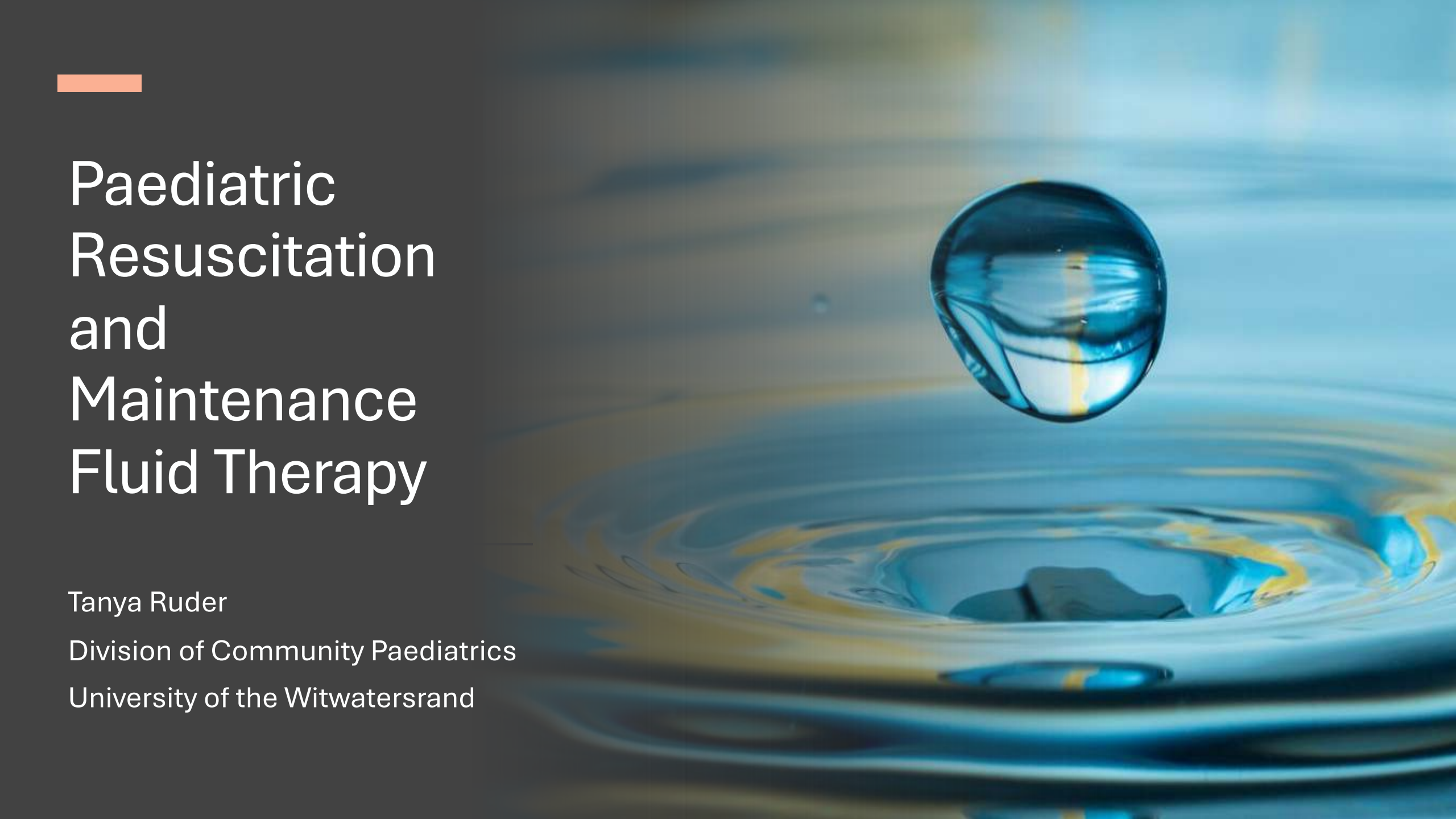
Paediatric Resuscitation and Maintenance Fluid Therapy



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health

Department:
Health
REPUBLIC OF SOUTH AFRICA

Standard Treatment Guidelines and Essential Medicines List for South Africa

PAEDIATRIC HOSPITAL LEVEL
2023 EDITION

Variations in intravenous fluid management for paediatric hypernatraemia in South Africa: A survey of junior and senior South African paediatric doctors

