FORUM ON
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# The role of nutrition within a broader framework for reducing stunting

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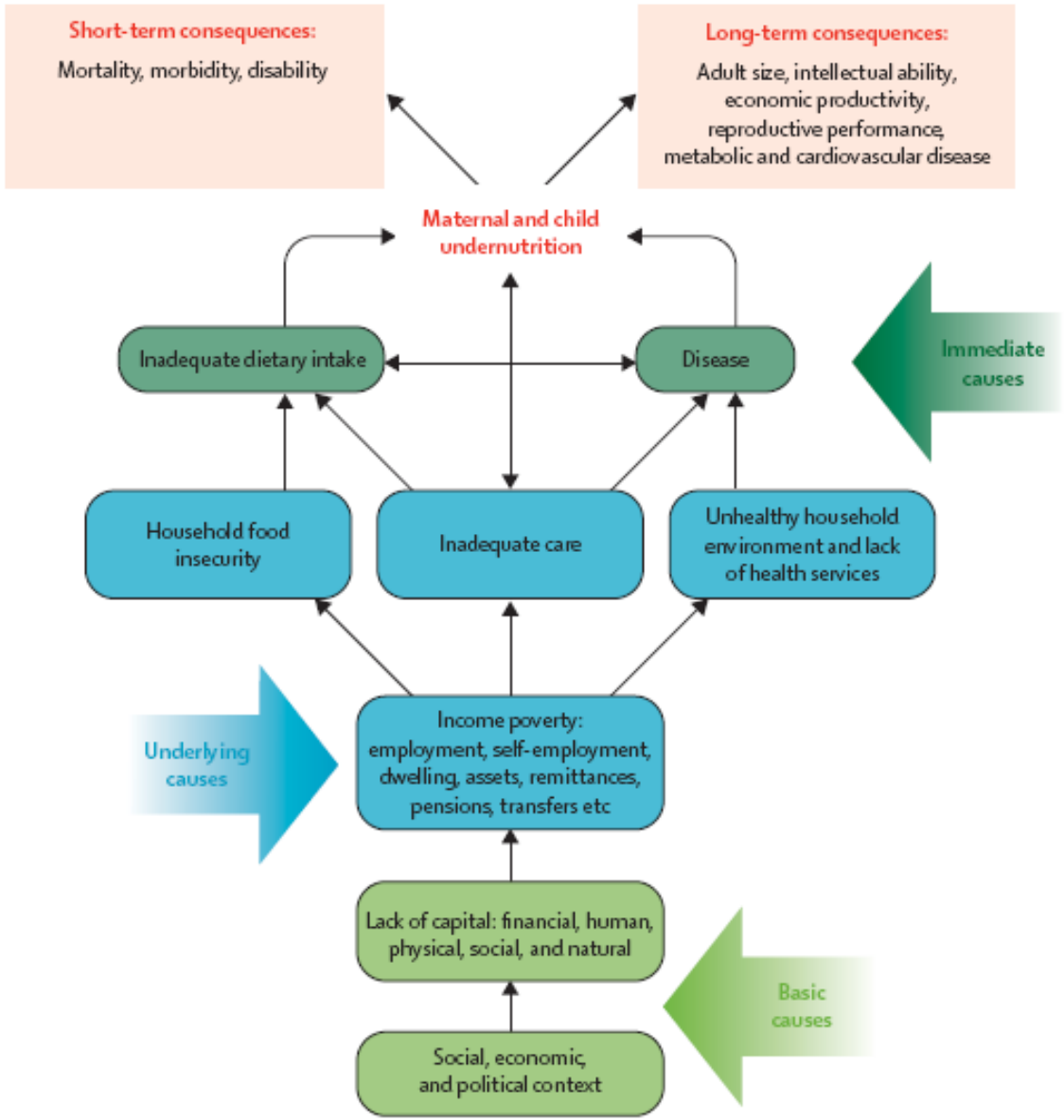
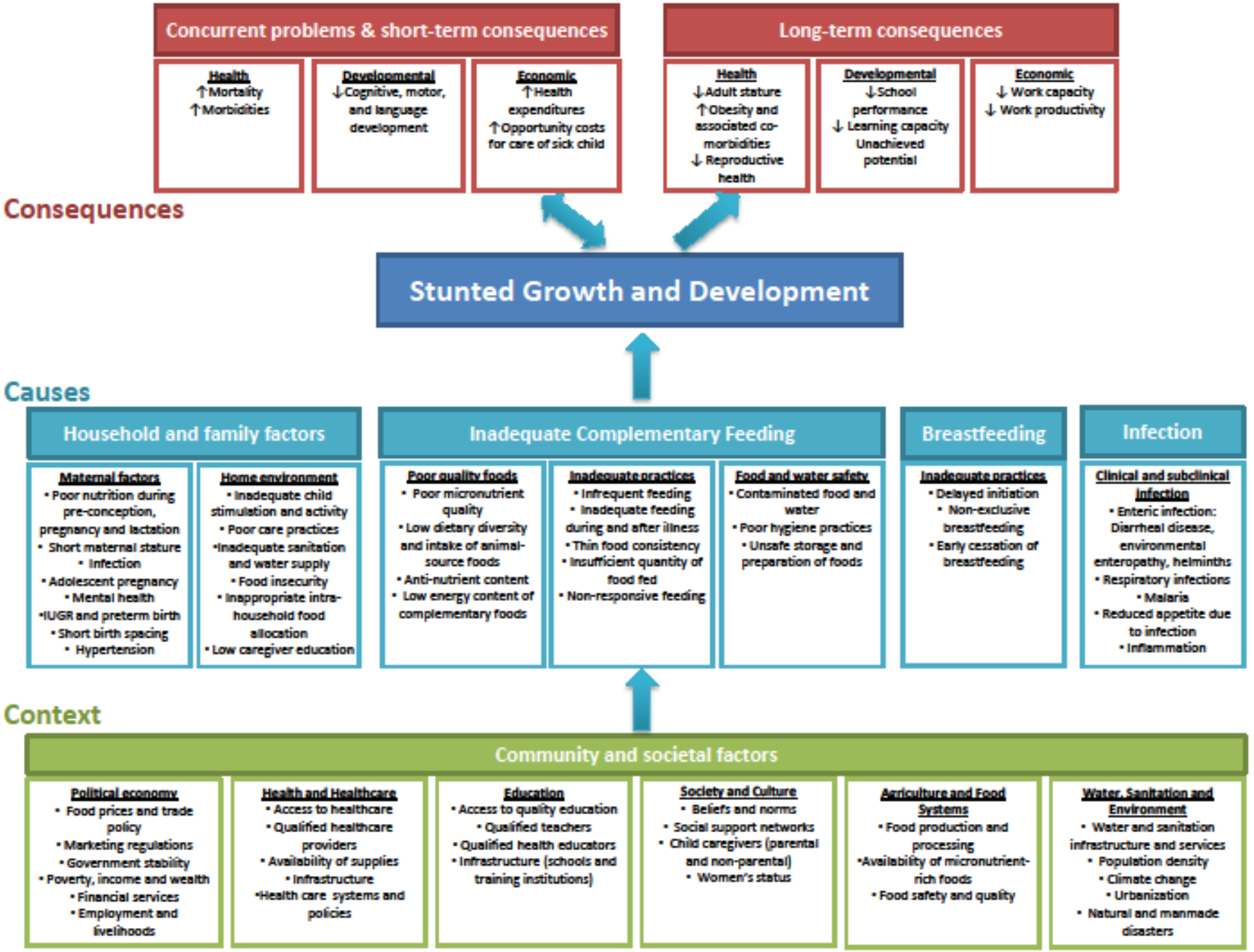
# Outline

