Education Rigorous Literature Review

Early childhood development and cognitive development in developing countries

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Contents

Executive Summary

Objectives

This review assembles extant evidence that will help determine how, why and under what conditions Early Childhood Development (ECD) interventions in developing-country contexts are effective in promoting cognitive development. Typical cognitive development can be defined broadly as expected gains in language, thinking and understanding. Atypical development can be characterised as a delay in expected gains. Our primary motivation was to determine: (i) type(s) of ECD interventions that are effective in attaining typical milestones and can be relatively easily scaled up in different developing-country contexts; (ii) the minimum "dosage" of intervention needed to achieve sustainable gains in children's cognitive development, considering their expected milestones; (iii) the best ways in which to support and involve parents, extended-family members and the community in promoting early learning; (iv) characteristics of effective change agents; and (iv) conceptual models that best explain ways to promote cognitive development, school readiness and learning achievement.

Method

To achieve our goal, we first searched for relevant keywords in (a) electronic databases; (b) reference lists of journals; and (c) specialist websites. Next, we applied a rigorous screening procedure to select 114 studies[1] for further analysis, but three of these were deemed to be of low quality and were excluded in the final analysis. Each study was then coded using a comprehensive coding scheme that was developed to gain a full understanding of the major components of reported interventions. In addition, we prepared narrative summaries of 14 studies. High inter-rater agreement was achieved based on the quality of the study and on at least one major take-home message derived from reported interventions.

Main findings and implications

1. A large, high-quality body of evidence, derived from 111 studies conducted in 40 developing countries, shows that early childhood interventions can have a reliable and positive effect on cognitive development.
2. The research designs of studies that form the basis for this conclusion included experimental, quasi-experimental and observational research. The effectiveness of parent-focused and child-focused interventions related to education, nutrition and/or health, income supplementation, as well as more extensive, integrated interventions that include a variety of interventions that are variable in terms of quality.
3. The largest effect sizes are associated with large-scale comprehensive programmes that usually include more than one type of intervention and are typically government-funded. Specific characteristics of effective change agents are significantly related to cognitive-development outcomes that can be defined as attainment of typical milestones. Investment in the training of specific change agents to promote cognitive development in developing countries is, therefore, recommended.

1 We use the term *study* to refer to one publication, be it a journal article or a report that included many individual studies.

4. Issues related to the type of intervention and other limitations in the extant evidence preclude strong conclusions about the minimum “dosage” of intervention recommended to achieve sustainable gains in typical milestones in cognitive development. This is because of large variations in study design and monitoring of implementation. More systematic research is, therefore, required.
5. The independent effect of a single invention on cognitive development is usually difficult to isolate from other factors. For example, cash incentives are commonly tied to other components, which are themselves interventions (for example, medical checks, parental counselling and/or programme attendance). Further use of causal statistical analyses is, therefore, recommended.
6. The review did not identify sufficient evidence to draw firm conclusions about the best ways in which to support and involve parents, extended-family members and communities in promoting early learning. However, the evaluations of parent-focused interventions suggest that parent-alone information-based interventions are less effective than interventions in which the change agent worked with both the parent and the child. Some small-scale pilot programmes offer promising outcomes, but they have not been fully evaluated.
7. Very few studies reported on the costs of the interventions, and the unit costs vary widely due to factors such as economies of scale, geography, income and price levels, and integration in other programmes. However, findings from some studies suggest that the cost of parent-focused interventions compares favourably to that of other interventions, such as day-care and preschool, and a cost–benefit analysis showed that, in at least some settings, parent-focused programmes may lead to high returns on investment. Parent-focused programmes are, therefore, likely to be cost-effective.
8. There is insufficient evidence to determine which curriculum models are the most effective for promoting typical cognitive development, school-readiness and learning attainment. However, the limited amount of evidence suggests that programme quality matters and that those programmes with greater structure and well-qualified change agents are associated with better cognitive outcomes. Therefore, the quality of provision must be prioritised in future interventions.
9. There is a geographical bias in the sample. For example, conditional cash transfers have typically only been used and evaluated in Latin America. Few studies have been conducted on the effectiveness of early childhood interventions in Africa, and the team found only two in the population giant, China. Further research is recommended.
10. The findings from the review are compatible with a conceptual model of brain and cognitive development that assumes typical development is enhanced by protective and promotive factors located in family, preschool and community settings. Within this framework, it is recommended that all locally available resources be utilised in intervention programmes in order to achieve sustainability.

Specific Recommendations

- ***Priority 1***: Invest in comprehensive large-scale programmes, such as the Pastoral del Niño programme in Paraguay, the Integrated Child Development Services in India, and the integrated programme in the Philippines.
- ***Priority 2***: Invest in well-designed and properly implemented parent-focused or child-focused interventions, as they have positive effects on children's cognitive development. Parent-focused interventions, in particular, may lead to beneficial changes in parents, which are consequently reflected in their relationships with their children and in the general atmosphere of the home. This contextual change may help to promote continuous cognitive development and support children's learning beyond the intervention period.
- ***Priority 3***: Invest in quality by allocating resources for (i) training change agents (be they parents, teachers or health workers), and (ii) age- and context-appropriate curriculum materials for children and context-appropriate learning materials for change agents.
- ***Priority 4***: Invest in additional rigorous research to determine the most effective methods of training change agents to promote cognitive development.
- ***Priority 5***: Invest in building the capacity of in-country teams to conduct evaluation research, thereby improving the quality and representativeness of the body of knowledge for evidence-based policy-making.

1. Introduction

1.1 Rationale and objectives

More than 200 million children in developing countries do not achieve their expected level of cognitive development due to poverty, stunting and associated lack of early learning opportunities (Grantham-McGregor et al. 2007). Expected levels of cognitive development are based on typical gains in language, thinking and understanding observed in children from economically advantaged countries. Atypical development can be characterised as a delay in these expected gains. Early Childhood Development (ECD) interventions that focus on health, nutrition, stimulation and formal education are reported to have positive and substantial impacts on the development of children from economically disadvantaged backgrounds in low- and middle-income countries (LMICs) (Alderman 2011, Baker-Henningham and Boo 2010, Engle et al. 2007, 2011, Nores and Barnett, 2010, UNESCO, 2006). However, the studies that led to this conclusion differ in the research designs employed, populations sampled, types of intervention and types of outcome measured. This diversity requires a systematic review and synthesis of research evidence to understand why, how and under what conditions ECD interventions are effective in achieving expected outcomes in typical cognitive development. Evidence-based decisions can then be made about which programmes are worthy of initial or continuing support and should be scaled up.

Over the last decade, the government of the United Kingdom has been advocating the concept of evidence-based policy. It is expected that basing policy decisions on up-to-date information of "what we know" will encourage success, impact and value-for-money of the programmes funded. However, much research into education in developing countries has been descriptive in nature. Much of it merely provides information on indicators relating to access and/or distance from targets, such as Education for All Goal 1 (*expand and improve comprehensive early childhood care and education*) and Millennium Development Goal 2 (*encouraging universal access to and completion of primary education*). More evaluative research is needed. Further, empirical studies conducted in developing countries have tended to be small in scale and investigator-driven and larger, potentially influential studies are also needed.

The fragmented nature of existing research has meant that it has not been possible to aggregate findings and provide the quality and strength of evidence normally required for more stringent systematic reviews[2]. Additionally, until very recently, there has been little emphasis on experimental research—that is, identifying and testing possible solutions to the problems facing policy-makers. Therefore, the Department for International Development (DFID) commissioned the current rigorous literature review systematically and comprehensively to identify and appraise a wide range of studies of variable designs and methodological quality, taken from both the academic and the grey literature, in order to assess the existing evidence on the effectiveness of ECD interventions on children's cognitive development in developing countries. Against this background, the aim of this review is to present evidence to answer the following question:

[2] In December 2011, four categories of evidence "products" were approved by DFID's Development Policy Committee: (i) rapid reviews, (ii) literature reviews, (iii) evidence papers, and (iv) systematic reviews. Each type of evidence product requires a different level of scope, rigour and standard of evidence.

How, why and under what conditions are ECD interventions effective in promoting typical cognitive development in developing-country contexts?

1.2 Definition of terms

The term ***Early Childhood Development*** (ECD) usually refers to the process of development during the early childhood period, which many professional organisations consider as lasting from birth to eight years old (although other stakeholders consider that the early childhood period lasts from birth to primary-school entry, which is six or seven years old in most countries). More and more, however, the term ECD is typically used by international-development agencies[3] to refer to holistic and converging services in health, nutrition, family care, education and social protection for children from conception to eight years old. For the purposes of this review, we define ECD as any kind of intervention designed to promote typical cognitive development that was implemented before the child was eight years of age and includes prenatal nutritional supplementation. Therefore, ECD includes (i) interventions for children below the age of three years (prenatal nutritional supplementation for mothers, health and nutrition, stimulation and education, parental support, income supplementation); (ii) informal and formal services for children ranging in age from three to eight years, which aim to prepare the child for formal primary education; and (iii) the early grades of primary school.

Cognitive development refers to advances in mental processes associated with perception, memory, reasoning, problem-solving, language-learning and other aspects of brain development that occur with increasing age. Historically, children's cognitive development was usually assessed through intelligence quotient (IQ) tests. It should be noted that there is a dearth of appropriate tools with which to assess cognitive development in very young children and there are currently no globally accepted tests of early cognitive development. While a few reliable and valid tests of early cognitive development have been normed in developed countries, there is concern about their validity in other countries due to cultural and contextual differences, not only in assessment techniques, but also in constructs to be measured. For present purposes, cognitive development has been operationalised to encompass performance in tests of developmental functioning, intelligence, language, literacy, numerical ability, memory, problem-solving, learning ability, academic attainment and cognitive control. Typical cognitive development can be defined as expected gains in language, thinking and understanding. Atypical development can be characterised as a delay in expected gains.

School readiness refers to children's attainment of a certain set of psychosocial, behavioural and cognitive skills needed to learn and function successfully in school. The term includes physical wellbeing and motor development, social and emotional development, language development, cognitive development and general knowledge and learning-related skills (Child Trends 2000, Kagan et al. 1995, Snow and Van Hemel 2008).

Learning achievement refers to children's performance in tests of language, literacy and mathematical attainment in this report. The contextual appropriateness and psychometric properties of these tests are pivotal for valid judgements about intervention effectiveness. If measures of learning achievement lack sensitivity, interventions may be incorrectly

[3] A variety of terms, including Early Childhood Development (ECD), Early Childhood Care and Education (ECCE), Early Childhood Education and Care (ECEC) and Early Childhood Care and Development (ECCD) have been used to describe services for young children.

deemed ineffective. However, if tests lack specificity, it is possible that an ineffective intervention could be judged to be effective.

Developing countries are defined based on World Bank Global Development Indicators, and our classification includes low- and middle-income countries (LMICs). A full list of developing countries is presented in Appendix 1.

1.3 Previous relevant research

Three inter-related strands of research studies have documented the relationship between early intervention and cognitive development, later school achievement and non-cognitive skills. This research, which stems from neuroscience, economic sciences, developmental and behavioural sciences, is summarised below.

Evidence from neuroscience. Brain development is rapid in the first years of life, and environmental factors can alter brain architecture and biological function. As early as gestation and through the first years of life, the environment (including nutrition, drug ingestion, infection, pollutants and levels of stress) influences how genes are expressed, and how the brain's architecture and function are set. The brain is relatively plastic in the early years and this means that young children are more open to learning and enriching experiences that shape typical cognitive development. However, developing brains are also more vulnerable to impoverished and sub-optimal learning environments. Critical periods for cognitive development are associated with the process of brain maturity. Brain development depends on sensory inputs (such as vision, hearing, touch and smell) and adult-child interactions. The brain's basic circuits are wired first, followed by increasingly more complex circuits. For example, sensing pathways for hearing and vision develop before language, and those for language develop before cognition. The potential for typical cognitive development in language, thinking and vision can be lost when critical periods in brain development are neglected.

These facts highlight the importance of early relationships and stimulation and the types of ECD intervention likely to be effective. Further, scientific studies confirm that prolonged adversity in early childhood can result in toxic stress and lifelong impairments in learning, health and behaviour (Shonkoff et al. 2009). The findings from these studies suggest that there should be a stronger emphasis on addressing the roots of disparities in early childhood than on trying to change adolescent and adult behaviours associated with poor learning and health outcomes. While the aim of intervention is to reduce risk factors, protective and supportive factors are equally necessary for healthy brain development.

Evidence from economic sciences. Studies on the economic returns from investment typically indicate higher returns to society when the investment is in early childhood education, rather than in adult education. In part, this is because a child is expected to live longer than an adult; but it is also because the early intervention can set a better path for the recipients. Early intervention lowers the cost of later investment, and later remediation efforts are less effective than earlier interventions (Cunha and Heckman 2007). However, data on long-term effects are restricted to relatively well-resourced, small-scale pilot programmes implemented primarily in developed countries.

Evidence from developmental and behavioural sciences. Evidence from both developed and developing regions indicates that participation in early childhood programmes promotes cognitive development and school success and narrows the achievement gap between children from low-income families and their more advantaged peers. Early interventions can also change the trajectory of neural development and prevent the development of secondary handicaps associated with socioeconomic disadvantage.

In the light of this evidence, governments must prioritise child health, support parenting education, and improve the quality of ECD interventions in order to achieve Education for All Goal 1 (see above).

Widespread agreement exists in principle on the benefits of ECD interventions. However, the studies that serve as the basis for this agreement vary markedly in research design, population targeted, type of intervention (for example, nutrition, education and/or parenting), and types of outcome measured (for example, children's cognitive development, social-emotional outcomes, school readiness, drop-out and/or parent/family outcomes). There are also differences in the short- and long-term effects achieved by the various programmes. Studies in developed countries have often been the basis for expanding preschool interventions in developing countries, and this is problematic, given the vast differences in learning-related contexts between developed and developing countries. Nevertheless, some dimensions of cognitive development may be common across different countries and regions.

1.4 Review questions

Many reviews provide guidelines for future research, but their conclusions about programme effects are commonly general. They do not detail areas for future research or provide answers to specific questions, such as, "What is the appropriate amount needed for a particular early intervention for disadvantaged children to achieve optimal development?" To inform programme design and policy-making in developing-country contexts, this review considers studies of the short-term and long-term effects of various ECD interventions on the cognitive development and learning achievement of children from both developed and developing countries. Specifically, this review provides empirically defensible responses to the following questions.

- Which type(s) of ECD intervention are effective and can be relatively easily scaled up in different country contexts?
- What is the minimum "dosage" of intervention needed to achieve sustainable gains in children's typical cognitive development?
- What are the best ways in which to support and involve parents, extended-family members and the community in promoting early learning?
- What are the characteristics of effective change agents?
- Which conceptual models are the most effective for promoting typical cognitive development, school-readiness and learning attainment?

1.5 Conceptual framework

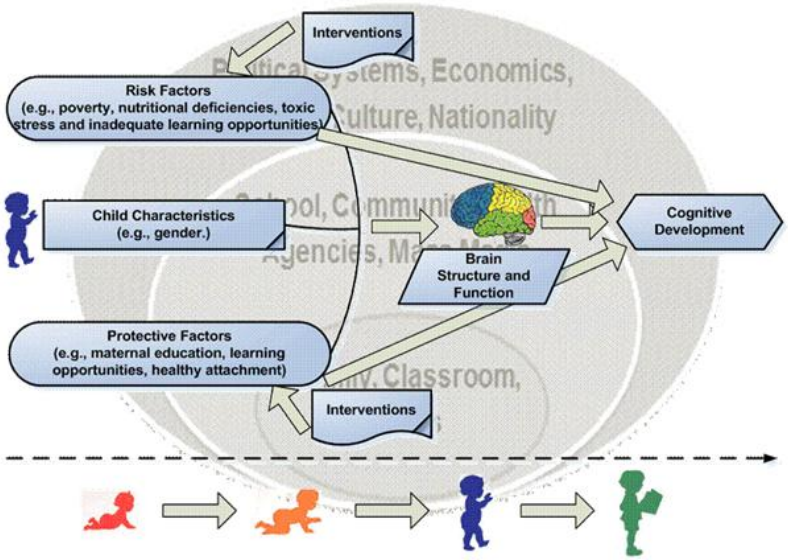
A rigorous review of the published literature on the relationship between ECD interventions and cognitive development must proceed from an articulated conceptual position. We draw upon Gottlieb's experiential canalisation model (1991, 1997), Blair and Raver's analysis (2012), and the work of Walker et al. (2011) to develop a conceptual framework to identify and contextualise the evidence.

In Gottlieb's experiential canalisation model (1991, 1997), biology and experience mutually influence each other during the developmental process. Adversity releases stress hormones that influence neural systems, which, in turn, affect cognitive and socio-emotional development (Blair and Raver 2012). Walker et al. (2011) identify several developmental-risk and protective factors that affect the brain at different developmentally sensitive periods. The effects of these risk factors are moderated by the intensity, timing and duration of adversity, as well as a child's reactivity to these factors. Risk influences genetic expression (*phenotypes*), which, in turn, affects brain structure and function and child development. Being exposed to early adversity (for example, maternal depression, domestic violence, drug abuse, having a single caregiver and poverty) is associated with developmental delays and chronic health problems, such as coronary heart disease, diabetes and depression later in life. Research has highlighted the importance of maternal emotional wellbeing for typical child development. For example, children whose mothers had suffered with depression during pregnancy and during the early years of their life were more likely to display intellectual deficits than other children (Cogill et al. 1986).

ECD interventions are designed to protect children from the negative consequences of living in disadvantaged situations, especially poverty, by reducing the detrimental influences of risk factors and bolstering the effects of protective factors on child development (Walker et al. 2011). For example, cortisol levels affect children's behaviours and emotional regulation, while community-level support for children living in poverty is associated with lower average cortisol levels (Fernald and Gunnar 2009). In addition, preschool attendance has been shown to facilitate disadvantaged children's cognitive development, including literacy, vocabulary, mathematics and quantitative reasoning, in both developed and developing countries (see, for example, Rao et al. 2012, Sammons et al. 2007). However, the influence of ECD programmes on typical child development is moderated by participants' unique characteristics (for example, gender and socioeconomic status) and the specific components of the interventions (for example, intensity, curriculum and medium of instruction; see, for example, Cannon et al. 2006, Schady and Paxson 2007, Votruba-Drzal et al. 2008). For example, preschool experience is more important for children from socio-economically disadvantaged backgrounds than for those from more advantaged backgrounds, since it can compensate for their relatively less favourable family circumstances and reduce disparities in school-readiness and achievement.

Both the risk and protective factors for typical cognitive development and interventions are situated at different levels of the socio-ecological context, from the most proximal levels of family and school to distal levels, including culture, the GDP of a country and the role of the state (Bronfenbrenner 1979). Therefore, despite a common biology and universal reactions to risk that challenge typical cognitive development, we assume that the cultural context matters. There are marked variations in economic development within countries and regions of the developing world. However, a disadvantaged child in sub-Saharan Africa or South Asia has fewer distal protective factors (food security or compulsory preschool education) than one in the developed world. Figure 1, below, illustrates the presumed relationship between risk factors and cognitive development.

Figure 1: Risk and protective factors, brain development, and cognitive development



Adapted from Walker et al. (2011)

2. Methodology

2.1 Search strategy

To reduce the risk of bias, an explicit search strategy was developed and systematically applied to a range of resources. Although DFID has indicated that the standard of quality (rigour, validity and reliability) required for an individual study to be included in a rigorous literature review is somewhat lower than for one to be included in a systematic literature review, we identified and appraised the available evidence using relatively stringent criteria. Our search strategy was developed based primarily on EPPI-Centre's (2007, updated 2010) guidelines for conducting systematic reviews and consists of four main approaches: (a) electronic-database searching, (b) hand searching of key journals, (c) searching of specialist websites, and (d) asking personal contacts, authors and experts in the field.

An important component of our search strategy was the use of electronic databases, which allowed us to locate a large number of research articles very quickly. We searched in nine computerised databases: Academic Search Elite/EBSCOhost, the Cochrane Reviews, Google Scholar, JSTOR, ProQuest, PubMed, Web of Science, PsycINFO, and Dragon (The University of Hong Kong Libraries Catalogue). Since we specifically looked at early childhood development interventions designed to enhance cognitive development and learning achievement of young children conducted in either developed or developing countries, the search terms we used reflected our two variables of interest, namely, ***Early Childhood Development*** and ***Cognitive Development***. The former included the following phrases: early childhood programme, preschool experience, early intervention, early childhood education, early learning, early cognitive stimulation, nutritional supplementation, early childhood health intervention, home-visiting programme, parental support and education, early reading programme, breakfast programme, lunch programme, income supplement and cash transfer. The latter variable included the following terms: school readiness, cognitive development, academic achievement, learning outcomes, child development, intelligence, language development, literacy, mathematical achievement, problem-solving skills, attention and executive functions, basic concepts, Intelligence Quotient (IQ), Developmental Quotient (DQ), thinking, communication skills, vocabulary, brain development and neural development.[4]

Our search terms reflected a greater emphasis on mental stimulation and interventions relating to learning opportunities and outcomes. This approach was, in fact, requested by DFID, as it seeks to update and expand the recent *Lancet* Series (2007 and 2011) on early childhood development and cognitive development, which focused heavily on health and

[4] Our search terms did not identify studies that looked at the influence of variations in language of instruction during the early years on language competence, cognitive development or academic achievement. However, many children are exposed to multilingual contexts, and mother-tongue-based early bilingual/multilingual education is strongly advocated in these contexts. Mother-tongue-based early education is particularly important for children from linguistic and ethnic minorities, as it promotes enrolment and achievement for disadvantaged groups. All the educational interventions we have identified appear to have been delivered in the national/state language. We paid particular attention to the linguistic context of educational interventions and considered the degree of linguistic distance between the language used in the intervention and the child's mother tongue.

nutrition. The search strategy varied, depending on the database and/or search engine used, with specific operators and syntax differing between databases. The objective was to maximise the chance of identification of relevant research; that is, those studies that covered the review questions as fully as possible.

