

Malnutrition in Children

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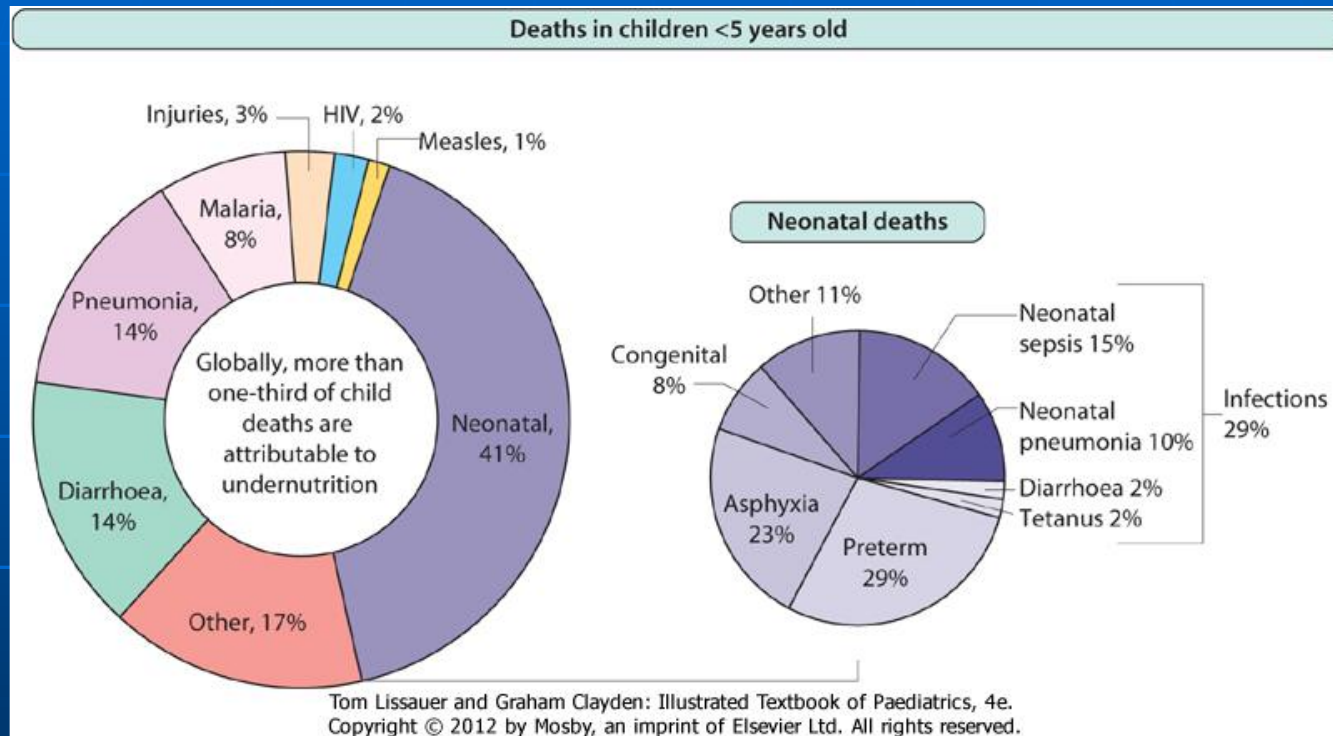
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Malnutrition and child deaths



Globally, > one-third of child deaths attributable to undernutrition

Assessment of nutritional status

Nutritional assessment

Anthropometry

- Weight
- Height
- Mid-arm circumference
- Skinfold thickness

Laboratory

- Low plasma albumin
- Low concentration of specific minerals and vitamins

Food intake




- Dietary recall
- Dietary diary

Immunodeficiency

- Low lymphocyte count
- Impaired cell-mediated immunity



Wasting and stunting

	Normal	Wasted	Stunted
			
Weight/age %	100	70	70
Weight/height %	100	70	100
Height/age %	100	100	84

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WHO definitions

- **Weight for height** – measure of wasting and an index of acute malnutrition
 - **Severe malnutrition** - weight for height > -3 standard deviations below the median on WHO growth chart. Corresponds to weight for height $< 70\%$ below median.
- **Mid upper-arm circumference (MUAC)** – < 115 mm severe malnutrition
- **Height for age** – measure of stunting and index of chronic malnutrition

