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Early Parenting Interventions to Foster Human Capital in Developing Countries

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Abstract

One out of every three children under age 5 in developing countries lives in conditions that impede human capital development. In this study, we survey the literature on parenting training programs implemented before age 5, with the aim to increase parental investment in human capital accumulation in developing countries. Our review focuses on the implementation and effectiveness of parenting training programs (i.e., training in child psychosocial stimulation and/or training about nutrition). We emphasize the mechanisms that drive treatment-induced change in human capital outcomes and identify the demand- and supply-side behaviors that affect efficacy and effectiveness. Although the literature includes evidence on program features that are associated with successful interventions, further evidence on the dynamics of human capital formation, documentation of medium- to long-term persistence of treatment impacts, and research on the implementation and evaluation of programs at scale are needed to delineate a scalable and inclusive program that provides long-term treatment impacts.



Early childhood: the period in utero to age 5 when neural and behavioral plasticity is highest

Sensitive period for human development: a limited period in development when the effects of experiences on skill development are unusually strong

Critical period for human development: a special class of sensitive periods that result in irreversible changes in skill development

Parenting: what parents do to support the development of their children, from providing food to guiding their cognitive and noncognitive development

Parenting training interventions: intervention programs that aim to promote child development via improved parenting practices

1. INTRODUCTION

Lu et al. (2016) estimate that 250 million children under age 5 in low- and middle-income countries (LMICs) are at risk of not reaching their full developmental potential owing to risk factors in the early home environment. Delayed attainment of age-appropriate developmental milestones during early childhood has been shown to be associated with lifelong functional limitations (Black et al. 2017) and reduced adult productivity (Knudsen et al. 2006). Investing in the development of disadvantaged children is a crucial step that can lead to improved social mobility (Heckman & Mosso 2014). Sustainable Development Target 4.2 of the United Nations' Sustainable Development Goals highlights the need to give more children a fair chance in life by ensuring that by 2030 "all girls and boys have access to quality early childhood development, care, and preprimary education so that they are ready for primary education" (UN Gen. Assem. 2015, p. 17). In order to accelerate the progress on the equality of opportunity, it is important to build and accumulate human capital that can function as a key driver for sustained economic growth, especially in regions with large shares of at-risk children (Solow 1956, Heckman 2013).

A child's developmental potential is established by the child's genetic and biological background in interaction with parental investments in a home environment with sufficient learning opportunities that is sensitive to the nutritional needs of young children during the first five years of life (Mischel & Shoda 1995, Doepke et al. 2019). Multiple sensitive and critical periods for human development occur during the first five years of life (Knudsen et al. 2006, Almond & Currie 2011). Parental investments in the home environment during this early stage of life have been identified as key inputs for early childhood development (ECD) and physical growth outcomes in the short term and improved adult human capital outcomes in the long term (Heckman & Mosso 2014, Cobb-Clark et al. 2019). Further insight into the role of parental investments and the impacts of parental behavior change interventions is important to guide the design of human capital policies that aim to improve social mobility and economic development.

The objective of this review is to present current evidence on parenting training interventions that aim to improve human capital outcomes of young children (i.e., under age 5) in developing countries. We segment the reviewed parenting training interventions into three groups based on their program content: parenting training in child psychosocial stimulation, nutrition, and integrated content (psychosocial stimulation plus nutrition). Earlier public health reviews on the impacts of parenting training interventions in LMICs did not include the economic rationale behind program design and treatment impacts (e.g., Aboud & Yousafzai 2015, Rao et al. 2017). This article is the first economic review of the experimental parenting literature in the context of developing countries. Our primary focus is the economic rationale for different implementation models and their effectiveness. The review also emphasizes the mechanisms and demand- and supply-side behaviors that explain program efficacy and effectiveness. Promising future research directions are highlighted, such as the need for more in-depth analysis on the dynamics of human capital formation to inform the design of scalable parenting training programs, in particular, how the process of human capital accumulation across different domains can be harnessed to increase program effectiveness and engender persistent treatment impacts that improve long-term welfare.

An important contribution of this review is that it summarizes the evidence on the mechanisms that drive treatment impacts, which is useful to shed light on the process of human capital formation and the effectiveness of intervention programs in the short, medium, and long terms. We review evidence on the three key mechanisms through which parenting training interventions can affect the human capital outcomes of children according to the theoretical model of human capital formation (see the sidebar titled The Human Capital Production Function): (a) Parenting training can have a direct impact on human capital development [e.g., the child may learn new skills



THE HUMAN CAPITAL PRODUCTION FUNCTION

The theoretical model of human capital formation of Cunha & Heckman (2007) can be formalized as follows. From conception, a child's development can be defined by a given set of k dimensions of human capabilities (e.g., cognitive skills, social-emotional skills, physical health) that evolve over time t . In addition, parental investments at a given time, I_t , influence the capability formation of the child (e.g., parental provision of a healthy diet, psychosocial stimulation for the child). If we denote the vector of skills as θ_t , then the accumulation process at stage t for dimension k can be described as

$$\theta_{k,t+1} = f_{k,t}(\theta_{k,t}, I_t, \theta_H, E_{k,t}), \quad \text{SB1.}$$

where θ_H is a set of household characteristics that remains fixed over time (e.g., parental education), and $E_{k,t}$ is a set of time-varying environmental influences that can affect child human capital formation (e.g., changes in parental health, household income, employment conditions).

while an instructor teaches new interactive caregiver–child activities to the caregiver and the child (Attanasio et al. 2020a); (b) parenting training can have an indirect impact on children's human capital development via an increase in an input of the human capital production function [e.g., as a result of parenting training, caregivers may decide to engage the child more frequently in cognitive stimulation activities (Singla et al. 2015)]; and (c) parenting training can lead to a change in the parameters of the human capital production function [e.g., parental training in child feeding practices during early childhood can enhance the effectiveness of later investments in child health, such as the take-up of deworming drugs (Nga et al. 2009)].

Investigating demand- and supply-side behaviors also is key to explain the effectiveness of an intervention program. Some parenting training interventions indeed improve child development outcomes in ideal settings and when the implementation is well monitored (Hurley et al. 2016, Aboud & Yousafzai 2019, WHO 2000). Demand- and supply-side behaviors, however, may drive a wedge between the efficacy and effectiveness of policies and programs in real-world settings. On the demand side, parental inputs (e.g., interactive caregiver–child reading activities, nutritional supplements) may be taken up at low rates by caregivers with limited resources, time, or knowledge of the intervention benefits (Foster & Rosenzweig 1995). In addition to demand-side decisions, a host of supply-side factors (e.g., poor training of trainers, lack of monitoring, absence of financial incentives) may hinder the effectiveness of interventions (Finan et al. 2017).

