General framework

The Optima Nutrition model: an overview

- Optima Nutrition is an allocative efficiency model to minimize stunting, wasting, anaemia and mortality

- The underlying model is a reproduction of the LiST framework
  - Tracks the under-5 population over a designated time period (e.g. 2018-2030)

- The model includes risk factors that contribute to these outcomes:
  - Birth outcomes (small versus average for gestational age; term versus pre-term)
  - Breastfeeding behaviours
  - Diarrhoea incidence

- Key outcomes: stunting cases, deaths (maternal and child), wasting prevalence and incidence, and anaemia prevalence (maternal and child)

- An optimization algorithm is included, which can determine how to allocate a budget across a interventions to achieve the objective of choice, or a combination of objectives.
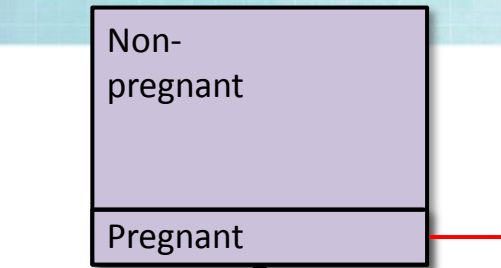
How Optima Nutrition works
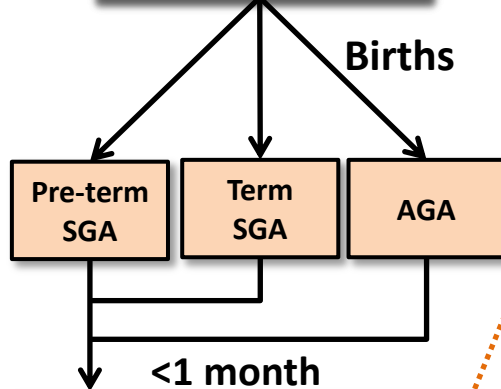
Women of reproductive age (WRA)

Non-pregnant

Pregnant → **Maternal death**

Risk factors for maternal mortality
- Haemorrhage
- Hypertensive disorders
- Sepsis
- Abortion
- Embolism
- Other

SGA: Small for gestational age
AGA: Appropriate for gestational age

Key endpoints

Stunting

Deaths

Births

Pre-term SGA | Term SGA | AGA

Risks of stunting include
-breastfeeding practices
-past stunting
-diarrhoea incidence

<1 month

Four categories tracked

Relative to global mean

-3 -2 -1
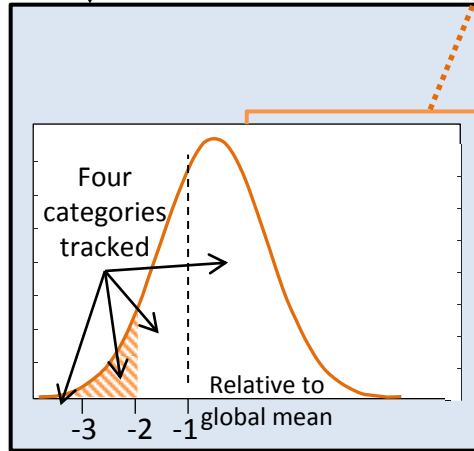
1-6 months **6-12 months** **1-2 years** **2-5 years**

Stunted

Others not stunted by age 5 years

Risk factors for mortality
- Diarrhea   • Sepsis
- Pneumonia   • Prematurity
- Asphyxia   • Other

Neonatal death

Post-neonatal death

Risk factors for mortality
- Diarrhea
- Pneumonia
- Measles
- Other

Weight-for-height categories

- Children are divided into weight-for-height Z-scores (WHZ) categories (similar to stunting)
    - Categories: severe acute malnutrition [SAM], moderate acute malnutrition [MAM], mild, and normal
    - Wasting considered to be SAM + MAM categories
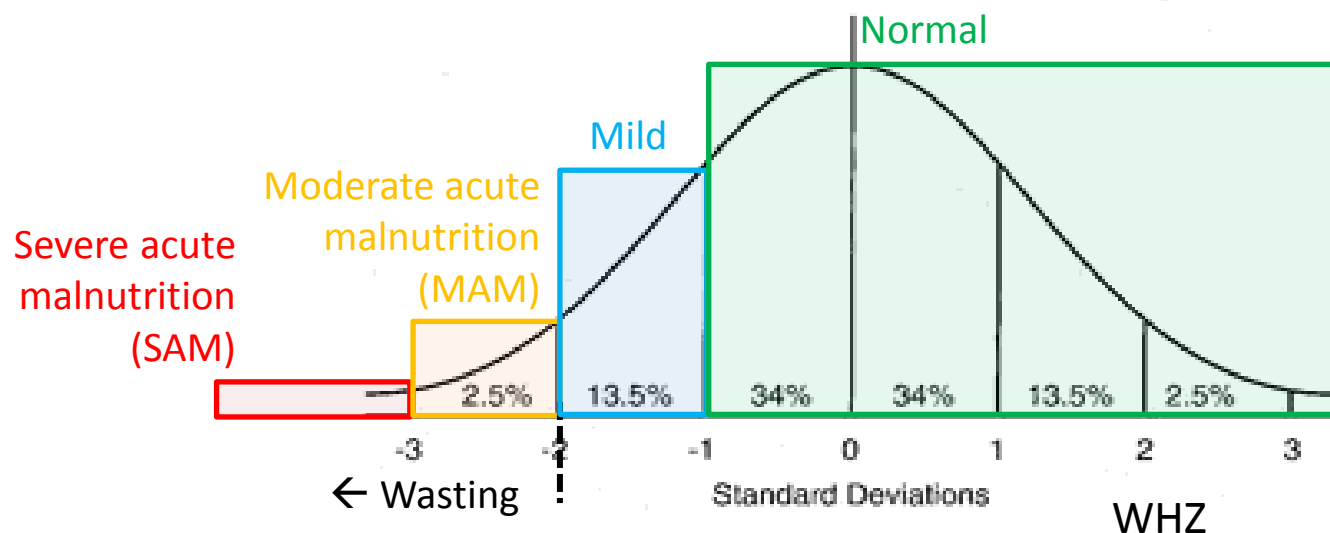
Model populations: overview of stratifications

