

## The Effect of Suboptimal Breastfeeding on Preschool Overweight/Obesity: A Model in PROFILES for Country-Level Advocacy

Lesley Oot, Kavita Sethuraman, Jay Ross, and A. Elisabeth Sommerfelt

### Introduction

Malnutrition has significant negative consequences for many developing countries, particularly in terms of poor human health, lost human capital, and decreased economic productivity. Investment in nutrition has been identified by the Copenhagen Consensus in 2012 as a best investment for developing countries; for every US\$1 spent on nutrition, there is a US\$16 return in health and economic benefits (International Food Policy Research Institute 2015). Despite this, funding and support for nutrition programming is often lacking.

To address this urgent need for attention and commitment to reducing malnutrition, the U.S. Agency for International Development (USAID)-funded Food and Nutrition Technical Assistance III Project (FANTA) at FHI 360, supports evidence-based country-level nutrition advocacy. The approach to nutrition advocacy that FANTA uses engages governments and national stakeholders to develop a shared vision and promote accountability and commitment for nutrition using a tool called PROFILES.

Developed to support country-level nutrition advocacy, PROFILES consists of a set of computer-based models that calculate consequences if malnutrition does not improve over a defined time period (e.g., 10 years) and the benefits of improved nutrition over the same time period, including lives saved, disabilities averted, human capital gains, and economic productivity gains. The estimates generated from this tool and its models are the cornerstone of the nutrition advocacy process and can be used to identify, prioritize, and



**Nutrition advocacy** is a planned, systematic, and deliberate process that is defined and shaped by the specific country context. Nutrition advocacy can strengthen the efforts and commitment of a given country at any stage along the way to providing nutrition services and reducing malnutrition. A central focus of nutrition advocacy is to promote accountability for nutrition and strengthen nutrition governance. For example, nutrition advocacy can support the development of a nutrition policy, investment of resources to strengthen and expand implementation of nutrition services, and greater coordination between government and nongovernmental organizations that play a role in providing nutrition services across a country. By examining the nutrition context and tailoring advocacy needs to that situation, advocacy can be more effective in igniting change and making strides toward the desired outcome of a comprehensive nutrition program.

advocate for evidence-based actions to reduce malnutrition. PROFILES estimates are calculated assuming there are reductions in the prevalence of country-specific nutrition indicators, such as iron deficiency anemia, low birth weight, vitamin A deficiency, iodine deficiency, suboptimal breastfeeding practices, and childhood chronic and acute malnutrition (i.e., stunting, underweight, and wasting). The country-specific information needed to calculate the estimates are discussed and agreed upon by participants during an in-country participatory workshop.

In 2016, FANTA updated the PROFILES tool to include a model that estimates the effect of suboptimal breastfeeding practices, where infants are not exclusively breastfed for the recommended 6 months, on overweight/obesity among preschool children. Estimates calculated by this model refer to the number of children 48–59 months of age that are likely to become overweight/obese if exclusive breastfeeding practices do not improve, and the number of children 48–59 months that will be prevented from becoming overweight/obese if exclusive breastfeeding practices improve. This brief explains why the model was developed, how estimates are calculated, and how the estimates are used for nutrition advocacy.

## Why Advocate for Optimal Breastfeeding Practices?

Optimal breastfeeding practices—defined as the early initiation of breastfeeding within 1 hour of birth, exclusive breastfeeding for the first 6 months of life, and continued breastfeeding for up to 2 years or beyond, with appropriate complementary feeding beginning at 6 months (WHO 2001; PAHO/WHO 2002)—has numerous advantages.<sup>1</sup> Globally, consistent and substantial evidence has shown that early, exclusive, and continued breastfeeding through 23 months significantly reduces neonatal and child mortality, as it protects against infections and supports recovery from illness (Black et al. 2008; Lamberti et al. 2011; Debes et al. 2013).

It is estimated that globally, 11.6 percent of child deaths under 5 years of age are attributable to suboptimal breastfeeding practices. In fact, promotion of optimal breastfeeding practices is one of the most effective interventions to prevent such deaths worldwide (Bhutta et al. 2013). In addition, breastfeeding also has health benefits for the mother, improving birth spacing and providing protection from breast cancer<sup>2</sup> and also, potentially, ovarian cancer and type 2 diabetes (Victora 2015).

## Benefits of Breastfeeding

- Universal optimal breastfeeding could save the lives of more than **800,000 children per year** (Black et al. 2013).
- Breastfeeding reduces morbidity and mortality from diarrhea and respiratory infections. About **half** of all diarrhea episodes and a **third** of respiratory infections could be avoided by breastfeeding. (Victora et al. 2016)
- Breastfeeding is associated with higher intelligence and greater economic productivity. About **\$302 billion per year** in economic losses have been associated with not breastfeeding, representing 0.49% of combined, worldwide gross national income (Rollins et al. 2016)
- Optimal breastfeeding can reduce the risk of overweight/obesity in childhood, with meta-analyses indicating benefits as high as a **31% reduced risk** (Horta et al. 2015; Yan et al. 2014).