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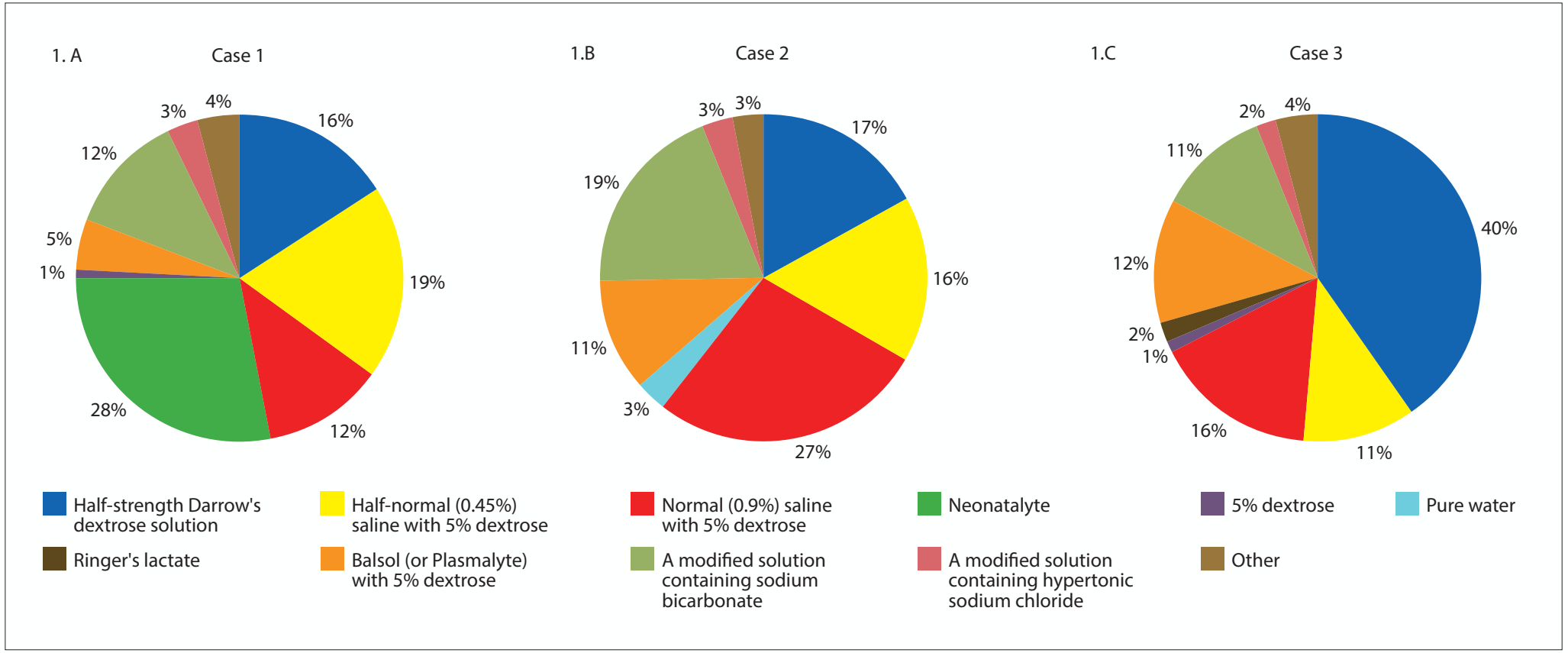