- Causes and consequences of stunting
- Impact on stunting of nutrition-specific interventions during the 1000 days
  - Prenatal nutrition interventions
  - Postnatal nutrition interventions
- The need for multi-sectoral approaches
- Conclusions

# UNICEF framework for causes of undernutrition



# WHO Conceptual Framework on Childhood Stunting: Context, Causes, and Consequences, with an emphasis on complementary feeding



# Clinical infection - the tip of the iceberg?

*Sub-clinical conditions probably far more common and may have profound effect on growth:*

- Environmental enteropathy
- Asymptomatic respiratory and other infections that may affect appetite
- Inflammation and impaired physiological/immune responses due to other environmental insults, e.g. household air pollution, mycotoxins

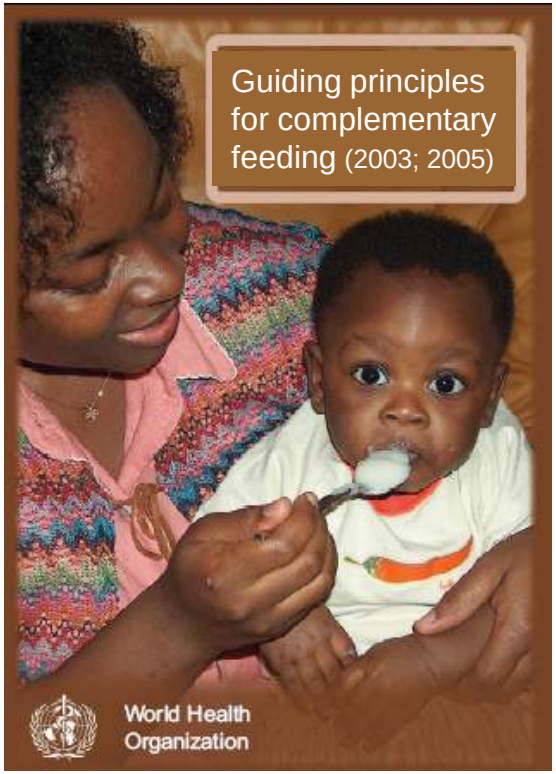
# Timing of interventions is important

# Key Window of Opportunity

**Preconception through pregnancy**

**0-6 mo: Exclusive breastfeeding**

**6-24 mo: Complementary feeding**



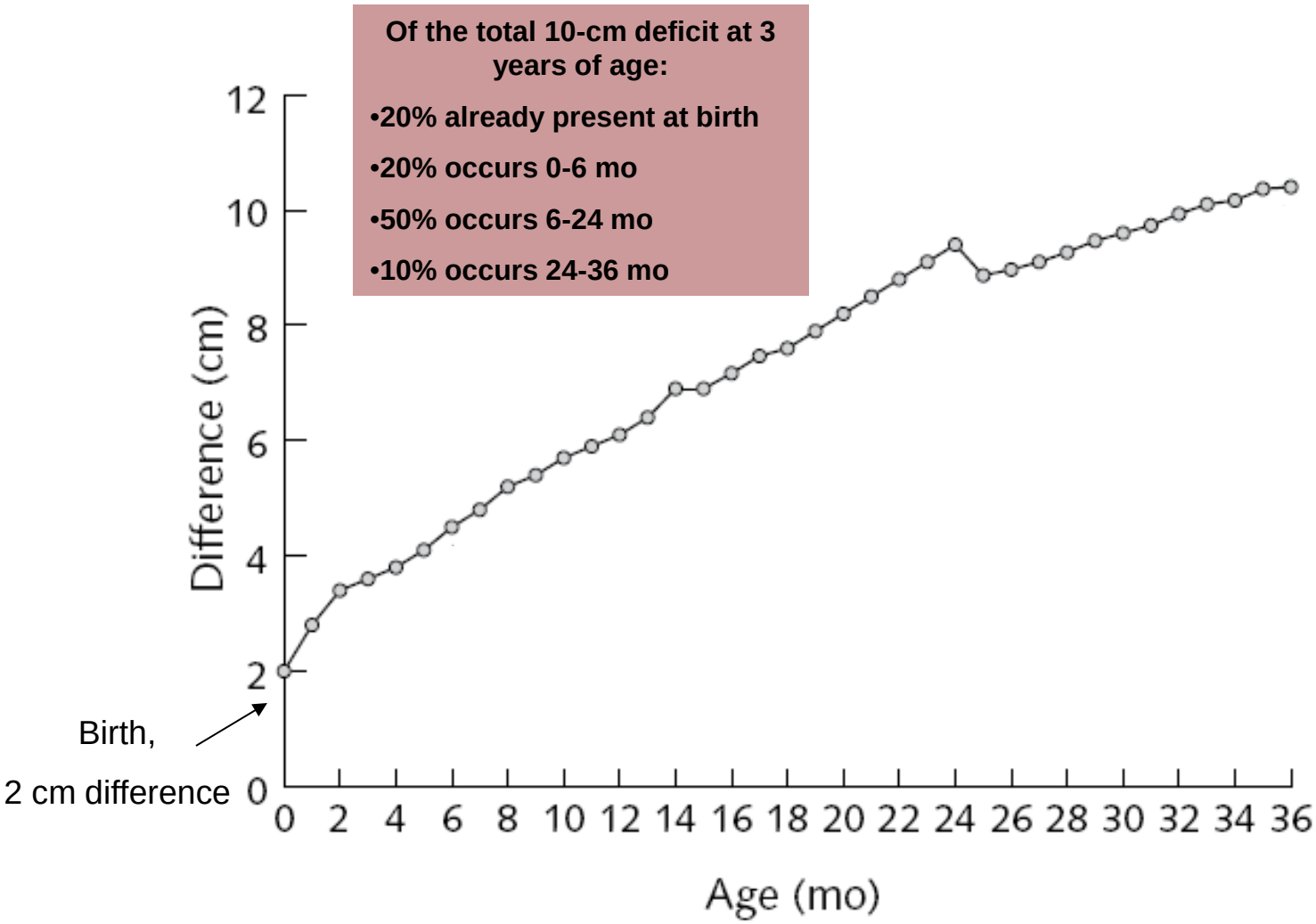

http://www.marieclaire.com/cm/marieclaire/images/mcx0807FEIndia001-med.jpg

http://www.who.int/child_adolescent_health/documents/media/9241593431.jpg

# Impact of prenatal nutrition interventions

# How much of childhood stunting is attributable to malnutrition in utero?

# Cumulative difference in stature between Malawi children and the median of the WHO Child Growth Standard




Source: Maleta et al. Arch Dis Child 2003; 88:1-5

# Prenatal nutrition interventions

## A. Multiple micronutrient supplements

*Meta-analysis in 2009 (Fall et al.):*

- Small but significant increase in birth weight (+22 g) but not birth length (+0.06 cm)
  - Measurement issues?
- 11-17% reduction in low birth weight
