method, was used to provide consensus where evidence was lacking and to help translate the evidence into relevant and unambiguous recommendations.

The recommendations for clinical practice are based on:

- The results of a systematic literature search, review and appraisal of the available research evidence identified from the electronic databases from 1966 to December 2002.
- A review of the literature identified by hand searching journals thought to be most relevant to the subject from January 1998 to January 2003.
- A search of the relevant journals not found on the electronic databases.
- A limited search for unpublished studies.
- Expert opinion from the Delphi panel where evidence was lacking.

### Composition of the Delphi panel

Members as listed in the acknowledgments.

The panellists selected were drawn from the United Kingdom, represented practice in both urban and rural settings and were clinicians who would be involved in management of a child after presentation at hospital. We did not include general practitioners, parents or patients. Ninety-six medical (consultant, registrar and SHO) and nursing staff from mixed adult/paediatric A&E departments, paediatric A&E departments, general paediatric departments (both teaching hospital and district general hospital) and specialist paediatric gastroenterology services were invited of whom 54 agreed to be included.

## Delphi process - Incorporating consensus into guideline development

### Performing Consensus Processing

Systematic reviews and meta-analyses are the gold standard for research and are used to summarize research evidence. Their conclusions can be readily incorporated into a guideline. In Paediatrics, however, as in many other disciplines, there is a dearth of available research evidence<sup>57</sup> and systematic reviews are not available to answer many of the clinical questions, especially those related to the decision-making processes. It is therefore important to be able to identify and critically appraise other levels and sources of evidence and use this information for producing recommendations so long as the process used to develop this recommendation is made clear to the guideline users.

Guidelines should ideally be based on the current available evidence and high quality evidence may currently be accumulating but we would be mistaken if we did not accept that other influences such as clinical experience have an effect on decision-making. We must be aware that the art of medicine is unlikely to be managed away for many years to come<sup>58</sup>.

Consensus methods can be used in guideline development as a means by which evidence can be combined with clinical acumen and experience to produce a practical and useable clinical tool. They can be described as qualitative rather than quantitative research methods used 'to determine the extent to which experts or lay people agree about a given issue<sup>59</sup>'. Qualitative methods are useful for studying decision-making processes and despite being criticized for lacking scientific rigor<sup>59</sup> they can be used to complement evidence-based medicine<sup>60</sup>. The guideline development group decided to use the Delphi method for the consensus process used in the development of this guideline.

### Delphi

#### *Introduction*

This method was named after the Greek oracle thought to have the power to predict the future<sup>61</sup>. It was initially developed as a research technique by the RAND Corporation in the 1950's to synthesize expert opinion on new technologies<sup>61</sup>. The method was originally used for military purposes but is now much more widely used and is still more commonly by nurses than by doctors. With the increasing interest in improving quality of care and clinical guidelines, the Delphi method is being adopted as a way to combine evidence with expert opinion and experience<sup>58</sup>. The technique can be used to deal with a complex problem by a multiple iteration survey<sup>62, 63</sup>. The key features of this procedure include anonymity, iteration, controlled feedback, and statistical group response<sup>64</sup>. Guidelines are an important component of clinical governance and to be useful to the clinician they have to be able to aid management decisions such as treatment, investigations, admission, discharge and follow-up. There are few areas in medicine which have an evidence base to answer all of these questions for a particular symptom or disease. Delphi consensus is a formal transparent process to aid this important part of guideline

development until a research base is available to address the particular questions. The first round of the Delphi consists of a group of invited individuals being presented with information in the form of statements<sup>62</sup>. These individuals have a particular interest in the subject under discussion or they have in-depth knowledge about it. The relevant individuals then provide an opinion on this information based on their own knowledge, experience and often information provided<sup>65</sup>. In the second round the questionnaire is mailed out to the respondents again but this time, the panel are able to alter their judgment in light of the group's responses. The panel ranks the level of agreement or disagreement with each of the statements after receiving feedback on the group's responses. This process continues and the participants continue to re-rank their agreement or disagreement with the statements until an accepted degree of consensus is reached<sup>62, 65</sup>. Finally, the responses are statistically analysed to determine which statements reached consensus of agreement or disagreement<sup>61</sup>. At no time does the group meet and therefore this method allows access to a large number of people and maintains anonymity. The Delphi method has however been adopted and altered over the years so that the technique can be used in a number of different circumstances<sup>66</sup>.

#### *Details of the Delphi process used in the development of the guideline for children with diarrhoea*

The guideline development group selected members of the Delphi panel. Panel members were selected to reflect their involvement in the care of children with diarrhoea. The aim was to compose a multi-professional panel and to select members whose input would be valued either for their expert knowledge base in the area, or their practical involvement with children or their expertise in interpreting evidence-based medicine.

#### *Delphi process - First round*

Panellists were sent: the literature review and derived management statements; complete copies of all the articles cited, the critical appraisal abstraction sheet and grade of evidence; a response form detailing each statement with a 1-9 Likert scale and space for comments.