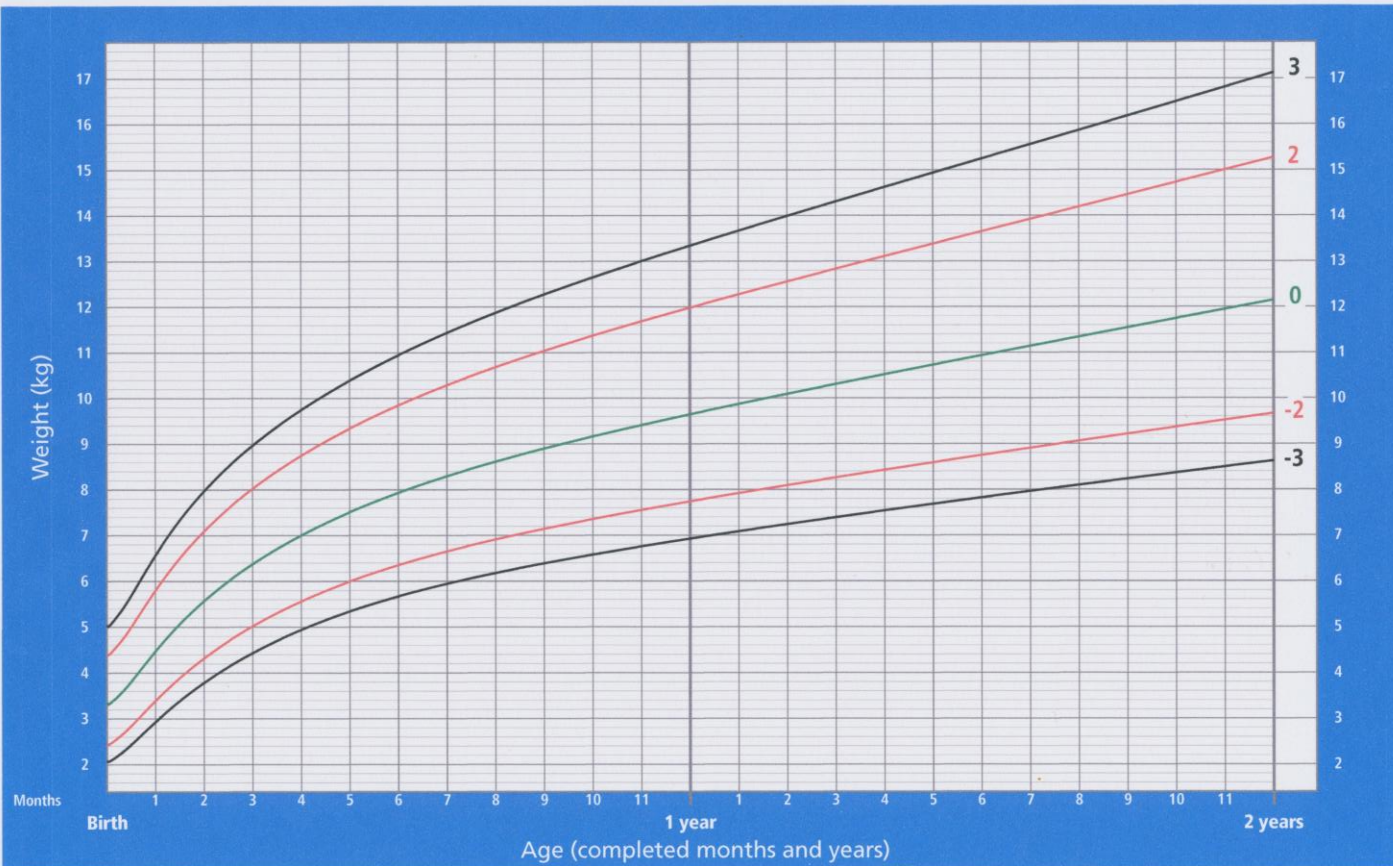
Weighing and height



Weight for Age – Z scores

Weight-for-age BOYS

Birth to 2 years (z-scores)