<sup>1</sup> Exclusive breastfeeding refers to feeding an infant only breast milk from his or her mother or a wet nurse, or expressed breast milk, and no other liquids or solids except vitamins, mineral supplements, or medicines in drop or syrup form (WHO 2001). Complementary feeding is defined as the process starting when breast milk is no longer sufficient to meet the nutritional requirements of an infant, necessitating the provision of other foods and liquids, along with breast milk. The target age range for complementary feeding is generally between 6 to 24 months of age; however, breastfeeding may continue beyond 2 years (PAHO/WHO 2002).

<sup>2</sup> Universal breastfeeding would prevent an estimated 20,000 annual deaths from breast cancer.

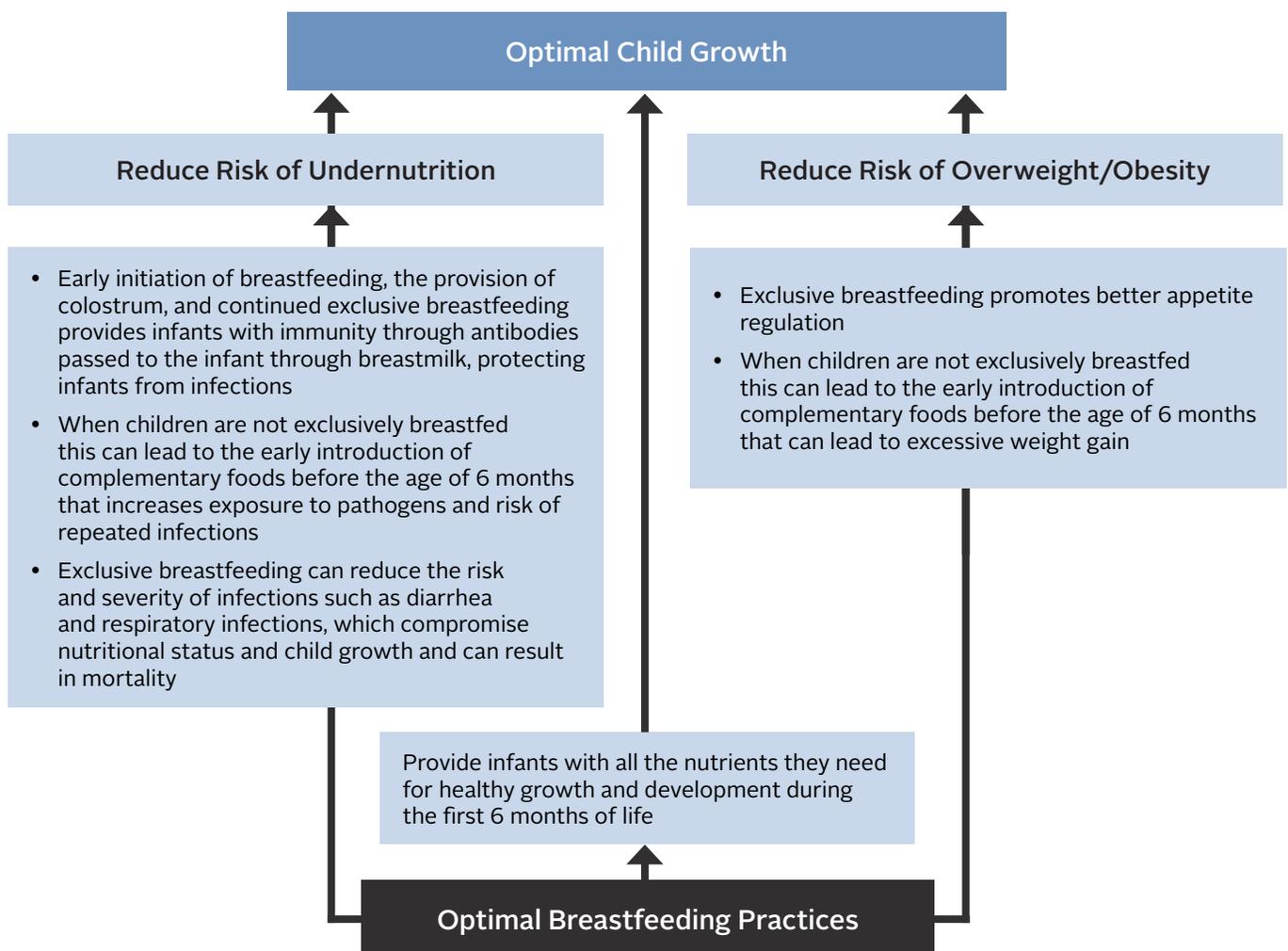
Breastfeeding is also associated with human capital benefits, including improved cognition (Anderson et al. 1999), increased years of schooling (Victora et al. 2005), and higher performance on intelligence tests (Horta and Victora 2013). A 30-year prospective, population-based birth cohort study in Brazil showed that increased duration of breastfeeding is associated with improved intelligence, educational attainment, and income, indicating that breastfeeding may have important long-term positive impacts on economic and social outcomes (Victora et al. 2015).

