An evidence and consensus based guideline for acute diarrhoea management

K Armon, T Stephenson, R MacFaul, P Eccleston, U Werneke

Abstract

Objective—To develop an evidence and consensus based guideline for the management of the child who presents to hospital with diarrhoea (with or without vomiting), a common problem representing 16% of all paediatric medical attenders at an accident and emergency department. Clinical assessment, investigations (biochemistry and stool culture in particular), admission, and treatment are addressed. The guideline aims to aid junior doctors in recognising children who need admission for observation and treatment and those who may safely go home.

Evidence—A systematic review of the literature was performed. Selected articles were appraised, graded, and synthesised qualitatively. Statements on recommendation were generated.

Consensus—An anonymous, postal Delphi consensus process was used. A panel of 39 selected medical and nursing staff were asked to grade their agreement with the generated statements. They were sent the papers, appraisals, and literature review. On the second and third rounds they were asked to re-grade their agreement in the light of other panelists’ responses. Consensus was predefined as 83% of panelists agreeing with the statement.

Recommendations—Clinical signs useful in assessment of level of dehydration were agreed. Admission to a paediatric facility is advised for children who show signs of dehydration. For those with mild to moderate dehydration, estimated deficit is replaced over four hours with oral rehydration solution (glucose based, 200–250 mOsm/l) given “little and often”. A nasogastric tube should be used if fluid is refused and normal feeds started following rehydration. Children at high risk of dehydration should be observed to ensure at least maintenance fluid is tolerated. Management of more severe dehydration is detailed. Antidiarrhoeal medication is not indicated.

Validation—The guideline has been successfully implemented and evaluated in a paediatric accident and emergency department.

Scope of the guideline

The guideline deals with children who have diarrhoea, with or without vomiting, rather than with a defined diagnosis, as the guideline should assist clinicians in diagnosis prior to management of a particular condition. Children presenting with vomiting alone or with chronic diarrhoea (more than seven days duration) are not considered. We present a summary version of the full guideline (which can be obtained from the corresponding author, or the Archives of Disease in Childhood website, www.archdischild.com) to which reference should be made for clarification or further information. The authors assume that health care professionals will use general medical knowledge and clinical judgement in applying the recommendations in this document to the management of individual patients. These recommendations may not be appropriate for use in all circumstances.
Method of development
Recommendations made are based on statements derived from a systematic review of published literature and refined by a three-round Delphi consensus development process.

The literature search used the following databases: Medline (1966 to June 1998), Embase (1980 to June 1998), and Cochrane (to June 1998). The following mesh headings and text words were used: diarrh*; diarrhea infantile; diarrhea to 14 years; gastroenteritis; differential diagnosis; diagnosis*; incidence; prevalence; aetiology; etiology; dehydration; patient admission; fluid therapy; intravenous; intravenous treatment; rehydration solution; administration, oral; enteral nutrition; faeces; feces; lactose intolerance; enteral; differential diagnosis. General search terms for the type of study required were also used (for example, for diagnostic procedures, the search “sensitivity and specificity or predictive value of tests or diagnostic errors or screening or diagnosis or sensitivity or specificity” was used).

Explicit inclusion criteria were set: articles that addressed the clinical questions identified, a scientific review of the literature, and a review or clinical guideline written by a national body. Articles were excluded if opinion based. Included articles were critically appraised using a standard proforma, and recommendations were graded using a standard grading scheme (see Appendix). The derived statements, together with the original papers referred to i–67 and appraisals were sent to a Delphi panel consisting of 39 medical and nursing staff who regularly manage children with diarrhea, with or without vomiting. The final guideline based on the literature review and predefined consensus agreement (agreement by at least 83% of panelists) is in the form of an algorithm (flow diagram or decision tree) shown in fig 1. Each box is numbered, and key decision points are allocated a letter, with recommendations explained in the text. 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.

The guideline
A: DIFFERENTIAL DIAGNOSIS OF CHILD PRESENTING WITH DIARRHOEA
Statement—There are no published data on the relative probabilities of possible diagnoses in the child presenting to hospital with diarrhea.

