The Double Burden of Malnutrition
What is it and what can we do about it

Rafael Pérez-Escamilla, PhD
Yale School of Public Health
CORE webinar
February 2, 2017
Topics

• The double burden of malnutrition (DBM)
• Maternal-child malnutrition cycle
• Conceptual framework for addressing DBM
• Intersectoral strategies
The Double Burden of Malnutrition

• Co-existence of undernutrition and overweight/obesity
  – Country level
  – Household level
    • Child stunting and maternal obesity
  – Individual level
    • Obese & stunted individuals
  – Strong implications for infectious and non communicable diseases
Causes of DBM

• Infectious diseases-malnutrition cycle
• Excessive caloric intake and sedentarism
  – Urbanization
  – Ultra processed foods
    • Cheap, energy dense, low nutritional value
    • Sugar sweetened beverages
• Environment-genome interactions

http://www.cpc.unc.edu/projects/nutrans/whatis
Lot’s of interest in the DBM

Introduction to the double burden of undernutrition and excess weight in Latin America

Juan A Rivera, Lilia S Pedraza, Reynaldo Martorell, and Angel Gil

“Double Burden of Malnutrition”: Reexamining the Coexistence of Undernutrition and Overweight Among Women in India

Vani S. Kulkarni, Veena S. Kulkarni, and Raghav Gaiha

Patterns and Determinants of Double-Burden of Malnutrition among Rural Children: Evidence from China

Nan Zhang, Laila Bécares, and Tarani Chandola

The epidemiological transition and the global childhood obesity epidemic

ST Broyles, KD Denstel, TS Church, J-P Chaput, M Fogelholm, G Hu, R Kuriyan, A Kurpad, EV Lambert, C Mahe, J Maia, V Matsudo, T Olds, V Onyewa, OL Sarmiento, M Standage, MS Tremblay, C Tudor-Locke, P Zhao, and PT Katzmarzyk for the ISCOLE Research Group

Key message 1.

- The world is losing hundreds of billions of dollars in annual productivity as a result of the double burden of malnutrition
## Child Mortality Due to Nutritional Disorders

2013 *MCN Lancet* Series

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Data are to the nearest thousand. *Prevalence estimates from the UN.
Non-communicable Diseases (NCDs)
The Global Picture

• **Annual cost to global economy of NCDs: Over US$1 trillion**
  - If current trends persist experts forecast $35 trillion in economic output loss from 2005 to 2030 (Bloom 2013)
  - Due to diabetes, heart disease, breast cancer, and COPD (Bloom 2013)

• **NCD’s risk factors include: Tobacco use, obesity, unhealthy diet, physical inactivity, and alcohol**
  - Context: aging of the population and negative effects of urbanization, international trade and marketing

• **Eight out of ten NCDs deaths occur in low- and middle-income countries**
  - 30% of NCDs deaths in people < 60
  - If current trends continue by 2030 52 million people will die of an NCD annually (WHO 2011)
Key Message 2

• Almost all low and middle income countries undergoing nutrition transition and corresponding DBM
Trends in prevalence and numbers of children with stunted growth (HAZ<-2), by selected UN regions and globally, 1990–2010, and projected to 2025

2013 MCN Lancet Series
Adolescent Nutrition: Important for Girls, and for the Future Generation

As many as half of all adolescent girls in some countries are stunted, increasing risk of complications in pregnancy and delivery and of poor fetal growth.
Trends in Thinness and Obesity for Women Aged 20-29 Years in UN Regions and Globally (1980-2008)

Prevalence of low BMI in adult women has decreased in Africa/Asia since 1980, but remains higher than 10%.

Maternal overweight and obesity has increased steadily since 1980; resulting in increased maternal morbidity and infant mortality.
BMI trends among 20-49 y old women: 1980-2008

AFRICA

AMERICAS & CARIBBEAN

ASIA

EUROPE

2013 Lancet Series
Trends in prevalence and numbers of children with overweight (WHZ>2), by selected UN regions and globally, 1990–2010, and projected to 2025.
Key Message 3

• Both chronic malnutrition (i.e., stunting) and obesity risk transmitted from mother to offspring
  – Maternal-child intergenerational cycles
Odds ratios for stunting in early childhood by small for gestational age (SGA), appropriate for gestational age (AGA) and preterm categories by United Nations region

2013 MCN Lancet Series
Prevalence of Weight for Recumbent Length > 95th %ile among US Children From Birth to 2 Years of Age, 2011-2012

Ogden, C. L. et al. JAMA 2014;311:806-814
Prevalence of BMI > 30 among US Women >19 Years of Age, 2011-2012

Ogden, C. L. et al. JAMA 2014;311:806-814
Disparities in Early Nutrition: Where the Problem Begins?