WHO Child Growth Standards

Weight-for-Height Reference Card

Boys' weight (kg)					Length (cm)		Girls' weight (kg)			
-4 SD (60%)	-3SD (70%)	-2SD (80%)	-1SD (90%)	Median	Median	-1SD (90%)	-2SD (80%)	-3SD (70%)	-4SD (60%)	
1.8	2.1	2.5	2.8	3.1	49	3.3	*2.9	2.6	2.2	1.8
1.8	2.2	2.5	2.9	3.3	50	3.4	3.0	2.6	2.3	1.9
1.8	2.2	2.6	3.1	3.5	51	3.5	3.1	2.7	2.3	1.9
1.9	2.3	2.8	3.2	3.7	52	3.7	3.3	2.8	2.4	2.0
1.9	2.4	2.9	3.4	3.9	53	3.9	3.4	3.0	2.5	2.1
2.0	2.6	3.1	3.6	4.1	54	4.1	3.6	3.1	2.7	2.2
2.2	2.7	3.3	3.8	4.3	55	4.3	3.8	3.3	2.8	2.3
2.3	2.9	3.5	4.0	4.6	56	4.5	4.0	3.5	3.0	2.4
2.5	3.1	3.7	4.3	4.8	57	4.8	4.2	3.7	3.1	2.6
2.7	3.3	3.9	4.5	5.1	58	5.0	4.4	3.9	3.3	2.7
2.9	3.5	4.1	4.8	5.4	59	5.3	4.7	4.1	3.5	2.9
3.1	3.7	4.4	5.0	5.7	60	5.5	4.9	4.3	3.7	3.1
3.3	4.0	4.6	5.3	5.9	61	5.8	5.2	4.6	3.9	3.3
3.5	4.2	4.9	5.6	6.2	62	6.1	5.4	4.8	4.1	3.5
3.8	4.5	5.2	5.8	6.5	63	6.4	5.7	5.0	4.4	3.7
4.0	4.7	5.4	6.1	6.8	64	6.7	6.0	5.3	4.6	3.9
4.3	5.0	5.7	6.4	7.1	65	7.0	6.3	5.5	4.8	4.1
4.5	5.3	6.0	6.7	7.4	66	7.3	6.5	5.8	5.1	4.3
4.8	5.5	6.2	7.0	7.7	67	7.5	6.8	6.0	5.3	4.5
5.1	5.8	6.5	7.3	8.0	68	7.8	7.1	6.3	5.5	4.8
5.3	6.0	6.8	7.5	8.3	69	8.1	7.3	6.5	5.8	5.0
5.5	6.3	7.0	7.8	8.5	70	8.4	7.6	6.8	6.0	5.2
5.8	6.5	7.3	8.1	8.8	71	8.6	7.8	7.0	6.2	5.4
6.0	6.8	7.5	8.3	9.1	72	8.9	8.1	7.2	6.4	5.6
6.2	7.0	7.8	8.6	9.3	73	9.1	8.3	7.5	6.6	5.8
6.4	7.2	8.0	8.8	9.6	74	9.4	8.5	7.7	6.8	6.0
6.6	7.4	8.2	9.0	9.8	75	9.6	8.7	7.9	7.0	6.2
6.8	7.6	8.4	9.2	10.0	76	9.8	8.9	8.1	7.2	6.4
7.0	7.8	8.6	9.4	10.3	77	10.0	9.1	8.3	7.4	6.6
7.1	8.0	8.8	9.7	10.5	78	10.2	9.3	8.5	7.6	6.7
7.3	8.2	9.0	9.9	10.7	79	10.4	9.5	8.7	7.8	6.9
7.5	8.3	9.2	10.1	10.9	80	10.6	9.7	8.8	8.0	7.1
7.6	8.5	9.4	10.2	11.1	81	10.8	9.9	9.0	8.1	7.2
7.8	8.7	9.6	10.4	11.3	82	11.0	10.1	9.2	8.3	7.4
7.9	8.8	9.7	10.6	11.5	83	11.2	10.3	9.4	8.5	7.6
8.1	9.0	9.9	10.8	11.7	84	11.4	10.5	9.6	8.7	7.7

Mid upper-arm circumference



Mid upper-arm circumference



Types of malnutrition - marasmus

Severe protein-energy malnutrition in children usually leads to marasmus:

- *weight for height > -3 standard deviations below the median,
<70% weight for height
- *Mid-arm circumference markedly reduced
- *Wasted, wizened appearance
- *Often withdrawn and apathetic.
- *Oedema not present

Marasmus



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Types of malnutrition - kwashiorkor

Another manifestation of severe protein malnutrition :

- **Generalised oedema** as well as severe wasting.
- **Reduced weight for age**, but because of oedema, weight as markedly reduced.

