Integrating Nutrition and Child Development Interventions: Scientific Basis, Evidence of Impact, and Implementation Considerations[1–3]

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ABSTRACT

The Millennium Development Goals (MDGs) have contributed to unprecedented reductions in poverty and improvement in the lives of millions of men, women, and children in low- and middle-income countries. Yet, hundreds of millions of children under 5 y of age are not reaching their developmental potential. This article reviews the scientific basis for early childhood nutrition and child development interventions, the impact of integrated interventions on children's linear growth and cognitive development, and implementation strategies for integrated nutrition and child development programs. Advances in brain science have documented that the origins of adult health and well-being are grounded in early childhood, from conception through age 24 mo (first 1000 d) and extending to age 5 y (second 1000 d). Young children with adequate nutrition, nurturant caregiving, and opportunities for early learning have the best chances of thriving. Evidence from adoption, experimental, and quasi-experimental studies has shown that stunting prevention is sensitive during the first 1000 d, and sensitivity to child development interventions extends through the second 1000 d. Cognitive development responds to interventions post–1000 d with effect sizes that are inversely associated with initial age and length of program exposure. Integrated interventions need governance structures that support integrated policies and programming, with attention to training, supervision, and monitoring. The MDGs have been replaced by the Sustainable Development Goals (SDGs), with targets for the next 15 y. Achievement of the SDGs depends on children receiving adequate nutrition, nurturant caregiving, and learning opportunities from conception through age 5. *Adv Nutr* 2015;6:852–9.

Keywords: 1000 days, nutrition intervention, child development intervention, Sustainable Development Goals, sensitive development periods, implementation science

Introduction

In 2000, world leaders adopted the Millennium Development Goals (MDGs)[7], with targets for reducing poverty by 2015. In the past 15 y, there have been unprecedented successes, including improvements in poverty reduction, child and maternal survival, primary education enrollment, gender equality, HIV treatment, availability of clean water, and global partnerships (1). Yet, many inequities remain, particularly for young children in low-and middle-income countries (LMICs). Recent evidence has shown that the origins of adult health and well-being stem from genetic-environmental interactions that extend from conception through age 24 mo (first 1000 d) and continue through age 5 y (second 1000 d) (2). Young children with adequate nutrition, nurturant caregiving, and opportunities for early learning have the best chances of thriving. Even in the face of biological or environmental threats, adequate nutrition, caregiving, and learning can provide protection. In contrast, the lack of these essential factors can undermine children's individual potential, and the potential of entire societies.

As global attention moves toward the post-2015 agenda and the Sustainable Development Goals (SDGs), there is recognition that ongoing success will depend on strategies

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[7] Abbreviations used: IQ, intelligence quotient; LMIC, low- and middle-income country; MDG, Millennium Development Goal; SDG, Sustainable Development Goal.

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to ensure the health and development of young children. The SDGs include goals specifically directed toward young children by targeting reductions in stunting and wasting among under-5 children through nutritional interventions and by ensuring access to quality early childhood development care and pre–primary education in preparation for primary education. With a focus on nutrition and early child development among under-5 children in the SDGs, there is a need for policies and programs to focus on the youngest children and to examine strategies that integrate (or coordinate) nutrition and child development interventions. This article reviews the scientific basis and theoretic framework for early childhood interventions targeting nutrition and child development, the impact of integrated interventions on children's linear growth and cognitive development after the first 1000 d, and implementation strategies for integrated nutrition and child development programs.

Current Status of Knowledge

Scientific basis for integrated nutrition and child development interventions

Nutrition. Nutritional deficiencies may begin prenatally, setting children onto negative trajectories before birth (3, 4). Stunting (height-for-age z score < -2, based on the WHO growth standard) is an indicator of chronic undernutrition. A recent meta-analysis showed that a 1-SD increase in height-for-age for children under 2 y of age was associated with an average increase in cognitive performance of 0.22 SD among cross-sectional studies and of 0.24 SD among longitudinal studies (5). Long-term studies have shown that early stunting is associated with less schooling, poor test performance, and low earnings in adulthood (6–8). Consequences of early stunting extend to the next generation. Maternal stunting before 24 mo of age has been associated with lower birth weight of the next generation in a pooled analysis from 4 LMICs (9), and a study from Jamaica showed that early parental stunting (both genders) is associated with low cognitive performance of their offspring (10). The consistent findings linking early stunting to developmental competence that extends to adulthood and into subsequent generations raise major public health concerns, because despite striking reductions in rates of stunting globally, an estimated 26% of under-5 children (~165 million) are stunted in LMICs (11).

