The Importance of Nutrition & Early Stimulation for Better Future Generation

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Risk of Developmental Delay
in Normal Birth Weight & Full Term Infants

pagepress

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Table 2. Developmental outcome in relation to low birth weight and gestational age.

Characteristics	Total no. of children (n=387), n (%)	Developmental delay (n=118), n (%)	Normal development (n=269), n (%)	P value	OR (95% Cl)
Birth weight					
Low birth weight (<2.5 kg)	206 (53.2)	80 (67.8)	126 (46.8)	X^2=14.47	
Normal (≥2.5 kg)	181 (46.8)	38 (32.2)	143 (53.2)	P=0.00014	2.39 (1.51-3.76)
Gestational age at birth					
Term (37 weeks and above)	244 (60.7)	61 (49.6)	183 (65.6)	X^2=14.6	
Preterm (less than 37 weeks)	158 (39.3)	62 (50.4)	96 (34.4)	P=0.002	1.94 (1.26-2.98)

Birth weight was not available in 40 infants, of which 21 had normal development while 19 had developmental delay. In the present study, Low birth Weight (LBW) was recorded amongst 206(53.2%). 67.8% LBW babies had developmental delay which differed significantly from the normally developing group (P=0.00014) LBW babies had more than twice the risk for developmental delay than normal birth weight children (OR 2.39 with 95% CI 1.51-3.76) Gestational age could not be recorded in 25 infants, of which 11 had normal development and 14 had developmental delay. 39.3% of children had preterm birth. More than half (50.4%) of preterm had developmental delay which differed significantly from children with normal development (P=0.002). Preterm children had almost twice the risk of developmental delay than those born at term (OR 1.94 with 95% CI (1.26-2.98).

Risk of Developmental Disorders in Normal Birthweight Infants

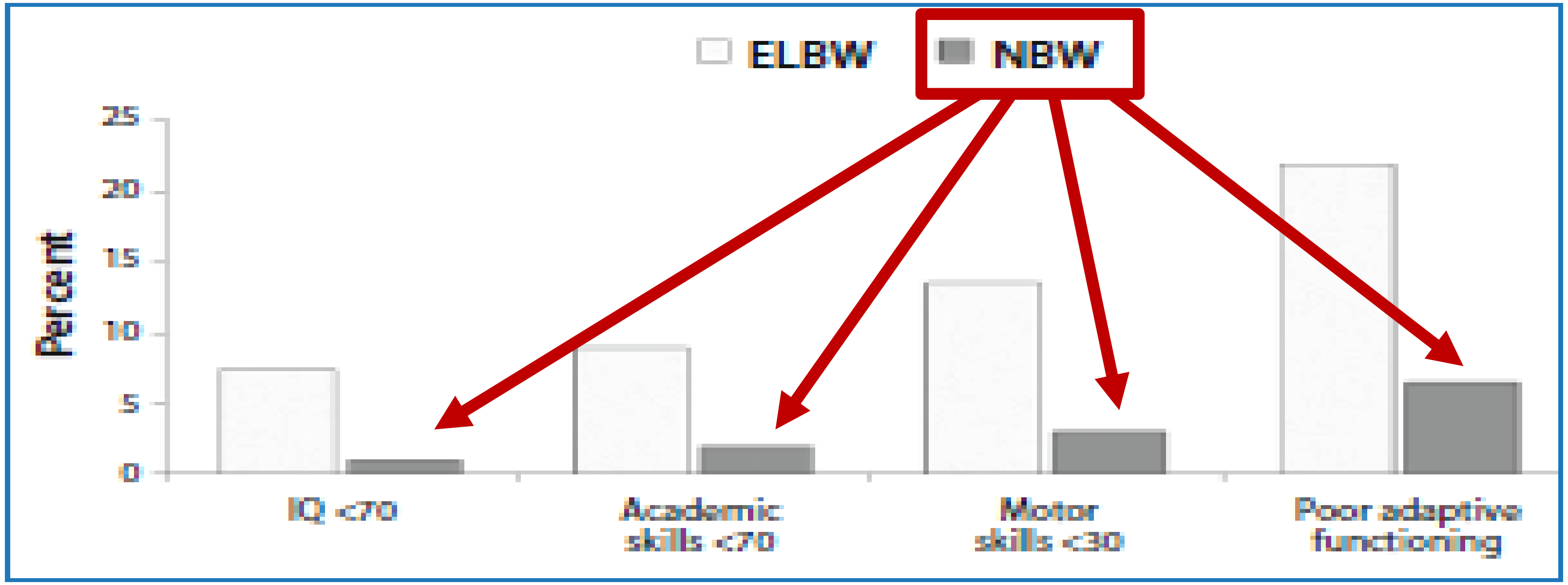


Fig. 18.4 Rates of subnormal IQ, academic skills, motor skills and poor adaptive functioning of extremely low birth weight infants (ELBW, <1kg birth weight) compared to normal birth weight (NBW) children at age 8 years. Data from [32]

G. Buonocore et al. (eds.), *Neonatology. A Practical Approach to Neonatal Diseases.*

Risk of Developmental Disorder in Normal Birthweight Infants

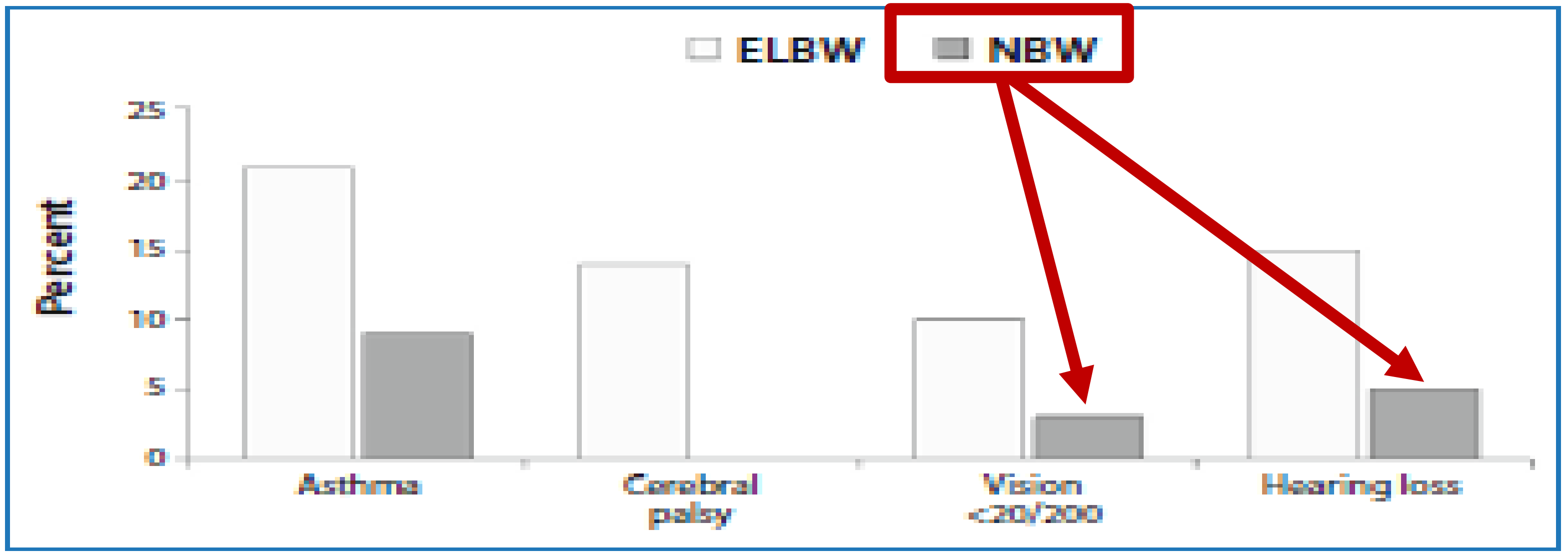
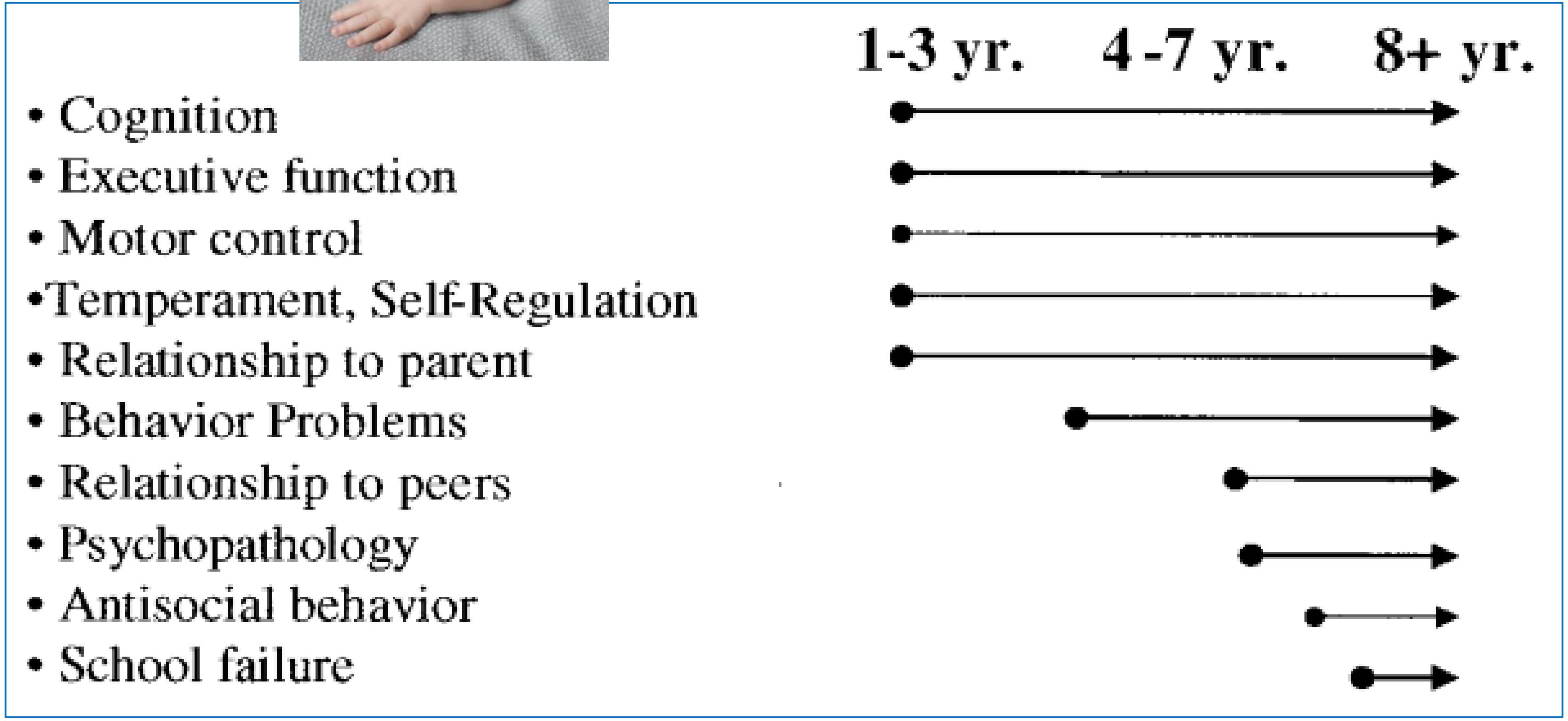


Fig. 18.3 Rates of asthma, cerebral palsy, vision < 20/200 and mild hearing loss (unilateral or bilateral hearing loss of more than 25 dB in at least 2 frequencies) of extremely low birth weight (ELBW, < 1kg birth weight) compared to normal birth weight (NBW) children at age 8 years. Data from [32]

G. Buonocore et al. (eds.), *Neonatology. A Practical Approach to Neonatal Diseases.*

The Time Line of Disorders Manifestation



AAP .Follow-up Care of High-Risk Infants. Pediatrics 2004

Developmental Delayed / Disorder

Lack of

- adequate nutrition
- opportunities for early learning
- responsive caregiving.

18. Engle PL, Fernald LC, Alderman H, Behrman J, O'Gara C, Yousafzai A, Mello CD, Hidrobo M, Ulkuer N, Ertem I, et al. Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. Lancet 2011;378: 1339–53.
.
20. Wachs TD, Georgieff M, Cusick S, McEwen BS. Issues in the timing of integrated early interventions: contributions from nutrition, neuroscience, and psychological research. Ann N Y Acad Sci 2014;1308:89–106.
21. Lake A, Chan M. Putting science into practice for early child development. Lancet 2015;385(9980):1816–7.

Primarily

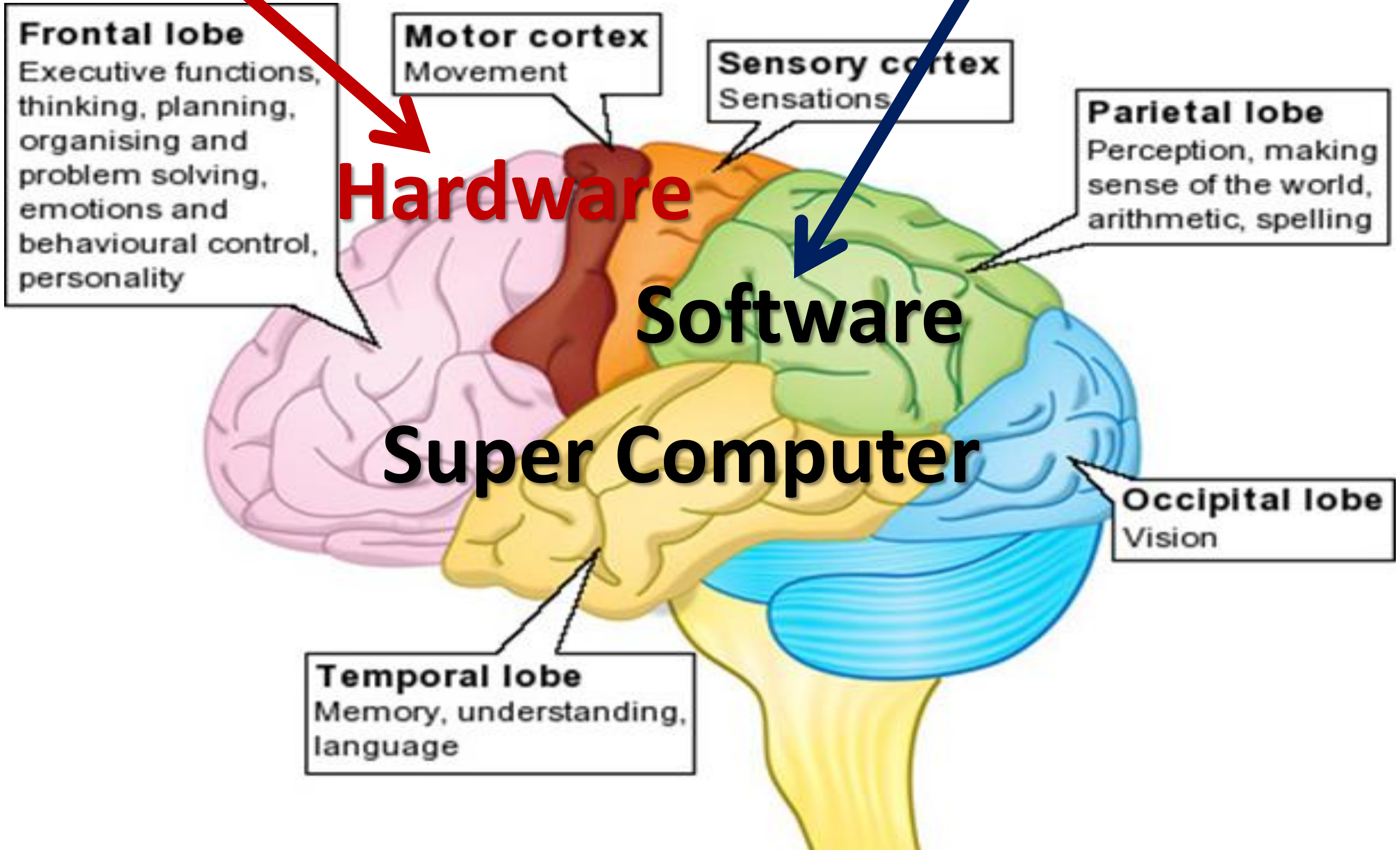
- the first 1000 d, child development (both first and second 1000 d)
- influenced by maturation and genetic-environmental interactions (20).

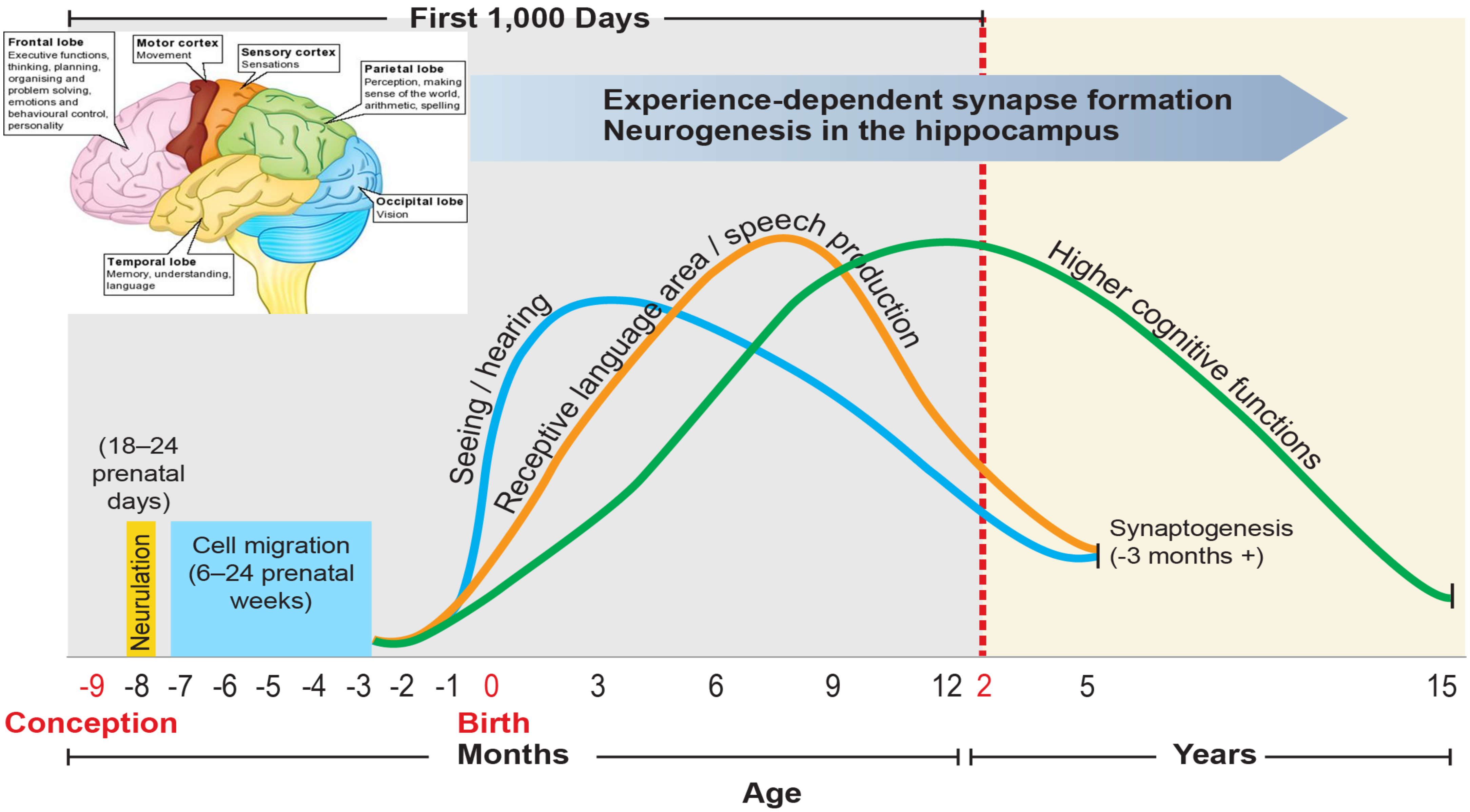
Integrated interventions : nutrition and child development

- to protect children from early adversities
- associated with poverty (18, 21).

NUTRIENTS :
macro & micro

STIMULATIONS: Early, Continuous, Responsives care & love





1. Thompson RA, Nelson CA. *Am Psychol.* 2001;56:5-15; 2. Martorell R, et al. *J Nutr.* 2010;140:348-54.

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Nutrition and brain development in early life

Elizabeth L Prado, Kathryn G Dewey

First published: 28 March 2014 Full publication history

POTEIN – ENERGY functions in brain development

- brain cells, cortical grey matter volume.[6, 7, 8]
- dendritic span and arborization (complexity of branching).[9]
- dendrite growth.[10]
- synapses and synaptic structural changes.a[11, 12]
- myelination [6]
  - IGF-1 levels and IGF-1-binding protein influence myelin production.[6]
- BDNF and IGF-1, cell death 14], IGF-1 and IGF-1-binding protein expression.[6]

6. Fugelstad A, Rao R, Georgieff MK. The role of nutrition in cognitive development. In: Nelson CA and Luciana M, ed. *Handbook of Developmental Cognitive Neuroscience*, 2nd ed. Cambridge, MA: MIT Press; 2008:623–641.
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9. Cordero ME, D'Acuna E, Benveniste S, et al. Dendritic development in neocortex of infants with early postnatal life undernutrition. Pediatr Neurol. 1993;9:457– 464.
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FATTY ACIDS in brain development

- FA : synthesis membrane phospholipid.
- DHA : neuron proliferation.[15]
- AA DHA : membranes at synaptic sites → maturation of synapses and neurotransmission.[16]
- Fatty acids : composition of myelin.[17, 18]

15. Coti Bertrand P, O'Kusky JR, Innis SM. Maternal dietary (n-3) fatty acid deficiency alters neurogenesis in the embryonic rat brain. J Nutr. 2006;136:1570–1575.
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IRON in Brain Development


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- enzyme ribonucleotide reductase, regulates brain cell division.[6]
- size of the hippocampus (learning and memory).[19]
- dendritic branching in the hippocampus, persists into adulthood despite iron repletion.[20]
- synaptic maturity and efficacy in the hippocampus, persists despite iron repletion.[21]
- number of dopamine D2 receptors and the density of dopamine transporter in the striatum and nucleus accumbens.[22]
- dopamine and norepinephrine metabolism.[23]
- myelin synthesis, myelin composition, not corrected with iron repletion.[24]

19. Rao R, Tkac I, Schmidt AT, et al. Fetal and neonatal iron deficiency causes volume loss and alters the neurochemical profile of the adult rat hippocampus
Nutr Neurosci. 2011;14:59–65.
20. Jorgenson LA, Wobken JD, Georgieff MK. Perinatal iron deficiency alters apical dendritic growth in hippocampal CA1 pyramidal neurons. Dev Neurosci. 2003;25:412–420.
21. Jorgenson LA, Sun M, O'Connor M, et al. Fetal iron deficiency disrupts the maturation of synaptic function and efficacy in area CA1 of the developing rat hippocampus. Hippocampus. 2005;15:1094–1102.
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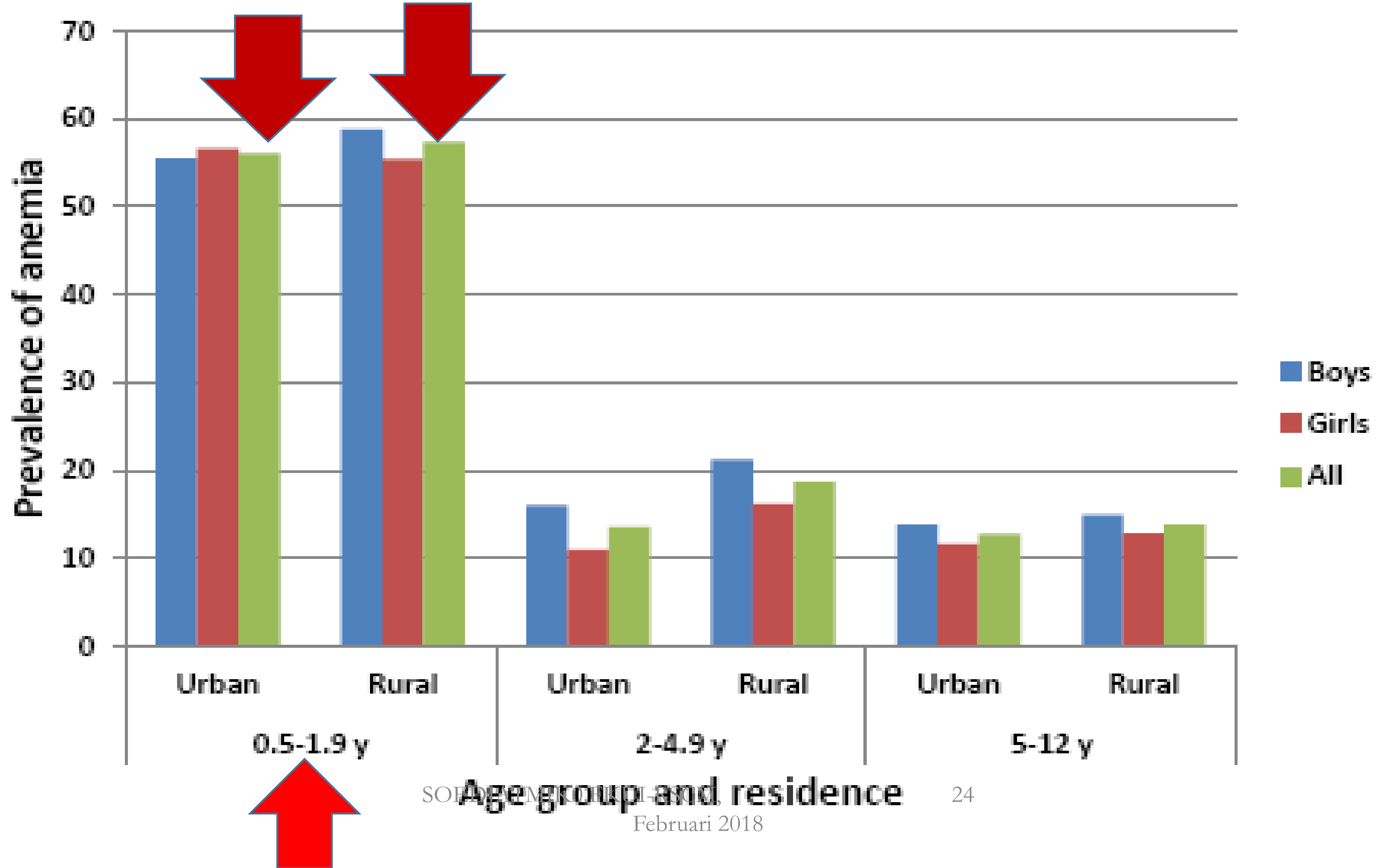
and myelin composition. J Nutr. 2000;130:2821–2830.

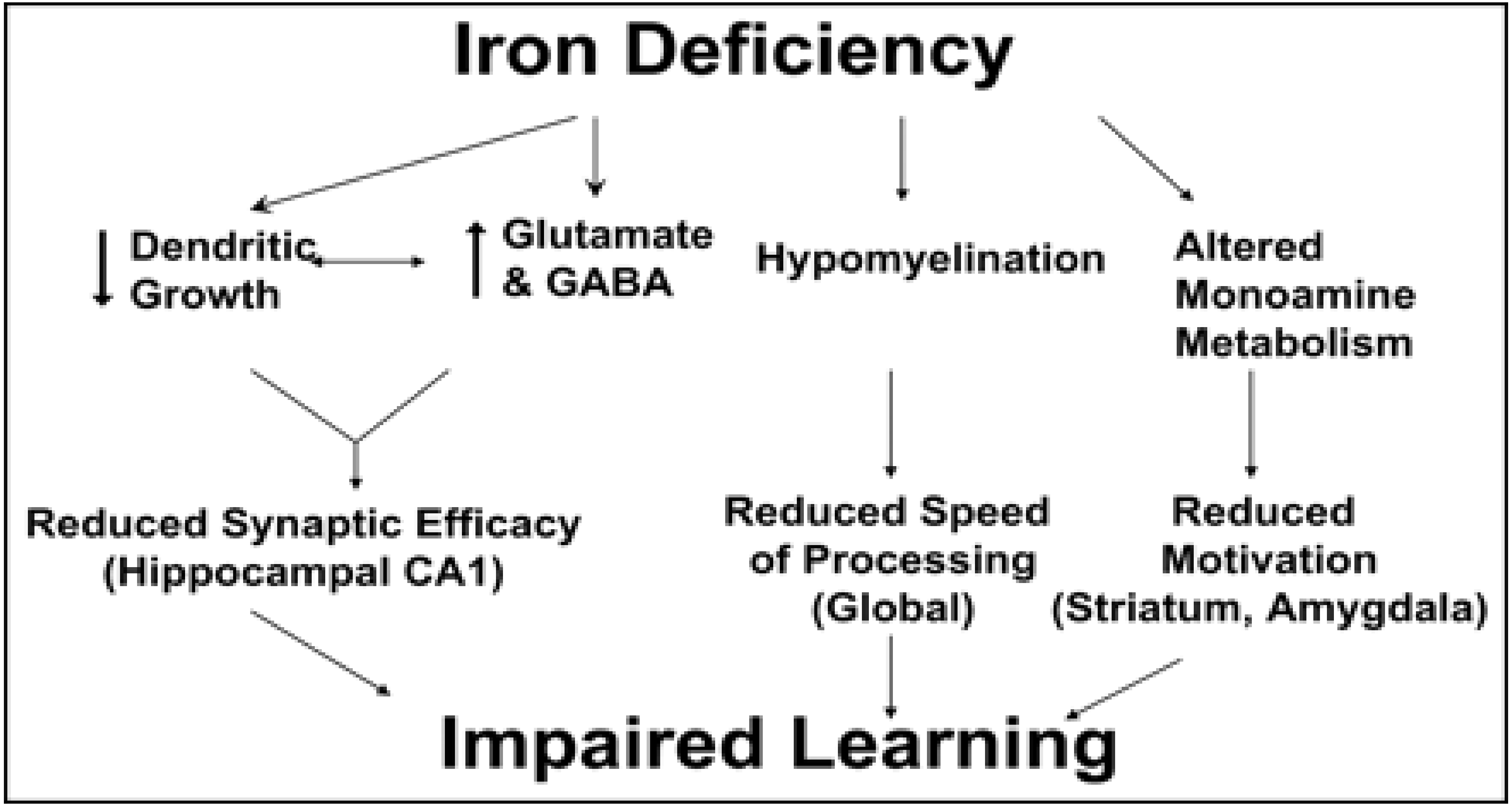
Anemia (kurang zat besi) 26 – 28 %

Tabel 3.16.9
Proporsi anemia penduduk umur ≥1 tahun menurut karakteristik, Indonesia 2013

Karakteristik	Anemia (%)
Kelompok umur	
12-59 bulan	28,1
5-14 tahun	26,4
15-24 tahun	18,4
25-34 tahun	16,9
35-44 tahun	18,3
45-54 tahun	20,1
55-64 tahun	25,0
65-74 tahun	34,2
>75 tahun	46,0
Jenis kelamin	
Laki-laki	18,4
Perempuan	23,9
Tempat tinggal	
Perkotaan	20,6
Perdesaan	22,8
Indonesia	21,7

Anemia (Kurang Zat Besi) di Indonesia : tinggi
pada **umur 0.5 – 1.9 tahun** (Seanuts, 2010-2011)





Iron Deficiency
↓ Dendritic Growth
↑ Glutamate & GABA
Hypomyelination
Altered Monoamine Metabolism
Reduced Synaptic Efficacy (Hippocampal CA1)
Reduced Speed of Processing (Global)
Reduced Motivation (Striatum, Amygdala)
Impaired Learning

Rekomendasi Ikatan Dokter Anak Indonesia (IDAI) 2011

Rutin Pemberian Besi mulai Bayi sampai Remaja

Umur	Dosis	Lama Pemberian
❑Bayi BBLR (<2500 g) sampai umur 2 thn	3 mg /kgbb / hari (maks. 15 mg/hari/x)	Umur 1 bulan sd 2 tahun, tiap hari
❑Bayi cukup bulan sampai umur 2 thn	2 mg /kgbb / hari (maks. 15 mg/hari/x)	Umur 4 bulan sd 2 tahun, tiap hari
❑2 – 12 thn	1 mg /kgbb / hari	2x /minggu, selama 3 bulan berturut-turut, tiap tahun
❑12 – 18 thn Laki-laki	60 mg /hari	idem
❑12 – 18 thn Perempuan	60 mg/hari + asam folat 400 ug	idem

IODINE and THYROID HORMONE in brain development

- brain weight and cell number, cell migration.[25]
- dendritic branching in visual & auditory cortex & cerebellum.[25,26, 27]
- synaptic density, not corrected with iodine repletion.[25]
- number and density of synapses in the cerebellum, and neurotransmitter levels.[27]
- myelination.[25, 27, 28]

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28. Jia-Liu L, Zhong-Jie S, Yu-Bin T, et al. Morphologic study on cerebral cortex development in therapeutically aborted fetuses in an endemic goiter region in Guizhou. Chin Med J (Engl). 1984;97:67–72.