The benefits of breastfeeding go beyond improving education, increasing incomes, and reducing mortality, however. Along with preventing or delaying the onset of stunting and wasting, exclusive breastfeeding provides

infants with optimal nutrition, which promotes age-appropriate growth that protects them from overweight/obesity in childhood. Several meta-analyses have found that breastfeeding can help to reduce children’s future risk of overweight/obesity and that risk reduction is greater the longer children are exclusively breastfed, with exclusive breastfeeding for a full 6 months conferring the greatest benefit (Horta and Victora 2013; Horta et al. 2015; Yan et al. 2014; Harder et al. 2005). As shown in Figure 1, optimal breastfeeding practices can promote optimal child growth, protecting children from both undernutrition and overweight/obesity.

Despite significant evidence demonstrating the many benefits of optimal breastfeeding practices, there has been little global improvement. A 2013 analysis by UNICEF showed that the global

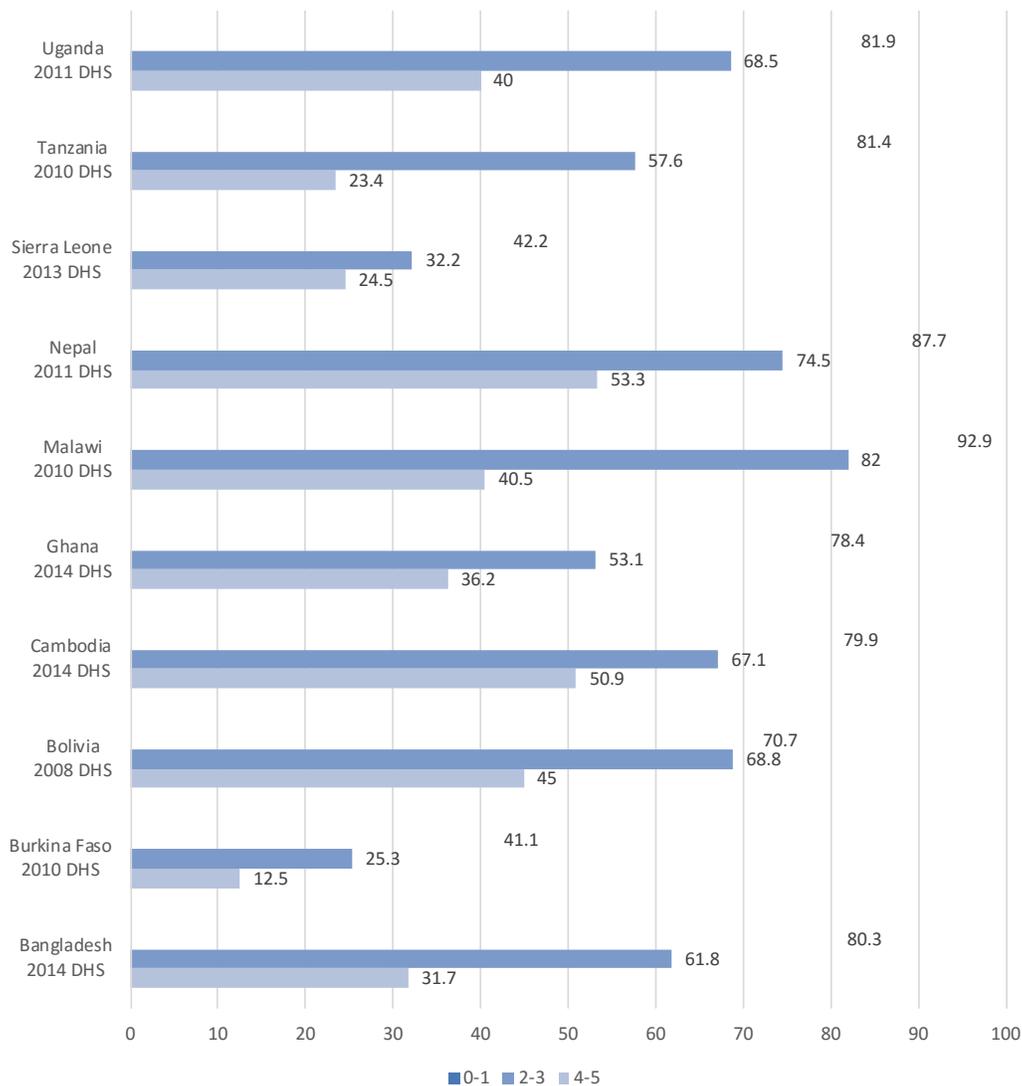
**Figure 1. Optimal Breastfeeding Practices Promote Healthy Infant Growth**



