

Chapter 19

Platforms to Reach Children in Early Childhood

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INTRODUCTION

This chapter reports on platforms that promote early child development. The economics of early child development programs and packages are covered in chapter 24 in this volume (Horton and Black 2017). Early child development research, programs, and policies have advanced significantly in low- and middle-income countries (LMICs) during the past two decades (Black, Walker, and others 2016), spearheaded by three prominent advances.

The first advance is the recognition that the foundations of adult health and well-being are based on prenatal and early-life genetic-environmental interactions that affect brain development. This recognition has created a strong emphasis on strategies to ensure that young children reach their developmental potential (Shonkoff and others 2012).

The second advance is the urgent call for strategies to promote early child development, following estimates that more than 200 million children younger than age five years in LMICs are at risk of not reaching their developmental potential (Grantham-McGregor and others 2007), largely due to nutritional deficiencies and a lack of responsive caregiving. Recent estimates report that although the prevalence of at-risk children has declined, more than 43 percent of children in LMICs are at risk for poor development (Lu, Black, and Richter 2016). Initiatives during the first 1,000 days of life—the period from conception through age 24 months, when nutritional requirements are high and brain

development is rapid—have focused attention on the need to ensure that children receive the interventions necessary to achieve their developmental potential.

Finally, global economic growth in the 1990s and the success of the Millennium Development Goals in reducing poverty and stunting and in increasing child survival have brought optimism to efforts to promote child health and development. The evidence that interventions early in life are effective in promoting early child development (Engle and others 2007; Engle and others 2011; Nores and Barnett 2010) supports the implementation of such programs at scale.

Calls from global leaders have emphasized increased investment, programs, and policies for early child development (Lake and Chan 2015) and have brought about the inclusion of early child development in the United Nations' Sustainable Development Goals (SDGs) (UN 2015). This chapter reviews the definition of early child development; risks and protective factors related to early child development; early child development systems (rights and equity, integrated interventions and multisectoral coordination, governance, and quality improvement and accountability); and platforms needed to implement early child development programs that address children's changing developmental skills across the continuum from infancy through early primary school. Definitions of age groupings and age-specific terminology used in this volume can be found in chapter 1 (Bundy and others 2017).

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EARLY CHILD DEVELOPMENT

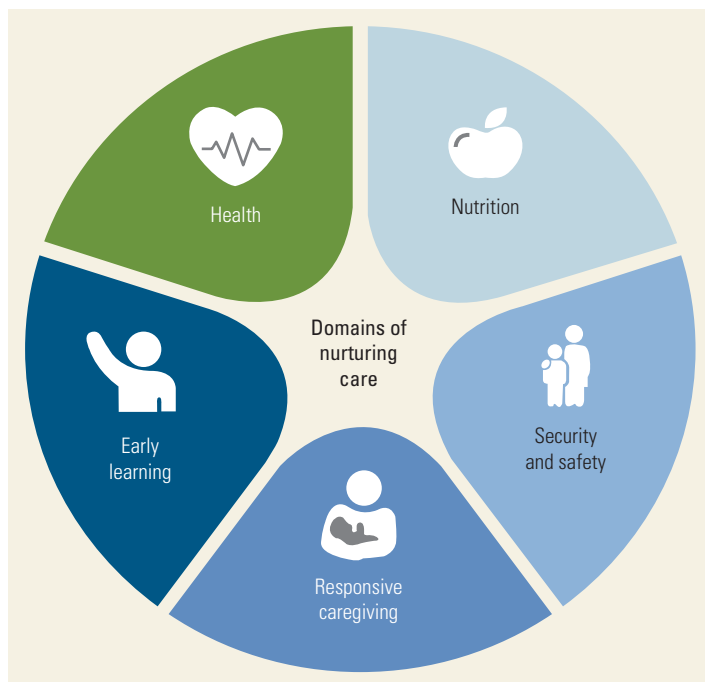
Early child development refers to the developmental progression of perceptual, motor, cognitive, language, socioemotional, and self-regulation skills through the first eight years of life. Within the grounding of social ecological theory (Bronfenbrenner and Morris 2007), children's early development is influenced by family, community, and environmental interactions. Families and caregivers provide proximal care for children and mediate distal influences from neighborhoods, communities, and the larger environments, including legal, safety, and cultural factors. Because children influence caregivers' interactions through their characteristics and behavior, and in turn, are influenced by caregivers (Bergmeier and others 2014), children participate in their own development through a transactional process. As children grow older, their direct interactions outside their family increase, through contact with friends, care providers, teachers, and other community members.

Children reach their developmental potential with the acquisition of competencies in academic, behavioral, socioemotional, and economic areas. Theories of child development take a life-course perspective, emphasizing that the skills acquired throughout childhood, adolescence, and adulthood build on the capacities established prenatally and early in life. Criteria for the proximal home environment, referred to as *nurturing care* (Black,

Walker, and others 2016), include a home environment that is sensitive to children's health and nutritional needs, responsive, emotionally supportive, and developmentally stimulating and appropriate, with opportunities for play and early learning, and protection from adversities (Black and Aboud 2011; Bradley and Putnick 2012). Nurturing care occurs through caregiver-child interactions and promotes children's developmental potential in multiple areas, including health, nutrition, security and safety, responsive caregiving, and early learning (figure 19.1).

Research into interventions has shown that in keeping with theories of early child development (Bronfenbrenner and Morris 2007), nurturing care extends beyond families to include community child care providers, teachers in early education, and community support to families (Farnsworth and others 2014). A family's capacity to provide nurturing care is enabled proximally by household characteristics and resources, and distally by community resources and exposures, policies, laws, and cultural variations. Recent evidence has shown that nurturing care during early childhood attenuates the detrimental effects of various risks on brain development (Hanson and others 2015; Noble, Houston, and others 2015) and on early growth (Black, Tilton, and others 2016) and helps children build healthy habits that promote development.

Figure 19.1 Domains of Nurturing Care Necessary for Children to Reach Their Developmental Potential



RISK AND PROTECTIVE FACTORS FOR EARLY CHILD DEVELOPMENT

Risks to children's development begin before conception and are often associated with poverty, nutritional deficiencies, and maternal stress; they can result in lifelong physical and mental health consequences that are thought to operate through epigenetic processes (Boersma and others 2014; Hanson and others 2012). The concept of biological embedding theorizes that the burden of many adult diseases is partially caused by early adversity, particularly socioeconomic stress factors, through a combination of latent effects, pathway effects, and accumulation of disadvantage (Hertzman 1999, 2013). Associations have been documented between adverse childhood experiences and later health outcomes (Brown and others 2010), including epigenetic signatures of the human genome (Bick and others 2012). These findings have led to the conclusion that the origins of adult disease are often found among developmental and biological disruptions occurring early in life (Shonkoff, Boyce, and McEwen 2009). Although there is increasing recognition that the early years serve as an entry point for reducing the burden of disease and

improving population health, policies and programs that promote early development are only beginning to emerge (Hertzman 2013).

Children in LMICs face multiple threats from infectious diseases, such as HIV/AIDS (human immunodeficiency virus/acquired immune deficiency syndrome), diarrhea, malaria, and pneumonia, which can negatively affect their development, particularly when they occur in the context of malnutrition. In addition, diagnostic and treatment services for children with developmental disabilities are limited in these settings (Engle and others 2011).

Poverty

Early life poverty is a well-documented risk to children's early development. Not only can poverty contribute to caregiver stress, but the effects are evident in children's brain development. Children raised in low-income families are at risk for smaller hippocampal gray matter volume (Hanson and others 2015; Noble, Engelhardt, and others 2015) and low frontal and temporal lobe volume—brain areas associated with cognitive and academic performance (Hair and others 2015). The impact of poverty is evident in children's growth and development in the first year of life (Black, Tilton, and others 2016; Hamadani and others 2014) and in language processing and vocabulary by age 18 months (Fernald, Marchman, and Weisleder 2013). Disparities increase throughout childhood; the effects of being raised in poverty extend to adulthood and result in low task-related activation of the brain regions that support language, cognitive control, and memory skills, and high activation of regions associated with emotional reactivity (Liberzon and others 2015; Pavlakis and others 2015).

Maternal education is one pathway out of the poverty trap. Maternal education has been positively related to children's health and development in LMICs (Black, Tilton, and others 2016; Walker, Wachs, and others 2011). Better-educated mothers are able to manage household resources and provide the protection, nurturance, and early learning opportunities that promote children's healthy growth and development (Bornstein and Putnick 2012). An increase in maternal education has been credited with the significant reduction in mortality in children under age five years in 175 countries from 1970 to 1990 (controlling for per capita income) (Gakidou and others 2010). This finding has been replicated in other cross-national studies as well as national studies in both low-income and high-income countries (HICs). For example, an inverse association between infant mortality and maternal education within families of equal poverty levels has been shown in Nicaragua (Peña, Wall, and Persson 2000), replicating findings from an early study in

Brazil (Victoria and others 1992); an inverse association between zinc deficiency, preschooler stress, and maternal education has been found in Vancouver (Vaghri and others 2011).