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ZINC in brain development

- cell division, role in DNA synthesis, number of cells, total brain DNA[29]
- brain mass in the cerebellum, limbic system, and cerebral cortex.[6]
- dendritic arborization.[6]
- synapses in the hippocampus and cerebral cortex modulates synapse function.
- zinc modulates postsynaptic NMDA receptors for glutamate and inhibits GABAB receptor activation.[30]
- expression of IGF-1 and growth hormone receptor genes.[31]

30. Walsh CT, Sandstead HH, Prasad AS, et al. Zinc: health effects and research priorities for the 1990s. Environ Health Perspect. 1994;2:5–46.
31. McNall AD, Etherton TD, Fosmire GJ. The impaired growth induced by zinc deficiency in rats is associated with decreased expression of the hepatic insuli nlike growth factor I and growth hormone receptor genes. J Nutr. 1995;125:874– 879.

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CHOLINE in brain development

- stem cell proliferation, neurogenesis.[6]
- stimulates cell division.[32]
- neurotransmitter acetylcholine, cholinergic neurotransmission.[32]
- apoptosis in hipocampus[32]

32. Blusztajn JK, Cermak JM, Holler T, et al. Imprinting of hippocampal metabolism of choline by its availability during gestation: implications for cholinergic neurotransmission. J Physiol Paris. 1998;92:199–203.

VITAMIN B6, in brain development

- dendritic branching, synaptic density in the neocortex and cerebellum.34,35
- synaptic efficiency, particularly in NMDA receptors,36
- dopamine levels and dopamine D2 receptor binding in the striatum.37
- myelination.38

Folic acid, vitamin B12

- neural tube forms, 2, 33

2. Couperus JW, Nelson CA. Early brain development and plasticity. In:McCartney K, Phillips D, eds. *The Blackwell Handbook of Early Childhood Development*. Malden, MA: Blackwell Publsihing; 2006:85–105.
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35. Groziak SM, Kirksey A. Effects of maternal restriction of vitamin B6 on neocortex development in rats: neuron differentiation and synaptogenesis. J Nutr.1990;120:485–492.
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Nutrition and Brain Development (1)

Nutrient	Associated Processes	Structural Impact	Functional Benefits
Protein[1]	• Cell proliferation, differentiation • Synaptogenesis • Growth factors	• Global • Cortex • Hippocampus	• Supports developmental processes and growth
Folate[2]	• Neural tube closure • DNA methylation	• Global	• Supports neurological development
Choline[1]	• Acetylcholine synthesis • DNA methylation • Myelin synthesis	• Global • Hippocampus • White matter	• Supports memory development
Iodine[3,4]	• Cell proliferation	• Global	• Supports cognitive and neurological development
Iron[1]	• Myelin • Monoamine synthesis • Neuronal and glial energy metabolism	• White matter • Striatal-frontal • Hippocampal-frontal	• Supports mental, cognitive and motor development

1. Georgieff MK. *Am J Clin Nutr*. 2007;85:614S-620S;
2. Botto LD, et al. *N Engl J Med*. 1999;341:1509-19;
3. Zimmerman MB. *Paediatr Perinat Epidemiol.* 2012;26:108-17;
4. Morreale de Escobar G, et al. *Eur J Endocrinol.* 2004;151:U25-37.

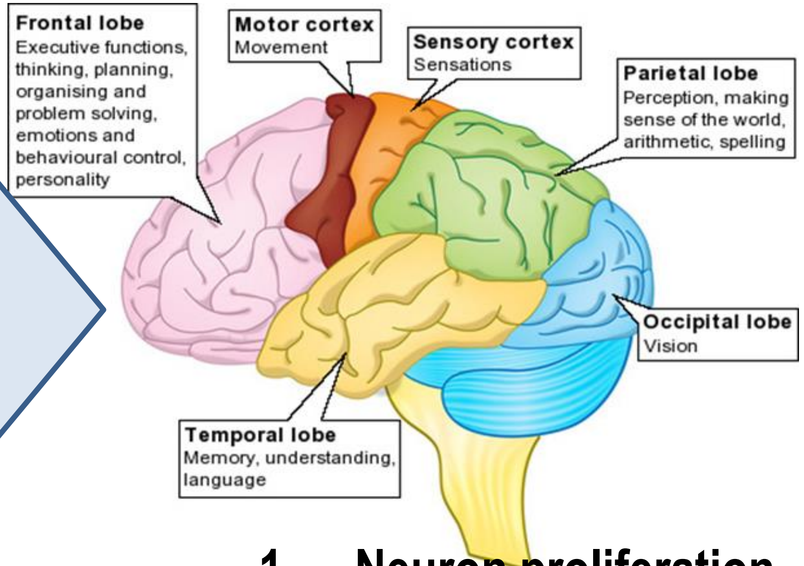
Nutrition and Brain Development (2)

Nutrient	Associated Processes	Impacted Area	Functional Benefits
Zinc[1]	• DNA synthesis • Neurotransmitter release	• Autonomic nervous system • Hippocampus • Cerebellum	• Supports memory and motor development
DHA, ARA, & Other LC-PUFAs[1,2]	• **Synaptogenesis** • **Myelin**	• **Global** • **Visual cortex, retina** • **Cortex**	• **Supports visual and cognitive development**
Vitamin A[2]	• Component of rhodopsin • Cellular differentiation	• Visual system	• Essential for color and night vision

1. Georgieff MK. *Am J Clin Nutr.* 2007;85:614S-20S;
2. Lien EL, Hammond BR. *Prog Retin Eye Res.* 2011;30:188-203
3. Alves-Rodrigues A, Shao A. *Toxicol Lett.* 2004;150:57-83;
4. Kijlstra A, et al. *Prog Retin Eye Res.* 2012;31:303-15.

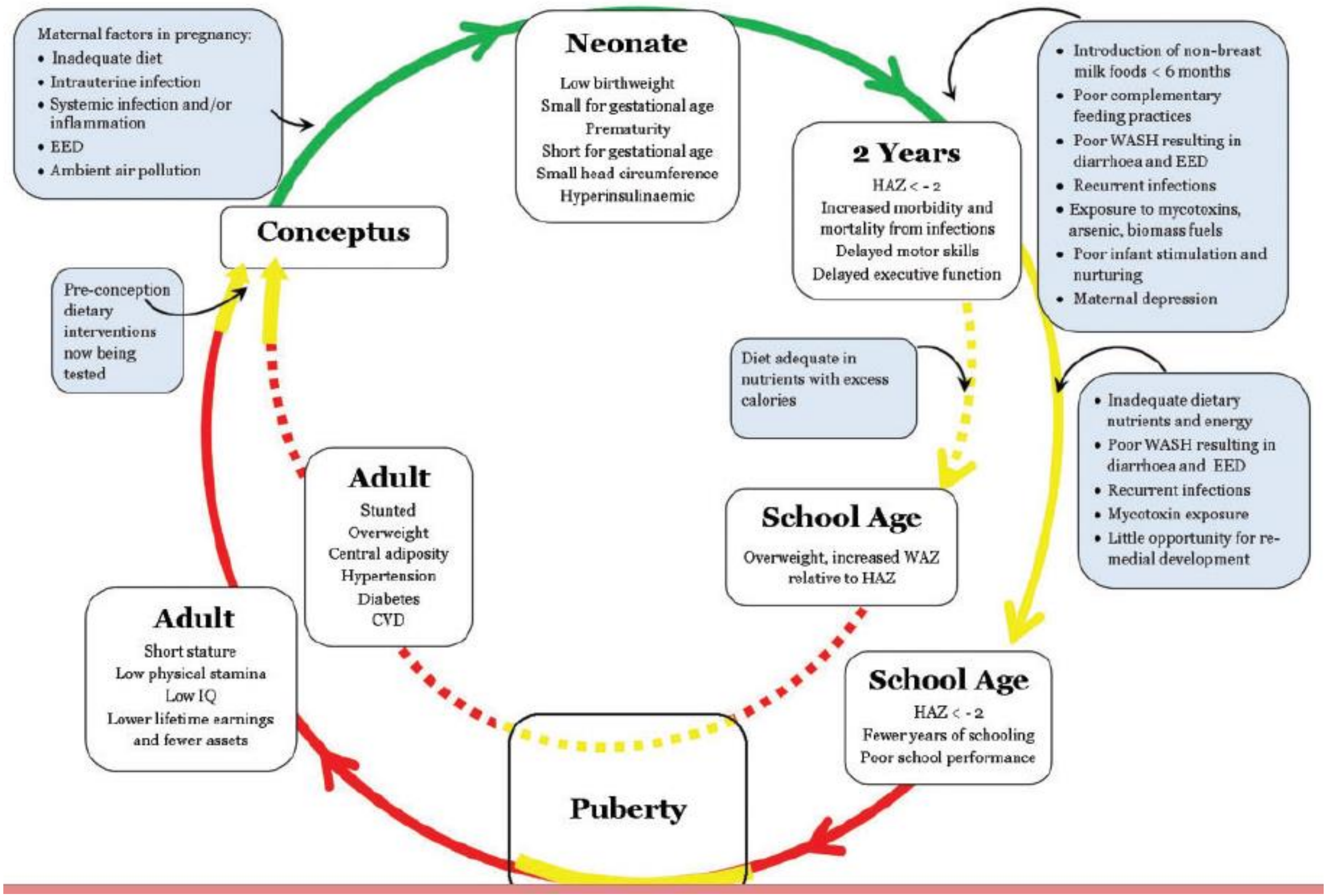
Evidences for the Role of Selected Nutrients and Experiences in 5 keys Neurodevelopmental Process

- Protein
- Energy
- Fatty accids
- Iron
- Iodine
- Zinc
- Choline
- B vitamin



1. Neuron proliferation
2. Axon & dendritic growth
3. Synapses formation & function
4. Myelination
5. Apoptosis

Prado EL, Dewey KG. Nutrition and brain development in early life. *Nutrition Reviews, 2014, 72(4):267–284*



Maternal factors in pregnancy:
• Inadequate diet
• Intrauterine infection
• Systemic infection and/or inflammation
• EED
• Ambient air pollution
Neonate
Low birthweight
Small for gestational age
Prematurity
Short for gestational age
Small head circumference
Hyperinsulinaemic
• Introduction of non-breast milk foods < 6 months
• Poor complementary feeding practices
• Poor WASH resulting in diarrhoea and EED
• Recurrent infections
• Exposure to mycotoxins, arsenic, biomass fuels
• Poor infant stimulation and nurturing
• Maternal depression
Conceptus
2 Years
HAZ < - 2
Increased morbidity and mortality from infections
Delayed motor skills
Delayed executive function
Pre-conception dietary interventions now being tested
Diet adequate in nutrients with excess calories
• Inadequate dietary nutrients and energy
• Poor WASH resulting in diarrhoea and EED
• Recurrent infections
• Mycotoxin exposure
• Little opportunity for re-medial development
Adult
Stunted
Overweight
Central adiposity
Hypertension
Diabetes
CVD
School Age
Overweight, increased WAZ relative to HAZ
Adult
Short stature
Low physical stamina
Low IQ
Lower lifetime earnings and fewer assets
School Age
HAZ < - 2
Fewer years of schooling
Poor school performance
Puberty

Maternal factors[28-32, 53]

- **Maternal age**
  - Adolesence pregnancy : risk of chronic malnutrition (*stunting),*

- **Maternal body height**
  - Lower BMI, smaller increased of BW in pregnancy → risk of LBW.
  - Maternal body height inverse with : mortality, body weight & *stunting* infant & children (109 health & demografic survey in 54 countries).[29]
  - Maternal body height related to (r 0,15-0,55 , *P* <0,001) with
    - birth height
    - postnatal stunting at age of 2 year
    - body height of children in all ages (longitudinal study of 5 cohort)[29]

1. Gibbs CM, Wendt A, Peters S, Hogue CJ. The impact of early age at first childbirth on maternal and infant health. Paediatr Perinat Epidemiol. 2012;26 (suppl 1):259–84.
29. Ozaltin E, Hill K, Subramanian SV. Association of maternal stature with offspring mortality, underweight, and stunting in low- to middle-income countries. JAMA. 2010;303:1507–16.

Maternal Nutritional Status & Child Spacing

- **Maternal Nutritional Status** [30-33]
  - share 20% problems in pregnancy, child mortality and chronic malnutrition (*stunting)*.
  - Prenatal balanced energy and protein **supplementation** reduced SGA **31%.** [30]
  - Prenatal micronutrient supplementation, reduced SGA **9%** [30]
  - Daily iron suplementation during pregnancy : reduced LBW 20% [31]
  - Ca supplementation during pregnancy increased birth weight **85** g (95% CI 37-133).[32]
  - **Vit D supplementation in pregnancy** significant increased of BW (RR 0,48, 95% CI 0,23-1,01). [33]
- **Spacing**. The shorter, the more problem in maternal nutritional status

30. Imdad A, Bhutta ZA. Effect of balanced protein energy supplementation during pregnancy on birth outcomes. BMC Public Health. 2011;11 (suppl 3):S17.
31. Imdad A, Bhutta ZA. Routine iron/folate supplementation during pregnancy: effect on maternal anaemia and birth outcomes. Paediatr Perinat Epidemiol. 2012;26 (Suppl 1:168–77
32. Imdad A, Bhutta ZA. Effects of calcium supplementation during pregnancy on maternal, fetal and birth outcomes. Paediatr Perinat Epidemiol. 2012;26 (Suppl 1):138–52.
33. De-Regil LM, Palacios C, Ansary A, Kulier R, Pena-Rosas JP. Vitamin D supplementation for women during pregnancy. Cochrane Database Syst Rev. 2012;2:CD008873.

Stunted mother → stunted children → adulthood → subsequent generatiopns

Longterm study

- Maternal stunting before 24 mo : lower birth weight of the next generation from 4 LMICs (9)
- Jamaica: early parental stunting (both genders) low cognitive performance of their offspring (10).

Meta-analysis : 1-SD increased in height-for-age for children under 2 y of age

- increased in cognitive performance of 0.22- 0.24 SD (5).

Early stunting : linking to developmental competence,

- performance, and low earnings in adulthood (6–8).
- extends to adulthoodless schooling, poor test and into subsequent generations (11)

5. Sudfeld CR, Charles McCoy D, Danaei G, Fink G, Ezzati M, Andrews KG, Fawzi WW. Linear growth and child development in low- and middle-income countries: a meta-analysis. Pediatrics 2015;135:e1266–75.
6. Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. Developmental potential in the first 5 years for children in developing countries. Lancet 2007;369:60–70.
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9. Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, SachdevHS. Maternal and child undernutrition: consequences for adult health and human capital. Lancet 2008;371:340–57.
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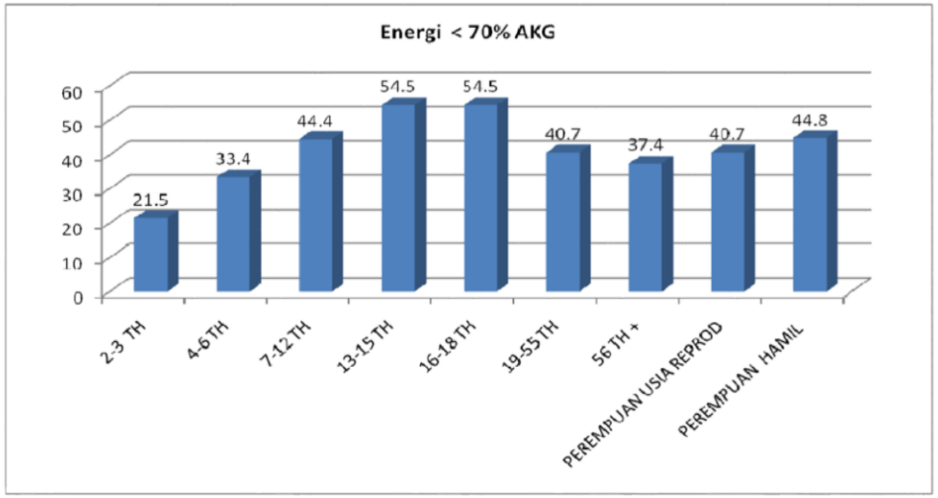
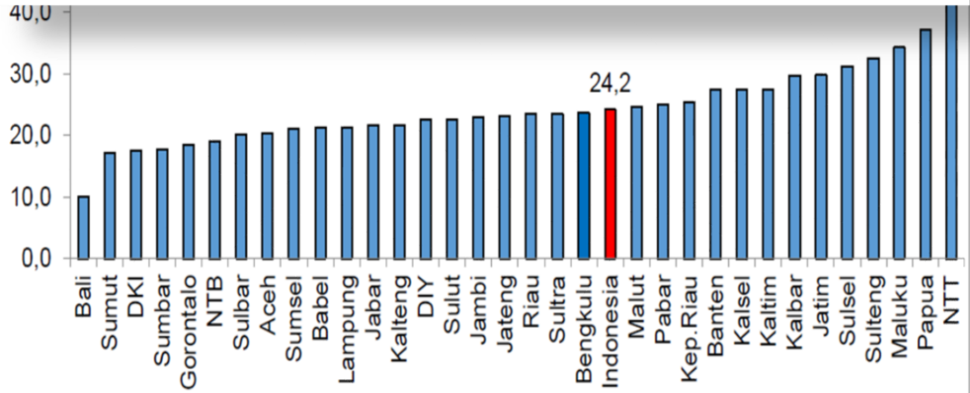
11. Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P, de Onis M, Ezzati M, Grantham-McGregor S, Katz J, Martorell R, et al. Maternal and child undernutrition and overweight in low-income and middleincome countries. Lancet 2013;382:427–51.

INDONESIA (Riskesdas 2013) : Chronic Energy and Protein Malnutrition In Reproductive & Pregnant Women

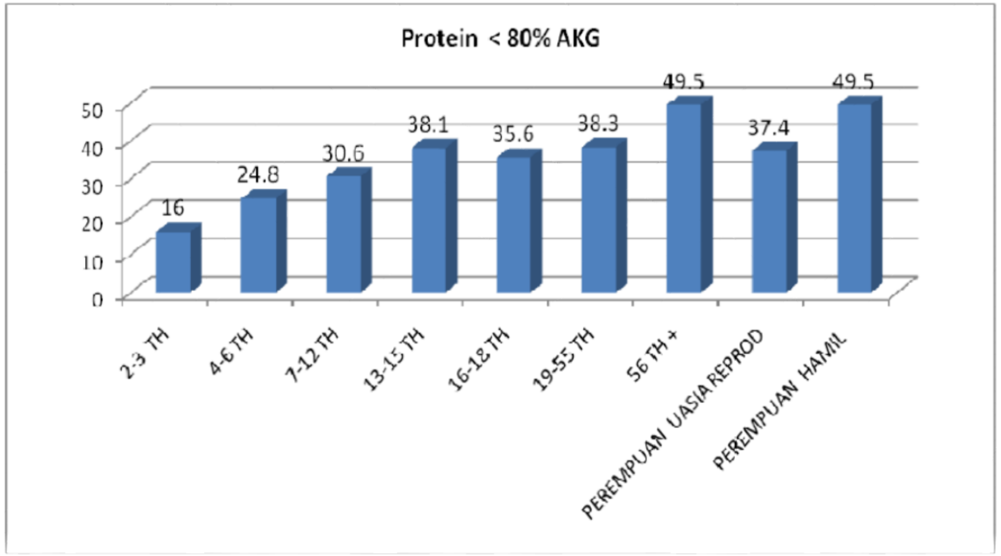
Gambar 3.1.2.3. Persentase Penduduk yang Mengkonsumsi Energi di bawah Kebutuhan Minimal menurut Kelompok Umur, Riskesdas 2010





Gambar 3.14.22
Prevalensi risiko KEK wanita hamil umur 15-49 tahun menurut provinsi, Indonesia 2013

Gambar 3.1.2.7. Persentase Penduduk yang Mengkonsumsi Protein di bawah Kebutuhan Minimal menurut Kelompok Umur, Riskesdas 2010



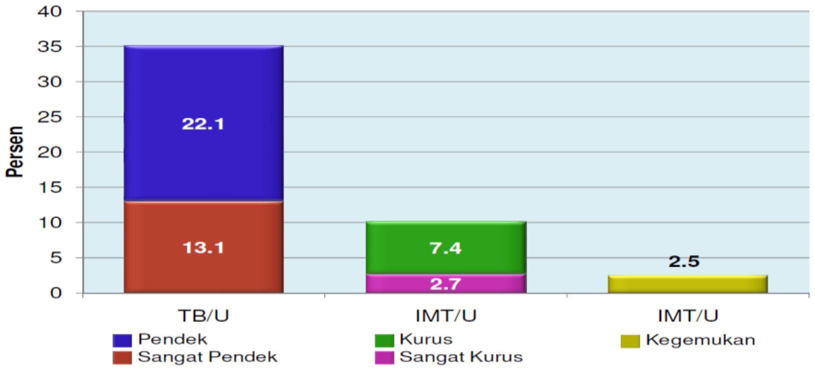
Antenatal care

Regular 70,4 % (minimal 4x in trimester3)

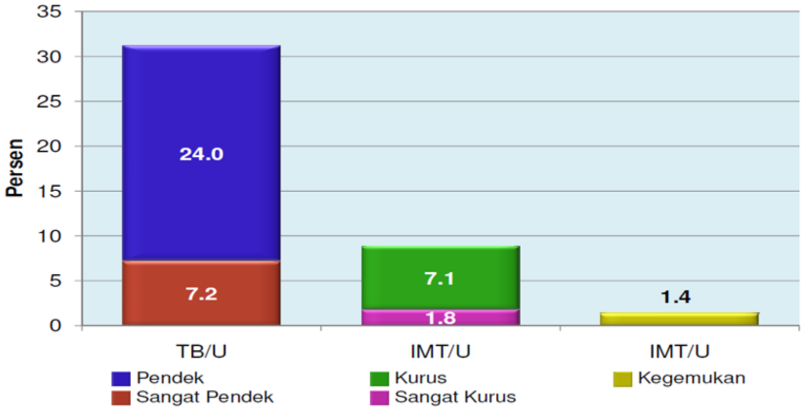
88 % by widwives, 52,5 % in midwives clinic

Adolescence & Adult Pregnancy in Indonesia (Riskesdas 2013)[104]

Gambar 3.1.1.19
Prevalensi Kependekan, Kekurusan dan Kegemukan
Pada Anggota Keluarga Umur 13-15 Tahun



Gambar 3.1.1.25
Prevalensi Kependekan, Kekurusan dan Kegemukan
Pada Anggota Keluarga Umur 16-18 Tahun



Adolescence & maternal age

- 2,6 % marriage at <15 year of age,
- 23,9 % marriage at 15-19 year of age
- Adolescence pregnancy (15-19 year of age) : 1,97 %.

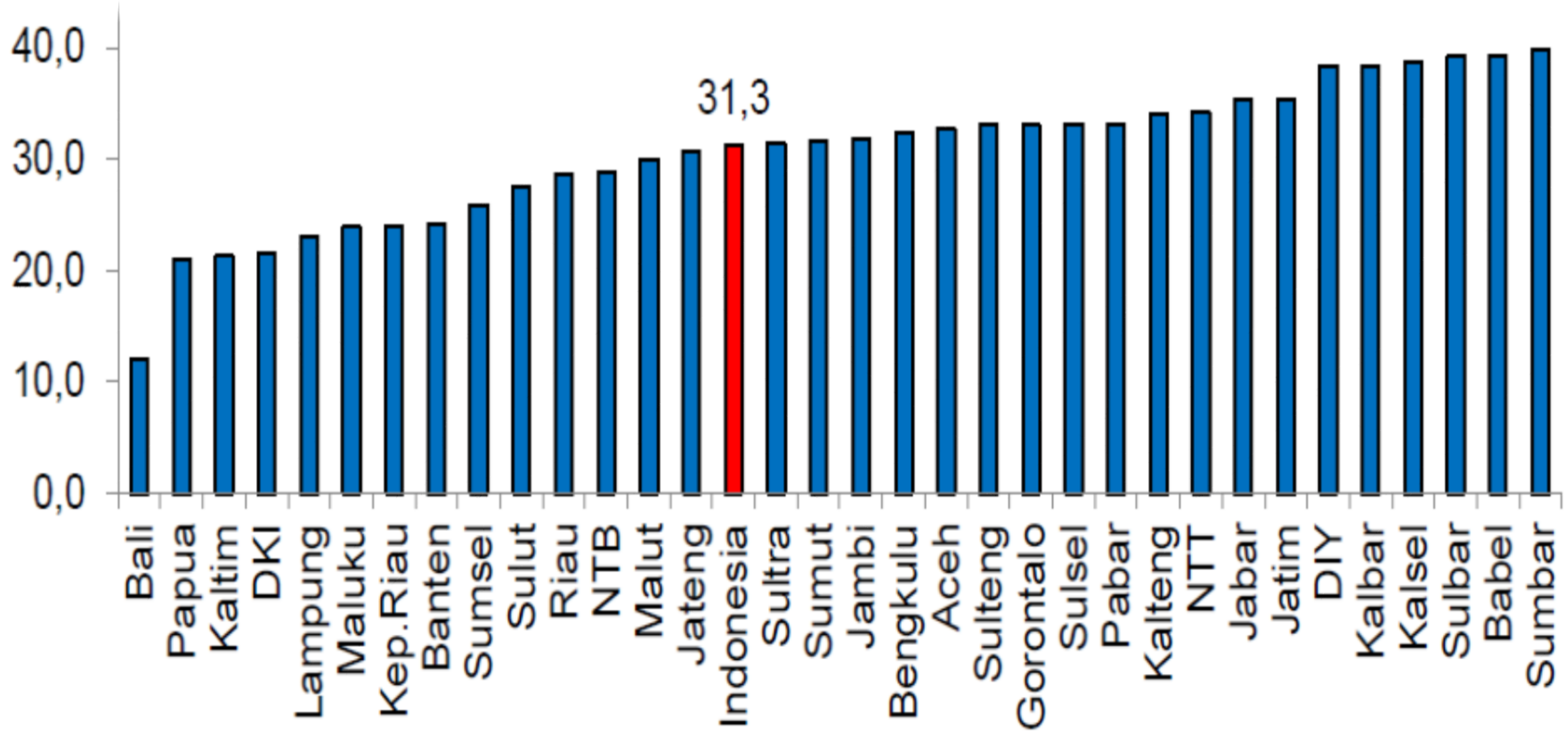
Stunted adolescent

- 13 – 15 year of age : 35,1 % (13,8% very short, 21,3% shorter).
- 16-18 year of age : 31,4 % (7,5% vrty short, 23,9% shorter).,

Stunted pregnant women. 31,3 % body height<150 cm (WHO 2007)

104. Badan Penelitian dan Pengembangan Kesehatan. Hasil Riset Kesehatan Dasar 2013. Kemkes RI. 2013.

Indonesia (2013) : stunted pregnant women 31,3 %



Gambar 3.14.25

Prevalensi wanita hamil berisiko tinggi (tinggi badan <150 cm) menurut provinsi, Indonesia 2013

Infant factors

- **Prematurity & LBW.** [36,37]
    - post natal stunting risk (in 19 cohort groups) sharply increased in
        - Prematurity [**OR 1,93** (95% CI 1,71-2,18)],
        - Small for Gestational Age OR **2.43** (2,22-2,66)] dan
        - **SGA**+ prematurity [**4,51** (3,42-5,93)]. [36], [37]
- **Nutritional status :** suboptimal breastfeeding, complementary feeding, recurrent infection, micro nutrien defficiency [1,2,3, 76]

1. UNICEF, WHO, World Bank. Levels and Trends in Child Malnutrition. Joint Child Malnutrition Estimates. New York,NY: United Nations International Children's Fund; Geneva:WHO; Washington, DC: World Bank, 2012. Available from: http://www.who.int/nutgrowthdb/estimates/en/
2. Martorell R, Zongrone A. Intergenerational influences on child growth and undernutrition. Paediatr Perinat Epidemiol. 2012;26 (suppl 1):302–14.
3. World Health Organization. Global Targets 2025. Available from: http://www.who.int/nutrition/topics/nutrition_globaltar gets2025/en/
36. Christian P, Lee SE, Donahue Angel M, Adair LS, ArifeenSE, Ashorn P, et al. Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low-andmiddle-income countries. Int J Epidemiol. 2013;42:1340–55.
37. Katz J, Lee AC, Kozuki N, Lawn JE, Cousens S, Blencowe H, et al. Mortality risk in preterm and small-for-gestational-age infants in low-income and middle-income countries: a pooled country analysis. Lancet. 2013;382:417–25.
76. Dewey KG, Adu-Afarwuah S. Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. In: Maternal and Child Nutrition. Davis, CA: Blackwell Publishing, 2008

Infant factors

- **Birth length** 34, 35
  - Birth length equal in : healty mother, medium–high SES (fetal growth study in *intergrowth-21 project in* 8 countries). [34]
  - Newborn HAZ in developing countries around -0,5, dercreased after birth and lowest -2,0 pada 18-24 bulan. [35]
  - Indonesia: birth length strong predictor body length at age of 12 month (Schmidt *et al.* 2002),
  - Malawi : ~ 20% **deficite of 1-cm at 3 year (in WHO curve) beginning at birth** (Dewey & Huffman 2009) .

34 Villar J, Papageorghiou AT, Pang R, Ohuma EO, Ismail LC, Barros FC, et al. The likeness of fetal growth and newborn size across non-isolated populations in the INTERGROWTH-21 Project: the Fetal Growth Longitudinal Study and Newborn Cross-Sectional Study. Lancet Diab Endocrinol. 2014. doi: 10.1016/S2213-8587(14)70121-4.
35. Victora CG, de Onis M, Hallal PC, Blossner M, Shrimpton R. Worldwide timing of growth faltering: revisiting implications for interventions. Pediatrics. 2010;125:e473–80.