A table of differential diagnoses (table 1) is shown derived from published texts18 65 (Vb, D) and consensus opinion, not intended to be comprehensive, but rather to act as an aide memoir to the clinician. (Based on Level Vb evidence and Delphi consensus, Grade D recommendation.)

It is essential that the clinician recognise any life threatening causes of diarrhea, such as intussusception19 (Vb, D), surgical abdomen20 (Vb, D), and haemolytic uraemic syndrome21 (III, C). Features suggestive of these conditions are identified, and although these features may occur in acute gastroenteritis the likelihood of a different aetiology is increased and should be actively sought.

Recommendation on differential diagnosis
The following clinical features should alert the clinician to look for causes other than acute viral gastroenteritis for a child’s diarrhoea with or without vomiting:
- Abdominal pain with tenderness, with or without guarding (Vb, D)
- Pallor, jaundice, oligo/anuria, bloody diarrhoea (III, C)
- Systemically unwell, out of proportion to the level of dehydration (Vb, D)
- Shock (Vb, D)

Features are based on evidence levels shown and Delphi consensus agreement.

B: ESTIMATION OF SEVERITY OF DEHYDRATION
The management of gastroenteritis consists of correction of dehydration (rehydration) and maintenance of hydration. An accurate estimate of the level of dehydration is required to achieve this end.

Statement—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). This is the “gold standard” against which other “tests” are measured19 (I, A).

In a prospective cohort study of children between 3 and 18 months of age in Egypt, Duggan and colleagues22 (III) found that “prolonged skinfold”, dry oral mucosa, sunken eyes, and “altered neurological status” were the best clinical signs correlating with dehydration as determined by post-rehydration weight gain. In a similarly designed study, with children under 4 years old, Mackenzie and colleagues23 (III) found “decreased skin turgor”, decreased peripheral perfusion, and deep (acidotic) breathing to be the best clinical indicators of dehydration. A urea of >6.5 mmol/l on serum blood sample and pH<7.35 on blood gas were positive investigations associated with dehydration. However the sensitivity and specificity of all these signs were low.

In both studies mild to moderate dehydration on clinical assessment was found to represent weight loss of 3–5%. Those with severe signs (circulatory collapse) had weight loss of 9–10%. These studies correlate well with the WHO guidance on dehydration assessment.24

Recommendation
See table 2 for estimating level of dehydration if weight loss not available. (Level III and Delphi consensus, Grade C recommendation.)

C: BLOOD TESTS
Statement—There is no direct evidence indicating when serum electrolytes should be measured in a child with diarrhea.

The indication from cohorts of children in the UK with gastroenteritis is that derangement of electrolytes is rare17 61 62 with 1% of admissions having hypernatraemia and no reports of hypokalaemia or hyponatraemia. Even when there is derangement of electrolytes in the
serum, this is a result of relative losses of salts and water. There will still be a total body depletion of sodium in hypernatraemic patients. Oral rehydration solution (ORS) with appropriate amounts of solutes and given in the correct quantity is sufficient in itself to correct electrolyte abnormalities. It is thus unnecessary to measure electrolytes in those children.
who will be rehydrated with ORS. All children having intravenous rehydration should have urea and electrolytes (U&E) measured, as hypernatraemia will alter the rate at which intravenous rehydration fluids are given and further measurements of U&E should be made as rehydration progresses. In addition the American Academy of Pediatrics (AAP) suggest in their practice parameter that electrolyte levels should be measured in moderately...
dehydrated children whose histories or physical findings are inconsistent with straightforward diarrhoeal episodes, and where a “doughy” feel to the skin may indicate hypernatraemia.

Recommendation on blood tests
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 a “doughy” feel to the skin might indicate hypernatraemia
- Moderately dehydrated children whose histories or physical findings are inconsistent with straightforward diarrhoeal episodes.

(Based on Level Vb evidence and Delphi consensus, Grade D recommendation.)

D: MANAGEMENT OF REHYDRATION
Following the evidence of several randomised controlled trials in the USA, Europe, and
Guideline for acute diarrhoea management

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cally unwell, out of proportion to the level of dehydration (other infections, surgical, congenital adrenal hyperplasia, Addison’s disease, hypoparathyroidism), immunodeficiency.