Early child development. Child development is defined as an orderly progression of skills (gross and fine motor, cognitive and language, and personal/social) that are formed by an interaction of genetic potential and environmental opportunities. Through a scaffolding process, early developmental skills form the basis for subsequent development, including school readiness and school performance. As children approach school age, individual and cultural differences emerge, and early disparities become more apparent. Early risks, including poverty, nutritional deficiencies (stunting and micronutrient deficiencies), and lack of learning opportunities, have resulted in >200 million children under age 5 y in LMICs not reaching their developmental potential (6).

Poverty and brain development. The negative effects of poverty on early child development have been shown in studies conducted in high-income countries, such as the United States (12), and in LMICs, such as Bangladesh (13). As the methodology to study brain development among young children has expanded, studies in brain science have shown that poverty can undermine both the structure and function of early brain development (14, 15). A recent study conducted in 6 sites in the United States showed that associations between poverty and children's low cognitive and academic performance were mediated by a decrease in the size of brain regions associated with cognitive functioning (hippocampus and frontal and temporal lobes) (16). The decreased brain volume contributed up to 20% of the variance in cognitive functioning. These compelling findings show the sensitivity of early brain development and the need to protect very young children from the negative consequences of poverty.

Brain development begins prenatally and continues throughout childhood, with the most rapid development occurring before age 5 (the first and second 1000 d: conception through 24 mo and 25–60 mo). Data from LMICs have shown that parenting and preschool interventions early in life have beneficial effects on children's cognitive performance and schooling (17, 18) that can extend into adulthood. The Jamaica trial was a 2-y randomized trial of a home-based intervention based on opportunities for play and early learning through homemade toys and materials that were delivered to low-income families of stunted toddlers. Young adults who had been randomly assigned to the intervention group were less likely to exhibit serious violent behavior; had higher intelligent quotient (IQ) scores, higher educational attainment, and fewer symptoms of depression (8); and earnings that were 25% higher compared with young adults in the control group (19). Jamaica has a strong history of providing universal preschool education, suggesting that the continuity of home-visiting with preschool and primary school may have contributed to the long-term success.

In addition to relations between poverty and early brain development, poverty may also compromise child development through lack of adequate nutrition and lack of opportunities for early learning and responsive caregiving. Early childhood, beginning prenatally, is characterized by sensitive periods for nutrition (primarily the first 1000 d) and child development (both first and second 1000 d) that are influenced by maturation and genetic-environmental interactions (20). These multiple pathways suggest that integrated (or coordinated) interventions that address both nutrition and child development are needed to protect children from early adversities associated with poverty and to provide promotive opportunities for nutrition, early learning, and nurturant caregiving (18, 21). The heterogeneous aspects of early brain development, whereby regions develop and

mature at different time points, and the plasticity of early brain development suggest that the window of opportunity for integrated nutrition and early child development interventions may extend beyond the first 1000 d (20).

Impact of integrated child development interventions on linear growth and cognitive development

This section focuses on interventions conducted post–1000 d and examines the impact of integrated nutrition and early child development interventions on the growth and development of children who were malnourished and living under deprived conditions during the first 1000 d of life.

Observational cohort studies. The Young Lives Study is a prospective observational study that has followed 12,000 children from 4 countries (Peru, Ethiopia, India, and Vietnam) from the first year of life through adolescence. Analyses have shown that stunting at 1 y of age does not necessarily translate into stunting at 8 y of age (ranging from 9.3% of children in Vietnam to 26% in Ethiopia), suggesting that substantial linear catch-up growth post–1000 d can occur (22), linear catch-up growth unexplained by growth before 12 mo of age is associated with improved cognitive function at 8 y of age (22), and catch-up linear growth between 8 and 15 y of age is associated with improved cognitive function among adolescents (23). These findings suggest that improvements between physical growth and cognition are closely associated and may occur throughout childhood and adolescence. Although adequate nutrition, caregiving, and early learning during the first 1000 d lay the foundation for human development, data from the Young Lives Study provide plausible evidence for the plasticity of early development and the possibility that interventions that integrate nutrition and child development post–1000 d may be effective in promoting both growth and development. However, answering questions about the impact of integrated interventions requires experimental or quasi-experimental designs.