The panellists were asked to rate their level of agreement with each statement and to comment. This first round 'pack' was piloted (n=4) and revised where necessary to improve clarity and remove ambiguity. A reminder letter and a subsequent telephone call were made to non-responders.

Definition of consensus was predetermined. Often consensus is accepted when 75% of participants agree, and lack of consensus when more than 25% disagree. For nominal groups, rules have been developed to assess agreement when statements have been ranked on a 9-point scale. We chose to apply this to the Delphi method since the same scale was used. One sixth of the ratings furthest from the median were removed (17%). This is done so that outliers (who may not have understood the question, or are unique in their views) do not overly influence the results. Consensus within the panel (known as 'relaxed' agreement for a nominal group) is defined as all remaining panellists' responses falling within 3

boxes of each other on the Likert scale Consensus agreement with the statement as presented to the panel is defined as all remaining responses falling in boxes 7-9 (thus agreement both within the panel members and with the statement as given, known as "strict agreement" for a nominal group).

#### *Second and third rounds*

All statements that achieved "strict" consensus were removed from subsequent rounds and used for guideline construction where evidence was lacking. Statements that did not gain consensus and modified or new statements were used in the second round. After the extreme one sixth of responses were removed, the range, inter-quartile range and median of the remaining responses were reported back to the panellists. Panellists were asked to re-consider the statements in the light of the responses and comments of the rest of the panel. A third round consisted of statements that had still not achieved consensus.

#### *Incorporation of Delphi into the guideline*

Statements that had reached Delphi consensus were used in the algorithm where evidence was lacking but never in preference to evidence. There was only one recommendation where evidence was lacking and the Delphi panel were unable to achieve consensus.

## **The guideline**

The literature review, level of evidence and grade of recommendation is given for each step on the algorithm. If no evidence was available this is clearly stated followed by a further statement which details whether Delphi consensus was reached. The algorithm formed the basis of an integrated care pathway, which was used to pilot the guideline (described later) and to study its impact.

Throughout, the word "admit" is defined as follows: "any admission to a paediatric facility with paediatric trained staff for observation, further investigation and management regardless of the expected length of stay".

## **Systematic Literature Review**

A systematic review of the literature was performed following the methodology suggested by SIGN. The literature was identified by an explicit search strategy, according to pre-set criteria, and evaluated against standards provided by SIGN. A librarian, (from the Greenfield Medical Library University of Nottingham), experienced in Medline searching, checked the initial searches and found them to be satisfactory.

The search strategies used identified:

- Existing guidelines
- Systematic reviews and meta-analyses
- Randomised controlled trials
- Observational studies
- Cohort studies

- Case series

### **Search strategy**

Full details about the pre-set criteria for identifying the relevant literature and the results of the literature search for critical appraisal can be found in Appendices 1 and 2.

In general, because research evidence in paediatrics is still sparse it was impossible to restrict inclusion to well-conducted randomised-controlled trials. However, the studies needed to use an appropriate study design for the question asked and the study needed to be rigorous and provide results that were valid and reliable. Articles were chosen according to four criteria:

- Addressed the key clinical question.
- Indicated a thorough scientific review of the literature.
- A review or guideline that was written by a national body.
- An indication of a well designed clinical trial.

We included the following computerised databases: The Cochrane Library, Medline, Embase, Cinahl, and Best Evidence. We searched from 1966 to the present (December 2002) using MeSH headings and "textwords", limited to 0-16 years of age. Further articles were obtained from colleagues and by hand searching the bibliography of articles. A hand search for the last 5 years of the most relevant journals was performed. The web site of Ulrichs Periodicals Directory was searched to identify any relevant journals not found on Medline. The journals not listed on Medline were only searched if thought to be relevant to the subject area. The Internet was searched for existing guidelines and links to other evidence based sites. (Details of all Internet sites searched can found in Appendix 1).

A systematic search for the evidence involved the following steps:

- 1) A search of internet sites for existing guidelines
- 2) A systematic search of appropriate databases for identification of existing studies
- 3) Hand search
- 4) Limited search for unpublished studies

#### *Inclusion criteria*

Papers were included if they:

- a) Addressed the clinical question
- b) Published since 1966
- c) Primary research
- d) Reliable and valid
- e) Included methodology in the paper and the results were thought to be valid and relevant

Searches were not limited to papers in the English language.

#### *Exclusion Criteria*

- a) Literature referring solely to adults
- b) Case reports
- c) Overviews
- d) Assessed to be of poor quality

### *Internet Search*

The following sites were accessed to look for evidence-based links and existing guidelines. This list of web sites was generated from information gathered from study days attended on guideline development and evidence based medicine, from an established list of sites searched by previous guideline developers at Nottingham and finally a search of the web for any new evidence based medicine sites.