Guarding and/or bilious vomiting (?surgical); pallor, jaundice, oligoanuria, bloody stool (?haemolytic–uraemic syndrome); systemic viral

NB. The following features may be indicative of diagnoses other than acute diarrhoea management

Recommendation in mild–moderate dehydration

- Children who have mild–moderate dehydration secondary to acute gastroenteritis should have their deficit estimated (3–8%) and replaced with ORS (30–80 ml/kg) given “little and often” over 3–4 hours, whenever this is practically possible.25 40 44 63 (Level I and Delphi consensus, Grade A recommendation.) (An attempt was made to define “little and often” further. The literature discusses the correct administration of ORS and recommends that it be given in 5 ml aliquots every 1–2 minutes. Only if this is well tolerated with no vomiting may the size of the aliquots be increased, with decreasing frequency.25 41 42 65 66) However this regime was thought to be too labour intensive for the UK by the Delphi panelists and did not achieve consensus.) (Definition of “whenever practically possible”: this implies that the child’s carer is willing and able to carry this out under supervision.)

- Where the child’s carer is not willing and able to carry this out, or when it is required overnight, rehydrate by continuous nasogastric tube infusion (preferred) or intravenous infusion. (Level Va and Delphi consensus, Grade D recommendation.)

- Regularly assess success of rehydration (for example, two hourly). If no improvement in clinical signs of dehydration or worsening signs, consider nasogastric tube or intravenous infusion. (Level Va and Delphi consensus, Grade D recommendation.)

Developing countries49 51 54 (II, B), it is acknowledged that ORS is quicker in the correction of dehydration and acidosis and safer than intravenous therapy25 40 (I, A).65 The overall failure rate of oral rehydration therapy (ORT, defined as the persistence or recurrence of signs of dehydration and other clinical indicators requiring the need for intravenous rehydration) was 3.6% (95% confidence interval 1.4 to 5.8).65 Moreover the use of ORT appears to reduce the risk of seizure during correction of hypernatraemic dehydration27 (II, B).

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E: COMPOSITION OF ORS

In the 1970s the WHO adopted a glucose–electrolyte solution that contained 90 mmol/l of sodium for the treatment of diarrhoea. Since then there have been many controlled trials looking at the ideal concentration of electrolytes and carbohydrate in ORS. A recent multicentre trial in four developing countries found that reduced osmolarity ORS (224 mmol/l) had advantages over standard ORS (311 mmol/l) in the treatment of non-cholera diarrhoea46 (II, B). In developed countries diarrhoea tends to be isotonic (mainly rotavirus induced) and the European Society of Paediatric Gastroenterology and Nutrition (ESPGAN)44 published guidelines on the ideal composition of ORS for children of Europe. Since this publication, studies from Finland45 (II, B) and a multicentre trial46 (II, B) have confirmed that reduced osmolarity ORS is preferable in European children. See table 8 for the composition of ORS recommended and those commercially available.

A recent meta-analysis of 13 clinical trials examining the effect of rice based ORS on total stool output and duration of diarrhoea showed that there appeared to be some benefit in those with cholera, but in those with non-cholera diarrhoea no benefit was shown46 (I, A).

Recommendation on the composition of ORS

- ORS used for rehydration of children with acute gastroenteritis in the UK should contain: 60 mmol/l sodium, 20 mmol/l potassium, ≥25 mmol/l chloride, and 74–111 mmol/l glucose. (Commercial solutions conforming to this include Dioralyte and Diocalm Junior.) (Level I and Delphi consensus, Grade A recommendation.)

F: MAINTENANCE OF HYDRATION/PREVENTION OF DEHYDRATION

The child who was not dehydrated and the child who is no longer dehydrated following rehydration should be allowed free fluids, and be encouraged to drink more than usual.25 40 Tables 3 and 4 show standard methods for calculating ORS requirements. Table 5 suggests when to send a stool sample to the laboratory.

Table 1 Broad differential diagnosis of the child presenting with acute diarrhoea (with or without vomiting). The latter diagnoses are more likely to present chronically.