Although rigorous, electronic-database searches might not locate all research reports, as some studies may not be referenced in the databases. We therefore conducted a hand search of relevant studies cited in reference lists of selected studies, using a *snowball* method; the four Spanish articles and reports included in our sample were retrieved in this way. However, this method could be problematic, as statistically significant positive results are more likely to be published and cited by others. To compensate, we also examined specialist websites, such as the UNICEF Evaluation Database and websites of UNESCO, the World Bank, the Brookings Institute, Save the Children, Bernard van Leer, the National Institute of Early Education Research (NIEER), The Consultative Group on Early Childhood Care and Development, Young Lives, Pratham, 3ie International Initiative for Impact Evaluation, the Open Society Institute and Plan International, to include the broader "grey literature" (that is, conference proceedings, research reports and policy papers) in order to reduce the potential effects of publication bias. Personal contacts, authors and experts in the field were also contacted for additional reports and articles.

2.2 Selection criteria

To be included in the reviews of effectiveness, selected studies had to meet the following 10 selection criteria:

1. The interventions must have begun during the early childhood period; that is, before the children were eight years of age.
2. The interventions must contain at least one of the following components: (a) parent-focused education and support; (b) child-focused education and stimulation; (c) nutrition and health; and (d) income supplementation, including cash transfers.
3. The interventions could be home-, centre-, and/or community-based. Centre-based approaches involved several kinds of institutions offering early-years provision, such as preschools, child-care centres, crèches, playgroups, day-care nurseries and nursery schools, which served as alternative physical and social environments for care, development and education.
4. The interventions must have explicitly documented cognitive and/or schooling outcomes.
5. The evidence assessed linkages between participation in the interventions and cognitive outcomes.
6. The studies were published after January 1992.
7. The studies provided information from a primary study, which was not a literature review.
8. Research methods, statistical analyses, and findings were sufficiently detailed to provide a basis for judgment about the robustness of the conclusions; that is, the research procedures and characteristics of the sample were specified in detail, so that the validity of the results could be evaluated.
9. Comparisons (concurrent between groups or before and after within groups) among groups of people exposed to the intervention and those who were not exposed or less exposed to the intervention were available.
10. Studies involving special populations, such as those with Down's syndrome, cerebral palsy, autism or any specific form of disability (sensory, physical, intellectual or psychological) were not included.

The screening was conducted in three steps. First, the title and abstract of each article were scanned to see if the study fitted the study-selection criteria. Second, all members of our multi-disciplinary research team were consulted to ensure that as many studies on the

topic as possible were included. Third, at least two members of the team screened the full text of the study and assessed whether the study should be included in the next stage.

2.3 Assessing the quality of studies

A rigorous literature review should be developed using trustworthy and relevant studies only. The EPPI-Centre (2007, updated 2010) recommends assessment of study quality by weighing evidence according to three key criteria: rigour of research design, soundness/trustworthiness of study, and topic relevance. Because our selection criteria limited us to studies that explicitly report only cognitive outcomes of ECD interventions, we were confident that all our studies would be of high topical relevance. Therefore, to assess the quality of included studies, we developed a scoring system focusing on the remaining two criteria: (a) rigour of research design; and (b) soundness of study.

2.3.1 Rigour of research design

A study was assessed on the methods used for sample selection and how it dealt with baseline differences between the control and intervention groups. A score of 1 to 6 was assigned as follows:

1. Lowest level of rigour
2. Single group before and after
3. Retrospective controlled/secondary data analysis with constructed comparison groups
4. Other prospective quasi-experimental design
5. Quasi-experimental design with the use of an econometric model
6. Randomised controlled trial

2.3.2 Soundness of the study

The soundness of the study was determined by the method deployed for (a) sampling, (b) data collection; and (c) data analyses. We followed DFID's (2013) guide in scoring these aspects. Scores (2 to 6) were determined by applying the following criteria:

- Low (major and or numerous deficiencies in sampling, data collection or data analyses): 2
- Medium (some deficiencies in sampling, data collection or data analyses, but the methods and interpretations were generally valid and reliable): 4
- High (demonstrates adherence to principles of appropriate sampling and data collection and reliable data analyses): 6

2.3.3 Overall quality judgment

The overall quality judgment (high, medium or low) of a study was determined by combining the scores obtained for rigour of research design and soundness of study:

- Low: 3–5
- Medium: 6–8
- High: 9–12

This scoring system was applied to all selected studies, and any studies of low quality were excluded.

2.4 Synthesising findings

We aimed to provide empirically defensible responses to the following question: How, why and under what conditions are ECD interventions effective in promoting cognitive development in developing-country contexts? However, considering marked differences

among included studies in terms of research design, population targeted, type(s) of intervention (for example, nutrition, education and parenting), as well as types of outcomes measured (for example, children's cognitive development, school readiness, drop-out and/or parent/family outcomes), we utilised multiple methods of analysis to systematically synthesise the research findings to answer the research questions.

2.4.1 Quantitative analysis

To capture the focus and details of each study, we developed a comprehensive quantitative-coding scheme for this review (see Appendix 2). With the aim of specifying which types of intervention are effective in different contexts, we carefully considered the intervention design, fidelity of implementation, location, dosage and intensity of the intervention, and the ages and genders of the target children in the construction of the coding scheme following a cross-disciplinary perspective. Details of the coding scheme, including operational definitions of the dimensions coded, can be found in Appendix 2. All the included studies were coded by six raters, including a bilingual Spanish/English coder who was responsible for coding the Spanish articles. All coders underwent training given by the one member of the team, who was considered the *gold standard*. Over half of the coding was randomly selected and checked by the gold standard to ensure consistency and accuracy in coding. At the end of the coding process, all the coding and studies selected for detailed coding were reviewed independently by all team members. The final coding allowed us systematically, objectively and simultaneously to analyse and describe different evaluation studies and, thereby, different early childhood development interventions, using various statistical procedures.

More importantly, where possible, we calculated the effect size (Cohen's *d* using Thalheimer and Cook's [2002] method) for each intervention (rather than each study, as a study might include more than one intervention) to determine the robustness of the findings. The interpretation of effect sizes was based on Cohen's (1988) benchmark: 0.20 was small, 0.50 was medium and 0.80 was large. The determination of the effect sizes allowed us to assess the strength of the outcomes of the ECD interventions and helped inform our conclusions and recommendations.

2.4.2 Narrative summaries

In addition to the aforementioned statistical procedures, we qualitatively evaluated high-quality studies selected to represent geographic regions and intervention types to form our conclusions and recommendations. To facilitate this analysis, we developed a protocol to extract text-based data from the selected studies. Information such as sample selection, intervention procedures, outcome measures and results was described in greater detail. Textual descriptions of the studies were prepared, read and re-read by team members to ensure they captured all the important characteristics of the interventions and why and how they worked (or did not work). Examples of these narrative summaries are provided in Appendix 3.

An important feature of the narrative protocol described above was that it allowed us to identify the "take-home messages" from the selected studies, formulated not just by simply extracting the authors' own statistical analyses or conclusions and recommendations for policy, practice or theory, but also by considering the larger geographic, cultural, religious and family-related factors that might influence the efficacy of the interventions. We then identified whether an effective intervention could truly be generalised, or whether its positive outcomes were context-specific, and might or might not be worth assessing in other contexts. These take-home messages were reviewed and discussed by all team members before the final analysis was agreed upon.

2.5 Assuring quality

For any literature review to be useful and credible, high quality should be maintained at every stage of the process, from selection of sources and studies to the production of the final report. As noted earlier, we abided by the following standard EPPI-Centre (2007, updated 2010) procedures for assuring quality:

1. Internal-review appraisal: Our multi-disciplinary research team (which represented the following disciplines: child development, economics, education, medicine, psychology, social work and social administration) with members with considerable experience in international-developmental work brought different expertise to support the review. All team members critically reviewed the draft reports.
2. External-review appraisal: Peer reviewers from different countries were asked by DFID to provide an independent appraisal of the quality of the review to ascertain its extensiveness and to ensure that our conclusions are contextually and culturally sensitive. A meeting was scheduled to provide an opportunity for some members of the Review Team to have a telephone discussion with the peer reviewers.
3. A roundtable meeting, which included members of the Review Team, representatives from DFID, the peer reviewers and seven ECD experts, was held on 3 July 2013 to evaluate critically the Report and to deliberate on the recommendations there from.
4. Process monitoring: Review processes among team members were checked by the PI regularly to ensure everything was understood, applied consistently and on schedule.
5. Maintaining database records: An online database of included articles and all important information relating to this rigorous review was set up using Google Drive and maintained throughout the entire review process to allow easy retrieval of review information and real-time collaboration among team members.

3. Descriptive details of studies

3.1 Quality of studies

We identified a total of 114 studies, including four studies written in Spanish, conducted in 41 developing countries. We applied the scoring system mentioned in Section 2.3 to them. Because of our rather rigorous selection criteria, a large proportion of the studies (82.5%, or 94 studies) was judged to be of high quality. Another 17 studies (14.9%) were rated as having medium quality. Only three low-quality studies (2.6%) were excluded in the end (Appendix 4) and our final analysis was conducted on 111 studies.

3.2 Literature volume

The final sample consisted of 111 studies conducted in 40 developing countries (see Appendix 6a for a complete list of countries in which interventions were conducted). Most (*n* = 82) of these studies were peer-reviewed journal articles. The rest were programme-evaluation reports (*n* = 19), working or discussion papers (*n* = 8), a conference paper (*n* = 1) and a policy brief (*n* = 1).

Our selection of studies was limited by a number of factors. First, until very recently, priority had not been given to experimental or rigorous research in many developing-country contexts. However, there are several small-scale pilot projects that have not been evaluated. This limited the number of studies in this rigorous literature review. Second, the lack of robust studies from developing countries points to the need for global strategies to build capacity for locally driven research, including support for collaborative research partnerships. However, successful long-term collaborations were only evident in a few developing countries, such as Bangladesh and Nepal, and they still tended to be conducted by a limited number of researchers or research teams.

Third, we have only included studies published in the last 20 years (1992–2013). Authors of systematic reviews usually consider studies published in the prior 10 years. However, because we also wished to consider the long-term effects of ECD interventions in contexts where robust evidence is scant, we decided to choose a longer period in order to include more longitudinal studies. At the same time, findings are up-to-date and relevant to contemporary developmental contexts. Some earlier studies, such as those on the initial effects of early supplementary feeding on cognition in rural Guatemala between 1969 and 1977, were not included, although we did include follow-up studies of these programmes published beyond 1992 to track their long-term effects (for example, Campbell and Ramey 1994, 1995, Campbell et al. 2002, Campbell et al. 2012, Pollitt et al.1993, Li et al. 2003, Maluccio et al. 2009).

To facilitate our analyses and the formation of recommendations, we also considered 142 studies conducted in 20 developed countries and regions that met the selection criteria (Appendix 7). These studies typically investigated children from low-income families. Findings from studies in developed countries may not be completely generalised to developing countries because of differences in context. However, given common biology and psychosocial needs, they are valuable as indicators of potentially effective methods of promoting cognitive development in developing-country contexts.

Altogether, we considered evidence from 253 studies conducted in 60 countries in different regions (Figure 24). Among the 253 studies, 111 were in developing countries.

Figure 2: Location of studies conducted in developing and developed countries (n = 253)

3.3 Broad characteristics of studies in developing countries

The majority of the 111 developing-country studies were conducted in rural areas (53%). About another 35% were conducted in urban areas, although often in slums. Only about 0.5% and 1% of the studies were conducted in remote and peri-urban areas, respectively. The remaining 10% of the developing-country studies were conducted in both urban and rural areas.

Twenty-five of the studies conducted in 11 developing countries were **parent-focused interventions**: five worked with either parents or caregivers only, and 20 worked with both parents/caregivers and children together. Among these 20 studies, six included a comparison group of children who received nutrition supplements in addition to the parent + child intervention. Studies were distributed among Asia, Central and Eastern Europe and the Commonwealth of Independent States, and Latin America and the Caribbean. Only one study was conducted in Africa. Figure 3, below, shows the distribution of the 25 studies.

Figure 3: Parent-focused interventions in developing countries (n = 25)

Child-focused educational interventions were more often found in Asia and Africa (see Figure 4). Most of them concerned pre-primary or other early childhood education programmes for children aged three or above (*n* = 24). A few studies (*n* = 5) looked at stand-alone infant (under one-year-old)/toddler (between the ages of one and three) stimulation interventions. One study investigated an intervention with both pre-primary education and infant/toddler-stimulation elements.

Figure 4: Child-focused educational interventions in developing countries (n = 32)

Our review included 32 studies of standalone **nutrition and health interventions**[5]**,** which were mainly implemented in Asian countries, although interventions were also seen in Africa and Latin America and the Caribbean (Figure 5).

Figure 5: Nutrition and health interventions in developing countries (n = 32)

Studies of interventions **with income-supplementation components** were found exclusively in Latin America and the Caribbean (Bolivia, Ecuador, Mexico and Nicaragua) (Figure 6). Among them, six studies looked at the effects of either standalone cash-transfer programmes or only the cash components of integrated cash-transfer programmes, and five studies analysed the effects of integrated cash-transfer programmes as a whole.

[5] Despite their differences, nutrition and health interventions were analysed together because all except one study focused on nutrition (for example, providing iron, zinc and folic acid supplements). The study (B062, see Appendix 8), which included both health and nutrition, involved giving children deworming medicine (health), along with iron supplements (nutrition). Hence, it was not possible for us to separate nutrition and health interventions in this review.

Figure 6: Interventions with income supplementation in developing countries (n = 11)

The remaining 11 studies concerned **large-scale comprehensive programmes**. These programmes offered comprehensive services (parenting education, early education and stimulation, dietary supplements and health check-ups) to parents and their young children. All of them had a social-development/community-development component. Studies in this type of intervention, however, were not found in Africa (Figure 7).

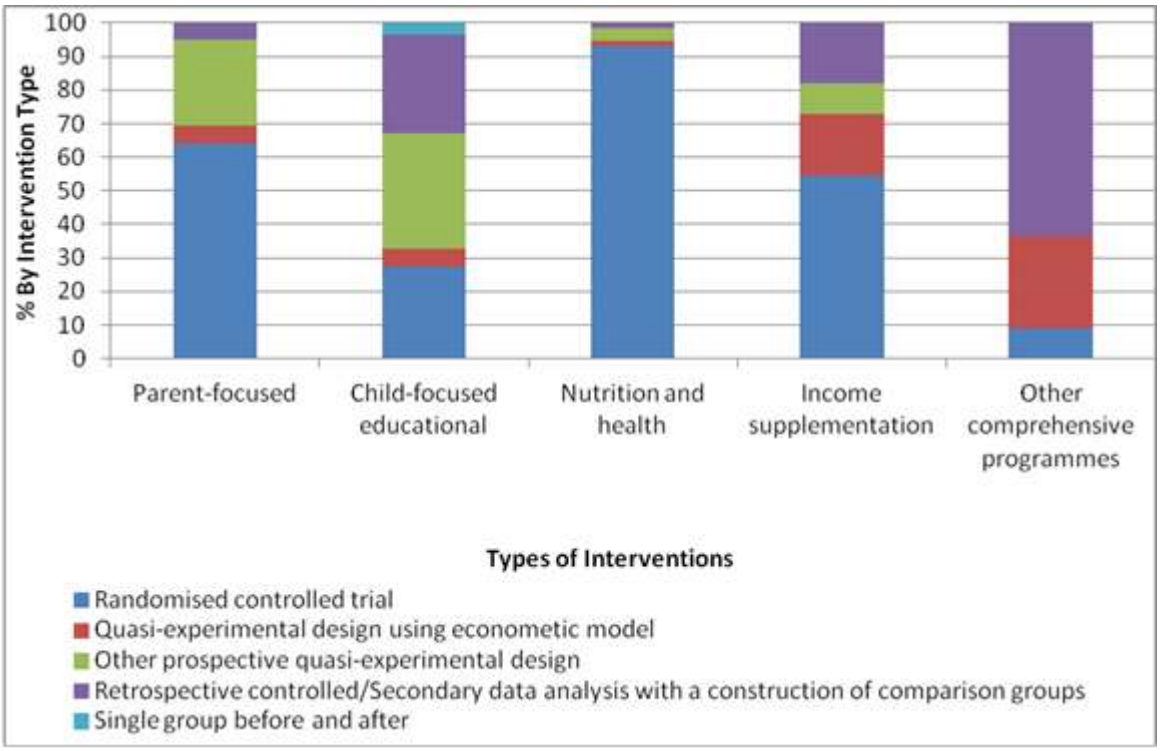
Figure 7: Large-scale comprehensive programmes in developing countries (n = 11)

Figure 8, below, shows the distributions of studies of the above types of intervention in 40 developing countries. A full list of studies conducted in developing countries, classified by intervention type, is presented in Appendix 8.

Figure 8: Distribution of studies of ECD interventions in developing countries (n = 111)

Figure 9, below, shows the rigour of the 111 developing-country studies. Almost all the studies of nutrition and health interventions were randomised controlled trials (*n* = 29). Randomised controlled trials were also often conducted to study the effects of parent-focused interventions and income-supplementation programmes. Studies on child-focused educational interventions were more likely to be quasi-experimental. Large-scale comprehensive programmes were most often studied using non-experimental methods or used human development indicators (HDIs) collected for national surveys.

Figure 9: Rigour of intervention by intervention type in developing countries (n = 111)



4. Review findings

4.1 Effects of interventions

We used the scale of intervention effect to synthesise findings across multiple studies and to detect major potential sources of variability in the programme effects. Since there was often more than one reported intervention in each study, we used the specific intervention, rather than the study, as the unit of analysis. For example, a study could have a control group and two intervention groups (see narrative summaries in Appendix 3 for examples). In such a situation, the study was considered to have two interventions. Further, if the same intervention was applied in different countries[6], there would be more than one effect size from a study.

We only included studies with at least one treatment group and a control group for these analyses. The effect size for each intervention was the difference between the treatment and control group in the outcome measure administered to both groups. Studies that did not report the necessary information for effect-size calculation were excluded from the analyses. The studies published in Spanish did not meet our criteria for inclusion in the meta-analysis and were, therefore, excluded. As a result, we focused on 115 interventions, reported in 70 studies conducted in the 30 developing countries that met our inclusion criteria. Of these 115 interventions, 74 were randomised controlled trials, the remaining 41 interventions were quasi-experiments, analysed using econometric models (n = 4), or evaluated using other methods, either prospectively (n = 19) or retrospectively (n = 18).

The standardised mean differences between experimental and control groups were estimated by subtracting the mean of the experimental group from the control group and dividing the result by the standard deviation (*SD*) of the population from which the groups were sampled. Since the population *SD* was usually unknown, we estimated the effect size based on sample SDs. Cohen's *d* was used when the *SD*s of the two groups were roughly the same, which was often the case in experimental designs. The *SD*s of the two groups (experimental and control groups) were pooled to calculate the index of effect size. However, Cohen's *d* has a slight bias and tends to overestimate the absolute value of effect size in small samples. We corrected the Cohen's *d*s by using Hedges's correction (Hedges and Olkin 1985) and this yielded an unbiased estimate of effect size d_{unbiased}. As noted earlier, the interpretation of the unbiased effect size of each intervention was based on Cohen's (1988) benchmark: .20 was small, .50 was medium and .80 was large.

Using the unbiased effect sizes for each independent intervention, we examined the common effect size of multiple studies, which were grouped into different types. Since the sample sizes of studies differed, the pooled estimates from the larger-scale studies were more precise than those from the smaller-scale studies. We therefore gave weight to the more precise estimates when pooling and the average effect size and *d*s were calculated using a weighted average based on the variance of unbiased effect sizes.

We also examined whether the interventions grouped into the same category shared a common effect size. The *Q* test of the homogeneity of effect size was used. The *Q* test has an approximate chi-square distribution with k - 1 degrees of freedom, where k is the number of interventions (Hedges and Olkin 1985). If all interventions had the same

[6] For example, in Study B063. See Appendix 8.

population effect size, (that is, if H_0: $\delta_1 = \delta_2 = \ldots = \delta_k$, was true), the test statistic *Q* would have an asymptotic chi-square distribution with *k* – 1 degrees of freedom. If the obtained value of *Q* exceeded the 100% (1 - α) critical value of the chi-square distribution with *k* – 1 degrees of freedom, we rejected the hypothesis that the δ_i were equal. The *Q* test is also sensitive to the sample size. Hence, we were mindful of the fact that rather small differences in large samples may lead to large values in the test statistics. The equations for the abovementioned statistics are in Appendix 5.

A total of 595 effect sizes (*n*e) (ranging from -1.00 to 2.46) were derived from these 115 interventions. The sample sizes for these interventions ranged from 21 to 10,088 participants. The overall weighted average effect size across the 115 interventions relating to various cognitive outcomes was .34 (*Mdn* = .23, *SE* = .05, *Q* = 2241.05, *df* = 114, *p* < .01). These results indicate a wide variation in terms of the effectiveness of different early interventions on children's cognitive development.

We first examined the correlations between the effect size for each intervention and characteristics of the intervention, including child age, intervention duration, sample size and implementation components that served the indexes of quality of the intervention (that is, level of fidelity in implementation, qualification of the direct-change agents, guidance to the direct-change agents, and rigour and soundness of the studies). There was a significant correlation detected between effect size and qualification of the direct-change agents (*r* = .35, *p* < .01). Interventions conducted by better qualified direct-change agents (those who were educated to tertiary level, or were considered to be paraprofessionals/ professionals) were more likely to achieve higher levels of effectiveness than those conducted by less highly qualified direct-change agents. This indicates the importance of selection/ training of direct-change agents in ECD interventions.

Although we can assume that higher levels of fidelity in implementation and quality guidance to change agents are also essential to make the intervention successful, we did not find significant associations between these factors and the effect sizes of interventions in our analyses. This might be because interventions included in the review tended to be of high quality and involved the provision of appropriate guidance to change agents and regular checks of the fidelity of the implementation. Hence, there may have been less variance in fidelity of implementation. In addition, we did not find associations between the effect sizes of interventions and children's age or intervention duration. This may be because different types of interventions are common at different ages. For example, nutrition interventions may start during gestation, while preschool interventions typically start at age three. Hence, analysing the association of age and duration of intervention may not be appropriate.