In addition, other clinical features:

- a 'flaky-paint' skin rash with hyperkeratosis (thickened skin) and desquamation
- a distended abdomen and enlarged liver (usually due to fatty infiltration)
- angular stomatitis
- hair which is sparse and depigmented
- diarrhoea, hypothermia, bradycardia and hypotension
- low plasma albumin, potassium, glucose and magnesium.

Kwashiorkor





Why do some children develop marasmus, others kwashiorkor?

- Unclear
- Both - protein-energy malnutrition
- Marasmus – in famine
- Kwashiorkor - feature of infants not weaned from the breast until about 12 months of age. Subsequent diet relatively high in starch. Often develops after an acute intercurrent infection e.g. measles or gastroenteritis



Definitions of Severe Protein Energy Malnutrition

WHO Classification:

	+ Oedema	No oedema
<70% weight for <u>height</u> (WHZ <-3)	Severe wasting + oedema*	Severe wasting

* If there is severe oedema the weight may appear reasonable initially.

Definitions of Severe PEM

WHO Classification:

	+ Oedema	No oedema
<70% weight for <u>height</u> (WHZ <-3)	Severe wasting + oedema*	Severe wasting

Two simple signs are useful for classification

Clinical Diagnosis – You must look!



Check large muscle groups

- *Buttocks and thighs*
- *Shoulders and upper arms*



Check the severity of oedema

- *Feet, knee, sacrum, face*
- *Oedema can make WAZ look OK*

Gentle nutritional rescue – the process of feeding



- Immediate feeding
- Small volume / frequent feeding because of small stomach capacity and precarious physiology
- Vomiting is NOT a contraindication to feeding
- Routine insertion of a naso-gastric tube should be considered
- Feeds are the ‘drug’ to cure malnutrition, they are a priority (after correction of dehydration if required).

Why do we not give more?

- The body really cannot tolerate more
- Too vigorous re-feeding has been associated with increased mortality.
- Too much sugar can cause an osmotic diarrhoea
- Higher protein contents cannot be handled by the liver
- Salt can make oedema worse and precipitate heart failure.

Feeds

- Specialised feeds are widely available.
- Initially Formula 75 (75 kcal/100 ml)
- Then Formula 100 (100 kcal/100 ml) or Ready-to-Use Therapeutic Food (RUTF).