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infections</td>
<td>Enteral: viral (commonest cause), bacterial, parasitic</td>
</tr>
<tr>
<td>Surgical</td>
<td>Non-enteral infections (urinary tract infection, pneumonia, otitis media)</td>
</tr>
<tr>
<td>Systemic illness</td>
<td>Appendicitis, intussusception, obstruction, short bowel syndrome</td>
</tr>
<tr>
<td>Antibiotic associated</td>
<td>Constipation with overflow, toxins, haemolytic–uraemic syndrome,</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>toddler diarrhoea, child abuse</td>
</tr>
<tr>
<td>Dietary disturbance</td>
<td>Food allergy/ intolerance (lactose, cows’ milk protein), starvation stools</td>
</tr>
<tr>
<td>Malabsorption</td>
<td>Cystic fibrosis, coeliac disease</td>
</tr>
<tr>
<td>Inflammation</td>
<td>Ulcerative colitis/Crohn’s disease, Hirschsprung’s enterocolitis</td>
</tr>
<tr>
<td>Idiopathic/psychogenic</td>
<td>Irritable bowel syndrome</td>
</tr>
</tbody>
</table>

NB. The following features may be indicative of diagnoses other than acute gastroenteritis: abdominal pain with tenderness/guarding and/or bilious vomiting (?surgical); pallor, jaundice, oligoanuria, bloody stool (?haemolytic–uraemic syndrome); systematically unwell, out of proportion to the level of dehydration (other infections, surgical, congenital adrenal hyperplasia, etc); shock.
Table 2  Assessment of severity of dehydration (if in doubt err by overestimating % dehydration)

<table>
<thead>
<tr>
<th>Dehydration (less than 3% weight loss)</th>
<th>Mild-moderate dehydration (3–8% weight loss)</th>
<th>Severe dehydration (&gt;8% weight loss)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No dehydration</td>
<td>(ordered by increasing severity)</td>
<td>(ordered by increasing severity)</td>
</tr>
<tr>
<td>No signs</td>
<td>Dry mucous membranes (be wary in the mouth breather)</td>
<td>Increasingly marked signs from the mild-moderate group plus:</td>
</tr>
<tr>
<td></td>
<td>Sunken eyes (and minimal or no tears)</td>
<td>Decreased peripheral perfusion (cool/mottled/pale peripheries; capillary refill time &gt;2 sec)</td>
</tr>
<tr>
<td></td>
<td>Diminished skin turgor (pinch test 1–2 sec)</td>
<td>Circulatory collapse</td>
</tr>
<tr>
<td></td>
<td>Altered neurological status (drowsiness, irritability)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deep (acidotic) breathing</td>
<td></td>
</tr>
</tbody>
</table>

Signs are ordered in each column by severity.
If a pre-illness accurate weight is available, calculate deficit from weight loss.
Pinch test: Pinch skin of abdomen. Skin recoils instantly = normal, 1–2 sec = mild-moderate, >2 sec = severe.

Table 3  Calculation of oral rehydration solution requirements in the dehydrated child with acute gastroenteritis

<table>
<thead>
<tr>
<th>Dehydration (3–8%)</th>
<th>Mild-moderate (3–8%) dehydration:</th>
<th>30–80 ml per kg in 4 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe dehydration</td>
<td>100 ml per kg in 4 hours</td>
<td></td>
</tr>
</tbody>
</table>

Practical points:
Children who are dehydrated are thirsty and do not normally refuse ORS.
Give fluid little and often. If the child is vomiting, decrease volumes and increase frequency (every 5–10 minutes). Where carers are not willing/able to do this under supervision (or child is asleep), then rehydrate by nasogastric tube.
Suitable ORS are Dioralyte, Dicolaun Junior, or Electrolate.

Table 4  Calculation of ORS maintenance fluid requirements

100 ml/kg/day for the first 10 kg of body weight
Added to: 50 ml/kg/day for the next 10 kg of body weight
Added to: 20 ml/kg/24 hours for remaining kg of body weight

For example, a 22 kg child has maintenance requirements of: (10 x 100) + (10 x 50) + (2 x 20) = 1540 ml/24 hours
Ongoing losses: these requirements should be supplemented if the child has frequent or substantial watery stools or vomits, by an additional 10 ml/kg per stool/vomit

Table 5  When to send a stool to the laboratory for microscopy, culture, sensitivity, and acute gastroenteritis