ASN Symposium
Experimental Biology Meetings
Tuesday April 12, 2011
Washington DC

Chair: R. Perez-Escamilla, Yale University
Co-Chair: O. Bermudez, Tufts

Advances in Nutrition (2012)
Maternal-Child obesity life course framework

Pre-pregnancy BMI

Pre-pregnancy BMI → Pre-pregnancy BMI

Early childhood obesity risk

Early childhood obesity risk → Pre-pregnancy BMI

Infancy weight gain rate

Infancy weight gain rate → Early childhood obesity risk

Post-partum weight retention

Post-partum weight retention → Infancy weight gain rate

Suboptimal Infant feeding

Suboptimal Infant feeding → Infancy weight gain rate

Gestational weight gain

Gestational weight gain → Early childhood obesity risk

Neonatal predisposition

Neonatal predisposition → Gestational weight gain

Pérez-Escamilla & Bermudez (2012)
Odds of each childhood obesity risk factor in black and Hispanic participants, relative to white participants*

*Odds ratios adjusted for maternal age, education, parity, and prepregnancy BMI; paternal BMI; household income; and child gender.
Executive summary: evaluating the evidence base to support the inclusion of infants and children from birth to 24 mo of age in the Dietary Guidelines for Americans—“the B-24 Project”\textsuperscript{1-3}

Daniel J Raiten, Ramkripa Raghavan, Alexandra Porter, Julie E Obbagy, and Joanne M Spahn

- **WG\textsubscript{1}:** 0-6 months
- **WG\textsubscript{2}:** 6-12 months
- **WG\textsubscript{3}:** 12-24 months
- **WG\textsubscript{4}:** Caregivers
Framework for actions to achieve optimum fetal and child nutrition and development

Benefits during the life course
- Adult stature
- Cognitive, motor, socioemotional development
- School performance and learning capacity
- Morbidity and mortality in childhood
- Work capacity and productivity
- Obesity and NCDs

Nutrition specific interventions and programmes
- Adolescent health and preconception nutrition
- Maternal dietary supplementation
- Micronutrient supplementation or fortification
- Breastfeeding and complementary feeding
- Dietary supplementation for children
- Dietary diversification
- Feeding behaviours and stimulation
- Treatment of severe acute malnutrition
- Disease prevention and management
- Nutrition interventions in emergencies

Optimum fetal and child nutrition and development
- Breastfeeding, nutrient-rich foods, and eating routine
- Feeding and caregiving practices, parenting, stimulation
- Low burden of infectious diseases

Nutrition sensitive programmes and approaches
- Agriculture and food security
- Social safety nets
- Early child development
- Maternal mental health
- Women’s empowerment
- Child protection
- Classroom education
- Water and sanitation
- Health and family planning services

Knowledge and evidence
- Politics and governance
- Leadership, capacity, and financial resources
- Social, economic, political, and environmental context (national and global)

2013 MCN Lancet Series
Plan of Action for the Prevention of Obesity in Children and Adolescents

Preventing Childhood Obesity in the Americas: The Life-Course Framework

Guest Editors: Dr. Rafael Pérez-Escamilla and Dr. Gilberto Kac
Microsystem: Home, school, work

Mesosystem: Neighborhood, home-work-social life relationships

Exosystem: Decision from town council regarding use of public spaces for leisure

Macrosystem: Social and health policies, cultural norms and values

Individual: Lifestyles (nutrition, physical activity), obesity status

Perez-Escamilla & Kac (IJOS, 2013)
Key Message 4

• Maternal-child obesity concentrating among the poor
Overweight and Obesity* among 5 to 11 Mexican year olds; 1999 & 2006 by rural/urban, ethnicity and wealth

* According to obesity task force criteria

Annual Percent Increase in Obesity Among Mexican Schoolers; 1999-2006; by rural/urban, ethnicity and wealth