### *Internet web sites searched*

- AHCPR (US Agency for Health Care Policy and Research)
- Canadian Medical Association Clinical Practice Guidelines Database
- Centre For Disease Control and Prevention
- Group Health Northwest: Evidence-Based Guidelines
- New Zealand Guidelines Project
- University of Washingtons Physicians
- Evidence-Based Guidelines and Critical Pathways For Quality Improvement
- Evidence Based Guidelines
- World Health Organization Site
- CDR Database (this site searches the databases of DARE, NHS EED, HTA)
- Scottish Intercollegiate Guideline Network
- National Institute of Clinical Excellence
- TRIP
- The Centre For Clinical Effectiveness
- Centre For Evidence-Based Child Health
- Centre For Evidence-Based Medicine
- Clinical Governance Resource
- E-guidelines
- Clinical Practice Guidelines Infobase
- Medical Matrix
- BestBETS
- Netting the Evidence
- SUM Search
- American Academy of Pediatrics

### *Computerized Databases*

The following databases were searched

- The Cochrane database of systematic reviews and Cochrane Trials Register
- Medline
- Embase
- Cinahl
- Best Evidence

The searches were performed using MesH headings and 'textwords' limited to 0-18 or 0-16 depending on the limits available on the different databases. The searches were limited to children with the filters available rather than using "Child" as a MesH heading as this generated more hits. The quality of the initial searches was checked and discussed with a librarian experienced in Medline searching and found to be satisfactory.

### Hand Search

A hand search of the following journals was performed from January 1998 to January 2003.

- Archives of Disease in Childhood
- Journal of Paediatric Gastroenterology and Nutrition
- Journal of Pediatrics

Further articles were obtained by speaking to colleagues (a mixture of specialists and general paediatricians). A search of Ulrich's Periodical Directory was undertaken to identify further journals relevant to the guideline. This directory contains some journals not available on the databases searched.

### Appraisal and Data Extraction

The research fellow used data-extraction forms and quality checklists developed by SIGN (2000) to appraise each paper.

Information from reports or existing guidelines was also extracted where appropriate but the guideline is clear about the source of information when providing a grade of recommendation. The articles were assessed for their relevance and quality and then critically appraised. Grading of the papers was discussed with colleagues experienced in critique of papers and evidence based medicine. Good quality data was recorded in evidence tables and the strength of evidence generated was graded. The level of evidence was graded 1 to 4 and recommendations were graded A to D based on the level of evidence found.

Database	MeSH	Hits	Abstracts Reviewed	Papers Reviewed	Papers Used
The Cochrane Library	diarrhoea or gastroenteritis	195	3	3	2
Cochrane trials register	diarrhoea or gastroenteritis	1322	113	6	3

### Hand Searching

Journal	Dates	Papers Reviewed	Papers Used
Archives of Disease In Childhood	January 1998 to January 2003	5	0
Journal of Pediatrics	January 1998 to January 2003	1	0
Journal of paediatric gastroenterology and nutrition	January 1998 to January 2003	5	0

1 article was found but not used due to being in a foreign language: Lugauer S et al. Incidence and symptoms of gastroenteritis in hospitalized children out of a cohort of 10271 *Monatsschrift* 2000,148:2; 119-22.

**Search strategies**

<i>Differential diagnosis of a child who presents with acute diarrhoea</i>				
Search Term	Medline	Cinahl	Best Evidence	Embase
Diarrhoea expl + tw	39642	1138	18	41592
Gastro expl + tw	6568	276	6	6102
Combine (or)	44866 -1	1367 -1	21 -1	46181 -1
Differential diagnosis	241461	1865	8	1208
Aetiology	17000	410	0	14433
Combine (or) 2	257396 -2	4722 -2	0 -2	15628 -2
1+2 Limit child	<b>813</b>	<b>8</b>	<b>0</b>	<b>111</b>
Abstracts reviewed	30	0	0	3 already found
Papers reviewed	3	0	0	0
Papers used	2	0	0	0

Most articles in these searches addressed the differential diagnosis of chronic rather than acute diarrhoea. The aetiology of acute infectious diarrhoea is well documented but the overall differential diagnosis of a child presenting with acute diarrhoea is not.

<i>Clinical signs as indicators of levels of dehydration in children</i>				
Search Term	Medline	Cinahl	Best Evidence	Embase
Diarrhoea exp + tw	39696	1151	18	41927
Gastro exp + tw	9210	278	6	5832
Combine (or)	47085 -1	1382 -1	25	46415 -1
Clinical signs tw	21339	154	17	14119
Dehydration exp + tw	5924	385	6	5437
Combine (and)	37 -2	1	0	42 -2
Combine 1 and 2	<b>13</b>	<b>1</b>	<b>0</b>	<b>16</b>
Abstracts reviewed	3	0	0	1
Papers reviewed	3	0	0	0
Papers used	2	0	0	0