- A history of blood with or without mucus in the stool
- Systemically unwell, severe or prolonged diarrhoea
- Recent travel abroad

Table 6  Management of feeding during acute gastroenteritis

<table>
<thead>
<tr>
<th>Type of feeding</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast fed</td>
<td>Continue breast feeding throughout rehydration and maintenance phases</td>
</tr>
<tr>
<td>Formula fed</td>
<td>Restart feed at full strength as soon as rehydration complete (ideally 4 hours)</td>
</tr>
<tr>
<td>Weaned children</td>
<td>Child’s normal fluids and solids following rehydration. Avoid fatty foods or foods high in simple sugars</td>
</tr>
</tbody>
</table>

Recommendation on maintenance fluids
- To prevent primary dehydration or recurrence of dehydration, allow unrestricted fluids (for example, milk or water). Ensure that at least maintenance fluids are taken. (Level Va and Delphi consensus, Grade D recommendation.)

G: REFEEDING FOLLOWING REHYDRATION

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

Table 7  Guide to drug treatment in acute gastroenteritis

<table>
<thead>
<tr>
<th>Antidiarrhoeal:</th>
<th>Infants and children should not be treated with antidiarrhoeal agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotics:</td>
<td>Patients with invasive Salmonella typhi, shigella, amoebiasis, and giardiasis should be treated with antibiotics. Consider in infants &lt;6 months with other salmonella infections, those who are systemically unwell, and the immunocompromised</td>
</tr>
</tbody>
</table>

In children with acute gastroenteritis who are formula fed, the vast majority (over 80%) can be successfully managed following rehydration with continued feeding of undiluted non-human milks (I, A). This is now recommended practice, including the introduction of age appropriate diets in children who are weaned.

Recommendation on refeeding (see table 6)
- Breast feeding children should continue to breast feed through the rehydration and maintenance phases of their acute gastroenteritis illness. (Level III and Delphi consensus, Grade C recommendation.)
- In the dehydrated child with gastroenteritis who is normally formula fed, feeds should stop during rehydration and restart as soon as the child is rehydrated (four hours). (Level I and Delphi consensus, Grade A recommendation.)

II: CRITERIA FOR ADMISSION OF CHILDREN WITH GASTROENTERITIS

Statement—There are no published trials comparing outpatient with inpatient management, nor are there any recommendations made by eminent bodies.

Recommendations for admission
The following reached Delphi consensus agreement.
- Children presenting to hospital with acute gastroenteritis who are severely dehydrated should be admitted to hospital.
- Those children with mild–moderate dehydration should be observed in a hospital paediatric facility for a period of at least 6 hours to ensure successful rehydration (3–4 hours) and maintenance of hydration (2–3 hours).
- Those children at high risk of dehydration on the basis of young age (infants <6 months) (III, C), high frequency of watery stools (more than eight per 24 hours) or vomits (more than four per 24 hours) should be observed in a hospital paediatric facility for at least 4–6 hours to ensure adequate maintenance of hydration.
- 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.

(Based on Delphi consensus.)

E: ROLE OF MEDICATION
There is evidence from several randomised controlled trials that antidiarrhoeal and anti-motility agents are not clinically beneficial in
Table 8 Composition of fluids for intravenous and oral rehydration in acute gastroenteritis

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Osmolality (mOsm/l)</th>
<th>Glucose (mmol/l)</th>
<th>Sodium (mmol/l)</th>
<th>Chloride (mmol/l)</th>
<th>Potassium (mmol/l)</th>
<th>Base (mmol/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intravenous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESPGAN</td>
<td>200-250</td>
<td>74-111</td>
<td>60</td>
<td>25</td>
<td>20</td>
<td>Citrate 10</td>
</tr>
<tr>
<td>Dioralyte</td>
<td>240</td>
<td>90</td>
<td>60</td>
<td>60</td>
<td>20</td>
<td>Citrate 10</td>
</tr>
<tr>
<td>Doscalm Jr</td>
<td>251</td>
<td>111</td>
<td>60</td>
<td>50</td>
<td>20</td>
<td>Citrate 10</td>
</tr>
<tr>
<td>Ringer's lactate</td>
<td>335</td>
<td>111</td>
<td>50</td>
<td>40</td>
<td>20</td>
<td>Bicarb 30</td>
</tr>
<tr>
<td>Intravenous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrolade</td>
<td>251</td>
<td>111</td>
<td>50</td>
<td>40</td>
<td>20</td>
<td>Bicarb 30</td>
</tr>
<tr>
<td>WHO ORS</td>
<td>330</td>
<td>111</td>
<td>50</td>
<td>80</td>
<td>20</td>
<td>Citrate 10</td>
</tr>
<tr>
<td>Oral</td>
<td>0.9% saline</td>
<td>308</td>
<td>154</td>
<td>154</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Intravenous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ringer's lactate</td>
<td>280</td>
<td>—</td>
<td>130</td>
<td>110</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>0.9% saline</td>
<td>308</td>
<td>—</td>
<td>154</td>
<td>154</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>