Recognizing the importance of parenting training interventions for long-term economic growth, this article reviews the evidence on ECD outcomes, parental investment, and the role of parenting training interventions during pregnancy and early childhood in LMICs. We highlight the mechanisms and demand- and supply-side factors that determine the efficacy and effectiveness of such interventions. We leverage knowledge of the human capital production function to target programs at malleable, fundamental parental investments during windows of opportunity for child development. We also outline a number of caveats and obstacles that need to be addressed to inform the design of a scalable program with long-term treatment impacts.

2. CHILD DEVELOPMENT AND PARENTAL INVESTMENT IN THE DEVELOPING WORLD

The largest losses of human potential due to poor parenting decisions are incurred in developing countries. Lu et al. (2016) estimate that 250 million or 43% of children under age 5 in LMICs are exposed to stunting or extreme poverty and, therefore, are at elevated risk of developmental delay.



Assessing rates of delay more directly, Lu et al. (2020) summarize data on child development according to Early Childhood Development Index (ECDI) scores, using data from the Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys conducted between 2010 and 2018.¹ **Figure 1** presents the percentage of young children between 3 and 5 years of age in low-income, lower-middle-income, and upper-middle-income countries assessed as being delayed based on their ECDI scores.² The population-weighted, aggregated, country-level ECDI scores show that 36.9% of young children in low-income countries are developmentally not on track. ECDI scores of children between 3 and 5 years of age in lower- and upper-middle-income countries indicate that 26.8% and 15.0%, respectively, are developmentally not on track. The prevalence of developmental delay is clearly negatively associated with the level of economic development of the countries. Due to a shortage of ECDI scores for high-income countries, we are unable to compare the prevalence of children who are developmentally not on track according to their ECDI scores across LMICs and high-income countries.³ Within countries, household wealth gaps show that children in the richest quintile have higher levels of development when compared to children in the poorest quintile.

In addition to developmental delays, poor physical development due to nutritional deficiencies and associated health issues during early childhood remain prevalent in LMICs. Bommer et al. (2020) provide an in-depth review of the negative impacts of nutritional deficiencies on the physical development of children. According to their analysis, protein–energy malnutrition remains prevalent in low-income countries. Chronic protein–energy malnutrition is linked to physical growth retardation and may, in severe cases, lead to stunting. In 2017, 35.2%, 31.5%, and 6.4% of the children under age 5 in low-income, lower-middle-income, and upper-middle-income countries, respectively, were stunted (UNICEF et al. 2018). The same sources of information note that iron and vitamin A deficiencies remain prevalent in low-income and lower-middle-income countries. Insufficient iron and vitamin A intake may lead to a higher disease burden. Low levels of iron and vitamin A are known to be associated with poor health and nutrition outcomes (e.g., vitamin A deficiency is a risk factor for blindness and child mortality due to measles and diarrhea) (Stevens et al. 2015) and lower levels of cognitive development (e.g., Nyaradi et al. 2013).

In recent years, empirical evidence has linked child development outcomes to parental investments in learning opportunities and healthy nutrition for children (Francesconi & Heckman 2016, Yue et al. 2017). A cognitively stimulating home environment with sufficient learning opportunities and adequate nutrition is key to a child's skill development (Black et al. 2017). **Supplemental Figure 1** displays the percentages of children in developing countries who do not receive adequate stimulation at home via engagement in interactive caregiver–child activities, using data from the DHS and Multiple Indicator Cluster Surveys. When we weight the sample by population size, we find that approximately 35% of children under the age of 5 in low-income and lower-middle-income countries do not receive adequate cognitive stimulation at home. Interestingly, cognitive stimulation of large shares of children in upper-middle-income countries (23.2%) is also

¹The data collection methodology and measurement protocols of both the DHS and Multiple Indicator Cluster Surveys scales are highly comparable, which allows comparison of results across the two surveys (see, e.g., Bornstein & Putnick 2012, Hancioglu & Arnold 2013, McCoy et al. 2018, and Gatica-Domínguez et al. 2021 for in-depth discussions on the comparability of the Multiple Indicator Cluster Surveys and DHS scales).

²No country-level data on ECD outcomes of 0- to 3-year-olds are available due to the absence of a global assessment tool for this age group.

³In the DHS and Multiple Indicator Cluster Surveys, ECDI scores are collected for no more than three high-income countries: 3.4%, 16.1%, and 31.7% of the children between 3 and 5 years of age in Barbados, Qatar, and Oman, respectively, are developmentally not on track.

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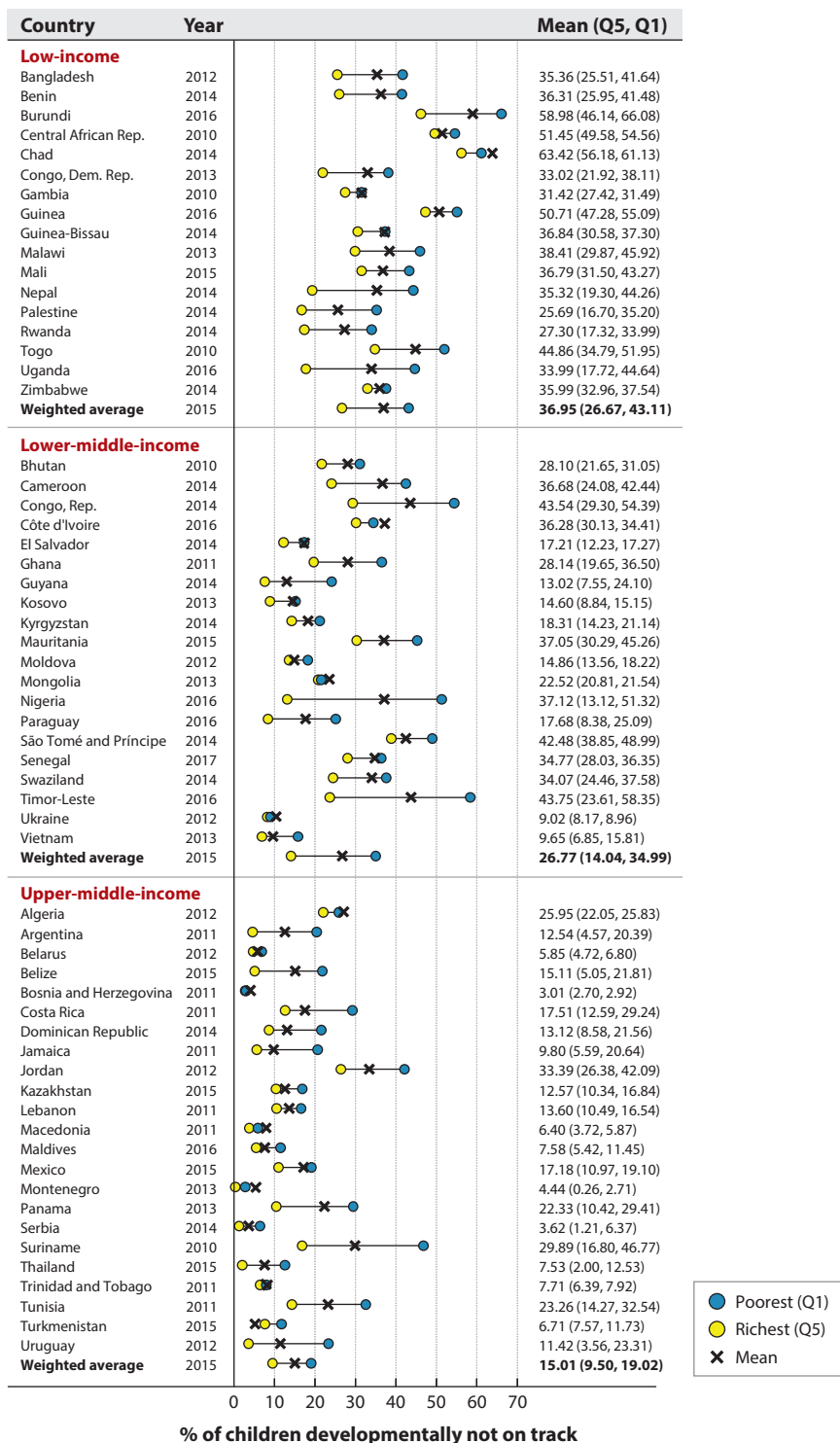