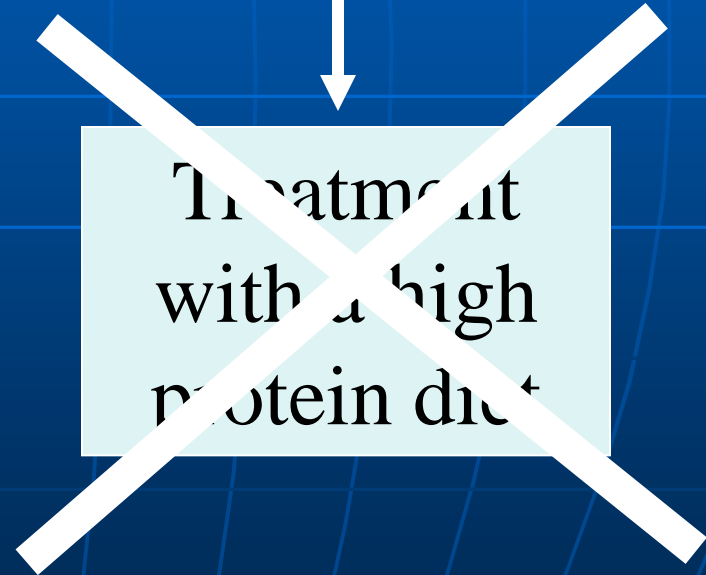


Kwashiorkor – where logic fails

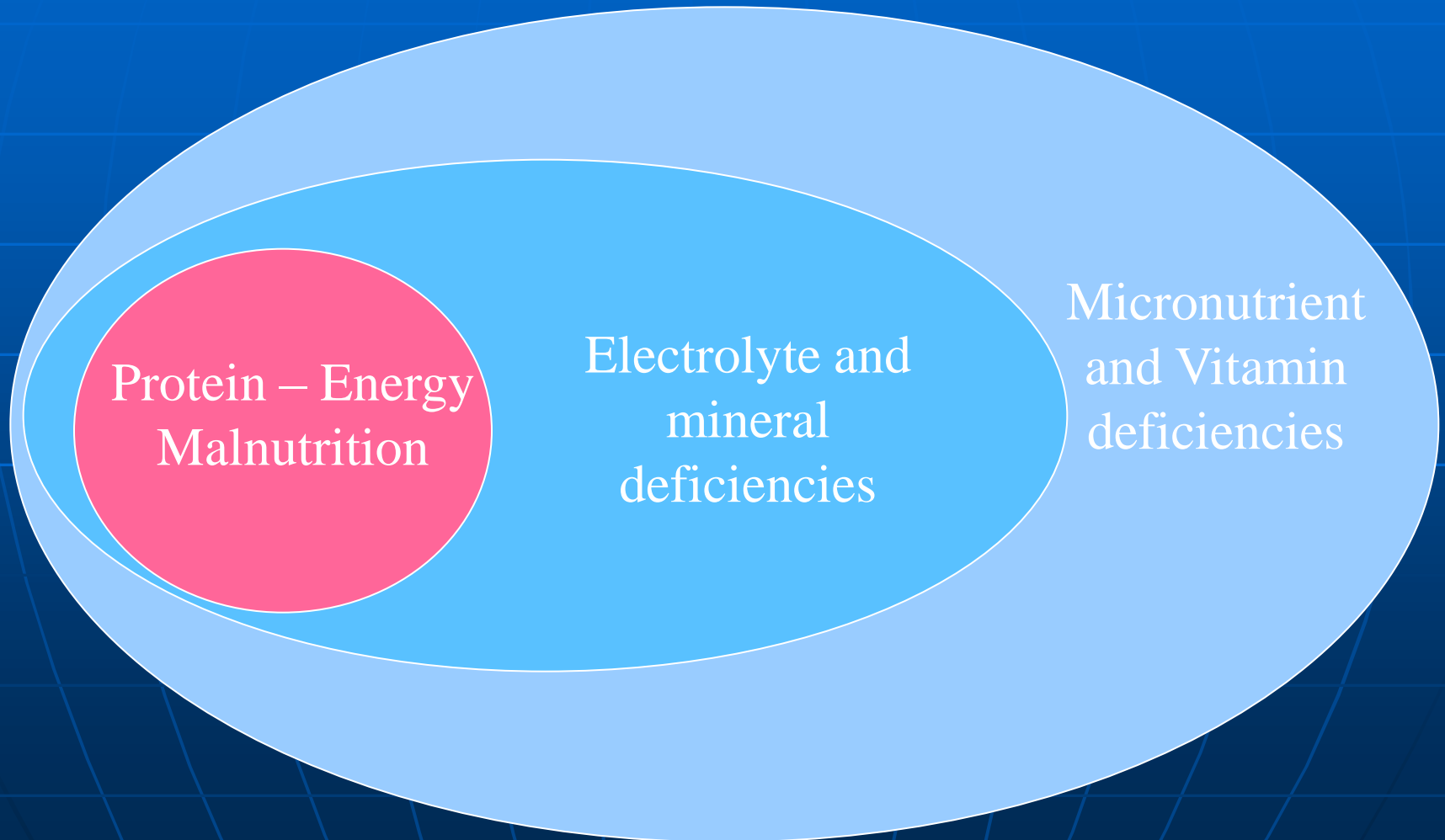


Protein
deficiency

Treatment
with a high
protein diet



Severe malnutrition



Electrolyte / Mineral Deficiencies

- Potassium:
 - Potassium supplements help reduce oedema
 - Magnesium
 - Zinc
 - Copper
 - Selenium
- **There is too much sodium so salty foods can be dangerous**