Annual Percent Increase in Obesity Among Mexican Adolescents between 1988-1999 and 1999-2006; by rural/urban, ethnicity and wealth

Annual Percent Increase in Obesity Among Mexican Women between 1988-1999 and 1999-2006; by rural/urban, ethnicity and wealth

Key Message 5

• SGA is prevalent and a risk factor for childhood obesity and future chronic diseases
  maternal overweight/obesity highly prevalent in countries with high burden of stunting and infant mortality
**Child Mortality Due to Nutritional Disorders**

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**SGA also linked with obesity and NCD risk later on in life**
Countries with the highest burden of malnutrition
These 34 countries account for 90% of the global burden of malnutrition

2013 MCN Lancet Series

Many of these countries have very high maternal overweight/obesity rates
Key Message 6

• Major scientific advances in our understanding of how food preferences develop and how children learn to eat
- **Familiarization**
  - Repeatedly offer healthy foods such as vegetables to young children

- **Associative learning**
  - Food preferences develop based on the context and psycho-emotional atmosphere in which it’s offered

- **Observation learning**
  - Children may also establish food preferences by observing what their caregivers eat

**Infancy and the toddlerhood and preschool periods represent major sensitive periods for the development of food preferences**
Positive caregiver verbalizations during feeding may increase child acceptance of food

Need consensus on what responsive feeding is

Prospective studies needed
• Flavors passed from mother to fetus through amniotic fluid
• Flavors passed from mother to infant through breast milk
• Breastfed babies accept more easily fruits and vegetables than children who were formula fed.
  – However, formula fed infants can end up accepting food low in sugar, salt and bitter tasting if the mothers are advised on repeatedly exposing the infants to them
  – Promoting the consumption of complementary foods low in salt and sugar is likely to have a positive influence on dietary choices, growth and weight outcomes later on in life
Implications for Development Agencies

- Prenatal care
- Infant and Young Child feedings programs
- Parenting programs
- Early Child Development programs
- Youth programs
- Food security programs
  - Conditional cash transfer programs

Challenge: Requires strong coordination between health, education, and social development sectors
Key Message 7

• Household food insecurity associated with child stunting, maternal obesity, and the DBM
Household food insecurity and excess weight/obesity among Brazilian women and children: a life-course approach
Michael Maia Schlüssel ¹
Antonio Augusto Moura da Silva ²
Rafael Pérez-Escamilla ³
Gilberto Kac ¹

Dietary Energy Density and Body Weight in Adults and Children: A Systematic Review
Rafael Pérez-Escamilla, PhD; Julie E. Obbagy, PhD, RD; Jean M. Altman, MS; Eve V. Essery, PhD; Mary M. McGrane, PhD; Yat Ping Wong, MS, MPH; Joanne M. Snoh, MS, RD, FADA; Christine L. Williams, MD, MPH
Understanding the double burden of malnutrition in food insecure households in Brazil

Muriel Bauermann Gubert*,†, Ana Maria Spaniol*, Ana Maria Segall-Corrêa† and Rafael Pérez-Escamilla‡

Key messages

• In Brazil, severe household food insecurity was associated with the double burden malnutrition in the same household.
• Life course policies and programmes targeting household food insecurity are needed to prevent the double burden malnutrition.
• Household food insecurity should be included as a key evaluation indicator of maternal-child nutrition programmes.
• Prospective research is needed to better understand the mechanisms explaining the simultaneous risk for maternal overweight/obesity and child stunting and to identify modifiable factors that affect this relationship.
Key Message 8

• Better systems thinking frameworks needed to address the double burden of malnutrition
The need for global visionary leadership to prevent malnutrition in all its forms

Strategic Plans based on sound policy and program evaluation framework

Past Results

Future Results

Impact of new paradigm should be much more than the sum of silos’ results

Interdisciplinary, multi-level, multi-sectorial collaborations
Addressing the DBM
Conclusions

• Integrate preconceptional, gestational, post-partum and infancy and early childhood as part of national childhood obesity prevention strategies
• Social-ecological model
• Social marketing framework
  • Generate political support
  • Mass media
  • Intersectoral initiatives/programs
Obesity among children and adolescents is on the rise in the countries of the Americas. The countries of the Americas have unanimously signed a 5-year Plan of Action for the Prevention of Obesity in Children and Adolescents, during the 53rd Directing Council of PAHO.