Non-pregnant women of Reproductive Age (WRA)[a,b]

15 - 19 years	Not anaemic	Anaemic
20 - 24 years	Not anaemic	Anaemic
25 - 29 years	Not anaemic	Anaemic
30 - 39 years	Not anaemic	Anaemic
40 - 49 years	Not anaemic	Anaemic

Pregnant women[b,c]

15 - 19 years	Not anaemic	Anaemic
20 - 29 years	Not anaemic	Anaemic
30 - 39 years	Not anaemic	Anaemic
40 - 49 years	Not anaemic	Anaemic

Children
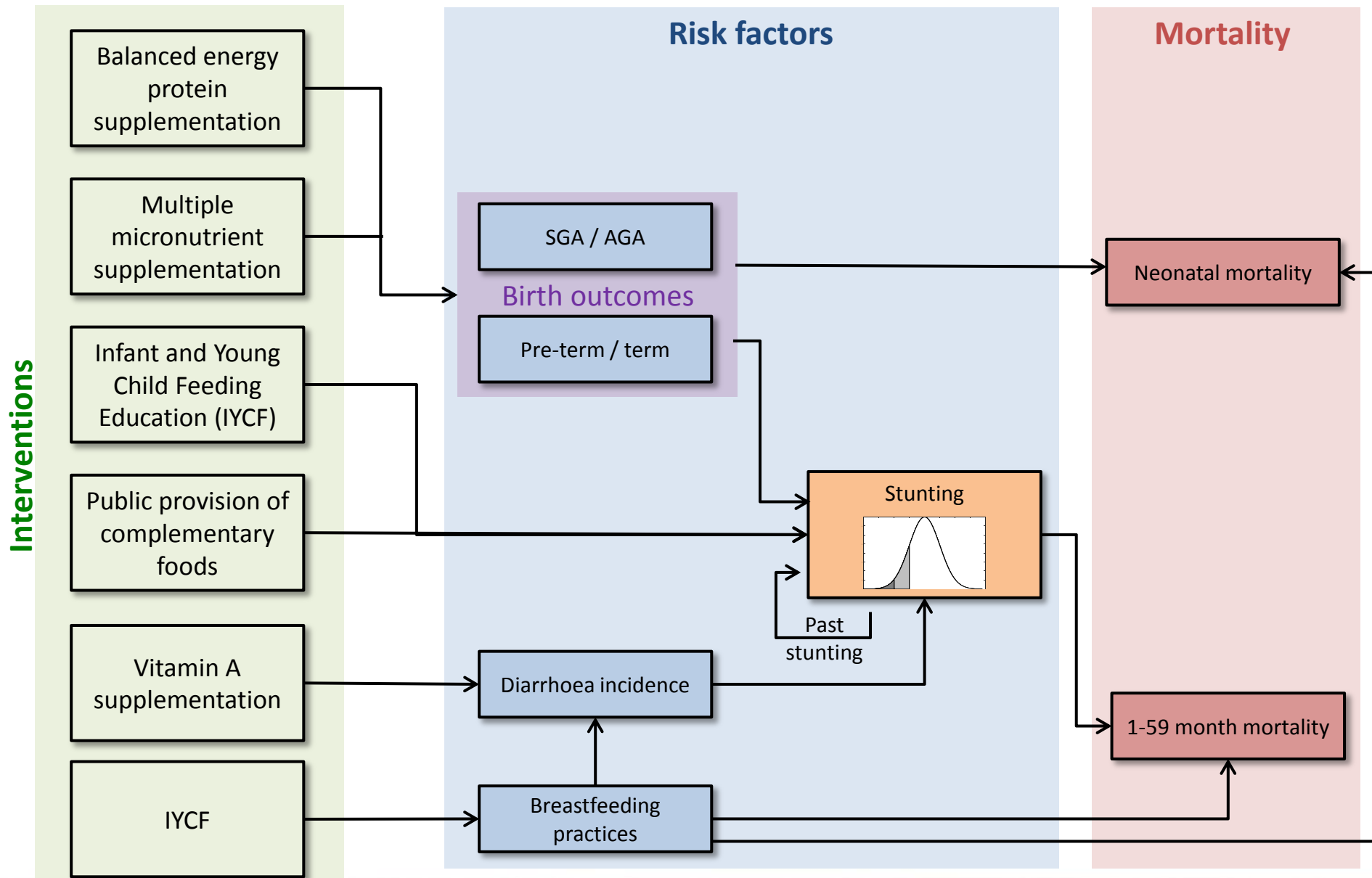**Also stratified by:**
- Stunting
- Wasting
- Breastfeeding