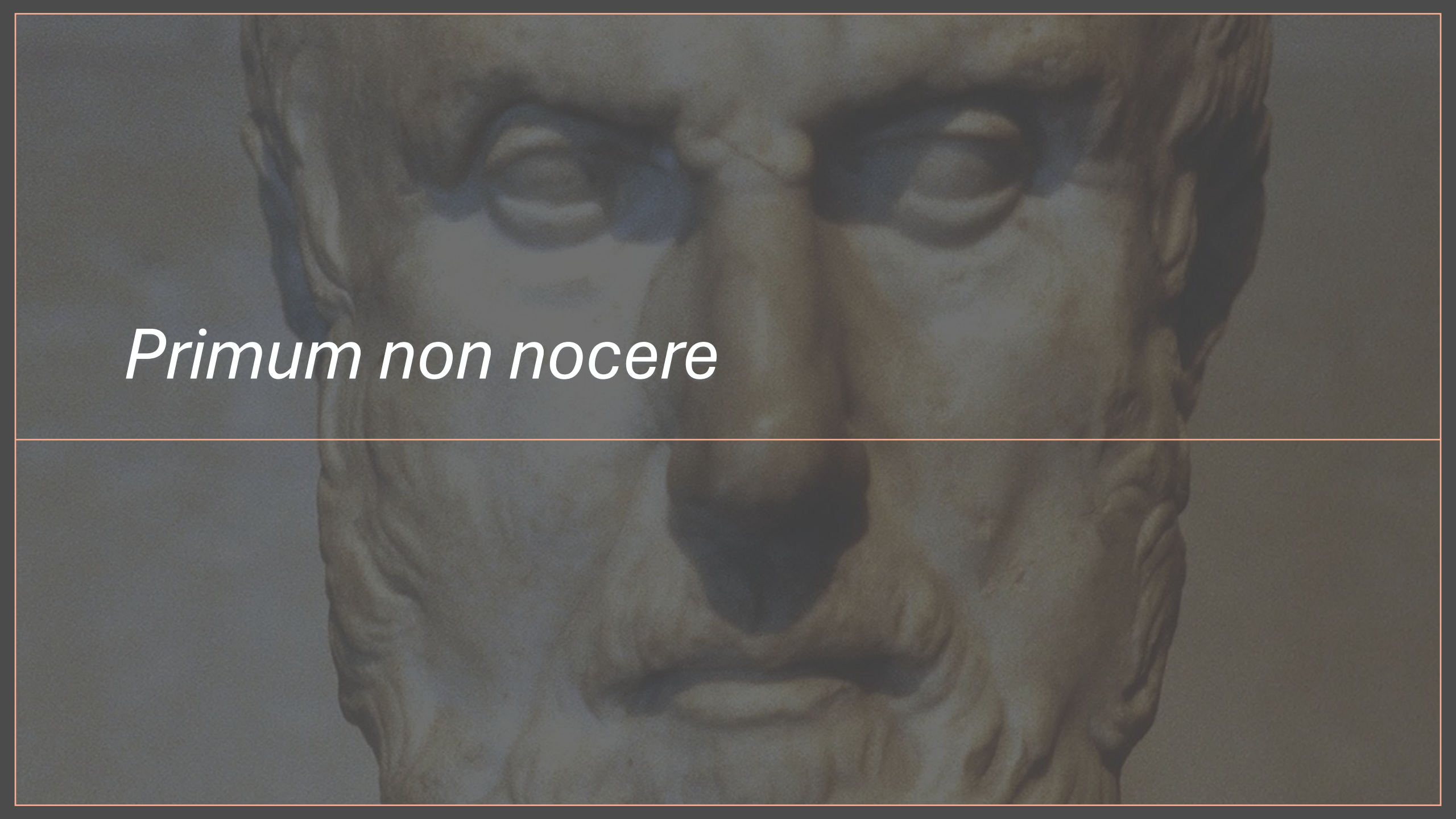
Fig. 1. Clinician-prescribed infusate for maintenance intravenous requirements in children for scenarios one (A), two (B), and three (C).

Consideration about dehydration

- Concern about **fluid** and **electrolyte** shifts
- Compensation mechanisms of the body
- Degree of dehydration is essential

Considerations about fluids

- Fluids are drugs
- Consider
  - Indication
  - Route of administration
  - Duration
  - Adverse effects



Primum non nocere

Fluid composition

	Resuscitation		Maintenance			
	Modified Ringer's lactate	Sodium chloride, 0.9%	½ Darrows Dextrose, 5%	Sodium chloride, 0.9%/Dextrose, 5%	Paediatric Maintenance Solution	Balanced solution
Na	130	154	61	154	35	130
K	4		18		12	4
Cl	109	154	51	154	47	110
Bicarb			27			27
Lactate	28					
Dextrose			50	50	50	
Osmolality	272	308	434	560	372	273
Tonicity	Isotonic	Isotonic	Hypotonic	Hypertonic	Hypotonic	Isotonic
pH	6,5		5			7,4

Values expressed in mmol/L, except osmolality and pH

Resuscitation Fluids: Saline versus Ringers Lactate

- The previous edition of the Paediatric STGs and EML only recommended Sodium Chloride, 0.9% .
- The consideration of Modified Ringers Lactate was evaluated during the current review cycle.


CLINICAL TRIALS

Randomized Double-blind Trial of Ringer Lactate Versus Normal Saline in Pediatric Acute Severe Diarrheal Dehydration

Gayathri Bhuvaneswaran Kartha, Ramachandran Rameshkumar, and Subramanian Mahadevan

A randomized trial comparing the effectiveness of Ringer lactate and normal saline for correction of paediatric acute severe diarrhoeal dehydration found that 38% of patients on Ringers lactate and 23% of patient on normal saline had improvement in clinical status and pH ≥ 7.35 after 6 hours, RR =1.63, 95% CI 0.8 to 3.4).
No significant differences were seen secondary outcomes regarding electrolyte, renal and blood gas parameters, or hospital stay duration.

Kartha GB, Rameshkumar R, Mahadevan S. Randomized Double-Blind Trial of Ringers Lactate versus Normal Saline in Pediatric Acute Severe Diarrheal Dehydration. JPGN, 2017, 65 (6):1.

Resuscitation Fluids: Saline versus Ringers Lactate

- Comparable in efficacy, the consider the costs:

Item	Price*
Sodium Chloride; 0.9%; Infusion (parenteral); 1 L	R12.37
Ringer Lactate; Infusion (parenteral); 1 L	R10.75

**January 2024*

Note: Much large volume on National Contract for NaCl compared to Ringers Lactate. As volumes of Ringers increase, it would be expected this price to go down

Modified Ringers Lactate was thus added as an alternative resuscitation fluid to sodium chloride, 0.9% in a shock, anaphylaxis, cardiac arrest and burns.