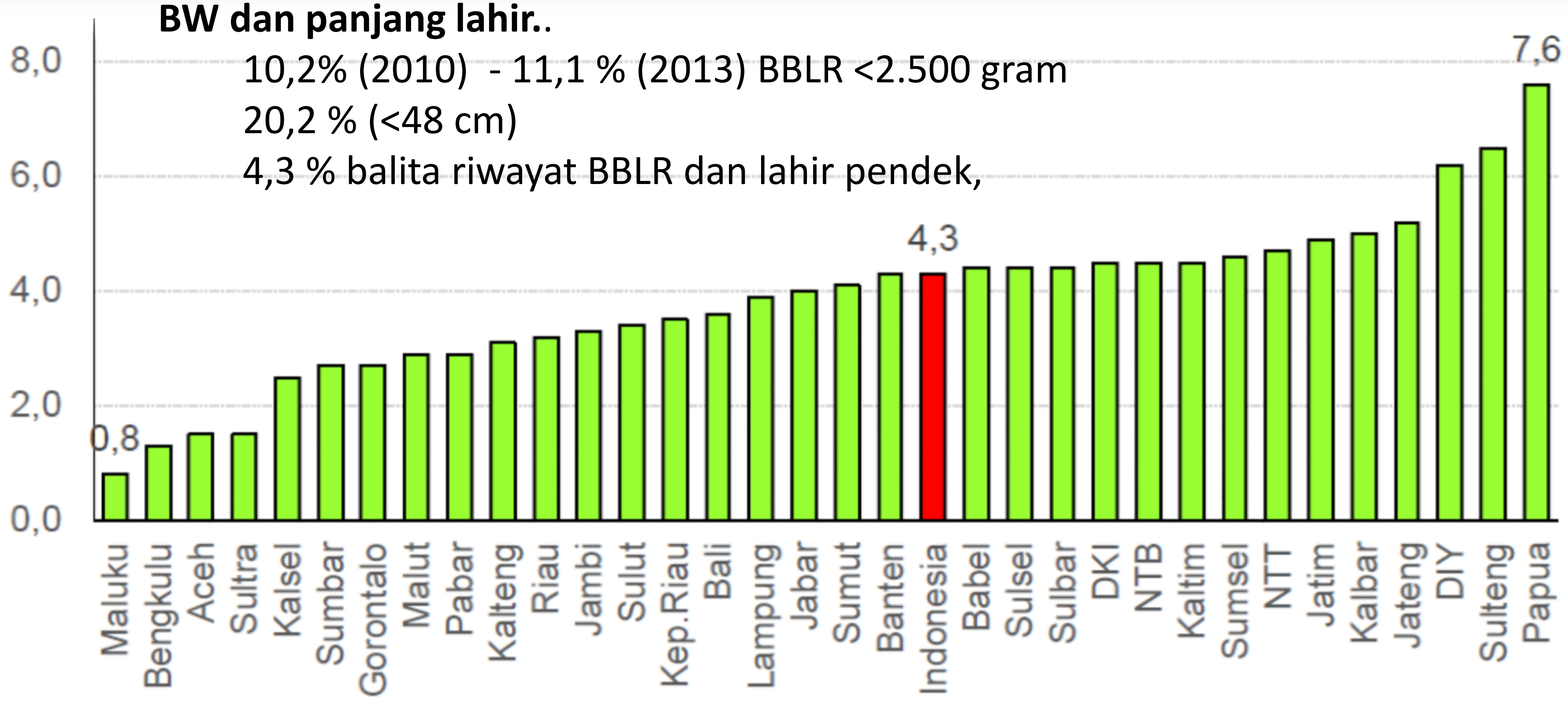
Birth Weight < 2500 gr, BL < 48 cm,
Indonesia 2013

BW dan panjang lahir..

10,2% (2010) - 11,1 % (2013) BBLR <2.500 gram

20,2 % (<48 cm)

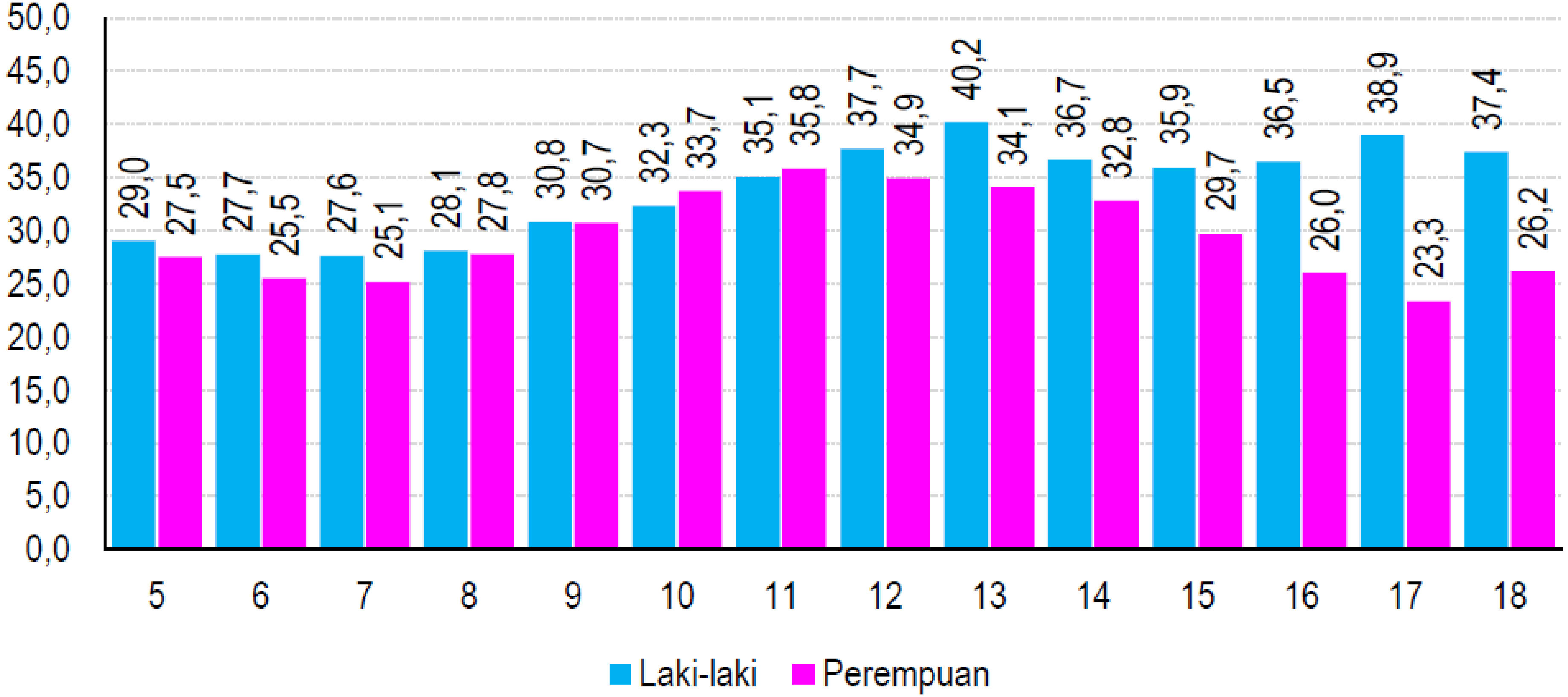
4,3 % balita riwayat BBLR dan lahir pendek,



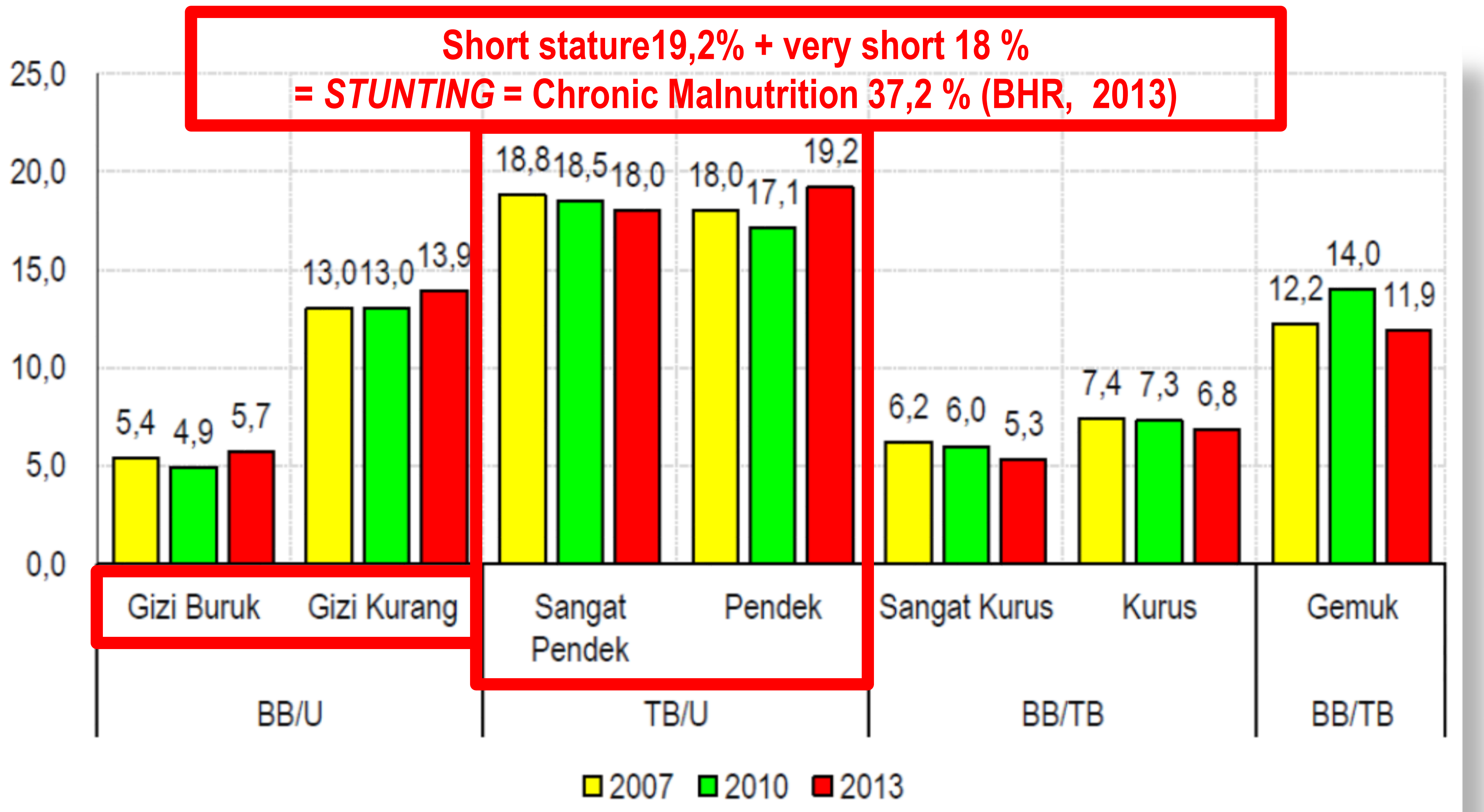
Gambar 3.13.2

Persentase umur 0-59 bulan dengan berat badan lahir <2500 gram dan panjang badan lahir <48 cm menurut Provinsi, Indonesia 2013

Indonesia (2013) : short stature at 5 – 18 year of age



Gambar 3.14.6
Prevalensi pendek anak umur 5-18 tahun, menurut jenis kelamin, Indonesia 2013



Gambar 3.14.4
Kecenderungan prevalensi gizi kurang, pendek, kurus, dan gemuk pada balita, Indonesia 2007,2010, dan 2013

Chronic malnutrition: long term impacts [20-25]

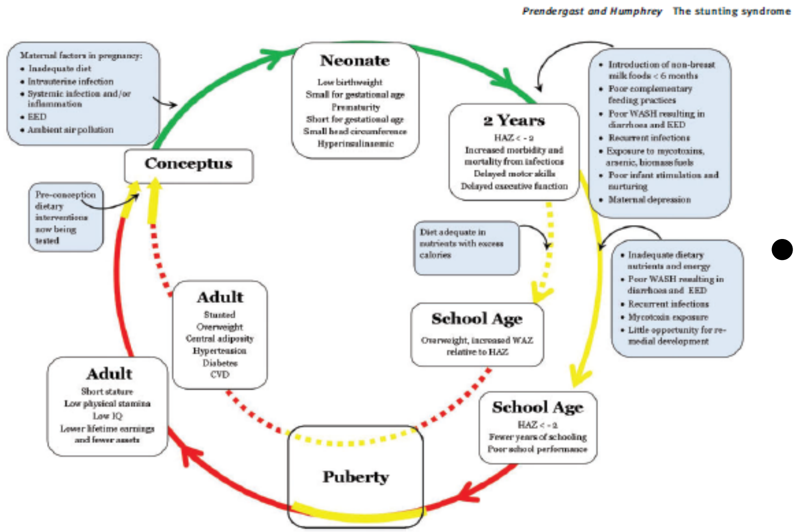


Figure 1 The stunting syndrome. The green pathway denotes the period between conception and 2 years (*'the first 1000 days'*)

- **In Childhood** :
  - Risk of : infections, death
  - Lower in : cognitive, academic performance
  - Higher risk of : behavior, emotional – social problem
- **At Adulthood**:
  - Shorter < 3.2 cm, lower stamina
  - Lower in : productivity, wage 8-46% , assets 66%
  - Higher risk of : metabolic / degeneratif diseases (hypertension, cardiac, diabetes, obesity)

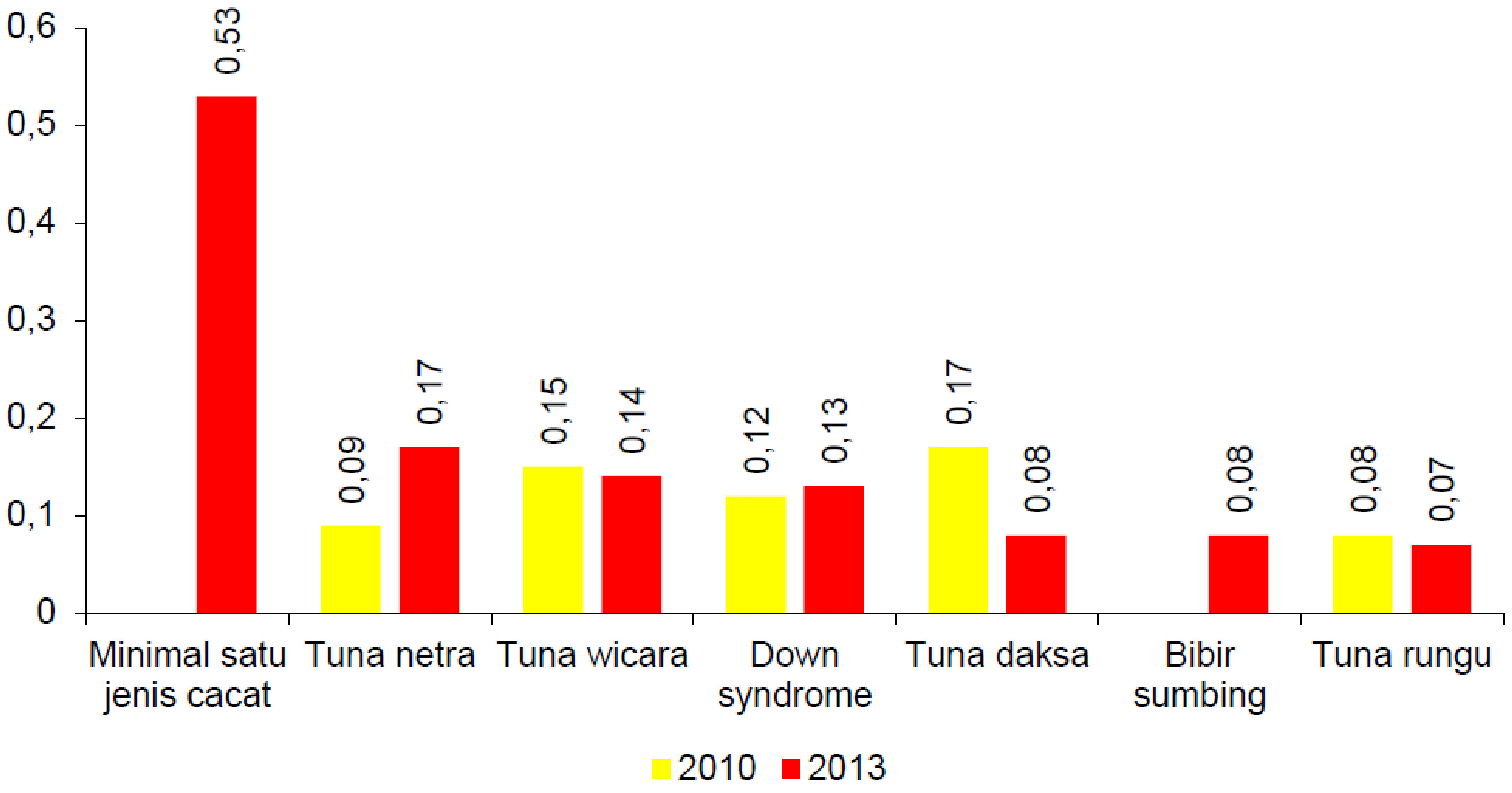
20 Moore SE, Cole TJ, Collinson AC, Poskitt EM, McGregor IA, Prentice AM. Prenatal or early postnatal events predict infectious deaths in young adulthood in rural Africa. Int J Epidemiol. 1999;28:1088–95.
21. Hoddinott J, Alderman H, Behrman JR, Haddad L, Horton S. The economic rationale for investing in stunting reduction. Matern Child Nutr. 2013;9 (Suppl 2):69–82.
22. Barker DJ, Hales CN, Fall CH, Osmond C, Phipps K, Clark PM. Type 2 (non-insulin-dependent) diabetes mellitus, hypertension and hyperlipidaemia (syndrome X): relation to reduced fetal growth. Diabetologia. 1993;36:62–7.
23. Sachdev HS, Fall CH, Osmond C, Lakshmy R, Dey Biswas SK, Leary SD, et al. Anthropometric indicators of body composition in young adults: relation to size at birth and serial measurements of body mass index in childhood in the New Delhi birth cohort. Am J Clin Nutr. 2005;82:456–66.
24. Hardy R, Sovio U, King VJ, Skidmore PM, Helmsdal G, Olsen SF, et al. Birthweight and blood pressure in five European birth cohort studies: an investigation of confounding factors. Eur J Public Health. 2006;16:21–30
25. Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. Maternal and child undernutrition: consequences for adult health and human capital. Lancet. 2008;371:340–57.

Poverty and brain development

- poverty : undermine the structure and function of early brain development (12,13, 14, 15).
- decreased up to 20 % in the size of : hippocampus, frontal and temporal lobes associated with cognitive functioning (16).

12. Brooks-Gunn J, Duncan GJ. The effects of poverty on children. Future Child 1997;7:55–71.
13. Hamadani JD, Tofail F, Huda SN, Alam DS, Ridout DA, Attanasio O, Grantham-McGregor SM. Cognitive deficit and poverty in the first 5 years of childhood in Bangladesh. Pediatrics 2014;134:e1001–8.
14. Hackman DA, Farah MJ. Socioeconomic status and the developing brain. Trends Cogn Sci 2009;13:65–73.
15. Noble KG, Houston SM, Brito NH, Bartsch H, Kan E, Kuperman JM, Akshoomoff N, Amaral DG, Bloss CS, Libiger O, et al. Family income,parental education and brain structure in children and adolescents. Nat Neurosci 2015;18:773–8.
16. Hair NL, Hanson JL, Wolfe BL, Pollak SD. Association of child poverty, brain development, and academic achievement. JAMA Pediatr 2015; 169(9):822–9.

Children with Special Needs



Gambar 3.13.4
Kecenderungan persentase kecacatan pada anak 24-59 bulan, Indonesia 2010 dan 2013

Delayed Development

Jumlah aspek yang mengalami keterlambatan	Pedesaan n (%)	Perkotaan n (%)
0	166 (70,3)	213 (81,3)
1	33 (14,0)	30 (11,5)
2	24 (10,2)	9 (3,4)
3	8 (3,4)	5 (1,9)
4	5 (2,1)	3 (0,8)
5	0 (0)	2 (0,7)
Total	236 (100,0)	262 (100,0)

Keterangan : $X^2 = 14{,}664$; $p = 0{,}012$

Fadlyana E et al 2003

Delayed Development

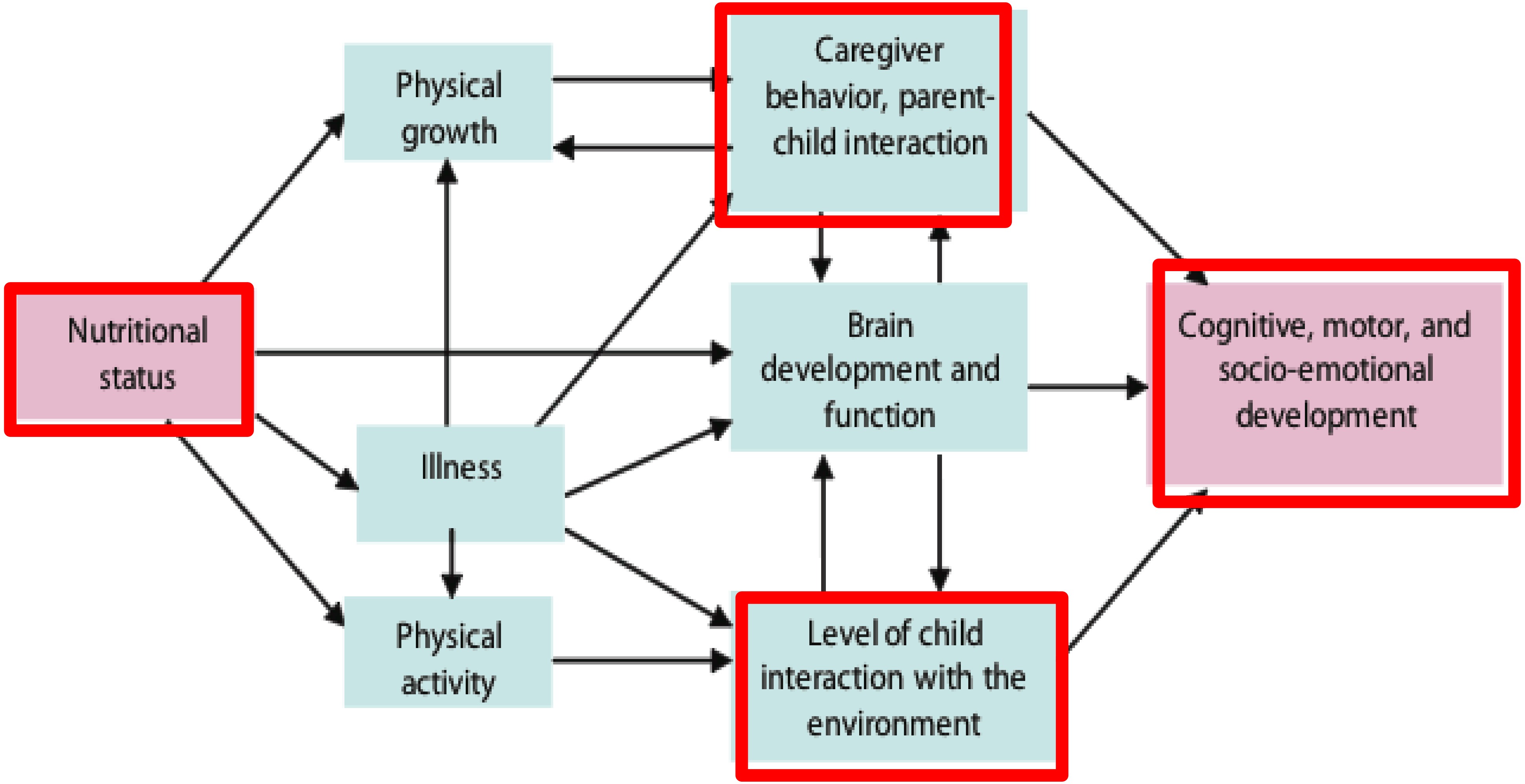
Jenis aspek yang mengalami keterlambatan	Pedesaan(n=236)	Perkotaan (n=262)		
	n (%)	n (%)	x^2	p
Motorik kasar	25 (10,6)	16 (5,0)	0,768	0,381
Motorik halus	25 (10,6)	19 (7,2)	0,015	0,903
Persepsi	27 (15,7)	18 (6,9)	0,001	0,971
Volkalisasi dan pengertian bicara	47 (19,9)	29 (11,1)	0,530	0,467
Sosial	1 (0,4)	6 (2,3)		0,019*

Keterangan * Berdasarkan Uji eksak Fisher

Fadlyana E et al 2003

Figure 3. Potential mechanisms for the effect of nutrient deficiency on children's cognitive, motor, and socio-emotional development

Adapted from Levitsky & Barnes (1972) and Pollitt (1993)



Parenting and preschool interventions in early life

- have beneficial effects on
  - children’s cognitive performance
  - schooling (17, 18)
  - extend into adulthood.

17. Engle PL, Black M, Behrman J, Cabral de Mello M, Gertler P, Kapiriri L, Martorell R, Young M. Strategies to avoid the loss of developmental potential among over 200 million children in the developing world. Lancet 2007;369:229–42.

18. Engle PL, Fernald LC, Alderman H, Behrman J, O’Gara C, Yousafzai A, Mello CD, Hidrobo M, Ulkuer N, Ertem I, et al. Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. Lancet 2011;378: 1339–53.

The Role of EXPERIENCES (STIMULATIONS) in brain development

- **Enriched environments (visual and tactile stimulation, toys**) :
  - greater brain **weight** and cortical **thickness** [39]
  - more **synapses** per neuron in visual & motor cortices 39]
  - more **dendritic spines**.[41]
  - More **myelination** of the corpus callosum.[44, 45]

- Higher levels of education : more **dendritic branching** in Wernicke's area, underlying language processing.[40]
- Children in Romanian **orphanages then adopted** into US families, having of early socioemotional deprivation, better **structured in white matter** [42]

- **Practicing the piano** in childhood correlated with **myelination** in areas underlying finger movements,.[43]

39. Kolb B, Whishaw IQ. Brain plasticity and behavior. Annu Rev Psychol. 1998;49:43–64.
40. Jacobs B, Schall M, Scheibel AB. A quantitative dendritic analysis ofWernicke's area in humans. II. Gender, hemispheric, and environmental factors. J Comp Neurol. 1993;327:97–111.
41. GreenoughWT, Black JE. Induction of brain structure by experience: substrates for cognitive development. In: Gunnar MR, Nelson CA, eds. *Developmental Behavioral Neuroscience*. Hillsdale, NJ: Erlbaum; 1992:155–200.
42. Eluvathingal TJ, Chugani HT, Behen ME, et al. Abnormal brain connectivity inchildren after early severe socioemotional deprivation: a diffusion tensor imaging study. Pediatrics. 2006;117:2093–2100.
43. Bengtsson SL, Nagy Z, Skare S, et al. Extensive piano practicing has regionally specific effects on white matter development. Nat Neurosci. 2005;8:1148–1150.
44. Juraska JM, Kopcik JR. Sex and environmental influences on the size and ultrastructure of the rat corpus callosum. Brain Res. 1988;450:1–8.
45. Sanchez MM, Hearn EF, Do D, et al. Differential rearing affects corpus callosum size and cognitive function of rhesus monkeys. Brain Res. 1998;812:38–49.

Multisensory Stimulations

auditory [56]

visual [22,33]

tactile [33]

vestibulary [37-40]

olfactory [29]

Benefits [1, 41-49]

emotional,

social,

effective learning

cognitive,

physical

Jean Piaget, Developmental Psychologist, Theory of Cognitive Development (1936) . Infants develop knowledge by coordinating multisensory experiences with physical actions. [60]

Anna Jean Ayres, Developmental Psychologist, Sensory Integration & Learning Disorders (1972) [60]

1.Clark-Gambelunghe MB, et al. Sensory development. Pediatr Clin North Am. 2015;62(2):367-84.
41. Guellai B, et al. Cues for early social skills: direct gaze modulates newborns' recognition of talking faces. PLoS One. 2011;6(4):e18610.
42. Holditch-Davis D, et al. Maternally administered interventions for preterm infants in the NICU: effects on maternal psychological distress and mother-infant relationship. Infant Behav Dev. 2014;37(4):695-710.
43. Medoff-Cooper B, et al. Multisensory intervention for preterm infants improves sucking organization. Adv Neonatal Care. 2015;15(2):142-9.
44. Mindell JA, et al. Bedtime routines for young children: a dose-dependent association with sleep outcomes. Sleep. 2015;38(5):717-22.
45. Mindell JA, et al. A nightly bedtime routine: impact on sleep in young children and maternal mood. Sleep. 2009;32(5):599-606.
46. White-Traut RC, et al. Effect of auditory, tactile, visual, and vestibular intervention on length of stay, alertness, and feeding progression in preterm infants. Dev Med Child Neurol. 2002;44(2):91-7.
47. White-Traut RC, et al. Salivary cortisol and behavioral state responses of healthy newborn infants to tactile-only and multisensory interventions. J Obstet Gynecol Neonatal Nurs. 2009;38(1):22-34.
48. Kanagasabai PS, et al. Effect of multisensory stimulation on neuromotor development in preterm infants. Indian J Pediatr. 2013;80(6):460-4.
49. Gabis LV, et al. The influence of a multisensory intervention for preterm infants provided by parents, on developmental abilities and on parental stress levels. J Child Neurol. 2015;30(7):896-903.

22. Farroni T, et al. Eye contact detection in humans from birth. Proc Natl Acad Sci U S A. 2002;99(14):9602-5.
29. Sullivan RM, et al. Clinical usefulness of maternal odor in newborns: soothing and feeding preparatory responses. Biol Neonate. 1998;74(6):402-8
33. Field T, et al. Lavender bath oil reduces stress and crying and enhances sleep in very young infants.
Early Hum Dev. 2008;84(6):399-401.
56. Dehaene-Lambertz G, et al. Language or music, mother or Mozart? Structural and environmental influences on infants' language networks. Brain Lang. 2010;114(2):53-65.

EXPERIENCES :
Daily Stimulations
INPUTS

Nutrition +

Immunization

OUTPUTS : [1, 41-49]
Skills & Behaviors /Performances

Sensory

- Auditory [56]
- Visual [22,23]
- Tactile [33]
- Vestibular [37-40]
- **Olfactory** [29]

Motor :

- Gross,
- Fine Motor

- **Emotion**
- **Speech / verbal**
- **Learning / Cognitive**
- **Problem solving**
- **Art, Creativity**
- **Motor skills**
- **Productivity**

Depend on :
Quality /Variability
Quantity /Intensity

Multiple Inteligences, Skills, Performances

Early Stimulation / Education

The Jamaica trial

- a 2-y randomized trial of a home-based intervention based on opportunities for play
- early learning through homemade toys and materials
- low-income families of stunted toddlers.

Intervention group (8)

- less likely to exhibit serious violent behavior;
- had higher intelligent quotient (IQ) scores,
- higher educational attainment,
- fewer symptoms of depression (8)
- earnings 25% higher compared with young adults in the control group (19).

the continuity of home-visiting with preschool and primary school : long-term success.

8. Walker SP, Chang SM, Vera-Hernandez M, Grantham-McGregor S.Early childhood stimulation benefits adult competence and reduces violent behavior. Pediatrics 2011;127:849–57.