*Glucose given with fructose 1 mmol/l and sucrose 94 mmol/l.

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Key recommendations

All gained consensus. The level of evidence and strength of recommendation follow each statement:

- Level of dehydration is assessed using a table modified from WHO criteria (III, C)
- Those with no dehydration (<3%) should continue with their normal fluids at least maintenance levels (Va, D)
- Those with mild–moderate dehydration (3–8%) should have their deficit estimated and replaced over four hours with oral rehydration solution (glucose based and reduced osmolality, 200–250 mOsm/l) (I, A)
- Oral rehydration solution should be given in small aliquots frequently. If vomiting persists it should be given by nasogastric tube (preferred) or intravenous rehydration commenced (I, A)
- No routine investigations of U&E are required unless intravenous rehydration is commenced or hypernatraemia is suspected clinically (Va, D)
- Children with mild–moderate and severe dehydration should be admitted to hospital for rehydration (consensus, D)
- Following rehydration (four hours) normal feeds should be recommenced (I, A)
- There is no place for anti diarrhoeal medication (I, A)

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Discussion

This guideline for the management of the child who presents with acute diarrhoea to hospital was developed using a systematic literature review and formal consensus using a Delphi panel. It is striking that for this type of management guideline the level of published evidence on which recommendations are based is poor. During the Delphi process, 41 statements were made, of which 13% were based on level I evidence, 25% on level III, 52% on level V, and 10% on textbook recommendations or Delphi panel contributions. The final guideline consists of 34 consensus statements (83% of the total presented to the Delphi panel).

This Delphi method of guideline development has several advantages. The use of a nationally selected panel of clinicians allows for a consensus view to be gained on those issues on which published evidence is lacking. Thus a comprehensive guideline can be produced with recommendations on all areas of management, which is likely to be acceptable and practical. It is likely to then need only simple local tailoring prior to being adopted. This method ensures that the guideline is clear on the level of evidence for each recommendation so that the clinician knows which are based on strong evidence from the literature and which on consensus.

There are also potential weaknesses with this approach. For the areas where there is little or no good evidence in the literature the process relies on the opinion of the participating panelists. It is therefore possible to tap into collective error—the whole group managing children in a certain way based on historical practice rather than evidence. The importance of stating the level of evidence for each recommendation is again highlighted, so individual clinicians and local guideline development panels can immediately see which are based on strong evidence and which are not. The method was time consuming, with the whole process taking one year from initiating literature review to implementation of the guideline. It is therefore possible that high quality evidence is published in the intervening period which cannot be included in the recommendations at the time of publication, since it did not go through the Delphi process.

Further research would be beneficial on many of the decision points discussed, for example: the assessment of risk of dehydration in the child in a developed country, outpatient versus inpatient management of rehydration, nasogastric versus oral rehydration, and cereal versus glucose based ORS for rehydration (and palatability) in a developed country.

We intend to review the evidence and consensus on which this guideline is based in approximately three years from the date of its completion (May 1999).
The Appendix section of the document contains a table summarizing levels of evidence and grade of recommendation. The table is titled "Table A1: Levels of evidence and grade of recommendation." It includes columns for Strength of evidence, Level (adapted from Muir & Gray), and Grade of recommendation (Cook et al.).