We also considered the long-term effects of early childhood interventions. Among the 70 studies, 38 studies reported the effects on cognitive development at least six months after the intervention was completed. The average effect size for each intervention ranged from -.31 to 2.30 (*n* = 66). No significant associations were found between the implementation components (duration of intervention, fidelity of implementation, qualification of change agents and guidance to the change agents) and effect sizes of these interventions as a whole. This might be due to the fact that almost half of these studies involved nutrition and health interventions (28 interventions reported in 17 studies). The effect sizes in these types of intervention, as discussed in Section 4.4, below, were much lower than those of other types of intervention. Different components of the intervention (for example, duration) did not have an effect on cognitive outcomes of children. Indeed, associations between some of the implementation components and the effect sizes of interventions were found when we

considered different types of interventions separately, as suggested in the following sections. But the above imbalance of distribution of studies in terms of intervention type may reflect a need to extend our focus on the long-term effects on cognitive development beyond nutrition and health interventions.

Figure 10: Weighted average effect sizes across different types of intervention (N= 115)

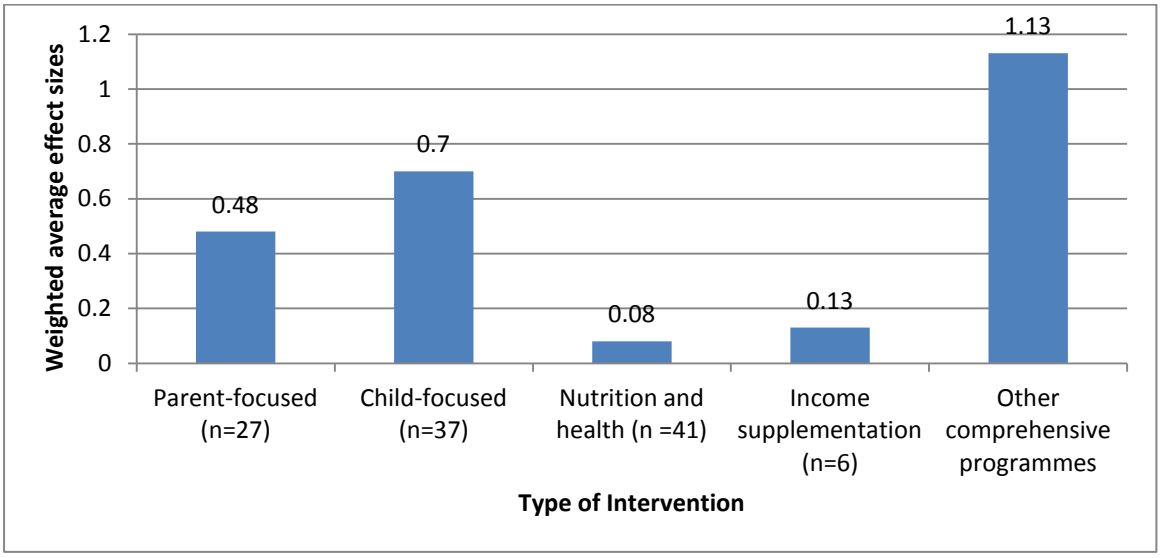


Figure 11: Number of interventions (N = 115) by intervention type in 70 studies in developing countries

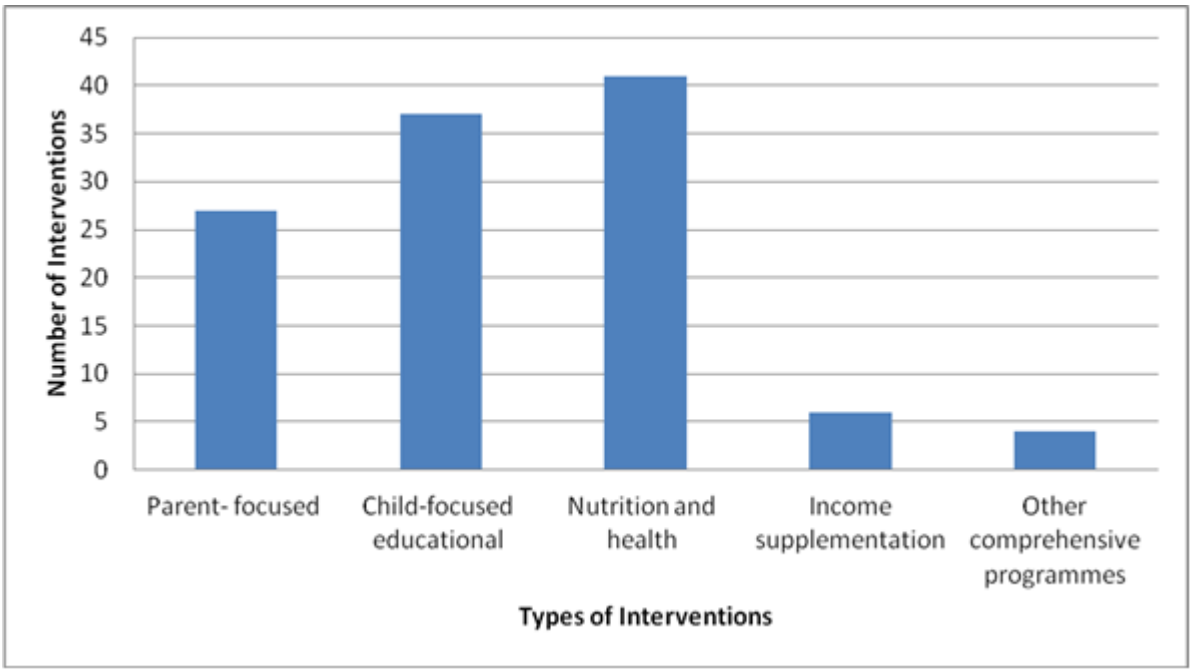
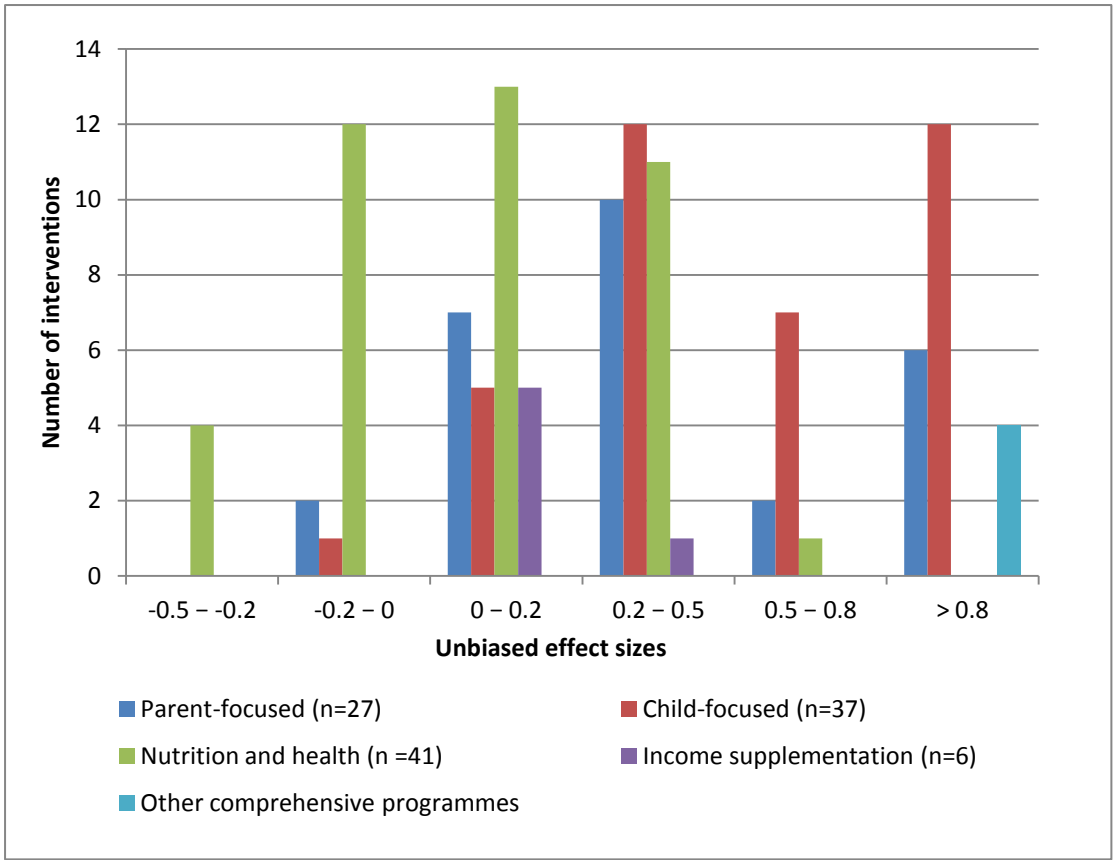


Figure 12: Distribution of unbiased effect sizes across different types of intervention (N = 115)



4.2 Parent-focused interventions

Parent-focused programmes are one of the most common forms of ECD intervention found in developing countries (Evans and Stansbery 1998). There are two major reasons for implementing such programmes in developing countries. First, parents' sensitive responsiveness to their infants and toddlers is essential to develop secure attachment bonds and the consequences of insecure attachments on later development have been clearly documented in the literature (NICHD Early Child Care Research Network 1997). Second, opportunities for stimulation and learning must be created at home if young children who are at risk for poor language and cognitive development do not attend preschool. This is especially crucial for children of poor and illiterate parents, who are often uninformed about the need for stimulation to promote child development (Guldan et al. 1993, UNICEF 2001).

Twenty five studies of 38 parent-focused interventions were reported in our review. These interventions were relatively small-scale interventions (with 10 to 184 parent participants in intervention groups), with an average of 62 parent participants in an intervention. Effect sizes were calculated based on 27 interventions in 20 of these studies. The weighted average effect size for these 27 interventions is .35, with a range from -.26 to 2.30 (see

Figure 10), and the homogeneity test showed a significant difference among these 27 interventions ($Q = 168.01$, $df = 26$, $p < .01$). Among the interventions, only one showed a negative effect size ($d = -.26$)[7] and all other trials showed small to large positive effects. Among the 26 interventions that showed small to large positive effects, 21 included regular monitoring of implementation (five did not report on the fidelity of implementation). These interventions were typically implemented at home by parents (usually mothers) who may vary greatly in their parenting skills and educational backgrounds. A systematic and regular monitoring system may guarantee the fidelity of implementation, which could be helpful in improving intervention effectiveness.

Most of the parent-focused interventions included in this review were designed to promote sensitive and responsive caregiver-child interactions through psychosocial stimulation, in order to improve cognitive and language abilities of infants and young children, but other topics, such as hygiene, feeding, positive discipline, solutions to child refusals and gender equality were also covered in intervention sessions. These interventions targeted children in deprived environments, and attempted to reverse the negative effects associated with risk factors such as poverty, low birth weight[8], iron-deficiency[9], undernutrition[10] and growth retardation[11]. Although paired- and dialogic-reading programmes, in which parents were trained to expand simple story reading into a more interactive reading activity by helping children become story-tellers, have been shown to enhance both children's schooling and cognitive development and parent-child interaction in developed countries, such an approach may not be feasible in developing-country contexts if parents are illiterate. Indeed, only one intervention in our developing-country sample used dialogic storybook reading techniques in middle-class, university-educated parents[12]. Instead, almost all of the parenting interventions we found in developing countries focused on teaching parents to stimulate children through play, often utilising homemade toys or other readily available household items. All interventions had key messages or defined curricula.

Parent-focused interventions were often delivered through home visits[13], community groups[14], and a combination of home visits, group sessions, community activities and primary healthcare and nutritional services[15]. Few interventions worked primarily with parents or caregivers[16]. Most programmes worked with parents or caregivers and children together[17] and focused on promoting development in infants and toddlers (children under three years). Only eight interventions targeted parents of children three years or above[18]. Many of these interventions were designed as an integrated part of, or as an add-on to, the existing healthcare system, thereby utilising professional or paraprofessional community health workers as instructors[19]. Other interventions relied on various trained persons[20], in

[7] Study B004. See Appendix 8.
[8] Studies B018, B042, B036. See Appendix 8.
[9] Study B081. See Appendix 8.
[10] Studies B073, B046. See Appendix 8.
[11] Studies B052, B050, B051. See Appendix 8.
[12] Study B109. See Appendix 8.
[13] Studies B021, B037, B074, B018, B042, B036, B081, B046, B052, B050, B051. See Appendix 8.
[14] Studies B004, B035, B085, B109, S006. See Appendix 8.
[15] Studies B022, B045, B083, B053, B073, B092, B007, B066, B001, B068. See Appendix 8.
[16] Studies B004, B021, B022, B037, B109, S006. See Appendix 8.
[17] Studies B092, B053, B073, B018, B042, B036, B074, B007, B081, B066, B068, B001, B045, B083, B109, B052, B050, B051, B046, B035. See Appendix 8.
[18] Studies B045, B083, B001, B109. See Appendix 8.
[19] Studies B021, B022, B092, B073, B018, B042, B036, B007, B052, B050, B051, B046. See Appendix 8.

particular trained village women (peer educators), who either received a small honorarium or worked on a voluntary basis[21]. Training of these direct-change agents could take many forms. Training also varied in length from only a few days before the initiation of the interventions, to continued training and supervision by programme leaders for up to two years. However, the receipt of continuous guidance was not significantly related to the effectiveness of the intervention.

In general, parent-focused interventions had positive effects on young children's cognitive development in developing-country contexts and were especially effective in compensating for delays in cognitive development in malnourished children. Interventions that involved both parent and child often had greater effect sizes (d = .42, n = 26) than did parent-only programmes (d = .11, n = 6), especially those information-based interventions. In fact, only two interventions were found to have no discernible effect on young children's cognitive development; both of them were information-based, parent-only programmes[22].

Interventions conducted at least partly in group settings (entirely group-based or home-based and group-based together) were found to have a slightly greater (d = .39, n = 19) effect than home-based interventions (d = .33, n = 13) alone. Significant positive effects on cognitive development were demonstrated in all short-term (from one week to 10 months) interventions for parents and/or at-risk infants/toddlers younger than two years, with at least two contact occasions and provision of a card with child development messages[23]. In fact, one study showed that an intervention up to 12 months in duration could only produce sizable and significant effects (0.5 *SD*) in enhancing cognitive development of children aged below 18 months, but not of older children, which suggested the importance of early intervention[24]. However, significant effects were shown in both younger and older children if the interventions lasted at least two years and usually consisted of at least fortnightly contact of 30 minutes to one hour. The most effective programmes were those with culturally appropriate materials, opportunities for sharing, discussion, and guided parental practice with children.

Although most of the studies were not longitudinal and only confirmed short-term effects on young children's cognition, three interventions showed significant positive long-term effects. In Jamaica, two longitudinal-intervention trials were conducted to combat cognitive deficits of low-birth-weight[25] and stunted infants/toddlers[26], respectively. Both interventions comprised weekly home visits for two years by community health workers, who demonstrated play techniques to the mother and taught concepts of colour, shape, size and position. Significant main effects on cognition were found in both low-birth-weight and stunted children in the intervention groups four years after the intervention ended. Stunted children who received home-based intervention in early childhood showed sustained cognitive and educational benefits, even at age 17–18 years, with reported effect sizes of 0.4–0.6 *SD*.
Significant long-term positive effects were also found in a two-year intervention for

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[20] Studies B081, B066, B001, B109, S006. See Appendix 8.
[21] Studies B037, B004, B092, B053, B068, B045, B083, B035. See Appendix 8.
[22] Studies B037, B004. See Appendix 8.
[23] Studies B035, B018, B022, B007, B046, B021, B073, B092, S006. See Appendix 8.
[24] Study B066. See Appendix 8.
[25] Studies B018, B042, B036. See Appendix 8.
[26] Studies B052, B050, B051. See Appendix 8.

mothers of children ranging in age from three to five years. The Turkish Early Enrichment Project (TEEP) was designed to sensitise mothers not only to the needs of their children, but also to their own needs as women[27]. Mothers participated weekly, alternating between one week at home and one week in a group setting. Depending on their educational levels, local women were trained either as "mother's aides", who visited the mothers at home, or as co-ordinators who conducted group meetings and supervise the mother's aides. Children's cognitive skills, social relations, and school adjustment were shown to be significantly higher than those of their control peers, even seven years after the end of intervention. They were also more likely to attend college and have jobs of significantly higher status 19 years after the end of TEEP.

While the encouraging effects of centre-based interventions (custodial or educational day care)[28] and nutritional supplementation[29] on children in the comparison groups had dissipated by 7–8 years after the end of the interventions, the positive effects of the above three parent-focused interventions sustained, and were mediated in part by, the improvement in the home environment. It appears that parent-focused interventions led to beneficial changes in parents, which were consequently reflected in their relation with her children and in the general atmosphere of the home. This contextual change helps to support the continuous cognitive development beyond the intervention period.

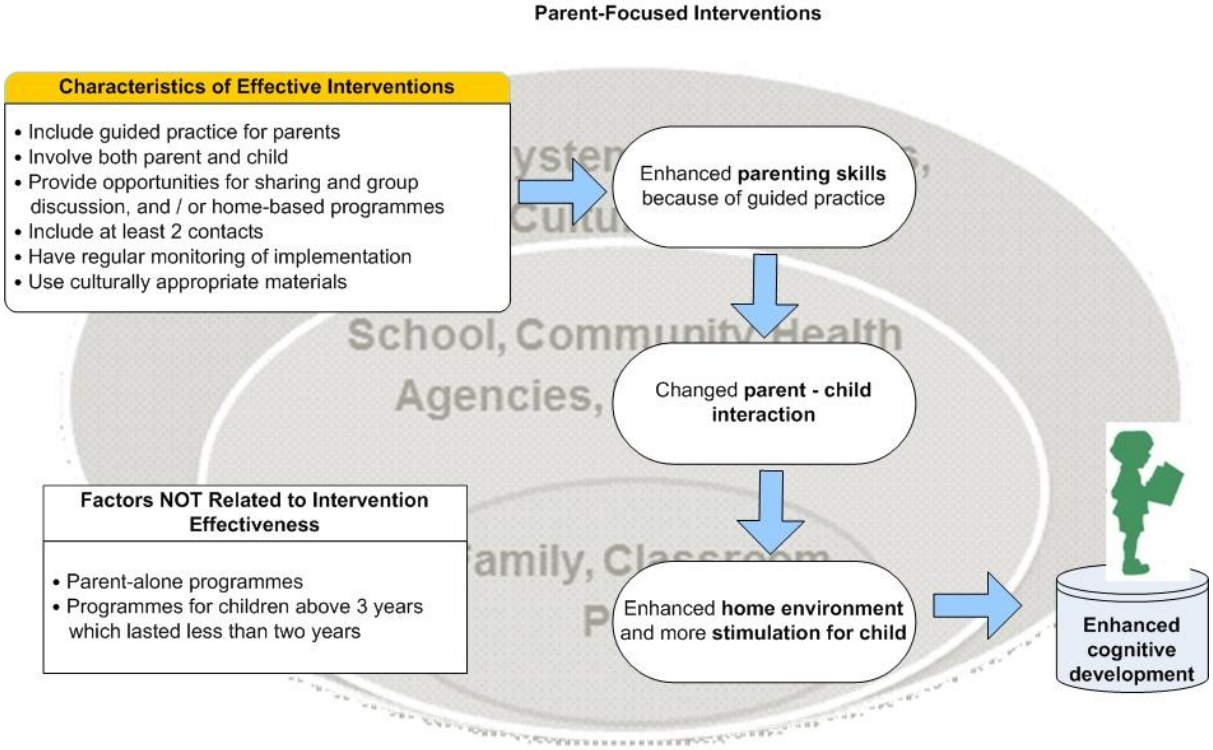
In this sense, then, parent-focused interventions present a cost-effective option in promoting cognitive development in developing-country contexts. Although very few studies reported on actual costs of the interventions, and the unit costs varied greatly due to economies of scale of programmes, geography, income and price levels, and integration in other programmes, etc., a number of studies suggested that the costs of parent-focused interventions compared favourably to those of other interventions, such as day care and preschools, and a cost-benefit analysis showed that parent-focused programmes lead to high returns on investment[30]. While a few of the interventions provided parents with transportation and relied on trained professionals or paraprofessionals in the existing healthcare system, which may increase the costs and the workload of these paraprofessionals, as well as limiting the number of parents and children who participate in the programmes, the feasibility and sustainability of the interventions' being conducted on a larger scale could be improved by community mobilisation and training of local mothers as change agents. In fact, studies showed that mothers often perceived better understanding and support from these peer instructors, and this could lead to a high level of participation and low absenteeism[31].

The following diagrams show the *Theories of Change* derived from the synthesis of quantitative findings from studies grouped together by intervention type. In each of the diagrams, the input is the intervention (shown on the left), the process of change is depicted in the centre, and the output variable is enhanced cognitive development in the child. As noted above, cognitive development is defined as expected levels of cognitive development, based on typical gains in language, thinking and understanding observed in economically advanced countries.

[27] Studies B045, B083. See Appendix 8.
[28] Studies B045, B083. See Appendix 8.
[29] Studies B052, B050, B051. See Appendix 8.
[30] Study B066. See Appendix 8.
[31] Studies B092, B045, B083. See Appendix 8.

Figure 13 shows the Theory of Change suggested by the synthesis of quantitative findings from 27 interventions from 20 studies that involved parent-focused interventions.

Figure 13: Theory of Change for parent-focused interventions



Summary:

Parent-focused interventions generally produced small-to-medium-sized positive effects on young children's cognitive development in developing-country contexts. Interventions that involved guided interactions and practice involving both parent and child often had larger effect sizes than did parent-only programmes or information-based interventions. Short-term interventions were effective for children under 18 months, but interventions that lasted at least two years were shown to have sustainable positive effects on older children. It appears that parent-focused interventions led to beneficial changes in parents, which were consequently reflected in their relationships with their children and in the general atmosphere of the home. This contextual change may have helped to support continuous cognitive development beyond the intervention period.

4.3 Child-focused educational interventions

Infants (below one year), toddlers[32] (between one and three years), and pre-schoolers[33] (three years or older) were the recipients of what we deemed child-focused educational interventions. We included 32 studies of child-focused efforts. The scales of the interventions varied greatly, ranging from less than 20 child participants in some

[32] Studies B019, B020, B033, B060, B082, B058. See Appendix 8.
[33] Studies B065, B059, B029, B094, B072, B108, B041, B008, B005, B015, B095, B110, B063, B006, B084, B087, B107, B071, B057, B056, B093, B091, B085, B104, S001, S004. See Appendix 8.

intervention groups, to over 20,000 child participants in a nationwide evaluation of pre-school participation.