<i>Indication for urea and electrolytes in children with diarrhoea or gastroenteritis</i>				
Search Term	Medline	Cinahl	Best Evidence	Embase
Diarrhoea exp + tw	39696	1151	18	41927
Gastro exp + tw	9210	278	6	5832
Combine (or)	47085 -1	1382 -1	25	46415 -1
Electrolytes focus		1174	0	2687 -2
Combine 1 and 2	197	<b>21</b>	0	157
Limit child, human	<b>106</b>		0	<b>128</b>
Abstracts reviewed	8	3	0	6
Papers reviewed	4	0	0	1
Papers used	2	0	0	1

<i>Indications for admission to hospital in children with diarrhoea</i>				
Search Term	Medline	Cinahl	Best Evidence	Embase
Diarrhoea exp + tw	39696	1151	18	41927
Gastro exp + tw	9210	278	6	5832
Combine (or)	47085 -1	1382 -1	21 -1	46415 -1
Hospitalization	75629 - 2	6892 - 2	202	4824
Combine 1 and 2	594	<b>30</b>	<b>1</b>	65
Limit child	<b>455</b>			<b>46</b>
Abstracts reviewed	25	0	0	12
Papers reviewed	2	0	0	2
Papers used	1	0	0	1

Most papers in this area addressed specific aspects of the child admitted with diarrhoea e.g. number of positive stool cultures rather than indication for admission

<i>Management of children with diarrhoea/gastroenteritis – fluid therapy</i>				
Search Term	Medline	Cinahl	Best Evidence	Embase
Diarrhoea exp + tw	39696	1151	18	41927
Gastro exp + tw	9210	278	6	5832
Combine (or)	47085 -1	1382 -1	21 -1	46415 -1
Fluid therapy	7801 - 2	4023 - 2	1 - 2	18274 - 2
Intravenous infusion	27793 - 3	650 - 3	0 - 3	6618 - 3
Combine 2 or 3	35251 - 4	4599 - 4	1 - 4	23074 - 4
Combine 1 and 4	1907	150	1	1652
Limit child	1398	111	1	747
Abstracts reviewed	73	23	1	43
Papers reviewed	6	0	0	1
Papers used	6	0	0	1

<i>Management of children with hypernatraemic dehydration</i>				
Search Term	Medline	Cinahl	Best Evidence	Embase
Diarrhoea exp + tw	39696 - 1	1151 - 1	18 - 1	41927 - 1
Gastro exp + tw	9210 - 2	278 - 2	6 - 2	5832 - 2
Dehydration	5930 - 3	628 - 3	0 3-	9666 - 3
Combine 1, 2 or 3	51942 - 4	1996 - 4	28 - 4	54062 - 4
Hypernatraemia*	598 - 5	37	2 - 5	556 - 5
Combine 4 and 5	243	49	<b>2</b>	192
Limit	162	18		78
Abstracts reviewed	11	1	0	1
Papers reviewed	0	0	0	0
Papers used	0	0	0	0

<i>Use of anti-diarrhoeals</i>				
Search Term	Medline	Cinahl	Best Evidence	Embase
Diarrhoea exp + tw	39696	1151	18	41927
Gastro exp + tw	9210	278	6	5832
Combine (or)	47085 -1	1382 -1	21 -1	46415 -1
Anti-diarrhoeals*	519 - 2			506
Combine	294			336
Limit	<b>92</b>			<b>58</b>
Abstracts reviewed	5	0	0	5
Papers reviewed	3	0	0	0
Papers used	0	0	0	0

### Rejected Papers

1. Enteric infections, cows milk intolerance and parenteral infections in 118 consecutive cases of acute diarrhoea in children. Capano G et al. *European Journal of Pediatrics* 1984 142:281-285. This was a prospective hospital cohort study. Aim not clearly stated. 118 children under 3 yrs referred with diarrhoea were studied and end diagnoses noted. This paper was selected for evidence to support the differential diagnoses that should be considered in children with diarrhoea. Rejected as the sample is not representative of all children who present to hospital with diarrhoea e.g. Children over 3 excluded and children presenting to other specialities e.g. surgeons.
2. Diarrhoea, diagnostic delay, and appendicitis. Murch S et al. *The Lancet* 2001 356:778. Commentary.
3. The diagnostic value of symptoms and signs in childhood abdominal pain. Williams NM et al. *Journal of the Royal college of Surgeons of Edinburgh*. 1998 43(6):390 –2. Retrospective case note review of children admitted with abdominal pain over a 1 year period. Split into 5 groups depending on final diagnoses non specific abdominal pain, viral gastroenteritis (3.8%), those who underwent appendectomy for acute appendicitis, constipation and miscellaneous. Symptoms and signs only extracted from the notes for the children with final diagnoses of acute appendicitis and non-specific abdominal pain.
4. Comparison of nasogastric and intravenous methods of rehydration in paediatric patients with acute dehydration. Nager AL et al *Pediatrics* 2002, 109(4):566-72. Randomised controlled trial of rapid NG or IV rehydration in children with acute moderate dehydration. Rejected as the mean post treatment weights only raised by 2.2% in the NG group and 3.58% in the IV group suggesting that this group of children infact had only mild dehydration. The children were given a challenge of ORS prior to being considered for the trial. It was not stated what this challenge consisted of and what was taken as a failure. It may have been that children were reluctant to drink ORS as they were only mildly dehydrated.
5. Evaluation of laboratory tests in dehydrated children with acute gastroenteritis. Yilmaz K et al *Journal of Pediatrics and Child Health*. 2002, 38:226-8. Aim to examine the usefulness of laboratory tests in estimating the severity of dehydration. Retrospective review of 238 notes, 70% of whom had had the biochemical tests under consideration carried out (sodium, bicarbonate and urea). Normal levels for the parameters were not given. No indication of the clinicians estimate of dehydration taken from the notes to enable comparison of estimated and true dehydration. If the estimated levels of dehydration had been recorded and were found to correlate with true levels then it could be assumed that further parameters to estimate dehydration are not needed. No indication of whether blood indices change management e.g. did the 30%