- Impact only evident in mothers with *higher* BMI

*Meta-analysis in 2012 (Ramakrishnan et al.):*

- Increase in mean birth weight (+53 g); data on birth length not presented
- 14% reduction in low birth weight

# Prenatal nutrition interventions

## B. Balanced protein-energy supplementation

*Meta-analysis in 2003 (Kramer & Kakuma):*

- Increase in mean birth weight (+38 g) but not birth length (+0.1 cm)
- 32% reduction in small-for-gestational-age births
- Larger effect on birth weight in hungry season and in undernourished women

*Meta-analysis in 2012 (Imdad & Bhutta):*

- Increase in mean birth weight (+73 g); did not report birth length
- 32% reduction in LBW and 34% reduction in SGA births
- Larger effect on birth weight in undernourished women

# Prenatal nutrition interventions

## C. Fortified foods for pregnant women

### Lipid-based nutrient supplement (LNS) in Burkina Faso [Huybregts et al. Am J Clin Nutr 2009]

- LNS: 373 kcal/d & similar micronutrients as MMN tablets
- LNS group (compared to MMN):
  - Birth weight +31 g (p=0.2)
  - Birth length +0.46 cm (p=0.001)
    - effect greater in thin mothers (BMI < 18.5): +1.2 cm

# Prenatal nutrition interventions

## C. Fortified foods for pregnant women

**Lipid-based nutrient supplements (LNS) in Ghana and Malawi** (iLiNS Project; unpublished data)

- Small-quantity LNS (118 kcal/d)
- Ghana: Effects on birth outcomes in primiparas (p=0.001) but not multiparas

| PRIMIPS | LNS | MMN | IFA |
|---|---|---|---|
| % LBW | 7.5* | 17.8 | 25.7 |
| Birth LAZ | -0.56* | -0.86 | -1.05 |
| Head circ. Z | -0.23* | -0.67 | -0.63 |

- Malawi: Effects on birth outcomes in vulnerable subgroups (low maternal education; malaria at baseline; HIV positive)
  - Effect of LNS generally not superior to MMN except for head circumference