prevalence of exclusive breastfeeding only increased from 32% to 40% between 1995 and 2011, based on trend data from 77 countries. Another recent study reported that only 37% of children under 6 months of age are exclusively breastfed in low and middle-income countries (LMIC) (Victora et al. 2016). While most mothers in LMIC breastfeed their babies, many do not follow the World Health Organization’s (WHO) recommendations for immediate and exclusive breastfeeding. Among the various reasons for this are inadequate time and rest, and lack of support

for exclusive breastfeeding from health providers, the community, and family. Figure 2 illustrates the precipitous drop in exclusive breastfeeding rates in many countries during the first 6 months of life, pointing to a common problem with breastfeeding quality that is seen around the world. While many women exclusively breastfeed during the first 2 months of their baby’s life (between 41.1% and 92.9% in the 10 countries depicted in the figure), the percentage of women who exclusively breastfeed declines substantially by 4–5 months of age (ranging between 12.5% and 53.3% in these 10 countries).

**Figure 2. Exclusive Breastfeeding from Birth up to 6 Months of Age**



Source: DHS report for each country: <http://www.dhsprogram.com/publications/index.cfm>

## Why is This Model Relevant?

This PROFILES model for estimating overweight/obesity among children 48–59 months of age related to suboptimal breastfeeding practices (not exclusively breastfeeding for 6 months) is particularly relevant now due to rising concern about the increasing prevalence of childhood overweight/obesity across the globe. Overweight/obesity (severe overweight) occur when children have too much body fat, putting their health at risk; an overweight/obese child weighs more than would be expected for a healthy child of the same height (WHO Multicentre Growth Reference Study Group 2006). Overweight/obesity for children under 5 years of age are defined as weight-for-height z-score values more than 2 standard deviations (SDs) and more than 3 SDs, respectively, above the median of the WHO 2006 standard. Overweight/obesity are caused by eating too much food and/or doing too little physical activity;

FANTA developed a model that estimates preschool overweight/obesity related to suboptimal breastfeeding practices (not exclusively breastfeeding for 6 months) to support evidence-based country-level nutrition advocacy.

however, certain medical conditions and genetic factors can also contribute to overweight/obesity.

From 2010 to 2013, the number of overweight/obese children under 5 years of age has increased from 32 million to 42 million globally, and rapid increases have also been reported in Africa and Asia (WHO 2014a). In fact, in terms of absolute numbers, more children in LMIC countries are



Source: Riccardo Gangale/VectorWorks/Photoshare

overweight/obese than in high-income countries (WHO 2016). In Africa, the number of overweight/obese children has nearly doubled since 1990, and 48% of overweight/obese children under 5 live in Asia (UNICEF, WHO, World Bank 2015). As of 2013, 18 million children under 5 in Asia were classified as overweight/obese, as were 11 million in Africa and 5 million in Latin America (WHO 2014a).

Although the current prevalence of overweight/obesity in children under 5 is low in most developing countries, the rate of increase is a cause for concern. Current estimates predict that the global prevalence of overweight/obesity in children under 5 will increase from 7% in 2012, to 11% by 2025 (WHO 2014a). Childhood overweight/obesity are associated with health risks in both childhood and adulthood, and the consequences of overweight/obesity begin tracking into adulthood during the preschool years (Guo 2002; Freedman 2005). Children who are

overweight/obese are at increased risk for type 2 diabetes, asthma, and high blood pressure, among other conditions (WHO 2014a). Importantly, overweight/obese children are at least twice as likely as their non-overweight/obese peers to become overweight/obese adults, suggesting that overweight/obesity has a degree of permanence (Singh et al. 2008). Because overweight/obese children are more likely to become overweight/obese adults, they are also at increased risk of poor health outcomes associated with adult overweight/obesity, including diabetes, heart disease, cancer, and stroke (Freedman 2005).

Although numerous factors may influence the development of overweight/obesity during childhood, breastfeeding can help to reduce this risk. The exact causal pathways explaining how breastfeeding protects children against future overweight/obesity risk are still unclear. However, several research findings may help to explain this relationship (WHO 2014b). First, breastfed infants have better appetite regulation in childhood as compared to bottle-fed infants, presumably because they control the amount of breast milk they consume while breastfeeding (DiSantis et al. 2011). Second, exclusive breastfeeding can prevent the early introduction of complementary foods before the age of 6 months, which can lead to excessive weight gain (Pearce et al. 2013). In addition, high protein intake during infancy has been associated with the development of overweight/obesity, and formula-fed infants tend to have a higher protein intake than breastfed infants (Rolland-Cachera et al. 1995; Heinig et al. 1993). Hormonal differences have also been found between breastfed and formula-fed babies, as formula-feeding increases insulin levels in the body, which can increase fat deposition and the number of adipocytes (cells that store fat) (Lucas et al. 1980).

