

Rehydration of children with malnutrition – An update

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Children without Malnutrition

The Guidelines



Assess dehydration

Table 12. Classification of the severity of dehydration in children with diarrhoea

Classification	Signs or symptoms	Treatment
Severe dehydration	Two or more of the following signs: <ul style="list-style-type: none"> ■ lethargy or unconsciousness ■ sunken eyes ■ unable to drink or drinks poorly ■ skin pinch goes back very slowly (≥ 2 s) 	<ul style="list-style-type: none"> ▶ Give fluids for severe dehydration (see diarrhoea treatment plan C in hospital, p. 131)
Some dehydration	Two or more of the following signs: <ul style="list-style-type: none"> ■ restlessness, irritability ■ sunken eyes ■ drinks eagerly, thirsty ■ skin pinch goes back slowly 	<ul style="list-style-type: none"> ▶ Give fluid and food for some dehydration (see diarrhoea treatment plan B, p. 135) ▶ After rehydration, advise mother on home treatment and when to return immediately (see pp. 133–4) ▶ Follow up in 5 days if not improving.
No dehydration	Not enough signs to classify as some or severe dehydration	<ul style="list-style-type: none"> ▶ Give fluid and food to treat diarrhoea at home (see diarrhoea treatment plan A, p. 138) ▶ Advise mother on when to return immediately (see p. 133) ▶ Follow up in 5 days if not improving.



IV Rehydration



Oral Rehydration - ORS



Home with advice

Severe dehydration – Plan C

If Shocked

- ▶ Attach Ringer's lactate or normal saline; make sure the infusion is running well.
- ▶ Infuse 20 ml/kg as rapidly as possible.

'Plan C'

Age	First give 30 ml/kg in:	Then give 70 ml/kg in:
Infants (< 12 months)	1 h ^a	5 h
Children (12 months to 5 years)	30 min ^a	2.5 h

^a Repeat once if radial pulse is still weak or not detectable

Children with Malnutrition

The Guidelines



WHO 2013 Guidelines

- 💧 Advise against IV rehydration
- 💧 No specific assessment of dehydration undertaken
- 💧 All children assumed to have some degree of dehydration

OPEN ACCESS Freely available online

PLoS one

Diarrhoea Complicating Severe Acute Malnutrition in Kenyan Children: A Prospective Descriptive Study of Risk Factors and Outcome

Alison Talbert¹, Nahashon Thuo¹, Japhet Karisa¹, Charles Chesaro¹, Eric Ohuma¹, James Ignas¹, James A. Berkley^{1,2}, Christopher Toromo¹, Sarah Atkinson^{1,3}, Kathryn Maitland^{1,4*}

¹Kenya Medical Research Institute Wellcome Trust Research Programme, Kilifi, Kenya, ²Centre for Clinical Vaccinology and Tropical Medicine, University of Oxford, Oxford, United Kingdom, ³Department of Paediatrics, University of Oxford, Oxford, United Kingdom, ⁴Wellcome Trust Centre for Clinical Tropical Medicine, Faculty of Medicine, Imperial College, Norfolk Place, London, United Kingdom



Key risk factors for death: **Diarrhoea**, bacteraemia, hyponatraemia and signs of **severe dehydration**

SAM with Diarrhoea AND severe dehydration mortality= 27%

Current Guidelines -WHO 2013

Chart 8 How to give intravenous fluids to a child in shock with severe malnutrition

Give this treatment only if the child has signs of shock (usually there will also be a reduced level of consciousness, i.e. lethargy or loss of consciousness).

- ▶ Insert an IV line (and draw blood for emergency laboratory investigations).
- ▶ Weigh the child (or estimate the weight) to calculate the volume of fluid to be given.
- ▶ Give IV fluid at 15 ml/kg over 1 h. Use one of the following solutions according to availability:
 - Ringer's lactate with 5% glucose (dextrose);
 - Half-strength Darrow's solution with 5% glucose (dextrose);
 - 0.45% NaCl plus 5% glucose (dextrose).

Shocked

Non-shocked

should receive emergency treatment accordingly (see charts on pp. 5–11).