Figure 1 (Figure appears on preceding page)

Children developmentally not on track. ECD outcomes of young children between 3 and 5 years of age in 60 LMICs are assessed in the DHS and Multiple Indicator Cluster Surveys with UNICEF's ECDI measure. UNICEF developed the ECDI to assess basic developmental milestones in four domains: literacy–numeracy, physical development, approaches to learning, and social-emotional development (Loizillon et al. 2017). A child is considered to be on track within a domain if the caregiver reports that the child has at least 50% of the relevant skills. In line with UNICEF guidelines, we define a child as developmentally on track if the child has at least 50% of the skills in at least three out of four domains. ECDI scores are extracted from the DHS and Multiple Indicator Cluster Surveys. Country-level aggregates are reported in Lu et al. (2020). Country-level data are weighed based on population size to construct the weighted average. Abbreviations: DHS, Demographic and Health Surveys; ECD, early childhood development; ECDI, Early Childhood Development Index; LMICs, low- and middle-income countries.

inadequate. The results from these surveys also show that a majority of children do not receive adequate nutrition. **Supplemental Figure 2** shows that 84.9%, 83.1%, and 62.8% of the children in low-income, lower-middle-income, and upper-middle-income countries, respectively, do not receive a diet that satisfies the WHO's requirements for a minimum acceptable diet (WHO 2007).

3. REVIEW APPROACH

The Jamaican Nutrition and Cognitive Stimulation Program in the 1980s provided initial evidence of short-term gains in ECD outcomes from parental training interventions (Grantham-McGregor et al. 1991, Walker et al. 1991), with lasting impacts on cognitive, noncognitive, and health outcomes 30 years later (Walker et al. 2021). In response to the promising results of this study, policy makers and academics experimented with various implementation models in geographically and culturally diverse contexts over the past three decades. Note that parenting training programs are not the only type of intervention programs that have been used to improve ECD outcomes in LMICs (see the sidebar titled Early Childhood Development Interventions).

Parenting training programs in the 1990s and early 2000s were designed mainly to target relatively severely disadvantaged subpopulations (e.g., underweight children in Walker et al. 2004, Gardner et al. 2005, Hamadani et al. 2006). Over the past 25 years, researchers and policy makers have also implemented a variety of nontargeted parenting training programs that focus on child psychosocial stimulation, nutrition, or both during pregnancy or early childhood. Our review of the literature provides evidence on psychosocial stimulation, nutrition, and integrated parenting

EARLY CHILDHOOD DEVELOPMENT INTERVENTIONS

Since the 1990 World Declaration on Education for All, a wide range of ECD interventions have been implemented to improve developmental and educational opportunities of young children in LMICs. ECD interventions can largely be organized into three groups: (a) income supplementation programs that aim to relieve parental resource constraints (e.g., cash transfer programs conditional on the uptake of healthcare), (b) child-focused programs that aim directly at improving child outcomes (e.g., micronutrient supplementation programs), and (c) parenting training programs that aim to raise child skills indirectly via improved parenting practices (for a systematic review of the treatment impacts of the full range of ECD interventions, see, e.g., Rao et al. 2017). This review focuses on parenting training programs. An important advantage of parenting training programs is that, if interventions produce a sustained elevation in the level of parental investments, then treatment impacts on human capital outcomes are more likely to persist (Cunha 2015, Bailey et al. 2017).



training programs from 22 LMICs in Africa, Asia, and Latin America. Baseline data for all of these studies but one (i.e., Guldan et al. 2000) were collected after 1998.

Here, we review the expanding literature on nontargeted parenting training programs in LMICs that are implemented during pregnancy or the first five years of life to improve the developmental potential of young children. We screened the literature and selected studies to be included in this review based on five inclusion criteria: (a) The study concerns a universal program that involves children in utero up to age 5 and their primary caregivers (i.e., the study does not concern a targeted program that specifically targets children who are severely malnourished, prematurely born, or suffering from a severe disease, mental trauma, or disability);⁴ (b) the parenting program aims to adjust parenting practices to primarily improve ECD, child health, or physical growth outcomes; (c) the study is situated and conducted in a developing country; (d) the study has a randomized controlled trial design; and (e) the study contains at least one outcome measure of child skill development, health, or physical growth.

The reviewed parenting training programs were organized into three groups: psychosocial stimulation, nutrition, and integrated. First, we focus on psychosocial stimulation programs that encourage caregivers to stimulate their child's skill development via sensory inputs (e.g., picture books, toys) and via an affectionate caregiver–child bond. Second, we consider parenting training programs that focus on nutrition education and information.⁵ Third, we summarize evidence on integrated parenting training programs with a psychosocial stimulation and nutrition component. Some studies have started to investigate the impacts of parenting training programs that focus on other types of parental investment, such as parental investment in sanitation and hygiene (e.g., Hartinger et al. 2016, Luby et al. 2018); however, these stand-alone studies are not included due to their limited number.