19. Gertler P, Heckman J, Pinto R, Zanolini A, Vermeersch C, Walker S, Chang SM, Grantham-McGregor S. Labor market returns to an early childhood stimulation intervention in Jamaica. Science 2014;344:998–1001.

Integrated : nutrition & development intervention
(Walker et al 2007 & 2011)

- poor nutrition and inadequate early learning :
  - risks for poor children's development (9, 10),
- nutritional and ECD should be integrated—for best outcomes.
- integrated interventions
  - not only affect a single child outcome
  - but also multiple outcomes : growth, health, and development.

9. Walker SP, Wachs TD, Gardner JM, Lozoff B, Wasserman GA, Pollitt E, Carter JA. Child development: risk factors for adverse outcomes in developing countries. Lancet 2007;369:145–57.

10. Walker SP, Wachs TD, Grantham-McGregor S, Black MM, Nelson CA, Huffman SL, Baker-Henningham H, Chang SM, Hamadani JD, Lozoff B, et al. Inequality in early childhood: risk and protective factors for early child development. Lancet 2011;378:1325–38.

Integrated nutrition and ECD interventions

(DiGirolamo, 2014)

- Integrated nutrition and ECD interventions : more efficient than the separate interventions.
- primary advantages ,
  - increased access to early learning opportunities
  - increasing the number of young children and families who exposed to information and resources
  - adequate access to affordable services.
  - easier to support the holistic care needs : “one-stop-shop” service
  - integrated and a relationship with a health worker who understands the total needs of the child and family (11).

11. DiGirolamo AM, Stansbery P, Lung’aho M. Advantages and challenges of integration: opportunities for integrating early childhood development and nutrition programming. Ann N Y Acad Sci 2014; 1308:46–53.

Nutrition & Psychosocial Stimulation Intervention

(Aboud et al, 2015)

Reviewed interventions since 2000 :

- nutrition supplementation (n = 18),
  - had a small-effect size, of d = 0.09.
- psychosocial-stimulation interventions (n = 21)
  - had a medium-effect size of d=0.43 on children's cognitive development
- integrated nutrition and early child development intervention :
  - may have additive or synergistic benefits for child development.

8. Aboud FE, Yousafzai AK. Global health and development in early childhood.
Annu Rev Psychol 2015;66:433–57.

- Grantham-McGregor et al. (7)
- little evidence of additive or synergistic benefits to growth or development outcomes as a result of integrated interventions.
- ECD interventions : consistently promote children's development,
- nutrition interventions : benefit children's growth and sometimes
- benefit children's development (7).

7. Grantham-McGregor SM, Fernald LC, Kagawa R, Walker S. Effects of integrated child development and nutrition interventions on child development and nutritional status. Ann N Y Acad Sci 2014;1308:11–32.

Early Developmental intervention : <u>**caregiver**</u> knowledge and responsiveness

The success of an early development intervention depends upon :

- caregivers know-how to provide consistent learning opportunities and
- responsive stimulation for their child within daily routines (12).

12. Yousafzai AK, Aboud F. Review of implementation processes for integrated nutrition and psychosocial stimulation interventions. Ann N Y Acad Sci 2014;1308:33–45.

Caregivers knowledge, skill, capacity in nutrition and development

1. Responsive care, :respond to their child's cues for,
   - feeding (13–16), social-emotional and cognitive language development (17).
2. Emotional availability of caregivers to recognize and appropriately
   - respond to cues from infants and young children.

Maternal depression is high :

- in low-income (15.9% for pregnant women, 19.8% for postpartum women)
- high-income countries (~10.0% for pregnant women, 13.0% for postpartum women) (19)

Maternal depression is associated with :

- nonresponsive child-feeding behaviors (20),
- inadequate and excess dietary intakes (13, 21), and
- the risk of child under- and overnutrition (22–24).

13. Bentley ME, Wasser HM, Creed-Kanashiro HM. Responsive feeding and child undernutrition in low- and middle-income countries. J Nutr 2011;141:502–7.
14. Black MM, Aboud FE. Responsive feeding is embedded in a theoretical framework of responsive parenting. J Nutr 2011;141:490–4.
15. Engle PL, Pelto GH. Responsive feeding: implications for policy and program implementation. J Nutr 2011;141:508–11.
16. Hurley KM, Cross MB, Hughes SO. A systematic review of responsive feeding and child obesity in high-income countries. J Nutr. 2011;141:495–501.
17. Eshel N, Daelmans B, de Mello MC, Martines J. Responsive parenting: interventions and outcomes. Bull World Health Organ 2006;84:991–8.
19. Fisher J, Cabral de Mello M, Patel V, Rahman A, Tran T, Holton S, Holmes W. Prevalence and determinants of common perinatal mental disorders in women in low- and lower-middle-income countries: a systematic review. Bull World Health Organ 2012;90:139G–49G.
20. Hurley KM, Black MM, Papas MA, Caulfield LE. Maternal symptoms of stress, depression, and anxiety are related to nonresponsive feeding styles in a statewide sample of WIC participants. J Nutr 2008;138:799–805.
21. Hurley KM, Black MM, Merry BC, Caulfield LE. Maternal mental health and infant dietary patterns in a statewide sample of Maryland WIC participants. Matern Child Nutr 2015;11:229–39.
22. Patel V, Rahman A, Jacob KS, Hughes M. Effect of maternal mental health on infant growth in low income countries: new evidence from South Asia. BMJ 2004;328:820–3.
23. Surkan PJ, Kennedy CE, Hurley KM, Black MM. Maternal depression and poor early childhood growth in developing countries: systematic review and meta-analysis. Bull World Health Organ 2011;89:608–15.
24. Hughes SO, Shewchuk RM, Baskin ML, Nicklas TA, Qu H. Indulgent feeding style and children's weight status in preschool. J Dev Behav Pediatr 2008;29:403–10.

Early Learning / stimulation

- Curricula : clear, concise, culturally appropriate, and complete.
- Community awareness : of children's needs for adequate nutrition, nurturant, and early learning (37).
- Mothers have time constraints :
  - limit their time for integrating learning activities into the daily routines,
  - such as feeding, bathing, and dressing.
- Integrating nutrition, caregiving, and learning opportunities
  - requires sensitivity to the number of messages
  - appropriate implementation strategies (39).
  - avoid overwhelming with nutrition- and development-promoting messages.

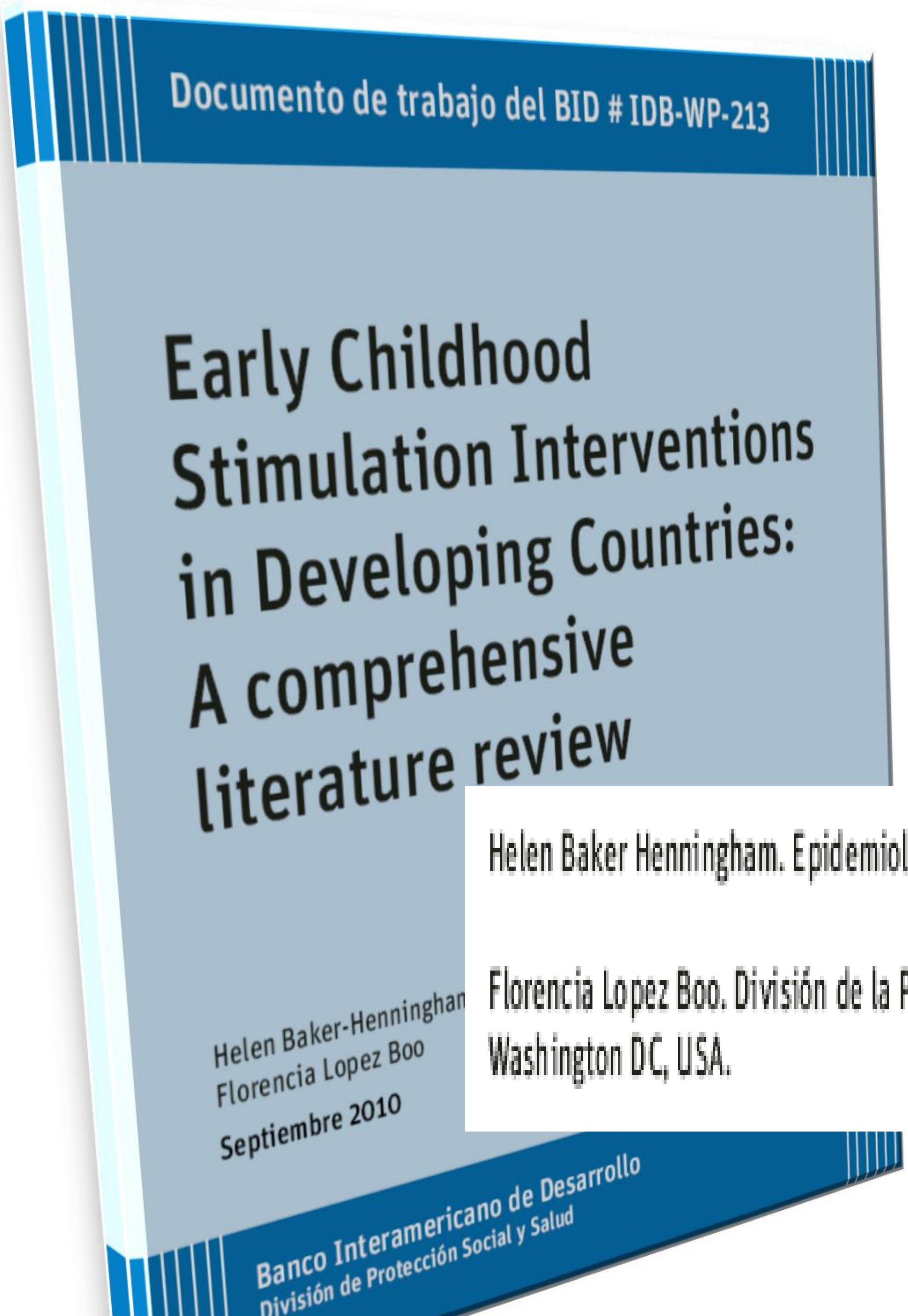
37. Hamadani JD, Nahar B, Huda SN, Tofail F. Integrating early child development programs into health and nutrition services in Bangladesh benefits and challenges. Ann N Y Acad Sci 2014;1308:192–203.
38. Sturke R, Harmston C, Simonds RJ, Mofenson LM, Siberry GK, Watts DH, McIntyre J, Anand N, Guay L, Castor D, et al. A multi-disciplinary approach to implementation science: The NIH-PEPFAR PMTCT implementation science alliance. J Acquir Immune Defic Syndr 2014;67 (Suppl 2):S163–7.
39. Vazir S, Engle P, Balakrishna N, Griffiths PL, Johnson SL, Creed- Kanashiro H, Rao SF, Shroff MR, Bentley ME. Cluster-randomized trial on complementary and responsive feeding education to caregivers found improved dietary intake, growth and development among rural Indian toddlers. Matern Child Nutr 2013;9:99–117.

Integrated nutrition and child development programs

- advantages integrated programs
  - multiple services across sectors (e.g., health, nutrition, education) and
  - flexibility for potential synergies services in one location

- International organizations, (UNESCO),
  - urged policy makers and program managers
  - to adopt an integrated approach.
  - “lessons learned” or guidelines for successfulof integrated interventions (35).

35. Grantham-McGregor SM, Fernald LC, Kagawa RM,Walker S. Effects of integrated child development and nutrition interventions on child development and nutritional status. Ann N Y Acad Sci **2014**;1308:11–32

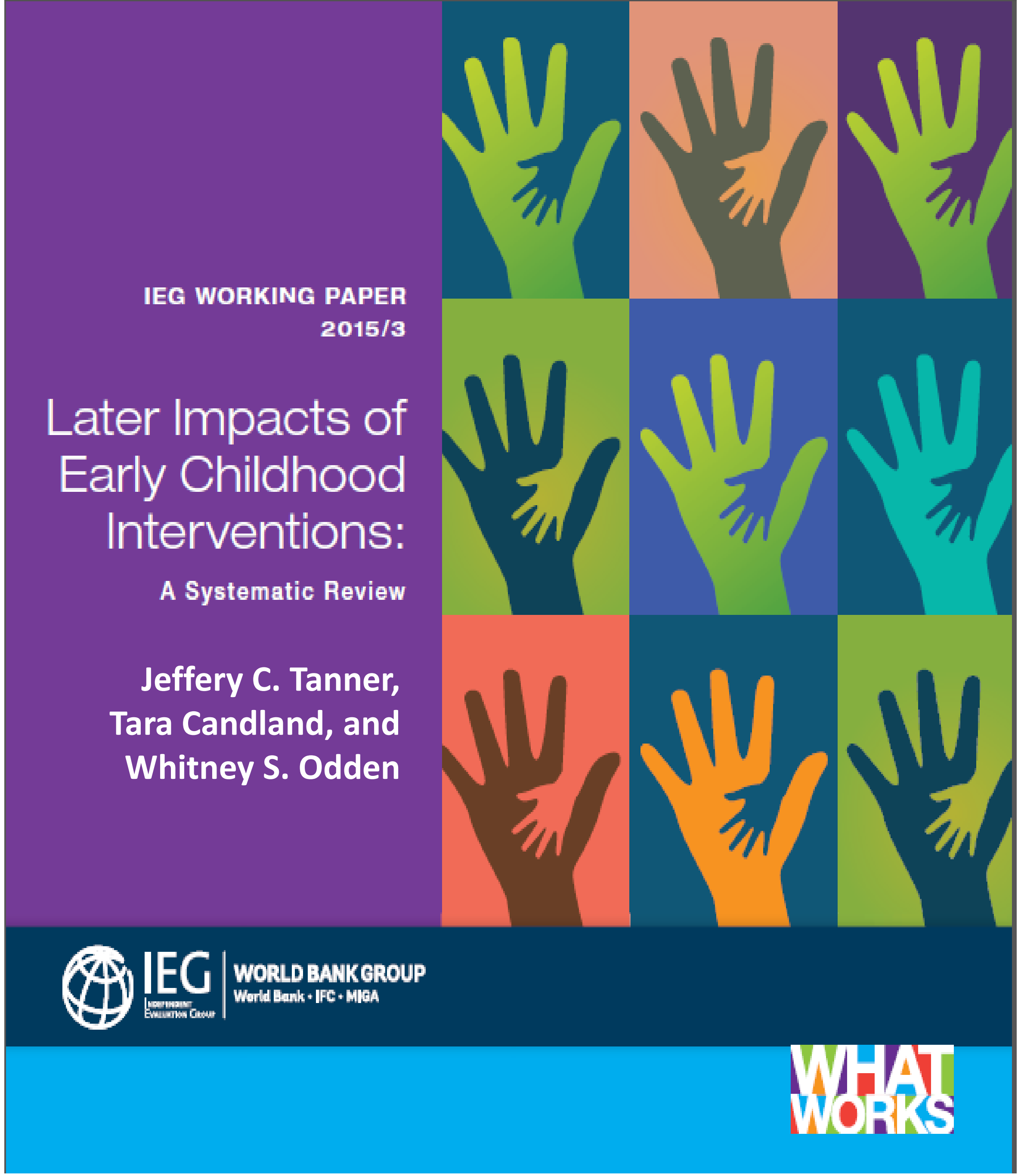


Helen Baker Henningham. Epidemiology Research Unit, University of the West Indies, Mona, Jamaica.

Florencia Lopez Boo. División de la Protección Social y Salud, Banco Inter-Americano de Desarrollo, Washington DC, USA.

12 Developing countries,
low or lower midle SES class

1. **Jamaica**
   - (Grantham- McGregor et al. 1983, 1987, 1989, 1994)
   - Kingston, Jamaica (Gardner et al. 2003)
   - Clarendon, rural Jamaica (Powell, 2004)
   - Kingston, Jamaica(Powell et al. 2004 Baker-Henningham et al. 2005)
   - Kingston, Jamaica (Walker et al. 2004, 2010)
2. **China**
   - (Bao et al. 1999)
   - Rural China (Jin et al. 2007)
3. **Brazil**, Northeast (Eickmann et al. 2003)
4. **Bolivia** (Behrman et al. 2003)
5. **Ethiopia** (Klein & Rye, 2004)
6. **Vietnam** (Watanabe et al. 2005)
7. **Philippines** (Armecin et al. 2006)
8. **Turkey**
   Ankara (Ertem et al. 2006)
   Turkey (Kagitcibasi et al. 2001, 2009)
9. **Bangladesh**
   Rural (Aboud, 2007)
   Dhaka, Bangladesh (Nahar et al. 2009)
10. **Pakistan,** rural (Rahman et al. 2008)
11. **India**
    Himachal Pradesh, India (Sharma & Nagar, 2009)
    South India (Nair et al. 2009)
12. **South Africa**
    Cape town, South Africa (Cooper et al. 2002, 2009).
    Soweto, South Africa (Potterton et al. 2010)


IEG WORKING PAPER
2015/3
Later Impacts of Early Childhood Interventions:
A Systematic Review
Jeffery C. Tanner, Tara Candland, and Whitney S. Odden
IEG
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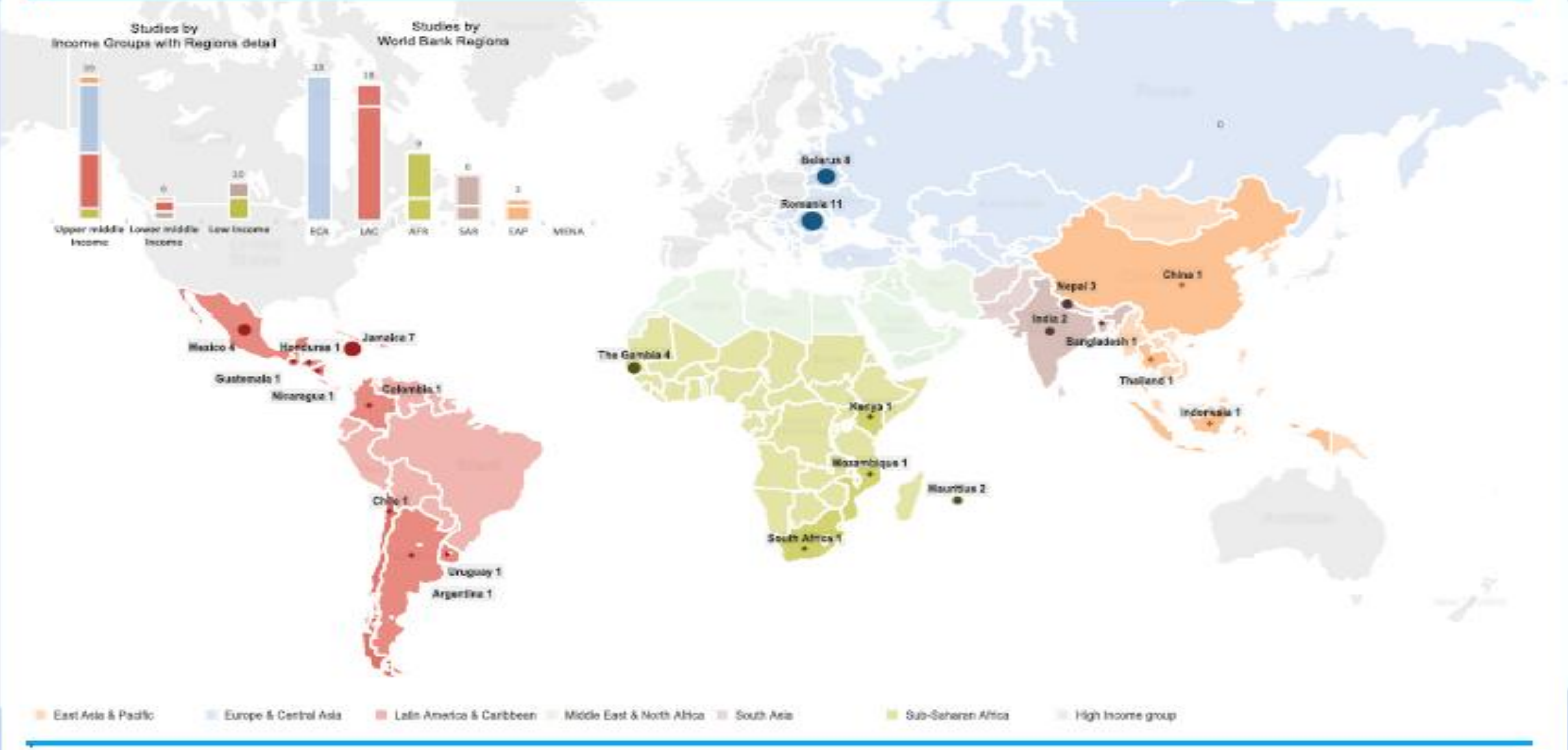
WHAT WORKS

Figure 10.2. Locations of ECD Programs with Medium- or High-Quality Impact Evaluations

55 Studies in 22 Countries on 21 Intervention Types



Source: IEG

Table 1.1. Impact Evaluations Investigating Physical Development

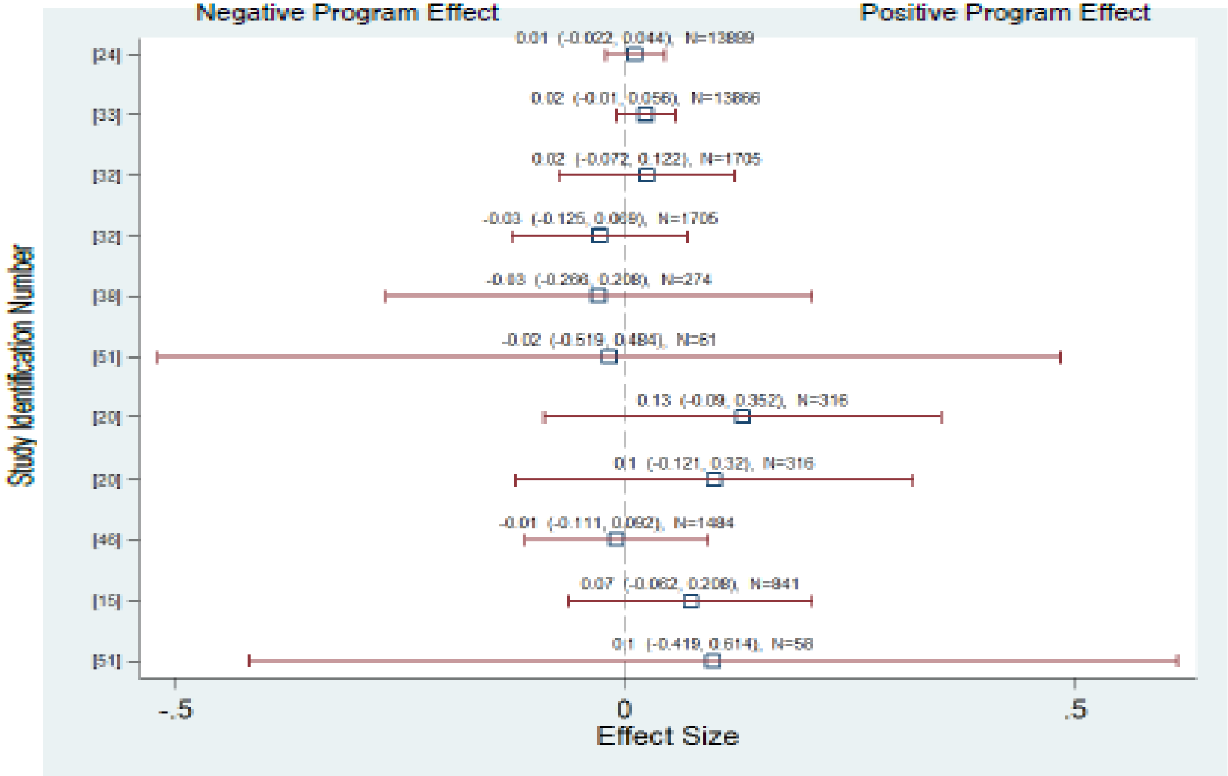
	Study	Country (Project)	Average Age at Intervention (Years)	Average Length of Exposure (Years)[a]	Age at Evaluation (Years)	Evaluated Intervention	Reviewed Outcomes
Nutrition	Kramer and others 2007a [24]	Belarus (Promotion of Breastfeeding Intervention Trial [PROBIT])	0	1	6	breastfeeding promotion	BMI; head circumference*; height; MUAC
	Martin and others 2013 [33]	Belarus (Promotion of Breastfeeding Intervention Trial [PROBIT])	0	1	11	breastfeeding promotion	BMI; head circumference; height; MUAC
	Stewart and others 2009a [45]	Nepal (maternal nutritional supplementation)	in utero	0.75	6–8	vitamins, micronutrients, or fortified food for pregnant women (folic acid, iron, and zinc)	height (folic acid+iron+zinc)*; height (folic acid, folic acid+iron, multiple micronutrient)
	Stewart and others 2009b [46]	Nepal (maternal nutritional supplementation)	in utero	0.75	6–8	vitamins, micronutrients, or fortified food for pregnant women (folic acid, iron, and zinc)	BMI (folic acid, folic acid+iron, folic acid+iron+zinc, multiple micronutrient)
	Devacumar and others 2014 [15]	Nepal (maternal multivitamin supplementation)	in utero	0.17	8.5	vitamins, micronutrients, or fortified food for pregnant women (multivitamin supplement)	BMIZ; HAZ; head circumference; height; MUAC; WAZ; weight (z-scores based on WHO standards)
	Hawkesworth and others 2008 [20]	Gambia, The (maternal supplementation)	in utero	0.5 (DR1)	11–17	vitamins, micronutrients, or fortified food for pregnant women (protein biscuits)	BMI; height***; weight
	Hawkesworth and others 2011 [22]	Gambia, The (maternal supplementation)	in utero	0.5 (DR1)	11–17	vitamins, micronutrients, or fortified food for pregnant women (protein biscuits)	BMI
	Alderman and others 2014 [1]	Gambia, The (maternal supplementation)	in utero	0.5 (DR1)	16–22	vitamins, micronutrients, or fortified food for pregnant women (protein biscuits)	height
	Walker and others 1996 [50][a]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	7–8	supplementary feeding	HAZ; WAZ (z-scores based on NCHS standards)
	Walker and others 2000 [51][a]	Jamaica	1.55	2	11–12	supplementary feeding	BMI; HAZ (z-scores based on NCHS standards)

		(stimulation and supplementation to stunted children)					
	Pongcharoen 2010 [38]	Thailand (micronutrient supplementation to children)	0.5	0.5	9	micronutrients and fortified food for children (iron and/or zinc supplementation)	BMIZ; HAZ*; MUAC; WAZ (z-scores based on WHO standards)
Early Learning/Childcare	Martinez, Naudeau, and Pereira 2012 [35]	Mozambique (preschool)	3.45	1.5	5–9	quality early childhood and preprimary program	fine motor skills*; HAZ; WAZ (no information given on reference population used for calculating the z-score)
	Walker and others 1996 [50][a]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	7–8	stimulation	HAZ; WAZ (z-scores based on NCHS standards)
	Levin and others 2014 [29]	Romania (Bucharest Early Intervention Project)	1.88	2.7	8	stimulation (foster care)	motor skills
	Walker and others 2000 [51][a]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	11–12	stimulation	BMI; HAZ (z-scores based on NCHS standards)
Health	Barham 2012 [5][b]	Bangladesh (Matlab)	NA	continuous	8–14	well child visits	HAZ** (normalized using comparison areas means and standard deviation)
	Ozier 2013 [36]	Kenya (primary school deworming project)	0	1	8–15	deworming	HAZ; height (z-scores based on WHO standards)
	Barham 2012 [5][b]	Bangladesh (Matlab)	NA	continuous	15–19	family planning	HAZ (normalized using comparison areas means and standard deviation)
Social Protection	Behrman and others 2008 [8]	Mexico (Progresa)	1.5	1.5 (DR2)	7–11	CCT	BMIZ; height (z-scores based on WHO standards)
	Manley, Fernald, and Gertler 2012 [32]	Mexico (Progresa)	1	1.5 (DR2)	8–10	CCT—conditionalities CCT—cash	BMIZ; HAZ (z-scores based on WHO standards) BMIZ; HAZ*** (z-scores based on WHO standards)
	Barham and others 2014 [6]	Nicaragua	in utero	3 (DR2)	10 (boys)	CCT	HAZ; WAZ (no information given on reference population

Figure 1.1. Forest Plot for BMI and BMI for Age z-Score

Country	Intervention	Measurement	Average Age at Evaluation (years)
Belarus	Breastfeeding promotion	BMI	6.5
Belarus	Breastfeeding promotion	BMI	11.5
Mexico[a]	CCT cash	BMI for age z-score	9
Mexico[a]	CCT conditionality	BMI for age z-score	9
Thailand	Nutrition (child, micronutrient)	BMI for age z-score	9
Jamaica[b]	Nutrition (stunted children)	BMI	11.5
Gambia, The[c]	Nutrition (mother)	BMI (girl)	13.8
Gambia, The[c]	Nutrition (mother)	BMI (boy)	13.8
Nepal[d]	Nutrition (mother)	BMI	7
Nepal	Nutrition (mother)	BMI for age z-score	8.5
Jamaica[b]	Stimulation (stunted children)	BMI	11.5

Study and Forest Plot



Note: The forest plot describes standard mean difference, 95 percent lower and upper bound confidence interval in parentheses, and sample size (N = number). The standard mean difference and confidence interval were calculated by Comprehensive Meta-Analysis software. Study numbers in [brackets] correspond to the numbered studies in References. Studies [32, 38] use 2006 National Center for Health Statistics growth reference to compute standardized z-score. BMI = body mass index; CCT = conditional cash transfer.

a. For Mexico study [32], the CCT effect is disentangled in cash and conditionality, and both estimates are reported in the forest plot. The Mexico [8] study is not included in this forest plot given that it looks at the same average age at evaluation with [32].