Adoption studies. International studies that examine the growth and development of children who experienced malnutrition and lack of care and learning opportunities early in life and were adopted into middle-class families represent a unique natural experiment. A study conducted >4 decades ago examined the linear growth and development of 240 orphaned Korean girls adopted by families in the United States when they were between 2 and 5 y of age (24). At follow-up, the girls with less severe malnutrition upon arrival to the United States had intellectual development and school performance scores that were above the US average and higher than the scores of the girls who were more severely malnourished upon arrival to the United States (24). Age at adoption was also related to achievement scores, favoring girls who were adopted at age 3 or younger. These findings show the powerful effect that an enriched environment post–1000 d can have on the growth and development of previously malnourished children.

A retrospective study conducted in rural Indian girls who were adopted by Swedish families when they were 3.7 y old on average showed that girls who were stunted upon arrival experienced very rapid linear catch-up growth until menarche, which occurred 2–3 y sooner than if they had stayed in India (25).The result was that the adopted girls who were stunted upon adoption had less time to grow in their enriched environment in Sweden, ending up with an average height that was similar to the one they may have attained had they stayed in India (25).

A team of researchers from the United Kingdom compared the growth and development of Romanian male and female orphans adopted by British families during the first 3.5 y of life with children from the United Kingdom who were adopted when they were <6 mo of age (26). At follow-up evaluations, age of adoption was inversely associated with IQ and scholastic achievement and positively associated with inattention and psychopathologies. Although there was substantial IQ catch-up among the Romanian adoptees, performance was highest among the group who were adopted when they were younger. In this study, strong prepubertal catch-up in linear growth was observed, which is consistent with the Swedish study.

The Bucharest Early Intervention Project randomly assigned 136 children who were abandoned at birth or soon after birth to remain under government institutional care or to be placed in foster care (27). The average age upon random assignment was 21 mo, ranging from 0–18 mo to >30 mo. Children placed in foster care had improved developmental quotients at 48 mo and improved IQ scores at 54 mo of age. However, the cognitive development of children in foster care was significantly lower than that of a reference group of children who were never institutionalized. The earlier the children were placed in foster care the stronger the benefit was for their cognitive development, suggesting that the first 2 y of life are a sensitive period for placement of abandoned infants into foster care.

In sum, the adoption studies suggest that linear catch-up growth can occur post–1000 d. Among girls, this catch-up growth has been associated with an earlier onset of puberty, which, in turn, has been associated with a shorter adult height. The mechanisms behind these observations are not fully understood, but they may reflect metabolic-endocrinologic disruptions resulting from chronic malnutrition during the first 1000 d of life. The adoption studies also suggest that enriched environments post–1000 d may lead to rapid catch-up in cognitive outcomes and that these developmental benefits remain. Overall, the evidence supports major improvements in developmental and cognitive outcomes with enriched environmental improvements, even if they start after the first 1000 d of life, with the evidence indicating that the earlier the nourishing and nurturing environments are provided, the stronger the benefit on the cognitive development of previously deprived children.

Experimental and quasi-experimental integrated studies. The Cali, Colombia, trial (28) is a robust experimental

TABLE 1 Issues related to integrated nutrition and child development interventions

Issue	Comment
Science of integration	Children require adequate nutrition, nurturant caregiving, and learning opportunities. Single components are not sufficient.
Impact of integrated intervention may be stronger than nutrition alone	Impact of nutrition intervention is strongest in the first 1000 d.
Impact of integrated intervention may be stronger than child development alone	Children require adequate nutrition, along with nurturant care and early learning. Impact of child development component of integrated interventions continues through age 5 y.
Economy of effort	One community worker may be able to deliver multiple messages. Caution in not overloading mothers.
Comprehensive	Integrated nutrition and child development intervention can address a child's needs and may result in synergy.
International organizations are promoting integrated interventions.	Policy support from international agencies has to be supported by program and evaluation support.
Individual home-visiting intervention vs. group intervention	Limited data on the impact of individual vs. group interventions.
Sampling bias	To evaluate programs, potential sampling biases (socioeconomic status and cultural context) should be eliminated.
Evaluation	Need support to incorporate evaluation into program planning.
Publication bias	Support publication of results, whether positive or negative.
Governance	Governance structure needed to support cross-sectorial coordination.
Training and supervision	Training and supervision needed for both nutrition and child development with strategies to integrate them into comprehensive messages.
Feasibility	Information on feasibility and "lessons learned" would be beneficial to program development.
Costing	Cost analyses should be built into programs.
Implementation science	Principles of implementation science, including stakeholder involvement, can assist with program sustainability and scaling.