0 - 1 months	Not anaemic	Anaemic
1 - 6 months	Not anaemic	Anaemic
6 - 11 months	Not anaemic	Anaemic
12 - 23 months	Not anaemic	Anaemic
24 – 59 months	Not anaemic	Anaemic

[a] Age brackets determined according to current age-specific fertility rate data (2014 Bangladesh Demographic and Health Survey)
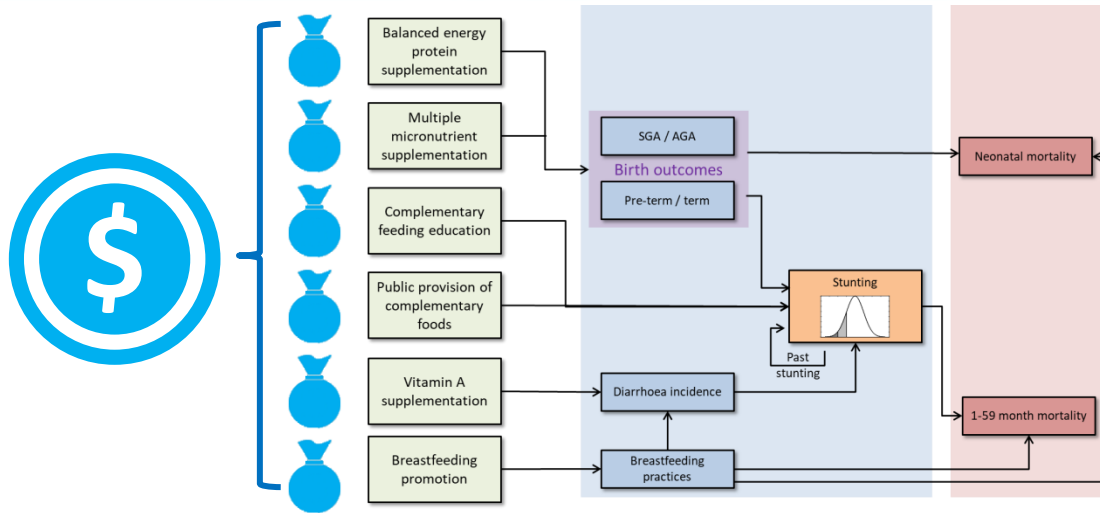[b] Age bands may vary based on the needs of the future family planning module
[c] Anaemia risks for pregnant women taken from non-pregnant WRA due to scarcity of data and unclear clinical definition

Stunting: risk factors, outcomes and interventions

Interventions

Risk factors

Mortality

- Balanced energy protein supplementation
- Multiple micronutrient supplementation
- Infant and Young Child Feeding Education (IYCF)
- Public provision of complementary foods
- Vitamin A supplementation
- IYCF