Resuscitation fluids

Sodium Chloride, 0.9%

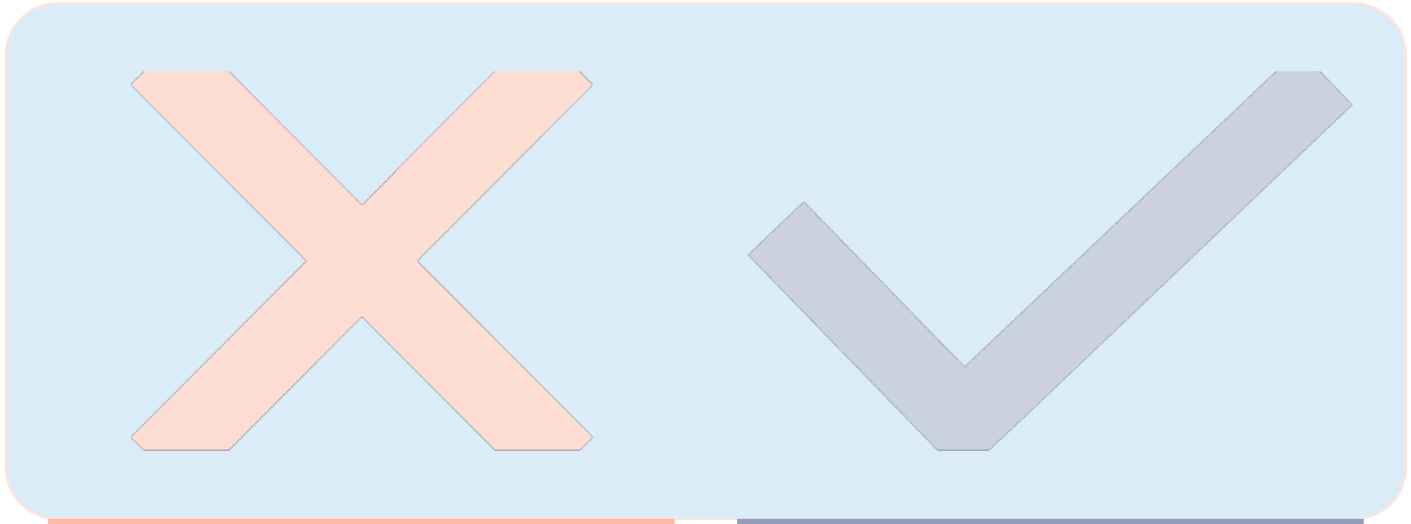
- Historical recommendation retained

Modified Ringers Lactate

- Alternative included

Maintenance fluids

Major change in fluid recommendations throughout



Previous recommendation

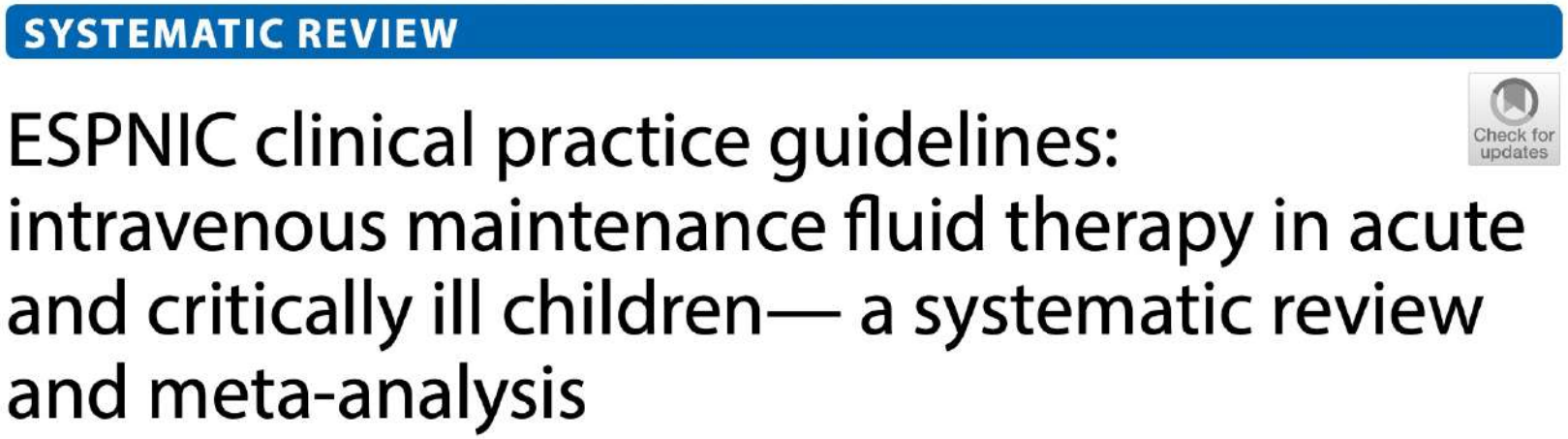
- ½ Darrow dextrose, 5%

Updated recommendation

- Saline, 0.9% with dextrose, 5%

Update in maintenance fluid recommendation for children

- Half-strength Darrow's solution has been used extensively for childhood dehydration in treatment internationally.
- Major adverse effect: **iatrogenic hyponatraemia**.