investigation of an integrated nutrition and child development intervention delivered at child care centers, with well-designed nutrition, health care, and psychoeducational stimulation components. The nutrition component included feeding locally available nutritious foods as well as a high-protein nutrition supplement containing 27% of the recommended daily intakes of protein and energy and 100% of the recommended intakes of vitamin A, thiamin, riboflavin, niacin, and iron. The health component was based on daily checks by nurse assistants of the children before they boarded the school bus. Sick children were referred to the study's pediatrician. The psychoeducational stimulation was designed to improve the children's cognitive development, social interactions, language, and fine and gross motor skills following age-appropriate curricula. Undernourished preschoolers were randomly assigned to an integrated intervention at 4 different ages spaced by 9- to 10-month intervals between 42 and 75 mo of age. The intervention ended when the children were 7 y old. The children were assessed at regular intervals during and after the intervention until they were 10.4 y of age. Overall cognitive ability (drawn from multiple tests) was superior in the longest-intervention-exposure groups, with substantial cognitive catch-up within each group corresponding to intervention exposure duration. However, substantial gaps in cognitive ability remained when comparing the maximum-exposure group with a reference group of children from families with high socioeconomic status.

The 3-y postintervention follow-up of the Cali trial found that cognitive ability was significantly higher in the maximal exposure group (i.e., 4 treatment periods) than in the group who was exposed for 1 period (29). There were no significant differences for the groups exposed for 2 or 3 treatment periods. Because age of enrollment was confounded with duration of exposure, the 2 variables could not be analyzed separately.

With regard to linear growth, during the intervention phase of the Cali trial there was significantly greater catch-up growth in the group exposed to 4 time periods followed by the group exposed to 3 time periods. However, the linear growth benefits waned after the discontinuation of the intervention and were no longer significant by 10 y of age (i.e., 3 y postintervention). There was a major gap between the maximum-exposure group and 2 comparison groups of nonstunted children who varied by socioeconomic status (high and low) (30). It is possible that this gap would have been narrowed had the children been exposed to enriched environments since birth, although this question could not be answered by this study.

The Cali study served as the foundation for the design and deployment of the large-scale Colombian "Hogares Comunitarios de Bienestar" integrated nutrition and child development program. This program focuses on home-based child care centers that offer supplementary nutrition and psychosocial stimulation. The program specifically aims to improve children's physical, cognitive, and social development; to support healthy parenting; and to connect families with community networks. To facilitate the implementation of the program, all child care providers are required to attend a 40-h preservice training on child development, health nutrition, safety, and community participation. Parents of participating children pay a monthly fee that cannot exceed 25% of the daily minimum wage. As in the Cali study, children receive nutritious local foods as well as a liquid

nutritious supplement containing high-quality protein and fortified with multiple vitamins and minerals. The food and supplement combined are expected to cover 70% of daily caloric requirements. The program currently serves 800,000 children <6 y of age. A quasi-experimental evaluation of the impact of the program on nutritional status among children under age 6 y and cognitive and socioemotional development among 3–6 y olds was recently published (31). The exposure variable was length of program participation, and all analyses were reported by age subgroups. Being exposed to the program for >15 mo compared with for <1 mo was associated with improved cognitive and socioemotional outcomes that were expected to translate into significant improvements in annual wages when the children became adults. Among children under age 6 y, there was no overall impact on linear growth, except for the older children who were exposed for >15 mo of programming. The authors attributed the lack of overall impact in linear growth to poor implementation of the nutrition component of the intervention, specifically the inappropriate assessment of portion sizes needed by the children (32).

Two additional studies of the potential impact of post–1000 d integrated nutrition and child development interventions were identified. An integrated intervention (psychoeducational stimulation and nutritional supplementation) in Bolivia targeting child care centers in private homes serving 6- to 72-mo-old children found that program exposure for >7 mo significantly improved the children's fine/gross motor skills, language, and psychomotor development. However, no benefit on weight or height was detected (33). In this program, women from the community are provided with training in child care and loans and grants to upgrade facilities in their homes. The program provides food to meet 70% of the children's nutritional needs as well as health and nutrition monitoring and age-appropriate psychoeducational stimulation.