4. EARLY PARENTING TRAINING INTERVENTIONS: IMPLEMENTATION

In this section, we describe program content and delivery mode of each intervention type. Please refer to **Supplemental Materials Part B** for a more comprehensive review of (a) the delivery mode (e.g., group sessions versus one-on-one training sessions, training delivered by health professionals or community workers); (b) location of the training (e.g., at home, in a clinic, at an ECD center); and (c) timing (e.g., prenatal or postnatal programs), program duration, and intensity.

4.1. Psychosocial Stimulation Programs

We find research on the implementation of 17 psychosocial stimulation programs in 13 African, Asian, or Latin American LMICs.⁶ Baseline data for each of these studies were collected after 2000. Each program contains at least one of the following four program components. First, programs

⁴We narrow the focus of this review to evidence from universal parenting training programs because this type of program has the potential to shift the skill distribution of the entire child population upward. Moreover, nontargeted programs are more likely to be cost-effective if they can benefit the skill development of a broader group of infants as compared to earlier programs that targeted children who were severely malnourished, prematurely born, and/or prone to disease.

⁵Please refer to Bommer et al. (2020) for a comprehensive review of the impacts of all types of nutritional interventions with and without a parenting training component (e.g., micronutrient supplementation programs without nutrition education).

⁶We find evidence of psychosocial stimulation programs in Antigua and Barbuda (Chang et al. 2015), Bangladesh (Tofail et al. 2013), China (Jin et al. 2007, Heckman et al. 2020, Shi et al. 2020, Sylvia et al. 2022), Colombia (Attanasio et al. 2014, Andrew et al. 2018), Ethiopia (Worku et al. 2018), India (Nair et al. 2009,

Universal program:

a program that involves the entire population of the community without imposing specific eligibility requirements for children or families

Targeted program:

a program that involves a certain subpopulation of the community by imposing specific eligibility requirements for children or families



provide information on ECD and the role of interactive and responsive parenting. Information on ECD can be spread via many channels, including pamphlets (e.g., Shi et al. 2020), flipcharts (e.g., Jin et al. 2007), radio podcasts (e.g., Abimpaye et al. 2020), and instruction by program staff (e.g., Yousafzai et al. 2014). Second, a subset of the programs contains one-on-one training sessions between caregiver–child dyads and parenting instructors on interactive caregiver–child activities (e.g., reading books, singing songs to the child; see, e.g., Attanasio et al. 2014, Yousafzai et al. 2014). Third, in other programs, group sessions are used to encourage interactive caregiver–child activities (e.g., Chang et al. 2015). Sylvia et al. (2022) combine one-on-one training in interactive caregiver–child activities with group-based reading and singing activities in parenting centers. Fourth, an open play area is sometimes provided to encourage free play with peers in a safe and healthy environment (e.g., Sylvia et al. 2022). ECD information, one-on-one sessions, and groups sessions are usually delivered by community health workers (e.g., Yousafzai et al. 2014), lay health workers (Araujo et al. 2021), or community volunteers (e.g., Abimpaye et al. 2020).

4.2. Nutrition Programs

Another set of parenting training programs targets a number of key maternal, infant, and young child nutrition (MIYCN) practices that are recommended to secure optimal child development during the first years of life. We review studies of 20 child nutrition training programs conducted across 12 African, Asian, and Latin American LMICs.⁷ These MIYCN programs have a number of fairly regular characteristics. First, programs target the intake of adequate nutrition for women of reproductive age (particularly to avoid iron deficiency). Second, nutrition programs encourage exclusive breastfeeding during the first six months of the lives of infants. Third, nutrition programs promote the initiation of adequate complementary feeding after six months of age, considering the adequate frequency and diversity of food sources (Bhutta et al. 2013, Britto et al. 2017). In many cases, nutrition training programs also include critical information on other aspects of health, such as hydration, sanitation, and hygiene practices, or proper access to medical care (e.g., vaccination schedule). Educational interventions that target caregivers and women of reproductive age are regarded as a critical strategy to improve MIYCN behaviors (Shi & Zhang 2011). Inadequate feeding practices are often associated with the poor health knowledge of caregivers, a lack of access to reliable information sources, and restrictions based on traditional beliefs (Balogun et al. 2015, Alderman & Fernald 2017). This type of child nutrition program is usually delivered by community-based health workers who are trained as part of the intervention plan. Frequently, the community health workers in these nutrition training programs work in collaboration with local health service workers and doctors. Although many programs are based on interactions (often one-on-one) between community health workers and caregivers, some programs also provide additional take-home materials, such as leaflets or books.

Wallander et al. 2014, Andrew et al. 2020), Jamaica (Chang et al. 2015), Pakistan (Wallander et al. 2014, Yousafzai et al. 2014), Peru (Hartinger et al. 2017, Araujo et al. 2021), Rwanda (Abimpaye et al. 2020), South Africa (Murray et al. 2016a,b; Vally et al. 2015), St. Lucia (Chang et al. 2015), and Zambia (Wallander et al. 2014).

⁷We find evidence on parenting training programs that focus only on child nutrition (and health) from Bangladesh (Roy et al. 2007, Darmstadt et al. 2010, Frongillo et al. 2017, Owais et al. 2017), Burkina Faso (Nikiema et al. 2017, McKune et al. 2020), China (Guldan et al. 2000, Shi et al. 2010), Ethiopia (Kang et al. 2017, Demilew et al. 2020, Abdulahi et al. 2021), India (Bhandari et al. 2004), Indonesia (Fahmida et al. 2020), Kenya (Waswa et al. 2015), Malawi (Fitzsimons et al. 2016, Kuchenbecker et al. 2017), Pakistan (Midhet & Becker 2010), Peru (Penny et al. 2005), Vietnam (Schroeder et al. 2002) and Zimbabwe (Rogawski McQuade et al. 2019).



4.3. Integrated Programs

A number of prominent studies concerned an integrated parenting curriculum that targets both domains of child development: cognitive/psychosocial development and child nutrition/health outcomes. In total, we identified 16 studies that evaluated an integrated parenting training program from nine LMICs in Africa, Asia, and Latin America.⁸ Baseline data for each of these impact evaluation studies were collected after 2000. The integrated intervention programs in nearly all of the child development programs are delivered as a comprehensive package of parenting training tools (Andrew et al. 2018). The program activities are a combination of those described in Sections 4.1 and 4.2. For example, certain programs combine parenting training in interactive caregiver–child activities (e.g., using toys to play with the child, reading books to the child) with age-appropriate information on child nutrition (e.g., optimal breastfeeding, complementary feeding practices; e.g., Singla et al. 2015, Luo et al. 2019, Sylvia et al. 2021).