Birth outcomes
- SGA / AGA
- Pre-term / term

- Stunting
- Past stunting
- Diarrhoea incidence
- Breastfeeding practices

- Neonatal mortality
- 1-59 month mortality

Linking investment in programs to impact

Which investment **combination** leads to optimal outcomes?
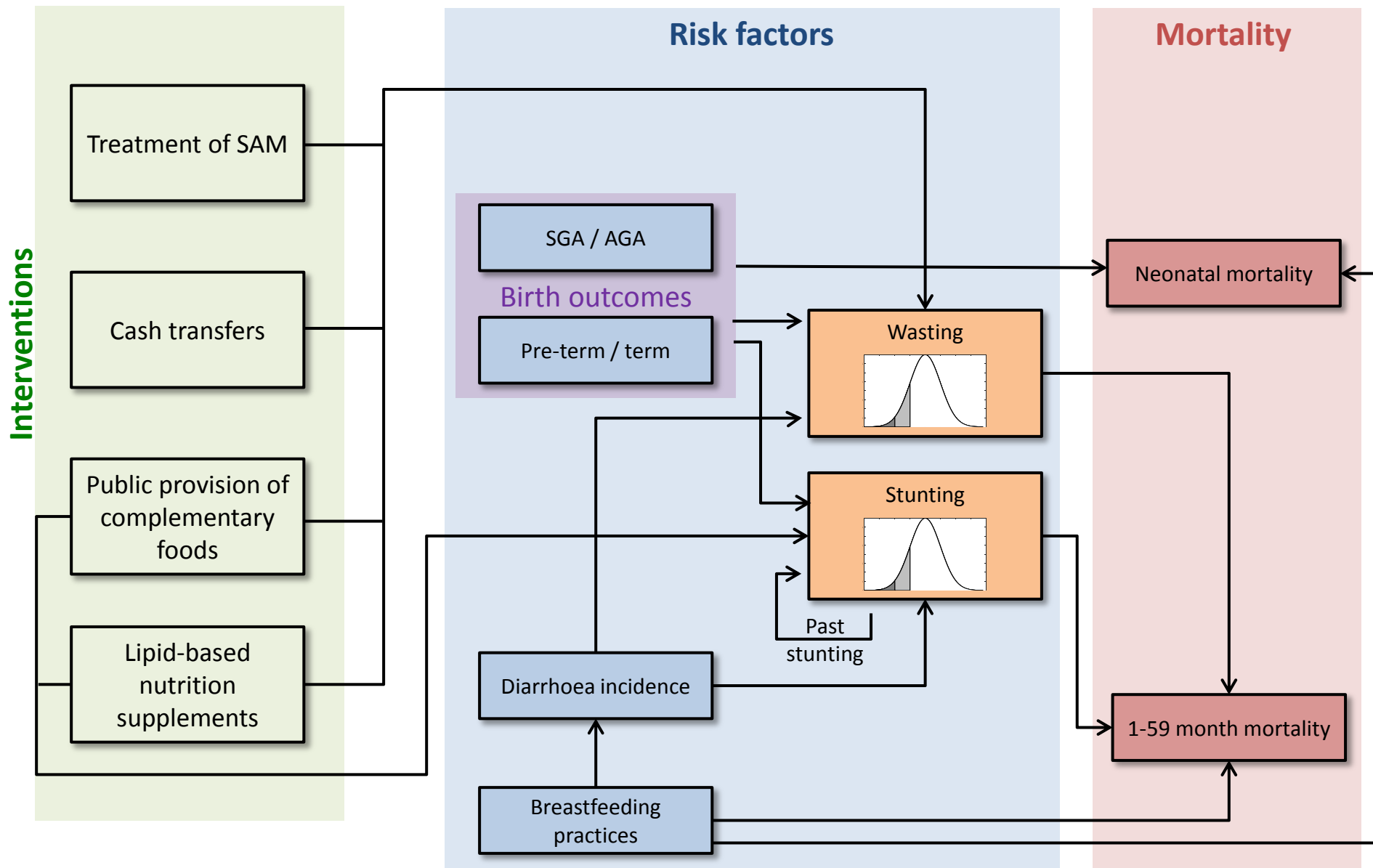
For each intervention, investment:

- Increases the number of people receiving the intervention

- Leads to reductions in stunting and deaths according to estimated effectiveness / odds ratios from the literature