Nutritional Deficiencies

Children have specific nutritional requirements early in life to support their rapid physical growth and brain development. Many aspects of brain development are activated either prenatally or in the first months of life (Fox, Levitt, and Nelson 2010). Stunting (length-for-age greater than two standard deviations below the median) and micronutrient deficiencies during this period increase the risk of subsequent cognitive, motor, and academic problems (Black 2003; Sudfeld and others 2015). Although the first 1,000 days are sensitive for nutritional adequacy, the timing of early brain development—with regions developing and maturing at different points—and the plasticity of early brain development suggest that the window of opportunity for early child development interventions extends through the second 1,000 days, up to age five years (Wachs and others 2014).

Maternal Stress

Stress, depression, and anxiety during pregnancy can affect fetal development, leading to low birth weight and increased risk of anxiety and metabolic dysregulation (Wachs and others 2014). Postnatal stress can interfere with parenting and early caregiver-child interactions, with long-term effects on child brain structure and function (Glover 2011). Recent evidence has also shown associations between maternal-reported stress and children's neuroendocrine-immune functioning (measured through saliva), suggesting that children of stressed mothers may be desensitized to inflammatory immune processes and therefore at risk for inflammatory diseases (Riis and others 2016). These findings occurred regardless of socioeconomic status in a sample of children age five years whose families were of high and low socioeconomic status, and suggest that interventions to reduce maternal stress may have additional benefits for children's health and development.

Accumulated Risks

Risks often co-occur, with accumulated risks more likely to undermine children's developmental potential than single risks, particularly when they co-occur early in life (Wachs and others 2014). The focus on risks to child development has often led to a harm-reduction perspective, with

delivery strategies targeting children at greatest risk. Although programs to alleviate single risks may be effective, evidence suggests that programs addressing multiple risks, such as both nutrition and early child development, have greater likelihood of producing sustainable results (Nores and Barnett 2010; Rao and others 2014). The co-occurrence of multiple risks has spurred recommendations for integrated interventions that address multiple risks (Black and Dewey 2014).

EARLY CHILD DEVELOPMENT SYSTEMS

Successful early child development programs are grounded in solid policy frameworks and systems. Vargas-Barón (2013) has identified eight domains that characterize strong and sustainable early child development systems. Five domains are particularly relevant to this chapter: equity and rights, integration and coordination, governance, quality improvement, and accountability.

Equity and Rights

Equity and rights can refer to the availability of early child development services. Delivery strategies for early child development programs are categorized as follows:

- *Universal*, when they are available to all
- *Selective*, when targeted to subpopulations at risk
- *Indicated*, when available to children identified by screening (Gordon 1983).

Public educational programs are universal and incorporated into the governance structure of the education sector. Making early child development programs universal can improve equity by ensuring that all children are able to acquire the skills to reach their developmental potential (Irwin, Siddiqi, and Hertzman 2007). However, universal approaches may not reach all children in low socioeconomic status households because of barriers to access, such as inability to pay fees, lack of transportation, and multiple languages (Carey, Crammond, and De Leeuw 2015). Early child development programs are often selective and available in regions or areas where large segments of the population experience extreme poverty, malnutrition, or other conditions that put them at risk of not reaching their developmental potential. The drawback of selective approaches is that they may be inequitable because they miss children in the middle socioeconomic status range, where most vulnerable children are found (Carey, Crammond, and De Leeuw 2015; Marmot and others

2010). The limitations of the traditional universal and selective approaches have led program personnel to seek an alternative that reaches all children by addressing the barriers that prevent children most in need from accessing services. The concept of proportionate universality, a universal service with scale and intensity proportionate to the level of disadvantage, is a promising approach to reducing inequity in areas with a social gradient in child development (Marmot and others 2010).

Integrated Interventions and Multisectoral Coordination

The concept of integrated interventions refers to services that address multiple issues with shared messages, the use of shared or existing platforms, and opportunities for synergy (Black, Perez-Escamilla, and Fernandez Rao 2015). Multisectoral coordination refers to coordinated services across sectors, with either sector-specific or unifying policies (Vargas-Barón 2013). Although multiple calls for integrated services have been made on theoretical and practical grounds (Black and Dewey 2014), few evaluations have been conducted (Grantham-McGregor and others 2014). The international community and development agencies have incorporated early child development into high-profile documents such as the World Health Organization's (WHO) *Report of the World Health Organization Commission on Social Determinants of Health* (WHO 2009), the World Bank's World Declaration on Education for All (UNESCO 1990), and the United Nations Educational, Scientific and Cultural Organization's Dakar Framework for Action (UNESCO 2000), and the SDGs. A critical role of these agencies is to support the governments of LMICs in the establishment of national early child development policies and structures, such as a national commission to coordinate early child development programs across ministries and sectors. Successful integrated programs and coordinated multisectoral processes can be sustainable and scaled up when they stand on solid policy ground (Vargas-Barón 2013). Very few LMICs have well-defined national early child development frameworks or policies. An early child development agenda within LMICs can benefit greatly from policies that are strong and comprehensive and result in enforceable mandates (Shonkoff and others 2012).

Table 19.1 lists considerations regarding integrated programs and multisectoral coordination related to early child development, highlighting both benefits and cautions. Integrated programs address the interdependencies among young children's basic needs, often building strength and learning through play (Woodhead and others 2014).

Table 19.1 Integrated Programs and Multisectoral Coordination for Nutrition and Child Development Interventions

Issue	Benefit	Cautionary note
Scientific basis	Children require support for health, nutrition, security and safety, responsive caregiving, and early learning. Single components are not sufficient.	Avoid overwhelming or confusing caregivers with multiple messages across domains.
Impact of integrated intervention may be stronger than single-sector models	Impact of nutrition intervention is strongest in the first 1,000 days.	Impact of child development interventions continues beyond the first 1,000 days.
Economy of effort	One community worker may be able to deliver multiple messages.	Additional time per visit may be required to deliver multiple messages.
Financial support	Sharing community workers across sectors may be economical.	Clarity is needed in balancing financial investment and administrative coordination across sectors.
Comprehensive approach	Integrated nutrition and child development intervention can address children's needs and may result in synergy.	Avoid overwhelming caregivers with multiple messages.
Promotion of integrated multisectoral policies by international organizations	Strong policies may result in more and better-quality programs that address the comprehensive needs of children.	Policy support from international agencies requires program, training, and evaluation support.
Existing delivery platform	Delivery platforms may vary across sectors, providing additional opportunities to reach participants.	Limited data exist on the impact of varying platforms (such as individual versus group).
Evaluation	Conducting evaluation across multiple domains may be efficient.	Evaluation demands from two sectors may occur.
Governance	Governance structure may facilitate cross-sector coordination.	Sectors have separate budgets, priorities, and management targets.
Training and supervision	Training and supervision could be coordinated across sectors to develop comprehensive, integrated messages.	Specialized training and supervision may be necessary to adequately meet the needs of differing domain and sector priorities.
Feasibility	Information on feasibility and lessons learned could enhance program development.	Additional costs may be incurred to evaluate feasibility across two sectors.
Costing	Cost analyses can be helpful to evaluate cost-benefit ratio of services.	Additional expenses may be incurred to build costing into services across two sectors.
Implementation science	Principles of implementation science, including stakeholder involvement, can assist with program sustainability and scaling.	Additional costs may be incurred to apply principles of implementation science across two sectors.

A meta-analysis of the impact of preschool programs concluded that integrated programs, which typically are government funded, had the largest effect on children's cognitive development (Rao and others 2014). The analysis, which included 115 interventions from 70 studies in 30 LMICs, also found that the most effective programs were provided by well-qualified personnel working with both parents and children.

In 1975, India established the Integrated Child Development Services, a government-sponsored nutrition and child development program for pregnant women and for children up to age six years (Rao 2005). The program is administered through the Ministry of

Women and Child Development, and includes preschools (Anganwadi Centers) in local communities throughout the country. Evaluations of the centers have demonstrated that they increase children's nutrition and development, although also showing variability in the quality of staff training and implementation and in the benefits to children (Chudasama and others 2014; Malik and others 2015; Rao 2010). With support from the World Bank and other organizations, the Indian government has launched the Integrated Child Development Services Systems Strengthening and Nutrition Improvement Program to promote children's nutrition and to raise the quality of the program by strengthening the policy framework, facilitating

community engagement, and increasing the focus on children under age three years.

Governance

Implementation of early child development programs is often fragmented, particularly for children under age five years, with limited regulatory systems or government oversight. Indicated approaches are generally reserved for children with specialized needs. The governance structure needs to be considered in making decisions regarding integrated services and coordination across sectors. Integrated services require governance structures that support integrated policies and programming, with attention to training, supervision, and monitoring.

Services that are incorporated into governance structures benefit from being able to call on infrastructure, public financing, and planning and coordination with other government services. Health and education are well-established government sectors, and both relate to early child development. However, the locus of early child development services varies widely across governance systems and often operates through nongovernmental organizations with limited state oversight (Britto and others 2014).