# Impact of postnatal nutrition interventions

# Exclusive breastfeeding 0-6 mo

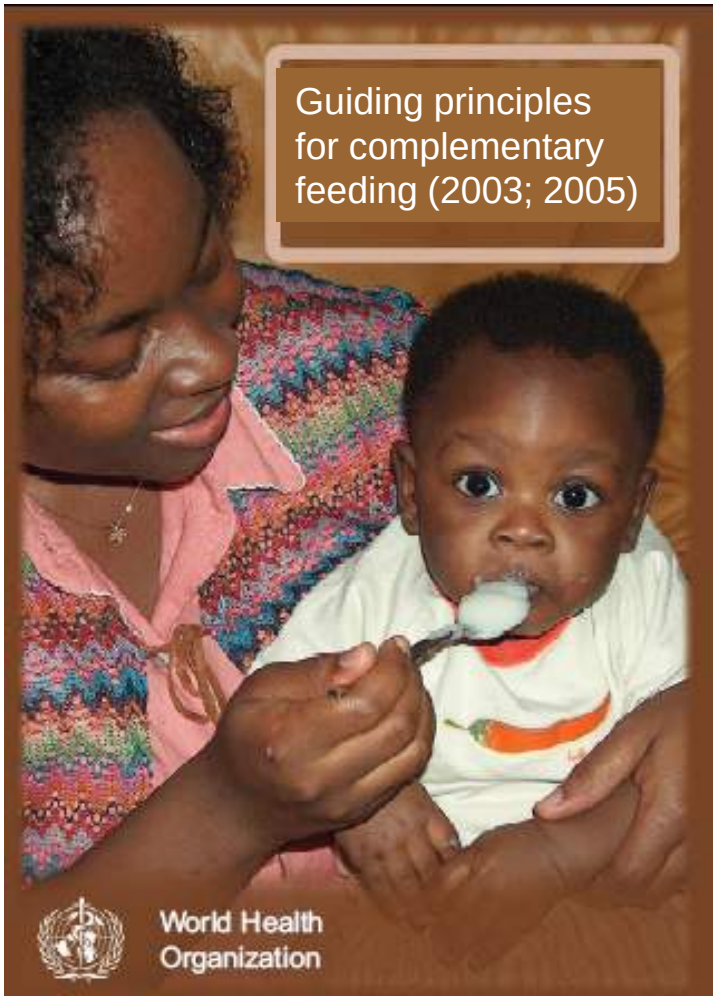
- Large impact on infant survival
- Little evidence of impact on stunting
    - Effect may be more likely in populations with high rates of infection during the first 6 mo postpartum, where promotion of exclusive breastfeeding may reduce infection and thus be more likely to promote linear growth than in populations where such infections are less common
    - Insufficient evidence to evaluate this question at present

# Complementary feeding 6-24 mo

Potential for major impact on stunting but evidence is mixed

Several strategies:

- Educational approaches
- Increasing energy density of complementary foods
- Provision of complementary food
- Fortification



# Complementary Feeding - 1

- Educational approaches: mixed results - some studies show substantial potential to reduce stunting

**CF Intervention in Peru:**

Emphasized 3 key messages, including consumption of nutrient-rich animal-source foods

Conducted in a population where animal-source foods were available & affordable

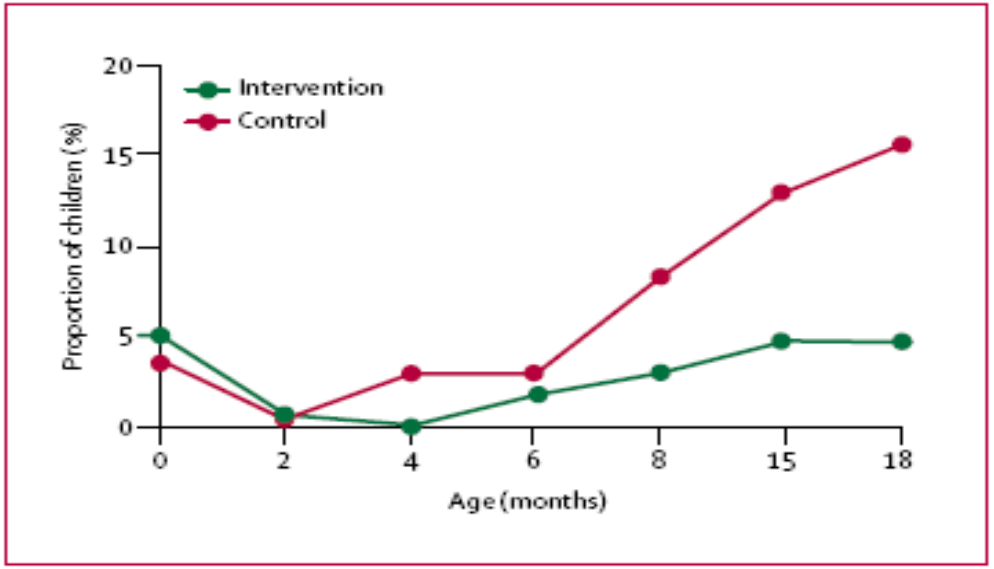



*Figure 4:* Cumulative rate of stunting from 0 to 18 months

**Penny et al., Lancet 2005;365:1863-72**

# Complementary Feeding - 2

- Interventions to increase energy density – mixed results
  - May be effective when traditional complementary food has low energy density & infant unable to compensate by increasing volume of food consumed or feeding frequency