- Those with signs of severe dehydration but not in shock should not be rehydrated with IV fluids, because severe dehydration is difficult to diagnose in severe malnutrition and is often misdiagnosed. Giving IV fluids puts these children at risk of over-hydration and death from heart failure. Therefore, these children should be rehydrated orally with the special rehydration solution for severe malnutrition (ReSoMal). See Chapter 7 (p. 204).

- ▶ Give the *ReSoMal rehydration fluid orally* or by nasogastric tube, more slowly than you would when rehydrating a well-nourished child:
 - Give 5 ml/kg every 30 min for the first 2 h.
 - Then give 5–10 ml/kg per h for the next 4–10 h on alternate hours, with F-75 formula. The exact amount depends on how much the child wants, the volume of stool loss and whether the child is vomiting.

And for children with Cholera?

- ◆ Without malnutrition - No different i.e. **follow Plan C**
- ◆ With malnutrition
 - ◆ Continue to advise against IV rehydration unless shocked
 - ◆ Oral or NGT rehydration recommended
 - ◆ Only change is to NOT use ReSoMal, but use hypo-osmolar ORS



Literature Reviews



Intravenous rehydration



IV Rehydration – the literature


- ◆ 4 papers
- ◆ Primary outcome: No evidence of fluid overload found in any of the studies
- ◆ Secondary outcomes:
 - ◆ Mortality – **High overall including those children managed using WHO recommendations.**
 - ◆ Cardiovascular compromise
 - ◆ Persistent low systolic BP and weak pulse associated with increased mortality
 - ◆ No evidence of biventricular heart failure found