Health Sector

Young children with adequate health and nutrition from conception through age 24 months have the best chance of thriving and reaching their developmental potential (Black and others 2013). Growth during this sensitive period is associated with subsequent cognition and school attainment (Martorell and others 2010); associations between growth and cognition or school attainment after 24 months are less strong (Hoddinott and others 2008). The timing of adequate nutrition is critical in health and nutritional interventions (Wachs and others 2014). For example, stunting before age 24 months is related to poor child development; increases in length-for-age before age 24 months are associated with increases in school-age cognitive performance (Sudfeld and others 2015). Although increases in height-for-age after 24 months have been associated with subsequent cognitive performance, the findings are relatively modest (Black, Perez-Escamilla, and Fernandez Rao 2015; Crookston and others 2013).

Similarly, micronutrient deficiencies are prevalent among young children, particularly during the first 1,000 days when rates of growth are high and children are moving from a milk-based to a food-based diet. Evidence on the impact of micronutrient supplementation among children younger than age 24 months is

emerging, with indications of benefits to children's motor and socioemotional development (Ramakrishnan, Goldenberg, and Allen 2011). The timing imperative of children's early health and nutrition is often addressed by the health sector through close involvement with women before delivery and with children through the first 24 months. After age 24 months, fewer routine health visits take place, and health sector services are dominated by acute care. The health sector plays an important role in providing anticipatory guidance, screening for developmental delays, and referring children for services, but there are few links with the education sector.

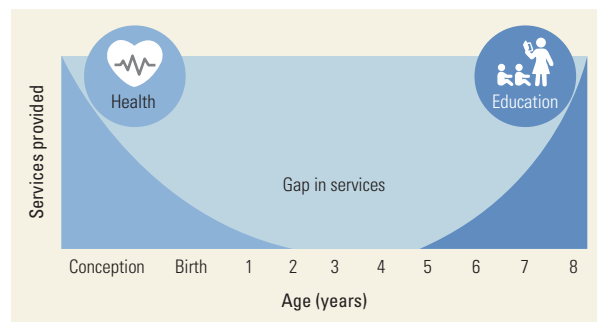
Education Sector

Early child development interventions have focused strongly on primary school education, with estimates from 2015 that 91 percent of eligible children are enrolled in primary school (UNESCO 2015). Historically, governments in LMICs provided a basic cycle of primary school beginning with grade 1 (usually from age six years, with some variation across countries), with no public educational services available before that.

Early child development was included in the initial Education for All documents of the United Nations (UNESCO 1990, 2000). Although preprimary education has since been incorporated into the educational sector in many LMICs, its structure and quality are variable. Primary school performance is enhanced by preprimary attendance (Berlinski, Galiani, and Gertler 2009), especially when the quality of preprimary education is high and the transition to primary school is well coordinated. High-quality preprimary education refers to both structural characteristics, such as environmental safety and hygiene, and teaching and learning characteristics, such as staff-child interaction and opportunities for play, exploration, and early learning.

Although healthy development depends on the complex and carefully timed interplay of nutritional, health, and educational inputs throughout children's first eight years, there is extremely limited coordination between the health and education sectors and a notable lack of purposeful investment. As a result, there is a gap between the end of regular health services at approximately age two years and the initiation of formal education at age five or six years (figure 19.2). This gap occurs at a very sensitive time in children's physical, cognitive, and socioemotional development. The impact of missed opportunities to intervene in support of healthy development for the most vulnerable may have lasting consequences for children and societies.

Figure 19.2 Age Gap in Early Child Development Services between Health and Education Sectors



Quality Improvement and Accountability

Quality assurance is a critical component of early child development programs, guided by strong monitoring and evaluation procedures (Berlinski and Schady 2015). A major challenge to early child development has been the lack of population-level indicators, such as stunting is for nutrition. Individual-level assessments provide information on the development of individual children, but require too much time and technical expertise to evaluate programs administered at scale. Population-level indicators are needed that are easy to administer and interpret; are reactive to program changes; and have strong psychometric properties, including reliability and validity (McCoy and others 2016; Raikes, Dua, and Britto 2015).

PLATFORMS TO IMPLEMENT EARLY CHILD DEVELOPMENT ACROSS A DEVELOPMENTAL CONTINUUM

The fragmentation in early child development services is partially associated with the rapidly changing societal and economic structure surrounding families. Historically, families have cared for young children with support from the health sector, through services such as monitoring growth and development, preventing infectious diseases with vaccines, treating childhood illnesses, and promoting breastfeeding and complementary feeding. Although families have succeeded in promoting their children's growth and development, particularly when mothers are well educated (Walker, Wachs, and others 2011), changes in social and economic structures in which mothers are employed, either inside or outside of the home, have led to heightened demand for alternative sources of care. Based on children's changing developmental needs, government and nongovernment platforms have emerged to provide care (table 19.2), although they vary in how well they enable children to meet their developmental potential.

Preconception and Pregnancy

Recent evidence has shown that adequate health, nutritional status, and psychological well-being before conception provide the best chance of a healthy pregnancy and healthy fetal and infant development (Boersma and others 2014). Although few systematic preparation programs for childbearing have been established, recent calls focus on ensuring that adolescents are prepared for pregnancy, particularly in areas where there are nutritional deficiencies among women of childbearing age (Thurnham 2013). Both the health and the education sectors could be engaged in preconception preparation for adolescents that includes reproductive health education to avoid unplanned early pregnancies and that also includes empowerment, stress alleviation strategies, and preparation for adulthood and parenting.

Birth to Age 24 Months: Clinic Services, Home Visiting, and Community Services

Although significant advances in maternal, newborn, and child health have been made, evidenced by declines in neonatal, under-five, and maternal mortality, rates of mortality remain high, especially in LMICs (Lassi, Kumar, and Bhutta 2016). In addition to poverty, mortality is associated with low maternal education, poor nutrition, comorbid health conditions, and lack of access to skilled care. Interventions to alleviate many of the causes of mortality are available through community-based care. Platforms to promote child development during infancy are also available through community-based care and include individual or group sessions in health clinics, home visiting, and community groups.

Care for Child Development is a comprehensive program developed by the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) to promote early growth and development in the context of health care contacts, either in clinics or homes (WHO and UNICEF 2012). The program is delivered through health care providers in Turkey, where there were benefits in the home environment (Ertem and others 2006), and through community home visitors in China and Pakistan (Jin and others 2007; Yousafzai and others 2014), with benefits to children's development. In a follow-up of children at age four years who participated in a randomized trial of home intervention from birth through two years, the children who received responsive caregiving had sustained effects in IQ, executive functioning, preacademic skills, and prosocial behaviors, and the mothers had benefits in responsive caregiving behaviors (Yousafzai and others 2016).

Table 19.2 Early Child Development Platforms by Age of Child

Sector	Platform	Preconception and prenatal	Age of Child			
			Ages 0–24 months	Ages 2–4 years	Age 5 years	Ages 6–8 years
Health sector	Clinic: individual or group sessions	X	X			
	Home visiting	X	X			
Nongovernmental organization, health and education sectors	Home visiting		X	X	X	
	Community groups		X	X	X	
	Media		X	X	X	
	Child care			X	X	
Education sector	Preprimary school				X	
	Primary school					X

Home visiting programs are often conducted by community health workers linked to health or social sectors and deliver interventions related to health and nutrition (Yousafzai and others 2014), maternal mental health (Rahman, Patel, and Maselko 2008), and child development (Walker, Chang, and others 2011). The long-term effects of early home visits can be seen in the Jamaica trial, a two-year randomized controlled assessment of home-based intervention promoting opportunities for play and early learning through homemade toys and materials, delivered to low-income families of stunted toddlers (Grantham-McGregor and others 1991). By age two years, no differences in performance were seen in standardized developmental assessments between stunted children who received the home visiting intervention and a comparison sample of healthy nonstunted children. The children received no further intervention and entered the Jamaican educational system. At ages 17–18 years, the stunted children in the early home visiting group did better in 11 of 12 measures of cognitive and educational performance, and they had better mental health indicators (lower rates of depression and anxiety, and higher self-esteem) and fewer attentional problems than stunted children in the control group (Walker and others 2005; Walker and others 2006). In early adulthood, those who had been randomized to the intervention group were less likely to exhibit serious violent behavior, and they had higher IQ scores, higher educational attainment, fewer symptoms of depression (Walker, Chang, and others 2011), and earnings of 25 percent more than young adults in the control group (Gertler and others 2014). Jamaica has a strong history of universal preschool education, suggesting that the continuity of home visiting with preschool and primary school may have contributed to the long-term success.

With support from the Saving Brains program of Grand Challenges Canada and the Inter-American Development Bank, the Jamaican program is being scaled up to other LMICs, as Reach Up and Learn.¹ Reviews of other home visiting programs have also demonstrated success in promoting developmental skills (Aboud and Yousafzai 2015), although there have been few long-term follow-ups.