Brosier, et al. ESPNIC clinical practice guidelines: intravenous maintenance fluid therapy in acute and critically ill children- a systematic review and meta-analysis. Intensive Care Med. 2022 Dec;48(12):1691-1708. doi: 10.1007/s00134-022-06882-z. Epub 2022 Oct 26..

Five PICOs

- Indications for IV maintenance fluid therapy (IV-MFT)
- Use of isotonic fluids
- Use of balanced solutions
- IV-MFT composition
- Volume of IV-MFT administered

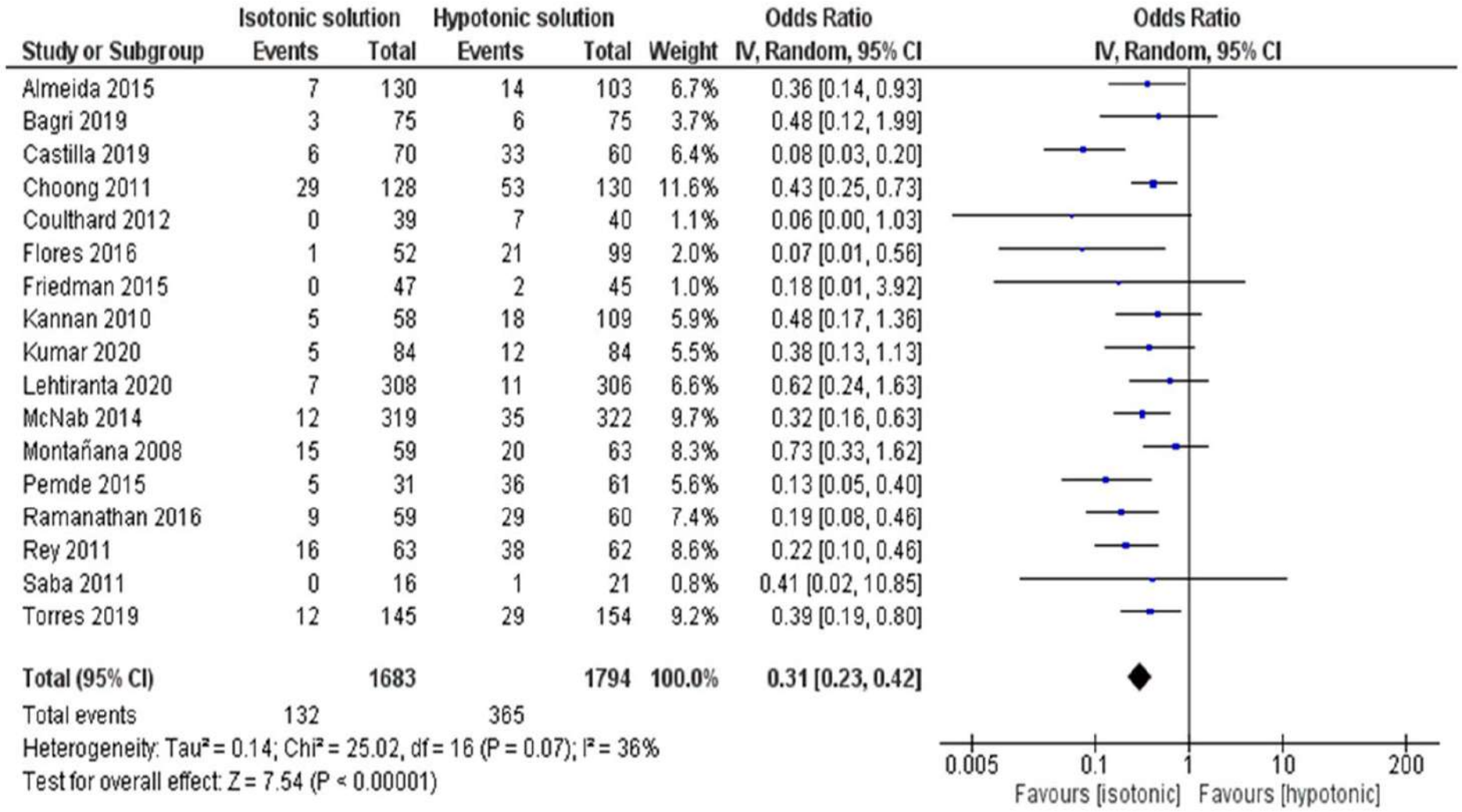


Fig. 3 Meta-analysis of studies comparing the impact on hyponatremia occurrence of isotonic versus hypotonic solutions