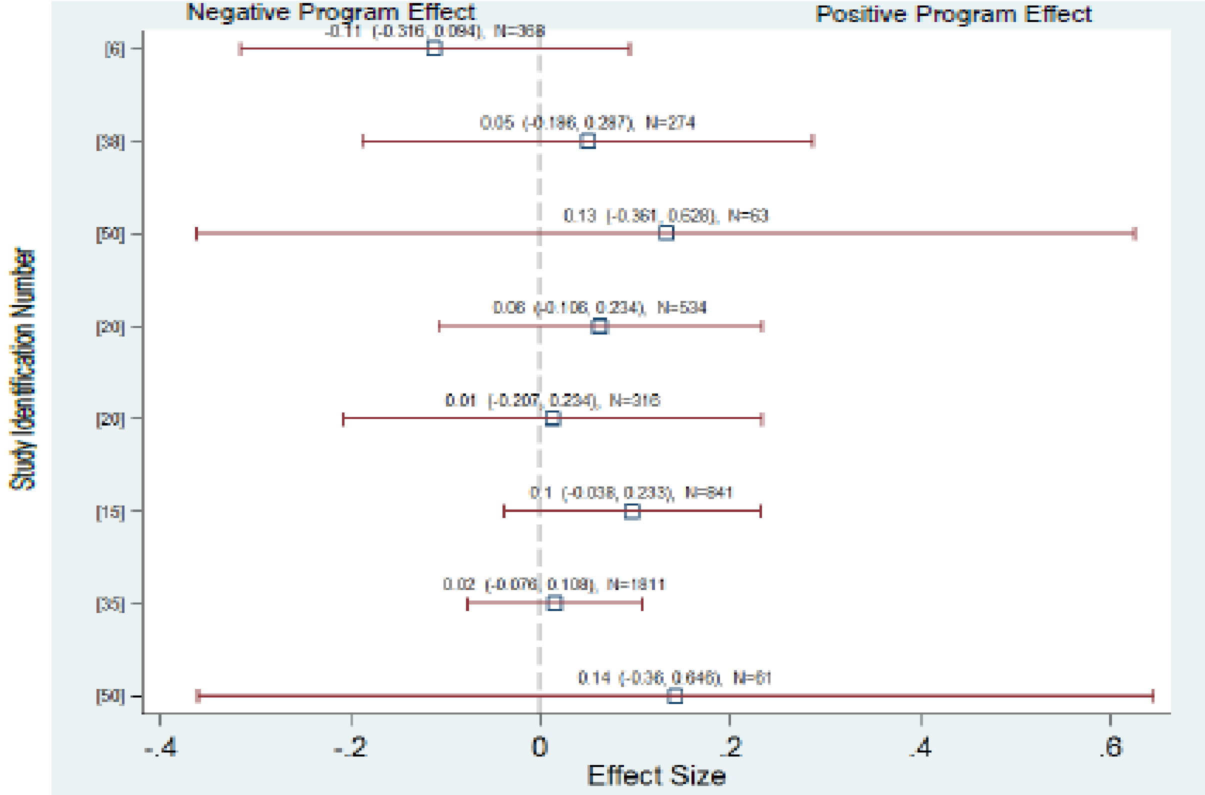
b. For The Gambia study [20], each gender estimate is included in the forest plot because the combined total estimate is not available.

c. For Jamaica study [51], given the combined intervention, information is not available in the article; stimulation intervention compares "stimulation only" and "control group." Similarly, supplementation intervention compares "supplementation only" and "control group."

d. For Nepal study [46], "multiple micronutrient" treatment group compared to the control group is used to compute the effect size.

Figure 1.2. Forest Plot for Weight and Weight-for-Age z-Score

Country	Intervention	Measurement	Average Age at Evaluation (years)	Study and Forest Plot
Nicaragua	CCT	WAZ (boy)	10	
Thailand	Nutrition (child, micronutrient)	WAZ	9	
Jamaica	Nutrition (stunted children)	WAZ	7.7	
Gambia, The[a]	Nutrition (mother)	Weight (boy, kg)	13.8	
Gambia, The[a]	Nutrition (mother)	Weight (girl, kg)	13.8	
Nepal	Nutrition (mother)	WAZ	8.5	
Mozambique	Pre-primary program	WAZ	7	
Jamaica	Stimulation (stunted children)	WAZ	7.7	



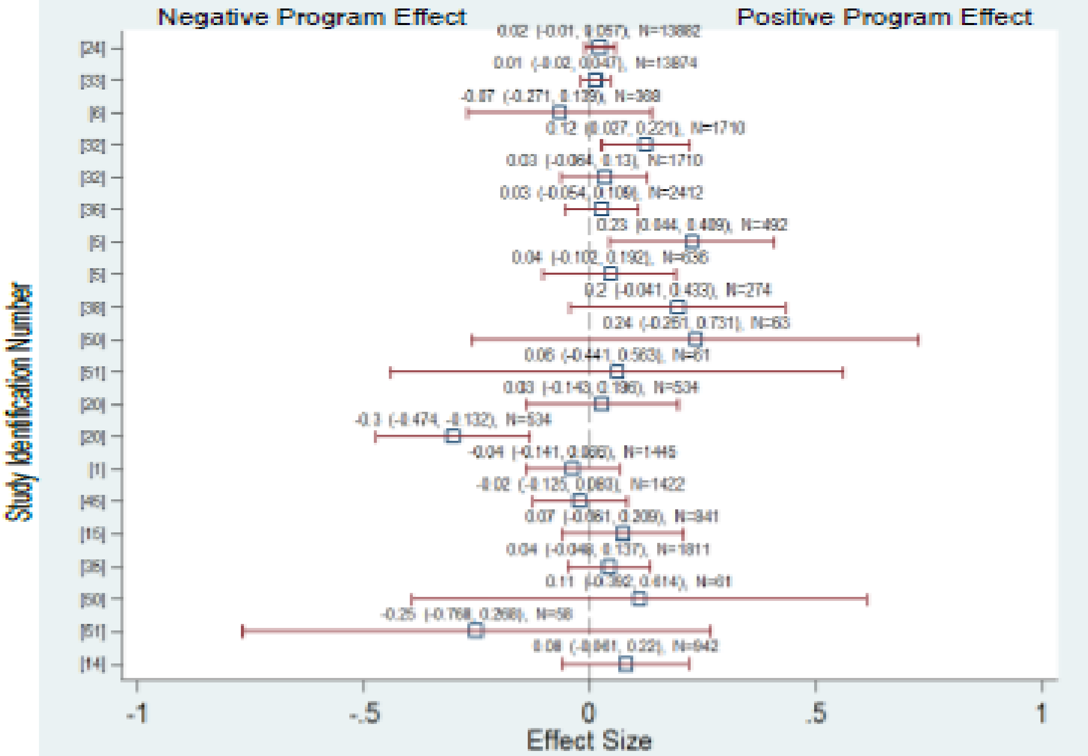
Note: The forest plot shows standard mean difference, 95 percent lower and upper bound confidence interval in parentheses, and sample size (N=number). The standard mean difference and confidence interval were calculated by Comprehensive Meta-Analysis software. Bracketed numbers correspond to the numbered list in References. Study [50] uses National Center for Health Statistics growth reference data to compute standardized z-score. Study [38] uses World Health Organization (WHO) 2006 growth references. Studies [6] and [35] do not; however, because they have been published recently, it is not unlikely these studies use WHO 2006 data as the growth benchmark. CCT = conditional cash transfer. WAZ = Weight for Age z-score.

a. For The Gambia study [20], each gender estimate is included in the forest plot because total estimate is not available in the article.

Figure 1.3. Forest Plot for Height and Height for Age z-Score

Country	Intervention	Measurement	Average Age at Evaluation (years)
Belarus	Breastfeeding promotion	Height (cm)	6.5
Belarus	Breastfeeding promotion	Height (cm)	11.5
Nicaragua[a]	CCT	HAZ (Boy)	10
Mexico[b]	CCT cash	HAZ	9
Mexico[b]	CCT conditionality	HAZ	9
Kenya	Deworming	HAZ	10
Bangladesh	Family planning and MCH	Height z-score	9
Bangladesh	Family planning, maternal health	Height z-score	9
Thailand	Nutrition (child, micronutrient)	HAZ	9
Jamaica	Nutrition (stunted children)	HAZ	7.7
Jamaica[c]	Nutrition (stunted children)	HAZ	11.5
Gambia, The[a]	Nutrition (mother)	Height (girl, cm)	13.8
Gambia, The[a]	Nutrition (mother)	Height (boy, cm)	13.8
Gambia, The[a]	Nutrition (mother)	Height (cm)	19.6
Nepal[d]	Nutrition (mother)	Height (cm)	7
Nepal	Nutrition (mother)	HAZ	8.5
Mozambique	Pre-primary program	HAZ	7
Jamaica	Stimulation (stunted children)	HAZ	7.7
Jamaica	Stimulation (stunted children)	HAZ	11.5
South Africa	Unconditional cash transfer	HAZ	10

Study and Forest Plot



Note: The forest plot describes standard mean difference, 95 percent lower and upper bound confidence interval in parentheses, and sample size (N = number). The standard mean difference and confidence interval were calculated by Comprehensive Meta-Analysis software. Bracketed numbers correspond to the numbered studies in References. Study [50, 51] use National Center for Health Statistics growth reference data to compute standardized z-score, and study [32, 36, 38] use WHO 2006 growth reference. Study [6, 14, 35] is not clear which growth reference data is used for computing the height for age z-score, but given they are published relatively recently, they are likely to use WHO 2006 growth reference. Study [5] height z-score is standardized by subtracting the comparison group mean and dividing by that group's standard deviation for people of the same age and gender. CCT = conditional cash transfer; MCH = maternal and child health; WHO = World Health Organization. HAZ = Height-for-age z-score.

a. For The Gambia study [20], each gender estimate is included in the forest plot because total estimate is not available in the article. Only boy's estimate is available for Nicaragua study [6].

b. For Mexico study [8], it is not included in this forest plot because it looks at same average age at evaluation with [32].

c. For Jamaica study [51], given the combined intervention information is not available in the article, stimulation intervention compares "stimulation only" and "control group." Similarly, supplementation intervention compares "supplementation only" and "control group."

d. For Nepal study [45], "multiple micronutrient" treatment group compared to the control group is used to compute the effect size.

Table 2.1. Impact Evaluations Investigating Cognitive Development

	Study	Country (Project)	Average Age at Intervention (Years)	Average Length of Exposure (Years)[a]	Age at Evaluation (Years)	Evaluated Intervention	Reviewed Outcomes
Nutrition	Kramer and others 2008a [27]	Belarus (Promotion of Breastfeeding Intervention Trial [PROBIT])	0	1	6	breastfeeding promotion	abbreviated IQ (total score)*; abbreviated performance IQ; nonverbal subscales
	Pongcharoen 2010 [38]	Thailand (micronutrient supplementation to children)	0.5	0.5	9	micronutrients and fortified food for children (Iron and/or zinc supplementation)	executive function (processing speed); full-scale IQ; performance IQ; nonverbal cognition (Raven's matrices)
	Alderman and others 2014 [1]	Gambia, The (maternal supplementation)	in utero	0.5 (DR1)	16–22	vitamins, micronutrients, or fortified food for pregnant women (protein biscuits)	executive function (backward digit span); nonverbal cognition (Raven's matrices)
	Walker and others 2005 [52][b]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	17–18	supplementary feeding	full-scale IQ; performance IQ; nonverbal cognition (Raven's matrices)
	Walker and others 2011 [55][b]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	supplementary feeding	full-scale IQ; performance IQ
	Maluccio and others 2009 [31][c]	Guatemala (INCAP supplementary feeding to children)	0	5.3	25–42	supplementary feeding	nonverbal cognition (Raven's matrices)**
Early Learning/ Childcare	Walker and others 2010 [54]	Jamaica (stimulation to low birthweight infants)	0	2	6	stimulation	executive function (short-term memory)***; full-scale IQ; performance IQ**

	Fox and others 2011 [17]	Romania (Bucharest Early Intervention Project)	1.88	2.7	8	stimulation (foster care)	executive function (processing speed); executive function (working memory); perceptual organization full-scale IQ*
	Bos and others 2009 [11]	Romania (Bucharest Early Intervention Project)	1.88	2.7	8	stimulation (foster care)	executive function (spatial working memory); executive function (stockings of Cambridge)
	Walker and others 2000 [51]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	11–12	stimulation	executive function (processing speed); full-scale IQ**; nonverbal cognition (Raven's matrices)**; performance IQ*
	Walker and others 2005 [52][b]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	17–18	stimulation	full-scale IQ**; nonverbal cognition (Raven's matrices)*; performance IQ*; working memory
	Gertler and others 2013 [18]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	stimulation	cognitive factor score***
	Walker and others 2011 [55][b]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	stimulation	full-scale IQ***; performance IQ***
Health	Cas 2012 [12]	Indonesia (Safe Motherhood program)	in utero	3	11–14	Access to obstetric and child health care	nonverbal cognition (Raven's matrices)***
Health	Ozier 2013 [36]	Kenya (primary school deworming project)	0	1	8–15	deworming	cognitive factor score**; nonverbal cognition (Raven's matrices)***
Social Protection	Behrman and others 2008 [8]	Mexico (Progresa)	1.5	1.5 (DR2)	7–11	CCT	abbreviated performance IQ

Manley, Fernald, and Gertler 2012 [32]	Mexico (Progresa)	1	1.5 (DR2)	8–10	CCT—conditionalities	abbreviated cognitive performance IQ
					CCT—cash	abbreviated cognitive performance IQ*
Barham and others 2014 [6]	Nicaragua (Red de Protección Social)	in utero	3 (DR2)	10 (boys)	CCT	executive function (processing speed)**; cognitive factor score***; nonverbal cognition (Raven's matrices)**

Note: Bracketed numbers correspond to numbered studies in References. More details for each study are found in appendix A. CCT = conditional cash transfer; DR = dose response; INCAP = Instituto de Nutrición de Centroamérica y Panamá; IQ = intelligence quotient.

a. DR in the length of exposure means the intervention period in terms of the dose response. DR is either randomized rotation (DR1) or phase-in (DR2). In terms of dose response, for instance, DR1 indicates the study from The Gambia where treatment group receives protein biscuit only in utero whereas control group receives it only in postpartum, and length of exposure is the length of intervention for treatment. DR2 describes the dose response where early and late treatment effect is compared, and length of exposure is the difference of the intervention period between treatment and control group.

b. Jamaica [52, 55] each has a multiple intervention arm, and each intervention type has a separate row for these studies.

c. INCAP provided supplementation to pregnant and lactating women but could not isolate effects as children could also receive the supplement after birth, and the study lacked power to evaluate the intervention by developmental period.

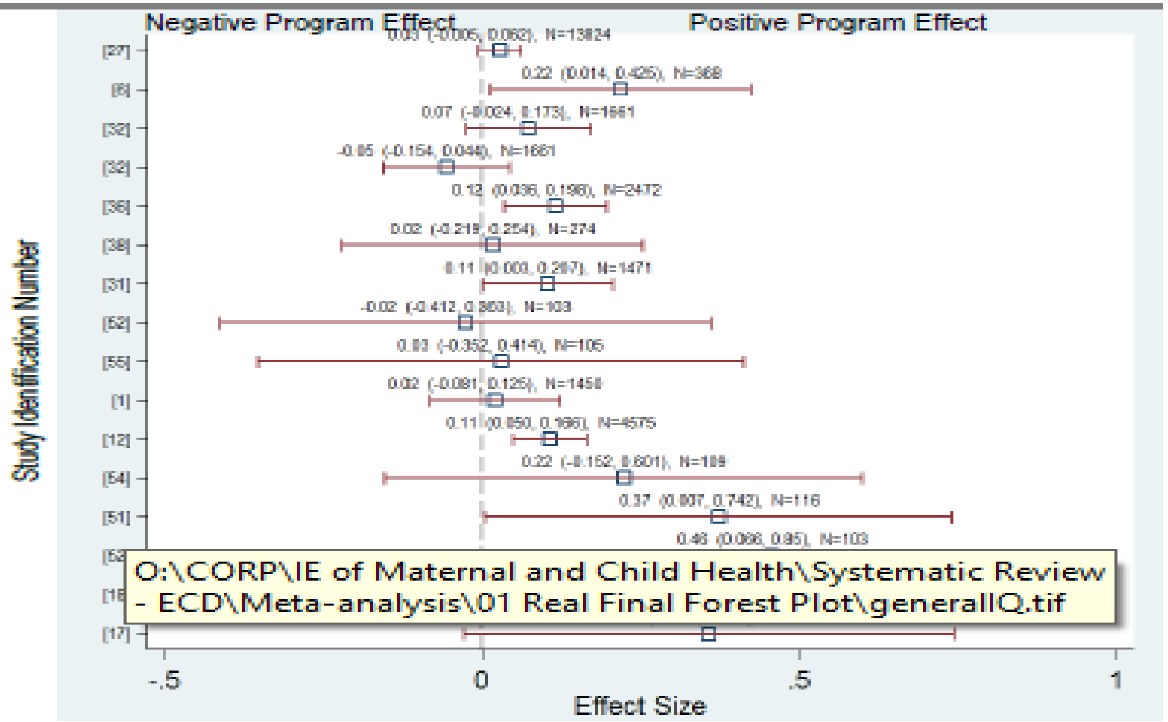
* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

Figure 2.1. Forest Plot for General Intelligence

	Intervention	Measurement	Average Age at Evaluation (years)
Belarus	Breastfeeding promotion	WASI	6.5
Nicaragua[a]	CCT	Raven's matrices	10
Mexico[b]	CCT cash	WASI	9
Mexico[b]	CCT conditionality	WASI	9
Kenya	Deworming	Raven's matrices	10
Thailand	Nutrition (child, micronutrient)	WISC-III	9
Guatemala[c]	Nutrition (child, SF)	Raven's matrices	32.3
Jamaica[d]	Nutrition (stunted children)	WAIS	17.5
Jamaica[d]	Nutrition (stunted children)	WAIS	22
Gambia, The	Nutrition (mother)	Raven's matrices	19.6
Indonesia	Safe motherhood program	Raven's matrices	12.5
Jamaica	Stimulation (LBW children)	WPPSI	6
Jamaica[d]	Stimulation (stunted children)	WISC-R	11.5
Jamaica[d]	Stimulation (stunted children)	WAIS	17.5
Jamaica[d, e]	Stimulation (stunted children)	Cognitive factor	22
Romania	Stimulation (foster care)	WISC-IV	8



Note: The forest plot describes standardized mean difference, 95 percent lower and upper bound confidence interval in parentheses, and sample size (N = number). The standardized mean difference and confidence interval were calculated by Comprehensive Meta-Analysis software. Bracketed numbers correspond to the numbered studies in References. The WASI, WISC, WAIS, and WPPSI reported in this forest plot use total scale scores (i.e., full-scale IQ). CCT = conditional cash transfer; WASI = Wechsler abbreviated scale of intelligence; WISC = Wechsler intelligence scale for children; WAIS = Wechsler adult intelligence scale; WPPSI = Wechsler preschool and primary scale of intelligence. LBW = Low birthweight. SF = supplementary feeding.

a. Nicaragua study [6] includes Cognitive outcome, but they are measured through Denver Development Screening Test, which is not necessarily comparable to other Wechsler scale. Therefore, Nicaragua study uses Raven's Colored Matrices included in the study.

b. For Mexico study [8], it is not included in this forest plot because it looks at same average age at evaluation with [32].

c. Guatemala study [31] uses first three of five scales in Raven's matrices as non-verbal cognitive ability outcome.

d. For Jamaica studies [18, 51, 52, 55] on stunted children, the stimulation compares "stimulation only + stimulation and supplementation" vs "no intervention + supplementation only". Similarly, the supplementation compares "supplementation + supplementation + stimulation" vs "no intervention + stimulation".

e. Jamaica study [18] uses (i) WRAT math, (ii) WRAT reading comprehension, (iii) PPVT, (iv) Verbal analogies, (v) Raven's matrices, (vi) WAIS full-scale IQ tests to compute cognitive factor through factor analysis.

Chapter 3
Language Development

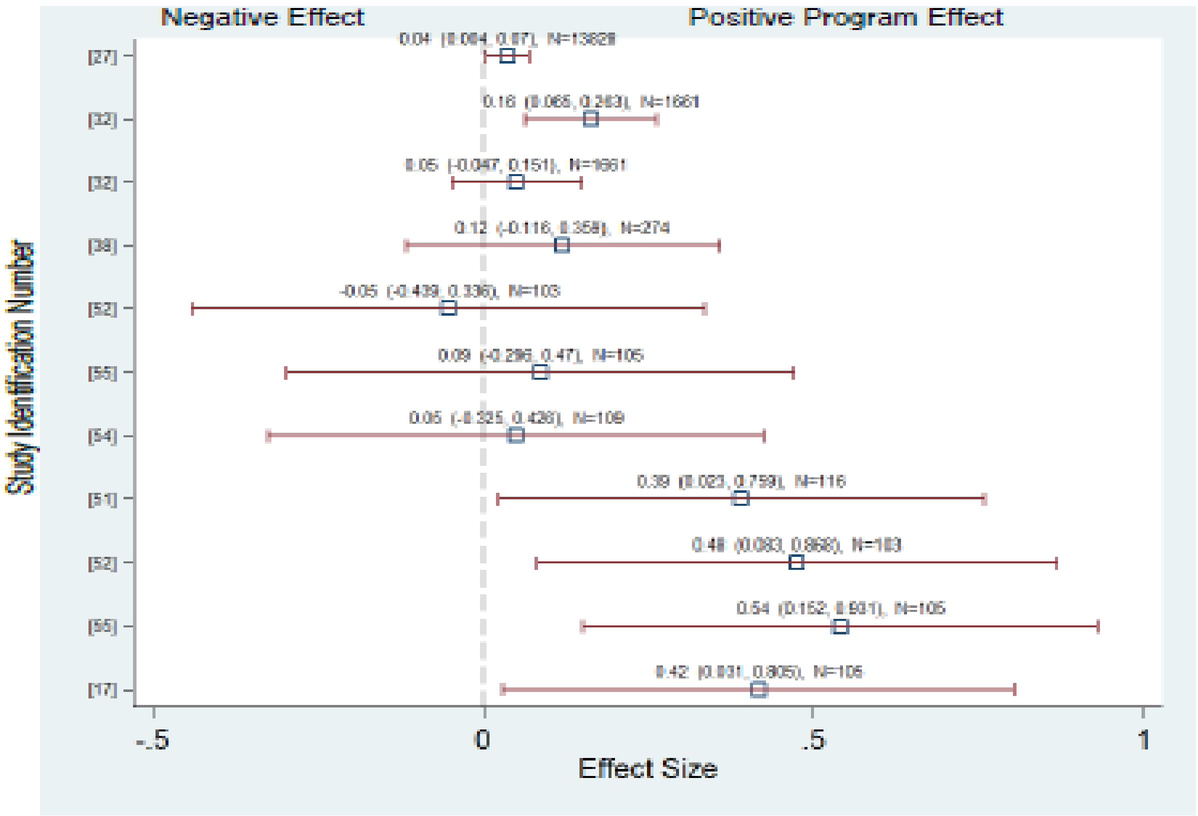
Table 3.1. Impact Evaluations Investigating Language Development

	Study	Country (Project)	Average Age at Intervention (Years)	Average Length of Exposure (Years)[b]	Age at Evaluation (Years)	Evaluated Intervention	Reviewed Outcomes
Nutrition	Kramer and others 2008a [27]	Belarus (Promotion of Breastfeeding Intervention Trial [PROBIT])	0	1	6	breastfeeding promotion	reading ability*; verbal abilities (abbreviated test)**; vocabulary**
Nutrition	Pongcharoen 2010 [38]	Thailand (micronutrient supplementation to children)	0.5	0.5	9	micronutrients and fortified food for children (iron and zinc supplementation)	verbal abilities
Nutrition	Alderman and others 2014 [1]	Gambia, The (maternal supplementation)	in utero	0.5 (DR1)	16–22	vitamins, micronutrients, or fortified food for pregnant women (protein biscuits)	vocabulary (expressive and receptive)
Nutrition	Walker and others 2000 [51][a]	Jamaica (stimulation and supplementation to stunted	1.55	2	11–12	supplementary feeding	receptive vocabulary; verbal abilities; vocabulary
Nutrition	Walker and others 2005 [52][a]	Jamaica (stimulation and supplementation to stunted	1.55	2	17–18	supplementary feeding	reading abilities; receptive vocabulary; verbal abilities; verbal analogies
Nutrition	Walker and others 2011 [55][a]	Jamaica (stimulation and supplementation to stunted	1.55	2	22	supplementary feeding	reading abilities; verbal abilities
Nutrition	Maluccio and others 2009 [31]	Guatemala (INCAP supplementary feeding to children)	0	5.3	25–42	supplementary feeding	reading abilities**
Early Learning/Childcare	Martínez, Naudeau, and Pereira 2012 [35]	Mozambique (preschool)	3.45	1.5	5–9	quality early childhood and preprimary program	receptive vocabulary
Early Learning/Childcare	Walker and others 2010 [54]	Jamaica (stimulation to low birthweight Infants)	0	2	6	stimulation	reading abilities; receptive vocabulary; verbal abilities

	Fox and others 2011 [17]	Romania (Bucharest Early Intervention Project)	1.88	2.7	8	stimulation (foster care)	verbal abilities**
	Walker and others 2000 [51][a]	Jamaica (stimulation and supplementation to stunted	1.55	2	11–12	stimulation	receptive vocabulary; verbal abilities**; vocabulary**
	Walker and others 2005 [52][a]	Jamaica (stimulation and supplementation to stunted	1.55	2	17–18	stimulation	reading***; receptive vocabulary**; verbal abilities**; verbal analogies**
	Walker and others 2011 [55][a]	Jamaica (stimulation and supplementation to stunted	1.55	2	22	stimulation	reading abilities***; verbal abilities***
Health	Ozier 2013 [36]	Kenya (primary school deworming project)	0	1	8–15	deworming	receptive vocabulary*
Social Protection	Secretariat of Social Development 2008 [8]	Mexico (Progresa)	1.5	1.5 (DR2)	7–11	CCT	reading comprehension; verbal abilities (abbreviated test)**
	Manley, Fernald, and Gertler 2012 [32]	Mexico (Progresa)	1	1.5 (DR2)	8–10	CCT—conditionalities	verbal abilities (abbreviated test)
						CCT—cash	verbal abilities (abbreviated test)***
	Barham and others 2014 [6]	Nicaragua (Red de Protección Social)	in utero	3 (DR2)	10 (boys)	CCT	receptive vocabulary**
	Rackstraw 2014 [39]	Honduras (Programa de Asignación Familiar)	1.5	2	13–15	CCT	reading abilities*
	DSD, SASSA and UNICEF 2012 [14]	South Africa (Child Support Grant)	1	2.5	10	unconditional or targeted income support	reading abilities
		India	0	continuous	6–8	adequate sanitation	reading*

Figure 3.1. Forest Plot for Verbal Abilities

Country	Intervention	Measurement	Average Age at Evaluation (years)	Study and Forest Plot
Belarus	Breastfeeding	WASI	6.5	
Mexico[a]	CCT cash	WASI	9	
Mexico[a]	CCT conditionality	WASI	9	
Thailand	Nutrition (child, micronutrient)	WISC-III	9	
Jamaica[a]	Nutrition (stunted children, SF)	WAIS	17.5	
Jamaica[a]	Nutrition (stunted children, SF)	WAIS	22	
Jamaica	Stimulation (LBW children)	WPPSI	6	
Jamaica[b]	Stimulation (stunted children)	WISC-R	11.5	
Jamaica[b]	Stimulation (stunted children)	WAIS	17.5	
Jamaica[a]	Stimulation (stunted children)	WAIS	22	
Romania	Stimulation (foster care)	WISC-IV	8	



Note: The forest plot shows standard mean difference, 95 percent lower and upper bound confidence interval in parentheses, and sample size (N=number). The standard mean difference and confidence interval were calculated by Comprehensive Meta-Analysis software. Bracketed numbers correspond to numbered studies in References. All the results come from the verbal abilities score calculated within each test (WASI, WISC, WAIS, WPPSI). CCT = conditional cash transfer; WASI = Wechsler abbreviated scale of intelligence; WISC = Wechsler intelligence scale for children; WAIS = Wechsler adult intelligence scale; WPPSI = Wechsler preschool and primary scale of intelligence. LBW = Low birthweight. SF = Supplementary feeding.

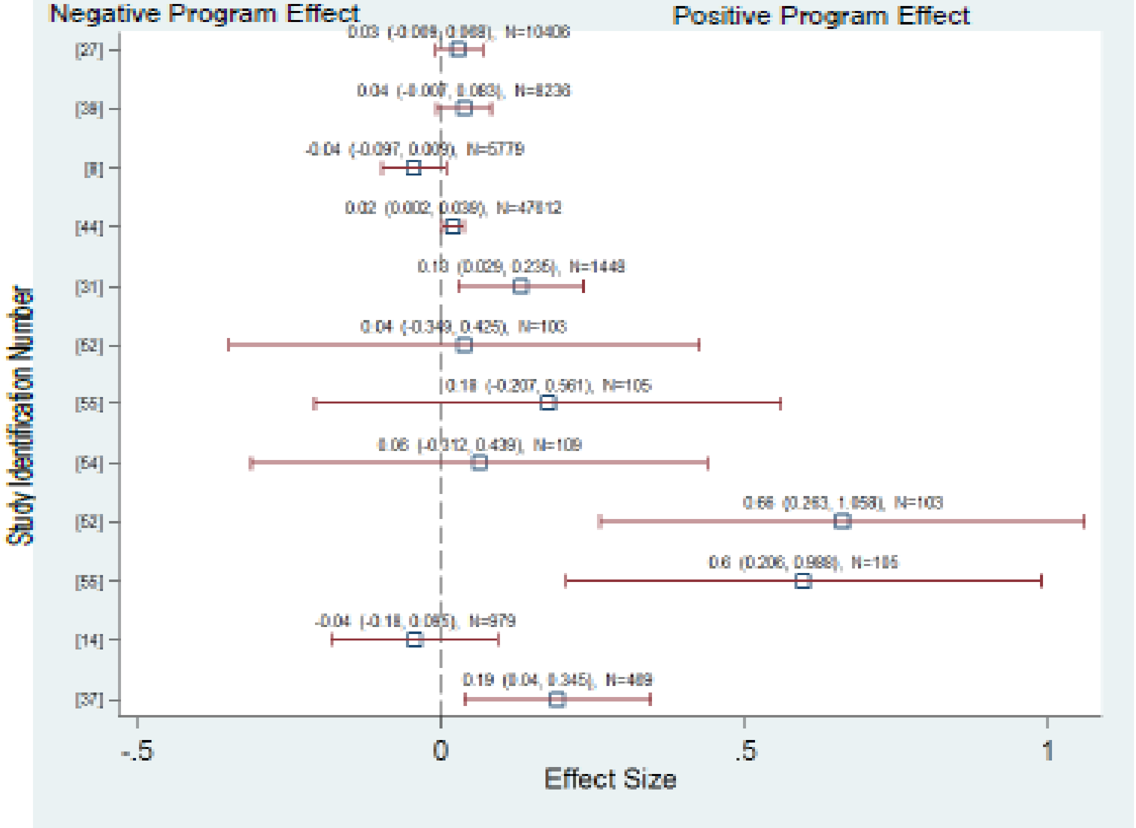
a. Mexico study [8] is not included in this forest plot given that it looks at same average age at evaluation with [32].

b. For Jamaica studies [51, 52, 55] on stunted children, the stimulation compares "stimulation only + stimulation and supplementation" versus "no intervention + supplementation only." Similarly, the supplementation compares "supplementation + supplementation + stimulation" versus "no intervention + stimulation."