Community programs to promote early child development are often organized by nonprofit organizations and provide general information on strategies to promote early child development. In a recent example from Uganda sponsored by Plan International, trained male and female community volunteers provided 12 family-oriented sessions that addressed child care (play, talk, diet, hygiene, and love and respect) and maternal well-being (for example, increasing father involvement) among families with children ages 12–36 months (Singla, Kumbakumba, and Aboud 2015). Most sessions were directed to both parents, with two exclusively for mothers and two for fathers. Sessions based on principles of social cognitive learning theory included messages, games, role plays, parent-child interaction, group problem solving, homework, and activity booklets with activities that parents were encouraged to practice with their child at home. The impact of the program on the home environment, maternal mental health symptoms, and children's development suggests that the group sessions were effective in altering the behavior of families and in promoting child development.

Ages Two to Four Years: Child Care

The period that encompasses ages two to four years presents a major gap (figure 19.2) in LMICs; neither the health sector nor the educational sector is

sufficiently responding to the needs of this group. Few government-supported programs are available, and child care is often provided by private, nongovernmental organizations with little regulation or oversight.

The number of child care programs has increased globally, often in response to the need for mothers of young children to work. However, there is little evidence regarding the impact on children. Cochrane reviews of the effects of child care programs on children's development and well-being were conducted in LMICs (Brown and others 2014) and in HICs (van Urk and others 2014). Both reviews yielded only a single controlled study. Child care enrollment has increased substantially, especially in Latin America (Berlinski and Schady 2015). A recent review of programs in LMICs, all from Latin America, reported large positive effects on children's development, with no evidence of either positive or negative effects on children's health and nutrition (Leroy, Gadsden, and Guijarro 2012). Regulatory guidelines for child care are emerging, but their quality varies substantially. The effects of child care on development vary by quality of child care, with stronger effects among programs that deliver opportunities for play and exploration along with safety and hygiene (Berlinski and Schady 2015).

Child care programs range from custodial care, often tied to maternal employment, to the provision of developmentally oriented, early learning opportunities. Much of the research into child care has been conducted in HICs. One of the most striking studies of the impact of a developmentally oriented, early learning program is the Abecedarian Project, a randomized controlled trial of a high-quality program for disadvantaged children from North Carolina, with long-term adult follow-up (Campbell and others 2012; Campbell and others 2014). The program, initiated in the 1970s, included all-day care from shortly after birth through age five years, with planned opportunities for learning, activities that promote social-emotional development, healthy nutrition, and access to health care. Follow-up when participants were in their thirties found the intervention produced beneficial effects on years of schooling (Campbell and others 2012) and on the risk factors for cardiovascular and metabolic diseases (Campbell and others 2014); effects on economic indicators were mixed, and few differences on social adjustment were observed.

The Abecedarian study, together with the Jamaican study (Gertler and others 2014), provide evidence that early intervention can have long-term effects on many aspects of children's health and development. Additional long-term systematic studies are needed

to understand the impact of child care on children's health and development.

Age Five Years: Preprimary School

Access to preprimary education has been a central objective of the Education for All initiative. Preschool has benefits for subsequent performance in primary school (Berlinski and Schady 2015), especially when programs include education (UNESCO 2015) and nutrition (Nores and Barnett 2010). Global preprimary enrollment increased by nearly two-thirds from 1999 to 2012, especially in Latin America and the Caribbean (UNESCO 2015). Despite that impressive increase, preprimary coverage ranges from 19 percent for low-income countries to 86 percent for HICs; the largest enrollment is among children from the highest wealth quintiles and in urban centers (UNESCO 2015). These trends are consistent with caregiver reports of early childhood care attendance from UNICEF's Multiple Indicator Cluster Survey. Based on data from 164,900 children across 58 LMICs, 31.4 percent of all children ages 36–59 months in the sample had access to early education programs; preprimary enrollment rates were nearly twice as high among children from the top wealth quintile (47.3 percent) than from the lowest quintile (19.7 percent).

Preprimary access and coverage are variable; 40 of the 58 LMICs in the Multiple Indicator Cluster Survey provide compulsory preprimary education. The recently adopted SDG pledge to ensure “all girls and boys have access to quality early childhood development, care, and preprimary education so that they are ready for primary education” marks the first time the global goal regime has made explicit the link between early childhood development and primary school readiness.

The body of rigorous evaluation of preprimary programs in LMICs in general, and in Sub-Saharan Africa in particular, is growing. Several recent studies serve as examples for the examination of the effect of preprimary attendance on children's cognitive development. A study of 423 preprimary-age children in Kenya; Zanzibar, Tanzania; and Uganda found that children who attended preprimary programs performed better on measures of cognitive development 18 months after enrollment, compared with children who did not attend (Mwaura, Sylva, and Malmberg 2008). A follow-up cross-sequential study found a positive curvilinear effect of preprimary programs on children's cognitive development (Malmberg, Mwaura, and Sylva 2011). Similar cognitive gains, as well as improvement in other developmental domains, have been documented in Mozambique in a randomized controlled trial of a community preprimary program sponsored by Save the Children (Martinez, Naudeau, and Pereira 2012).

Children who attended this program demonstrated improved cognitive, fine motor, and socioemotional skills, as well as increased primary school enrollment at the appropriate age. The preprimary program also produced positive impacts on the primary school enrollment of older siblings and increased the labor supply of primary caregivers, suggesting that the benefits of preprimary attendance extend beyond the enrolled children to their families. The researchers estimated the cost of the program to be US\$2.17 per student per month.

Evaluations of preprimary education elsewhere have also concluded that preprimary attendance is associated with better academic and preacademic performance. An assessment of 880 Cambodian children age five years showed children who had attended any type of preprimary school performed better than those who had not, although children in state-supported preprimary schools had significantly higher scores than children in community or home-based schools (Rao and others 2012).

Other efforts are underway to reach young children with educational content through media. Radio, television, and other media can increase home access to early child development programming aimed at either children or parents. Local versions of *Sesame Street* reach children in more than 150 countries (Cole, Richman, and McCann Brown 2001). In Bangladesh, almost 50 percent of a sample of preschoolers watched television daily (Khan and others 2007); among television watchers, 83 percent of urban and 58 percent of rural children watched *Sesame Street*. A meta-analysis representing more than 10,000 young children from 15 countries found significant benefits from *Sesame Street* in literacy and numeracy, in health and safety, and in social reasoning and attitudes toward others (Mares and Pan 2013).

As children approach school age, limited attention is often paid to the impact of health and nutrition on learning and well-being. However, nutritional deficiencies, infection, and inflammation are major contributors to impaired child neurodevelopment during early and middle childhood and can adversely affect children's academic performance and social-emotional development (John, Black, and Nelson 2016).

Ages Six to Eight Years: Primary School

The past 25 years have seen an enormous expansion of access to primary school, with the largest growth in LMICs (UNESCO 2015). The enrollment gap between HICs and LMICs has closed considerably, driven in part by the commitments to Education for All that were made in Jomtien, Thailand, in 1990 (UNESCO 1990) and affirmed in Dakar, Senegal, in 2000 (UNESCO 2000).

By 2008, the average LMIC was enrolling students in primary school at nearly the same rate as the average HIC (Gove and Cvelich 2011). However, access to primary school continues to be a global concern. The 2015 *Global Monitoring Report* estimates that 58 million children of primary school age were out of school in 2015. The main contributors to persistently large numbers of out-of-school children include crisis and conflict, challenging economic conditions, distance to school, and denial of access for girls and for children with disabilities (UNESCO 2015).

Although substantial gains in primary school enrollment have been achieved, by the 2015 Education for All deadline, one in six children in LMICs—more than 100 million—did not complete primary school (UNESCO 2015). Not only are children in LMICs less likely to complete primary education than children in HICs, they are learning less while in school. Estimates from large-scale international assessments of literacy and numeracy conducted in fourth grade show that the average student in low-income countries is performing at the third percentile of students in HICs (Crouch and Gove 2011).

Although raising the quality of learning is central to global goals, much of government and donor efforts have focused on expanding access to education. The goals of universal primary enrollment and completion are clear and reasonably easy to measure, and can readily be compared across countries with common methods developed and publicized by the UNESCO Institute for Statistics. In contrast, systematic approaches to student learning measurements that can be reported at the global level are lacking. While international large-scale assessments—such as the Progress in International Reading Literacy Study and the Trends in International Mathematics and Science Study—contribute to cross-country learning comparisons, their coverage is largely restricted to the global north. The few LMIC participants scored quite poorly on these assessments, with the overall results deemed to be unreliable in some cases. Regional assessments, such as the Second Regional Comparative and Explanatory Study from Latin America and the Caribbean, the Southern and Eastern Africa Consortium for Monitoring Educational Quality, and the CONFEMEN Programme for the Analysis of Education Systems in West Africa, have been slow to expand, and LMICs continue to struggle with how to conduct and use student assessment results to improve learning in their classrooms (Gove and others 2015).

The U.S. Agency for International Development (USAID) commissioned development of the Early Grade Reading Assessment (EGRA) to help LMICs rapidly diagnose and improve learning outcomes while also informing the global community. The EGRA was

formulated in 2006, guided by research on the development of early reading skills, and relies on individual oral assessment of children to understand the reading process in achieving and struggling readers. The EGRA has been adapted for use in more than 75 countries and in more than 120 languages. Open-source versions are available, with guidance for adaptation based on the characteristics of a given language and country (RTI International 2016). Its widespread use has delivered a shared language for describing results and monitoring educational system changes, while enabling countries to incorporate their unique contexts and cultures (Dubeck and Gove 2015).