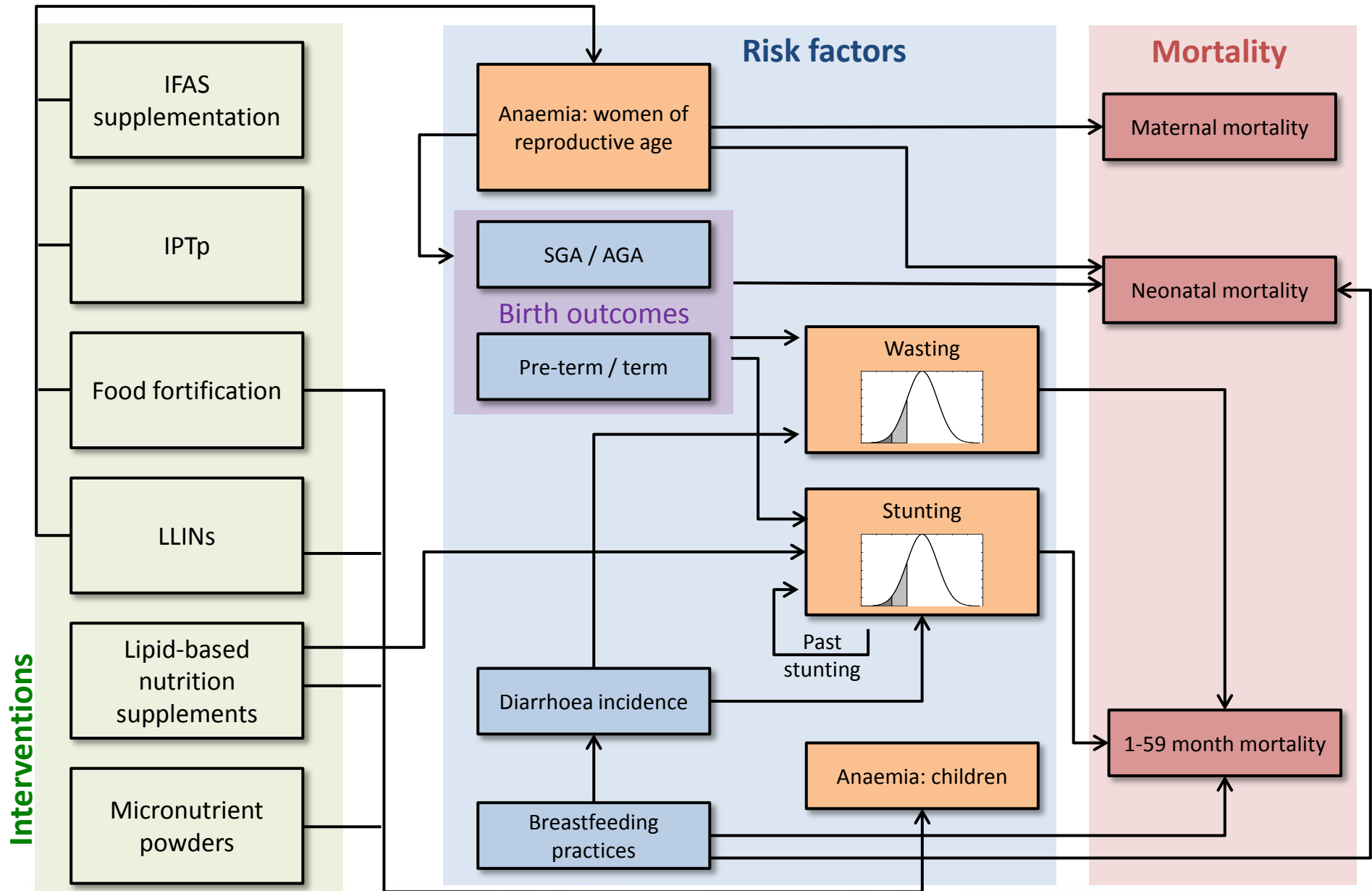- There is a saturation effect when scaling up programs
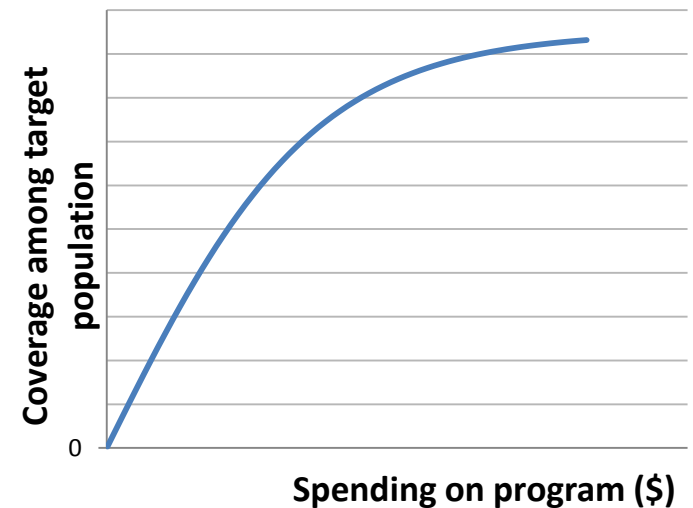
Wasting: risk factors, outcomes and interventions

Anaemia: risk factors, outcomes and interventions

Diarrhoea and other supplements

Interventions

- Calcium supplementation
- Magnesium sulphate
- Prophylactic zinc supplementation
- Oral rehydration solution (ORS)
- ORS + Zinc

Risk factors

- Anaemia: women of reproductive age
- SGA / AGA
- **Birth outcomes**
- Pre-term / term
- Wasting
- Stunting
- Past stunting
- Diarrhoea incidence
- Anaemia: children
- Breastfeeding practices