### Table A1: Levels of evidence and grade of recommendation

<table>
<thead>
<tr>
<th>Strength of evidence from at least one systematic review of multiple, well designed randomized controlled trials</th>
<th>Level (adapted from Muir &amp; Gray)</th>
<th>Grade of recommendation (Cook et al.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong evidence from at least one systematically designed randomized controlled trial of appropriate size</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Strong evidence from at least one properly designed controlled trial of multiple, well designed randomized controlled trials</td>
<td>II</td>
<td>B</td>
</tr>
<tr>
<td>Evidence from well designed trials without randomisation, single group designs, case-control, cohort, time series, or matched case-control studies</td>
<td>III</td>
<td>C</td>
</tr>
<tr>
<td>Evidence from well designed, non-experimental studies from more than one centre or research group</td>
<td>IV</td>
<td>D</td>
</tr>
<tr>
<td>Opinions of respected authorities</td>
<td>Va</td>
<td>D</td>
</tr>
<tr>
<td>Clinical evidence, descriptive studies, or reports of expert committees</td>
<td>Vb</td>
<td>D</td>
</tr>
</tbody>
</table>

Commentary

No doctor can hope to keep up to date with the literature across a broad spectrum of practice. National guidelines are helpful where they bring together all the evidence from research and synthesise it into a series of recommendations showing the strength of that evidence. Dr Armon and colleagues have used a formal consensus process to provide guidance, and this raises a number of important questions. It happens that there are also recent guidelines on acute diarrhoea management published by Murphy in 1998,1 and by the American Academy of Paediatrics (AAP) in 1996.2 If guidelines are to provide truly evidence based recommendations, they must be developed rigorously. How do these three guidelines measure up to the standards published by the Royal College of Paediatrics and Child Health?3

They are all based on a detailed review of the literature, and two contain explicit levels of evidence for the recommendations. They were not conducted with the rigour of the systematic reviews in the Cochrane database. For example, the review of Dr Armon et al did not include textword searching, and none included hand searching through journals not covered by the electronic databases. There was no attempt to establish whether unpublished trials exist; publication bias can result when journals are more likely to publish trials with positive results. The AAP guideline was supplemented by a technical report and focused on three specific aspects of management.

The consensus guideline of Dr Armon et al involved consultants from several specialties, nurses, and specialist registrars. This is important in ensuring that the perspectives of all those involved contribute to the guidance. However, with only two nurses on the panel, the Delphi process would have allowed consensus to be achieved, even when both nurses disagreed. The lack of any primary care or parent input to the process undermines the usefulness of the section on admission criteria, for which research evidence appears to be lacking. The assistance of parents with recent experience of managing acute diarrhoea in their children would have been most valuable in formulating written material for parents.

The key message to emerge from all three guidelines is the safety and effectiveness of oral rehydration solutions, even in children with moderate (up to 8%) dehydration without shock. Additionally, that administration of the calculated deficit over a few hours is simple and effective. Care is needed in writing success with oral rehydration solution is the time that it takes carers to administer. All three guidelines recommend the correction of dehydration orally over a period of four hours. This would mean for some infants and children a rate of up to 80 ml/kg over four hours. However, in none of six controlled trials that I looked up,4-9 was this rate of oral administration attempted, and in only one5 was it achieved. Is this recommendation therefore actually consistent with the evidence, or indeed better than six or eight hours for achieving rehydration? It was rated an A grade in Dr Armon and colleagues’ guideline.

Where does this leave the UK practising paediatrician? Given the limitations of the three guidelines, there is a risk that important evidence may be missing or inadequately interpreted. We still need a well conducted evidence based guideline, involving all professional groups, primary care and parents, and based on a rigorous literature review. However, the studies that support these guidelines are compelling, and we should not wait before using a multiprofessional approach to getting oral rehydration therapy into practice at the local level. Read all three guidelines as a starting point in reviewing or developing local guidelines, but check back to the key original publications. I will leave it to you, the reader, to judge how much extra value you get from Dr Armon and colleagues’ consensus statements.

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Rapid responses

Letters on the following papers have been published recently as rapid responses on the ADC website. To read these letters visit www.archdischild.com and click on “Read eLetters”:


**Adrenaline syringes are vastly over prescribed.** Unsworth DJ. *Arch Dis Child* 2001;84:410–11.


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