Because the research findings around its benefits have been so favorable, USAID sees breastfeeding as a critical, high-impact intervention that is necessary to achieve reductions in malnutrition, as described in the agency's Multi-Sectoral Nutrition Strategy (USAID 2014). The WHO also considers the promotion of optimal breastfeeding practices as a key component of an effective strategy to reduce the risk of childhood overweight/obesity (WHO 2014b). In addition, the World Health

### The World Health Assembly's 2025 Global Nutrition Targets

“Recognizing that accelerated global action is needed to address the pervasive and corrosive problem of the double-burden of malnutrition, in 2012 the World Health Assembly (WHA) unanimously agreed to a set of 6 global nutrition targets that by 2025 aim to:

- Achieve a 40% reduction in the number of children under 5 who are stunted
- Achieve a 50% reduction of anemia in women of reproductive age
- Achieve a 30% reduction in low birth weight
- Ensure there is no increase in childhood overweight/obesity
- Increase the rate of exclusive breastfeeding in the first 6 months up to at least 50%
- Reduce and maintain childhood wasting to less than 5%”

Source: WHO. 2014c. *Global Nutrition Targets 2025: Policy Brief Series*. Geneva: WHO.

Assembly's (WHA) 2025 Global Nutrition Targets (see related box) seek to increase the prevalence of exclusive breastfeeding in the first 6 months to at least 50% and ensure that childhood overweight/obesity does not increase, among other goals (WHO 2014c).

Global evidence establishes that to effectively improve breastfeeding practices, mothers need support at multiple levels (family, community, and societal) during pregnancy and beyond. This requires improving both facility and community-based strategies to support exclusive breastfeeding and an enabling policy environment that promotes the implementation of the Baby-Friendly Hospital Initiative, adheres to the International Code of Marketing Breast-milk Substitutes, and supports continued breastfeeding in the workplace through paid maternity leave and workplace amenities (e.g. lactation rooms) (Rollins et al. 2016). Investing in approaches that provide mothers with effective, intensive, targeted support to be able to exclusively breastfeed their children during the first 6 months of life and that improve the overall quality and duration of breastfeeding in line with WHO recommendations, is critically important to achieving the WHA targets for exclusive breastfeeding, stunting, wasting, and childhood overweight/obesity.

Intensive efforts are required across multiple levels and by various stakeholders to support not only national-level policy changes, but also community-level implementation of interventions and services that effectively improve breastfeeding practices. This requires advocacy to create an enabling environment for political commitment, multi-sectoral collaboration, and effective interventions at both the health system and community levels. Country-level advocacy to support optimal breastfeeding is critical to garnering the political will at multiple levels to support efforts to mitigate the consequences of suboptimal breastfeeding and to fulfill national commitments to the WHA targets. Both the new PROFILES model that estimates the effect of suboptimal breastfeeding practices on overweight/obesity and the existing model that estimates the [impact of suboptimal breastfeeding on child mortality](#) are useful tools that can help support country-level advocacy efforts to improve breastfeeding practices.

## Information Needed to Generate PROFILES Estimates

Every model in PROFILES utilizes the following information to generate estimates:

- A **time period** is needed to determine the number of years for which the estimates should be calculated (e.g., 10 years).
- **Prevalence information** provides the magnitude of the nutrition problem (for example, percent of children 4–5 months of age who are exclusively breastfed). Current prevalence information is needed to serve as a baseline for the equations in the model.<sup>a</sup> Exclusive breastfeeding prevalence is often included in nationally representative household surveys such as the Demographic and Health Survey and in Multiple Indicator Cluster Surveys.
- **Targets** are set to determine what the goal should be with regard to prevalence of the nutrition problem at the end of the given time period (e.g., improve exclusive breastfeeding prevalence from 40 percent to 65 percent). The targets reflect the proportion by which the nutrition problem will be reduced (or in this case improved) over the chosen time period and therefore influence the outcome of interest.<sup>b</sup>
- **Demographic information** serves as the basis for the population projections by providing population size and structure.
- **Mortality, economic, employment, or education-related information** provides details to estimate the outcome of interest. This information is needed to compute the consequence of the nutrition problem on the outcome of interest.

<sup>a</sup> PROFILES uses the best available, recent information on point prevalence, which is the prevalence at a point in time, often referred to as a snapshot of a population.

<sup>b</sup> It is important to note that specific nutrition interventions are not entered into the model to develop the PROFILES estimates. Rather, the improvement in the nutrition situation is based on the expectation that if nutrition interventions that are known to be effective are implemented at scale they will succeed in reaching the stated targets.