A study in Mozambique that randomly assigned communities to deliver psychosocial stimulation to 36- to 59-mo-old children and nutrition and literacy workshops to their parents found significant improvements in schooling and cognitive domains (elementary school enrollment, time spent on school-related activities, fine motor development, problem solving). Consistent with the Bolivian study, there were no impacts detected on weight or height or in child morbidity (34). This program focused on preliteracy and numeracy skills as well as on play activities. Teachers were offered a 5-d initial training followed by monthly mentoring. In addition to the monthly health and nutrition parents' groups, the program built latrines and hand-washing stations in the community preschools where the intervention took place.

Implementation strategies of integrated nutrition and child development programs

There are advantages and challenges to providing integrated programs that offer multiple services across sectors (e.g., health, nutrition, education) and allow the flexibility for potential synergies by providing services in one location (see **Table 1**). International organizations, including the Association for the Development of Education in Africa and the UN Educational, Scientific, and Cultural Organization (UNESCO), have urged policy makers and program managers to adopt an integrated approach as optimal for children. However, beyond the programs reviewed in the previous section, evaluations have been limited, with few "lessons learned" or guidelines for successful implementation of integrated interventions (35).

Intervention success is often dependent on technical and managerial capabilities, capacity building, and multisectoral policies. For instance, an integrated intervention aimed at reducing malnutrition experienced success in some countries in South East Asia and Latin America, largely because there was simultaneous implementation of policies and programs aimed at improving food security, reducing poverty and social inequalities, and improving maternal education (36).

Mutual understanding of programs activities can lead to identification of opportunities for integration by expanding traditional messages. For example, the Infant and Young Child Feeding (IYCF) community often refers to providing IYCF support as part of other services (e.g., antenatal care, delivery, postnatal, growth-monitoring programs, immunization, community management of acute malnutrition, and other community services or programs), with the goal of incorporating nutrition and feeding messages at health contacts.

Opportunities and challenges in implementation and evaluation of integrated programs

Programs are often dependent on governmental policies and international donors (37). Despite their effectiveness, factors such as competing financial demands may affect their sustainability. Principles of implementation science, an interdisciplinary process of moving science to policy, can be applied to the implementation of integrated interventions. For example, the prevention of mother-to-child transmission of HIV infection has been a successful program that integrates multiple aspects of HIV care and prevention and has been scaled up in multiple sites by involving stakeholders, formulating measurable objectives and benchmarks, implementing training and monitoring procedures, and adhering to other components of prevention science (38).

Integrated interventions should be mindful about staff workload, training, and supervision (36). The workload of community health workers and volunteers delivering intervention is high. Strong, continuous, and supportive supervision is necessary for successful implementation of interventions. For integrated interventions, supervision can be complicated by the need to ensure that both the nutritional and the early caregiving and early learning components are well supervised.

A major challenge is to culturally adapt early learning intervention material. Curricula should be clear, concise, culturally appropriate, and complete. Community awareness of children's needs for adequate nutrition, nurturant

caregiving, and early learning opportunities should be created (37). Mothers in LMICs may have time constraints that 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 and culturally appropriate implementation strategies (39). Caution is necessary to avoid overwhelming mothers with nutrition- and development-promoting messages while respecting her other household and caregiving responsibilities.

In some studies (37) home visits were conducted and children and mothers participated in one-on-one sessions, thereby tailoring the intervention to mothers' specific situations. This approach may be more acceptable than asking mothers to visit community centers, but few evaluations have compared individual with group interventions.

Monitoring, evaluation, and staff training are additional challenges of integrated interventions. India also has a long history of providing integrated nutrition and child development services to young children through the government-sponsored Integrated Child Development Services in which preschools (Anganwadi Centers) are established in local communities throughout the country. Evaluations of Anganwadi Centers have shown variability in the quality of their staff training and implementation components (40).

Overall, there are multiple challenges to the evaluation of integrated programs. Pre-post evaluations do not account for naturally occurring or cohort changes; control or comparison groups are necessary (41). However, there may be a bias if the intervention and control groups differ in socioeconomic or cultural context. Although robust statistical methods are necessary, they cannot overcome sampling biases. Program evaluations that address issues of feasibility, sustainability, and coverage are useful because they convey information about implementing programs in real-life settings (37).

Donors and program implementers encourage impact evaluations to determine whether the intervention was effective. For nutrition, weight and height are common measures of effectiveness, with uniform procedures and standards. There are no uniform procedures or standards for measuring child development. Some programs use process measures, such as program attendance. There are recently published guidelines for determining the validity, reliability, and cultural appropriateness of child development measures (41).