# Complementary Feeding - 3

- Provision of complementary food – mixed results
  - May depend on food security of target population
  - May depend on nutrient quality of food provided
  - Two studies directly compared food + education vs. education only (both in S Asia): somewhat greater impact when food included

# Complementary Feeding - 4

- Fortification (or improved bioavailability) *alone* has little effect on linear growth
  - Exception: fortified vs. unfortified milk powder in India
- Combination of macro- and micro-nutrients in may have a larger impact
- Nutrient quality of fortified products is likely to be important
  - Amount and bioavailability of nutrients needed for growth
  - Inclusion of milk
  - Essential fatty acids

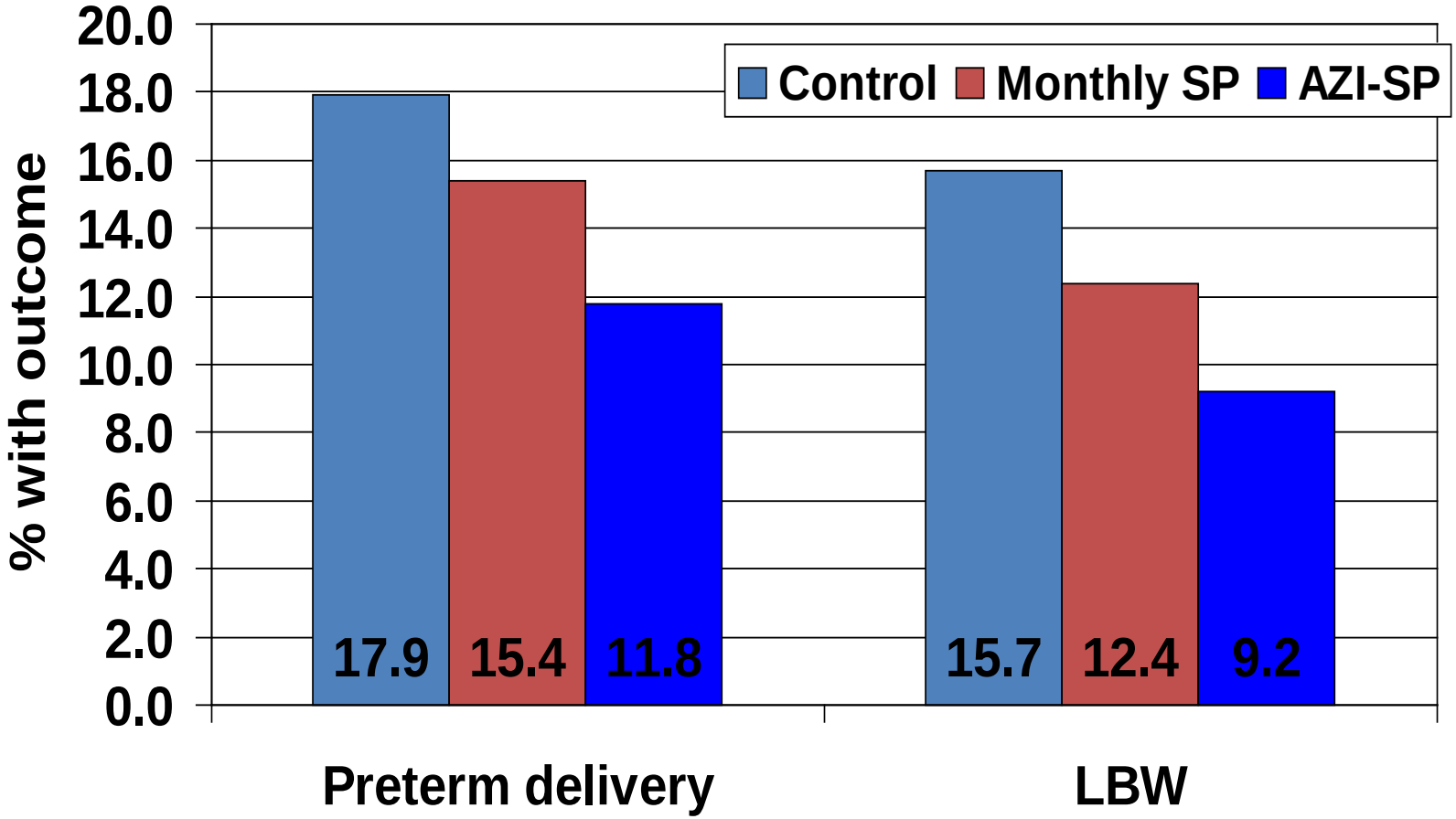
# The need for multi-sectoral interventions