More than a dozen countries have used the EGRA data to develop benchmarks and standards for achievement across different grades. The EGRA has been used for program monitoring and evaluation and for development of reports reflecting educational systems within countries and at the country-level² and consolidated information across contexts (Gove and Cvelich 2011). Using these benchmarks, countries can estimate the proportion of children in grades 2–3 meeting minimum proficiency in reading, an indicator that could be reported globally, as required by the SDGs (specifically SDG 4.1). Enabling LMICs to monitor and improve learning outcomes in the early grades is likely to promote attendance and academic success and to improve the quality of the education system.

The expansion of primary schools and the elimination or reduction of school fees have boosted primary school enrollment. However, quality in many primary schools in LMICs is low, particularly in Sub-Saharan Africa (UNESCO 2012). Assessment strategies, such as the EGRA, India’s Annual Status of Education Report, and East Africa’s Uwezo initiative, have helped focus attention on the low learning levels in many primary schools in LMICs (UNESCO Institute for Statistics 2016). Children who do not acquire basic literacy and numeracy skills early in their academic careers have difficulty with subsequent subjects and are at risk of dropping out, which would limit their economic opportunities and those of entire societies.

Early academic success depends on strong teacher training and a curriculum and materials that support learning. With the global shift in focus from access to learning, governments and donors are experimenting with classroom-level interventions, such as the Primary Mathematics and Reading Initiative (PRIMR) (Piper, Zuilkowski, and Mugenda 2014). A randomized controlled trial of the approach in more than 400 schools in Kenya found that the intervention significantly improved oral reading fluency in grades 1 and 2 for both English and Kiswahili, with PRIMR students two to three times

more likely to read and comprehend than control students (Piper, Zuilkowski, and Mugenda 2014).

Based on the success of PRIMR, the Kenyan government extended the collaboration to develop the Tusome Early Grade Reading Activity. Tusome means “let’s read” in Kiswahili and is designed to promote early literacy in English and Kiswahili through the provision of structured teaching and learning materials and extra training for grade 1 and 2 teachers through tutors and coaching. Tusome has been scaled up into more than 23,500 public and alternative education institutions nationwide, and by 2018 it will reach 5.4 million Kenyan children in grades 1 and 2 (USAID 2016). Kenya’s experience and similar efforts supported by USAID and other donors have highlighted the need for additional evidence on how to take pilot programs to scale. While there have been several reviews of evaluations of learning improvement efforts in LMICs (Evans and Popova 2015; McEwan 2015), few programs have been able to scale up and sustain the level of improvement observed in the pilot.

CONCLUSIONS

The field of global early child development is emerging, stimulated by promising findings from the impact of ensuring adequate development early in life and by encouragement from international leaders through the SDGs. Significant gaps exist in programming and investment that may interfere with future success, particularly for children under age five years. Limited attention to workforce development and support, program standards and materials, best practices, and quality are concerns (Yousafzai and Aboud 2014). Although initial efforts to estimate cost-effectiveness suggest that interventions that include responsive stimulation are more cost-effective than nutrition interventions alone in promoting children’s early development (Gowani and others 2014), there have been few attempts to estimate costs (Horton and Black 2017). Population-based indicators are needed for early child development, along with national databases to enable countries to plan and evaluate intervention programs for young children.

These actions are meant to continue the advances that have been made in early child development policies, programs, and research in recent decades. Government commitments through education ministries to provide schools, teacher training, learning materials, and supplementary support to enable young children to attend primary school—such as the elimination of school fees and the provision of school meals—have helped increase

primary school access. LMICs, with the support of international donors, have developed and evaluated curricula designed to promote early grade reading and mathematics, as well as systematic methods to measure progress. Children who acquire these skills in the first years of primary school are likely to remain in school, to learn, and to acquire the skills needed for sustainable development.

Policies and programs for children up to age five years are less well developed than those for primary schools. From a positive perspective, preprimary education has been endorsed globally by Education for All and incorporated into the SDGs, the number of programs has increased, and the evidence demonstrates that many preprimary programs prepare children well for primary school. However, standards for preprimary vary, and the exclusion of many children increases inequities. Recommendations for preprimary include stronger attention to quality, to preprimary curricula and standards, to learning materials, and to teacher training and support.

The gap between the health and education sectors for children up to age five years is a major concern that may impede children's early development. Although the number of child care programs has been increasing, often to support employment of mothers, few organized platforms are available; many programs are fragmented, with limited attention to developmentally oriented early learning activities, little oversight, and few evaluations.

The health and nutrition sectors focus on children during the first 1,000 days, with primary emphasis on the first year of life. Although they promote breastfeeding, complementary feeding, and other health- and nutrition-related care, other aspects of nurturing, including responsive caregiving and early learning, are often minimal or absent. Integrated programs that combine health and nutrition with early child development, and coordinated programs across multiple sectors, have been recommended. Examples are emerging, and the logistical and workforce issues are being clarified. In particular, platforms that support families, such as home visiting, have shown long-term success in enabling children to reach their developmental potential.

Early experiences, both positive and negative, are the foundation of life-course trajectories that affect adult health and well-being. Investing in effective policies and programs and ensuring that they are part of an organizational structure that pays attention to quality will enhance early child development. This will enable children to build the health, intelligence, innovativeness, and dedication necessary to become healthy and productive adults.

NOTES

World Bank Income Classifications as of July 2014 are as follows, based on estimates of gross national income (GNI) per capita for 2013:

- Low-income countries (LICs) = US\$1,045 or less
- Middle-income countries (MICs) are subdivided:
 - a) lower-middle-income = US\$1,046 to US\$4,125
 - b) upper-middle-income (UMICs) = US\$4,126 to US\$12,745
- High-income countries (HICs) = US\$12,746 or more.

1. For more information, see <http://www.reachupandlearn.com/>.
2. For more information, see the websites <http://www.eddataglobal.org> and <http://www.earlygradereadingbarometer.org>.

REFERENCES

- Aboud, F. E., and A. K. Yousafzai. 2015. "Global Health and Development in Early Childhood." *Annual Review of Psychology* 66: 433–57. doi:10.1146/annurev-psych-010814-015128.
- Bergmeier, H., H. Skouteris, S. Horwood, M. Hooley, and B. Richardson. 2014. "Child Temperament and Maternal Predictors of Preschool Children's Eating and Body Mass Index: A Prospective Study." *Appetite* 74: 125–32.
- Berlinski, S., S. Galiani, and P. Gertler. 2009. "The Effect of Pre-Primary Education on Primary School Performance." *Journal of Public Economics* 93 (1): 219–34.
- Berlinski, S., and N. Schady. 2015. *The Early Years: Child Well-Being and the Role of Public Policy*. Development in the Americas Series. New York: Macmillan.
- Bick, J., O. Naumova, S. Hunter, B. Barbot, M. Lee, and others. 2012. "Childhood Adversity and DNA Methylation of Genes Involved in the Hypothalamus-Pituitary-Adrenal Axis and Immune System: Whole-Genome and Candidate-Gene Associations." *Development and Psychopathology* 24 (4): 1417–25.
- Black, M. M. 2003. "Micronutrient Deficiencies and Cognitive Functioning." *Journal of Nutrition* 133 (11): 3927S–31S.
- Black, M. M., and F. E. Aboud. 2011. "Responsive Feeding Is Embedded in a Theoretical Framework of Responsive Parenting." *Journal of Nutrition* 141 (3): 490–94.
- Black, M. M., and K. G. Dewey. 2014. "Promoting Equity through Integrated Early Child Development and Nutrition Interventions." *Annals of the New York Academy of Sciences* 1308 (1): 1–10. doi:10.1111/nyas.12351.
- Black, M. M., R. Perez-Escamilla, and S. Fernandez Rao. 2015. "Integrating Nutrition and Child Development Interventions: Scientific Basis, Evidence of Impact, and Implementation Considerations." *Advances in Nutrition* 6: 852–59. doi:10.3945/An.115.010348.
- Black, M. M., N. A. Tilton, K. Harding, S. Fernandez-Rao, K. M. Hurley, and others. 2016. "Growth and Development among Infants and Preschoolers in Rural India: Economic Inequities and Caregiver Protective/Promotive Factors."