The plan calls for the implementation of fiscal policies, regulation of food marketing and labeling, improvement of school nutrition and physical activity environments, and promotion of breastfeeding and healthy eating.

Each Member State is encouraged to implement policies and regulations proposed in this Plan of Action according to its national needs and objectives.
TABLE 1. Principles and objectives of the Canada-US-Mexico Trilateral Cooperation on Childhood Obesity Initiative

**Principles**

1. As governments, we have a responsibility to lead our countries’ efforts to address the public health challenge of childhood obesity.
2. We recognize that complex public health issues such as childhood obesity require the engagement of all sectors of our societies to achieve effective and sustained change.
3. Our trilateral collaboration will be visibly present, taking action in each country while drawing on the expertise, resources, and efforts of each trilateral partner State.
4. Our trilateral collaboration will build on our common interest to accelerate action while valuing and respecting the different experiences and national contexts of our three countries.

**Objectives**

1. Facilitate the exchange of relevant information, including policies, program activities, guidelines, and regulations, with a view to informing the work of other trilateral partners.
2. Promote the exchange of lessons learned and best practices.
3. Encourage and facilitate individual contacts and networks between technical experts.
4. Identify opportunities for adopting and implementing the promising practices and successful initiatives of other trilateral partners.

1. Decreasing sedentary behavior among children and their families.
2. Improving the levels of awareness, skills, and knowledge, including among parents and caregivers, regarding the importance of physical activity.
3. Designing the built (man-made) environment of communities, including transportation systems, to facilitate active living.
4. Designing specific initiatives to improve physical activity among vulnerable children and their families.
5. Enhancing physical activity during school and in the before-and after-school period.
6. Increasing access to community locations and safe, affordable opportunities for physical activity.

Dietary & Physical Activity Guidelines

The Mexican Dietary and Physical Activity Guidelines: Moving Public Nutrition Forward in a Globalized World

Rafael Pérez-Escamilla

J Nutr 2016;146(Suppl):1924S–7S

The 2015 Dietary Guidelines Advisory Committee Scientific Report: Development and Major Conclusions

Barbara E Millen, Steve Abrams, Lucile Adams-Campbell, Cheryl AM Anderson, J Thomas Brenna, Wayne W Campbell, Steven Clinton, Frank Hu, Miriam Nelson, Marian L Neuhouser, Rafael Perez-Escamilla, Anna Maria Siega-Riz, Mary Story, and Alice H Lichtenstein

Adv Nutr 2016;7:438–44
Breastfeeding Gear Model

How did Brazil do it!
Multi-component maternal-child “life course” indicator - e.g., proportion of women who:

• enter pregnancy with appropriate weight
• gain weight during gestation within recommendations
• return to pre-pregnancy weight by 6 months post-partum
• breastfeed their babies exclusively for 6 months
• introduce nutritious complementary foods at 6 months
• continue breastfeeding until child is two years old
Evidence Highlights Importance of Nutritional Status in Women Before and During Pregnancy

Short maternal stature may lead to obstructed labour and maternal and fetal or neonatal death

Maternal stunting and low Body Mass Index increases the risk of fetal growth restriction (small for gestational age)

Maternal obesity leads to gestational diabetes, pre-eclampsia, haemorrhage and higher risk of neonatal and infant death
Key message 9. The Double Burden of Malnutrition needs to be addressed for the SDGs to be met
Key messages

1. The world is losing hundreds of billions of dollars in annual productivity as a result of the double burden of malnutrition
2. Almost all low and middle income countries undergoing nutrition transition and corresponding DBM
3. Maternal-child cycles explain intergenerational transmission of both stunting and obesity
4. Maternal-child obesity concentrating among the poor
5. SGA is prevalent and a risk factor for childhood obesity and future chronic diseases
6. Major scientific advances in our understanding of how food preferences develop and how children learn to it
7. Household food insecurity associated with child stunting, maternal obesity, and the DBM
8. Better systems thinking frameworks needed to address the double burden of malnutrition
9. The Double Burden of Malnutrition needs to be addressed for the SDGs to be met
Thank you!

rafael.perez-escamilla@yale.edu