Figure 3.2. Forest Plot for Reading and Literacy

Country	Intervention	Measurement	Average Age at Evaluation (years)
Belarus	Breastfeeding	Reading ability (TRAP)	9
Honduras	CCT	Literacy	14
Mexico	CCT	Ability to read	9
India	Sanitation	Recognizing letters	6
Guatemala	Nutrition (child, SF)	IARCT	32.3
Jamaica[a]	Nutrition (stunted children, SF)	Group reading test (RCC)	17.5
Jamaica[a]	Nutrition (stunted children, SF)	WRAT (Reading (log))	22
Jamaica	Stimulation (LBW children)	ERA (sqrt)	6
Jamaica[a]	Stimulation (stunted children)	Group reading test (RCC)	17.5
Jamaica[a]	Stimulation (stunted children)	WRAT (Reading (log))	22
South Africa[b]	UCT	Ability to read a story	10
India	Women's political reservation	EGRA	8

Study and Forest Plot



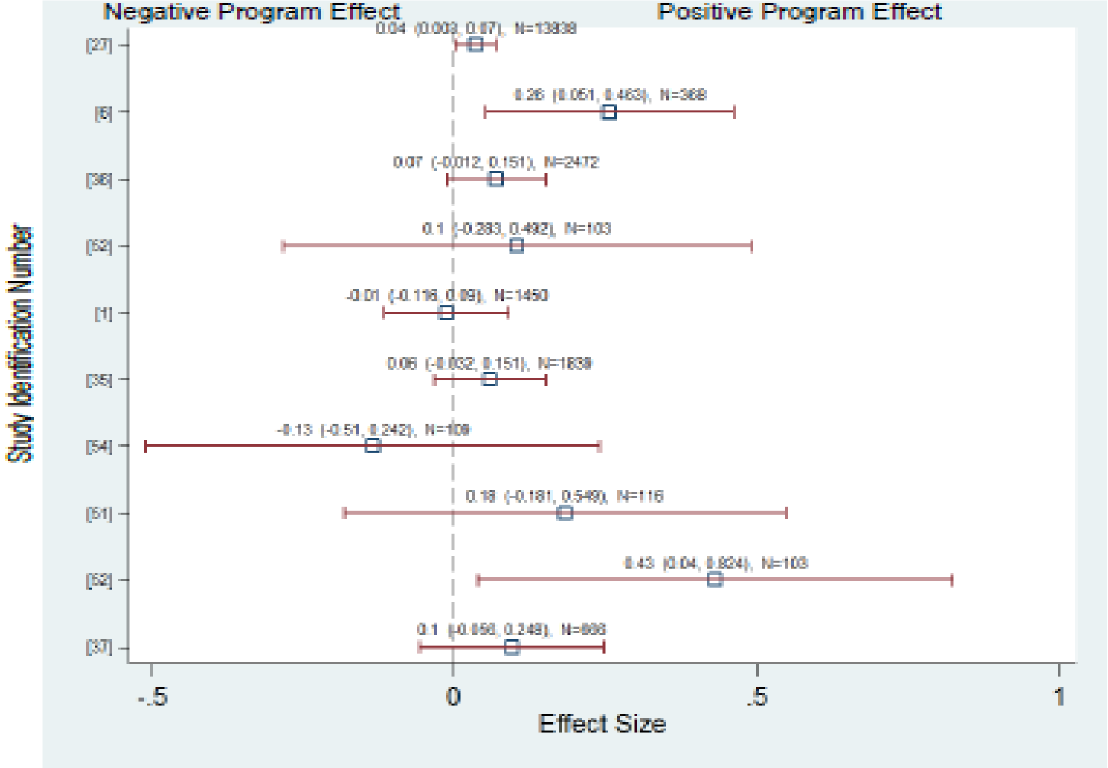
Note: The forest plot describes standard mean difference, 95 percent lower and upper bound confidence interval in parentheses, and sample size (N = number). The standard mean difference and confidence interval were calculated by Comprehensive Meta-Analysis software. Bracketed numbers correspond to the numbered studies in References. CCT = conditional cash transfer; UCT = unconditional cash transfer. TRAP = Teacher Ratings of Academic Performance. SF = Supplementary feeding. LBW = Low birthweight. IARCT = Inter-American reading and comprehension test. RCC = Reading context comprehension. WRAT = Wide Range Achievement Test. ERA = Early reading assessment. EGRA = Early grade reading assessment.

a. For Jamaica studies [52, 55] on stunted children, the stimulation compares "stimulation only + stimulation and supplementation" versus "no intervention + supplementation only." Similarly, the supplementation compares "supplementation + supplementation + stimulation" versus "no intervention + stimulation."

b. For South Africa study [14], the outcome is measured through the Early Grade Reading Assessment in which a child has to do a timed reading of letters and familiar words.

Figure 3.3. Forest Plot for Vocabulary

Country	Intervention	Measurement	Average Age at Evaluation (years)	Study and Forest Plot
Belarus	Breastfeeding promotion	WASI	6.5	
Nicaragua[a]	CCT	TVIP[b] (boy)	10	
Kenya	Deworming	PPVT	10	
Jamaica[c]	Nutrition (stunted children, SF)	PPVT	17.5	
Gambia, The	Nutrition (mother)	MHVT	19.6	
Mozambique	QEC and PPP	TVIP[b]	7	
Jamaica	Stimulation (LBW children)	PPVT	6	
Jamaica[c]	Stimulation (stunted children)	PPVT	11.5	
Jamaica[c]	Stimulation (stunted children)	PPVT	17.5	
India	Women's political reservation	RV	8	



Note: The forest plot describes standard mean difference, 95 percent lower and upper bound confidence interval in parentheses, and sample size (N = number). The standard mean difference and confidence interval were calculated by Comprehensive Meta-Analysis software. Study numbers in brackets correspond to the numbered studies in References. CCT = conditional cash transfer; PPVT = Peabody Picture Vocabulary Test; TVIP = Test de Vocabulario en Imagenes Peabody; WASI = Wechsler abbreviated scale of intelligence. SF = supplementary feeding. LBW = Low birthweight. MHVT = Mill Hill Vocabulary Test. RV = Receptive vocabulary. QEC = Quality early childhood. PPP = Pre-primary program.

a. Nicaragua study [6] only reports boy's outcome.

b. TVIP is a Spanish version of PPVT.

c. For Jamaica studies on stunted children, the stimulation compares "stimulation only + stimulation and supplementation" versus "no intervention + supplementation only." Similarly, the supplementation compares "supplementation + supplementation + stimulation" versus "no intervention + stimulation."

Table 4.1. Impact Evaluations Investigating Socioemotional Development

	Study	Country (Project)	Average Age at Intervention (Years)	Average Length of Exposure (Years)[b]	Age at Evaluation (Years)	Evaluated Intervention	Reviewed Outcomes
Nutrition	Kramer and others 2008b [28]	Belarus (Promotion of Breastfeeding Intervention Trial [PROBIT])	0	1	6	breastfeeding promotion	strength and difficulties questionnaire (total difficulties)
Nutrition	Pongcharoen 2010 [38]	Thailand (micronutrient supplementation to children)	0.5	0.5	9	micronutrients and fortified food for children	Freedom from Distractibility Index
Nutrition	Walker and others 2011 [55][a]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	supplementary feeding	anxiety; depression; involved in a physical fight; involved in a violent crime; social inhibition; weapon use
Early Learning/Childcare	Walker and others 2010 [54]	Jamaica (stimulation and supplementation to stunted children)	0	2	6	stimulation	attention (map search, opposite-same (switching)); strength and difficulties questionnaire (total difficulties)**
Early Learning/Childcare	Humphreys and others 2015 [23]	Romania (Bucharest Early Intervention Project)	1.88	2.7	12	stimulation (foster care)	externalizing behavior**; hyperactivity; internalizing behavior
Early Learning/Childcare	Walker and others 2006 [53]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	17–18	stimulation	anxiety***; attention deficit**; depression**; hyperactivity; oppositional behavior*; self-esteem**
Early Learning/Childcare	Raine and others 2003 [41]	Mauritius (Child Health Project)	3	2	17	quality early childhood and preprimary program	anxiety; attention problem; hyperactivity**
Early Learning/Childcare	Gertler and others 2013 [18]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	stimulation	externalizing behavior factor; internalizing behavior factor**
Early Learning/Childcare	Walker and others 2011 [55][a]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	stimulation	anxiety; depression**; involved in a physical fight*; involved in a violent crime**; social inhibition*; weapon use

	Raine and others 2003 [41]	Mauritius (Child Health Project)	3	2	23	quality early childhood and preprimary program	court-reported criminal offenders*; self-reported criminal offenders**
Social Protection	Behrman and others 2008 [8]	Mexico (Progresa)	1.5	1.5 (DR)	7–11	CCT	strength and difficulties questionnaire**
	Manley, Fernald, and Gertler 2012 [32]	Mexico (Progresa)	1	1.5 (DR)	8–10	CCT—conditionalities	strength and difficulties questionnaire**
						CCT—cash	strength and difficulties questionnaire

Note: Bracketed numbers correspond to numbered studies found in References. More details for each study are found in appendix A. CCT = conditional cash transfer; DR = dose response; INCAP = Instituto de Nutrición de Centroamérica y Panamá.

a. Jamaica [55] has a multiple intervention arm, and each intervention type has a separate row for this study.

b. DR in the length of exposure means intervention period in terms of the Dose Response. Specifically, DR here describes the dose response where early and late treatment effect is compared, and length of exposure is the difference of the intervention period between treatment and control group.

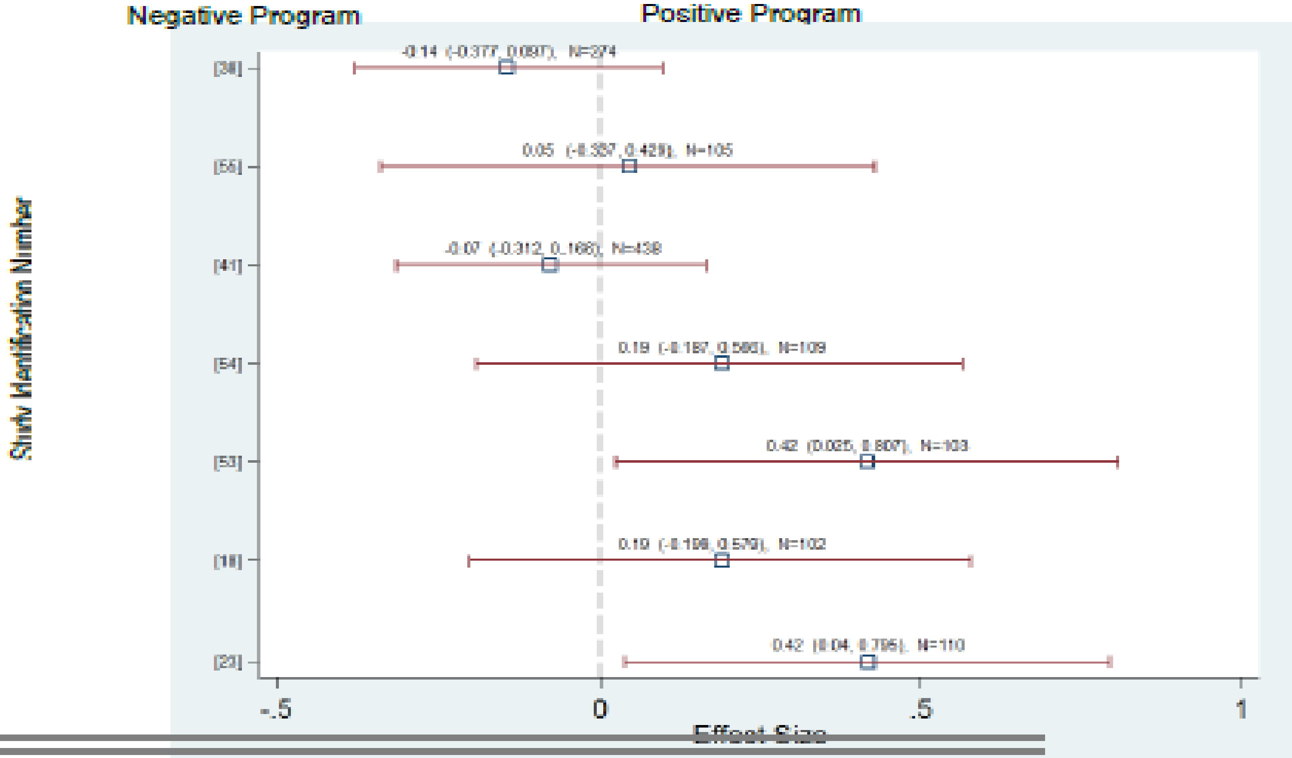
* Statistically significant at 10 percent.

** Statistically significant at 5 percent.

*** Statistically significant at 1 percent.

Figure 4.1. Forest Plot for Socioemotional Outcomes

Countr	Intervention	Measurement	Average Age at Evaluation (years)
Thailand	Nutrition (child micronutrient)	Freedom from DI[a]	9
Jamaica	Nutrition (stunted children, SF)	Social inhibition[b]	22
Mauritius	QEC and PPP	Attention	17
Jamaica	Stimulation (LBW	Attention (map search)[d]	6
Jamaica[e]	Stimulation (stunted children)	Attention deficit[f]	17.5
Jamaica[e]	Stimulation (stunted children)	Externalizing BF[g]	22
Romania	Stimulation (foster care)	Externalizing symptom	12



Note: The forest plot describes standard mean difference and 95 percent lower and upper bound confidence interval in parentheses (calculated by Comprehensive Meta-Analysis software) as well as sample size (N=number). Bracketed numbers correspond to numbered studies in References. Externalizing behavior scores in [28] were measured through supplemental behavior questions from the Canadian National Longitudinal Survey of Children and Youth, assessed by teachers but not included because details are lacking. Argentina's quality early childhood and preprimary program [9] is excluded because it measures attention using teacher assessment questionnaires ("How many of your students pay attention in class?") in administrative records of the National Education Ministry (i.e., National Education Assessment Operation). DI = Distractibility index. SF = supplementary feeding. LBW = Low birthweight. QEC = Quality early childhood. PPP = Pre-primary program. BF = Behavior factor.

a. Freedom from distractibility index in [38] is derived from arithmetic and digit span subtests.
b. Social inhibition in [55] is measured through 3 subscales from the inventory on Interpersonal Problems.
c. Attention problems in [41] is measured through Revised Behavior Problem Checklist, which is not comparable with other socioemotional outcomes.
d. Attention (Map Search) in [54] is measured through Test of Everyday Attention for Children.
e. For Jamaica studies [18, 53] on stunted children, the stimulation compares "stimulation only + stimulation and supplementation" versus "no intervention + supplementation only." Similarly, the supplementation compares "supplementation + supplementation + stimulation" versus "no intervention + stimulation."
f. Attention deficit in [53] is measured through Conners' Parent Rating Scale (short form).
g. Externalizing behavior factor in [18] is from the factor analysis of the WRAT math, WRAT reading comprehension, PPVT, verbal analogies, Raven matrices, and WAIS full scale intelligence tests.

Table 5.1. Impact Evaluations Investigating Schooling Outcomes

		Study	Country (Project)	Average Age at Intervention (Years)	Average Length of Exposure (Years)[b]	Age at Evaluation (Years)	Evaluated Intervention	Reviewed Outcomes
Nutrition		Kramer and others 2008a [27]	Belarus (Promotion of Breastfeeding Intervention Trial [PROBIT])	0	1	6	breastfeeding promotion	math achievement; other subjects; reading**; writing**
		Pongcharoen 2010 [38]	Thailand (micronutrient supplementation to children)	0.5	0.5	9	micronutrients and fortified food for children (Iron and/or zinc supplementation)	English; math achievement; on-time primary school enrollment; science; Thai
		Alderman and others 2014 [1]	Gambia, The (Maternal Supplementation)	in utero	0.5 (DR1)	16–22	vitamins, micronutrients, or fortified food for pregnant women (protein biscuits)	school years completed
		Walker and others 2005 [52][a]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	17–18	supplementary feeding	math assessment
		Walker and others 2011 [55][a]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	supplementary feeding	general exams; math assessment; school years completed
		Maluccio and others 2009 [31]	Guatemala (INCAP supplementary feeding to children)	0	5.3	25–42	supplementary feeding	school years completed (men, women**)
Health		Cas 2012 [12]	Indonesia (Safe Motherhood program)	In utero	3	11–14	Access to obstetric and child health care	math assessment***; on-time primary school enrollment; school years completed**
Early Learning/Childcare		Martínez, Naudeau, and Pereira 2012 [35]	Mozambique (preschool)	3.45	1.5	5–9	quality early childhood and preprimary program	on-time primary school enrollment**
		Berlinski, Galiani, and Gertler 2009 [9]	Argentina (preprimary education)	4	1	8	quality early childhood and preprimary program	math achievement**; Spanish**

		Valdes 2011 [13]	Chile (Early Childhood Care and Education)	2.9	1.8	10	quality early childhood and preprimary program	math achievement***
		Berlinski, Galiani and Manacorda 2008 [11]	Uruguay (preschool)	4	1.5	7–15	quality early childhood and preprimary program	school years completed***
		Walker and others 2005 [52][a]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	17–18	stimulation	math assessment
		Gertler and others 2013 [18]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	stimulation	general exams*; probability of attending post-secondary school*; school years completed*
		Walker and others 2011 [55][a]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	stimulation	general exams*; math assessment**; school years completed**
Social Protection		Todd and Winters 2011 [47]	Mexico (Progresa)	2	2.8 (DR1)	6–9	CCT	on-time primary school enrollment*
		Secretariat of Social Development 2008 [8]	Mexico (Progresa)	1.5	1.5 (DR2)	7–11	CCT	school years completed
		Behrman, Parker, and Todd 2009 [7]	Mexico (Progresa)	1.5	1.5 (DR2)	6–14	CCT	on-time primary school enrollment (boys); on-time primary school enrollment (girls)*; school years completed***
		Rackstraw 2014 [39]	Honduras (Programa de Asignación Familiar)	1.5	2	13–15	CCT	school years completed***
		DSD, SASSA and UNICEF 2012 [14]	South Africa (Child Support Grant)	1	2.5	10	unconditional/targeted income support	numeracy; on-time primary school enrollment (boys); on-time primary school enrollment (girls)**; school years completed**
			Colombia	3	1.2	8–17	childcare/daycare	

Child care		Attanasio and Vera-Hernández 2004 [4]	(Hogares Communitarios)					probability of attending secondary school**
Water and Sanitation		Spears and Lamba 2013 [44]	India (Total Sanitation Campaign)	0	continuous	6–8	adequate sanitation	numeracy (6 years old)**; numeracy (7–8 years old)
		Xu and Zhang 2014 [57]	China (rural drinking water program)	1	1	18–25	access to safe water	school years completed (exposed to 0–2 years)***; school years complete (exposed to 3–5 years)
Other		Pathak and Macours 2013 [37][c]	India (women's political reservation)	pre-birth birth	3 (DR1)	8	governance (women's political reservation)	numeracy

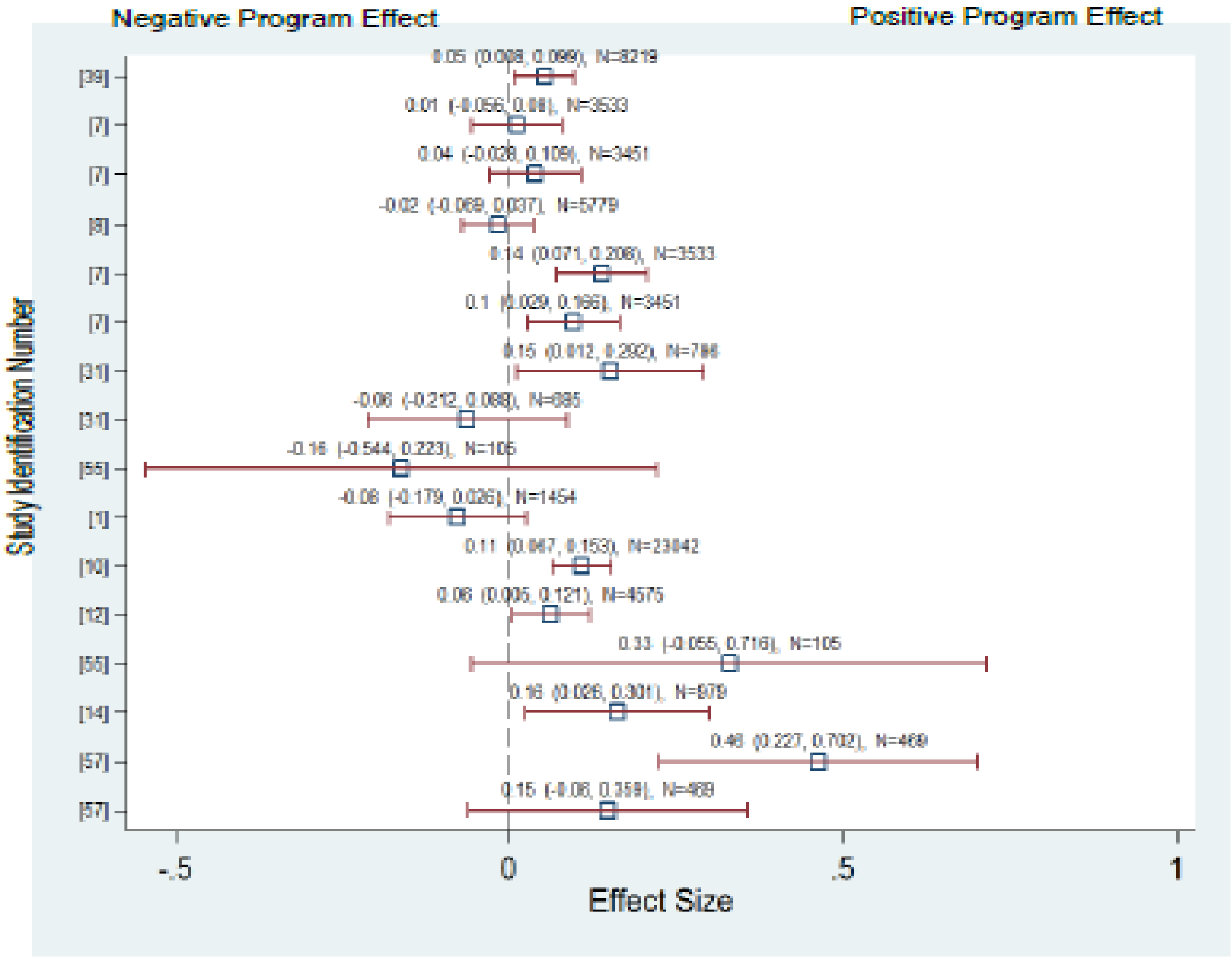
Note: Numbers in [brackets] correspond to the numbered studies in References. More details for each study are found in appendix A. CCT = conditional cash transfer; DR = dose response; INCAP = Instituto de Nutrición de Centroamérica y Panamá.

a. Jamaica [52, 55] each has a multiple intervention arm, and each intervention type has a separate row for these studies.

b. DR in the length of exposure means intervention period in terms of the Dose Response. DR is either randomized rotation (DR1) or phase-in (DR2). In terms of dose response, DR1 indicates the treatment and control group received the intervention for the same period of time but at different ages. DR2 describes the dose response where early and late treatment effect is compared, and length of exposure is the difference of the intervention period between treatment and control group.
c. India study [37] has multiple experimental arms. One treatment group is in utero when the political seats were randomized for women, and the other treatment group is between the ages of newborn and five years old during the reservation. The control group was children who were not exposed to reserved seats until six years and beyond.
* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

Figure 5.1. Forest Plot for School Years Completed

Country	Intervention	Measurement	Average Age at Evaluation (years)	Study and Forest Plot
Honduras	CCT	Highest grade attained	14	[39]
Mexico	CCT	Highest grade attained (girl)	7	[7]
Mexico	CCT	Highest grade attained (boy)	7	[7]
Mexico	CCT	School years completed	9	[8]
Mexico	CCT	Highest grade attained (girl)	10	[7]
Mexico	CCT	Highest grade attained (boy)	10	[7]
Guatemala	Nutrition (child, SF)	Highest grade completed (boy)	32.3	[31]
Guatemala	Nutrition (child, SF)	Highest grade completed (girl)	32.3	[31]
Jamaica[a]	Nutrition (stunted children)	Highest grade level	22	[55]
Gambia, The	Nutrition (mother)	Highest grade attained	19.6	[1]
Uruguay	Pre-primary program	Years of schooling	15	[10]
Indonesia	Safe motherhood program	School level attained	12.5	[12]
Jamaica[a]	Stimulation (Stunted children)	Highest grade level	22	[55]
South Africa	Unconditional cash transfer	Highest grade attained	10	[14]
China	Water quality	Highest grade attained	19	[57]
China	Water quality	Highest grade attained	22	[57]



Note: The forest plot describes standardized mean difference, 95 percent lower and upper bound confidence interval in parentheses, and sample size (N = number). The standard mean difference and confidence interval were calculated by Comprehensive Meta-Analysis software. Bracketed numbers correspond to numbered studies in References. SF = Supplementary feeding.

a. For Jamaica study [55], the stimulation compares "stimulation only + stimulation and supplementation" and "no intervention + supplementation only."

Chapter 6
Employment and Labor Market Outcomes

Table 6.1. Impact Evaluations Investigating Employment and Labor market Outcomes

	Study	Country (Project)	Average Age at Intervention (years)	Average Length of Exposure (years)	Age at Evaluation (years)	Evaluated Intervention	Reviewed Outcomes
Early Learning	Gertler and others 2013 [18] Gertler and others 2014 [19]	Jamaica (stimulation and supplementation to stunted children)	1.55	2	22	stimulation	earnings***; migration*; employment

Note: Bracketed numbers correspond to numbered studies in References. More details for each study are found in appendix a. CCT = conditional cash transfer; DR = dose response; INCAP = Instituto de Nutrición de Centroamérica y Panamá.
* Statistically significant at 10 percent.
** Statistically significant at 5 percent.
*** Statistically significant at 1 percent.

Integrated approaches focus on

- the child (stimulation and nutrition),
- the parent (maternal depression),
- and the parent-child relationship (caregiver responsiveness)
    - (knowledge and responsive skills for feeding, play, and communication)

More effective and sustainable than approaches

- consider to the child
- with little attention to the family care context.

Early Child Development and Nutrition: A Review of the Benefits and Challenges of Implementing Integrated Interventions1–4, Adv Nutr 2016;7:357–63; doi:10.3945/an.115.010363

Caregiver responsiveness

- Responsive in : feeding or play (e.g., responding appropriately to nonverbal and verbal cues of hunger, satiety, and feelings),
- effective ways of supporting responsive caregiving (14, 18).

14. Black MM, Aboud FE. Responsive feeding is embedded in a theoretical framework of responsive parenting. J Nutr 2011;141:490–4.
18. Landry SH, Smith KE, Swank PR, Zucker T, Crawford AD, Solari EF. The effects of a responsive parenting intervention on parent-child interactions during shared book reading. Dev Psychol 2012;48:969–86.

- **maternal depression** is associated with
  - **nonresponsive child-feeding behaviors** (20),
  - inadequate and excess dietary intakes (13, 21), and
  - the risk of child under- and overnutrition (22–24).

13. Bentley ME, Wasser HM, Creed-Kanashiro HM. Responsive feeding and child undernutrition in low- and middle-income countries. J Nutr 2011;141:502–7.
20. Hurley KM, Black MM, Papas MA, Caulfield LE. Maternal symptoms of stress, depression, and anxiety are related to nonresponsive feeding styles in a statewide sample of WIC participants. J Nutr 2008;138:799–805.
21. Hurley KM, Black MM, Merry BC, Caulfield LE. Maternal mental health and infant dietary patterns in a statewide sample of Maryland WIC participants. Matern Child Nutr 2015;11:229–39.
22. Patel V, Rahman A, Jacob KS, Hughes M. Effect of maternal mental health on infant growth in low income countries: new evidence from South Asia. BMJ 2004;328:820–3.
23. Surkan PJ, Kennedy CE, Hurley KM, Black MM. Maternal depression and poor early childhood growth in developing countries: systematic review and meta-analysis. Bull World Health Organ 2011;89:608–15.
24. Hughes SO, Shewchuk RM, Baskin ML, Nicklas TA, Qu H. Indulgent feeding style and children's weight status in preschool. J Dev Behav Pediatr 2008;29:403–10.

Best practice in child development interventions.

- Yousafzai et al. (12) reviewed 31 studies ; integrated early childhoodinterventions
- several keys associated with successful programs.
- Common features
  - a structured curriculum (e.g., organized by developmental stages),
  - use of low-cost materials (e.g.,homemade toys), and
  - opportunities for parents to practice play (stimulation) activities with their young children
  - feedback on how the interaction might be strengthened
  - problem solving.
- successful interventions. : fortnightly (2x a week **home visits** lasting 30–60 min)
- compliance was high in home visit programs
- in parenting groups
  - lower compliance in longer-duration programs
  - higher compliance in shorter, more intense programs).

12. Yousafzai AK, Aboud F. Review of implementation processes for integrated nutrition and psychosocial stimulation interventions. Ann N Y
Acad Sci 2014;1308:33–45.

Behavior Change Communication

Techniques

- 1) structured information and instruction;
- 2) performance activities (modeling healthy eating, practice, feedback, and positive reinforcement);
- 3) problem solving (identifying facilitators and barriers to behavior
- change and solutions to reducing barriers);
- 4) social support (peer, community, and authority support);
- 5) material (nutritional supplements); and
- 6) small media (songs, role plays, pictures, flash cards, and posters) (29).

29. Briscoe C, Aboud F. Behaviour change communication targeting four health behaviours in developing countries: a review of change techniques. Soc Sci Med 2012;75:612–21.

TABLE 1 Similarities and differences in best practices across nutrition and ECD interventions[1]

	Best practice in nutrition	Best practice in ECD
Recipients	Adolescent females, women of reproductive age, pregnant women, neonates, and infants and young children (28)	Caregivers, infants, and preschool-aged children through school entry (3)
Intervention-specific strategies[2]	Provision of health care, nutrition education, and nutrition supplements	Parenting education and support on a range of topics (e.g., importance of play and communication, positive discipline, practices, school readiness, providing support to mothers and fathers) and provision of play material and books (homemade, low-cost, or via book and toy libraries)
Intervention-sensitive strategies[3]	Agriculture (including biofortification and home-gardening) (32); social safety nets (including conditional and unconditional cash transfers, school feeding programs, household food distributions, and emergency assistance programs) (32); ECD (13, 38); schooling (32)	Social safety nets (including conditional and unconditional cash transfers (36, 37); nutrition (education, including responsive feeding, and supplements) (38, 39)
SBCC techniques	Information and instruction: communicating information and verbal instruction about responsive feeding and optimal feeding practices (type, frequency, and preparation of infant foods) (40–45)	Information and instruction: communicating information and verbal instruction about what caregivers should do with their children and why (8)
	Performance activities: modeling, practicing, and providing feedback for responsive feeding (40); modeling optimal feeding practices (amount, frequency, and preparation of infant foods) (41–45)	Performance activities: demonstrating and practicing with feedback about how to talk and play with children (8, 12)
	Problem solving: identifying barriers and solutions to support responsive feeding and optimal feeding practices (40, 41)	Problem solving: addressing maternal depression, need for family support, lack of time, lack of resources, and not knowing how to talk to infants (8, 12)
	Social support: encouraging peer (40), community (41), and authority (44) support, and support for responsive feeding and optimal feeding practices (type and amount of infant foods)	Social support: encouraging family support during intervention home visits and facilitating peer groups (8, 12)
	Material: provision of nutritional supplements (38, 39)	Material: play material (e.g., homemade, low-cost, or via toy and book libraries) (8, 12)
	Small media: illustrating responsive feeding and optimal feeding practices (amount, frequency, and preparation of infant foods) via pictures, flipcharts, and posters (8, 13, 38)	Small media: illustrating stimulation practices via posters, video, and discussion (8, 12)

[1] ECD, early child development; SBCC, social and behavior change communication.