- of children who didn't have the full battery of tests have a different outcome to the group that did.
6. Childhood hospitalization for psychosocial reasons: The case of gastroenteritis. McGee HM, Fitzgerald M. *International Journal of Psychiatry In Medicine*. 1991, 21;355-368. This paper reports the same study as a paper in Family Practice 1990 Fitzgerald et al quoted in the guideline.
  7. How commonly are children hospitalized for dehydration eligible for care in alternative settings? McConnochie KM, Connors GP, Wilson C. *Archives of Pediatric and Adolescent Medicine*. 153(12):1233-41. Good paper which tries to address why children remain in hospital when rehydration has taken place and whether they could be care for in alternative settings but is beyond the scope of the guideline. Doesn't address whether appropriate treatment was being administered as inappropriate use of IV fluids may have led to prolonged admissions in some children.
  8. Regulating the use of drugs in diarrhoea. Mittal SK. *Journal of Paediatric Gastroenterology and Nutrition*. 2001, 33(2):26-30. Review article
  9. Efficacy and tolerability of racecadotril in acute diarrhoea in children. Cezard JP et al. *Gastroenterology* 2001, 120(4):779-805. Anti-diarrhoeal in question not in the BNF or Medicines For Children.
  10. Travellers diarrhoea among children returning to the United Kingdom from visits abroad. Msengi AE et al. *Annals of tropical paediatrics*. 1988, 8:173-80. Case series
  11. Is dilution of cows milk formula necessary for dietary management of acute diarrhoea in infants aged less than 6 months. Chew F et al. *Lancet* 1993, 341:194-7. Cochrane review found on the same topic.
  12. Acute gastroenteritis in infants under than 6 months old. Fox R et al. *Archives of Disease in Childhood* 1990;65:936-938. Cochrane review found on the same topic.
  13. A comparative trial of rapid oral and intravenous rehydration in acute diarrhoea. Vesikari T et al. *Acta Paediatrica Scandinavia*. 1987;76:300-305. Cochrane review found on the same topic.
  14. Guidelines for managing acute gastroenteritis based on a systematic review of published research. Murphy MS. *Archives of Disease in Childhood*. 1998;79:279-284. This was an excellent review and provided important background reading and references but recommendations were not used for the following reasons. The literature search included Medline and Cinahl only therefore was not systematic. The article was not transparent about linking recommendations to specific studies.
  15. Efficacy of glucose based oral rehydration therapy. Gavin N et al. *Pediatrics* 1996;1(98):45-51. This metanalysis included studies with oral and IV arms and those comparing different strength ORS's. A RCT comparing oral and IV treatment is the best trial to answer the clinical question of whether ORS is as efficacious as IV therapy. In view of this the best individual studies with both oral and IV arms were looked at individually and used to make a recommendation.
  16. Outpatient Oral Rehydration in the United States. Listernick et al. *American Journal of Disease in Childhood* 1986;140:211-215. Larger studies found to address the same question.
  17. Oral rehydration therapy of infantile diarrhoea. Santosham M et al. *The New England Journal of Medicine*. 1982;18:1070-1073. Better studies found to address the question.
  18. Efficacy of glucose-based oral rehydration therapy. Gavin et al. *Pediatrics*. 1996;98:45-51. This was a meta-analysis that included studies comparing oral and IV fluids and those comparing different strength oral rehydration solutions. Studies directly comparing oral and IV therapy were felt to be the most relevant to make a recommendation about the best method of rehydration and so these studies were individually examined.

## **Dissemination**

Prior to implementation an active period of dissemination was undertaken. This involved teaching sessions with nurses and doctors working in accident and emergency and in the GP referral unit. Copies of the algorithm and the tables were distributed to these areas.