Most of the interventions were conducted in a preschool setting. We were able to calculate effect sizes from 22 of the studies and report on the 37 interventions. The weighted average effect size is .64 (range from -.02 to 2.46; see Figure 10). There was also wide variation in terms of the intervention effectiveness on children's cognitive development (Q = 905.62, df =36, p < .01). We did not find any significant differences in terms of the duration, location, change agents or recipients' age of implementation across the interventions, with different effect sizes. However, a more detailed examination of the studies indicated that children benefited more from the child-focused interventions with higher quality. In keeping with professional notions of pre-school quality, our definition of quality considered the following information if available: teacher qualification, the existence of a child-centred curriculum, and teacher-child ratios.

Quality was associated with qualifications and training of change agents, programme structure and child-appropriate curricula and instruction. For example, among the three interventions implemented in China[34], the higher-quality interventions (pre-primary and kindergarten groups, d = .39 and .83, in study 1, and d = .94 and .96 in study 2) had higher effect sizes than intervention trials of lower quality (mixed group of Grade 1 and pre-school-aged children, d = .05 and d = .47). In Bangladesh, students also gained more when the quality of preschool improved (d = .05, .27, and .68, in 2006, 2007 and 2008, respectively, compared to when no special efforts were made to improve preschool quality)[35]. In Costa Rica, individual-based intervention (d = .14) was found to be more effective than the general classroom-based intervention (d = -.02) in facilitating children's language development[36]. Further, the results indicated that, although preschool or early day-care enrolment might be useful in facilitating children's cognitive development, the effectiveness was limited if the interventions did not emphasise stimulation quality, but merely focused on children's participation (ds $\leq$ .13)[37].

The majority of child-focused educational interventions for children below three were centre-based[38], often targeting children in orphanages[39] as parents were not available to offer early stimulation at home. However, the majority of interventions for children over three years were provided almost exclusively in preschools[40] or in day-care centres[41]. Only one intervention was designed to enhance basic cognitive skills and socio-emotional development of pre-schoolers, through a television programme that children could watch at home[42]. The length of the intervention varied from one to 30 hours per week[43], but most of the studies did not provide information about the number of hours per week that children attended. The duration of the intervention also varied considerably, from one month in

[34] Study B056. See Appendix 8.
[35] Study B087. See Appendix 8.
[36] Study B085. See Appendix 8.
[37] Studies B060, B108. See Appendix 8.
[38] Studies B019, B020, B033, B060. See Appendix 8.
[39] Studies B019, B020, B033. See Appendix 8.
[40] Studies B065, B059, B029, B094, B108, B041, B008, B005, B015, B110, B063, B006, B084, B087, B071, B057, B056, B093, B091, B085. See Appendix 8.
[41] Studies B072, B107, B104, B091. See Appendix 8.
[42] Study B095. See Appendix 8.
[43] Study B056. See Appendix 8.

Bangladesh[44] to three academic years in Uruguay[45], Ethiopia[46], Kenya, Tanzania/Zanzibar and Uganda[47].

Change agents of the child-focused interventions tended to be early childhood educators/teachers[48], although other change agents, such as trained university students or child-care workers, participated in a few studies. Most of the change agents had received at least secondary-school education; many received on-going training, even after they started teaching[49].

Pre-school participation has generally increased all over the world, with the fastest increase documented in Latin America and the Caribbean (Engle et al. 2013). Given the medium-to-large effect sizes generated by child-focused educational interventions, there is considerable value in scaling up these interventions. There is limited research that systematically examines the relationship between the dosage of early childhood intervention, the nature of pre-school experiences in different forms of pre-school programmes, and children's cognitive development. A caveat is that quality matters and that structured programmes with well-qualified change agents are associated with better outcomes. This is not to state that informal programmes should not be scaled up; indeed, there were no significant differences between home-based and centre-based community programmes in one study[50], but the qualifications of the change agents are significantly associated with quality and child outcomes and formal programmes typically have better qualified educators.

The studies reviewed had a variety of research designs (see Figure 9) and, in the light of the meta-analysis, investment in child-focused educational services seems appropriate. The data suggest that even community-based preschool education with well-trained early childhood educators have positive effects. However, there are many gaps in the data. First, they cover a limited part of the world. Preschool enrolment is highest in Latin America, but, as shown in Figure 4, there are few studies from there that consider this type of intervention.
Many promising programmes that have been documented were not included in our review because they were not evaluated (ARNE 2012). This highlights the importance of focusing on building capacity to conduct evaluation.

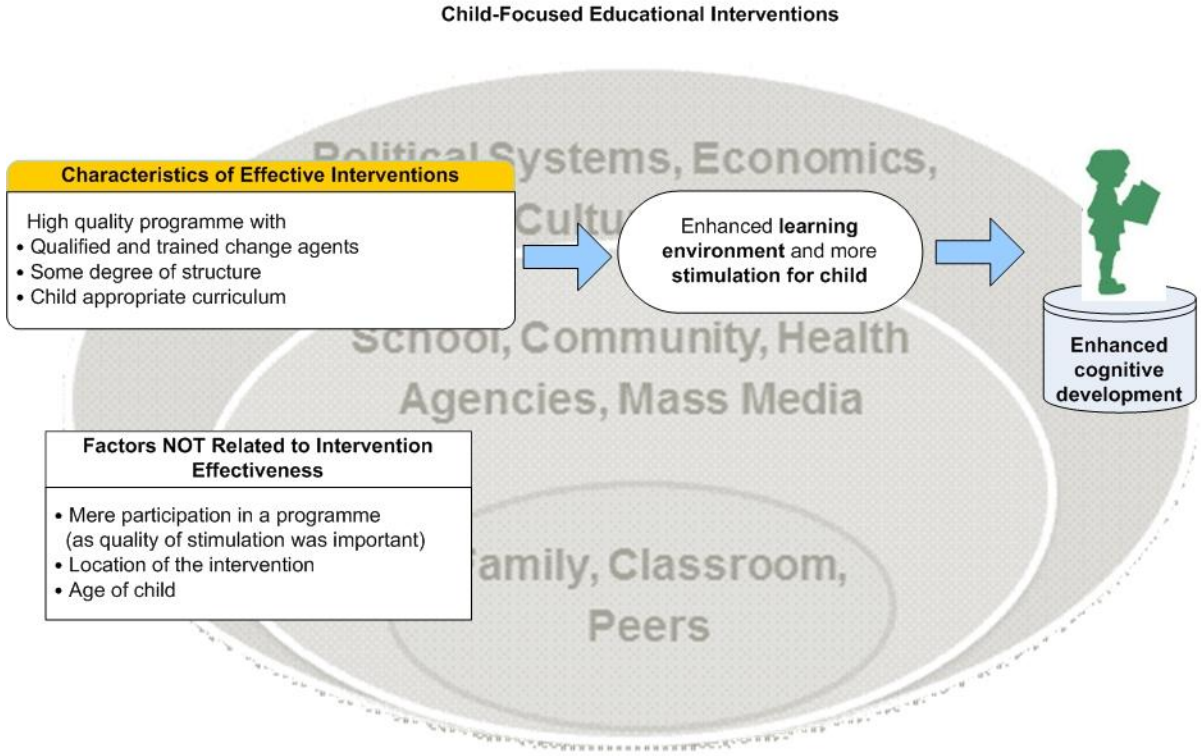
Only one among the 32 studies provided information about unit cost. Cost-effectiveness is typically determined by comparing costs and outcomes among children who attend with those who do not (control) or attend a different programme (comparison group). However, evidence from both developed and developing countries suggests that child-focused educational interventions usually yield higher returns on investment than interventions effected later in life.
Our review did not uncover any indirect benefits of cognitive development of early childhood education. One such benefit is related to women's participation in the workforce. When women engage in paid employment, they are likely to invest their extra income in

[44] Study B015. See Appendix 8.
[45] Study B110. See Appendix 8.
[46] Study B108. See Appendix 8.
[47] Studies B041, B008. See Appendix 8.
[48] Studies B065, B059, B029, B094, B072, B108, B041, B008, B005, B015, B110, B006, B084, B087, B107, B071, B057, B056, B093, B091, B058, B104, S001. See Appendix 8.
[49] Studies B041, B008, B091, B033, B057, B005, B015, B006, B087, B063, B091. See Appendix 8.
[50] Study B057. See Appendix 8.

children's education (Behrman and Knowles 1999, Glick 2002, Engle et al. 2013). The dearth of childcare is a barrier to women's participation in paid employment and this lack of income negatively affects children's cognitive development. A study on the impact of early childcare, which allocated limited childcare spaces based on a lottery system (weighted in favour of low-income families) showed that women were able to earn more income than they could receive from welfare (Barros et al. 2010). In addition, despite longer working hours, they were less depressed and had a higher degree of mental wellbeing. Many poor and rural women engage in physically demanding low-paid work in the informal economy. They struggle to make a living and may have little energy to stimulate their young children when they come home (Engle et al. 2013).

Figure 14, below, shows the *Theory of Change* suggested by the synthesis of quantitative findings from 37 interventions from 22 studies that considered child-focused educational interventions.

Figure 14: Theory of Change for child-focused educational interventions



4.4 Nutrition and health Interventions

Nutrition has long-term effects on health, learning and behaviour. For example, several studies (for example, Barker 1995, 1999, Barker et al. 1990, Eriksson et al. 2010) suggest that chronic diseases such as cardiovascular disease in mid- to late life are derived from nutritional deficits and impaired growth occurring in early, or even prenatal, life. We also have sufficient evidence that nutrition inputs such as iron, zinc and folic acid are critical to child development. However, the effectiveness of nutrition interventions as regards the cognitive development of young children appears to be inconclusive, based on the 32 developing-country studies of nutrition and health interventions, with an average of 254 child participants in intervention groups (ranging from 40 to 1,082 participants).

Effect sizes for early nutrition and health interventions were based on 41 trials reported in 26 of the studies. The weighted average effect size is .08 (ranging from -0.37 to .55, see Figure 10). The homogeneity test also showed large variations in terms of the effects of the

intervention on children's cognitive development (Q = 515.92, df = 40, p < .01). Among the 41 nutrition and health interventions, 16 showed negative effect sizes (ranging from -.37 to -.01) and 13 showed none to small positive effects on children's cognitive development (ranging from .003 to .19). Only 12 relevant interventions had a small-to-medium level of effectiveness on cognitive development (ranging from .20 to .55). Effect sizes did not depend on the type of supplement provided (micronutrients, such as zinc, iron, folic acid, vitamins, proteins and any combinations of the above). However, it should be noted that the null and weak evidence on the effectiveness of nutrition interventions during the prenatal and infancy period among healthy population may be partially due to the use of less sensitive tools for measuring development (that is, Bayley Scales), which may fail to capture subtle changes. Sub-group analyses often revealed a significant nutritional and developmental deficiency among undernourished mothers and their offspring, who were also most likely to benefit from the nutritional interventions as such.

The finding that the effects of nutrition and health interventions alone were not as strong as for other types of interventions may also be because of the following: (i) the publication period covered in this review has excluded some earlier important evidence; (ii) the inappropriateness of assuming a causal connection between severe malnutrition and intellectual functioning; (iii) the interrelationships between socio-economic circumstances, nutrition and cognitive development, which make it difficult to isolate the specific effects of malnutrition on cognitive development; and (iv) the interventions reviewed tended to consider the influence of a single input intervention on a single outcome (namely, cognitive development) and did not consider the interactive influences of different facets of early experience on cognitive development. It is also important to be mindful of the fact that nutritional supplementation has positive effects on growth and motor development and that supplementation may be associated with improvements in important non-cognitive and socio-emotional skills.

Delivery of the interventions was straightforward. Children (or pregnant women) were most often given the supplements at home by parents/caregivers[51] and/or other direct-change agents, such as community health workers and midwives[52]. Supplements, breakfasts and lunches were also distributed in preschools or day-care centres by teachers[53] and/or other direct-change agents[54]. In Brazil[55], Gambia[56] and Guatemala[57] the interventions were delivered at community level by field workers. Most of the studies reported high fidelity in terms of implementation of the interventions being checked on a regular basis.

Interventions that commenced during pregnancy showed that some nutrients may be more effective than others in protecting children from the detrimental effects of maternal undernutrition on child motor and cognitive development. In Bangladesh[58] and China[59], small benefits of prenatal multi-micronutrient (MM) supplementation (compared with iron and/or folic supplementation) were found in infants ($d \leq .19$). Although the findings were statistically significant, these benefits were of doubtful functional and clinical importance.

[51] Studies B003 B044 B049 B076 B078 B099 B103 B075 B077. See Appendix 8.
[52] Studies B012 B013 B014 B016 B017 B075 B077 B079 B080 B096 B097. See Appendix 8.
[53] Studies B031 B062 B104 B032 B027. See Appendix 8.
[54] Studies B024 B032 B043. See Appendix 8.
[55] Study B030. See Appendix 8.
[56] Study B102. See Appendix 8.
[57] Studies B002 B009 B011 B098. See Appendix 8.
[58] Study B097. See Appendix 8.
[59] Study B016. See Appendix 8.

A smaller beneficial effect size (*d* = .01) was evidenced in similar interventions during pregnancy and up to three months post-partum in Indonesia[60], yet MM supplements only benefited the motor and cognitive abilities of children of undernourished or anaemic mothers up to 3.5 years later. No detectable effect on the infants' mental and psychomotor development was found associated with prenatal vitamin A and/or iron supplements at six and 12 months of age[61]. A potential negative effect of prenatal zinc supplementation on the infant's mental development was even suggested at 13 months of age[62].

The effects of iron and zinc supplements were most commonly studied in the intervention trials directly supplementing young children since infancy (≤ 2 years) in developing countries[63]. Nonetheless, results seemed to suggest that the supplementations only provided some benefits in growth, but not in cognitive development[64]. One intervention supplementing six-month-olds' micronutrient-fortified food until they reached two years, however, showed a substantial improvement in children's development and intelligence at 3.5–4 years and persisted to six years (*d* = .55)[65]. However, it should be noted that, unlike in other trials reviewed here, the evaluation of this intervention was quasi-experimental, with townships not chosen randomly in each county, even though children in the community control group recruited from nearby villages had similar socioeconomic status and were matched in terms of age with children in intervention groups.

Somewhat more positive outcomes were found in the few trials that targeted older children[66]. Potentially positive effects on the school performance of 6–8-year-olds were found to be associated with MM-fortified biscuits[67] and fortified milk[68]. The iron and deworming drug programme for 2–6-year-olds in India[69] did not demonstrate enhancement in cognitive performance per se, but it led to substantial gains in child weight and pre-school participation, as well as reducing absenteeism by 20%. Subsidised school meals in Kenya, however, increased school participation, but they only led to higher test scores from children in schools that had better teaching quality[70].

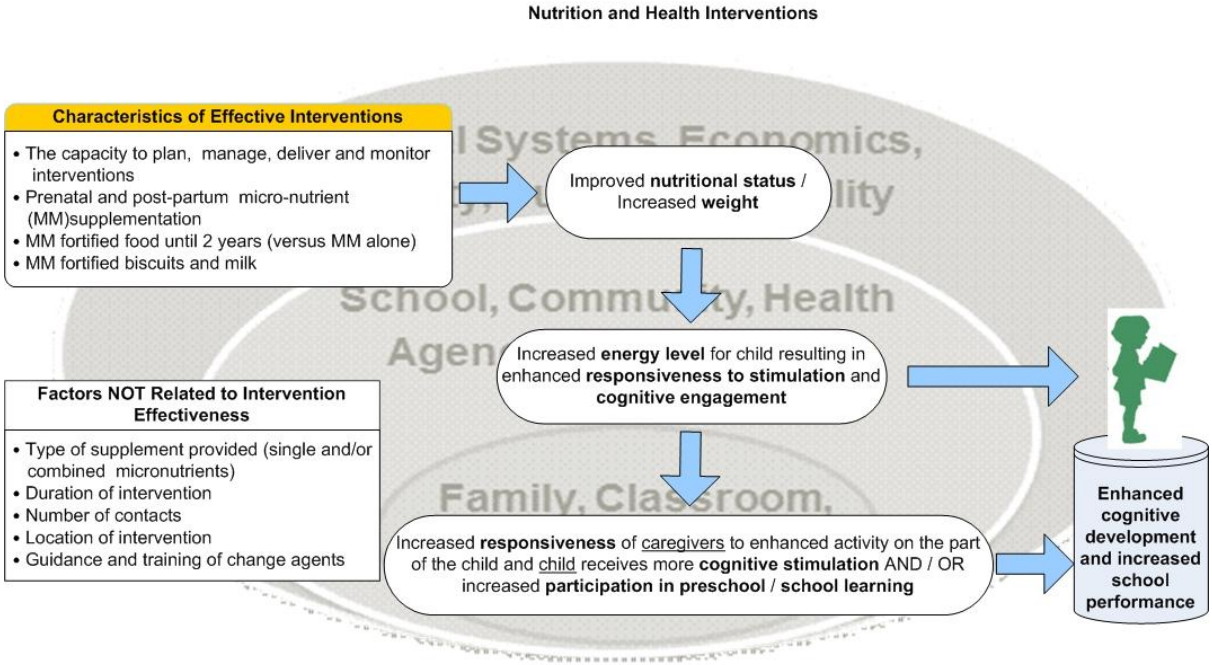
In general, the duration of interventions, numbers of contacts, location of interventions (that is, home, day-care centre or school), and characteristics of and provision of guidance to change agents were not clearly related to the size of the effect. The factors determining programme success were often dependent on capacity to plan, manage, deliver and monitor these services. For example, even though Colombia's home-based care using *madres comunitarias* ("community mothers"), who received a short period of training, have been

[60] Study B100. See Appendix 8.
[61] Study B038. See Appendix 8.
[62] Study B079. See Appendix 8.
[63] Studies B075, B003, B014, B049, B077, B080, B099, B103, B078, B012, B013, B044. See Appendix 8.
[64] Studies B103, B003, B077, B076, B075. See Appendix 8.
[65] Study B099. See Appendix 8.
[66] We initially considered the results of nutrition and health interventions as a function of the age of target children. However, it was ultimately not possible to separate children into different age groups, as many studies included in the review did not do so. Most interventions (38 of the 41 interventions with ES calculated) targeted children under three years (mean ES = 0.03) and three interventions targeted children aged 6–8 (mean ES = 0.03). There were also six interventions without ES, in which the age of targeted children ranged from birth to adolescence.
[67] Study B031. See Appendix 8.
[68] Study B032. See Appendix 8.
[69] Study B062. See Appendix 8.
[70] Study B027. See Appendix 8.

plagued by accusations of low quality, evaluation of the programme has shown positive effects in terms of school enrolment and increased level of school performance[71].

Regarding cost-effectiveness and value for money, only a few studies[72] calculated the unit costs, ranging from 14 US cents to US$20.83 per month. They did not provide much evidence to enable cost–benefit analysis and determine the practicality of scaling up nutrition interventions to enhance cognitive development of young children in developing-country contexts. Further, a few issues need to be tackled preliminarily in order to assess the feasibility of scaling up. Although the available evidence suggested fortified-food supplementation and MM may be more effective than single-micronutrient supplementation in terms of improving children's cognitive development, a small group of selected MM need to be tailored to minimise the cost of fortification, especially for the poorest communities in resource-poor countries. Better understanding is needed of the combined or interactive effects of nutrition/micronutrients on development. Also, many of the small-scale, effectiveness studies of sufficient quality, as illustrated by the list of studies reviewed, were often staffed with external researchers. Therefore, the transfer of capacity to local researchers or practitioners could be limited. The studies included in this review did not indicate a direct and consistent relationship between nutrition and health interventions and cognitive outcomes, based on the synthesis of quantitative findings from 41 interventions, taken from 26 studies that focused on nutrition and health interventions. However, based on prior work in related areas, we propose a possible theory of change for nutrition and health interventions in developing-country contexts, which involves monitoring of the implementation of nutrition and health programmes and training of local change agents.

Figure 15: Theory of Change for nutrition and health interventions



[71] Study B024. See Appendix 8.
[72] Studies B011, B098, B024, B062. See Appendix 8.

Summary

Our review of 32 studies of nutrition and health interventions conducted in developing countries suggests that their effects on the cognitive development of young children are inconsistent. The average effect size for nutrition and health interventions was close to zero and only 12 of 41 interventions had a small-to-medium effect size. In general, the type of supplementary nutrition provided, duration of intervention, the number of contacts, location of intervention, and characteristics of and provision of guidance to change agents, were not related to the size of the effect. The factors determining programme success were often dependent on the capacity to plan, manage, deliver and monitor these services. Although the weak evidence on the effectiveness of nutrition interventions may be partially due to the use of less sensitive tools for measuring development, the optimal timing for nutritional supplementation is not yet clear, given the dearth of rigorous research and the fact that few studies have evaluated cognitive and other outcomes in adolescence and adulthood.

4.5 Income supplementation

Income-supplementation programmes, particularly Conditional Cash Transfer (CCT) programmes, have been widely used in Latin America as a poverty-alleviation tool. In traditional (unconditional) cash-transfer programmes, beneficiaries receive monies solely because of their low income levels. In contrast, in conditional cash-transfer programmes, the family (usually via the mother) only receives the benefits in compliance with certain requirements. These requirements commonly include taking the child for health checks, sending the child to school, or attending parenting programmes. While the positive impact of CCTs on children's health and nutrition has been documented in earlier work, only recently has the influence of CCTs on children's early cognitive development been evaluated.

Eleven studies, conducted in Bolivia[73], Ecuador[74], Mexico[75] and Nicaragua[76] included a component of income supplementation as part of an intervention and considered its effects on cognitive development. All of the interventions evaluated in these studies were large-scale interventions and the sample size of children in intervention groups ranged from 797 to 65,259 children. The best-known income-supplementation intervention is Mexico's Oportunidades programme. However, only six income-supplementation interventions were included in calculation of the effect sizes of this type of early intervention in children's cognitive development.