The economic rationale for the integration of multiple program components is threefold. First, there may be program delivery synergies to the extent to which the total cost of delivering both services is lower when two program components are administered jointly than when they are delivered separately (Alderman et al. 2014a, Luo et al. 2019). Second, program integration may lead to synergies in terms of program uptake. If two program components are delivered jointly, then the incremental investment for caregivers to participate in an additional component will be low. Third, the integration of program components can lead to concurrent and dynamic synergies between the impacts of program components (Alderman et al. 2014a). For example, early investments in a specific developmental domain (e.g., parental investment in child nutrition) may lead to better child development outcomes (e.g., better health, stronger physical ability to move around) during early childhood, which may entail dynamic effects for the child's human capital formation during later stages of childhood (e.g., the child may develop stronger cognitive skills if they are healthier and better able to move around and explore the home environment).

5. EARLY PARENTING TRAINING INTERVENTIONS: EFFECTIVENESS

5.1. Psychosocial Stimulation Programs

The reviewed studies provide evidence that psychosocial stimulation programs can improve child cognition, language, motor, and social-emotional skill development outcomes. Each study finds a significant and positive treatment impact on at least one of these domains, and all but two studies (i.e., Murray et al. 2016a, Tofail et al. 2013) find significant, positive impacts on child cognitive development. A key lesson learned is that parenting training in caregiver–child interaction is effective for improving ECD outcomes in LMICs.

It is much less clear, however, whether parenting training programs that focus on psychosocial stimulation can improve child health or nutrition outcomes. Three of the reviewed studies evaluate impacts on child health and nutrition outcomes. The studies find no treatment impacts on child length-for-age *z*-scores, weight-for-age *z*-scores (Attanasio et al. 2014, Yousafzai et al. 2014, Chang et al. 2015), or hemoglobin values (Attanasio et al. 2014, Yousafzai et al. 2014). Yousafzai et al.'s study is the only one that detects a significant treatment impact of a psychosocial stimulation

⁸We find evidence of integrated psychosocial stimulation and nutrition programs that were implemented in Bangladesh (Aboud 2007, Aboud & Akhter 2011, Aboud et al. 2013, Ara et al. 2019), China (Luo et al. 2019, Sylvia et al. 2021), India (Vazir et al. 2013, Grantham-McGregor et al. 2020), Malawi (Gladstone et al. 2018), Mexico (Knauer et al. 2016, Fernald et al. 2017), Pakistan (Khan et al. 2018), Sierra Leone (Chandra et al. 2021), Uganda (Singla et al. 2015, Muhoozi et al. 2018), and Zambia (Rockers et al. 2016).



program on child health. The study finds that monthly home visits in combination with community-based group sessions on interactive caregiver–child activities lead to a significant reduction in the incidence of diarrheal illness and respiratory tract infection after two years of intervention.

These studies also provide evidence on the causal mechanisms behind treatment effects by evaluating impacts on secondary outcomes, such as parental investments in a cognitively stimulating home environment, parenting-related knowledge, and beliefs among caregivers. Empirical evidence shows positive treatment impacts on parental investments and parenting knowledge and beliefs, indicating that parents are often willing to reinforce (or learn from and put into practice what they learned) the intervention. Our review of the studies also suggests that the observed changes in parental investments in the child’s home environment and changes in parental knowledge are the main mechanisms driving the treatment impacts on child development (see, e.g., structural parameter estimates of Attanasio et al. 2020a).

5.2. Nutrition Programs

The reviewed studies show that the provision of nutrition education to parents usually has a positive impact on children’s anthropometric and health outcomes, regardless of the program intensity or delivery mechanism (Bhandari et al. 2004, Shi et al. 2010, Frongillo et al. 2017, Kang et al. 2017). Although it is outside the scope of this review, we note that some nutrition education programs seem more effective at halting growth retardation when they are combined with nutritional supplementation (Rockers et al. 2016, Gladstone et al. 2018, Muhoozi et al. 2018) or other interventions such as microfinancing or the provision of agricultural inputs (Marquis et al. 2015, 2018; Muehlhoff et al. 2017).

A subset of the nutrition education interventions assess impacts on ECD outcomes as well. The evidence on treatment impacts on ECD outcomes is mixed, with some studies reporting positive impacts on child skill development (e.g., Frongillo et al. 2017), while other studies detect no impacts (e.g., Vazir et al. 2013). On the whole, the impact of nutrition education interventions on child anthropometrics and health is well established, but future research is needed to determine which types of nutrition education programs can have a positive impact on child skill development.

Most studies also measure intermediate outcomes, such as knowledge of child diet and nutrition. Evidence suggests that gains in linear growth appear to be mediated by improved parenting self-efficacy, motivation, feeding knowledge, and feeding practices (Guldan et al. 2000, Schroeder et al. 2002, Bhandari et al. 2004, Britto et al. 2017). Knowledge, however, does not always translate to improved dietary practices, such as higher breastfeeding rates (see, e.g., Waswa et al. 2015). A recent review of findings suggests that nutritional counseling might be more effective when including behavioral change strategies (e.g., role modeling) rather than focusing on knowledge alone (Fabrizio et al. 2014).

Nonetheless, a fraction of studies indicates that, despite the positive impact on feeding practices and knowledge, some MIYCN parental training interventions that target pregnant women fail to have a significant impact on anthropometric outcomes (Nikiema et al. 2017, Owais et al. 2017). For example, a personalized nutrition counseling intervention that targets pregnant women in Burkina Faso shows improved behavior uptake, such as higher breastfeeding rates, feeding frequency, and dietary diversity (Nikiema et al. 2017). Nevertheless, the positive impacts on feeding practices found in this study do not translate into impacts on child height or weight. The authors suggest that a key reason to explain these findings is that the intervention was delivered at the facility level (rather than through home visits), which can negatively affect continued program uptake and follow-up data collection for the most disadvantaged children. Low program uptake (e.g., due



to a distant living location) also can explain low effectiveness, particularly in clinic-/facility-based programs (De Souza et al. 2006). Other explanations for the absence of treatment impacts on child height and weight include a high level of environmental enteropathy, overall poor health at baseline, and limited dietary intake of animal-based foods (Majamanda et al. 2014).