- International Journal of Behavioral Development*. doi: 10.1177/0165025416644690.
- Black, R. E., C. G. Victora, S. P. Walker, Z. A. Bhutta, P. Christian, and others. 2013. "Maternal and Child Undernutrition and Overweight in Low-Income and Middle-Income Countries." *The Lancet* 382 (9890): 427–51.
- Black, M. M., S. P. Walker, L. C. H. Fernald, C. T. Anderson, A. Digirolamo, and others. 2016. "Early Child Development Coming of Age: Science Through the Life-Course." *The Lancet*. <http://www.sciencedirect.com/science/article/pii/S0140673616313897>.
- Boersma, G. J., T. L. Bale, P. Casanello, H. E. Lara, A. B. Lucion, and others. 2014. "Long-Term Impact of Early Life Events on Physiology and Behaviour." *Journal of Neuroendocrinology* 26 (9): 587–602.
- Bornstein, M. H., and D. L. Putnick. 2012. "Cognitive and Socioemotional Caregiving in Developing Countries." *Child Development* 83 (1): 46–61.
- Bradley, R. H., and D. L. Putnick. 2012. "Housing Quality and Access to Material and Learning Resources within the Home Environment in Developing Countries." *Child Development* 83 (1): 76–91. doi:10.1111/J.1467-8624.2011.01674.X.
- Britto, P. R., H. Yoshikawa, J. Van Ravens, L. A. Ponguta, M. Reyes, and others. 2014. "Strengthening Systems for Integrated Early Childhood Development Services: A Cross-National Analysis of Governance." *Annals of the New York Academy of Sciences* 1308 (1): 245–55. doi:10.1111/nyas.12365.
- Bronfenbrenner, U., and P. A. Morris. 2007. "The Bioecological Model of Human Development." In *Handbook of Child Psychology* (sixth edition): Volume 1, *Theoretical Models of Human Development*, edited by R. M. Lerner, 793–828. Hoboken, NJ: John Wiley & Sons, Inc.
- Brown, D. W., R. F. Anda, V. J. Felitti, V. J. Edwards, A. M. Malarcher, and others. 2010. "Adverse Childhood Experiences Are Associated with the Risk of Lung Cancer: A Prospective Cohort Study." *BioMed Central Public Health* 10 (1): 1.
- Brown, T. W., F. C. Van Urk, R. Waller, and E. Mayo-Wilson. 2014. "Centre-Based Day Care for Children Younger than Five Years of Age in Low- and Middle-Income Countries." *Cochrane Database of Systematic Reviews* (9): CD010544. doi:10.1002/14651858.CD010543.pub2.
- Bundy, D. A. P., N. de Silva, S. Horton, G. C. Patton, L. Schultz, and D. T. Jamison. 2017. "Child and Adolescent Health and Development: Realizing Neglected Potential." In *Disease Control Priorities* (third edition): Volume 8, *Child and Adolescent Health and Development*, edited by D. A. P. Bundy, N. de Silva, S. Horton, D. T. Jamison, and G. C. Patton. Washington, DC: World Bank.
- Campbell, F. A., G. Conti, J. J. Heckman, S. H. Moon, R. Pinto, and others. 2014. "Early Childhood Investments Substantially Boost Adult Health." *Science* 343 (6178): 1478–85.
- Campbell, F. A., E. P. Pungello, M. Burchinal, K. Kainz, Y. Pan, and others. 2012. "Adult Outcomes as a Function of an Early Childhood Educational Program: An Abecedarian Project Follow-Up." *Developmental Psychology* 48 (4): 1033–43. doi:10.1037/a0026644.
- Carey, G., B. Crammond, and E. De Leeuw. 2015. "Towards Health Equity: A Framework for the Application of Proportionate Universalism." *International Journal for Equity in Health* 14 (1): 81. doi:10.1186/s12939-015-0207-6.
- Chudasama, R. K., A. M. Kadri, P. B. Verma, U. V. Patel, N. Joshi, and others. 2014. "Evaluation of Integrated Child Development Services Program in Gujarat, India." *Indian Pediatrics* 51 (9): 707–11.
- Cole, C. F., B. A. Richman, and S. A. McCann Brown. 2001. "The World of Sesame Street Research." In *"G" Is for Growing: Thirty Years of Research on Children and Sesame Street*, edited by S. M. Fisch and R. T. Truglio, 147–79. Mahwah, NJ: Lawrence Erlbaum.
- Crookston, B. T., W. Schott, S. Cueto, K. A. Dearden, P. Engle, and others. 2013. "Postinfancy Growth, Schooling, and Cognitive Achievement: Young Lives." *American Journal of Clinical Nutrition* 98 (6): 1555–63. doi:10.3945/ajcn.113.067561.
- Crouch, L., and A. K. Gove. 2011. "Leaps or One Step at a Time: Skirting or Helping Engage the Debate? The Case of Reading." In *Policy Debates in Comparative, International, and Development Education*, edited by W. Jacob and J. Hawkins, 155–74. New York: Palgrave Macmillan.
- Dubeck, M. M., and A. Gove. 2015. "The Early Grade Reading Assessment (EGRA): Its Theoretical Foundation, Purpose, and Limitations." *International Journal of Educational Development* 40: 315–22.
- Engle, P. L., M. M. Black, J. R. Behrman, M. Cabral de Mello, P. J. Gertler, and others. 2007. "Strategies to Avoid the Loss of Developmental Potential among Over 200 Million Children in the Developing World." *The Lancet* 369 (9557): 230–42.
- Engle, P. L., L. C. Fernald, H. Alderman, J. Behrman, C. O'Gara, and others. 2011. "Strategies for Reducing Inequalities and Improving Developmental Outcomes for Young Children in Low-Income and Middle-Income Countries." *The Lancet* 378 (9799): 1339–53. doi:10.1016/S0140-6736(11)60889-1.
- Ertem, I. O., G. Atay, B. E. Bingoler, D. G. Dogan, A. Bayhan, and others. 2006. "Promoting Child Development at Sick-Child Visits: A Controlled Trial." *Pediatrics* 118 (1): e124–31.
- Evans, D. K., and A. Popova. 2015. "What Really Works to Improve Learning in Developing Countries? An Analysis of Divergent Findings in Systematic Reviews." Policy Research Working Paper 7203, World Bank, Washington, DC.
- Farnsworth, S. K., K. Böse, O. Fajobi, P. P. Souza, A. Peniston, and others. 2014. "Community Engagement to Enhance Child Survival and Early Development in Low- and Middle-Income Countries: An Evidence Review." *Journal of Health Communication* 19 (Suppl 1): 67–88.
- Fernald, A., V. A. Marchman, and A. Weisleder. 2013. "SES Differences in Language Processing Skill and Vocabulary Are Evident at 18 Months." *Developmental Science* 16 (2): 234–48.
- Fox, S. E., P. Levitt, and C. A. Nelson III. 2010. "How the Timing and Quality of Early Experiences Influence the Development of Brain Architecture." *Child Development* 81 (1): 28–40.
- Gakidou, E., K. Cowling, R. Lozano, and C. J. L. Murray. 2010. "Increased Educational Attainment and Its Effect on Child