RESEARCH

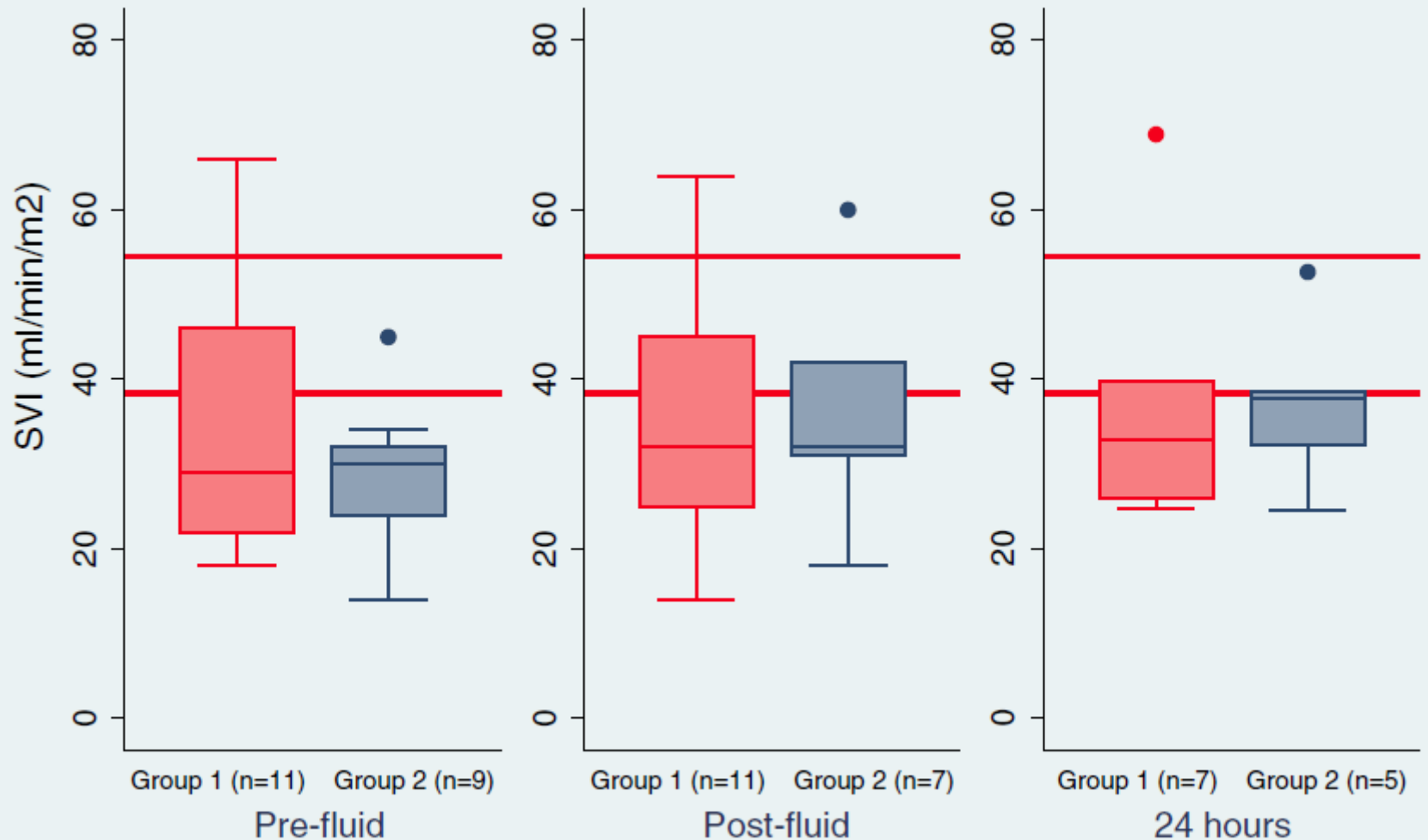
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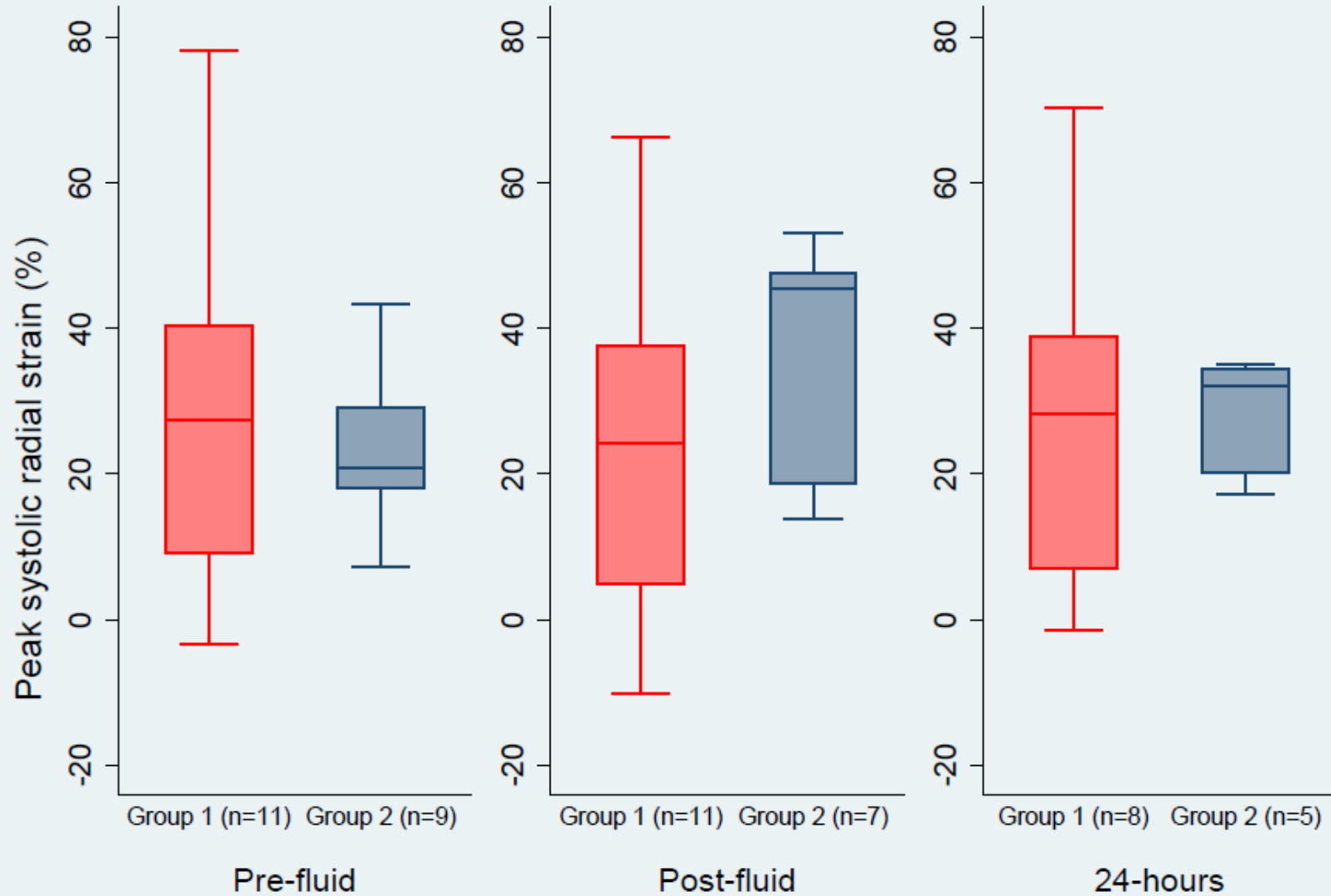
Myocardial and haemodynamic responses to two fluid regimens in African children with severe malnutrition and hypovolaemic shock (AFRIM study)