Mortality

- Maternal mortality
- Neonatal mortality
- 1-59 month mortality

WASH interventions
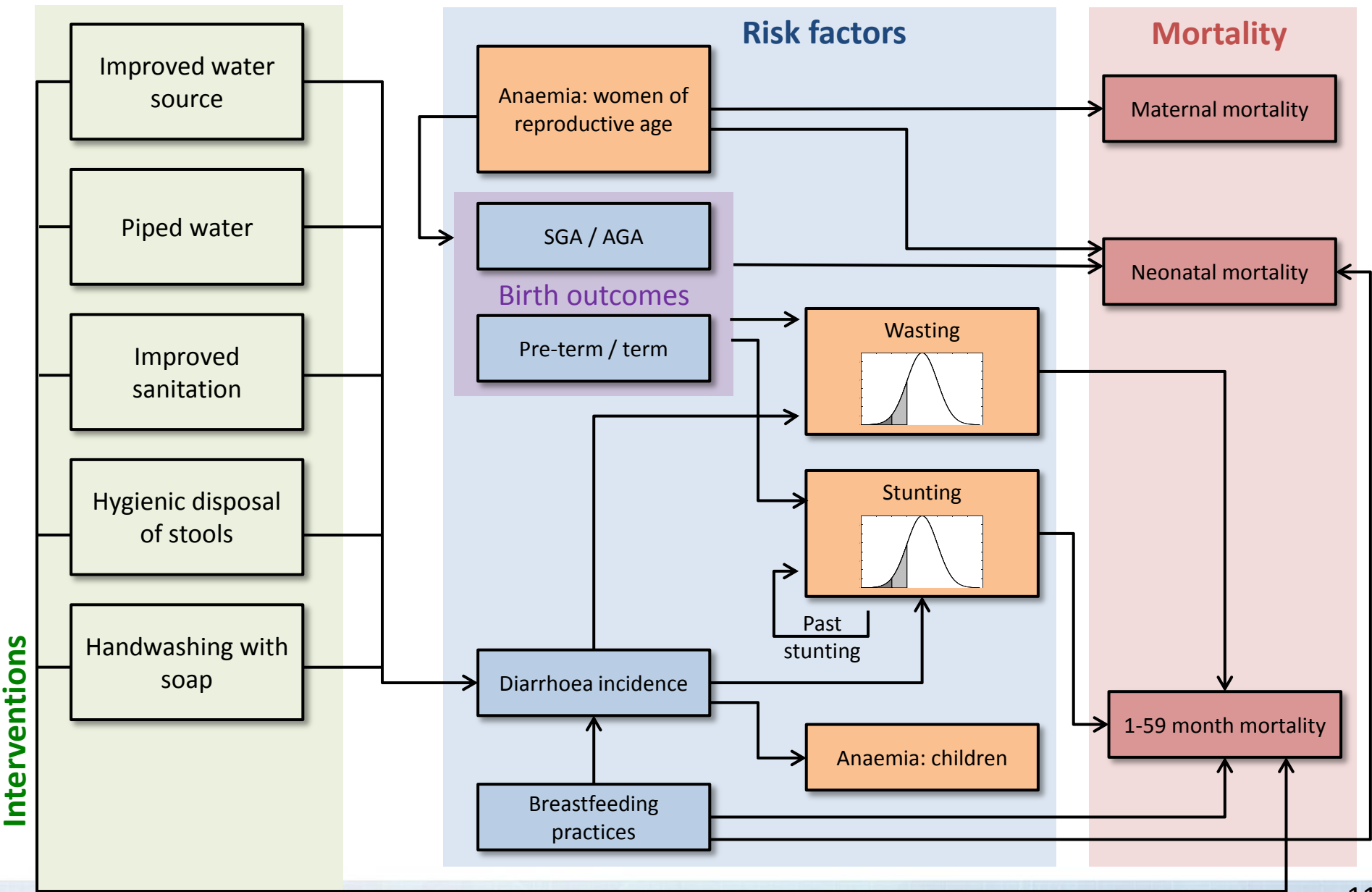
Infant and young child feeding (IYCF) packages

- **An IYCF package in the model refers to a user-defined collection of breastfeeding promotion and complementary feeding education interventions**

- Multiple delivery modes:
  - Health facilities (GP, hospital)
    - Can reach only pregnant women and mothers seeing a doctor
    - Much lower maximum coverage (depends on availability of health facilities / free health care)
  - Community health workers
    - Reaches all women and can therefore have much higher coverage
  - Mass media
    - Can cover all groups, depending on the message, with high coverage possible

- Greater impact for parents receiving multiple delivery models

User defined IYCF packages and input sheet

- Users can design their own IYCF packages using the table below
- For example, below might reflect an IYCF package that includes:
  - **Pregnant women**: counseling for pregnant women attending health facilities
  - **<6 months**: visit from community health worker + counseling during facility child visits
  - **> 6 months**: community lectures
  - **Mass media messages**

Target population	Health facility	Community	Mass media
Pregnant women	x		
< 1 months	x	x	
0- 5 months	x	x	x
6-23 months		x	

Interventions

Intervention	Target population	Effects	Source / effect size
Balanced energy protein supplementation	Pregnant women below the poverty line	Reduces risk of SGA birth outcomes	RRR = 0.79 [Ota et al. 2015, The Cochrane Library]
Multiple micronutrient supplementation in pregnancy	Pregnant women	Reduces risk of SGA birth outcomes	RRR = 0.77 [LiST†]
Vitamin A supplementation	Children 6-59 months	Reduces diarrhoea incidence mortality	Incidence RRR = 0.87 [Imdad et al. 2011, BMC Public Health] Mortality RRR = 0.82 [Imdad et al. 2011, BMC Public Health]
Public provision of complementary foods	Children 6-23 months below the poverty line	Reduces the odds of stunting	OR = 0.89 [Bhutta et al. 2008, The Lancet; Imdad et al. 2011, BMC Public Health]
Breastfeeding promotion	Children <6 months	Improves odds of correct breastfeeding	See parameters document; parametersand sources consistent with LiST.
Partial breastfeeding + complementary feeding education	Children 6-23 months	Improves odds of correct breastfeeding Reduces probability of stunting	