5.3. Integrated Programs

Integrated psychosocial stimulation and nutrition programs show that individual effects of single-component programs are maintained, but, in general, there is no evidence of synergies between program impacts. Except for the programs in the studies by Rockers et al. (2016) and Chandra et al. (2021), each of the reviewed programs detects a positive and significant impact on child skill development. In addition, we find that integrated parenting training programs can reduce the risk of child morbidity (Vazir et al. 2013, Rockers et al. 2016, Luo et al. 2019, Grantham-McGregor et al. 2020), improve hemoglobin levels (Vazir et al. 2013), improve length-for-age z-scores (Ara et al. 2019), and reduce the risk of stunting (Khan et al. 2018) and wasting (Chandra et al. 2021). In line with the evidence reported in Section 5.2, we find that most, but not all, of the intervention programs with a nutrition education component produce an impact on child health or nutrition outcomes (e.g., no impact on anthropometrics) (Rockers et al. 2016, Gladstone et al. 2018, Muhoozi et al. 2018).

Integrated parenting programs also provide evidence of the causal mechanisms of treatment effects. In terms of effects on intermediate outcomes, integrated programs lead to improvements in parental investment in a cognitively stimulating home environment (e.g., Aboud et al. 2013, Luo et al. 2019) and a healthier child diet (e.g., Aboud et al. 2013, Singla et al. 2015). In addition, integrated programs can facilitate adjustments in attitudes and beliefs toward psychosocial stimulation (e.g., Aboud et al. 2013) and responsive feeding practices (e.g., Vazir et al. 2013). Singla et al. (2015) and Knauer et al. (2016) use mediation analysis to establish the mediating role of parental investment in psychosocial stimulation for child cognitive skill development.

A key issue that arises across (psychosocial stimulation, nutrition, and integrated) interventions is the role of compliance (participation) for the efficacy and effectiveness of intervention programs. According to our review, treatment impacts on primary and secondary outcomes are likely to be identified and maximized under full compliance, but imperfect uptake diminishes the effects of programs, particularly in those that are implemented on a larger scale in less-controlled environments (Araujo et al. 2021). Low compliance can also lead to the failure to detect a treatment impact in small (potentially underpowered) samples (Croke et al. 2016).

Compliance is found to be affected by a diverse set of demand-side factors (e.g., parental resource, time, knowledge constraints) and supply-side factors (e.g., monitoring, delivery setting). Resource and knowledge constraints are likely to be more stringent for parents in disadvantaged communities in developing countries than for their more well-off counterparts (Bornstein 2003). Moreover, parents in more advantaged communities can use their resources to free up time otherwise allocated to household chores or commuting (Guryan et al. 2008, Falk et al. 2021).

From the supply side, program fidelity (i.e., implementation delivered as planned) can be affected by the commitment and skills of trainers as well as delivery location. Supervision and financial incentives are important to convince service providers to commit to their job as parenting instructors (Finan et al. 2017, Josephson et al. 2017). Sylvia et al. (2022) compare compliance and treatment impacts of a facility-based, at-home parenting training program in rural China. Home-based delivery is better able to reach more disadvantaged children, with greater catch-up potential. In facility-based models, however, disadvantaged households may be more likely to drop out due to resource constraints (De Souza et al. 2006).



Self-productivity:
the stock of a child's capability produced at one stage of childhood augments the development of this capability at later stages

Cross-productivity:
the stock of a child's capability produced at one stage of childhood augments the development of another capability at later stages

Dynamic complementarity:
capabilities produced at one stage of childhood raise productivity of parental investments at later stages of childhood

6. FUTURE RESEARCH PRIORITIES

6.1. Fadeout of Treatment Impacts

The short-term efficacy of parenting training programs to improve ECD outcomes is well established in the literature. It has been shown, however, that promising intervention impacts on cognitive outcomes often fade out in the medium term and reemerge in the longer term (Schweinhart et al. 2005, Campbell et al. 2014, Bailey et al. 2017). For example, the initial impact of the Jamaican Nutrition and Cognitive Stimulation Program on cognitive development of infants and toddlers declined over the age of the child and was no longer significant by age 7 (Grantham-McGregor et al. 1997). Treatment impacts reemerged, however, by the time the child turned 11 years old (Walker et al. 2000). Treatment-induced IQ gains persisted even at 31 years of age (Walker et al. 2021).

Further research is needed to investigate causes of medium-term fadeout. First, it is possible that studies do not detect significant medium-term impacts because they are not measuring the appropriate outcomes relative to the natural plasticity of human development. The results discussed in this review show that nutrition and stimulation counseling during the first 1,000 days yields impacts for cognition, health, and anthropometrics early in life. Noncognitive developmental gains, however, might become more salient in later years (Attanasio et al. 2020b). Future studies need to investigate medium-term treatment impacts of parenting training programs on a wider range of child outcomes, including a variety of noncognitive outcomes (e.g., executive functioning).

Second, it is possible that some interventions fail to equip children with the right skills at the right time to seize emerging opportunities [e.g., children may need to acquire basic language skills to be able to develop more advanced literacy skills later on (Bailey et al. 2017)]. Little is known about the optimal timing of intervention programs across developmental domains. A number of studies in LMICs, including the work of Attanasio et al. (2017; 2020a,c), find evidence of dynamic self-productivity and cross-productivity effects in the process of human capital formation during the first five years of life. Attanasio et al. (2017, 2020c) find that child health at age 1 is important for the cognitive development of 5-year-olds in Ethiopia, India, and Peru. Attanasio et al. (2020a) show that the cognitive development of Colombian 1-year-olds fosters social-emotional skill development at age 2. Furthermore, a number of studies provide evidence of dynamic complementarity between early child capabilities and parental investments later on (see, e.g., Attanasio et al. 2017; 2020a,c). These findings indicate that it may be optimal to start investing early in developmental domains such as child health and cognitive development. Further evidence is needed on the optimal timing of intervention programs.

Third, sustained changes in parenting behavior and the home environment may be key to avoiding fadeout (Heckman & Mosso 2014, Bailey et al. 2017). Obradović et al. (2016) find that the lasting impacts of a parenting training program in rural Pakistan on child cognition two years after program completion coincide with lasting changes in parental investments. In contrast, the treatment impacts of a parenting training program in rural Colombia on parental investment and child skill development faded out two years after program completion (Andrew et al. 2018). Hence, a fruitful avenue for future research is to investigate whether studies that produce lasting impacts on parenting knowledge and beliefs can lead to lasting changes in parenting behavior and are, therefore, more likely to have an ongoing impact on child development outcomes in the longer term.