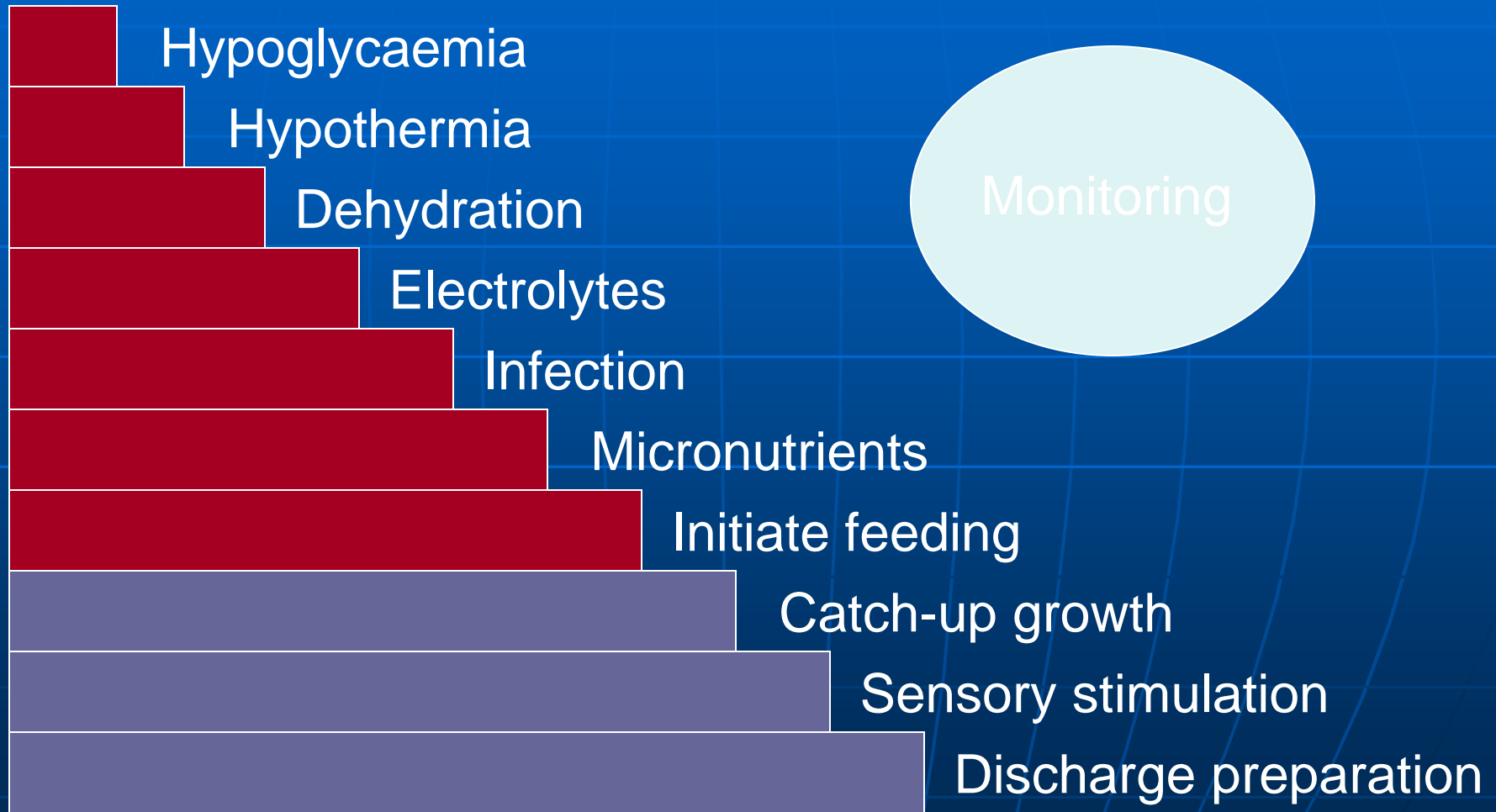


Pre-packaged F75 and F100 and Ready to Use Foods (RTUF) have all the 'good ones' – they do not need to be added

What other problems do these children commonly have?



10 Step Approach



Hypoglycaemia and Hypothermia

- All new admissions with malnutrition should be kept warm until there are signs of recovery.
- Glucose for those who are unconscious or very severely ill with no glucose measurement.
- Immediate nasogastric feeding for conscious children with blood glucose $< 3\text{mmol/l}$