Most published program evaluations are positive, raising concerns about publication bias. Not only can it be difficult to publish null or negative findings but program implementers may fear loss of funds if they do not produce positive findings. However, interventions can be improved by conducting rigorous evaluations and publishing the findings.

Cost analysis. Integrated nutrition and early child development interventions are thought to be cost-effective because existing resources can be used to provide services across multiple content areas. Although there is a need to document the real costs, benefits, and challenges of integrating interventions for young children across multiple sectors, few studies have addressed this important element of integrated programming (36). This gap in knowledge regarding costs may play a key role in why interventions shown to be efficacious often fail to be translated from research to practice (42). Cost analyses can be complex and difficult to conduct, partly because estimations depend on the phase of implementation and are often not incorporated into program planning or budgeting (43).

Integration and coordination of governance. Despite enthusiasm regarding integrated nutrition and child development programs, there are few successful models. Sectorial funding and priorities often compromise attempts at program integration, because single-sector leaders tend to guide the associated content. For example, the nutrition sector responds to indicators that are aligned with nutrition and health, and the early child development sector responds to indicators that are aligned with early child development and education. Nutrition and early child development are generally organized in different ministries, where they function independently (36). Intersectoral integration may be an elective strategy for integrated interventions.

Political will and government involvement are integral components of program success. Governments can promote integrated services through the implementation of vertical or horizontal coordination that emphasizes integrated programming and accountability. Horizontal coordination occurs within an administrative level and includes representatives from nutrition and early child development services, such as nutrition-oriented programs that incorporate early childhood messages. Vertical or combined ministries, such as health and protection ministries, tend to enable greater multisectorial coordination related to early child development (44). Although there have been few evaluations of organizational structures, successful programs have included highly articulated horizontal and vertical coordination systems (45). Decentralization, in which decision-making and/or budgeting responsibilities are handled at the local levels of government, has been associated with integrated nutrition and early child development programs (45).

In LMICs in which donor spending outweighs government spending on programs, the government may have a limited role in decisions regarding program models and policy. Funding decisions often occur within the Finance Ministry, with content expertise within the Ministries of Health, Education, and Protection (45). Coordination across nutrition and child development services requires guidelines to establish the roles and responsibilities for policy makers at national levels and for service providers at local levels (45).

Conclusions

Clear, consistent evidence indicates that children should be exposed to optimal nourishing and nurturing environments from conception throughout childhood. Yet, hundreds of millions of children are raised without adequate nutrition, care, or learning opportunities. The evidence reviewed in

this article shows the benefits from integrated nutrition and child development interventions. Although, in some cases, reversal of stunting has been demonstrated before puberty, many studies have shown no effect on growth and, in others, growth effects have been attenuated. Thus, stunting prevention may be most sensitive during the first 1000 d.

In contrast, beneficial effects on cognitive development and academic achievement have been demonstrated in multiple studies, showing that sensitivity to child development interventions extends through the second 1000 d and into the school-age years. Our review suggests that cognition can be improved even in the absence of benefits to anthropometric status. Although the 2 areas are often related at the extremes early in life, many other factors are related to cognition. Evidence strongly suggests that the earlier children are exposed to integrated nutrition and child development interventions, the stronger the cognitive benefit will be.

Thus, human development policies should be guided by the sensitive-periods paradigm (46–48). The implementation of effective early child development programs requires strong intersectoral coordination. Although integrated programming can provide diverse essential services more efficiently, there are major implementation challenges associated with fragmented governance structures, lack of coordination across sectors, and lack of adaptation of curriculums to the local context. The evaluation of integrated programs is challenging, and publication bias may be a concern.

Topics for future research into integrated nutrition and child development interventions include the following (49):

1. How do caregiving environments during the first 1000 d affect the effectiveness of post–1000 d integrated nutrition and child development interventions?
2. What is the role of initial age compared with length of exposure in understanding the cognitive benefits of post–1000 d integrated nutrition and child development interventions?
3. Are the cognitive benefits from integrated nutrition and child development programs maintained only in environments that continue to be nurturing and nourishing?
4. How can linear catch-up growth be maintained among children stunted early in life?
5. Does improved measurement of child development indicators improve evaluation capacity and governance of integrated programs.

Achievement of the SDGs depends on ensuring adequate nutrition, nurturant caregiving, and learning opportunities for children during the first and second 1000 d (conception to age 5). In addition to governance structures that support integrated policies and programming, guidance from implementation science, with attention to training, supervision, and monitoring, will be instrumental in supporting families and strengthening future generations.

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