Nchafatso Obonyo^{1,3,6}, Bernadette Brent^{1,2}, Peter Olupot-Olupot³, Michael Boele van Hensbroek⁴, Irene Kuipers⁴, Sidney Wong⁵, Kenji Shiino^{6,7}, Jonathan Chan^{6,7}, John Fraser^{6,7}, Job B. M. van Woensel^{4†} and Kathryn Maitland^{1,2*†} 

Stroke volume index



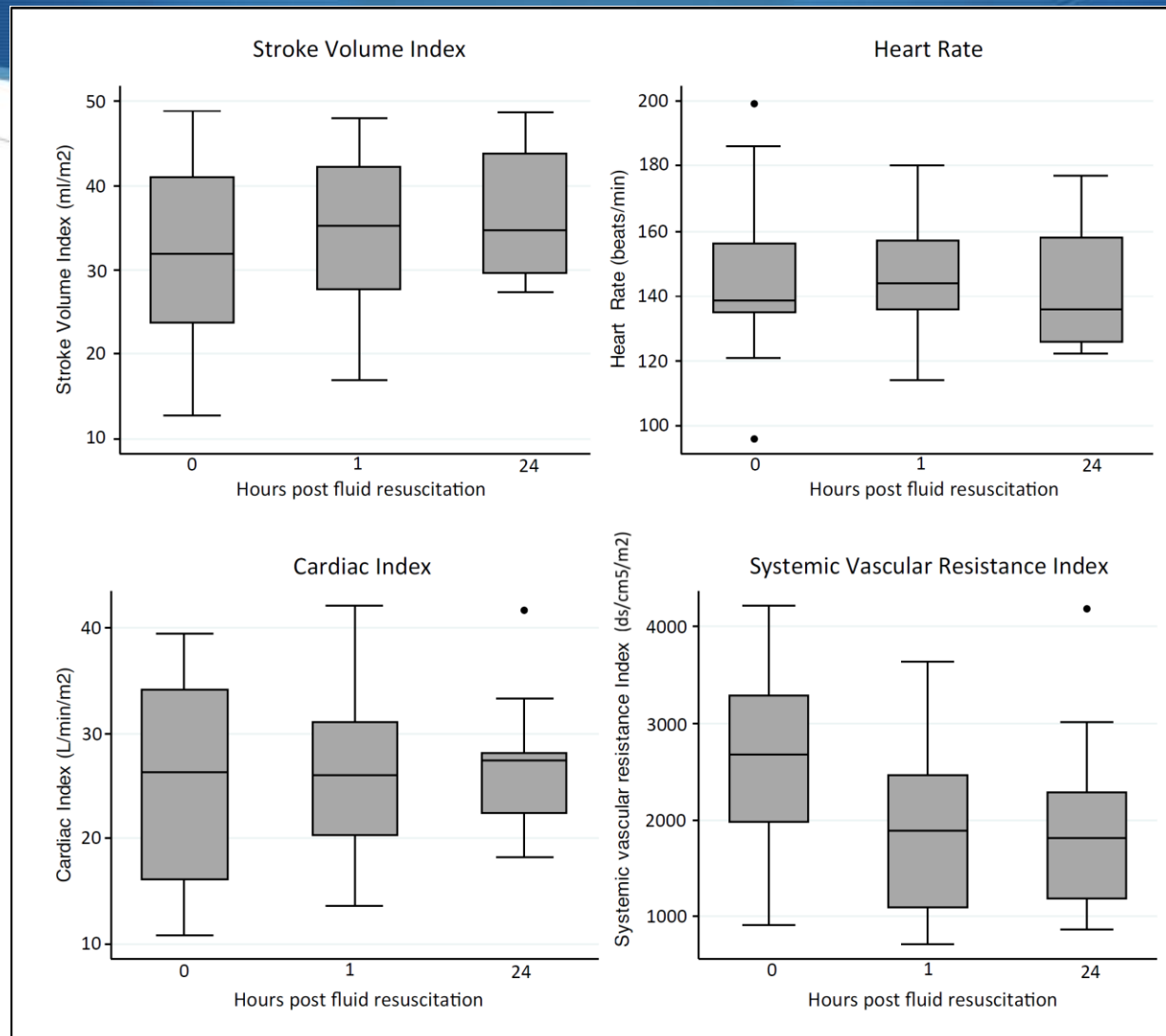
Cardiac strain



Further evidence

- ◆ CAPMAL, 2018, submitted for publication
 - ◆ Myocardial mass LOWER at admission but RECOVERED
 - ◆ Global Cardiac function - within normal range and similar in cases and controls.
 - ◆ No evidence of cardiac failure in SAM children, including those receiving intravenous fluids to correct hypovolaemia.
 - ◆ Cardiac dysfunction associated with comorbidity and typical of hypovolaemia, with few differences between the marasmus and kwashiorkor

Cardiac indices before and after IV rehydration – CAPMAL, 2018



Cholera and IV rehydration

- ◆ WHO Guidelines for IV rehydration are the same
- ◆ Just one study evaluating safety of IV fluids in SAM and cholera:
 - ◆ 149 (85%) presented with severe dehydration and required IV rehydration
 - ◆ 18-25ml/Kg/hr (over 4-6hrs) – **mean of 103ml/Kg**
 - ◆ No significant difference in baseline electrolyte abnormalities
 - ◆ No children died and none developed signs of fluid overload
 - ◆ None developed hyponatraemia
 - ◆ All rehydrated within 6 hours

Summary for IV...

- ◆ No demonstration of fluid overload
- ◆ Children with SAM may remain under-filled when following current WHO guidelines, especially in the case of Cholera
- ◆ Guidelines are challenging to **implement in practice**
- ◆ **Guideline Slippage** Potential misclassification of up to 20% of children who are severely dehydrated (ie $\geq 10\%$ loss of body weight in an well nourished child)



Oral rehydration



Oral rehydration – the Literature

- ◆ 6 studies evaluation ORS in SAM
- ◆ Primary Outcome – ReSoMal places children at risk of severe hyponatraemia, but is not recommended in Cholera
- ◆ Secondary Outcomes –
 - ◆ Hypo-osmolar solutions do appear to reduce time to recovery and stool output
 - ◆ ReSoMal better at correcting low potassium – but hyponatraemia has twice the impact on risk of mortality when compared with hypokalaemia

Cholera and Oral rehydration

- ◆ WHO guidelines in cholera advise against ReSoMal
- ◆ Across 5 of the studies 259/665 (39%) patients had cholera
- ◆ One study included only children with cholera and another two presented sub-analyses
- ◆ Reduction in stool output with children receiving rice-based ORS
- ◆ No significant difference in frequency of hyponatraemia between rehydration solutions (inc ReSoMal, old and standard ORS)