- **Infection control**
- **Care for mother and child**
- **Nutrition**
  - **Prenatal + postnatal** (and possibly pre-conception)
  - **Macronutrients + micronutrients:** Adequate supply of macronutrients may be needed to ensure growth response to micronutrients

# Potential impact of prenatal infection control

## Lungwena Antenatal Intervention Study (Malawi)

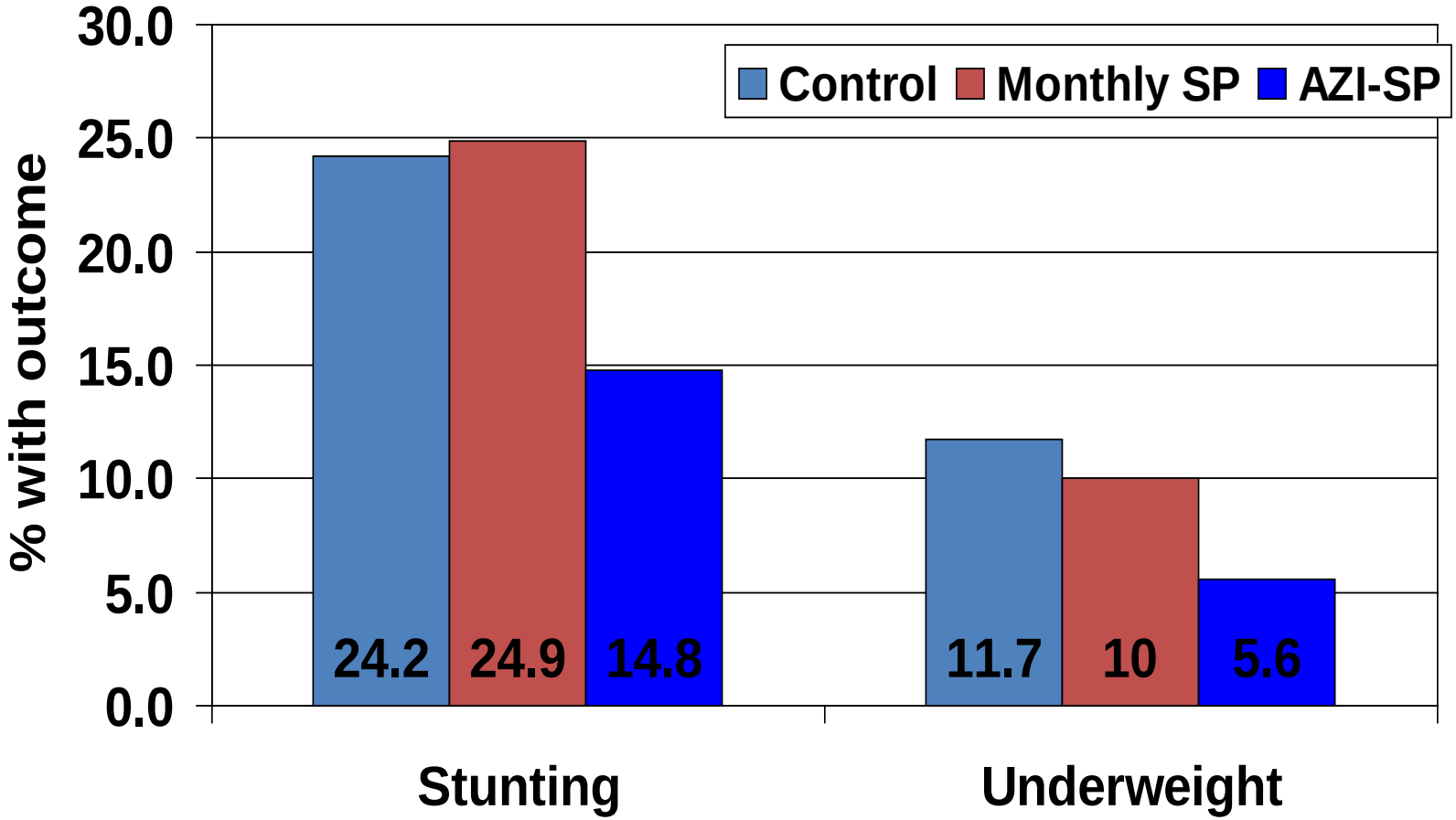
[standard care vs. monthly anti-malarial (SP) vs. monthly SP + 2 doses of antibiotic (azithromycin); n=1320]