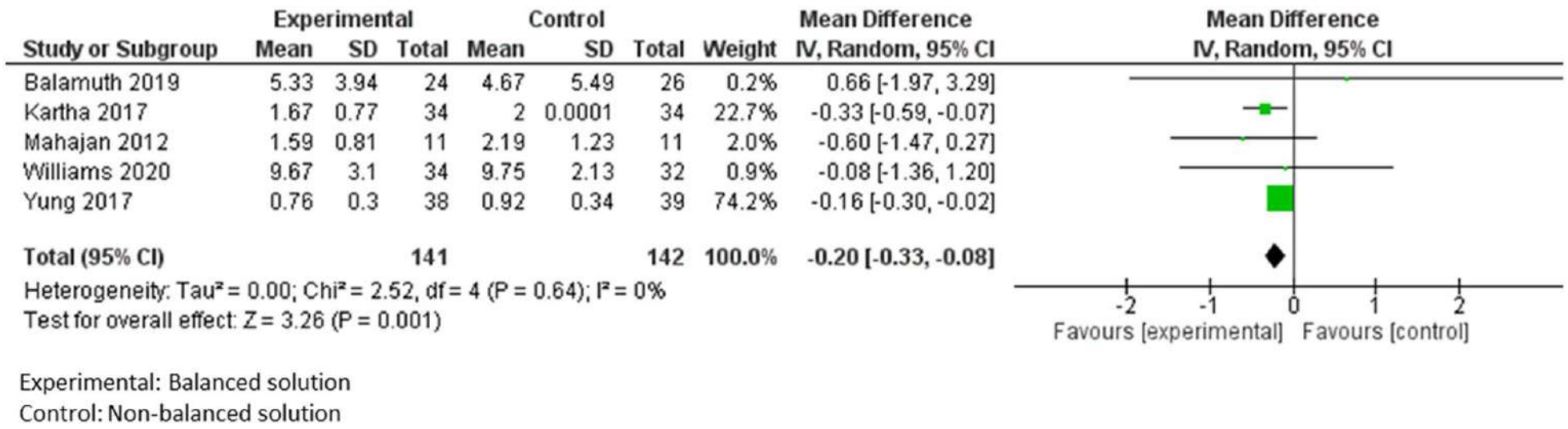
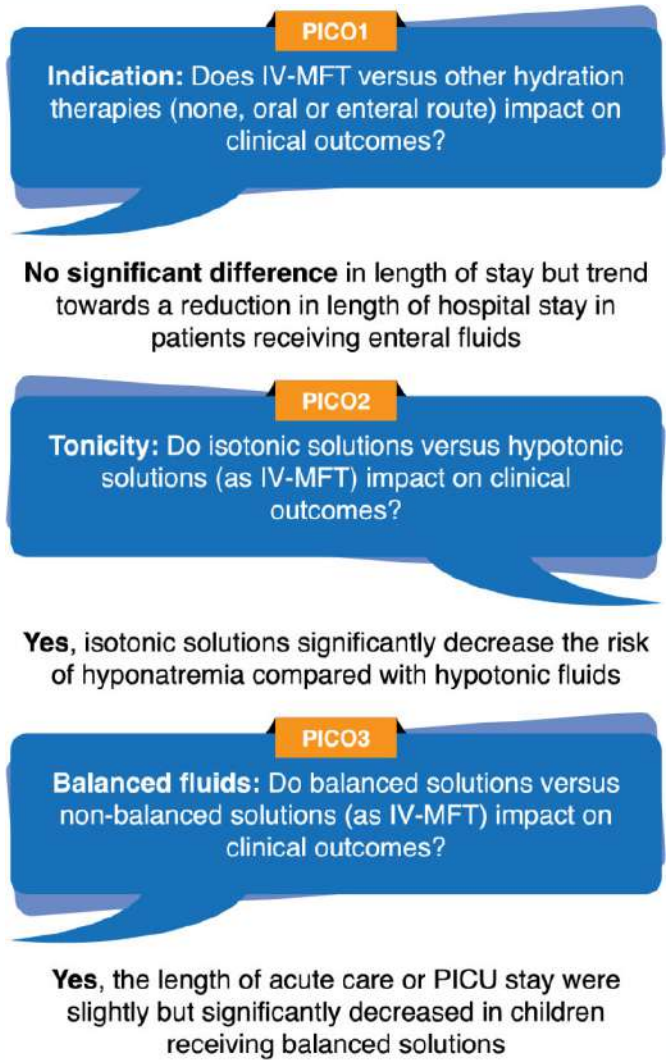
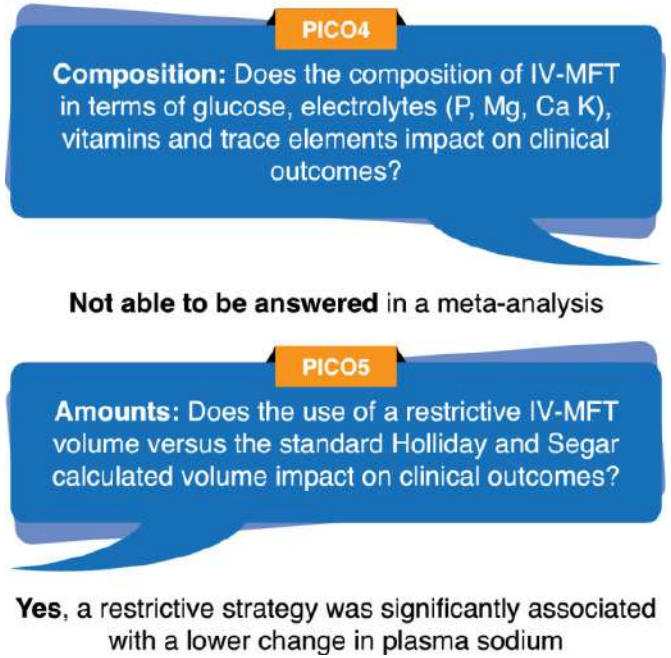