As shown in Figure 10, the weighted average effect size was .48 (ranging from .03 to .44). The sample sizes in all the six studies were large (> 1,000) and that in one trial[77] exceeded 10,000, which affected the estimation of average effect size. The effectiveness of these interventions was not consistent ($Q = 208.79$, $df = 5$, $p < .01$). Four interventions[78] showed small, positive effects (ranging from .03 to .12) and two[79] showed positive, medium-sized effects ($d = .28$ and $d = .44$, respectively). There are variations in effect sizes across countries. However, specific features of the CCT design also diverge across countries.

[73] Study B055. See Appendix 8.
[74] Studies B039, B040. See Appendix 8.
[75] Studies B025, B026, B047, B048, B088, B089. See Appendix 8.
[76] Studies B028, B090. See Appendix 8.
[77] Study B055. See Appendix 8.
[78] Studies B048, B039, B026, B040. See Appendix 8.
[79] Studies B047, B055. See Appendix 8.

Programmes differ in terms of how much, when and how the beneficiaries are given the cash. Further, evaluation designs also vary. For example, Fernald et al. (2008) compared an intervention group to a group that was initially a waiting-list control, but received the intervention later. Hence, they dub their analysis as being analogous to a dose/response analysis, as opposed to treatment-control analyses[80].

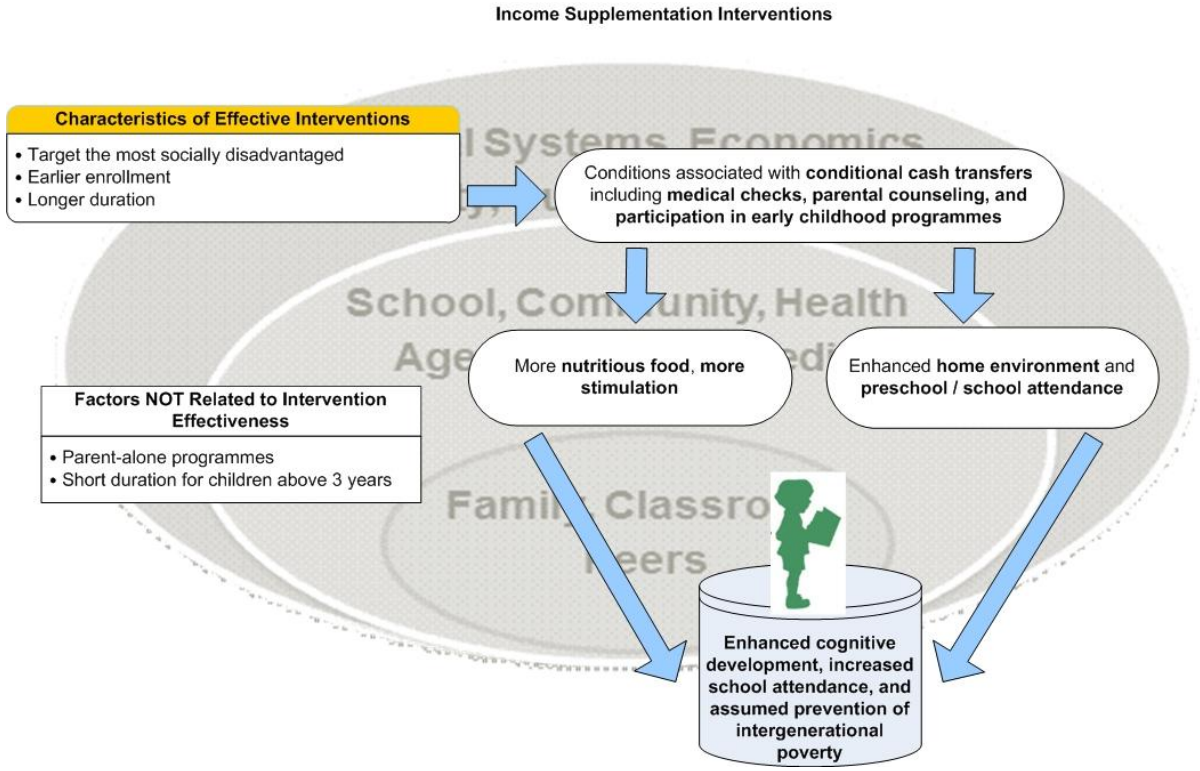
In terms of delivery channels, these programmes are relatively easy to implement and monitor if there is a birth-registration/ID system to ensure that the cash goes to the correct beneficiary. There must be a bank/post-office, community centre/school near the parent's residence where s/he can collect the funds. Otherwise, parents may incur *opportunity costs* (missing a day of work and salary) to collect the cash.

CCT programmes have the potential to offer parental education and support, improve maternal wellbeing and improve the child's environment. In some countries, mothers receive nutrition counselling to encourage them to provide more nutritious food to their children, which will prevent stunting and the loss of cognitive potential. The greatest benefits to children's cognitive development were recorded for children from the poorest households. The long-term effects of Mexico's CCT programme were not found for cognition and language and this may be partly because of the tests used to assess these skills[81].
It is assumed that parents use the cash associated with CCTs to improve children's health outcomes and provide them with more nutritious food, more stimulation and more opportunities for learning. This approach attempts to prevent the intergenerational effects of poverty. Parents are given cash to invest in children's health, nutrition and education as a protective factor against future poverty. The programme has been taken to scale in many Latin American countries and various CCTs now cover over 110 million people in the region.
Cash-transfer programmes are different from supply-side interventions, such as providing preschool education or food supplementation, in that they allow parents to choose the investments they make in their children. Young children's cognitive development may be directly facilitated because parents may choose to purchase more nutritious food for children, improve the quality of the home environment, or send their children to early childhood programmes. However, cognitive development may be indirectly facilitated by improving the psychological wellbeing of mothers, by decreasing financial strain and improving maternal nutrition and healthcare. Hence, the exact reason why CCT's programmes work is hard to pinpoint. Further, cash incentives are usually associated with conditions and these requirements are themselves interventions (medical checks, parental counselling or programme attendance). It is difficult, therefore, to isolate the independent effect of cash on cognitive development. However, these studies seem to suggest that earlier enrolment and longer duration of exposure produce larger positive effects in young children[82]. This, of course, requires greater financial commitment from the government or other financing bodies.

Figure 16 shows the *Theory of Change* suggested by the synthesis of quantitative findings from six interventions from six studies that focused on income-supplementation programmes.

[80] Study B047. See Appendix 8.
[81] Study B048. See Appendix 8.
[82] Studies B048, B055. See Appendix 8.

Figure 16: Theory of Change for income-supplementation programmes



Summary

Income-supplementation programmes have shown small-to-medium effect sizes, but there are variations in effect sizes across countries. Programmes differ in terms of how much, when and how the beneficiaries are given the cash. The exact reason why income-supplementation programmes, particularly conditional cash-transfer programmes, work is hard to pinpoint, because cash incentives are usually associated with conditions and these requirements are themselves interventions (medical checks, parental counselling or programme attendance). Therefore, it is difficult to isolate the independent effect of cash on cognitive development.

4.6 Other comprehensive programmes

Our search uncovered 11 studies covering different comprehensive interventions in six countries: Albania[83], Colombia[84], India[85], Paraguay[86], Peru[87] and the Philippines[88], with an average of 2,511 children in intervention groups. Effect sizes were calculated for four

[83] Study B070. See Appendix 8.
[84] Studies B067, S002. See Appendix 8.
[85] Studies B064, B086, B105, B106. See Appendix 8.
[86] Study B034. See Appendix 8.
[87] Study B061. See Appendix 8.
[88] Studies B010, B023. See Appendix 8.

large-scale comprehensive programmes[89] and the unbiased *d*s were .82, 1.64, .98 and 2.10, respectively. The weighted average effect size for the large-scale comprehensive programme is 1.84, which is also a function of the large sample size in such interventions. The homogeneity test also showed inconsistent effectiveness across those interventions (Q = 9915.02, df = 3, p < .01). Despite the small number of large-scale comprehensive programmes included in the analyses, the results strongly supported the claim that children could benefit from the comprehensive early intervention programmes, which support child development comprehensively in developing countries. It should be noted that these findings are largely based on secondary-data analyses with a constructed comparison group. Hence, designs are less rigorous than those used to evaluate other interventions (see Figure 9).

Although the interventions reviewed here were largely separated and tailored to the needs to each country, they demonstrated some overarching similarities. First, all of them targeted children and parents in low-income families. Second, all of them aimed to benefit large numbers of children. Third, all of them included a mix of different services (for example, pre-school education and childcare, parental education or healthcare services) and children from a range of ages. Most of these programmes are Head Start-type programmes[90] initiated by the government or faith-based organisations. Fourth, most of the interventions fostered community involvement, encouraging the beneficiaries of the programmes to become agents of change themselves.

In Albania, community groups were formed around the parents and other caregivers, in a "collaborative model of communication, interaction and reducing discrimination based on gender"[91], to improve child development. In Colombia[92], programme staff trained local women (usually mothers) to serve as parent educators. Later on, selected parent educators became supervisors, and these supervisors would have the opportunity to serve as programme advisors. Additionally, siblings were often recruited to help. In Peru[93], the Wawa Wasi programme employed *mother-carers* from local communities to head the Wawa Wasi centres. Some mother-carers became *guide mothers* to monitor the current mother-carers, along with *the field co-ordinators*. In Paraguay[94], the programme relied almost entirely on local volunteers on the national, diocesan, zone, parish and community levels. By comparison, the ECD project in the Philippines[95] and the Integrated Child Development Services Scheme (ICDS) in India[96] involved recruiting Child Development or Anganwadi workers to provide services to the community.

Unit cost for programmes is not always explicitly provided, although inferences can be made based on the type of programme in existence. For instance, because of the heavy reliance on volunteers in Paraguay, the presumed cost per child is low. Similarly, because there were no new programmes initiated in the Philippines, cost per child should be low as well. The Albania's Gardens of Mothers and Children project was reported to have low

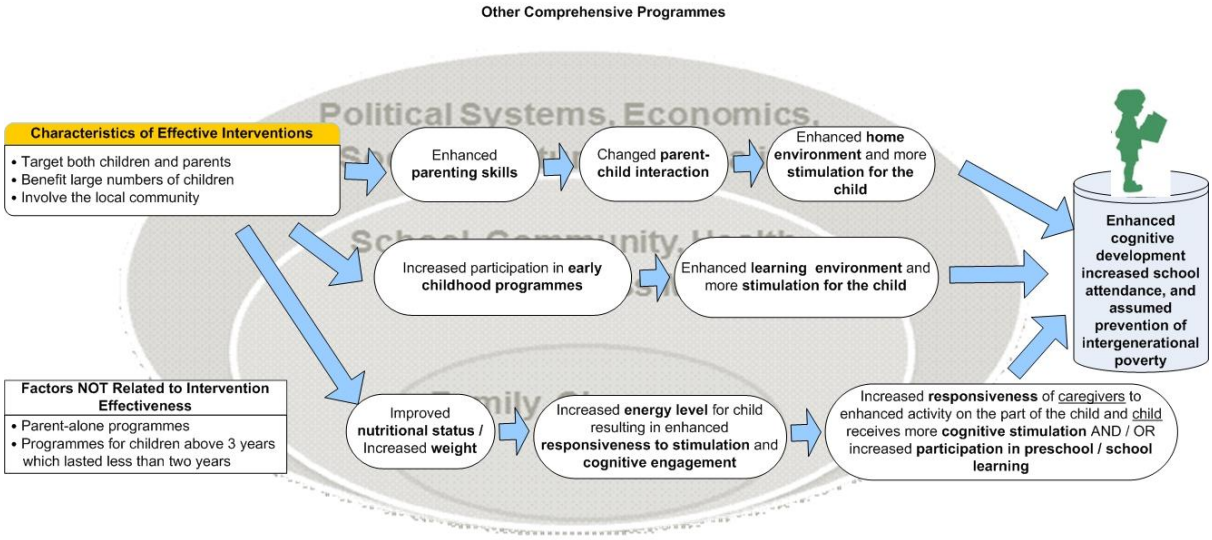
[89] Studies B034, B010, B086, B105. See Appendix 8.
[90] Launched in 1965, Head Start is a United States federal programme that provides education, healthcare, nutrition, and parent-education services to low-income families with children ranging in age from birth to five years. It is one of the best known early-years interventions in the world.
[91] Study B070. See Appendix 8.
[92] Study B067. See Appendix 8.
[93] Study B061. See Appendix 8.
[94] Study B034. See Appendix 8.
[95] Study B023. See Appendix 8.
[96] Studies B010, B023, B086, B105. See Appendix 8.

initial costs, even though the expansion of services to different geographic areas may have increased the costs significantly. The reported cost per child for both the PROMESA and the CINDE-PLAN programmes in Colombia was only US$4.20, while that for the Peruvian Wawa Wasi programme was US$24, as mother-carers were paid a small salary, of US$37.50–US$56.25 per month. Because of their low cost per child and their success in improving school retention rates, children's intellectual development and academic achievement, these integrated programmes were considered good investments in human-capital development.

All of the comprehensive programmes reviewed are large-scale ones that are typically government-funded. Many of them have large group sizes, which means that there is less individual attention given to each child. All of the programmes have been faulted for a variety of reasons, including operating as feeding centres, neglecting pre-school education, not reaching the most disadvantaged sections of society and having undertrained early childhood educators. Government and donor funding, along with continued monitoring and improvements to the current programmes, will be necessary to enhance programme effectiveness and the cognitive development of children from economically disadvantaged backgrounds.

Figure 17 shows the *Theory of Change* suggested by the synthesis of quantitative findings from four large-scale interventions from four studies that evaluated comprehensive programmes.

Figure 17: Theory of Change for comprehensive programmes



Summary

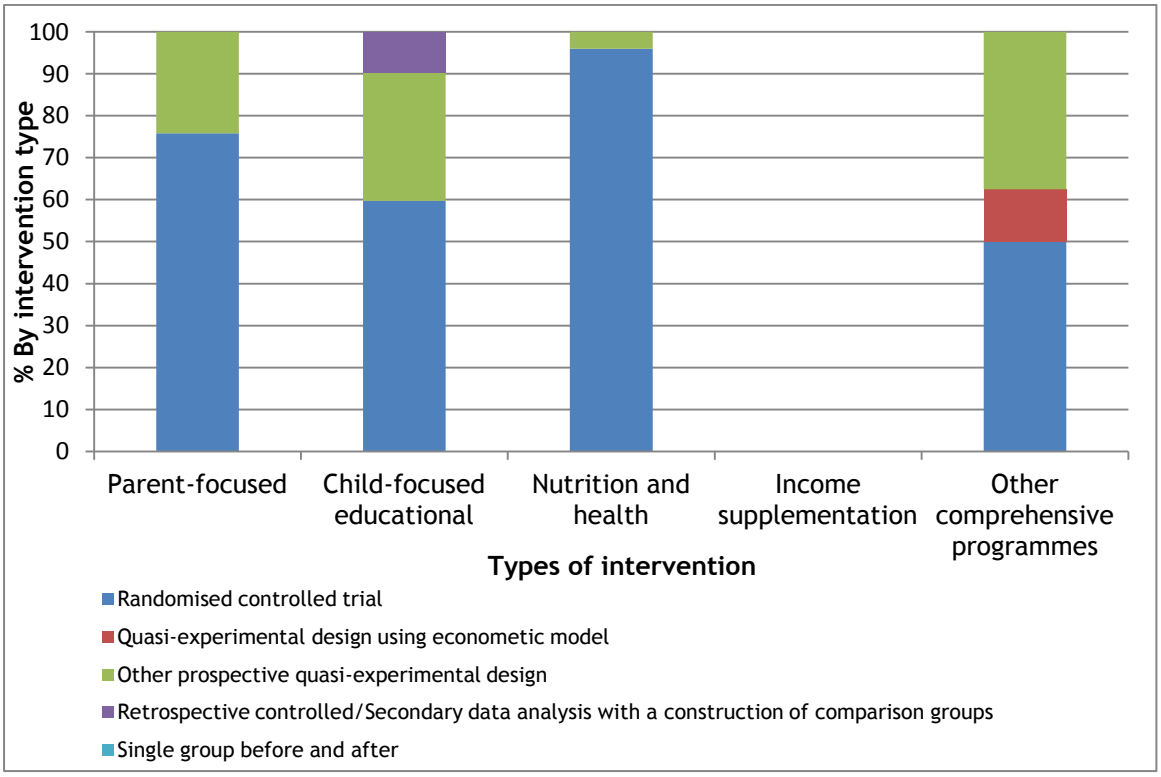
The comprehensive programmes evaluated in the 11 studies demonstrated some overarching similarities: (i) they all targeted children and parents in low-income countries, (ii) they aimed to benefit large numbers of children, (iii) they included a mix of different services and children from a range of ages, and (iv) most of the interventions fostered community involvement, encouraging the beneficiaries of the programme to become agents of change themselves. Despite the limited number of interventions included in the analyses, the results showed that comprehensive early intervention programmes were very effective in supporting the cognitive development of young children in developing countries.

5. Studies conducted in developed countries

5.1 Broad characteristics of studies in developed countries

Only about 8% of the world's children are born in high-income countries, while the other 92% of children live in LMICs (UNICEF 2009). However 56% of the studies (142 studies conducted in 20 different developed countries) that met our inclusion criteria were conducted in developed countries. As shown in Figure 2, the majority of these were conducted in North America. About half (*n* = 72) of the studies featured child-focused educational interventions. The rest involved parent-focused (*n* = 29) interventions, nutrition and health interventions (*n* = 25), and other comprehensive programmes (*n* = 16). None of the studies conducted in developed countries included income-supplementation components. Compared to studies conducted in developing countries (see Figure 9), studies conducted in developed countries often employed more rigorous research designs to evaluate the effectiveness of the interventions on cognitive development of young children (Figure 18). As in the case of studies conducted in developing countries, almost all the studies conducted in developed countries on nutrition and health interventions were randomised controlled trials (*n* = 24). However, instead of quasi-experimental designs, randomised controlled trials were also most often conducted to study the effects of parent-focused interventions (*n* = 22) and child-focused educational interventions (*n* = 43). Large-scale comprehensive programmes were studied using either randomised controlled trials or quasi-experimental methods.

Figure 18: Rigour of intervention by intervention type in developed countries (N = 142)



We concentrated on parent-focused interventions, as we felt that, despite variations in developed- and developing-country contexts and in enrolment ratios in early childhood programmes, parents/primary caregivers were likely to be effective change agents, regardless of where the child lived. We also assumed that our rapid review of findings of

studies conducted in developed countries would have implications for the recommendations we made for developing countries.

Because of our common physiological systems and psychological needs, the conceptual model presented in Figure 1 is universally applicable. However, contextual factors influence the operation of risk and protective factors that affect brain development, and, in turn, cognitive development. We were also cognisant of the fact that: (i) the degree of poverty is much higher in developing countries with concomitant higher rates of malnutrition and stunting, which affect cognitive development; (ii) the pervasiveness of educational poverty has implications for expectations of change agents. For example, parents may not be able to read, so interventions such as parent-implemented dialogic reading are not feasible; and (iii) there are fewer safety nets in developing countries than there are in developed countries. For example, the lack of universal birth registration and income protection in many developing countries means that ECD interventions also need to focus on getting children into the system and providing income support to families living in poverty.

5.2 Implications for developing countries

Our review of parent-focused interventions in developed countries has the following implications. Developing countries should:

- Invest in promoting the quality of ECD interventions by allocating resources for (i) training change agents (be they parents, teachers or health workers) and (ii) age- and context-appropriate curriculum materials for children and context-appropriate learning materials for change agents.
- Invest in research to determine the most effective methods of training change agents to promote cognitive development.
- Invest in building the capacity of in-country teams in developing countries to conduct evaluation research, thereby improving the quality and representativeness of the body of knowledge for evidence-based policy-making.

6. Summary and conclusions

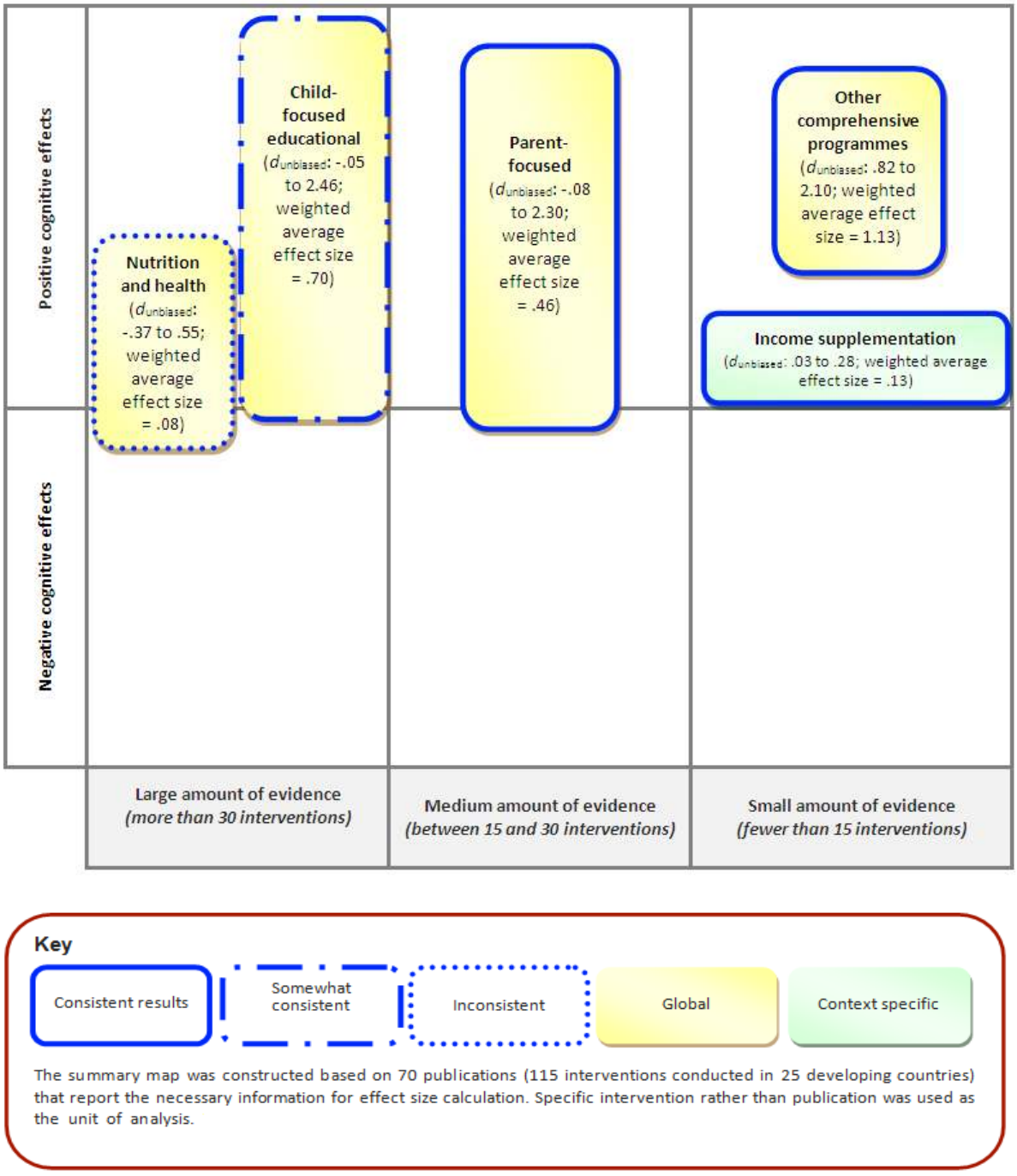
6.1 Summary and implications of findings

Table 2 and Figure 19 summarise the rating of the body of evidence covered in this review.

