Proposed Framework for Chapter 4: Physical Growth and Child and Adolescent Development

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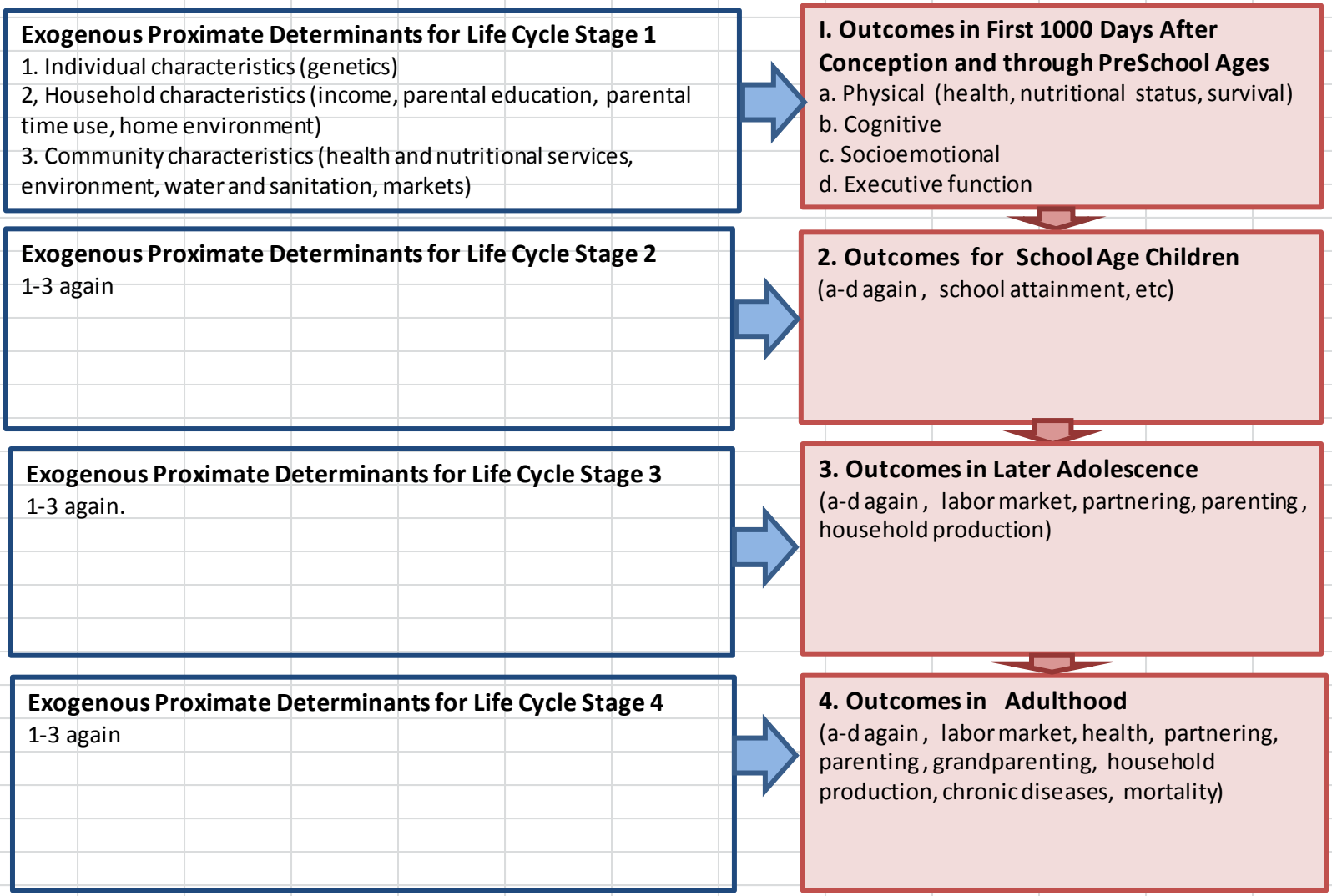
- Need to link different ages inherent in the chapter organization into a life cycle model
- The model recognizes exogenous inputs in each stage but also assesses path dependency
- This necessitates a consideration of catch up growth as well as whether an outcome in one period influences the response to inputs in the subsequent
- Finally, despite the emphasis on physical growth, we should stress that a major outcome of good nutrition is skills development.

Figure 4.0.2.1 Physical Growth , Other Developmental Outcomes, within a Life Cycle Framework



Source: Drawn by the authors.

One Additional Point for Consideration

Disease priorities can be based on risk factors or on current benefit-cost evidence of programs at scale.