Fig. 4 Meta-analysis of studies comparing the impact on acute or critical care stay of balanced versus non-balanced solutions

Update in maintenance fluid recommendation for children





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Update in maintenance fluid recommendation for children

Half strength Darrow with glucose 5% is the **more costly** option compared to saline 0.9%/dextrose 5% option

	Half Darrow With Glucose; 5%; Infusion (parenteral); 500 ml	Sodium Chloride, Dextrose; 0.9%, 5%; Infusion (parenteral); 1 L	Sodium Chloride, 0.9% Dextrose, 5%; Infusion (parenteral); 200 ml
Current contract price*	R12.86	R12.37	R22.28
Price per litre	R25.72	R12.37	R111,40

**January 2024*

Thus removed: replaced with Sodium Chloride 0.9%/Dextrose 5% solution

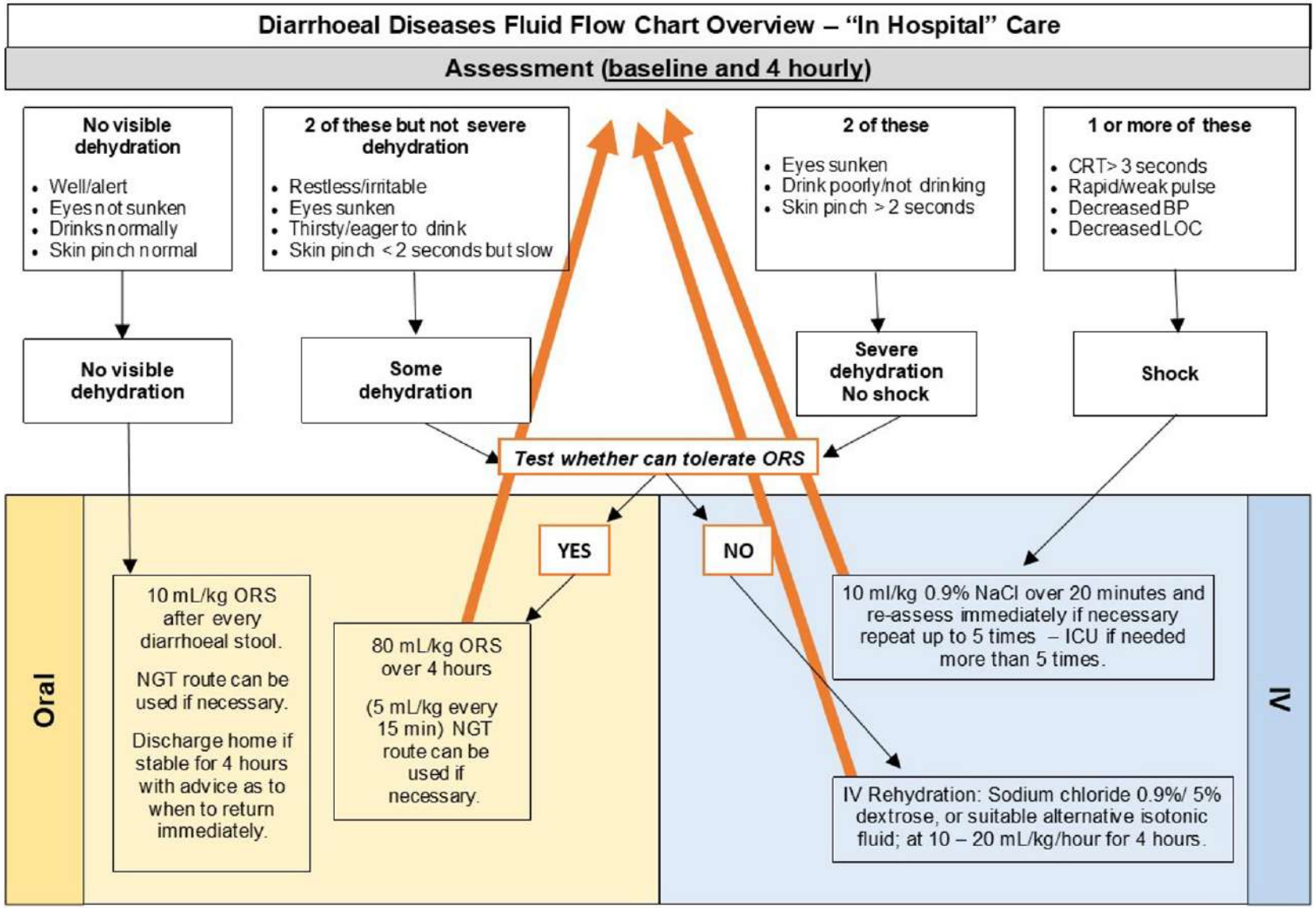
Update in maintenance fluid recommendation for children