Table 2: Rating of the body of evidence covered in the review

Interventions	Quality (High, Moderate, Low)	Size (Large, Medium Small)	Context (Global, Context-specific)	Consistency (Consistent, Inconsistent)
Parent-focused	Moderate	Medium	Global	Consistent
Child-focused educational	Low/ Moderate	Large	Global	Somewhat consistent
Nutrition and health	High	Large	Global	Inconsistent
Income supplementation	Moderate	Small	Context-specific	Consistent
Other comprehensive programmes	Low/ Moderate	Small	Global	Consistent

Figure 19: Summary map of evidence covered in the review



6.1.1 Parent-focused interventions

In general, parent-focused interventions produced small-to-medium-sized positive effects on young children's cognitive development in developing-country contexts. Interventions that involved both parent and child often had larger effect sizes than did parent-only programmes or information-based interventions. Short-term interventions were effective for children under 18 months, but interventions that lasted at least two years were shown to have sustainable positive effects on older children. The most effective programmes were those with culturally appropriate materials, opportunities for sharing, discussion, and guided parental practice with children.

It appears that parent-focused interventions led to beneficial changes in parents, which were consequently reflected in their relationships with their children and in the general atmosphere of the home. This contextual change helped to support continuous cognitive development beyond the intervention period.

However, although some parent-focused interventions, such as paired- and dialogic-reading programmes, have been shown to enhance both children's schooling and cognitive development and parent-child interactions in developed countries, they may not be feasible in developing-country contexts, given lower literacy rates in socially disadvantaged groups. Given the known relationship between maternal literacy and child outcomes, and the fact that parents are the child's first teachers, perhaps, in some programmes, adult-literacy education should be conceptualised as a component of ECD interventions.

6.1.2 Child-focused educational interventions

Child-focused educational interventions produced generally consistent positive effects on children's cognitive development. Effects were medium in size and studies were conducted in different parts of the world. Our findings are consistent with those reported in other reviews; that is, participation in early childhood programmes promotes cognitive development and school success and narrows the achievement gap between children from low-income families and their more advantaged peers. However, a more detailed examination of the results revealed that quality mattered and that child-focused interventions with a higher quality of stimulation translated to significantly higher levels of cognitive development for children who received it compared to children who did not. Quality was associated with qualifications and training of change agents, structured and child-appropriate curricula and instruction.

Competencies at school entry are predictive of later academic and occupational success, and children from low-income families start school with less-developed cognitive, language, and social skills than their more advantaged peers. These achievement gaps, which are largely due to differences in parental education and family wealth, are wide and persistent and ECD is considered to promote cognitive development and learning-related skills to "level the playing field for disadvantaged children" during the early years.

Pre-school participation has been increasing all over the world and governments in many large LMICs are moving towards providing ECD to poor, rural and vulnerable children. Supporting the expansion of high-quality early childhood programmes is a worthwhile investment.

6.1.3 Nutrition and health interventions

Among the 41 nutrition and health-related interventions included in this review, 16 showed negative effect sizes, 13 showed small to no positive effects on children's cognitive development. Only 12 of the interventions had a moderate level of effectiveness on cognitive development. The level of effect size did not vary based on the type of supplementary nutrition components provided. Further, the duration of interventions, number of contacts, location of interventions, and characteristics of and provision of guidance to change agents, were not clearly related to the size of the effect. The factors determining programme success were often dependent on capacity to plan, manage, deliver and monitor these services.

The average effect size for nutrition and health interventions was small compared to other types of ECD intervention. However, it is also very important to be cognisant of several issues when considering the findings of the effects of malnutrition on cognitive development.

First, some of the seminal work in this area (for example, Benton and Roberts 1988, Seshadri and Gopaldas 1989, Super et al. 1981, 1990) was conducted before the cut-off date for inclusion in our analyses (that is, January 1992). For example, Super et al. (1981, 1990) demonstrate additive coaction effects in infants who had received both food supplementation and psychosocial stimulation compared to infants not receiving both interventions. Hence, it can be argued that the exclusion of this early evidence has influenced the results of our analyses on the effects of nutrition and health interventions on the cognitive development of young children.

Second, researchers recommend caution in assuming a causal link between early severe malnutrition and subsequent mental functioning. This is because the "particular socio-environmental factors which led to the development of early clinical malnutrition in some children and not in others in the same family or in the same community may also have contributed directly to the reduced intellectual performance observed" (Ricciuti 1981).

Third, it is difficult to disentangle the specific effect of malnutrition on cognitive development because of the close link between malnutrition and socio-economic disadvantage, which can also have an independent, adverse effect on cognitive development. Ricciuti (1993) points out the methodological flaws and inconsistencies in the simplistic view of malnutrition as a direct and independent cause of impaired learning and cognitive development. The false assumption that adequate supplementation alone can improve cognitive development leads to further inconsistencies.

Fourth, our meta-analyses indicated that the effect of supplementation on the cognitive development of malnourished children is mixed (16 nutrition interventions showed negative effect sizes and 24 showed small to no positive effects). Nutritional supplementation has positive effects on growth and motor development, regardless of whether children have received psychosocial stimulation. However, the effects of supplementation on growth depend on the age of the child, with younger children benefiting more from supplementation than older children. Again, it is difficult to conclude that nutrition-supplementation interventions have limited or no effect on cognitive development.

Fifth, the studies reviewed tended to consider whether or not supplements (for example, iron, zinc, vitamin A, folate) were effective in promoting cognitive development or educational attainment. The focus was typically on a single input intervention and a single outcome (cognitive development) and they did not consider the interactive influences of different facets of early experience (nutrition, poverty, exposure to toxins and child-adult interaction) on brain development. Therefore, not only is better understanding needed of the combined or interactive effects of different nutrients and of the most effective timing for nutritional supplementation of cognitive development, but further information is also required on the interactive effects of nutrition and other early experiences on the cognitive development of young children.

In support of the above assertion, a most recent analysis of the long-term effects of early childhood stimulation from the seminal Jamaica study (which is not included in the quantitative analysis, as it was published subsequently) shows that nutrition supplementation did not have a lasting impact on child outcomes compared with parenting education. Hence, standalone nutrition or health interventions that do not improve stimulation in the home environment may have a limited positive impact on cognitive development. The long-term benefits associated with supplementation and stimulation interventions may be derived from improvements in non-cognitive (socio-emotional) skills.

This review offers an important opportunity to draw attention to synergies between child development and nutrition and health interventions as pathways for increasing integrated delivery of these interventions (for example, responsive care), particularly for children below three years of age. Nutrition alone may be inadequate to produce long-term benefits to young children's cognitive capacities; however, in combination with other interventions, additive and synergistic benefits may be visible.

6.1.4 Income supplementation

CCT programmes have shown small-to-medium effect sizes, but there are variations in effect sizes across countries. Specific features of the CCT design also vary across countries. Programmes differ in terms of how much, when and how the beneficiaries are given the cash. There are some conditions for CCTs to work, including systems that permit easy identification of beneficiaries and a system for dispersing benefits. The exact reason why CCT programmes work is, therefore, hard to pinpoint because they result in both direct and indirect benefits to children's cognitive development. Furthermore, cash incentives are usually associated with conditions and these conditions are themselves interventions (medical checks, parental counselling or programme attendance). Therefore, it is difficult to isolate the independent effect of cash on cognitive development. However, available studies do seem to suggest that earlier enrolment and longer duration of exposure produce greater positive effects on young children.

6.1.5 Other comprehensive programmes

Despite the limited number of large-scale comprehensive programmes included in the analyses and the less rigorous (non-experimental) study design, the very large sample sizes in many of these studies increased their statistical power to detect programme impact and compensated for their relatively lower rigour. The results strongly support the claim that children could benefit from the comprehensive early intervention programmes, which support holistic child development in developing countries.

The programmes reviewed demonstrated some overarching similarities: (i) they all targeted children and parents in low-income families, (ii) they aimed to benefit large numbers of children, (iii) they included a mix of different services and children from a range of ages, and (iv) most of the interventions fostered community involvement, encouraging the beneficiaries of the programme to become agents of change themselves.

Based on all the above results and subject to the specific social objectives of the jurisdiction concerned, we suggest a comprehensive programme, which may produce long-term positive effects in developing country contexts, should include the following components: (i) early (preferably from birth) parent-focused intervention for at least two years that involves interaction between parent and child; (ii) quality preschool or other child-focused educational intervention with culturally and developmentally appropriate curriculum after the child reaches three years of age; (iii) on-going nutritional supplementation and/or health check-ups; (iv) opportunities to foster community involvement; and (v) support from the government.

6.2 Limitations

6.2.1 Variations in the rigour of evaluations

Interventions in developing countries were not evaluated using the same research methods and there are considerable variations in the rigour of the studies (see Figure 9). Randomised

controlled trials were most often conducted to study effects of nutrition and health interventions, parent-focused interventions and income-supplement programmes. Studies on pre-primary education and infant/toddler-simulation interventions were more likely to be quasi-experimental. Large-scale comprehensive programmes were most often studied using non-experimental method or used HDIs collected for demographic and health surveys or other surveys.

6.2.2 Evaluations do not reflect world population distributions of children in developing countries

As shown in Appendix 6b, most of the studies included in this review were conducted in Latin America and the Caribbean (38%) and South Asia (28%), while studies conducted in Africa, East Asia and the Pacific, and Central and Eastern Europe and the Commonwealth of Independent States only accounted for 34% of the total number of studies. A higher number of studies is identified in some countries (for example, Jamaica) but not in other, often more populous countries (for example, China and India), due to the existence of collaborative research partnerships. Therefore, the numbers of studies does not reflect the population distributions of children in developing countries.

6.2.3 Assessment of cognitive development

Our review suggests, above, that sometimes the ineffectiveness of certain interventions could be due to the lack of appropriate tools to assess cognitive development in very young children. The studies reviewed adopted a variety of outcome measures in examining children's cognitive development, including IQ, language, mathematical abilities, executive functions, problem solving and academic achievement. This makes it difficult to draw strong conclusions regarding the effectiveness of interventions on cognitive development. As noted earlier, there are currently no globally accepted tests of early cognitive development. This is largely because of concerns that Western assessments may not be valid in other countries due to cultural and contextual differences, not only in assessment techniques, but also in the overarching constructs to be measured. Yet, culturally and contextually appropriate tests are particularly needed in developing regions because a large percentage of children are at risk for poor developmental outcomes and government investment in early child development is limited. There is, therefore, an urgent need for a measurement tool to evaluate the efficacy of interventions and make evidence-based decisions on which programmes should be scaled up.

6.2.4 Few studies examine long-term effects of early childhood interventions

The few studies in developing countries that examined long-term intervention effects on children's cognitive development involved nutrition and health interventions (see Section 4.1). This imbalance in the distribution of studies suggests that we should extend our focus on the long-term effects of ECD interventions beyond merely nutrition and health interventions. More importantly, studies should consider whether ECD interventions, when implemented in combination, may produce long-term additive and synergistic benefits to the development of young children in developing countries.

6.3 Conclusions

6.3.1 Implications for policy

- Invest in comprehensive large-scale programmes, such as the Pastoral del Niño programme in Paraguay, the Integrated Child Development Services in India, and the integrated programme in the Philippines, as these have the largest effects.

- Invest in well-designed and properly implemented parent-focused or child-focused interventions, as they have positive effects on children's cognitive development. Parent-focused interventions, in particular, may lead to beneficial changes in parents, which are consequently reflected in their relation with their children and in the general atmosphere of the home. This contextual change may help promote continuous cognitive development and support children's learning beyond the intervention period.
- Invest in quality by allocating resources for (i) training change agents (be they parents, teachers or health workers), and (ii) age and context-appropriate curriculum materials for children and context-appropriate learning materials for change agents.
- Invest in additional, rigorous research to determine the most effective methods of training change agents to promote cognitive development.
- Invest in building the capacity of in-country teams to conduct evaluation research, thereby improving the quality and representativeness of the body of knowledge for evidence-based policy-making.

6.3.2 Implications for research

- **Focus on understanding how and by what mechanisms genes and early social contexts determine the trajectories of biological and behavioural development**. There is evidence that gene-environment interactions set trajectories for health, development, learning and behaviour (Rutter 2006) and these have their origins in early childhood. As the field expands exponentially, a new agenda for research studies would be to examine how and by what mechanisms both genes and early social contexts (nutrition, care and education) determine the trajectories of early development. By gaining a better understanding of these mechanisms, we can effect changes in children at risk of failing to achieve their developmental potential.
- **Ensure that research has a developmental focus**. It is important to focus on the timing, frequency and persistence of exposure to risk factors to achieve typical cognitive development. There is variability in the effects of adversity according to the age of the child and the intensity and duration of the exposure to risk. Therefore, intervention at critical periods in development is likely to yield the most positive outcomes for children and communities in the developing world.
- **Recognise the importance of evaluating socio-emotional skills**. While cognitive skills are necessary for typical development, so are social and self-regulatory skills. The ability to sit still, pay attention and engage in learning can lead to better cognitive skills. Better health conditions can lead to fewer lost school days and well-nourished children can also have greater capacity to concentrate and hence develop better cognitive skills. Cognitive skills, such as literacy, generate better health practices and produce greater motivation and self-involvement (Heckman 2013). Therefore, future research must include both cognitive and non-cognitive skills as outcome measures of early childhood investments in developing countries. Focusing only on cognitive development and/or school attainment as an outcome, or only on the impact of early interventions, may not fully reveal the impact of the programme, as shown in seminal pilot programmes, such as the Perry, Abecedarian and Jamaican interventions.
- **Focus of defining and measuring the quality of early childhood educational interventions.** Definitions of pre-school quality are contested, as children live in vastly different environments. However, we know that the qualifications of the change agent (early childhood educators) make a difference to child outcomes and research can inform us about the minimum level of qualifications and training of change agents required to see positive changes in children's cognitive outcomes.

- **Focus on cost-benefits, rather than cost-effectiveness.** As noted above, evidence from longitudinal studies indicates that typical development of "non-cognitive" skills are at least as important as cognitive skills in terms of the long-term health, learning and behavioural outcomes that follow early successful childhood interventions. Therefore, it is important to focus on cost-benefits, which is a comparison of the cost of different input options for a desirable or common effect. For example, nutrition inputs have different effects on brain development, but are necessary at different stages of development.
- **Evaluate cost-benefits of large-scale programmes**. Mere replication of cost-effectiveness studies should no longer be a priority for investigation. Instead, work should focus on the cost–benefits of large-scale programmes to assess the feasibility of scaling up results for wider inclusion. The key is to consider "how to take programmes to scale" and "what are the cost–benefits of the programmes."

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Appendices

Appendix 1: List of developing countries

Income groups correspond to 2012 gross national income (GNI) per capita (*World Bank Atlas* method).
Source:
http://data.worldbank.org/about/country-classifications/country-and-lending-groups

Low-income	Lower-middle-income	Upper-middle-income
Afghanistan	Albania	Angola
Bangladesh	Armenia	Algeria
Benin	Belize	American Samoa
Burkina Faso	Bhutan	Antigua and Barbuda
Burundi	Bolivia	Argentina
Cambodia	Cameroon	Azerbaijan
Central African Republic	Cape Verde	Belarus
Chad	Congo, Rep.	Bosnia and Herzegovina
Comoros	Côte d'Ivoire	Botswana
Congo, Dem. Rep	Djibouti	Brazil
Eritrea	Egypt, Arab Rep.	Bulgaria
Ethiopia	El Salvador	Chile
Gambia, The	Fiji	China
Guinea	Georgia	Colombia
Guinea-Bissau	Ghana	Costa Rica
Haiti	Guatemala	Cuba
Kenya	Guyana	Dominica
Korea, Dem Rep.	Honduras	Dominican Republic
Kyrgyz Republic	Indonesia	Ecuador
Liberia	India	Gabon
Madagascar	Iraq	Grenada
Malawi	Kiribati	Iran, Islamic Rep.
Mali	Kosovo	Jamaica
Mauritania	Lao PDR	Jordan
Mozambique	Lesotho	Kazakhstan
Myanmar	Marshall Islands	Latvia
Nepal	Micronesia, Fed. Sts.	Lebanon
Niger	Moldova	Libya
Rwanda	Mongolia	Lithuania
Sierra Leone	Morocco	Macedonia, FYR
Somalia	Nicaragua	Malaysia
Tajikistan	Nigeria	Maldives
Tanzania	Pakistan	Mauritius
Togo	Papua New Guinea	Mexico
Uganda	Paraguay	Montenegro
Zimbabwe	Philippines	Namibia

Appendix continues overleaf

Low-income	Lower-middle-income	Upper-middle-income
	Samoa	Palau
	São Tomé and Principe	Panama
	Senegal	Peru
	Solomon Islands	Romania
	South Sudan	Russian Federation
	Sri Lanka	Serbia
	Sudan	Seychelles
	Swaziland	South Africa
	Syrian Arab Republic	St. Lucia
	Timor-Leste	St. Vincent and the Grenadines
	Tonga	Suriname
	Ukraine	Thailand
	Uzbekistan	Tunisia
	Vanuatu	Turkey
	Vietnam	Turkmenistan
	West Bank and Gaza	Tuvalu
	Yemen, Rep.	Uruguay
	Zambia	Venezuela

Appendix 2: Coding Scheme

Code	**Exclude/ Include** in the analyses
0	Exclude
1	Include

Authors: Enter authors' names
Year: Enter year of publication
Country: Enter country name

Code	**HDI:** Country's Human Development Index (http://hdr.undp.org/en/statistics/)
1	Low
2	Medium
3	High
4	Very high

Code	**Location of intervention**
1	Remote area
2	Rural area
3	Peri-urban area
4	Urban area
999	Unknown

Code	**Intervention type:** Components included in the intervention		
		n	N
1	Parent- focused interventions		25
	Parent-focused support/training/education	5	
	Parent-focused support/training/education +infant/child stimulation	14	
	Parent-focused support/training/education +infant/child stimulation + nutrition	6	
2	Child-focused educational interventions		32
	Pre-primary or other ECE programme	26	
	Infant/toddler stimulation	5	
	Pre-primary or other ECE programme + Infant/toddler stimulation	1	
3	Nutrition and health interventions		32
4	Interventions with income supplementation		11
	Cash transfers	6	
	Cash transfers + parent-focused interventions + nutrition	4	
	Cash transfers + parent-focused interventions + child-focused educational interventions + nutrition	1	
5	Other Comprehensive programmes		11
	Child-focused educational interventions + parent-focused interventions and or nutrition + social development/community development component		

Hours per week: Number of hours per week that children participated in the intervention. Coded only for programmes with component(s) 1, 2 and/or 3. Coded NA for others.

Duration of intervention: Length of the intervention in months

Code	**Child age:** Age range of target children
0.5	Prenatal
1	0–1
2	1–2
3	2–3
4	3–4
5	4–5
6	5–6
7	6 –8
8	Mixed

If age range is "Mixed", specify the age range: Enter age range.
If range is not "Mixed", enter NA.

Mean age of children in years: (NA if unknown)

Code	SES of families of children participating in the intervention
1	Low
2	Middle
3	High
999	Not specified

Code	**Minority status:** Whether children participating in the intervention from minority groups in the country
0	No
1	Yes

Code	**Location of intervention:** where the intervention was conducted
1	Home
2	Take-home remedy (for example, some nutrition programmes)
3	Community
4	Centre (for example day-care)
5	School (for example, preschool)
6	Mixed
999	Unknown

Code	**Change agents:** The persons who had direct contact with the beneficiaries of the intervention (that is, parents and/or children) of the intervention
1	Parents/ family members/ guardians
2	Community workers
3	Child-care workers
4	Teachers
5	Other paraprofessional/ professional (for example, nurse)
6	University students
7	Mixed
8	Others
999	Unknown

Code	**Characteristics of change agents:** Designation/Relationship between change agent and child
1	Teachers/ Early childhood educators
2	INGO employees (for example, UNICEF, Save the Children)
3	Local NGO employees
4	RAs/ university students/ interns
5	Parents/ family members/ guardians
6	Other volunteers (non-paid)
7	Local NGO + INGO employees
8	Parents/ family members/ guardians + teachers/early childhood educators (+other change agents)
9	Parents/ family members/ guardians + any other change agents (NO teachers)
10	Teachers/ early childhood educators + any other change agents (NO parents)
11	Other combinations (for example, interns + volunteers + INGO employees)
999	Unknown

Code	**Minimum qualifications of change agents**: Professional status of the change agents
0	No minimum-qualification requirement
1	Primary education (six years of schooling or less)
2	Secondary education (7–12 years of schooling)
3	Tertiary education
4	Paraprofessional
5	Professional
6	Mixed
999	Unknown

Code	**Provision of guidance to change agents:** Amount of guidance provided to the change agents
0	None
1	Once at initiation of programme
2	More than once/ Continuous support

Relative cost per child: Enter relative cost (if available). If unavailable, enter NA.