## **Implementation pilot**

The guideline has been provided as a series of recommendations and also as a care pathway to aid the decision-making process by clinicians. Pre- and post implementation data has been collected from the paediatric emergency department at the Queens Medical Centre Nottingham where the guideline has been developed and piloted. It would be possible for any institution implementing this guideline to undertake a similar audit process. Cost analysis was not addressed but would be important to consider in a further audit.

**Method:** A care pathway was developed with nursing and medical staff, based on the guideline algorithm. This was used as the documentation for children presenting with diarrhoea, and followed the child to the ward if admitted.

The key elements of the assessment and management of the child with diarrhoea, using this guideline, were used to develop a data collection form. These data were collected from the notes of children attending A&E, (both GP referrals and self referrals), during a four month period in 1997 and compared with those attending during a four month period in 1999, following implementation of the care pathway. Data were compared using SPSS<sub>j</sub>, Chi-square and Man-Whitney-U tests.

**Results:** 292 children attended with diarrhoea pre care pathway and 239 post. There was no difference in age, sex, or time of arrival. Numbers admitted increased from 27% to 34%. During the same period there was a 14% increase in admissions of children presenting with all other medical problems. There was no change in the numbers of children returning to A&E having been discharged.

The time taken from seeing the doctor to discharge was reduced by 15 minutes from a median of 55 minutes to 40 minutes, and the total time in the department reduced by 24 minutes from median 102 to 78 minutes. The number of children investigated for FBC and U&E fell (17% to 6%,  $c^2$   $p = 0.02$  and 18% to 7%,  $p=0.02$  respectively), and intravenous infusions fell (13% to 2%,  $c^2$   $p=0.002$ ). Other investigations remained the same. Documentation of symptoms, signs and management plan was improved.

**Conclusion:** The implementation of a care pathway for diarrhoea was associated with a reduction in the number of unnecessary investigations and unnecessary IV cannulations. It also reduced the time spent in the A&E department. The proportion of attenders admitted increased in keeping with the overall increase in medical admissions.

## Annex 6: Additional Searches and Appraisals Undertaken for Southern Health Adaptation

### Searches

<i>Stool culture for children with diarrhoea</i>				<i>14/01/05</i>
	Search Term	Medline 1996-2005	Cinahl	The Cochrane Library
1	Gastro/diarrhoea terms	55421	3968	Not specified as search undertaken in Wiley interface
2	Limit to English, human, 2003-5	8637	813	
3	Culture terms	55160	3608	
4	Child/infant terms	584075	150825	
5	Combine 1, 2, 3 & 4	268	18	
	Abstracts reviewed	5	0	136
	Papers reviewed	1	0	0
	Papers used		0	0

<i>Repeated weight measurement in children with diarrhoea</i>				<i>17/01/05</i>
	Search Term	Medline 1996-2005	Cinahl	The Cochrane Library
1	Gastro/diarrhoea terms	55421	3968	Not specified as search undertaken in Wiley interface
2	Weight terms	189777	23202	
3	Dehydration terms	18929	5940	
4	Child/infant terms	422452	118707	
5	Combine 1, 2, 3 & 4	124	16	
	Limit 5 to human and English	102	n/a	191
	Abstracts reviewed	1	0	0
	Papers reviewed	0	0	0
	Papers used	0	0	0

<i>Urinalysis for children with diarrhoea</i>				<i>31/01/05</i>
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Gastro/diarrhoea terms	168527	3968	13123
2	Child/infant terms	1473445	118707	47947
3	Urinalysis terms	120299	3140	8978
4	Fever terms	100600	3097	7339
5	Combine 1, 2, 3 & 4	89	2	54
6	Limit to English, human, 2003-5	65	2	54
	Abstracts reviewed	0	0	1
	Papers reviewed	0	0	1
	Papers used	0	0	0

<i>Electrolyte disturbance in children with diarrhoea in Australia</i>				<i>01/02/05</i>
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Gastro/diarrhoea terms	168551	3968	13123

2	Child/infant terms	1473731	118707	47947
3	Electrolyte terms	322191	2156	4063
4	Australia terms	60648	16146	3828
5	Combine 1, 2, 3 & 4	12	0	11
6	Limit to English and human	12	0	11
	Abstracts reviewed	1	0	0
	Papers reviewed	1	0	0
	Papers used	?	0	0

<i>Doughy skin as a sign in children with diarrhoea</i>		<i>01/02/05</i>		
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Doughy	45	1	1
2	Limit to English and human	26	0	1
	Abstracts reviewed	0	0	0
	Papers reviewed	0	0	0
	Papers used	0	0	0

<i>Fluids other than ORS in children with diarrhoea</i>		<i>03/02/05</i>		
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Gastro/Diarrhoea terms	168551	4009	13123
2	Child/infant terms	1473731	120260	47947
3	Rehydration terms	30670	5712	1603
4	Drinks terms	306673	4649	8273
5	Combine 1, 2, 3 & 4	470	13	79
	Limit to English and human and 2003-5	11	2	13
	Abstracts reviewed	2	0	0
	Papers reviewed	0	0	0
	Papers used	0	0	0