## How Does the Model Work?

The basic approach in PROFILES is to provide two scenarios: a status quo scenario and an improved scenario. The status quo scenario calculates estimates based on the assumption that the current situation throughout a chosen time period (e.g., 10 years) will not change, aside from projected changes in population size and structure, and that the prevalence of exclusive breastfeeding will remain the same from year to year. In contrast, the improved scenario calculates estimates for the same time period, assuming that the prevalence of exclusive breastfeeding is improved. For the improved scenario, it is necessary to set targets for the increase in exclusive breastfeeding prevalence; these targets are discussed and agreed upon by participants during PROFILES workshops, taking into account various national priorities and development objectives. The improved scenario assumes a linear change in exclusive breastfeeding, with a gradual improvement from the first year (when prevalence equals that in the status quo scenario) to the last year (when the target prevalence is reached).

Models in the PROFILES spreadsheet workbook rely on coefficients based on the scientific literature to show the association between a nutrition problem and an outcome of interest. To create the suboptimal breastfeeding and overweight/obesity model, FANTA reviewed peer-reviewed literature that quantified the association between breastfeeding practices and overweight/obesity risk. In 2015, Horta et al. reviewed the evidence to date on the association between breastfeeding and overweight/obesity. This review served as the starting point for the development of the PROFILES model. Horta et al. (2015) reported a pooled odds ratio and 95% confidence interval of 0.69 (0.61; 0.79),  $p < 0.001$  for a reduced risk of overweight/obesity later in life from 24 estimates (which were categorized as estimates related to exclusively breastfeeding for a given number of months).

Although the Horta et al. 2015 review provided an overall odds ratio for the reduced risk of overweight/obesity later in life related to exclusive breastfeeding for a given number of months, FANTA was interested in knowing more specifically

about the impact that the optimal duration of exclusive breastfeeding (for the first 6 months of life) had on future /overweight/obesity risk in childhood, particularly because almost all children in developing countries are breastfed initially, but the length of time for which they may be exclusively breastfed is often short. To address this question, FANTA selected a set of studies from the Horta review based on two inclusion criteria: 1) duration of exclusive breastfeeding for 6 months, and 2) assessment of childhood overweight/obesity among children aged 4 to 5 years of age in the sample. Five studies<sup>3</sup> met the inclusion criteria and were used to arrive at a coefficient, an odds ratio (OR), for use in the PROFILES model. FANTA calculated the OR using the methods described in the Cochrane Handbook for Systematic Reviews of Interventions, specifically the “generic inverse variance” method.<sup>4</sup> The calculated pooled OR was 0.68, indicating a decreased risk of becoming overweight/obese at 4 to 5 years of age for children who are exclusively breastfed according to recommendations. This translates into an OR of 1.48, indicating an increased risk of becoming overweight/obese at 4 to 5 years of age associated with not exclusively breastfeeding for 6 months. The latter is the coefficient used in the new model.

In addition to this coefficient, the model also uses country-specific exclusive breastfeeding information (prevalence of exclusive breastfeeding among children 4–5 months of age),<sup>5</sup> and information on the prevalence of overweight/obesity (weight-for-height z-score more than 2 SD above the median of the WHO 2006 standard) at 48–59 months of age (that is, among children 4 years of age). The population attributable fraction (PAF)<sup>6</sup> is calculated as a function of the prevalence of the risk factor (not being exclusively

<sup>3</sup> Komatsu 2009, Simon 2009, Rathnayake 2013, Kumar 2014, and Zheng 2014

<sup>4</sup> More information on this method can be found at <http://handbook.cochrane.org/> (Part 2, Chapter 7, Section 7.7.7).

<sup>5</sup> In the model, the duration of exclusive breastfeeding at 4–5 months of age is used as a proxy for the optimal duration of exclusive breastfeeding because the Demographic and Health Surveys (DHS), which are often utilized as input information for PROFILES estimates, typically have this information, which is considered the best available measure of the optimal duration of exclusive breastfeeding.

breastfed at 4–5 months) and the relative risk of overweight/obesity among children 4 years of age who were not exclusively breastfed for 6 months. The number of children whose overweight/obese status at 4 years of age is related to their not having been exclusively breastfeeding for 6 months is then calculated by multiplying the PAF by the number of overweight/obese children 48–59 months of age in the population. The estimates calculated by this model refer to the likelihood of children 48–59 months becoming overweight/obese related to suboptimal breastfeeding practices in infancy and the reduced likelihood if breastfeeding practices were improved. In the status quo scenario the results would be presented as “x number of children 48–59 months of age would become overweight/obese related to suboptimal breastfeeding practices,” Whereas for the improved scenario the results would be presented as “x number of children 48–59 months of age would be prevented from becoming overweight/obese related to improved breastfeeding practices.”

Using the method described, the PROFILES suboptimal breastfeeding and overweight/obesity model calculates country-specific estimates of the number of children 48–59 months of age who will become overweight/obese related to suboptimal breastfeeding practices over a certain time period (assuming that there is no change in exclusive breastfeeding prevalence); and the number of children 48–59 months who will be prevented from becoming overweight/obese if the exclusive breastfeeding prevalence is improved over the same time period.