Code	**Fidelity of implementation**: Monitoring, by a supervisor of the extent to which the change agent complied with requirements in delivering the intervention
1	Low (informal implementation check)
2	Medium (at least one formal, scheduled implementation check)
3	High (regular, scheduled implementation checks: at least two)
999	Undetermined

Code	**Rating of intervention:** Effects of the intervention
1	Negative effects
2	Potentially negative effects
3	No discernible effects
4	Mixed effects
5	Potentially positive effects
6	Positive effects

Code	**Rigour of study:** Level of rigour in study design
1	Other, less rigorous study
2	Single group before and after
3	Retrospective controlled/ Secondary-data analysis w/a construction of comparison groups
4	Other prospective quasi-experimental design
5	Quasi-experimental design with the use of an econometric model
6	Randomised controlled trial

Code	**Soundness of study:** Level of validity and reliability of the study
1	Low (major and or numerous deficiencies in sampling, data collection or data analysis)
2	Medium (some deficiencies in sampling, data collection or data analysis, but the methods and interpretations were generally valid and reliable)
3	High (demonstrates adherence to principals of appropriate sampling and data collection and reliable data analysis)

Code	**Overall quality of study:** code of rigour + code of soundness
1	Low (overall score = 3–5)
2	Medium (overall score = 6–8)
3	High (overall score = 9–12)

Appendix 3: Narrative Summaries

Take-home messages from narrative summaries

Parent-focused interventions
B037 India Vazir, S, Engle, P, Balakrishna, N, Griffiths, PL, Johnson, SL, Creed-Kanashiro, H, Fernandez Rao S, Bentley, ME (2013) ➢ Educating mothers/caregivers on age and culture-appropriate complementary foods improves infant and toddler growth. ➢ Responsive complementary feeding + child-focused educational intervention + parent-focused intervention to stimulate infants through play to improve toddlers' developmental outcomes.
B083 Turkey Kagitcibasi, C, Sunar, D, Bekman, S, Baydar, N, Cemalcilar, Z (2009) ➢ Children who receive early enrichment have more favourable cognitive- and social-developmental trajectories than those who do not.
B001 Vietnam Watanabe, K, Flores, R, Fujiwara, J, Tran, LTH (2005) ➢ ECD intervention compensated for loss caused by poor physical growth. ➢ ECD inputs during the preschool years enhanced the cognitive potential of children in early primary-school grades. Effects were more pronounced for malnourished children. ➢ Insights led to development of an integrated intervention model (nutrition + ECD).
B051 Jamaica Walker, SP, Chang, SM, Powell, CA, Grantham-McGregor, SM (2005) ➢ Growth in first two years of life is more important for later development than growth after two years of age. ➢ Along with preventive strategies, there is a need to increase stimulation of already undernourished children.
Child-focused educational interventions
B057 Cambodia Rao, N, Sun, J, Pearson, V, Pearson, E, Liu, H, Constas, MA, Engle, PL (2012) ➢ Children who attended formal preschool programmes showed better cognitive development than those who participated in community-based or home-based programmes. ➢ Home-based programmes produced a level of school readiness that is equal to that of community-based provision, although they use far fewer resources and require less caregiver training. ➢ The results indicate that some preschool experience is better than none at all.
B041 Kenya, Tanzania/ Zanzibar and Uganda Malmberg, LE, Mwaura, P, Sylva, K (2011) ➢ MRC children in the three countries in East Africa showed significantly greater cognitive gains over a period of three years compared to non-MRC children. ➢ Quality of intervention schools was related to child outcomes. ➢ There were country-specific patterns in cognitive development highlighting the influence of contextual factors.
B091 Tanzania/ Zanzibar Education Development Center, Inc. (EDC) 2009 ➢ IRI radio programming + early childhood education promote access to ECD and enhanced learning. ➢ IRI is an innovation worthy of scaling up.
B029 Mozambique Martinez, S, Naudeau, S, Pereira, V (2012) ➢ Community participation resulted in effective pre-schooling at a relatively low cost. ➢ Older siblings and caregivers were released for schooling and work.

➢ Preschool expansion is a promising policy option.
Nutrition and health interventions
B002 Guatemala Li, H, Barnhart, HX, Stein, AD, Martorell, R (2003) ➢ Better nutrition during early childhood resulted in improved educational achievement in adulthood, but only among those who completed primary school.
B027 Kenya Vermeersch, C, Kremer, M (2004) ➢ The context in which a school-meal programme is implemented is very important; a programme that increases school participation, but in an environment with low teaching quality is likely to fail to translate into better educational achievement. ➢ School meals cannot be complementary to teaching if there is little teaching going on, or if the teaching is of very poor quality.
B016 China Li, Q, Yan, H, Zeng, L, Cheng, Y, Liang, W, Dang, S. Wang, Q, Tsuji, I (2009) ➢ Multi-micronutrient supplementation is preferable to supplementation with folic acid and iron, or iron alone.
Interventions with income supplementation
B039 Ecuador Fernald, LCH, Hidrobo, M (2011) ➢ In rural areas, an unconditional cash-transfer programme led to significantly better performance in terms of the number of words a child used and on the probability of the child combining two or more words.
B048 Mexico Fernald, LCH, Gertler, PJ, Neufeld, LM (2009) ➢ Early enrolment in Mexico's Oportunidades programme reduced behavioural problems for all children in the early (versus late) treatment group. ➢ An additional 18 months in the programme for children whose mothers had no education resulted in improved child growth in height-for-age Z score, independent of cash received.
➢ B055 Bolivia Behrman, JR, Cheng, Y, Todd, PE (2004) ➢ Test-score gains depended on duration of exposure to the PIDI programme, which aimed at improving early cognitive skills and nutrition. ➢ Positive effects were observed in children who participated for at least seven months and increasing effects were observed with longer durations, although the impacts on the anthropometric outcomes were not precisely measured.

Doc # B057

Rao, N, Sun, J, Pearson, V, Pearson, E, Liu, H, Constas, MA, Engle, PL (2012). Is something better than nothing? An evaluation of early childhood programmes in Cambodia

Abstract

This study evaluated the relative effectiveness of home-based, community-based and state-run early childhood programmes across Cambodia. A total of 880 five-year-olds (55% girls) were selected from six rural provinces in Cambodia attending state preschools, community preschools, home-based programmes, or no programmes. They were assessed twice using the Cambodian Developmental Assessment Test. Controlling for baseline differences, children who participated in any early childhood programmes performed significantly better in post-test than those of children who did not participate in any programmes. Children in state preschools scored significantly higher than those in either community preschools or home-based programmes; scores did not differ as a function of attending community preschools or home-based programmes. The results indicate that some preschool experience was better than none at all.

Country
Cambodia
Sample
880 five-year-old children from six rural provinces in Cambodia attending state preschools, community preschools, home-based programmes, or no programme.
Intervention
Study evaluated the relative effectiveness of home-based, community-based and state-run early childhood programmes across Cambodia.
Measures
Cambodian Developmental Assessment Test. Interview for understanding standard demographic details, information about the child's preschool history, maternal and paternal education levels, maternal and maternal occupation, and information about the child's siblings
Outcomes
Cognitive and school-readiness scores
Results
Children in state preschools scored significantly higher than those in either community preschools or home-based programmes. Scores did not differ among children attending community preschools or home-based programmes. Teachers in state preschools have higher academic and professional qualifications than those in community preschools.
Take-home messages
➢ Children who attended formal preschool programmes showed better cognitive development than those who participated in community-based or home-based programmes. ➢ Home-based programmes produced a level of school-readiness that is equal to that of community-based provision, although they use far fewer resources and require less caregiver training. ➢ The results indicate that some preschool experience is better than none at all.

Doc # B037

Vazir, S, Engle, P, Balakrishna, N, Griffiths, PL, Johnson, SL, Creed-Kanashiro, H, Rao, SF, Shroff, MR, Bentley, ME (2013) Cluster-randomized trial on complementary and responsive feeding education to caregivers found improved dietary intake, growth and development among rural Indian toddlers.

Abstract

Sixty villages in Andhra Pradesh were randomised into three groups of 20 villages with 200 mother–infant dyads in each group. The control group (CG) received routine Integrated Child Development Services (ICDS); the complementary feeding group (CFG) received the ICDS plus the World Health Organization (WHO) recommendations on breastfeeding and complementary foods; and the responsive complementary feeding and play group (RCF&PG) received the same intervention as the CFG plus skills for responsive feeding and psychosocial stimulation. Both intervention groups received bi-weekly visits by trained village women. The groups did not differ at three months on socioeconomic status (SES), maternal and child nutritional indices, and maternal depression. After controlling for potentially confounding factors using the mixed-models approach, the RCF&PG group significantly increased median intakes of energy, protein, Vitamin A, calcium (CFG), iron and zinc after the 12-month intervention. Compared to the control group, stunting was significantly reduced in the CFG group, and Bayley Mental Development scores were significantly higher in the RCF&PG than in the control group. Community-based educational interventions improved dietary intake, length (CFG) and mental development (RCF&PG) for children under two years in food-insecure rural Indian families.

Country

India (Andhra Pradesh)

Sample

200 mother-infant (three months) dyads

Intervention

The CG received routine ICDS; CFG received the ICDS plus the WHO recommendations on breastfeeding and complementary foods; and RCF&PG received the same intervention as the CFG, plus skills for responsive feeding and psychosocial stimulation. Both intervention groups received bi-weekly visits by trained village women.

Measures

Demographic data; 24-hour recall and food-frequency questionnaire; maternal knowledge and beliefs in complementary and responsive feeding; maternal depression; anthropometry; Bayley Scales of Infant Development; haemoglobin-morbidity data

Outcomes

Dietary, growth and developmental outcomes

Results

The groups did not differ at three months on SES, maternal and child nutritional indices or maternal depression.

After controlling for potentially confounding factors using the mixed-models approach, the 12-month intervention in the CFG and RCF&PG significantly increased median intakes of energy, protein, Vitamin A, calcium (CFG), iron and zinc, reduced stunting [0.19, confidence interval (CI):0.0–0.4] in the CFG (but not RCF&PG) and increased ($P<0.01$) Bayley Mental Development scores (mean=3, CI:0.8–5.3) in the RCF&PG (but not CFG) compared with CG.

Take-home messages

- Educating mothers/caregivers on age and culture-appropriate complementary foods improves infants and toddler growth.
- Responsive complementary feeding + child-focused educational intervention + parent-focused intervention to stimulate infants through play to improve toddlers' developmental outcomes.

Doc # B083

Kagitcibasi, C, Sunar, D, Bekman, S, Baydar, N, Cemalcilar, Z (2009) Continuing effects of early enrichment in adult life: The Turkish Early Enrichment Project 22 years later.

Abstract

The study reported on the assessment of long-term outcomes of the Turkish Early Enrichment Project (TEEP), in which children from deprived environments, aged 4–6 years, participated in 1983–85.The evaluation followed the emerging pattern to carry out assessment of adult effects when participants were in their early to mid-twenties. Children were assessed at four points: pre-programme, immediately post-programme, seven years after the programme and 19 years after the programme. The last follow-up aimed at exploring the continuing effects of early intervention on educational attainment, socio-economic success, family relationships, life satisfaction and social participation and adjustment on reaching adult age. It also investigated separately the effects of early care environments, focusing on mothers' training/stimulating care and exposure to any other form of enriched experience/s. Children of TEEP had more favourable trajectories of development into adulthood in cognitive and social domains.

Country

Turkey (Istanbul)

Sample

Target families: 255; seven-year follow-up: 225 located, only 217 participated; last follow up: 131 families (61%) could be included.

Intervention

Judiciously designed; a combination of intensive parent education and enriched, centre-based pre-schooling based on the assumption that both enrichments would have beneficial effects, and, combined, would result in greater gains. Three kinds of care environment, educational day-care, custodial day-care and home, were identified. Half of the mothers from each of three environments were randomly chosen to receive training, and others were not trained. The training module comprised the conducting of stimulating activities, using learning material and parental support in developing caregiving and self-development competencies.

Measures

Demographic, educational and occupational elements, attitudes towards family life, social participation. Cognitive Composite test scores and IQ scores. Nineteen-year follow-up Achievement Composite-Vocabulary Score. Assessment of last grade completed and self-assessment. Occupational Status Index based on Kagitcibasi (1973).
Social-development, assimilation in urban society, age at gainful employment, estimated household expenditure and occupational prestige.

Outcomes

As noted above children received educational day care, custodial day care or remained at home (three conditions) and mothers of half the children in each group received training on how to conduct cognitively stimulating activities with their children.

Results

High-quality early childhood enrichment for children from deprived environments, whether provided through mother training or educational preschool, or both, had positive effects on overall development and were carried to young adulthood. Instead of one-point analyses for outcomes, development trajectories were examined across stages. It revealed that any type of enrichment benefited cognitive/achievement and social-development domains, but varied by sex, age and type of intervention. Complete post-intervention effects indicated that children whose cognitive deficits were mild-moderate, as opposed to severe, benefited more from the intervention.

Take-home messages

- Children who receive early enrichment have more favourable cognitive and social developmental trajectories than those who do not.

Doc # B001

Watanabe, K, Flores, R, Fujiwara, J, Tran, LTH (2005) Early childhood development interventions and cognitive development of young children in rural Vietnam.

Abstract

The study investigated the long-term benefits of an Early Childhood Development (ECD) intervention, combined with nutrition, on cognitive development. Two communes with high prevalence of child malnutrition and poor economic conditions in Thanh Hoa province in rural Vietnam were selected for the study. The sample comprised 313 children, who were exposed to a nutrition-only intervention (n=172) or nutrition + ECD intervention (n=141), from 1999 to 2003. All children for the initial two years, between 0-36 months, received the nutrition intervention. A further 141 children, while at preschool age (4-5 years), were exposed to an enriched ECD for two years. Between ages 6.5-8.5 years, the children were tested using measures of height and weight and Raven's Progressive Matrices Test for cognitive scores. Mothers were interviewed to get family and household profiles. When analysed, the integrated longitudinal data, collected across surveys, pointed to a significant effect of ECD intervention as compared to the nutrition intervention on cognitive scores. The insights, relating the beneficial effects of ECD, were used in developing an effective integrated-package intervention for children in rural Vietnam.

Country

Vietnam (Vinh Loc district, Thanh Hoa province)

Sample

Three hundred and thirteen children aged 6.5—8.5 years registered in the commune (2003) and living there since 1998.

Intervention

Nutrition intervention: monthly growth monitoring, nutrition education and rehabilitation programme to learn nutrition and health-seeking behaviours, combined with home gardening; saving and credit were added for sustainability. ECD intervention: strengthened pre-school centres with material support and teacher training. Parents were educated using ten theme modules on childcare and child development. Play corners at homes for children and local libraries for parents were set up.

Measures

Anthropometric measurements: height and weight.
Raven's Colored Progressive Matrices Test: cognitive scores
Interview schedule for mothers: household, family and childcare information
Questionnaire: demographic profile, socioeconomic and residential status

Outcomes

Height-for-age Z score (HAZ): heights compared with National Centre for Health Statics/WHO/CDC standards (25) using EPI Info 2000 (CDC); Raven's Test Scores

Results

Children exposed to ECD + nutrition intervention had significantly higher scores on Raven's test than their counterparts exposed to only nutrition.
Within-group differences showed minimal differences in cognitive scores between stunted and non-stunted children in ECD + nutrition group, but were significantly larger in only-nutrition group
Effect of ECD was found to be independent of physical growth and negated the growth-failure effect on cognitive development.

Take-home messages

- ECD intervention compensated for loss caused by poor physical growth.
- ECD inputs during the preschool years enhanced the cognitive potential of children in the early primary-school grades. Effects were more pronounced for malnourished children.

Insights led to development of an integrated intervention model (nutrition + ECD).

Doc # B051

Walker, SP, Chang, SM, Powell, CA, Grantham-McGregor, SM (2005) Effects of early childhood psychosocial stimulation and nutritional supplementation on cognition and education in growth-retarded Jamaican children: Prospective cohort study.

Abstract

A study was conducted to investigate the effects of early childhood psychosocial stimulation and nutritional supplementation on cognition and education in growth-retarded Jamaican children. A prospective-cohort study was conducted of stunted (n=103) and non-stunted children (n=64) aged 17–18 years and living in Kingston, Jamaica. Previously stunted children were randomly assigned at 9–24 months to supplementation (1 kg milk-based formula per-week), stimulation (weekly play sessions), both types of intervention or no intervention. Primary outcomes were cognition and educational achievement. Analysis was by intention to treat. No significant effects of supplementation were noted. Children in the intervention group received higher full-scale and verbal scale IQ scores and higher scores on the Peabody Picture Vocabulary Test and the verbal analogies and reading tests than children who did not receive intervention. School drop-out rates were higher in the non-stimulated stunted children than in children who were stimulated (29% vs. 15%). Overall, stunted non-stimulated participants had significantly poorer scores than the non-stunted group in 11 of 12 cognitive and educational tests. It may, therefore, be inferred that stunting in early childhood is associated with cognitive and educational deficits in late adolescence, which are reduced by stimulation at a young age.

Country

Jamaica (Kingston)

Sample

One hundred and three stunted and 64 non-stunted children aged 17–18 years

Intervention

Previously enrolled stunted 9–24-month-old children were assigned to four groups: control; supplementation; stimulation; supplementation and stimulation. Non-stunted children were enrolled and matched to control groups.

Supplementation comprised 1 kg of milk-based formula per week; stimulation comprised weekly one-hour home visit by a community health worker. Effects of these on cognition and education parameters were studied at 17–18 years.

Measures

Wechsler Adult Intelligence Scale for cognitive functions. Raven's progressive matrices for non-verbal reasoning. Corsi Blocks Test for visual-spatial working memory. Auditory working memory with the digit-span forwards and backwards sub-tests of the WAIS. Peabody Picture Vocabulary Test for verbal analogies. Wide-range achievement test for educational achievements (Mathematics). Socio-demographic information. Height, weight and body mass index (BMI).

Outcomes

Cognition and educational achievement.

Results

Supplementation had no effect on any outcome. Compared with no intervention, stimulation resulted in higher full-scale IQ scores and higher scores on the verbal sub-scale, Peabody Picture Vocabulary Test, verbal analogies and reading tests. School drop-out rates were higher in non-stimulated stunted children than in children who were stimulated (29% vs. 15%). Stunted non-stimulated participants had significantly poorer scores than the non-stunted group on 11 of 12 cognitive and educational tests.

Take-home messages

- Growth in the first two years of life is more important for later development than growth after age two.
- Along with preventive strategies, there is a need to increase stimulation of already undernourished children.

Doc # B041

Malmberg, L-E, Mwaura, P, Sylva, K (2011) Effects of a preschool intervention on cognitive development among East-African preschool children: A flexibly time-coded growth model.

Abstract

This study investigated the effects of the Madrasa Resource Centre (MRC), a child-centred intervention programme, on East-African (Kenya, Zanzibar and Uganda) preschool children's cognitive development. A total of 321 children (153 non-intervention and 168 intervention) participated in a cross-sequential study over three time points during preschool (mean ages 4.3, 6.0 and 7.1 years). A multi-level model (MLM; time points nested within children, nested within schools), in which time was coded flexibly (that is, a child's age was operationalised as months from start of the intervention), showed a beneficial curvilinear effect of the intervention programme on children's cognitive gains. A moderation analysis suggested that the effect of observed preschool quality (ECERS) was stronger in the intervention programme. The findings are discussed within the context of East-African preschool policy.

Country

Kenya, Tanzania/Zanzibar and Uganda

Sample

Three-hundred and twenty-one children aged 3–6 years at enrolment (168 MRC and 153 non-MRC)

Intervention

Madrasa Resource Centre programme (in line with constructivist theory and focuses on material, manipulation, choice, language and support), half a day, five days a week, for three years.

Measures

British Ability Scale II (block building, verbal comprehension, picture similarities)
African Child Intelligence Test (exclusion, closure, verbal meaning)
ECERS-R and ECERS-E

Outcomes

Age-residualised cognition scores calculated at three time points (mean ages 4.3, 6.0 and 7.1 years).
Preschool quality

Results

The MRC group had significantly higher cognitive scores than non-MRC children.
The change over time in the MRC group had an inverted U-shape, showing the intervention effect more accentuated around Time 2, but not accelerating as fast towards Time 3.
The magnitude of the change over time was stronger in Uganda than elsewhere, as Ugandan parents tended to send their more cognitively capable children to primary schools early.
Preschool quality was higher in the MRC group and had an overall positive effect on cognitive development.

Take-home messages

- MRC children in the three countries in East Africa showed significantly greater cognitive gains over a period of three years compared to non-MRC children.
- Quality in intervention schools was related to child outcomes.
- There were country-specific patterns in cognitive development highlighting the influence of contextual factors.

Doc # B091
Education Development Center, Inc. (EDC) (2009) Radio Instruction to Strengthen Education (RISE) in Zanzibar. *Report of the Education Development Center, Inc. (EDC)*

Abstract

Under project RISE the Ministry of Education and Vocational Training (MoEVT) of Zanzibar and Education Development Center Inc. USAID developed Interactive Radio Instruction (IRI), childhood teaching learning package-Tucheze Tujifunze (Tu Tu) in 2006.This unique intervention was aired weekly and aimed at improving access to education and quality of learning. The study attempted to measure gains among IRI beneficiaries across three delivery models of the programme. Baseline and outcome tests were administered to treatment and control-group samples. Results showed that IRI beneficiaries outperformed control subjects by 7.5 points. Test scores rose by three points in Kiswahili, and by two and 2.5 points for English and Mathematics, respectively. Learning gains among treatment girls were greater than gains made by boys. Both the non-formal model that used community and mentors and the formal model where classroom teachers were facilitators were found to be effective service models and scores of the intervention groups increased relative to control groups. Evidence indicated that IRI not only increased access to education, but also improved students'/ childrens' achievement scores.

Country.

Zanzibar

Sample

Treatment districts: North A in Unguja and Micheweni in Pemba participants of RISE; Control Group: North B in Unguja and Mkoani in Pemba.