6.2. Heterogeneity and Catch-Up Potential

A major consideration in the ECD literature is the presence of treatment heterogeneity across different subgroups. Researchers and policy makers are interested in knowing whether community-based parenting training interventions can provide a potential for catch-up for the



most disadvantaged children in the community. Fernald et al. (2017) and Sylvia et al. (2021) find that more disadvantaged children with lower baseline skills benefit more from increased parental investment in child psychosocial stimulation. A number of nutrition-focused interventions also yield the largest impacts on growth and development outcomes for children in severely deprived households (Andrew et al. 2016, Croke et al. 2016). Other studies, however, find no evidence of progressive program impacts. For example, Attanasio et al. (2020a) find that disadvantaged children in rural Colombia are unable to catch up with better developed children because the most disadvantaged children lack the basic skills required to develop more advanced capabilities. Future randomized interventions are needed to provide more comprehensive knowledge about impact heterogeneity based on differences in baseline capability sets to investigate which basic capabilities at what ages are required to secure children's potential to catch up.

Evidence on impact heterogeneity also can be useful to tailor intervention programs to the developmental stage of children. It is possible that an intervention targeted at a specific developmental domain (e.g., health) during an early stage of childhood may raise the productivity of later investments in the same or another developmental domain (e.g., cognitive development). To date, there is limited research on this type of dynamic productivity effects in human capital formation (Yousafzai et al. 2014, Hurley et al. 2016, Britto et al. 2017). To the best of our knowledge, no evidence has been provided of dynamic productivity effects across different human capital domains (e.g., cognitive development, health).

Impact heterogeneity is driven by not only differences in baseline characteristics of children and households but also differences in program uptake and compliance. Sylvia et al. (2021) show that the size of the program impact of a home visitation program in rural China is linearly correlated with the number of completed home visits. Sylvia et al. (2022) show that, in rural Chinese settings, the number of completed parenting training sessions is lower for children from disadvantaged households in a facility-based program, but compliance is higher for more disadvantaged children in home-based programs. In-depth research is needed to manage drivers of demand- and supply-side compliance and to quantify compliance-based heterogeneity in treatment impacts.

6.3. Program Design and Scalability

In order to bring intervention programs to scale and deliver them as regular health and education services, further research is needed to determine which program features are key for sustained parental involvement and improved child development. For example, future studies need to investigate in more detail which program curricula (e.g., interactive reading activities versus group-based play activities) can be more effective at stimulating development in which specific human capital domain. Optimal timing, duration, and intensity also remain to be investigated. The standard human capital production function, as introduced by Cunha & Heckman (2007), provides a helpful theoretical framework to think about the optimal timing for human capital interventions. The production function is characterized by dynamic productivity and complementarities that can produce multiplier effects, which are one of the key mechanisms through which skills beget skills. Hence, the theoretical framework indicates that it is optimal to start investing early. Empirical evidence confirms that the first years of life provide a unique window of opportunity for human capital intervention (Knudsen et al. 2006, Almond & Currie 2011). However, further evidence is needed on the optimal timing of any intervention program. For example, in the absence of further involvement in intervention programs, it is unclear whether parenting training interventions on child psychosocial stimulation or nutrition initiated during pregnancy are more effective at improving child cognition than interventions initiated during early infancy (Alderman et al. 2014b, Akter et al. 2020).



POPULATION-LEVEL EARLY CHILDHOOD DEVELOPMENT ASSESSMENT TOOLS

There is an urgent need for the development of a population-level assessment tool for ECD outcomes of children under age 5 (Clark et al. 2020). As shown in **Figure 1**, ECD outcomes of young children between 3 and 5 years old have been assessed at scale with UNICEF's ECDI questionnaire. The 10-item ECDI questionnaire, however, is not suitable for the assessment of ECD outcomes of children under age 3 (Loizillon et al. 2017). UNICEF recently published the ECDI2030, an extended 20-item version of the ECDI questionnaire for the assessment of ECD outcomes of 2- to 5-year-olds (UNICEF 2021). No assessment tool for ECD outcomes of children under age 2 is available for global, large-scale deployment (Olusanya et al. 2021). Moreover, observation-based ECD measures are, in general, more objective and accurate than questionnaire-based ECD measures (Rubio-Codina et al. 2016). An observation-based ECD assessment tool that is less costly and time consuming to administer than existing observation-based ECD measures would be a valuable tool for high-quality assessments of ECD outcomes at scale.

Most of the findings in the parenting intervention literature are based on relatively small-scale programs that are implemented in highly controlled environments. Evidence from a scaled-up parenting program in Peru (i.e., the Cuna Más program) indicates that the home-based parenting training program is effective at scale, but much remains unknown about the optimal design and cost-effectiveness of such scalable program (Josephson et al. 2017, Richter et al. 2017). Comparative cost-effectiveness analyses across programs are often not straightforward due to the incomparability of evidence across programs stemming from differences in data availability, data quality, duration of treatment, length of follow-up, and other characteristics of the different programs/interventions. There is a need for the development of a highly scalable ECD assessment tool for children under age 2 to support the comparative evaluation of large-scale programs across different contexts and cultures (see the sidebar titled Population-Level Early Childhood Development Assessment Tools).

The intervention literature indicates that the following program features benefit cost-effectiveness and scalability. First, delivering parenting training via existing service platforms or by involving local community representatives most likely can lead to gains in cost-effectiveness and scalability (Gowani et al. 2014, Yousafzai & Aboud 2014).⁹ Second, the use of new technologies (e.g., podcasts) also can benefit scalability (Abimpaye et al. 2020). Third, as discussed in Section 4.3, the integration of program components can benefit scalability due to synergies in program delivery, uptake, and treatment impacts (Alderman et al. 2014a).¹⁰ Fourth, group-based parenting training programs may have a higher potential for successful scaling than may home-based models due to shared delivery and monitoring costs (Grantham-McGregor et al. 2020).¹¹ As discussed in Section 5.3, however, children in less-well-off households are more likely to miss out on a clinic-/facility-based intervention, which may lower the cost-effectiveness (Sylvia et al. 2022). Further research is needed to increase scalability and the potential for parenting training interventions to be adopted into policy and practice.

⁹Gowani et al. (2014) calculate that integrating a psychosocial stimulation, nutrition, or integrated program in existing health services in rural Pakistan costs no more than US\$4 per child per month.

¹⁰Gowani et al. (2014) confirm that an integrated psychosocial stimulation and nutrition program in rural Pakistan is more cost-effective than the single-component programs.

¹¹Walker et al. (2015) compare the benefit-to-cost ratios of center-based parenting programs in Antigua, Barbuda, St. Lucia, and Jamaica and a home-based program in Jamaica. They find that the ratio of benefits over costs ranges from 5.3 to 9.9 and from 3.8 to 7.1 for the center-based and home-based programs, respectively.