### How Can This Model Be Used to Support Country-Level Advocacy?

The promotion of optimal breastfeeding practices is critical to reducing global undernutrition and

helping to slow the rise in childhood overweight/obesity. From the standpoint of nutrition advocacy, using the new PROFILES model in contexts where childhood overweight/obesity is a concern provides another avenue through which to engage country governments and donors to improve exclusive breastfeeding practices as part of the broader nutrition advocacy process. With the support of PROFILES estimates, advocacy can emphasize that addressing suboptimal breastfeeding practices is not only critical to reducing childhood morbidity and mortality, but is also essential to helping prevent, slow, and reverse the rising trend in childhood overweight/obesity. Improving breastfeeding practices can help prevent countries from having to face a double burden of malnutrition, in which already-stressed health systems are forced to address both undernutrition and overweight/obesity, ultimately saving countries time and resources while simultaneously improving children’s lives.

For more information on FANTA’s country-level nutrition advocacy activities using PROFILES, visit [www.fantaproject.org/tools/profiles](http://www.fantaproject.org/tools/profiles) or email FANTA at [fantamail@fhi360.org](mailto:fantamail@fhi360.org).

<sup>6</sup> The population attributable fraction is the proportion (or *fraction*) of the condition (child overweight/obesity) that is *attributable* to the risk factor (not being exclusively breastfed at 4–5 months).

## References

- Anderson, J.W. et al. 1999. "Breast-Feeding and Cognitive Development: A Meta-Analysis." *American Journal of Clinical Nutrition*. 70(4): pp. 525–535.
- Black, R.E. et al. 2008. "Maternal and Child Undernutrition: Global and Regional Exposures and Health Consequences." *The Lancet*. 371(9608): pp. 243–260.
- Black, R.E. et al. 2013. "Maternal and Child Undernutrition and Overweight in Low-Income and Middle-Income Countries." *The Lancet*. Volume 382, Issue 9890, pp. 427–451.
- Copenhagen Consensus. 2012. "Expert Panel Findings." [http://www.copenhagenconsensus.com/sites/default/files/outcome\\_document\\_updated\\_1105.pdf](http://www.copenhagenconsensus.com/sites/default/files/outcome_document_updated_1105.pdf)
- Debes, A.K. et al. 2013. "Time to Initiation of Breastfeeding and Neonatal Mortality and Morbidity: A Systematic Review." *BMC Public Health*. 13(Suppl 3): p. S19.
- DiSantis, K.I.; Collins, B.N.; Fisher, J.O.; Davey, A. 2011. "Do Infants Fed Directly from the Breast Have Improved Appetite Regulation and Slower Growth during Early Childhood Compared with Infants Fed from a Bottle?" *International Journal of Behavioral Nutrition and Physical Activity*. 8(89).
- Freedman, D.S. et al. 2005. "The Relation of Childhood BMI to Adult Adiposity: The Bogalusa Heart Study." *Pediatrics*. 115(22).
- Guo, S.S.; Wu, W.; Chumlea, W.C.; Roche, A.F. 2002. "Predicting Overweight and Obesity in Adulthood from Body Mass Index Values in Childhood and Adolescence." *Am J Clin Nutr* 76: 653–8.
- Harder, T.; Bergmann, R.; Kallischnigg, G.; Plagemann, A. 2005. "Duration of Breastfeeding and Risk of Overweight: A Meta-Analysis." *Am J Epidemiol*. 162: 397–403.
- Heinig, M.J.; Nommsen, L.A.; Peerson, J.M.; Lonnerdal, B.; Dewey, K.G. 1993. "Energy and Protein Intakes of Breast-Fed and Formula-Fed Infants during the First Year of Life and Their Association with Growth Velocity: The DARLING Study." *American Journal of Clinical Nutrition*. 58(2): 152–161.
- Horta, B.L.; Loret de Mola, C.; Victora, C.G. 2015. "Long-Term Consequences of Breastfeeding on Cholesterol, Obesity, Systolic Blood Pressure and Type 2 Diabetes: a Systematic Review and Meta-Analysis." *Acta Paediatr. Suppl*. 104: 30–7.
- Horta, B.L. and Victora, C.G. 2013. *Long-term effects of breastfeeding*. Geneva: World Health Organization.
- International Food Policy Research Institute (IFPRI). 2015. *Global Nutrition Report 2015: Actions and Accountability to Advance Nutrition and Sustainable Development*. Washington, DC: IFPRI.
- Lamberti, L.M. et al. 2011. "Breastfeeding and the Risk for Diarrhea Morbidity and Mortality." *BMC Public Health*. 11(Suppl 3): S15.
- Lucas, A. et al. 1980. "Breast vs Bottle: Endocrine Responses Are Different with Formula Feeding." *The Lancet*. 1: 1267–9.
- Pan American Health Organization (PAHO)/World Health Organization (WHO). 2002. *Guiding Principles for Complementary Feeding of the Breastfed Child*. Washington, DC: PAHO/WHO.
- Pearce, J.; Taylor, M.A.; Langley-Evans, S.C. 2013. "Timing of the Introduction of Complementary Feeding and Risk of Childhood Obesity: A Systematic Review." *International Journal of Obesity*. 37(10): 1295–306.
- Rolland-Cachera, M.F. et al. 1995. "Influence of Macronutrients on Adiposity Development: a Follow-Up Study of Nutrition and Growth from 10 Months to 8 Years of Age." *Int J Obes Relat Metab Disord*. 19: 573–8.
- Rollins, N.C. et al. 2016. "Lancet Breastfeeding Series: Why Invest, and What It Will Take to Improve Breastfeeding Practices in Less Than a Generation." *The Lancet*. 387: 491–504.
- Singh, A.S.; Mulder, C.; Twisk, J.W.R.; van Mechelen, W.; Chinapaw, M.J.M. 2008. "Tracking of Childhood Overweight into Adulthood: A Systematic Review of the Literature." *Obesity Reviews* 9: 474–488.
- UNICEF, WHO, World Bank. 2015. *Levels and Trends in Child Malnutrition: UNICEF-WHO-World Bank Joint Child Malnutrition Estimates*. New York: UNICEF; Geneva: WHO; Washington, DC: World Bank.