Integrated Home-based Intervention Package (IHIP) vs Early Child Development Program (ECD)

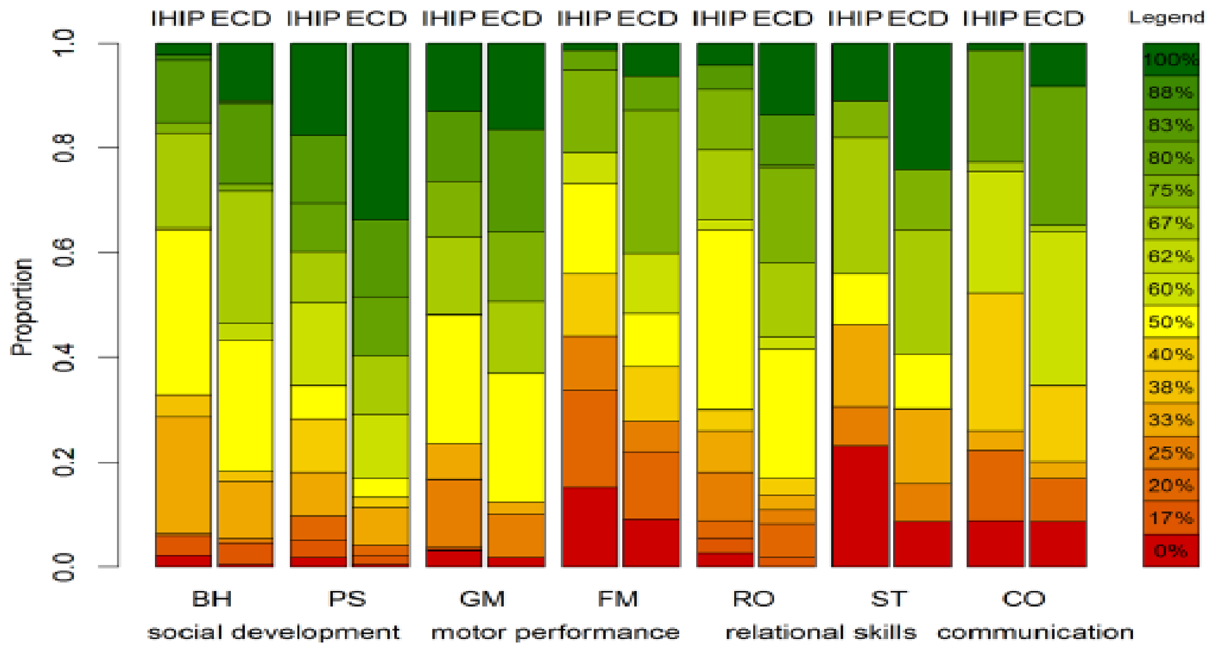


Figure 3 Percentage of ECD assessment tasks successfully completed at final assessment by proportion of children in ECD or IHIP group separated by the seven development domains. The scale on the left indicates the proportion of children. The legend on the right indicates using colour-coding the percentage of tasks fulfilled by children in the ECD or IHIP group and separated by the seven development domains. BH, basic habits; CO, communication; ECD, early child development; FM, fine motor skills; GM, gross motor skills; IHIP, integrated home-based intervention package; PS, personal and social development; RO, relationship between objects; ST, space and time.

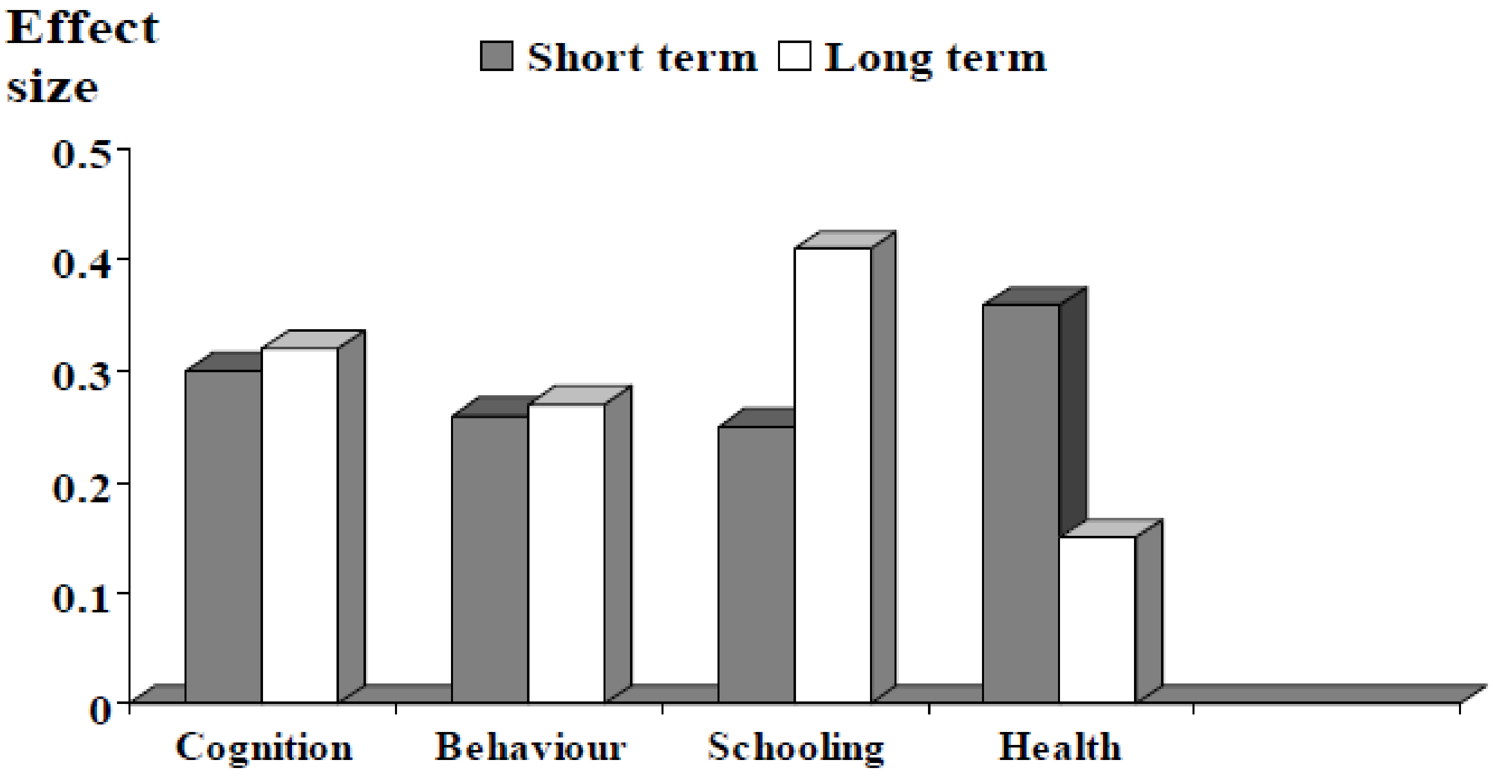
Conclusions

The home-based intervention effectively improved child development overall domains and separately by investigated domain.

Homebased strategies could be a promising component of poverty alleviation programmes seeking to improve developmental outcomes among rural Peruvian children

- Hartinger SM et al. , Impact of a child stimulation intervention on early child development in rural Peru: a cluster randomised trial using a reciprocal control design. J Epidemiol Community Health. 2017 Mar; 71(3): 217–224.

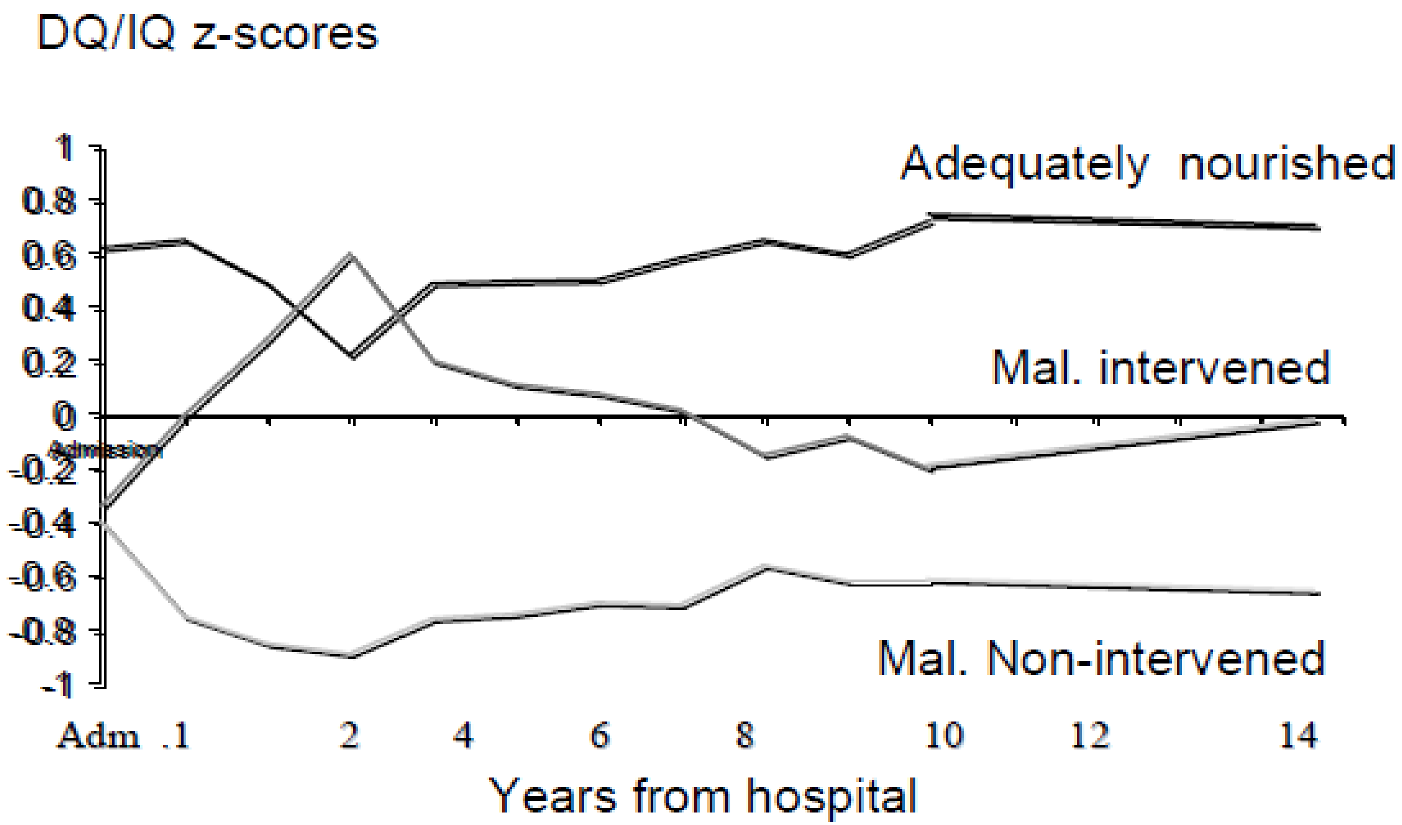
Figure 1. Overall effect sizes of early childhood interventions on child cognition, behavior, schooling and health outcomes over the short and longer term



Source: Nores & Barnett 2010

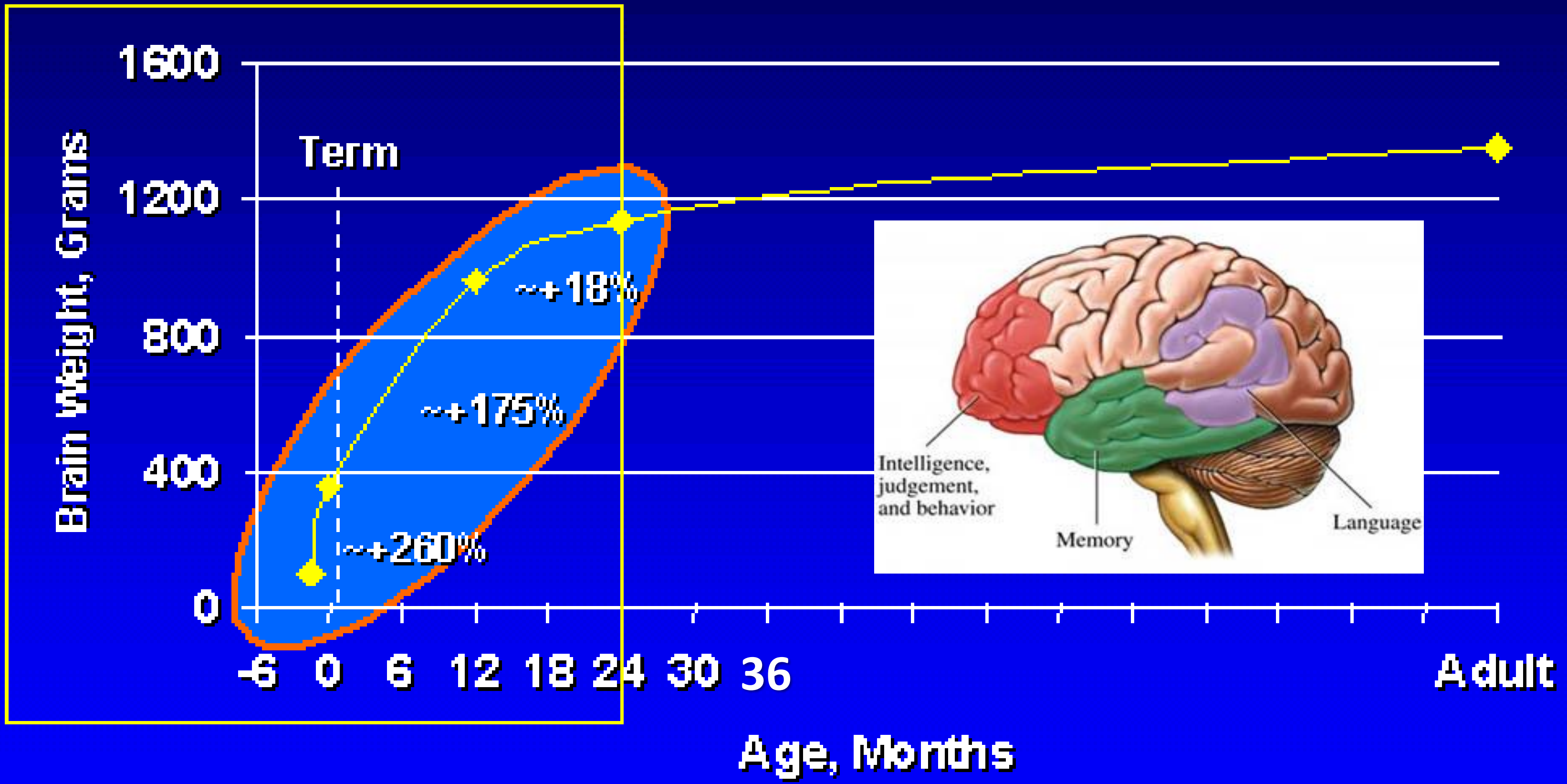
Baker-Henningham H, Boo FL. Early Childhood Stimulation Intervention in Developing Countries: A comprehensive literature review. División de Protección Social y Salud. Documento de trabajo del BID # IDB-WP-213, Banco Interamericano de Desarrollo, Septiembre 2010

Figure 2. Developmental levels of severely malnourished Jamaican children until adolescence



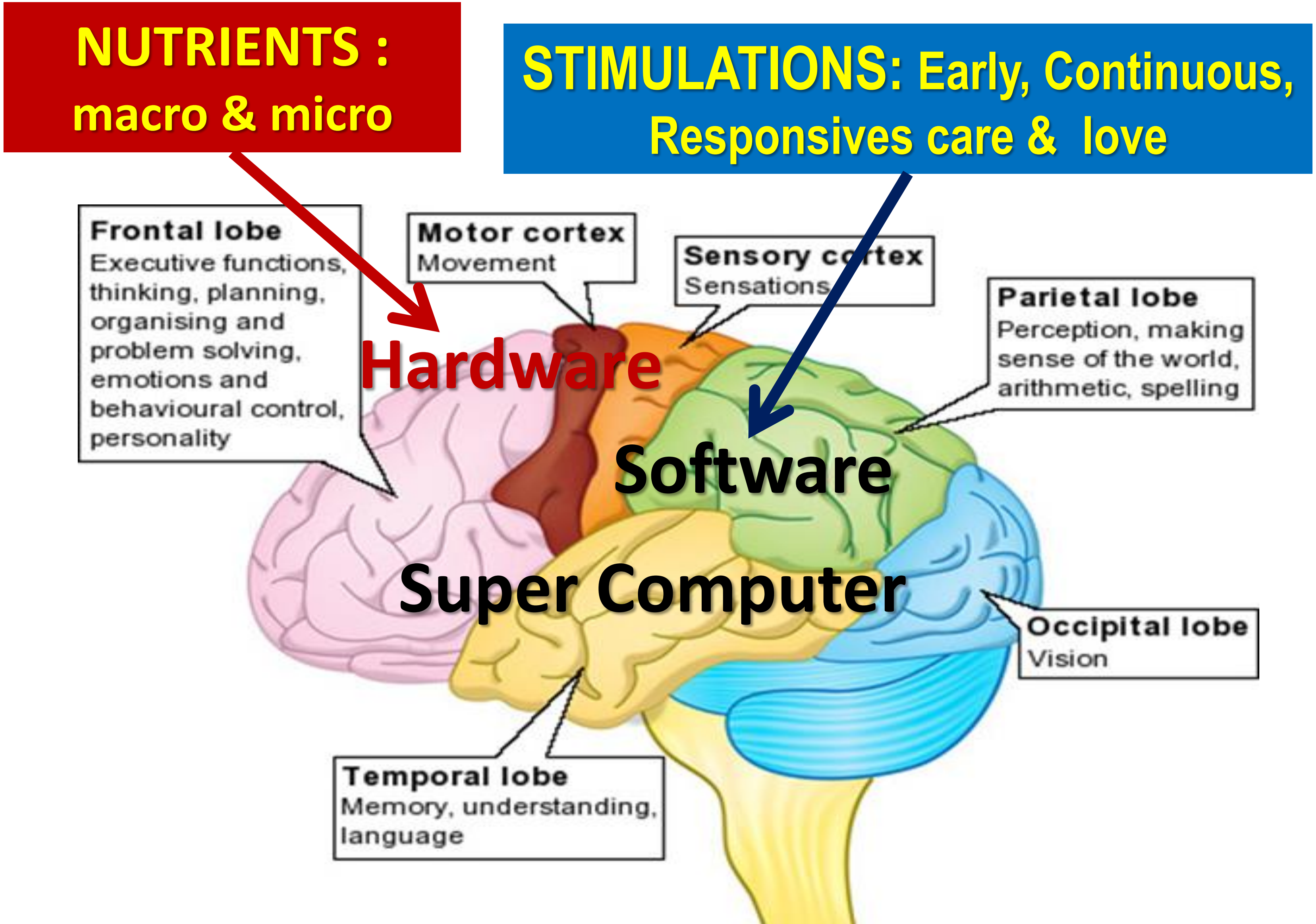
Grantham-McGregor et al, 1994

The Brain Grows ~175%* in the First 24 Months of Life: A Critical Period for Optimal Nutrition and Stimulation



*Even greater growth of ~260% is seen during the third trimester of pregnancy.

Dobbing J, et al. *Arch Dis Child.* 1973;48:757-767.


NUTRIENTS :
macro & micro
STIMULATIONS: Early, Continuous,
Responsives care & love
Frontal lobe
Executive functions, thinking, planning, organising and problem solving, emotions and behavioural control, personality
Motor cortex
Movement
Sensory cortex
Sensations
Parietal lobe
Perception, making sense of the world, arithmetic, spelling
Hardware
Software
Super Computer
Occipital lobe
Vision
Temporal lobe
Memory, understanding, language

Tabel 3.2.14
Persentase Kepemilikan KMS Anak Balita Menurut Karakteristik, Riskesdas 2010

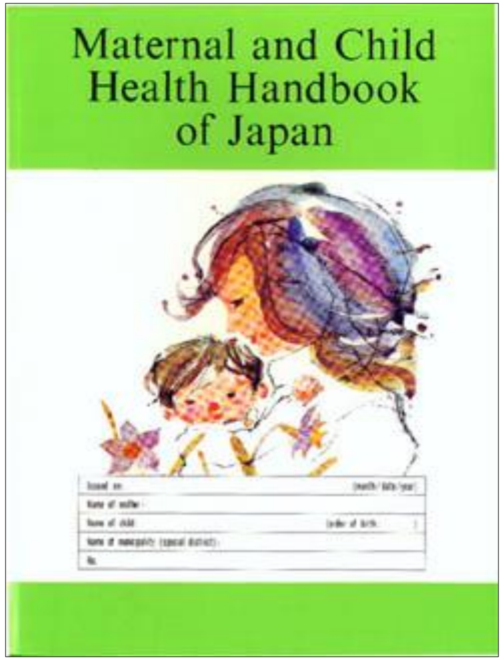
Karakteristik	Kepemilikan KMS			
	Dapat Menunjukkan	Disimpan di Tempat Lain	Sudah Hilang	Tidak Pernah Memiliki
Kelompok Umur				
0 – 5 bulan	52,0	18,6	3,4	26,0
6 – 11 bulan	51,9	20,5	8,1	19,5
12 – 23 bulan	40,5	24,1	17,7	17,6
24 – 35 bulan	26,8	25,9	29,3	17,9
36 – 47 bulan	20,8	26,5	35,1	17,6
48 – 59 bulan	15,3	[illegible]	[illegible]	[illegible]

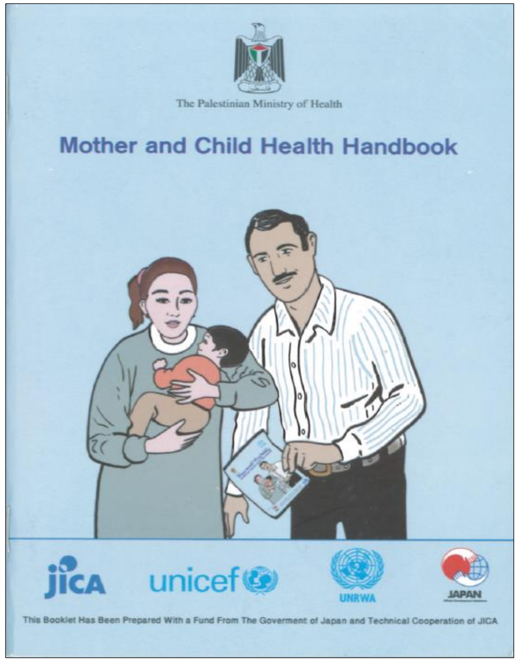
Growth Chart & Maternal Child Health Book

Tabel 3.2.16
Persentase Kepemilikan Buku KIA Anak Balita Menurut Karakteristik, Riskesdas 2010

Karakteristik	Kepemilikan Buku KIA			
	Dapat Menunjukkan	Disimpan di Tempat Lain	Sudah Hilang	Tidak Pernah Memiliki
Kelompok Umur				
0 – 5 bulan	49,7	14,7	4,6	31,0
6 – 11 bulan	44,1	18,6	9,3	28,0
12 – 23 bulan	33,5	18,9	17,0	30,6
24 – 35 bulan	21,6	20,0	26,9	31,5
36 – 47 bulan	16,4	20,3	30,9	32,4
48 – 59 bulan	12,1	17,4	37,2	33,3

Maternal & Child Health Book
for Integrating Nutrition and Early Stimulation Intervention



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I. NUTRITION

BAYI BARU LAHIR/NEONATUS (0-28 HARI)

3. PERAWATAN BAYI BARU LAHIR

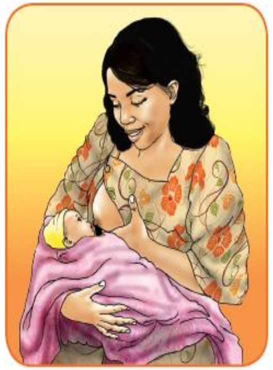
a. Pemberian ASI

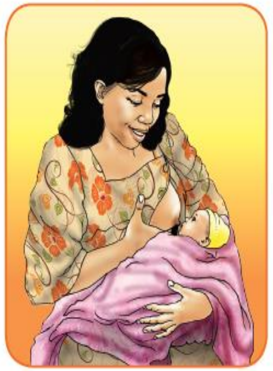
- Segera lakukan inisiasi menyusu dini (IMD).
- ASI yang keluar pertama berwarna kekuningan (kolostrum) mengandung zat kekebalan tubuh, langsung berikan pada bayi, jangan dibuang.
- Berikan hanya ASI saja sampai berusia 6 bulan (ASI Ekslusif).

Manfaat pemberian ASI:

1. Sehat, praktis dan tidak butuh biaya.
2. Meningkatkan kekebalan alamiah pada bayi.
3. Mencegah perdarahan pada ibu nifas.
4. Menjalin kasih sayang ibu dan bayi.
5. Mencegah kanker payudara.

- Berikan ASI yang pertama keluar dan berwarna kekuningan (kolostrum)
- Jangan beri makanan/ minuman selain ASI
- Susui bayi sesering mungkin
- Susui setiap bayi menginginkan, paling sedikit 8 kali sehari
- Jika bayi tidur lebih dari 3 jam, bangunkan lalu susui





- Susui dengan payudara kanan dan kiri secara bergantian
- Susui sampai payudara terasa kosong, lalu pindah ke payudara sisi lainnya

- **Susui anak dalam kondisi menyenangkan, nyaman dan penuh perhatian.**
- **Dukungan suami dan keluarga penting dalam keberhasilan ASI Eksklusif.**

MP-ASI yang baik:

1. Padat energi, protein dan zat gizi mikro (zat besi, Zinc, Kalsium, Vit. A, Vit. C dan Folat).
2. Tidak berbumbu tajam, tidak menggunakan gula, garam, penyedap rasa, pewarna dan pengawet.
3. Mudah ditelan dan disukai anak.
4. Tersedia lokal dan harga terjangkau.

UMUR	BENTUK MAKANAN	BERAPA KALI SEHARI	BERAPA BANYAK SETIAP KALI MAKAN
6 – 8 Bulan	– ASI – Makanan lumat (bubur dan makanan keluarga yang dilumatkan)	– Teruskan pemberian ASI sesering mungkin – Makanan lumat 2–3 [illegible] – Maka[illegible] selin[illegible] seha[illegible] bisku[illegible]	2 – 3 sendok makan secara bertahap hingga mencapai 1/2 gelas atau 125 ml setiap kali makan

BERI ANAK KAPSUL VITAMIN A

- Vitamin A untuk meningkatkan kesehatan mata dan pertumbuhan anak.
- Mintalah kapsul vitamin A pada bulan Februari dan Agustus di Posyandu
- Ada dua jenis kapsul Vitamin A;

Kapsul Biru
Untuk anak umur 6–11 bulan
Berikan 1 kali dalam setahun

Kapsul Merah
Untuk anak umur 1– 5 Tahun
Berikan 2 kali dalam setahun

50

Pemberian makan pada ba[illegible]

1. Anak harus mulai dikenalkan dan diberi makanan pendamping ASI sejak umur 6 bulan.
2. Makanan utama adalah makanan padat yang diberikan secara bertahap (bentuk, jumlah dan frekuensi), lihat pada tabel.
3. ASI diberikan sampai anak usia 2 tahun.

CARA MEMBUAT MP-ASI UNTUK ANAK USIA 6-9 BULAN

JANGAN MENGGUNAKAN PERALATAN DARI PLASTIK DAN MELAMIN!

BUBUR SUMSUM KACANG HIJAU

Bahan:

- 15 gr (1,5 sdm) tepung beras.
- 10 gr (1 sdm) kacang hijau, rebus, haluskan.
- 75 cc (1/3 gelas belimbing) santan encer.
- 20 gr daun bayam, iris halus.

Cara membuat:

1. Rebus kacang hijau dan daun bayam, saring dengan saringan atau blender halus, sisihkan.
2. Campurkan sedikit air dengan tepung beras hingga larut, tambahkan santan, masak di atas api kecil hingga matang.
3. Tambahkan hasil saringan no. 1, aduk rata.

PISANG LUMAT HALUS

Bahan:

- Pisang masak 1 buah.

Cara membuat:

- Cuci kulit pisang sampai bersih
- Kupas kulitnya separuh
- Keroklah pisang dengan sendok kecil
- Segera berikan kerokan pisang kepada bayi

Pemberian makan pada bayi 9-11 bulan

- Terus berikan ASI.
- Berikan MP-ASI yang lebih padat.
  Contohnya bubur nasi, nasi tim dan nasi lembek.

UMUR	BENTUK MAKANAN	BERAPA KALI SEHARI	BERAPA BANYAK SETIAP KALI MAKAN
9 – 11 bulan	– ASI – Makanan lembik atau dicincang yang mudah ditelan anak. – Makanan selingan yang dapat dipegang anak diberikan di antara waktu makan lengkap.	– Teruskan pemberian ASI – Makanan lembik 3-4 kali sehari – Makanan selingan 1-2 kali sehari.	1/2 gelas/mangkuk atau 125 ml

CARA MEMBUAT MP-ASI UNTUK ANAK USIA 9-11 BULAN

JANGAN MENGGUNAKAN PERALATAN DARI PLASTIK DAN MELAMIN!

Nasi Tim Kangkung Saos Pepaya (MP-ASI Lengkap)

Bahan:
- 50 gr nasi aron
- 10 gr ikan, haluskan
- 20 gr tempe, haluskan
- 15 gr kangkung
- 10 gr tomat
- 1 sdt minyak kelapa
- 75 cc (1/3 gelas belimbing) kaldu
- 50 gr pepaya, haluskan

Cara membuat:
1. Masukkan nasi aron, ikan, tempe, minyak kelapa ke dalam mangkok tim.
2. Tambahkan air kaldu, tim hingga matang.
3. Masukkan kangkung dan tomat, tim hingga matang.
4. Angkat, sajikan dengan saos pepaya.

Nasi Tim Kacang Merah (MP-ASI sederhana)

Bahan:
- 50 gr nasi aron
- 20 gr (2 sdm) kacang merah, tumbuk kasar
- 25 gr labu siam, iris tipis
- 1 sdt minyak kelapa

Dapat ditambahkan daun bawang, seledri, bawang bombay

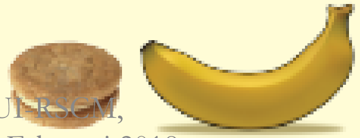
Cara membuat:
1. Letakkan nasi aron, kacang merah dan air dalam wadah tim.
2. Tambahkan minyak kelapa, tim hingga matang.
3. Tambahkan labu siam, tim hingga matang.
4. Siap dihidangkan.

PEMBERIAN MAKAN PADA ANAK USIA 1-2 TAHUN

UMUR	BENTUK MAKANAN	BERAPA KALI SEHARI	BERAPA BANYAK SETIAP KALI MAKAN
12-24 bulan	- Makanan keluarga - Makanan yang dicincang atau dihaluskan jika diperlukan - ASI	- Makanan keluarga 3-4 kali sehari - Makanan selingan 1-2 kali sehari - Teruskan pemberian ASI	- 3/4 gelas nasi/ penakar (250 ml) - 1 potong kecil ikan/ daging/ayam/telur - 1 potong kecil tempe/tahu atau 1 sdm kacang-kacangan - 1/4 gelas sayur - 1 potong buah - 1/2 gelas bubur/ 1 potong kue/ 1 potong buah

DI ATAS UMUR 2 TAHUN

- Lanjutkan beri makan makan orang dewasa.
- Tambahkan porsinya menjad 1/2 piring.
- Beri makanan selingan 2 kali sehari.
- Jangan berikan makanan manis sebelum waktu makan, sebab bisa mengurangi nafsu makan.



II. EARLY STIMULATION / LEARNING, Caregiver responsiveness (0-3 mo, 3–6 mo)

Stimulasi bayi usia 0 – 3 bulan

Dilakukan Oleh Keluarga:

- Sering memeluk dan menimang bayi dengan penuh kasih sayang.
- Gantung benda berwarna cerah yang bergerak dan bisa dilihat bayi.
- Tatap mata bayi dan ajak tersenyum, bicara dan bernyanyi.
- Perdengarkan musik/suara kepada bayi.
- Mulai 3 bulan, bawa bayi ke-luar rumah memperkenalkan lingkungan sekitar.