Luntamo et al, Am J Trop Med Hyg, 2010

# Lungwena Antenatal Intervention Study

## **Stunting & Underweight at 4 wk**




N=376-391/group

Luntamo et al, Trop Med Int Hlth 2013

# How nutrition may reduce the negative impact of infections on child growth

- Strengthening the immune system
  - may reduce the severity and duration of infections
- Providing extra amounts of nutrients
  - May compensate for poor absorption during infection, losses during diarrhoea, reallocation due to immune system activation or reduced appetite during infection
  - Allows for catch-up growth following infection
- Preventing poor appetite caused by micronutrient deficiencies
- Favoring the growth of beneficial bacteria in the gut that enhance gut function and immune defenses

# Trials with combined nutrition + infection control are underway

- **WASH Benefits (water, sanitation and hygiene interventions: singly, combined or in combination with nutrition intervention)**
- **SHINE (independent and combined effects of improved water, sanitation and hygiene and improved infant feeding)**

Both target only the postnatal period

# iLiNS-ZINC trial: LNS + morbidity surveillance and treatment reduced stunting in Burkina Faso

**Growth:**

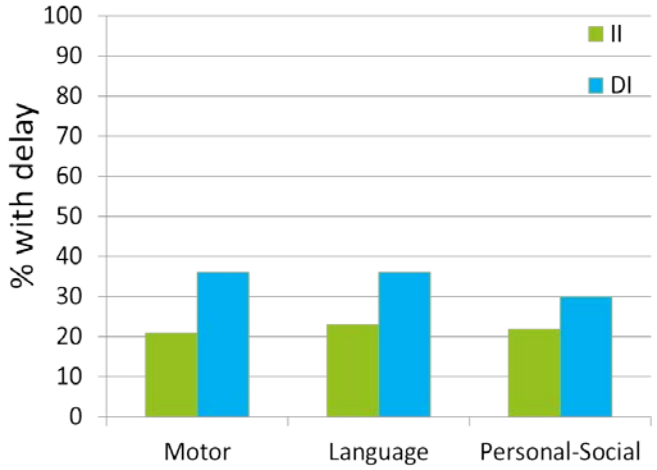
Stunting prevalence at 18 mo reduced by 25%

[endline prevalence 29% in intervention groups combined vs. 39% in DI group]

**Development:**

Moderate-to-severe developmental delay reduced at 18 mo:

- 42% reduction in motor delay
- 37% reduction in language delay
- 28% reduction in personal-social delay




**Conclusion:**

Small quantity LNS along with selected child health services (brief feeding advice, diarrhea and malaria treatment) significantly improved growth and development in young Burkinabe children

**[Hess SY; Abbeddou S; Yakes E; Some JW; Prado E; Ouedraogo ZP; Guissou R; Vosti SA; Ouedraogo JB; Brown KH]**

# Conclusions - 1

- **Large reductions in stunting are possible, but probably not with nutrition interventions alone**
- **Effect size of successful nutrition interventions generally modest**
  - Need to be realistic about expected impact of nutrition interventions on stunting
- **However, effects on stunting (% with low height-for-age) may be larger than effects on mean height**

# Conclusions - 2

- Need to include the entire “window of opportunity”
- Must pay attention to dietary quality, not just quantity
- Integrate nutrition interventions within a comprehensive approach to reduction of stunting


# Thank you!