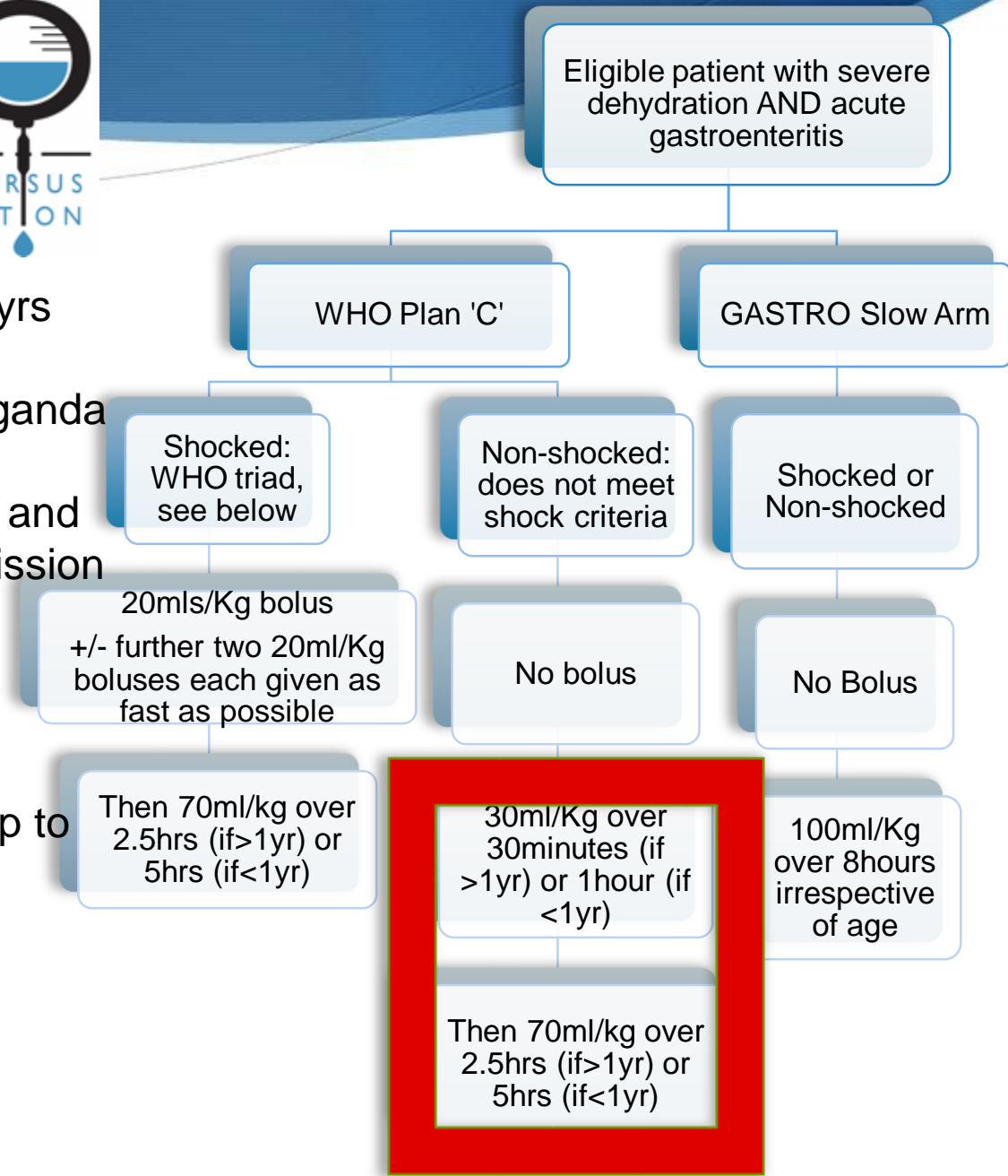
Update...



GASTRO

GASTROENTERITIS AGGRESSIVE VERSUS SLOW TREATMENT FOR REHYDRATION

- 120 children aged 2 mo to 12 yrs
- Kilifi, Kenya, Mbale & Soroti Uganda
- Gathered clinical, biochemical and physiological data during admission and at 7 day review
- Completed recruitment
- Potential misclassification of up to 20% as malnourished
- Currently undergoing analysis
- Results due early 2019