† Source to be confirmed

Wasting prevention interventions

Intervention	Target population	Effects	Source / effect size
Public provision of complementary foods (PPCF)	Children 6-23 months below the poverty line	Reduces the odds of stunting Reduces the incidence of SAM Reduces the incidence of MAM *Indirectly reduces SAM mortality* *Indirectly reduces MAM mortality*	Stunting: OR = 0.89 [Bhutta et al. 2008, The Lancet; Imdad et al. 2011, BMC Public Health] SAM / MAM incidence RRR = 0.913 [LiST†]
Lipid-based nutrition supplements (LNS)	Children 6-23 months below the poverty line	Similar to PPCF but also impacts anaemia (see next session)	
Cash transfers	All children below the poverty line	Reduces the incidence of SAM Reduces the incidence of MAM *Indirectly reduces SAM mortality* *Indirectly reduces MAM mortality*	SAM incidence: RRR = 0.766 for 6-23 months, RRR = 0.792 for 24-59 months [Langendorf et al. 2014, PLoS Med] MAM incidence: RRR = 0.719 for 6-23 months, RRR = 0.792 for 24-59 months [Langendorf et al. 2014, PLoS Med]

† Source to be confirmed
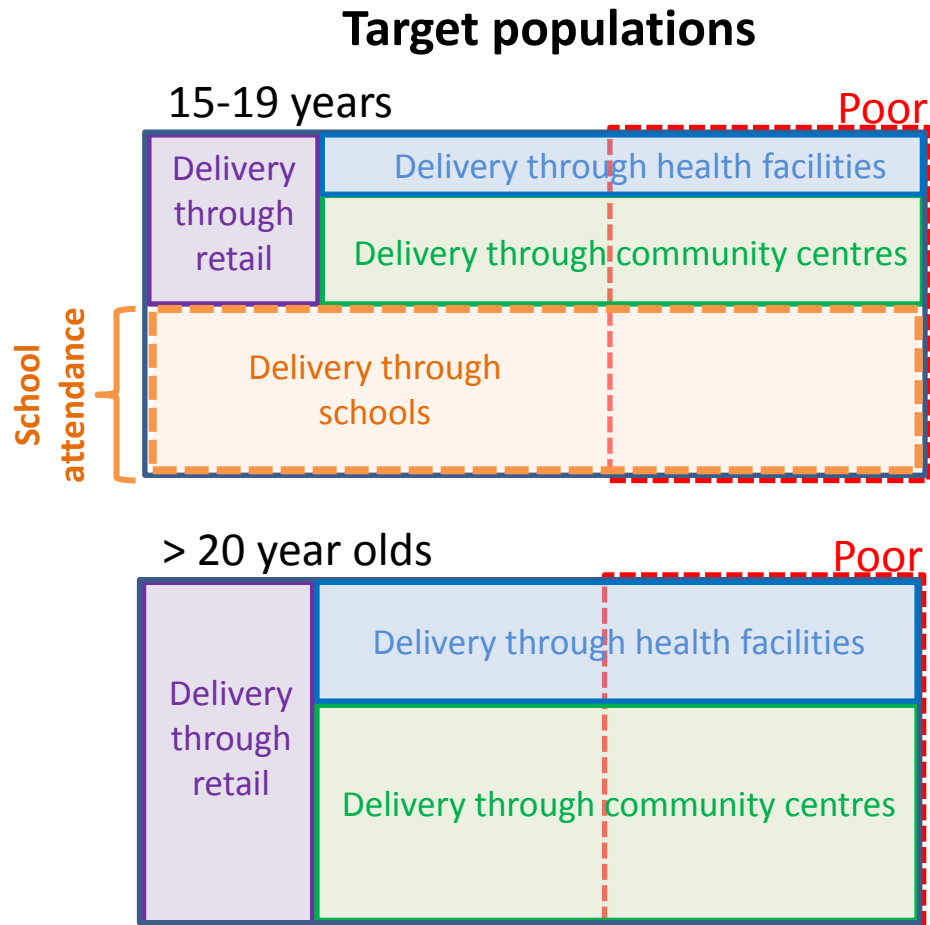
Anaemia interventions

Intervention	Target population	Effects	Source / effect size
Lipid-based nutrition supplements (LNS)	Children 6-23 months below the poverty line	Reduces stunting Reduces incidence of MAM/SAM Reduces anaemia	Stunting OR = 0.89 [assumed the same as PPCF] MAM/SAM incidence RRR = 0.913 [assumed to be the same as PPCF] Anaemia RRR = 0.69 for all-cause anaemia[assumed to be the same as micronutrient powders]
Micronutrient powders	Children 6-59 months, not already receiving LNS	Reduces anaemia	RRR = 0.69 [De-Regil et al. Chochrane review 2013]
IFAS pregnant women	Pregnant women. Not given to women receiving MMS	Reduces anaemia Reduces SGA birth outcomes	Anaemia RRR = 0.33 [Pena-Rosas et al, Cochrane Database Reviews 2015] SGA RRR = 0.85 [Pena-Rosas et al, Cochrane Database Reviews 2015]
IFAS non-pregnant WRA		Reduces anaemia	RRR = 0.73 [Fernandez-Gaxiola & De-Regil 2011, Cochrane Database Syst Rev]
IPTp	Pregnant women in areas where there is malaria risk	Reduces anaemia Reduces SGA birth outcomes	Anaemis RRR = 0.83 [Radeva-Petrova et al. 2014, The Cochrane Library] SGA RRR = 0.65 [Eisele et al. 2010, I J Epi]
Long-lasting insecticide-treated bed nets	Everyone in areas where there is malaria risk	Reduces anaemia Reduces SGA birth outcomes	Anaemia RRR = 0.83 [Eisele et al. 2010, Int J Epi] SGA RRR = 0.65 [Eisele et al. 2010, Int J Epi]
Food fortification	Everyone	Reduces anaemia Reduces neonatal mortality	Anaemia OR = 0.976 [RRR = 0.678 Barkley et al. 2015, B J Nutrition] Neonatal mortality RRR = 0.678 [congenital