The former approach predominates in past DCP. As an illustration, although there is no current practical vaccine for malaria, one can illustrates its potential benefit and thus the priority in seeking one.

But Jere and I also present a framework for the latter (though there is not space for a full review of evidence).

What is the working balance (given space constraints) between what are the risk and what is current known to work?

4.1. Physical Growth in Preschool Children

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- **4.1.1 Prevalence of Preschool Nutritional Problems in Major World Regions**
- **4.1.2 Associations between Preschool Nutritional Indicators and Outcomes in Subsequent Life-Cycle Stages**
- **4.1.3 Benefit-Cost Ratios for Interventions to Lessen Nutritional Problems in Preschool Life-Cycle Stage**

4.1.1 Prevalence of Preschool Nutritional Problems in Major World Regions

Table 4.1.1.1 Children Nutritional Status in Major World Regions, Most Recent Available Data

Region or Sub-Region	Low Birth Weight (<2500 gm, %)	Children First 6 Months Exclusive Breastfeeding (%)	Children < 5 Years of Age				
			Underweight (moderate and severe, %)*	Underweight (severe, %)	Wasting (moderate and severe, %)*	Overweight/ Obese (%)*	Stunting (moderate and severe, %)*
Sub-Saharan Africa (SSA)	15	-	21	7	9	7	40
Eastern and Southern Africa	14	41	18	5	7	5	40
West and Central Africa	15	20	23	8	12	9	39
Middle East and North Africa	12	29	8	-	9	12	20
South Asia	27	38	33	14	16	3	39
East Asia and the Pacific**	6	43	6	4	4	5	12
China	3	-	4	-	2	7	10
Latin America and the Caribbean (LAC)	9	-	3	-	2	7	12
Central and Eastern Europe/Commonwealth of Independent States (CEE/CIS)	6	22	2	-	1	16	12
Industrialized countries	7	-	2	-	2	15	7
Least developed countries	17	-	23	7	10	4	38
World**	14	-	16	10	8	7	26

Sources (all accessed 11 January 2014; all last updated February 2013): For low birth weight http://www.childinfo.org/low_birthweight_profiles.php; for exclusive breastfeeding http://www.unicef.org/progressforchildren/2006n4/index_breastfeeding.html; all others http://www.childinfo.org/malnutrition_nutritional_status.php A1

* Regional averages for underweight (moderate and severe), stunting (moderate and severe), wasting (moderate and severe) and overweight/obese are estimated using statistical modelling of data from the UNICEF and WHO Joint Global Nutrition Database, 2011 revision (completed July 2012). The severe underweight indicator was not included in this exercise; regional averages for this indicator are based on a population-weighted average calculated by UNICEF. "Moderate" ("Severe") is defined as more than 2 (3) SD from age-gender specific reference median (below the medians except for overweight/obese).

**Excludes China for last five columns with children < 5 years of age

Table 4.1.1.2 Estimated Prevalence and Millions of Children Under 5 Years of Age Overweight/Obeseand Stunted in Major Regions, 1990-2020								
	Overweight/Obese				Stunted			
	1990	2000	2010	2020	1990	2000	2010	2020
Prevalence (%)								
Africa	4.0	5.7	8.5	12.7	40.3	39.3	38.2	37.1
Asia	3.2	3.7	4.9	6.8	48.6	37.7	27.6	19.0
South-Central	2.3	2.9	3.5	4.3	60.7	48.4	36.4	25.9
LAC	6.8	6.8	6.9	7.2	23.7	18.1	13.5	10.0
All developing	3.7	4.5	6.1	8.6	44.4	36.1	29.2	23.7
Global	4.2	5.1	6.7	9.1	39.7	32.9	26.7	21.6
Millions of children < 5 years old								
Africa	4.5	7.4	13.3	22.0	44.9	51.3	60.0	64.1
Asia	12.4	13.7	17.7	24.3	189.9	138.0	99.5	68.4
South-Central	4.2	5.4	6.6	8.0	110.1	90.9	69.0	48.4
LAC	3.8	3.8	3.7	3.5	13.2	10.2	7.2	4.9
All developing	20.7	25.0	34.7	49.9	248.4	199.9	167.2	137.9
Global	26.9	31.4	42.8	59.4	253.0	203.8	171.4	142.0

Sources: Overweight/obese (> 2 SDs from weight-for-height median) from de Onis et al. (2010; Stunting (< 2 SDs from height-for-age median) from de Onis et al. (2011).