- Mortality in 175 Countries between 1970 and 2009: A Systematic Analysis." *The Lancet* 376 (9745): 959–74.
- Gertler, P., J. Heckman, R. Pinto, A. Zanolini, C. Vermeersch, and others. 2014. "Labor Market Returns to an Early Childhood Stimulation Intervention in Jamaica." *Science* 344 (6187): 998–1001. doi:10.1126/Science.1251178.
- Glover, V. 2011. "Annual Research Review: Prenatal Stress and the Origins of Psychopathology: An Evolutionary Perspective." *Journal of Child Psychology and Psychiatry* 52 (4): 356–67.
- Gordon, R. S. 1983. "An Operational Classification of Disease Prevention." *Public Health Reports* 98 (2): 107–9.
- Gove, A., C. Chabbott, A. Dick, J. Destefano, S. King, and others. 2015. "Early Learning Assessments: A Retrospective." Background Paper for Education for All Global Monitoring Report, United Nations Educational, Cultural and Scientific Organization, Paris. <http://unesdoc.unesco.org/images/0023/002324/232419e.pdf>.
- Gove, A., and P. Cvelich. 2011. "Early Reading: Igniting Education for All. A Report by the Early Grade Learning Community of Practice." RTI International, Research Triangle Park, NC.
- Gowani, S., A. K. Yousafzai, R. Armstrong, and Z. A. Bhutta. 2014. "Cost Effectiveness of Responsive Stimulation and Nutrition Interventions on Early Child Development Outcomes in Pakistan." *Annals of the New York Academy of Sciences* 1308 (1): 149161.
- Grantham-McGregor, S. M., Y. B. Cheung, S. Cueto, P. Glewwe, L. Richter, and others. 2007. "Developmental Potential in the First 5 Years for Children in Developing Countries." *The Lancet* 369 (9555): 60–70. doi:10.1016/S0140-6736(07)60032-4.
- Grantham-McGregor, S. M., L. C. Fernald, R. M. Kagawa, and S. Walker. 2014. "Effects of Integrated Child Development and Nutrition Interventions on Child Development and Nutritional Status." *Annals of the New York Academy of Sciences* 1308: 11–32. doi:10.1111/nyas.12284.
- Grantham-McGregor, S. M., C. A. Powell, S. P. Walker, and J. H. Himes. 1991. "Nutritional Supplementation, Psychosocial Stimulation, and Mental Development of Stunted Children: The Jamaican Study." *The Lancet* 338 (8758): 1–5. doi:10.1016/0140-6736(91)90001-6.
- Hair, N. L., J. L. Hanson, B. L. Wolfe, and S. D. Pollak. 2015. "Association of Child Poverty, Brain Development, and Academic Achievement." *Journal of the American Medical Association* 169 (9): 822–29. doi:10.1001/Jamapediatrics.2015.1475.
- Hamadani, J. D., F. Tofail, S. N. Huda, D. S. Alam, D. A. Ridout, and others. 2014. "Cognitive Deficit and Poverty in the First 5 Years of Childhood in Bangladesh." *Pediatrics* 134 (4): E1001–08. doi:10.1542/Peds.2014-0694.
- Hanson, J. L., B. M. Nacewicz, M. J. Sutterer, A. A. Cayo, S. M. Schaefer, and others. 2015. "Behavioral Problems after Early Life Stress: Contributions of the Hippocampus and Amygdala." *Biological Psychiatry* 77 (4): 314–23. doi:10.1016/J.Biopsych.2014.04.020.
- Hanson, M. A., P. D. Gluckman, R. C. W. Ma, P. Matzen, and R. G. Biesma. 2012. "Early Life Opportunities for Prevention of Diabetes in Low and Middle Income Countries." *BioMed Central Public Health* 12: 1025.
- Hertzman, C. 1999. "The Biological Embedding of Early Experience and Its Effects on Health in Adulthood." *Annals of the New York Academy of Sciences* 896 (1): 85–95.
- . 2013. "The Significance of Early Childhood Adversity." *Paediatrics and Child Health* 18 (3): 127.
- Hoddinott, J., J. A. Maluccio, J. R. Behrman, R. Flores, and R. Martorell. 2008. "Effect of a Nutrition Intervention during Early Childhood on Economic Productivity in Guatemalan Adults." *The Lancet* 371 (9610): 411–16. doi:10.1016/S0140-6736(08)60205-6.
- Horton, S., and M. M. Black. 2017. "Identifying an Essential Package for Early Childhood Development: Economic Analysis." In *Disease Control Priorities* (third edition): Volume 8, *Child and Adolescent Health and Development*, edited by D. A. P. Bundy, N. de Silva, S. Horton, D. T. Jamison, and G. C. Patton. Washington, DC: World Bank.
- Irwin, L. G., A. Siddiqi, and C. Hertzman. 2007. *Early Child Development: A Powerful Equalizer*. Final Report to the World Health Organization Commission on Social Determinants of Health. Geneva: World Health Organization.
- Jin, X., Y. Sun, F. Jiang, J. Ma, C. Morgan, and others. 2007. "Care for Development Intervention in Rural China: A Prospective Follow-Up Study." *Journal of Developmental and Behavioral Pediatrics* 28 (3): 213–18.
- John, C. C., M. M. Black, and C. A. Nelson. 2016. "Neurodevelopment: The Impact of Nutrition and Inflammation during Early to Middle Childhood." *Pediatrics*. Under review.
- Khan, M. S. H., N. Chakraborty, A. P. M. Rahman, and T. Nasrin. 2007. "2007 Follow-Up (Wave II) Evaluation of the Reach and Impact of Sisimpur: A Technical Report." Associates for Community and Population Research, Dhaka, Bangladesh.
- Lake, A., and M. Chan. 2015. "Putting Science into Practice for Early Child Development." *The Lancet* 385 (9980): 1816–17. doi:10.1016/S0140-6736(14)61680-9.
- Lassi, Z. S., R. Kumar, and Z. A. Bhutta. 2016. "Community-Based Care to Improve Maternal, Newborn, and Child Health." In *Disease Control Priorities* (third edition): Volume 2, *Reproductive, Maternal, Newborn, and Child Health*, edited by R. Black, R. Laxminarayan, M. Temmerman, and N. Walker, 263–84. Washington, DC: World Bank.
- Leroy, J. L., P. Gadsden, and M. Guijarro. 2012. "The Impact of Daycare Programmes on Child Health, Nutrition and Development in Developing Countries: A Systematic Review." *Journal of Development Effectiveness* 4 (3): 472–96. doi:10.1080/19439342.2011.639457.
- Liberzon, I., S. T. Ma, G. Okada, S. Shaun Ho, J. E. Swain, and others. 2015. "Childhood Poverty and Recruitment of Adult Emotion Regulatory Neurocircuitry." *Social Cognitive Affective Neuroscience* 10 (11): 1596–606. doi:10.1093/Scan/Nsv045.
- Lu, C., M. M. Black, and L. M. Richter. 2016. "Risk of Poor development in Young Children in Low-Income and Middle-Income Countries: An Estimation and Analysis at the Global, Regional, and Country Level." *Lancet Global Health*. Epub ahead of print. <https://www.ncbi.nlm.nih.gov/pubmed/27717632>.

- Malik, A., M. Bhilwar, N. Rustagi, and D. K. Taneja. 2015. "An Assessment of Facilities and Services at Anganwadi Centers under the Integrated Child Development Service Scheme in Northeast District of Delhi, India." *International Journal for Quality in Health Care* 27 (3): 201–6. doi:10.1093/Intqhc/Mzv028.
- Malmberg, L.-E., P. Mwaura, and K. Sylva. 2011. "Effects of a Preschool Intervention on Cognitive Development among East-African Preschool Children: A Flexibly Time-Coded Growth Model." *Early Childhood Research Quarterly* 26 (1): 124–33.
- Mares, M.-L., and Z. Pan. 2013. "Effects of Sesame Street: A Meta-Analysis of Children's Learning in 15 Countries." *Journal of Applied Developmental Psychology* 34 (3): 140–51.
- Marmot, M. G., J. Allen, P. Goldblatt, T. Boyce, D. McNeish, and others. 2010. *Fair Society, Healthy Lives: The Marmot Review*. London: The Marmot Review.
- Martinez, S., S. Naudeau, and V. Pereira. 2012. "The Promise of Preschool in Africa: A Randomized Impact Evaluation of Early Child Development in Rural Mozambique." World Bank and Save the Children, Washington, DC. http://www.savethechildren.org/Atf/Cf/%7b9def2ebe-10ae-432c-9bd0-Df91d2eba74a%7D/MARTINEZ_NAUDEAU_PEREIRA.MOZ_ECD_REPORT-FEB_7_2012.PDF.
- Martorell, R., B. L. Horta, L. S. Adair, A. D. Stein, L. Richter, and others. 2010. "Weight Gain in the First Two Years of Life Is an Important Predictor of Schooling Outcomes in Pooled Analyses from Five Birth Cohorts from Low- and Middle-Income Countries." *Journal of Nutrition* 140 (2): 348–54. doi:10.3945/Jn.109.112300.
- McCoy, D. C., M. Black, B. Daelmans, and T. Dua. 2016. "Measuring Development in Children from Birth to Age 3 at Population Level." *Early Childhood Matters* 125: 34–39. https://bernardvanleer.org/app/uploads/2016/07/Early-Childhood-Matters-2016_6.pdf.
- McEwan, P. J. 2015. "Improving Learning in Primary Schools of Developing Countries: A Meta-Analysis of Randomized Experiments." *Review of Educational Research* 85 (3): 353–94.
- Mwaura, P. A. M., K. Sylva, and L.-E. Malmberg. 2008. "Evaluating the Madrasa Preschool Programme in East Africa: A Quasi-Experimental Study." *International Journal of Early Years Education* 16 (3): 237–55.
- Noble, K. G., L. E. Engelhardt, N. H. Brito, L. J. Mack, E. J. Nail, and others. 2015. "Socioeconomic Disparities in Neurocognitive Development in the First Two Years of Life." *Developmental Psychobiology* 57 (5): 535–51.
- Noble, K. G., S. M. Houston, N. H. Brito, H. Bartsch, E. Kan, and others. 2015. "Family Income, Parental Education and Brain Structure in Children and Adolescents." *Nature Neuroscience* 18 (5): 773–78. doi:10.1038/Nn.3983.
- Nores, M., and W. S. Barnett. 2010. "Benefits of Early Childhood Interventions across the World: (Under) Investing in the Very Young." *Economics of Education Review* 29 (2): 271–82.
- Pavlikis, A. E., K. Noble, S. G. Pavlikis, N. Ali, and Y. Frank. 2015. "Brain Imaging and Electrophysiology Biomarkers: Is There a Role in Poverty and Education Outcome Research?" *Pediatric Neurology* 52 (4): 383–88. doi:http://dx.doi.org/10.1016/J.Pediatrneurol.2014.11.005.
- Peña, R., S. Wall, and L.-A. Persson. 2000. "The Effect of Poverty, Social Inequity, and Maternal Education on Infant Mortality in Nicaragua, 1988–1993." *American Journal of Public Health* 90 (1): 64.
- Piper, B., S. S. Zuilkowski, and A. Mugenda. 2014. "Improving Reading Outcomes in Kenya: First-Year Effects of the PRIMR Initiative." *International Journal of Educational Development* 37: 11–21.
- Rahman, A., V. Patel, and J. Maselko. 2008. "Maternal Depressive Symptoms at 2 to 4 Months Post Partum and Early Parenting Practices." *Archives of General Psychiatry* 160: 279–84.
- Raikes, A., T. Dua, and P. R. Britto. 2015. "Measuring Early Childhood Development: Priorities for Post-2015." *Early Childhood Matters* 124: 74–77.
- Ramakrishnan, U., T. Goldenberg, and L. H. Allen. 2011. "Do Multiple Micronutrient Interventions Improve Child Health, Growth, and Development?" *Journal of Nutrition* 141: 2066–75.
- Rao, N. 2005. "Children's Rights to Survival, Development, and Early Education in India: The Critical Role of the Integrated Child Development Services Program." *International Journal of Early Childhood* 37 (3): 15–31.
- . 2010. "Preschool Quality and the Development of Children from Economically Disadvantaged Families in India." *Early Education and Development* 21 (2): 167–85.
- Rao, N., J. Sun, V. Pearson, E. Pearson, H. Liu, and others. 2012. "Is Something Better than Nothing? An Evaluation of Early Childhood Programs in Cambodia." *Child Development* 83 (3): 864–76. doi:10.1111/j.1467-8624.2012.01746.x.
- Rao, N., J. Sun, J. M. S. Wong, B. S. Weekes, P. Ip, and others. 2014. "Early Childhood Development and Cognitive Development in Developing Countries: A Rigorous Literature Review." U.K. Department for International Development, London.
- Riis, J. L., D. A. Granger, C. S. Minkovitz, K. Bandeen-Roche, J. A. Dipietro, and others. 2016. "Maternal Distress and Child Neuroendocrine and Immune Regulation." *Social Science and Medicine* 151: 206–14.
- RTI International. 2016. *Early Grade Reading Assessment Toolkit*. 2nd ed. <https://www.eddataglobal.org/Reading/Index.Cfm?Fuseaction=Pubdetail&ID=929>.
- Shonkoff, J. P., W. T. Boyce, and B. S. McEwen. 2009. "Neuroscience, Molecular Biology, and the Childhood Roots of Health Disparities: Building a New Framework for Health Promotion and Disease Prevention." *Journal of the American Medical Association* 301 (21): 2252–59.
- Shonkoff, J. P., L. Richter, J. Van Der Gaag, and Z. A. Bhutta. 2012. "An Integrated Scientific Framework for Child Survival and Early Childhood Development." *Pediatrics* 129 (2): E460–72. doi:10.1542/Peds.2011-0366.
- Singla, D. R., E. Kumbakumba, and F. E. Aboud. 2015. "Effects of a Parenting Intervention to Address Both Maternal