7. CONCLUSIONS

A large number of children under age 5 in developing countries are developmentally delayed. Of the children under age 5 in low-income and lower-middle-income countries, more than 35% and 25%, respectively, are not attaining their age-appropriate developmental milestones (**Figure 1**). The prevalence of developmental delays is associated with a lack of parental investment, such as the provision of early learning opportunities and a healthy diet for their children (Heckman & Mosso 2014, Cobb-Clark et al. 2019, Emmers et al. 2021). We find that approximately 35% and 84% of children under age 5 in low-income and lower-middle-income countries, respectively, do not receive adequate psychosocial stimulation and nutrition at home (**Supplemental Figures 1 and 2**). In addition, in upper-middle-income countries, 23.2% and 62.8% of the children do not receive adequate psychosocial stimulation or nutrition, respectively.

Parenting training interventions that focus on child psychosocial stimulation and nutrition during pregnancy or early childhood have emerged as promising tools to improve ECD, health, and physical growth outcomes. The reviewed studies provide rich evidence of the short-term impacts of nontargeted parenting training programs on early skill development, health, and physical growth outcomes of 0- to 3-year-olds in LMICs. Parenting training in psychosocial stimulation consistently improves child skill development, while education on child nutrition in most, but not all, studies has an impact on child health or growth outcomes.

In addition, the reviewed studies consistently find positive short-term intervention impacts on secondary outcomes, such as parental investment in cognitively stimulating caregiver-child activities and dietary diversity for young children, which indicates that parents are willing to reinforce the intervention program. Increased parental investment in response to the intervention is an important mechanism that drives program impacts on child development, health, and growth. Attanasio et al. (2020a) estimate a structural model to show that the effects of a parenting training program on early cognitive development can be largely explained by changes in parental investment.

Although the short-term efficacy of intervention programs to improve ECD outcomes is well established, the presence of fadeout, whereby impacts of initially promising interventions fade out in the medium to long term, but reemerge in the longer term (Schweinhart et al. 2005, Campbell et al. 2014, Bailey et al. 2017), warrants further investigation. Future research is needed to investigate to what extent and under which conditions the treatment impacts of intervention programs can persist over time. Sustained higher levels of parental investment after the end of the intervention program may be crucial to avoid fadeout of initially promising treatment effects in the longer term (Obradović et al. 2016, Andrew et al. 2018). Hence, a fruitful avenue for future research is to investigate whether studies that produce lasting impacts on parenting beliefs and behavior are more likely to have persisting impacts on child development outcomes.

Further, we find that most evidence in the parenting intervention literature is collected based on research from relatively small-scale programs that are implemented in highly controlled environments. It is unclear, however, how this type of intervention program can be implemented on a large scale. Integration of parenting training programs into existing community-based health and nutrition services, the use of new technologies for program delivery, and the integration of the components of the programs can all lead to gains in cost-effectiveness and can benefit program scalability (Gowani et al. 2014, Abimpaye et al. 2020). In addition, clinic-/facility-based programs are, on average, less costly to deliver than are home-based programs (Walker et al. 2015). More stringent resource, time, and knowledge constraints, however, may lower caregivers' ability or willingness to participate in a clinic-/facility-based program, which can lower the effectiveness of these programs. Children in less-well-off households will be more likely to miss out in a



clinic-/facility-based intervention due to more stringent resource constraints (Sylvia et al. 2022). Home-based programs are likely to be more inclusive of the most disadvantaged children, who would benefit the most from a parenting training intervention (Fernald et al. 2017, Sylvia et al. 2021). Hence, it may be optimal to combine less-costly clinic-/facility-based service delivery with home visits for the most disadvantaged households. Further research is needed to investigate the design of a parenting training program that can be cost-effective on a large scale.

The design of a scalable policy intervention with persisting treatment impacts on human capital outcomes requires a further understanding of the mechanisms that drive program impacts. Careful data collection on program costs and short-, medium-, and long-term effects is needed to inform this research. A major advantage of experiments is the flexibility with respect to data collection and the design of treatment arms. If experimental economists utilize rich data sets from developing countries in combination with experimental variation and innovative analysis methods, they can greatly contribute to advancing the academic frontier on the technology of human capital formation and optimal intervention design. More research is needed to delineate a parenting training program that can be used to achieve long-term improvements in human capital formation and social mobility on a large scale.

SUMMARY POINTS

1. The human capital development of the future global labor force is at risk. At least 35% and 25% of young children under age 5 in low-income and lower-middle-income countries, respectively, are developmentally delayed (**Figure 1**).
2. Approximately 35% and 84% of the children under age 5 in low-income and lower-middle-income countries, respectively, do not receive adequate psychosocial stimulation or nutrition at home (**Supplemental Figures 1 and 2**).
3. Psychosocial stimulation programs are a highly effective tool to improve child skill development in the short term. It remains unclear, however, to what extent treatment impacts persist over time.
4. Short-term efficacy of nutrition education programs is heterogeneous. Interventions usually improve feeding knowledge, dietary quality, and maternal, infant, and young child nutrition (MIYCN) behaviors, but gains do not always translate to changes in physical growth outcomes.
5. Integrated psychosocial stimulation and nutrition programs manage to sustain the individual effects of single-component programs, but there is no evidence of synergies between program impacts.
6. The impacts of parenting training programs on child development and health outcomes are mediated by parental investments, parenting knowledge, and parental self-efficacy.
7. The integration of parenting programs into existing community health services, the use of new technologies, and integration of components of the programs can all lead to gains in cost-effectiveness and can benefit program scalability.
8. Clinic-/facility-based programs have the potential to be less costly in certain settings, but home-based programs may be better at retaining the most disadvantaged children, who are likely to experience higher gains. Hence, it may be optimal to combine clinic-/facility-based service delivery with home visits for the most disadvantaged households to ensure cost-effectiveness and inclusiveness.



FUTURE ISSUES

1. Understanding the optimal combination of program features (e.g., timing, duration of programs) is critical to increase effectiveness, scalability, and adherence of parenting training interventions when delivered at scale.
2. Future randomized interventions need to include protocols to study treatment impact heterogeneity, particularly as a function of the developmental stage of children, parental capabilities, and other household characteristics.
3. Studies need to research whether integration of different program components can lead to synergies between the impacts of these components.
4. In-depth research on the demand- and supply-side drivers of compliance and fidelity is needed to explain patterns of program uptake and compliance-based heterogeneity in treatment impacts.
5. Future studies need to investigate fadeout, whereby initially promising treatment impacts on early cognitive development fade out in the medium term but reemerge in the longer term.
6. There is a need for the development and validation of intuitive, unbiased, and cost-effective (observation-based) early childhood development (ECD) assessment tools. These tools are key for large-scale assessment and evaluation of impacts of parenting interventions on ECD outcomes.

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