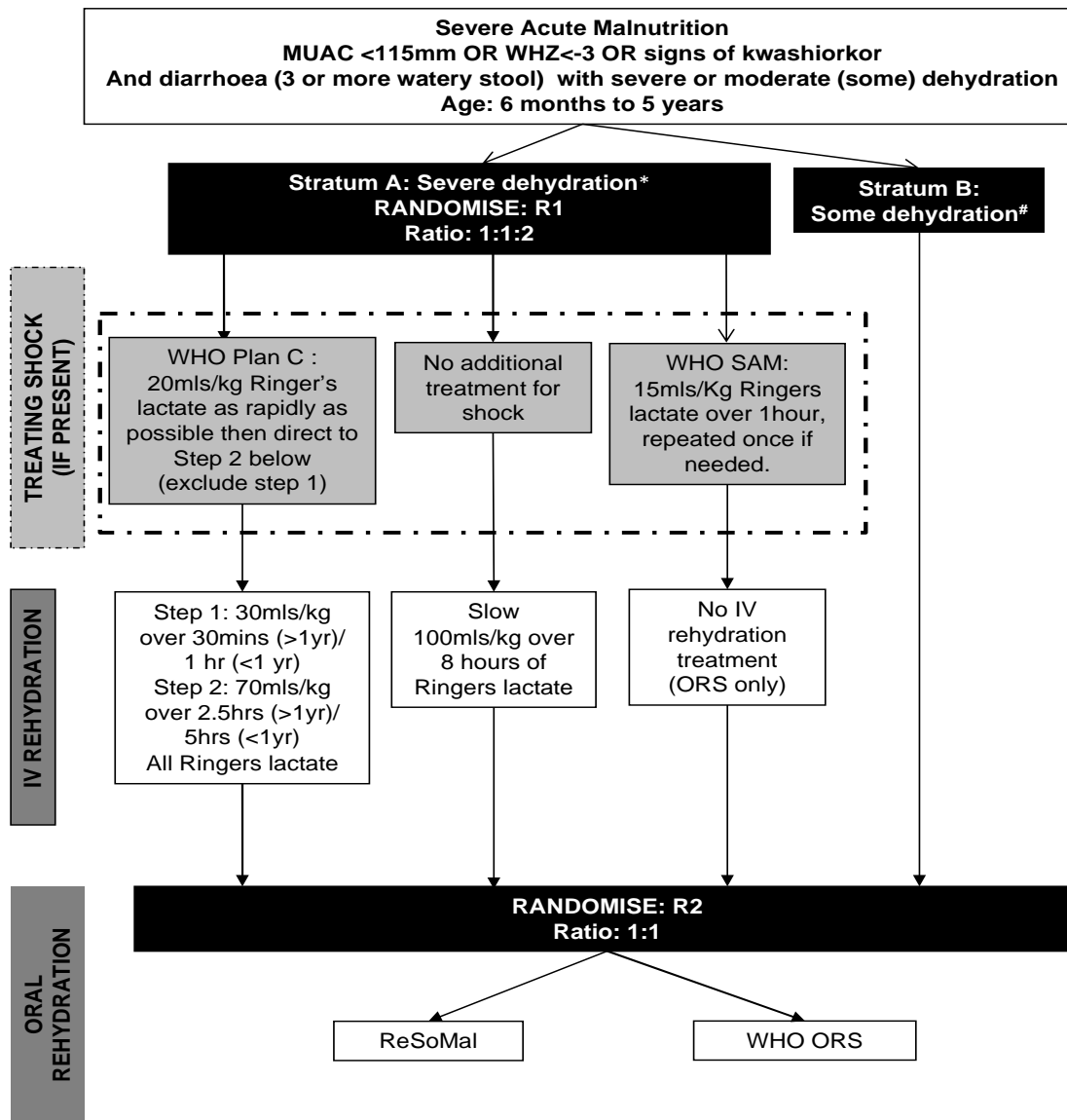


GASTRO results

	Enrolled	SAEs	Deaths
Slow Arm (Experimental)	61	2	1
WHO Plan C Arm	61	3	2
Total	122	5	3

💧 **Only 3 deaths (2.5% mortality)**

Funded and in development



Assessment of severity of dehydration as per WHO 2013 Pocketbook

*All children receiving IV fluids for severe dehydration (R1) will also be randomised for oral rehydration (R2).

#All children who present with some dehydration will be randomised as per R2. If they go on to develop severe dehydration during admission, they will follow current WHO SAM guidelines.

Future plans

- ◆ Complete GASTRO and GASTRO SAM → develop a protocol for a multi-site, multi-national, Phase III RCT assessing rehydration of children with severe dehydration, including both SAM and non-SAM children
- ◆ GOAL – to improve outcomes in the care of all children with severe dehydration, malnourished and non-malnourished

Thank you