Stimulasi bayi usia 3 – 6 bulan

Orangtua dan aggota keluarga lainnya perlu melakukan hal berikut:

- Sering telungkupkan bayi.
- Gerakkan benda ke kiri dan kanan, di depan matanya.
- Perdengarkan berbagai bunyi-bunyian.
- Beri mainan benda yang besar dan berwarna.

EARLY STIMULATION / LEARNING, Caregiver responsiveness (6 – 12 mo)

EARLY STIMULATION / LEARNING, Caregiver responsiveness (1 – 2 y)

Stimulasi anak usia 1-2 tahun

Dilakukan Oleh Ibu/Ayah/anggota keluarga lainnya:

- Ajari berjalan diundakan/tangga
- Ajak membersihkan meja dan menyapu
- Ajak membereskan mainan
- Ajari mencoret-coret dikertas
- Ajari menyebut bagian tubuhnya
- Bacakan cerita anak
- Ajak bernyanyi
- Ajak bermain dengan teman
- Berikan pujian kalau ia berhasil melakukan sesuatu
- Ajari anak untuk bergerak bebas dalam pengawasan
- Orang tua membimbing agar anak mematuhi aturan permainan
- Biasakan menggunakan perkataan santun

EARLY STIMULATION / LEARNING, Caregiver responsiveness (2 – 3 y)

Stimulasi anak usia 2-3 tahun

Dilakukan oleh Ibu, Ayah dan anggota keluarga lainnya

- Ajari berpakaian sendiri
- Ajak melihat buku bergambar
- Bacakan cerita anak
- Ajari makan dipiring sendiri
- Ajari cuci tangan
- Ajari buang air besar dan kecil di tempatnya
- Ajari anak untuk menghormati orang lain
- Ajari anak untuk beribadah
- Bawa anak ke PAUD

EARLY STIMULATION / LEARNING, Caregiver responsiveness (3 – 5 y)

Stimulasi anak usia 3–5 tahun

Dilakukan oleh Ibu, Ayah dan anggota keluarga lainnya:

- Minta anak menceritakan apa yang dilakukan
- Dengarkan anak ketika bicara
- Jika anak gagap, ajari bicara pelan-pelan
- Awasi anak ketika bermain

- Ajak anak mulai melibatkan diri dalam kegiatan bersama.
- Ajarkan anak tentang perbedaan jenis kelamin.
- Ajarkan anak menjaga alat kelaminnya.
- Latih anak tidur terpisah dari orang tua dan anak yang berbeda jenis kelamin.
- Biasakan anak untuk berkata jujur, berterima kasih dan meminta maaf
- Figur ayah sebagai contoh bagi anak laki-laki, dan figur ibu sebagai contoh bagi anak perempuan.
- Kembangkan kreativitas anak dan kemampuan bergaul.

EARLY STIMULATION / LEARNING, Caregiver responsiveness (5 – 6 y)

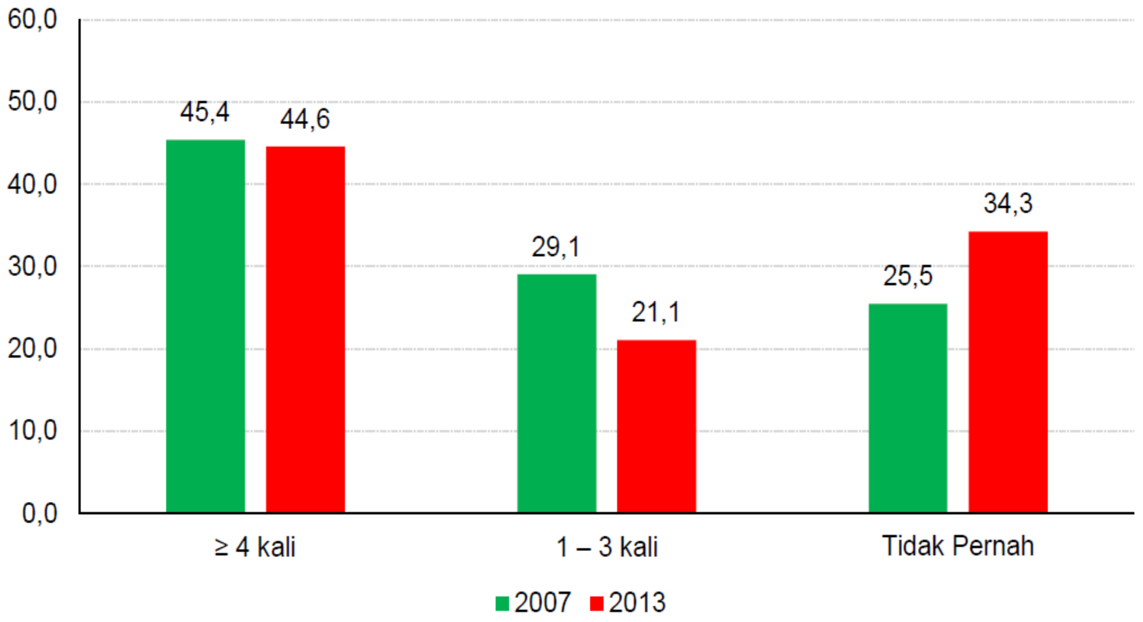
Stimulasi anak usia 5-6 tahun

Dilakukan oleh Ibu, Ayah dan anggota keluarga lainnya:

1. Ajari anak bermain sepeda.
2. Bantu anak mengerti urutan kegiatan, contoh mencuci tangan.
3. Minta anak menceritakan apa yang dilakukannya.
4. Ajari anak melempar dan menangkap bola dengan dua tangan.
5. Ajari anak mengenai warna, huruf, angka, dan benda-benda yang ada di sekitar.
6. Ajak anak untuk membantu dalam melakukan pekerjaan rumah seperti menyiapkan bahan makanan.
7. Ajari anak konsep waktu, seperti tahun, bulan, hari, dan jam.

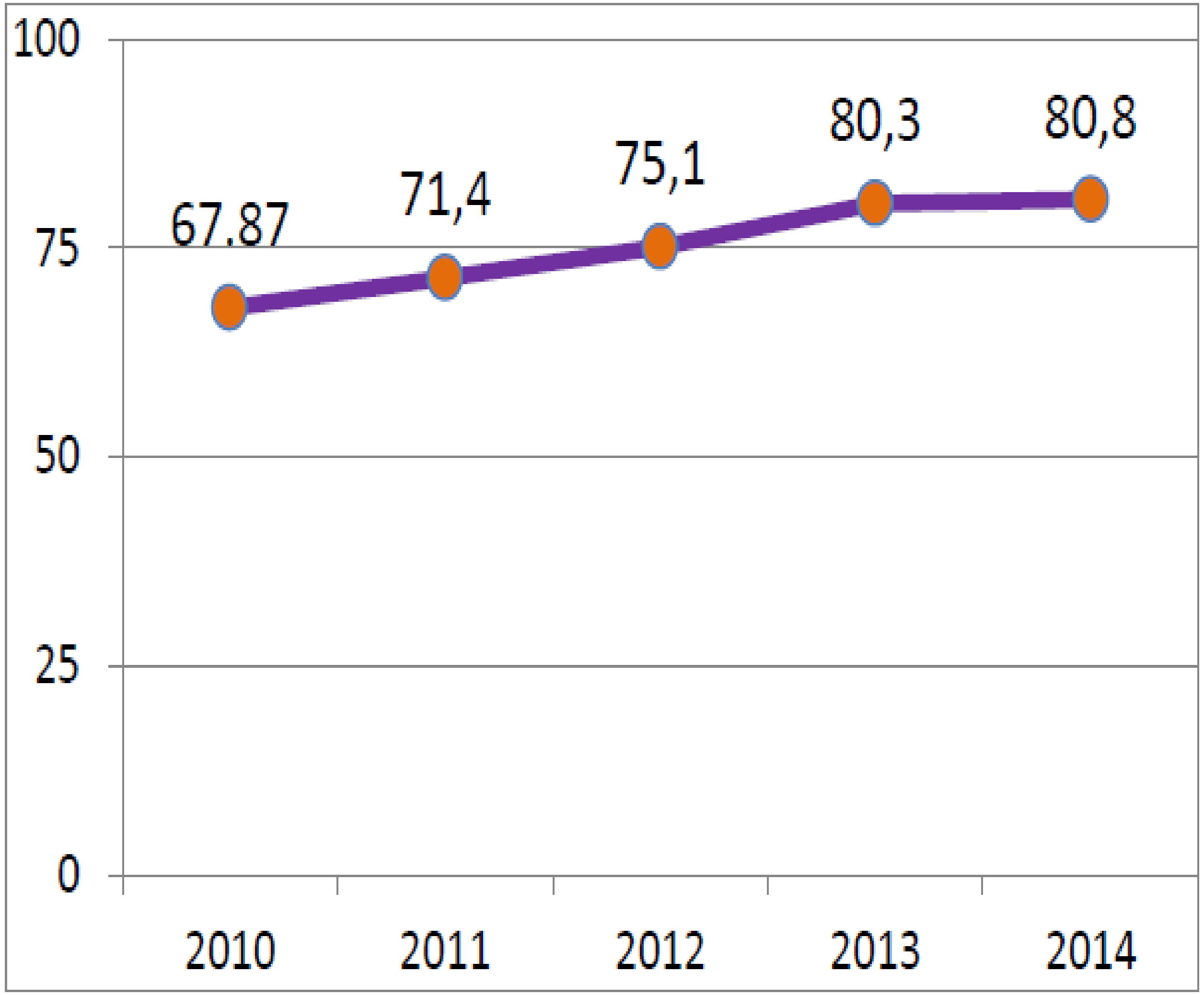
Monitoring / Evaluation
using Maternal & Child Health Book

Growth child monitoring



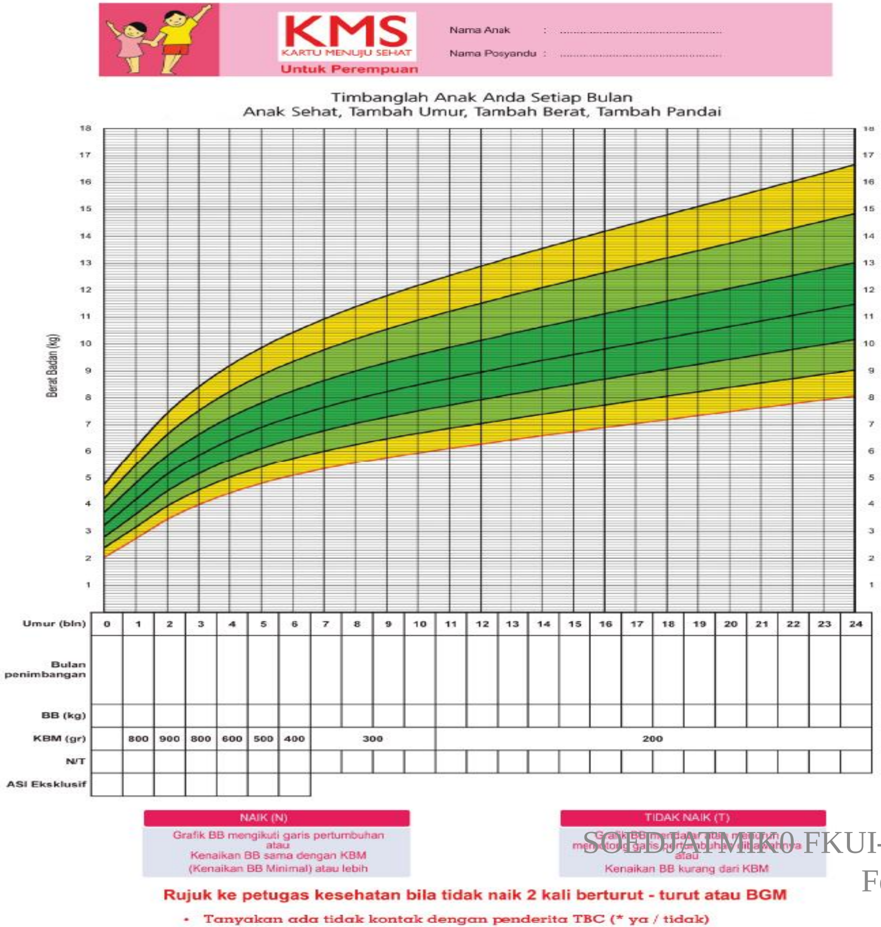
Gambar 3.13.13
Kecenderungan frekuensi pemantauan pertumbuhan anak umur 6-59 bulan dalam 6 bulan terakhir, Indonesia 2007 dan 2013

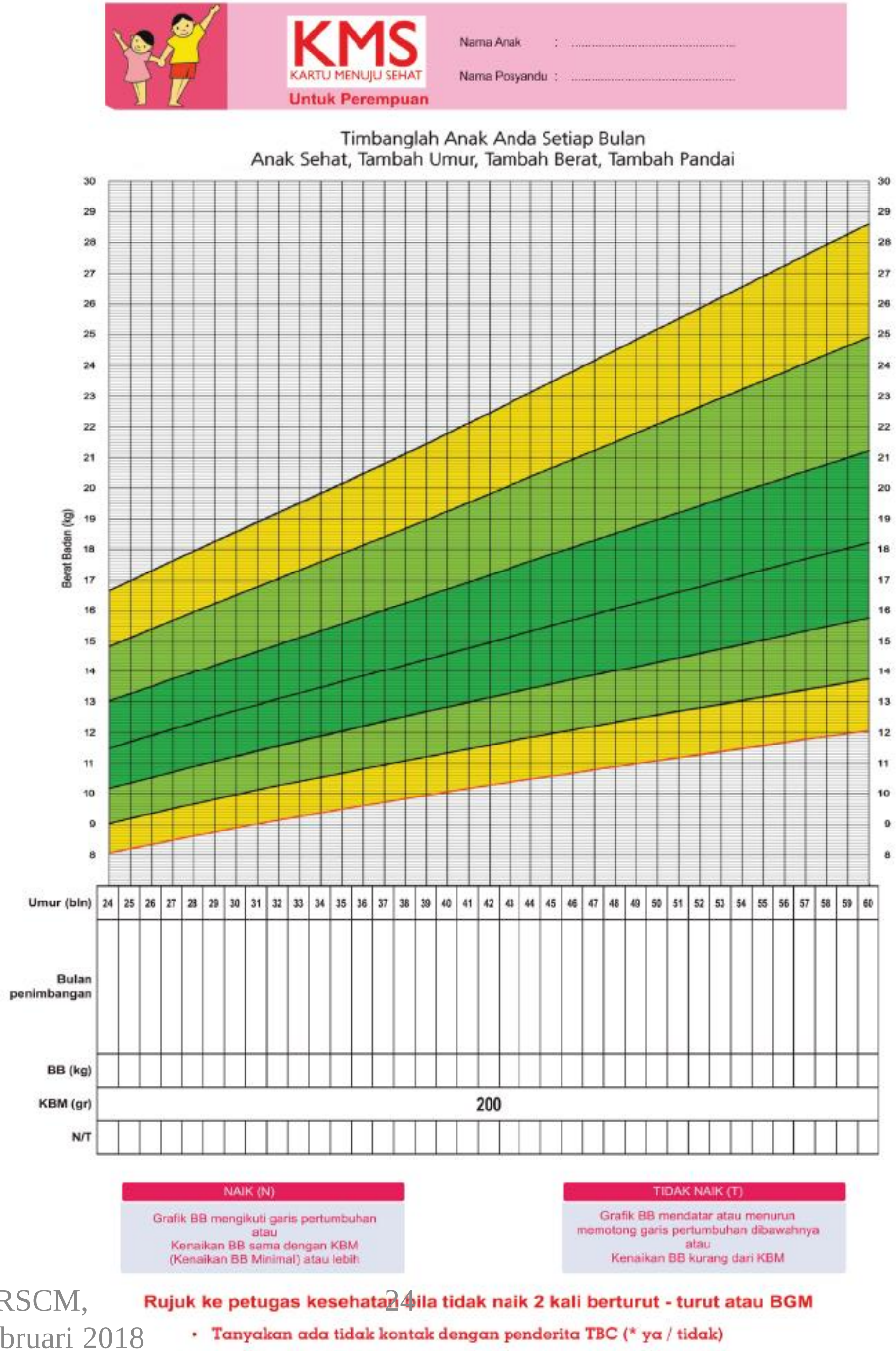
TREN CAKUPAN PENIMBANGAN BALITA (D/S) DI INDONESIA TAHUN 2010-2014



Sumber : Ditjen Bina Gizi dan KIA, Kemenkes RI, 2015

Body weight monitoring





Catch up growth and improved Cognitive function

- The Young Lives Study prospective 12,000 ;children Peru, Ethiopia, India, and Vietnam
- first year of life through adolescence.
- stunting at 1 y of age does not translate into stunting at 8 y of age
- (ranging from 9.3% of children in Vietnam to 26% in Ethiopia),
- substantial linear catch-up growth post–1000 d can occur (22),
- linear catch-up growth before 12 mo of age is associated with improved cognitive function at 8 y of age (22),
- catch-up linear growth between 8 and 15 y of age is associated with improved cognitive function among adolescents (23).

22. Crookston BT, Schott W, Cueto S, Dearden KA, Engle P, Georgiadis A, Lundeen EA, Penny ME, Stein AD, Behrman JR. Postinfancy growth, schooling, and cognitive achievement: Young Lives. Am J Clin Nutr
2013;98(6):1555–63.
23. Crookston BT, Forste R, McClellan C, Georgiadis A, Heaton TB. Factors associated with cognitive achievement in late childhood and adolescence: the Young Lives cohort study of children in Ethiopia, India,

Peru, and Vietnam. BMC Pediatr 2014;14:253.

Pada umur 1 bulan, bayi bisa:

- Menatap ke ibu ☐
- Mengeluarkan suara o... o... ☐
- Tersenyum ☐
- Menggerakkan tangan dan kaki. ☐

Pada umur 3 bulan bayi bisa:

- Mengangkat kepala tegak ketika tengkurap ☐
- Tertawa ☐
- Menggerakkan kepala ke kiri dan kanan ☐
- Membalas tersenyum ketika diajak bicara/tersenyum ☐
- Mengoceh spontan atau bereaksi dengan mengoceh ☐

Pada umur 9 bulan, bayi bisa:

- Merambat ☐
- Mengucapkan ma ... ma, da ... da ☐
- Meraih benda sebesar kacang ☐
- Mencari benda/mainan yang dijatuhkan ☐
- Bermain tepuk tangan atau ci-luk-ba ☐
- Makan kue/biskuit sendiri ☐

Pada umur 12 bulan, bayi bisa:

- Berdiri dan berjalan berpe-gangan ☐
- Memegang benda kecil ☐
- Meniru kata sederhana seperti ma.. ma.., pa.. pa.. ☐
- Mengenal anggota keluarga ☐
- Takut pada orang yang belum dikenal ☐
- Menunjuk apa yang diinginkan tanpa menangis/merengek ☐

Pada umur 6 bulan, bayi bisa:

- Berbalik dari telungkup ke telentang. ☐
- Mempertahankan posisi kepala tetap tegak. ☐
- Meraih benda yang ada didekatnya. ☐
- Menirukan bunyi. ☐
- Menggenggam mainan. ☐
- Tersenyum ketika melihat mainan/gambar yang menarik. ☐

Pada umur 2 tahun, anak bisa:

- Naik tangga dan berlari-lari ☐
- Mencoret-coret pensil pada kertas ☐
- Dapat menunjuk 1 atau lebih bagian tubuhnya ☐
- Menyebut 3-6 kata yang mempunyai arti, seperti bola, piring dan sebagainya ☐
- Memegang cangkir sendiri ☐
- Belajar makan-minum sendiri ☐

Pada umur 3 tahun, anak bisa:

- Mengayuh sepeda roda tiga ☐
- Berdiri di atas satu kaki tanpa berpegangan ☐
- Bicara dengan baik menggunakan 2 kata ☐
- Mengenal 2-4 warna ☐
- Menyebut nama, umur dan tempat ☐
- Menggambar garis lurus
- Bermain dengan teman
- Melepas pakaiannya sendiri
- Mengenakan baju sendiri

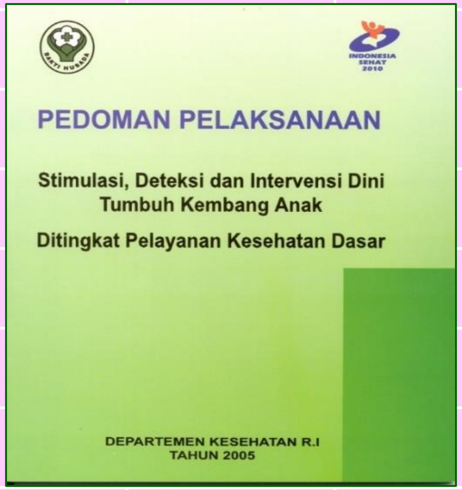
Pada umur 5 tahun, anak bisa:

- Melompat-lompat 1 kaki, menari dan berjalan lurus. ☐
- Menggambar orang 3 bagian (kepala, badan, tangan/kaki) ☐
- Menggambar tanda silang dan lingkaran ☐
- Menangkap bola kecil dengan kedua tangan ☐
- Menjawab pertanyaan dengan kata-kata yang benar ☐
- Menyebut angka, menghitung jari ☐
- Bicaranya mudah dimengerti ☐
- Berpakaian sendiri tanpa dibantu ☐
- Mengancing baju atau pakaian boneka ☐
- Menggosok gigi tanpa bantuan ☐

Pada umur 6 tahun, anak bisa:

1. Berjalan lurus ☐
2. Berdiri dengan 1 kaki selama 11 detik ☐
3. Menggambar 6 bagian (contoh: menggambar orang lengkap: kepala, badan, 2 tangan, dan 2 kaki) ☐
4. Menangkap bola kecil dengan kedua tangan ☐
5. Menggambar segi empat ☐
6. Mengerti arti lawan kata ☐
7. Mengenal angka, bisa menghitung angka 5-10 ☐
8. Mengenal warna ☐
9. Mengikuti aturan permainan ☐
10. Berpakaian sendiri tanpa dibantu ☐

Age	MONITORING of							
	GROWTH		DEVELOPMENT			BEHAVIOR		
	BB/TB	LK	KPSP	TDL	TDD	KMME	*CHAT*	GPPH
0 mo	V	V						
3 mo	V	V	V		V			
6 mo	V	V	V		V			
9 mo	V	V	V		V			
12 mo	V	V	V		V			
15 mo	V		V					
18 mo	V	V	V		V		V	
21 mo	V		V				V	
2 y	V	V	V		V		V	
2 ½ y	V		V		V		V	
3 y	V	V	V	V	V	V		V
3 ½ y	V		V	V	V	V		V
4 y	V	V	V	V	V	V		V
4 ½ y	V		V	V	V	V		V
5 y	V	V	V	V	V	V		V



III. IMMUNIZATION

MENTERI KESEHATAN
REPUBLIK INDONESIA

PERATURAN MENTERI KESEHATAN REPUBLIK INDONESIA
NOMOR 12 TAHUN 2017
TENTANG
PENYELENGGARAAN IMUNISASI

JADWAL IMUNISASI

0–7 hari : HB0
1 Bulan : BCG, Polio 1
2 Bulan : DPT–HB–Hib 1, Polio 2
3 Bulan : DPT–HB–Hib 2, Polio 3
4 Bulan : DPT–HB–Hib 3, Polio 4, IPV
9 Bulan : Campak
18 Bulan: DPT–HB–Hib
24 Bulan: Campak

Tabel 3. Jadwal imunisasi lanjutan pada anak usia sekolah dasar

Sasaran	Imunisasi	Waktu Pelaksanaan
Kelas 1 SD	Campak	Agustus
	DT	November
Kelas 2 SD	Td	November
Kelas 3 SD	Td	November

CATATAN IMUNISASI ANAK

UMUR (BULAN)	0	1	2	3	4	5	6	7	8	9	10	11	12+**
Vaksin	Tanggal Pemberian Imunisasi												
HB-0 (0-7 hari)													
BCG													
*Polio													
*DPT-HB-Hib 1													
*Polio 2													
*DPT-HB-Hib 2													
Polio 3													
*DPT-HB-Hib 3													
*Polio 4													
*IPV													
Campak													

UMUR (BULAN)	18	24
Vaksin	Tanggal Pemberian Imunisasi	
***DPT-HB-Hib Lanjutan		
***Campak Lanjutan		

- Jadwal tepat pemberian imunisasi dasar lengkap
- Waktu yang masih diperbolehkan untuk pemberian imunisasi dasar lengkap
- Waktu Pemberian imunisasi bagi anak di atas 1 tahun yang belum lengkap
- Waktu yang tidak diperbolehkan untuk pemberian imunisasi dasar lengkap

CATATAN IMUNISASI ANAK

* Jarak antara (interval) pemberian vaksin DPT-HB-Hib minimal 4 minggu (1bulan) • Jarak antara pemberian vaksin Polio minimal 4 minggu (1 bulan)

** Anak di atas 1 tahun (12 bulan) yang belum lengkap imunisasinya tetap harus diberikan imunisasi dasar lengkap. Sakit ringan seperti batuk, pilek, diare, demam ringan dan sakit kulit bukan halangan untuk imunisasi.

*** Pemberian imunisasi DPT-HB-Hib lanjutan diberikan minimal 12 bulan setelah pemberian imunisasi DPT-HB-Hib 3 dan dapat diberikan dalam rentang usia 18-24 bulan

**** Pemberian imunisasi campak lanjutan diberikan minimal 6 bulan setelah pemberian imunisasi campak terakhir dan dapat diberikan dalam rentang usia 18-24 bulan

Tambahan Vaksin lain	Vaksin	Tanggal Pemberian			

HYGIENE

Cara cuci tangan yang benar ☐

Gunakan sabun dan air bersih mengalir

1 Telapak dengan telapak

2 Telapak kanan di atas tangan kiri dan telapak kiri di atas punggung tangan kanan

3 Telapak dengan telapak dan jari terkait

4 Letakkan punggung jari pada telapak satunya dengan jari saling mengunci

5 Jempol kanan digosok memutar oleh telapak kiri dan sebaliknya

6 Jari kiri menguncup, gosok memutar ke kanan dan ke kiri pada telapak kanan dan sebaliknya

7 Pegang pergelangan tangan kiri dengan tangan kanan dan sebaliknya, gerakan memutar

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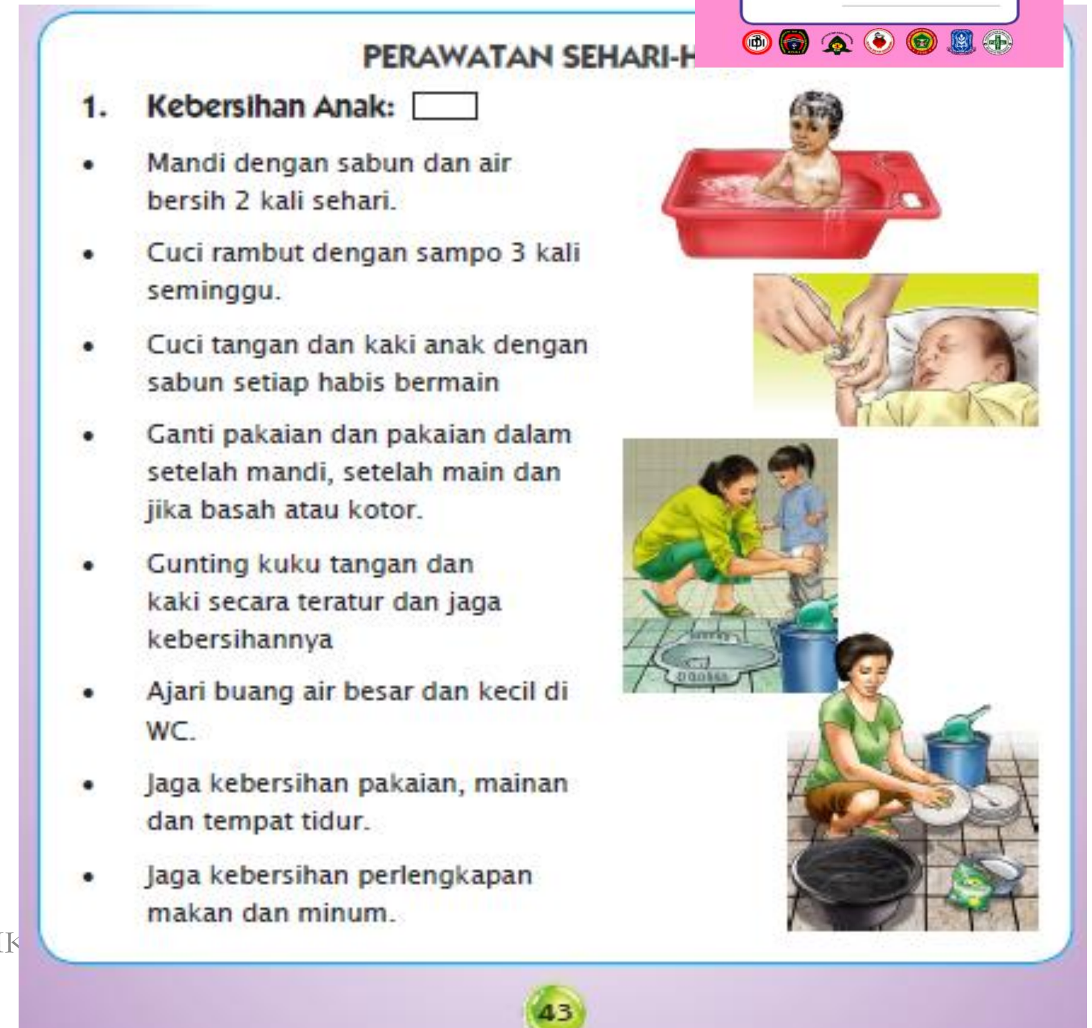

PERAWATAN SEHARI-H

1. **Kebersihan Anak:** ☐

- Mandi dengan sabun dan air bersih 2 kali sehari.
- Cuci rambut dengan sampo 3 kali seminggu.
- Cuci tangan dan kaki anak dengan sabun setiap habis bermain
- Ganti pakaian dan pakaian dalam setelah mandi, setelah main dan jika basah atau kotor.
- Gunting kuku tangan dan kaki secara teratur dan jaga kebersihannya
- Ajari buang air besar dan kecil di WC.
- Jaga kebersihan pakaian, mainan dan tempat tidur.
- Jaga kebersihan perlengkapan makan dan minum.

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1. Awali menyikat gigi pada seluruh permukaan kunyah gigi atas dan bawah dengan gerakan lurus ke arah depan dan ke belakang (maju mundur).
2. Selanjutnya sikatlah permukaan luar gigi (yang menghadap ke pipi dan bibir), letakkan bulu sikat di daerah batas gusi dan gigi, lalu lakukan gerakan memutar (sirkuler) mulai dari sisi belakang kiri sampai ke sisi belakang kanan.
3. Selanjutnya sikat permukaan dalam gigi (yang menghadap ke langit-langit dan lidah) atas dan bawah, dengan gerakan maju mundur

CHILD PROTECTION (Neglect / Abuse)

Training, Home visit monitoring, Problem Solving

NUTRIENTS :
macro & micro

STIMULATIONS: Early, Continuous, Responsives care & love