<i>IV fluids in children with diarrhoea</i>		<i>03/02/05</i>		
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Rehydration terms	28474	4009	1309
2	Gastro/Diarrhoea terms	168551	5611	13123
3	IV terms	376740	8754	41202
4	Hartman/Ringer terms	50201	906	2098
5	Saline terms	84387	1353	9425
6	Combine 1, 2, 3 4 & 5	9	1	5
7	Limit to English and human	2	0	5
	Abstracts reviewed	0	0	0
	Papers reviewed	0	0	0
	Papers used	0	0	0

<i>Anti-emetics in children with diarrhoea</i>				<i>07/02/05</i>
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Gastro/Diarrhoea terms	139789	2453	6089
2	Child/infant terms	1475097	120260	47947
3	Anti-emetic terms	102949	1958	10558
4	Combine 1, 2, & 3	129	11	9
5	Limit to English and human	104	11	9
	Abstracts reviewed	4	No new	No new
	Papers reviewed	3	No new	No new
	Papers used	3	No new	No new

<i>Feeding in children with diarrhoea receiving IV fluids</i>				<i>07/02/05</i>
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Rehydration terms	28507	5611	1309
2	Gastro/Diarrhoea terms	168784	4009	13123
3	IV terms	377146	8754	41202
4	Feeding terms	289525	19783	12155
5	Combine 1, 2, 3 & 4	71	3	49
6	Limit to English and human	55	3	49
	Abstracts reviewed	2	0	0
	Papers reviewed	0	0	0
	Papers used	0	0	0

<i>Bolus or continuous fluids for children with diarrhoea receiving nasogastric rehydration</i>				<i>07/02/05</i>
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Gastro/Diarrhoea terms	168784	4009	13123
2	Rehydration terms	30707	5712	1603
3	Child terms	1475097	120260	47947
4	Nasogastric terms	8326	641	834
5	Bolus terms	67566	2076	9729
6	Combine 1, 2, 3, 4 & 5	0	0	0
	Limit to English and human	0	0	0
	Abstracts reviewed	0	0	0
	Papers reviewed	0	0	0
	Papers used	0	0	0

<i>Trial of oral fluids for children with diarrhoea</i>				<i>07/02/05</i>
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Gastro/Diarrhoea terms	168786	4009	13123
2	Rehydration terms	30707	5712	1603
3	Child terms	1475097	120260	47947
4	Oral rehydration terms	4578	530	1030

5	Trial or acceptance terms	226770	21984	119242
6	Combine 1, 2, 3, 4 & 5	156	11	170
	Limit to English and human	144	11	170
	Abstracts reviewed	0	0	0
	Papers reviewed	0	0	0
	Papers used	0	0	0

<i>Rehydration for children with hyponatraemic dehydration</i>		<i>22/03/05</i>		
	Search Term	Medline 1966-2005	Cinahl	The Cochrane Library
1	Gastro/Diarrhoea terms	169835	6339	13204
2	Rehydration terms	30259	5751	1415
3	Hyponatraemia terms	6280	351	226
4	Combine 1, 2 & 3	153	4	36
	Limit to English and human	101	4	36
	Abstracts reviewed	8	0	0
	Papers reviewed	2	0	0
	Papers used	0	0	0

## Appraisal Tables

### Signs of Dehydration

#### Study Selection Criteria

<b>Patient</b>	Children with diarrhoea	<b>Comparison</b>	Any
<b>Intervention</b>	Clinical signs	<b>Outcomes</b>	Assessment of severity of dehydration
<b>Study Type</b>	Any comparative study	<b>Language</b>	English
		<b>Publication Date</b>	Any

Number of included studies:

#### Characteristics of included studies:

Study	Study Type	N(total)	Patients	Intervention	Comparison	Outcomes
Steiner 2004	Sys Review	1246 (13 RCTs)	Children with dehydration	Clinical signs	Difference between rehydration weight and acute weight, divided by the rehydration weight	Assessment of severity of dehydration

#### Quality of included studies:

Study	Focused research question	Specified inclusion/exclusion criteria	Explicit and comprehensive search strategy	Validity of included trials appraised	Homogeneity between studies assessed	Summary of main results presented	Strengths and limitations of included studies discussed	Comments
Steiner 2004	Yes	Partially	Yes	Yes	Yes	Yes	Yes	<ul style="list-style-type: none"> <li>Inclusion/exclusion criteria not explicitly listed, described in text</li> </ul>

#### Results of included studies:

- Signs of dehydration are imprecise and inaccurate
- Three studies evaluated history of low urine output, the pooled analysis did not show any increase in the likelihood of 5% dehydration
- Two studies agreed that parental report of normal urine output decreases likelihood of dehydration
- Capillary refill time, skin turgor and abnormal respiratory pattern are the 3 best individual examination signs
- Groups of signs improve diagnostic accuracy