Other supplement interventions

Intervention	Target population	Effects	Source / effect size
Oral rehydration salts (ORS)	Children 0-59 months (different quantity by age)	Reduces diarrhoea mortality	RRR = 0.18 [Munos, et al. 2010, I J Epi; Walker & Black 2010, I J Epi]
ORS + Zinc	Children 0-59 months (different quantity by age)	Reduces diarrhoea mortality	RRR = 0.14 [Munos, et al. 2010, I J Epi; Walker & Black 2010, I J Epi]
Prophylactic zinc supplementation	Children 1-59 months	Reduces diarrhoea incidence Reduces diarrhoea and pneumonia mortality	Diarrhoea incidence RRR = 0.805 [Bhutta et al. 2013, The Lancet; Yakoob et al. 2011, BMC Public Health] Mortalities RRR = 0.85 [Bhutta et al. 2013, The Lancet; Yakoob et al. 2011, BMC Public Health]
Calcium supplementation	Pregnant women	Reduces maternal mortality (hypertensive disorders) Reduces pre-term births	Mortality RRR = 0.80 [Ronsmans et al. 2011, BMC Public Health] Pre-term RRR = 0.78 [Imdad et al. 2011, BMC Public Health]
MgSO4 for pre-eclampsia / eclampsia	Pregnant women	Reduces maternal mortality (hypertensive disorders)	RRR = 0.41 [Ronsmans et al. 2011, BMC Public Health]

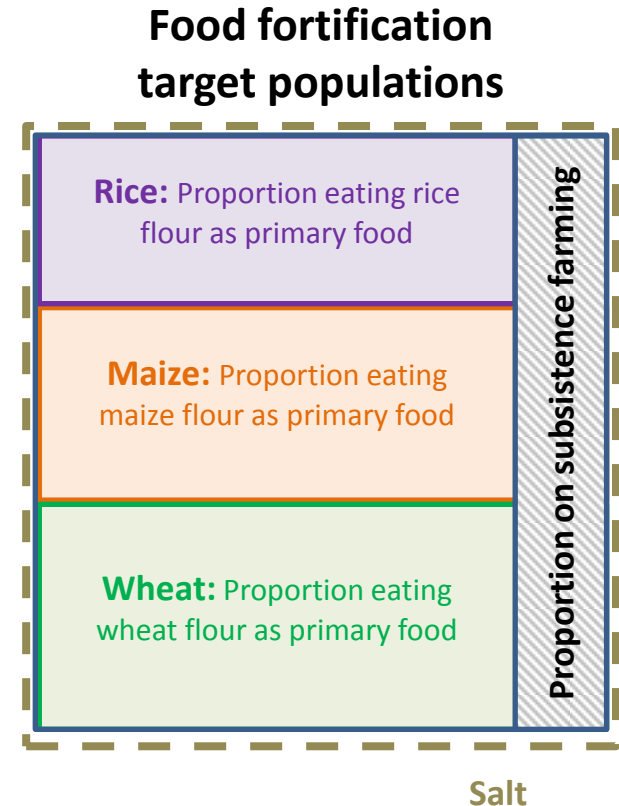# IFAS: non-pregnant women of reproductive age

- Delivered through four modalities:
  - Schools (the only modality for 15-19 year olds who attend)
  - Health facilities (available for those not at school and attending clinics)
  - Community centres (available for those not at school)
  - Retail (only available for the fraction who are not poor and not at school)

Target populations

15-19 years — Poor

Delivery through retail

Delivery through health facilities

Delivery through community centres

School attendance

Delivery through schools

> 20 year olds — Poor

Delivery through retail

Delivery through health facilities

Delivery through community centres

*Coloured areas represent 100% coverage of IFAS through a particular delivery mode.

Interventions: fortification of foods

- Target population: everyone excluding <6 months

- **Fortification with iron and folic acid**:
  - Three vehicles: wheat, rice and maize flour
  - Coverage restricted to fraction who eat each food as their staple, determined from consumption data
  - Does not reach the fraction on subsistence farming

- Double fortification of salt (iron + iodine)
  - Targets entire population

Food fortification target populations

Rice: Proportion eating rice flour as primary food

Maize: Proportion eating maize flour as primary food

Wheat: Proportion eating wheat flour as primary food

Proportion on subsistence farming

Salt

*Coloured areas represent 100% coverage of a particular food fortification.
**Depending on the country, the target population of a particular food vehicle may be zero

Acknowledgements

Optima Nutrition team

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