Balanced solutions..?

	Half Darrow With Glucose; 5%; Infusion (parenteral); 500 ml	Sodium Chloride, Dextrose; 0.9%, 5%; Infusion (parenteral); 1 L	Sodium Chloride, 0.9% Dextrose, 5%; Infusion (parenteral); 200 ml	Plasmalyte B (Balsol); 1 L
Current contract price*	R12.86	R12.37	R22.28	R21.58#
Price per litre	R25.72	R12.37	R111,40	R21.58

*January 2024
Non-EML

Thus removed: replaced with Sodium Chloride 0.9%/Dextrose 5% solution


Diarrhoeal Diseases Fluid Flow Chart Overview – "In Hospital" Care
Assessment (baseline and 4 hourly)
No visible dehydration
Well/alert
Eyes not sunken
Drinks normally
Skin pinch normal
2 of these but not severe dehydration
Restless/irritable
Eyes sunken
Thirsty/eager to drink
Skin pinch < 2 seconds but slow
2 of these
Eyes sunken
Drink poorly/not drinking
Skin pinch > 2 seconds
1 or more of these
CRT> 3 seconds
Rapid/weak pulse
Decreased BP
Decreased LOC
No visible dehydration
Some dehydration
Severe dehydration No shock
Shock
Test whether can tolerate ORS
YES
NO
Oral
10 mL/kg ORS after every diarrhoeal stool.
NGT route can be used if necessary.
Discharge home if stable for 4 hours with advice as to when to return immediately.
80 mL/kg ORS over 4 hours
(5 mL/kg every 15 min) NGT route can be used if necessary.
IV
10 ml/kg 0.9% NaCl over 20 minutes and re-assess immediately if necessary repeat up to 5 times – ICU if needed more than 5 times.
IV Rehydration: Sodium chloride 0.9%/ 5% dextrose, or suitable alternative isotonic fluid; at 10 – 20 mL/kg/hour for 4 hours.

The Case for Oral Rehydration Therapy

The human body has strict physiologic control to maintain a balance of fluid and electrolytes.

The case for oral rehydration therapy

Physiology

- Antidiuretic hormone
- Renal regulation of urinary water losses
- Thirst centre to regulate intake

The case for oral rehydration therapy

Evidence

- Equal efficacy
- Fewer complications, e.g. phlebitis
- Shorter duration of hospitalisation
- Lower cost
- Easier to administer
- Quicker to treatment commencement

Also…

- Opportunity to empower the caregiver

IMCI

Key points to note

Most children should receive maintenance fluids orally or via nasogastric tube

All children receiving IV fluid should be re-assessed frequently (4 hourly)

For rehydration, the oral or nasogastric route is preferred

Rapid rehydration over 4 hours (vs slow rehydration) is preferred

Key points to note

Encourage normal nutrition

Be extremely cautious with IV fluid in SAM patients

Rehydration is additional to nutrition (not a replacement)

Zinc 10 mg daily for 14 days to all

Acknowledgements

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  - Dr Nilesh Lala
  - Dr Gary Reubenson
  - Dr Martie Wege