## Antiemetics

### Study Selection Criteria

<b>Patient</b>	Children with vomiting associated with acute gastroenteritis	<b>Comparison</b>	Placebo
<b>Intervention</b>	Ondansetron or other antiemetic	<b>Outcomes</b>	Any
<b>Study Type</b>	RCT	<b>Language</b>	English
		<b>Publication Date</b>	Any

### Characteristics of included studies:

Study	Study Type	N(total)	Patients	Intervention	Comparison	Outcomes
Cubeddu (1997)	RCT	36	6 months to 8 years	Ondansetron 0.3mg/kg, single dose IV	Metoclopramide 0.3mg/kg or placebo	Various
Reeves (2002)	RCT	107	1 month to 22 years	Ondansetron single dose 0.15mg/kg	Placebo	Various
Ramsook (2002)	RCT	145	6 months to 12 years	Ondansetron every 8 hours (~6 doses) varying dose with age	Placebo	Various

### Quality of included studies:

Study	Specified inclusion/exclusion criteria	Adequate method of randomisation	Concealment of allocation	Groups similar at baseline	Blinding - patients/ investigators/ assessors	Duration of follow-up	Proportion lost to follow up	Objective & independent assessment of outcomes	Inclusion of all subjects in analysis	Comments
Cubeddu (1997)	Yes	Maybe	Yes	No	Yes	24 hrs	0%	Yes	Yes	Funded by drug company
Reeves (2002)	Yes	Yes	Yes	Yes*	Yes	5 days	0%	Yes	Yes	* except ondansetron group more likely to have serum CO <sub>2</sub> <15% Funded by drug company
Ramsook (2002)	Yes	Yes	Yes	Yes	Yes	48 hours	17% at 24 hrs 22% at 48hrs	Yes	No	Funded by drug company

### Results of included studies:

All 3 of these studies were funded by Glaxo-Wellcome who produce ondansetron. The study by Cubeddu et al, found metoclopramide did not significantly reduce emesis. The mean number of emetic episodes over 24 hours from administration was 5 in the placebo group and 2 in the ondansetron group (p=0.048). Both ondansetron and metoclopramide resulted in significantly more episodes of diarrhoea over the first 24 hours compared with placebo. In the Reeves et al study patients receiving ondansetron were more likely to cease vomiting (70% compared with 51%, p=0.04). There were no differences between the groups in admission rate, duration of diarrhoea, median number of diarrhoea episodes or length of hospital stay. In the Ramsook et al study the median number of vomiting episodes after administration was 0 in both groups. Patients in the ondansetron group were more likely to cease vomiting in the emergency department but there was no difference between the groups in the rate of cessation of vomiting over the 24 hour period from administration. Less patients receiving ondansetron required IV fluids (8% vs 23%, p=0.15) however patients in the ondansetron group had significantly more diarrhoeal episodes over the 48 hours following admission (4.7 vs 1.4, p=0.002 for first two hours and 3.0 vs 1.0, p=0.015 over following 24 hours).

## Probiotics

### Study Selection Criteria

<b>Patient</b>	Children with diarrhoea	<b>Comparison</b>	Normal care or placebo
<b>Intervention</b>	Probiotics	<b>Outcomes</b>	Any
<b>Study Type</b>	RCT or Systematic Review	<b>Language</b>	English
<b>Number of included studies:</b>		<b>Publication Date</b>	Any

### Characteristics of included studies:

Study	Study Type	N(total)	Patients	Intervention	Comparison	Outcomes
Allen 2003	Sys Rev	1917 (23 RCTs)	Adults and children with acute diarrhoea (duration < 14 days) that is proven or presumed to be of infectious origin	Specific, identified probiotic	Placebo or no probiotic	Diarrhoea lasting 3+ and 4+ days. Duration of diarrhoea. Stool frequency and volume.

### Quality of included studies:

Study	Focused research question	Specified inclusion/exclusion criteria	Explicit and comprehensive search strategy	Validity of included trials appraised	Homogeneity between studies assessed	Summary of main results presented	Strengths and limitations of included studies discussed	Comments
Allen 2003	Yes	Yes	Yes	Yes	Yes	Yes	Yes	•

### Results of included studies:

- In individual studies, probiotics appeared to be moderately effective as adjunctive therapy in reducing the duration of diarrhoea. However, there were insufficient studies of specific probiotic regimens in defined groups of children or adults to inform the development of evidence-based treatment guidelines.
- Mean duration of diarrhoea in the subset of children with rotavirus diarrhoea was reported in two trials (Guandalini 2000; Guarino 1997) and in two studies that recruited only children with rotavirus diarrhoea (Isolauri 1994; Sugita 1994). Duration of diarrhoea was reduced by 38.10 hours (95% CI 8.10 to 68.10) in the probiotic group compared to the controls

## **Annex 7: Southern Health Infection Control Documents**