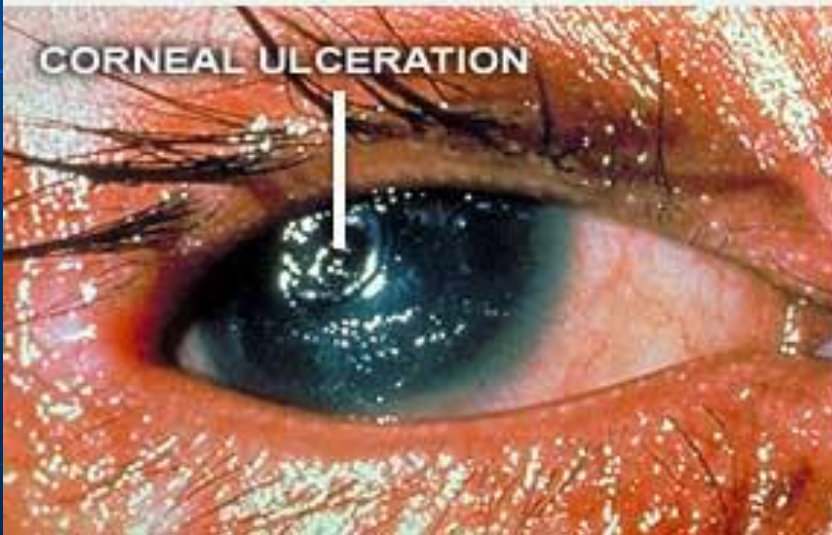
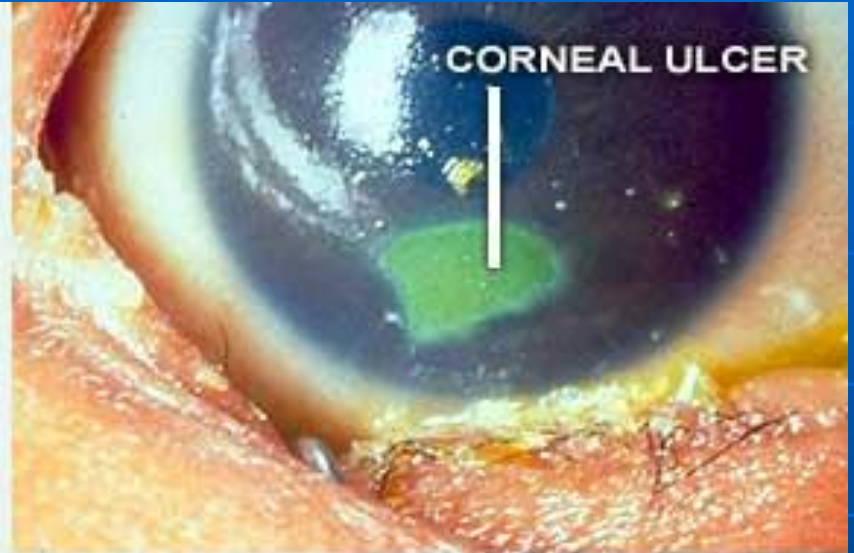
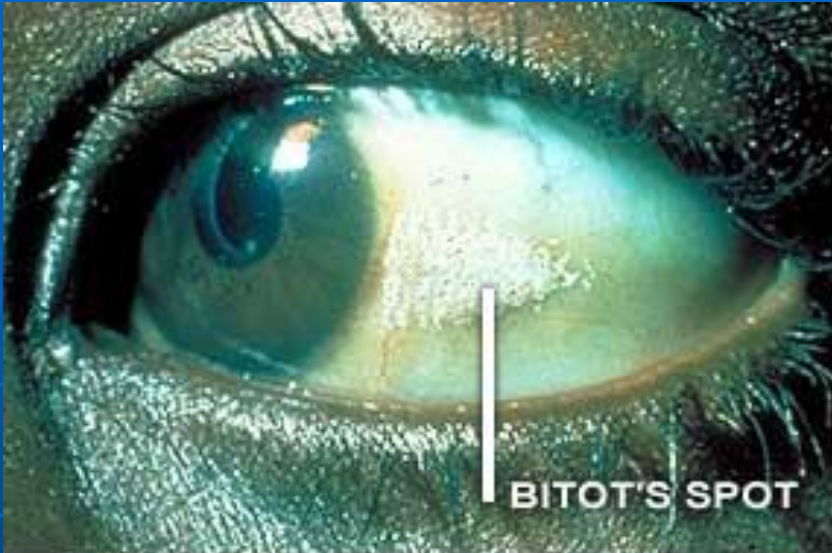
Dehydration

- Shock is treated
- Oral rehydration is with ORS (oral rehydration solution)
- Feeding must be introduced during the first 12 hours of treating dehydration

Infection

- Up to 1/3rd children with malnutrition who die have septicaemia / bacteraemia
- Fever and other signs of infection are not helpful in identifying infection in these children
- ALL sick children with severe malnutrition in hospital should be started on antibiotics.

Vitamin A deficiency



Summary

- The risk of death in children with severe malnutrition is very high.
- The children have many problems and each needs treating.
- The 10 steps approach allows each problem to be treated
- Feeding should not be a high protein diet

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