- UNICEF. 2013. *Breastfeeding on the Worldwide Agenda*. New York: UNICEF.
- USAID. 2014. *Multi-Sectoral Nutrition Strategy 2014–2025*. Washington, DC: USAID.
- Victora, C.G. et al. 2005. “Breastfeeding and School Achievement in Brazilian Adolescents.” *Acta Paediatrica*. 94(11): 1656-60.
- Victora, C.G. et al. 2015. “Association between Breastfeeding and Intelligence; Educational Attainment, and Income at 30 Years of Age: A Prospective Birth Cohort Study from Brazil.” *The Lancet*. 3 : e199-205.
- Victora, C.G. et al. 2016. “Breastfeeding in the 21st Century: Epidemiology, Mechanisms, and Lifelong Effect.” *The Lancet*. 387: 475–90.
- WHO. 2001. *Global Strategy for Infant and Young Child Feeding. The Optimal Duration of Exclusive Breastfeeding*. Geneva: WHO.
- WHO. 2014a. *Global Nutrition Targets 2025. Childhood Overweight Policy Brief*. Geneva: WHO.
- WHO. 2014b. “Exclusive Breastfeeding to Reduce the Risk of Childhood Overweight and Obesity.” e-Library of Evidence for Nutrition Actions (eLENA). [http://www.who.int/elena/titles/bbc/breastfeeding\\_childhood\\_obesity/en/](http://www.who.int/elena/titles/bbc/breastfeeding_childhood_obesity/en/)
- WHO. 2014c. *Global Nutrition Targets 2025: Policy Brief Series*. Geneva: WHO.
- WHO. 2014d. *WHA Global Nutrition Targets 2025: Breastfeeding Policy Brief*. (WHO/NMH/NHD/14.3). Geneva: WHO.
- WHO Multicentre Growth Reference Study Group. 2006. *WHO Child Growth Standards: Length/Height-for-Age, Weight-for-Age, Weight-for-Length, Weight-for-Height and Body Mass Index-for-Age: Methods and Development*. Geneva: WHO.
- WHO. 2016. *Report of the Commission on Ending Childhood Obesity*. Geneva: WHO.
- Yan, J.; Liu, L.; Zhu, Y.; Huang, G.; Wang, P. 2014. “The Association between Breastfeeding and Childhood Obesity: A Meta-Analysis.” *BMC Public Health*. 14(1267).

**Contact Information:**

Food and Nutrition Technical Assistance III Project  
(FANTA)  
FHI 360  
1825 Connecticut Avenue, NW  
Washington, DC 20009-5721  
Tel: 202-884-8000  
Email: [fantamail@fhi360.org](mailto:fantamail@fhi360.org)

**Recommended Citation:** Oot, L.; Sethuraman, K.; Ross, J.; and Sommerfelt, A.E. 2016. *The Effect of Suboptimal Breastfeeding on Preschool Overweight/Obesity: A Model in PROFILES for Country-level Advocacy*. Washington, DC: FHI 360/FANTA.

This brief is made possible by the generous support of the American people through the support of the Office of Health, Infectious Diseases, and Nutrition, Bureau for Global Health, U.S. Agency for International Development (USAID) under terms of Cooperative Agreement No. AID-OAA-A-12-00005, through the Food and Nutrition Technical Assistance III Project (FANTA), managed by FHI 360.

The contents are the responsibility of FHI 360 and do not necessarily reflect the views of USAID or the United States Government.



[www.fantaproject.org](http://www.fantaproject.org)



@FANTAproject