4.1.2 Associations between Preschool Nutritional Indicators and Outcomes in Subsequent Life-Cycle Stages

Table 4.1.2.1. Selected Associations between Infant Anthropometric Measures and Adult Outcomes

Schooling attainment	0.5 grades for 1 HAZ at age 2
	0.5 grades for 1 WAZ at age 2
	0.3 grades for 1 kg at birth
Adult height	3.2 cm for 1 HAZ at age 2
	0.7-1.0 cm for 1 cm at birth
Labor income	8% for 1 HAZ at age 2 males
	8-25% for 1 HAZ at age 2 females
Birthweight of offspring	70-80 g for 1 HAZ or 1 WAZ of mother at age 2

Source: Constructed by authors based on Victora et al (2008).

Table 4.1.2.2 Guatemalan INCAP Estimates of Effects of Child HAZ on Key Adult Outcomes for Child HAZ at 24 m and 72 m

HAZ at	Estimated marginal effects 95% CI			
	Adult Raven Z score	**Partner's highest grade attained**	**Number of pregnancies**	**Log per capita household expenditure (%)**
24 months	0.248	1.021	-0.632	21
	0.09, 0.41	0.42, 1.62	-1.05, -0.21	8, 35
72 months	0.283	0.986	-0.699	21
	0.104, 0.463	0.343, 1.630	-1.175, -0.223	8, 36

Source: Based on Hoddinott et al. (2013b, Supplementary Table 2)

4.1.3 Benefit-Cost Ratios for Interventions to Lessen Nutritional Problems in Preschool Life-Cycle Stage

Table 4.1.3.1. Estimates of Present Discounted Values in U.S. dollars of 7 Major Impacts of Moving One Infant Out of LBW Status in a Low-Income Developing Country

	Annual discount rate (%)		
Impacts	3	**5**	10
1. Reduced infant mortality	$95	$99	$89
2. Reduced neonatal care	$42	$42	$42
3. Reduced costs of infant and child illness	$36	$35	$34
4. Productivity gain from reduced stunting	$152	$85	$25
5. Productivity gain from increased cognitive ability	$367	$205	$60
6. Reduced costs of chronic diseases	$49	$15	$1
7. Intergenerational effects	$92	$35	$6
Total Benefits	$832	$510	$257

Source: Constructed by authors based on Alderman and Behrman (2006)

Table 4.1.3.2. Benefit-Cost Esimates for Nutritional Interventions for PreSchool Children with discount rates of 3-5%

		Benefit/ Cost Ratio
1. Reducing LBW for pregnancies with high probabilities LBW		
	1a. Treatments for women with asymptomatic bacterial infections	0.58-4.93
	1b. Treatment for women with presumptive STD	1.26-10.71
	1c. Drugs for pregnant women with poor obstretic history	4.14-35.20
2. Improving infant and child nutrition in populations with high prevalence of child malnutrition		
	2a. Breastfeeding promotion in hospitals in which norm has been promotion of use of infant formula	5.6-67.1
	2b. Integrated child care programs	9.4-16.2
	2c. Intensive pre-school program with considerable nutrition for poor families	1.4-2.9
3. Reducing micro nutrient deficiencies		
	3a. Iodine (per woman of child bearing age)	15-520
	3b Vitamin A (pre child under six years)	4.3-43
	3c Iron (pregnant women)	6.1-14

Source: Constructed by authors based on Behrman, Alderman and Hoddinott (2004)

Table 4.1.3.3 Benefit-Cost Ratios for Moving Child from Stunting at 24 months to not-Stunted in 17 Selected Heavily-Burdened Countries

Region	Country	Income Benefit/ Budgetary Cost from Hoddinott et al. (2013a)	Adusted Benefit-to- Cost Ratio[a]
Sub-Saharan Africa	Democratic Republic of Congo	3.5	2.4
	Madagascar	9.8	6.8
	Ethiopia	10.6	7.3
	Uganda	13	9.0
	Tanzania	14.6	10.1
	Kenya	15.2	10.5
	Sudan	23	15.9
	Nigeria	24.4	16.9
Middle East and North Africa	Yemen	28.6	19.8
South Asia	Nepal	12.9	8.9
	Burma	17.2	11.9
	Bangladesh	17.9	12.4
	Pakistan	28.9	20.0
	India	38.6	26.8
East Asia	Vietnam	35.3	24.5
	Philippines	43.8	30.4
	Indonesia	47.7	33.1

Source: Constructed by authors based on Hoddinott et al. (2013a) estimates with Bhutta et al. (2013) cost and intervention data.

[a]Adjustments include increasing benefits by 20% to represent non-income/consumption benefits and increasing costs by 50% to represent private costs and by 25% to represent distortion costs.