- Psychological Wellbeing and Child Development and Growth in Rural Uganda: A Community-Based, Cluster Randomised Trial." *The Lancet Global Health* 3 (8): E458–69. doi:10.1016/S2214-109x(15)00099-6.
- Sudfeld, C. R., D. C. McCoy, G. Danaei, G. Fink, M. Ezzati, and others. 2015. "Linear Growth and Child Development in Low- and Middle-Income Countries: A Meta-Analysis." *Pediatrics* 135 (5): E1266–75. doi:10.1542/Peds.2014-3111.
- Thurnham, D. I. 2013. "Nutrition of Adolescent Girls in Low- and Middle-Income Countries." *Sight Life* 27: 26–37.
- UN (United Nations). 2015. *Transforming Our World: The 2030 Agenda for Sustainable Development*. New York: United Nations General Assembly. http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E.
- UNESCO (United Nations Educational, Scientific and Cultural Organization). 1990. *Meeting Basic Learning Needs: A Vision for the 1990s*. Jomtien, Thailand: UNESCO. <http://unesdoc.unesco.org/Images/0009/000975/097552e.pdf>.
- . 2000. *The Dakar Framework for Action: Education for All Meeting Our Collective Commitments*. Paris: UNESCO.
- . 2012. *Adult and Youth Literacy 1990–2015: Analysis of Data for 41 Selected Countries*. Montreal: UNESCO Institute for Statistics. <http://www.uis.unesco.org/literacy/documents/uis-literacy-statistics-1990-2015-en.pdf>.
- . 2015. *EFA Global Monitoring Report 2015*. Paris: UNESCO. <http://unesdoc.unesco.org/Images/0023/002322/232205e.Pdf>.
- UNESCO Institute for Statistics. 2016. *Understanding What Works in Oral Reading Assessments*. Recommendations from Donors, Implementers and Practitioners. Montreal: UNESCO Institute for Statistics. <http://www.uis.unesco.org/Education/Documents/what-works-oral-reading-assessments.pdf>.
- USAID (U.S. Agency for International Development). 2016. "Kenya and East Africa: Tusome Early Grade Reading Activity." USAID, Washington, DC. <https://www.usaid.gov/sites/default/files/documents/1860/Tusome%20%20Factsheet%202016.pdf>.
- Vaghri, Z., H. Wong, S. I. Barr, G. E. Chapman, and C. Hertzman. 2011. "Associations of Socio-Demographic and Behavioral Variables with Hair Zinc of Vancouver Preschoolers." *Biological Trace Element Research* 143 (3): 1398–412.
- van Urk, F. C., T. W. Brown, R. Waller, and E. Mayo-Wilson. 2014. "Centre-Based Day Care for Children Younger than Five Years of Age in High-Income Countries." *Cochrane Database of Systematic Reviews* (9): CD010544. doi:10.1002/14651858.CD010544.pub2.
- Vargas-Barón, E. 2013. "Building and Strengthening National Systems for Early Childhood Development." In *Handbook of Early Childhood Development Research and Its Impact on Global Policy*, edited by P. E. Engle, P. R. Britto, and C. S. Super, 443–66. New York: Oxford University Press.
- Victoria, C. G., S. R. A. Huttly, F. C. Barros, C. Lombardi, and J. P. Vaughan. 1992. "Maternal Education in Relation to Early and Late Child Health Outcomes: Findings from a Brazilian Cohort Study." *Social Science and Medicine* 34 (8): 899–905.
- Wachs, T. D., M. Georgieff, S. Cusick, and B. S. McEwen. 2014. "Issues in the Timing of Integrated Early Interventions: Contributions from Nutrition, Neuroscience, and Psychological Research." *Annals of the New York Academy of Sciences* 1308: 89–106. doi:10.1111/Nyas.12314.
- Walker, S. P., S. M. Chang, C. A. Powell, and S. M. Grantham-McGregor. 2005. "Effects of Early Childhood Psychosocial Stimulation and Nutritional Supplementation on Cognition and Education in Growth-Stunted Jamaican Children: Prospective Cohort Study." *The Lancet* 366 (9499): 1804–7. doi:10.1016/S0140-6736(05)67574-5.
- Walker, S. P., S. M. Chang, C. A. Powell, E. Simonoff, and S. M. Grantham-McGregor. 2006. "Effects of Psychosocial Stimulation and Dietary Supplementation in Early Childhood on Psychosocial Functioning in Late Adolescence: Follow-Up of Randomised Controlled Trial." *BMJ* 333 (7566): 472.
- Walker, S. P., S. M. Chang, M. Vera-Hernandez, and S. Grantham-McGregor. 2011. "Early Childhood Stimulation Benefits Adult Competence and Reduces Violent Behavior." *Pediatrics* 127 (5): 849–57. doi:10.1542/Peds.2010-2231.
- Walker, S. P., T. D. Wachs, S. Grantham-McGregor, M. M. Black, C. A. Nelson, and others. 2011. "Inequality in Early Childhood: Risk and Protective Factors for Early Child Development." *The Lancet* 378 (9799): 1325–38. doi:http://dx.doi.org/10.1016/S0140-6736(11)60555-2.
- WHO (World Health Organization). 2009. *Closing the Gap in a Generation: Health Equity through Action on the Social Determinants of Health*. Final Report of the Commission on Social Determinants of Health. Geneva: WHO. http://www.who.int/social_determinants/thecommission/finalreport/en/.
- WHO (World Health Organization) and UNICEF (United Nations Children's Fund). 2012. *Care for Child Development: Improving the Care of Young Children*. Geneva: WHO.
- Woodhead, M., I. Feathersone, L. Bolton, and P. Robertson. 2014. *Early Childhood Development: Delivering Inter-Sectoral Policies, Programmes and Services in Low-Resource Settings*. Oxford: Health and Education Advice and Resource Team.
- Yousafzai, A. K., and F. Aboud. 2014. "Review of Implementation Processes for Integrated Nutrition and Psychosocial Stimulation Interventions." *Annals of the New York Academy of Sciences* 1308 (1): 33–45.
- Yousafzai, A. K., J. Obradovic, M. A. Rasheed, A. Rizvi, and X. A. Portilla. 2016. "The Effects of Responsive Stimulation and Nutrition Intervention on Children's Development and Growth at 4 Years in a Disadvantaged Population in Pakistan: Longitudinal Follow-Up of a Cluster-Randomized Effectiveness Trial." *The Lancet Global Health* 4 (8): E548–58.
- Yousafzai, A. K., M. A. Rasheed, A. Rizvi, R. Armstrong, and Z. A. Bhutta. 2014. "Effect of Integrated Responsive Stimulation and Nutrition Interventions in the Lady Health Worker Programme in Pakistan on Child Development, Growth, and Health Outcomes: A Cluster-Randomised Factorial Effectiveness Trial." *The Lancet* 384 (9950): 1282–93.