Intervention

Interactive Radio Instruction (IRI) childhood teaching and learning package Tucheze Tujifunze (Tu Tu) comprised 79–99 episodes of 30 minutes, broadcast weekly. It was based on child-friendly pedagogy and the formal Zanzibar curriculum for preschool and children in grades one and two (10,000). Kiswahili language, Mathematics, English and basic life skills taught through songs, stories, problem-solving activities and self-directed exploration, delivered through informal, formal and combination models. Training of teachers, mentors, village leaders to facilitate participation in live programme, and using the guidebook of Tu Tu to maximise learning.

Measures

Background profile/demographic, household, education, school health facilities, and income expenditures. Relevant variables, district classroom/centre, teacher/ mentor, student/ child levels. Qualitative data during site visits.

Outcomes

Means/ ratios/ per cent for treatment groups (three models) and control groups for all variables analysed for significant differences (t test).
Baseline and outcome tests
Mean scores).

Results

Overall, the IRI group scored five points higher than the control group. The test scores of non-formal and formal groups increased by nine and 11 points, respectively, against control group. Girls scored lower than boys in the pre-test, but the average change in post-test scores of girls was higher than that of boys. Non-formal treatment group showed greater gains than the control group, despite adverse conditions of learning, and were closer to those of formal group.

Take-home messages

- IRI radio programming + early childhood education promote access to ECD and enhanced learning.
- IRI is an innovation worthy of scaling up.

Doc # B029
Martinez, S, Naudeau, S, Pereira, V (2012) *The promise of preschool in Africa: A randomized impact evaluation of ECD in rural Mozambique*. The World Bank/Save the Children Report.

Abstract

This study evaluated the impact of the Save the Children community- based preschool intervention in 30 rural communities of Mozambique in 2008–10.The detailed baseline survey across 76 communities (control and treatment), covering 2,000 households with preschool-aged children, community leaders, school teachers and first-grade pupils was conducted in 2008 and again in 2010 as an end-line survey. A battery of tests was used to measure the children's outcomes. Improved enrolment of children, enhanced participation in activities and improvement in all child-development domains were reported, except language. Caregivers showed improved caring practices and provided cognitive stimulation to the children. The access to centre-based preschool education relieved caregivers and older siblings from looking after the young ones, enabling them to engage in income-generating activities or pursue education. The experience, it was felt, was worth scaling up and replication after necessary adaptation across other provinces of Africa.

Country

Mozambique: Rural Gaza Province districts: Manjacaze, Xai Xai and Bilene

Sample

Seventy-six communities, 30 randomly assigned to treatment and 46 to control.
Two thousand households with children aged 36–59 months in 2008 (base line).
Other respondents from 76 communities: community leaders, school principals, first-grade teachers and first-graders (1,045).

Intervention

Community's inputs: space, local material, labour for construction and setting up of management-supervision committee. Family contribution of 50–80 US cents monthly for sustainability. Programme inputs. Financial and technical support under the programme for providing classrooms, children's toilets and safe drinking water and playgrounds. Continued capacity building of teachers' workshops, mentoring, coaching, learning circles and supportive supervision.
Structured curriculum, with school-readiness 3Rs, use of local language and Portuguese, multi-age/grade classrooms, play and learning materials. Parental education in healthcare, nutrition, childcare and general parenting.

Measures

Baseline and endline household survey
Baseline and endline survey of community leaders
Baseline and endline school/preschool survey
Child development Tests: Ages and Stages Questionnaires, Peabody Picture Vocabulary Test

Outcomes

Present Value Total Cost to work out per-child, per-month cost. Preschool enrolment, average days of attendance per week, hours-per-day participation, parental awareness of preschool availability.
Programme impact: linear-regression analysis for baseline characteristics, ASQ scores, EDI domains, TVIP scores, anthropometric measures.

Results

Enrolment rates increased significantly in treatment communities. Additional time spent by children at preschool per week. Significant improvement in child-development outcomes (cognitive, fine motor, socio-emotional), leading to higher levels of school-readiness. Primary-school enrolment of older siblings, and increased labour force of primary caregivers, enhanced awareness of caregivers of child and home stimulation.

Take-home messages

- Community participation resulted in effective pre-schooling at a relatively low cost
- Older siblings and caregivers were released for schooling and work

- Preschool expansion is a promising policy option

Doc # B002
Li, H, Barnhart, HX, Stein, AD, Martorell, R (2003) Effects of early childhood supplementation on the educational achievement of women.

Abstract

The longitudinal study (1969–99) assessed the effects of improved nutrition in early life on the educational achievement (EA) of adult women in rural Guatemala. A sample of 130 women aged 22–29 years was exposed to either Atole or Fresco nutrition supplements during prenatal and the first two years of their life. Assessment of general knowledge, numeracy and reading, comprehension and vocabulary was undertaken first in 1989 and then in 1999, with five tests to compute Educational Achievement EA. Outcome variables were categorised in quintiles. Analysis was based on proportional odd model. Overall, around 36% of the women completed primary school. Women exposed to Atole had better EA than those exposed to Fresco. On further analysis, by factoring in the treatment and schooling interaction, Atole was associated with improved EA only for those women who completed primary schooling and not for others.

Country

Guatemala (four Spanish-speaking villages in the eastern part)

Sample

Sample comprised 130 females (22–29 years) from four villages, stratified by size (two large and two small) that were covered in the study of INCAP during 1966–96, and randomised to receive either Atole or Fresco food supplements during prenatal and the first two years of their life.

Intervention

Nutrition supplementation: subjects exposed either to Atole high-energy and high-protein (53%, 91kcal and 6.4 g protein/100ml) or Fresco (47% 33kcl/100ml. no protein).
Both supplements fortified with vitamins and minerals given twice daily around the year to pregnant , lactating women and children up to the ages of seven years.

Measures

EA was computed using five tests assessing general knowledge, numeracy, reading, comprehension and vocabulary. Composite score for SES was constructed based on family possessions, parents' education and occupational levels.

Outcomes

Subjects of Atole or Fresco were categorised as treatment groups-TRT 1 or 2. EA scores and outcome variables were categorised into quintiles (five ordinal levels). Analysis was based on a proportional odds model, an extension of logistic regression for ordinal outcomes. First controlled for age, then age and SES, followed by schooling-GRADE (completion of primary school or not).
Finally, two interactional terms TRT x SES and TRT x GRADE model, to assess whether treatment effects were modified by SES or schooling.

Results

Women exposed to Atole during prenatal and early postnatal periods had significantly better EA than those exposed to Fresco after adjusting for SES and schooling. Atole subjects scored significantly higher than their Fresco counterparts for general knowledge, numeracy, comprehension and vocabulary, consistent with the results of the follow-up study when subjects were 13–19 years old.
Supplementation and schooling were independent predictors of EA, but the effects of schooling were of greater magnitude. Among women who did not complete primary school, Atole was not associated with EA, and for those who had completed primary school it resulted in improved EA.

Take-home messages

- Better nutrition during early childhood resulted in improved adult-education achievement, but only among those who completed primary school.

Doc # B027
Vermeersch, C, Kremer, M (2004). *School meals, educational achievement and school competition: Evidence from a randomized evaluation.* The World Bank Policy Research Working Paper.

Abstract

The paper presented an exhaustive review of subsidised school-meals programmes in developing countries. It examined, in particular, the effects of the school-meals programme of a Denmark-based non-governmental organisation (NGO), International Christelijk (ICS), implemented in 2000–02 in the rural preschools of Western Kenya. The impact of the breakfast programme on school participation was ascertained using an intention-to-treat estimator. From a pool of 50 preschools, 25 were randomly assigned to meal programmes and the rest formed a comparison group. It was found that more children participated in the treatment group than in the comparison group. Also, subsidising meals improved learning for children where teachers were more experienced. The programme benefited boys' weight, but not girls' anthropometric measurements. This study emphasised the importance of interaction between teacher quality and rates of school participation and other quality-related aspects of school, but not providing the meal alone.

Country

Kenya (two districts in the west: Busia and Tesco)

Sample

The 50 schools identified were randomly divided into two groups of 25 schools. Treatment group-meal provided, comparison group with no meal provision.

Intervention

ICS Funds: costs of 500ml porridge, nutrition value of 400 calories, made from protein-rich flour, sugar, corn oil and water, served as breakfast to pre-schoolers, transportation of rations, cooking utensils and salary of a women cook.
School: Storage and cooking space, maintenance of attendance of children and teachers.
Parents: firewood, serving cup for each child, overseeing implementation, setting up food committee.

Measures

Attendance records of children and teachers validated by repeated observations (13 in 2000–01)
Anthropometric measurements of children
Cognitive and achievement tests: 30-minute test, oral and written
Household / family survey and socioeconomic survey
Teacher profiles

Outcomes

Average school-participation rate pre- and post-programme across two groups; regression analyses
Factor analysis of teacher variables: education, experience; children's background variables: ethnic orientation, gender, family variables. Height-for-age, weight-for-age Z score: height and weight percentile. Price effects of price-per-day participation in school.

Results

Participation of children in treatment schools improved by 30%.
Meal-programme schoolchildren scored higher on curriculum tests than children in the comparison group, but only where the teachers were relatively experienced.
The school meal resulted in displaced teaching time and larger class size. Treatment schools raised their fees and the comparisons school reduced their fees.
Programme had an effect on boys' weight, but not that of girls.

Take-home messages

- The context in which a school-meal programme is implemented is very important: a programme that increases school participation, but in an environment with low teaching quality is likely to fail to translate into better educational achievement.

Doc # B016
Li, Q, Yan, H, Zeng, L, Cheng, Y, Liang, W, Dang, S Wang, Q, Tsuji, I(2009) Effects of maternal multi-micronutrient supplementation on the mental development of infants in rural western China: Follow-up evaluation of a double-blind, randomized, controlled trial.

Abstract

The study aimed to investigate the benefits of maternal multi-micronutrient supplementation during gestation on the mental and psychomotor development of infants. It was conducted in two rural counties in western China. A double-blind, randomised, controlled trial was carried out. Pregnant women (N = 5,828) were assigned randomly to receive multi-micronutrient, folic acid plus iron, or folic-acid supplementation daily from 14 weeks of gestation until delivery. A subset of the newborns (n = 1,305) was also taken for the three supplementation groups by measuring their mental and psychomotor development with the Bayley Scales of Infant Development, at three, six and 12 months of age. Multi-level analyses were used to compare the mental-development and psychomotor-development raw scores at three ages.
Multi-micronutrient supplementation was found to be associated with mean increases in mental development raw scores for infants at one year of age of 1.00 and 1.22 points, compared with folic acid only and folic acid plus iron supplementation, respectively. However, supplementation did not increase significantly the psychomotor-development raw scores up to one year of age. It can be concluded that, compared with iron and folic-acid supplementation, the administration of multi-micronutrients to pregnant women saw comparatively greater mental development of their children at one year of age.

Country

China (two rural counties of western China)

Sample

Five thousand, eight hundred and twenty-eight pregnant women; 1,305 newborns.

Intervention

Double-blind, cluster-randomised control trial. Pregnant women from assigned villages to three supplementation groups: daily folic acid (400 µg), folic acid and iron (400 µg and 60 mg, respectively), or multi-micronutrient supplements (five minerals and 10 vitamins) using random number tables. Supplements given from 14 weeks of pregnancy until delivery.

Measures

Baseline information of pregnant women. Motor and psychomotor development (MD and PD) of infants at three, six and 12 months of age using Bayley Scales of Infant Development. Information of infants on different parameters.

Outcomes

Mental and psychomotor indicators

Results

Index at 12 months	Score, mean (95% CI)			p
	Folic acid	Folic acid + iron	Multi-micronutrients	
Age adjusted MD raw score Difference	 103.33 1.09	 103.22 1.20	 104.42 Reference	.01
Multivariate-adjusted MD raw score Difference	 102.65 1	 102.44 1.22	 103.65 Reference	.02

Daily oral multi-micronutrient supplementation during pregnancy was consistently associated with increase in infants MD scores at one year of age. Mothers consuming ≥150 tablets, male infants and young mothers (<24 years at delivery) were significantly determinants found associated with increase in infants MD scores. Multi-micronutrient supplementation did not affect PD significantly.

Take-home messages

- Multi-micronutrient supplementation is preferable to supplementation with folic acid and iron or iron alone.

Doc # B039
Fernald, LCH, Hidrobo, M (2011) Effect of Ecuador's cash-transfer program (Bono de Desarrollo Humano) on child development in infants and toddlers: A randomized effectiveness trial.

Abstract

The study examined the effects of Ecuador's Bono de Desarollo Humano (BDH) an unconditional cash-transfer programme (CTP) on the health and development of very young children. It also explored whether BDH affected rural and urban families differently and attempted to examine the role of pathways such as health inputs and quality of parenting through which BDH could be operating. One rural and one urban community was randomly assigned to treatment and comparison groups that received BDH in 2004 and the other one began receiving the benefits in 2006. Monthly cash stipend of US$15, which accounted for a 6-10% increase in the household income, was given to the family. The sample was composed of children aged 12–35 months, numbering 797 in the treatment and 399 in the comparison group. The outcomes assessed were language skills, HAZ, and haemoglobin concentration.
There were no significant differences between the treatment and controlled groups in respect of mother or child baseline characteristics. The treatment effect on all child outcomes for the total sample was non-significant. In the rural areas, the significant treatment effect was noted for measure of language development, but not for HAZ and haemoglobin outcomes. The treatment group was more likely to access vitamin and iron supplementation and was provided with toys and other forms of stimulation.
The study provided evidence of significant benefits of Unconditional-Cash-Transfer (UCT) for language development and indicated that BDH/ Conditional-Cash-Transfer (CCT) intervention could have a greater effect on language and other child-development domains if it were not merely a cash-transfer programme, but also included child stimulation through parent education or high-quality day-care opportunities.

Country

Ecuador

Sample

The sample comprised children aged 12–35 months, randomly assigned to groups, 797 children in the treatment group and 399 children in the comparison groups. They were drawn from rural and urban communities receiving BDH.

Intervention

The BDH programme consisted of giving cash transfers of US$15 per month to mothers of children from low-income groups in the treatment parishes in 2004. The comparison-parishes BDH was given two years later.

Measures

Base line/follow-up survey. IDHDC- Shorter Spanish adaptive version of MacArthur-Bates. Communicative Development Inventory to assess early language skills. Height and haemoglobin measure. Food index. Home observation for measurement of the environment inventory.

Outcomes

Mean values of variables compared for treatment and control groups. IDHC-B, HAZ and haemoglobin counts used for assessing effect of BDH. Intent to treat approach to explore pathways through which BDH could work.

Results

Treatment effect on children outcomes for total sample was non-significant. In rural areas, treatment effect was significant for language scores and for receiving toy and vitamin supplements during last six months.

Take-home messages

- In rural areas, an UCT programme led to significantly better performance in terms of the number of words a child used and on the probability of the child combining two or more words.

Doc # B048

Fernald, LCH, Gertler, PJ, Neufeld, LM (2009) 10-year effect of Oportunidades, Mexico's conditional cash transfer programme, on child growth, cognition, language, and behaviour: A longitudinal follow-up study.

Summary

From seven states of Mexico, 506 low-income rural communities were chosen for Conditional Cash Transfer (CCT) programme (April 1998). Of these communities, 320 were randomly assigned to early intervention and, after a gap of 18 months, 186 to late-intervention treatment groups. The study investigated the effects of CCT on growth, cognition, language, and behaviour of children. After ten years of the programme, children aged 8–10 years from two groups—early intervention (n=1,093), and late intervention (n= 700)—were assessed for outcomes. The effects were ascertained through height for age, BMI, cognitive, language and behavioural scores. The comparisons between early- and late-treatment groups were also examined. The analysis revealed no differences between early and late groups for Z scores, BMI, cognitive or language- assessment scores .The inclusion in the programme at an early age and with an additional 18 months resulted in a reduced number of socio-emotional problems in children. The cumulative cash transfer was found to be positively associated with height, cognitive and language development and had negative association with behavioural problems. Independent of cash received, inclusion in the programme before the age of three years was found to result in improved HAZ scores for children whose mothers had no formal education.

Country

Mexico

Sample

Out of 506 rural communities selected for intervention, 320 communities were randomly assigned to early intervention (April 1998) and 186 communities to late-intervention groups (October 1999).

After ten years, children aged 8–10 years who were recipients of Oportunidades from two groups composed the sample for assessing outcomes (early Intervention=1,093; late intervention=700).

Intervention

Female head of household was given the cash transfer, adding 20–30% to the household income Conditional criteria: children attending school, family members availing themselves of preventive medical care, and participation in health-education talks. Once every two months, a fixed stipend for food, educational scholarship for school-aged children was disbursed. Food supplements: milk-based fortified food for pregnant and lactating women, children 6–24 months, and low body weight aged 2–4 years.

Measures

Anthropometry: height and weight. Wechsler Abbreviated scale. Adapted Strength and Difficulties Questionnaire: interview of mothers.

Outcomes

Height and weight for age, BMI. Cognitive, language and behavioural scores. Multivariate regression and t test: comparisons across groups

Results

Early enrolment in CCT reduced behavioural problems for all children in the early-treatment group as compared to the late-treatment group.

There were no differences found between the two groups in BMI for age Z scores, language and cognitive outcomes.

Independent of CCT, for additional 18 month and enrolment before the age of three years resulted in improved child growth, particularly for children whose mothers had no education.

Take-home messages

- Early enrolment in Mexico’s Oportunidades programme reduced behavioural problems for all children in the early-treatment group.
- An additional 18 months in the programme for children whose mothers had no education resulted in improved child growth in HAZ score, independent of cash received.

Doc # B055

Behrman, JR, Cheng, Y, Todd, PE (2004) Evaluating preschool programs when length of exposure to the program varies: A nonparametric approach.

Abstract

The study investigated effectiveness of the Proyecto de Desarollo Infantil (PIDI), an early childhood development programme for children (6–72 months) from poor urban habitations in Bolivia. The intervention package provided healthcare, nutrition, education, parenting skills and grants for upgrading home facilities. Non-experimental data were used to ascertain the impact of the programme on cognitive, psychosocial and anthropometric outcomes. Impacts were found to be highly dependent on age at joining the programme and duration of the exposure.

Comparison across three groups: children in the feeder area, but not in the programme; children in the programme for more than one month; and children in the same area without the programme, revealed that estimates were robust for significant positive effects of PIDI on cognitive and psychosocial outcomes with more than seven months' exposure. The age patterns of effects, however, differed slightly from the comparison group. Cost–benefit analysis based on estimates of wage studies indicated that the programme was likely to give high rates of return.

Country

Bolivia

Sample

Representative sample of entire participating child population.

Two comparison groups were selected from random stratified sample households:

A: with children in the age range of beneficiaries from feeder, but not in the programme.

B: with at least one child of the age range served within a three-block radius without the programme.

Intervention

Package of services comprised full day-care centre with 1:5 adult-child ratio, nutrition, healthcare, education, and training in childcare for mothers. Loan/grant up to US$500 for upgrading home environment.

Measures

Anthropometric measures: height-for-age and weight-for-age.

Psychosocial and cognitive development: scores on battery of tests for various domains of development.

Parental and child characteristics.

Outcomes

Generalised matching estimator developed for non-random selectivity into the programme.

Time/age at which the programme was made available to the child.

Variation in duration of time spent in the programme.

Results

The test score outcomes for bulk-motor and fine-motor skills, language and auditory competencies were significantly correlated with each other.

Height and weight percentile measures were positively correlated. Height-for-age percentile is slightly positively correlated with test-score-outcome measures.

Test-score gain depended strongly on duration of exposure and positive effects were found only after seven months and further increased with longer duration.

Cost estimates were approximately US$43 per-child, per-month. A cost–benefit analysis indicated that expected benefit of IPDI overweighed the costs by a significant amount.

Take-home messages

- Test-score gains depended on duration of exposure to the PIDI programme, which was aimed at improving early cognitive skills and nutrition.
- Positive effects were observed in children who participated for at least seven months and increasing effects observed with longer durations, although the impacts on the anthropometric outcomes were not precisely measured. .

Appendix 4: Studies excluded in final screening

Year	Author(s)	Title	Country
2007	Arora, S, Bharti, S, Sharma, S	Comparative study of cognitive development of ICDS and non-ICDS children (3–6 Years)	India
2002	le Roux, W	The challenges of change: A tracer study of San preschool children in Botswana	Botswana
2012	Bibi, W, Ali, A	The impact of pre-school education on the academic achievements of primary school students	Pakistan

Appendix 5: Methods adopted to calculate effect sizes

We first calculated Cohen's *d* according to equation (1):

$$\text{Cohen's } d = \frac{M_1 - M_2}{SD_{pooled}} \quad (1)$$

After establishing the Cohen's *d*, we calculated the unbiased effect-size estimate according to Hedges and Olkin's (1985) correction. The correction is shown below in equation *(2)*, in which *N* represents the total sample size on which *d* is based.

$$d_{unbiased} = \left(1 - \frac{3}{4(N-2)-1}\right) \times d \quad (2)$$

If there were multiple achievement tests conducted to examine the effects of one intervention, multiple unbiased effect sizes were calculated for this intervention. We then used the average value of the multiple unbiased effect sizes related to this intervention as the index of the unbiased effect size of this intervention.

We further calculated the average effect size (d_+) for each type of interventions using a weighted average based on the variance of unbiased effect sizes ($\sigma^2_{(d)}$). The variance of effect sizes is calculated using equation *(3)*, in which *ns* refer to the sample size of two experimental groups. The variance estimate achieved is placed into equation *(4)* to obtain the weighted average effect size (*di* is the unbiased effect size for study *i*).

$$\hat{\sigma}^2_{d_i} = \frac{n_i^e + n_i^c}{n_i^e n_i^c} + \frac{d_i^2}{2\left(n_i^e + n_i^c\right)} \quad (3)$$

$$d_+ = \frac{\sum_{i=1}^{k} \frac{d_i}{\hat{\sigma}^2_{d_i}}}{\sum_{i=1}^{k} \frac{1}{\hat{\sigma}^2_{d_i}}} \quad (4)$$

Finally, to do the test of homogeneity of effect sizes of a group of interventions, the statistic *Q* is used. Equation *(5)* shows how this test is calculated.

$$Q = \sum_{i=1}^{k} \frac{(d_i - d_+)^2}{\hat{\sigma}^2_{d_i}} \quad (5)$$

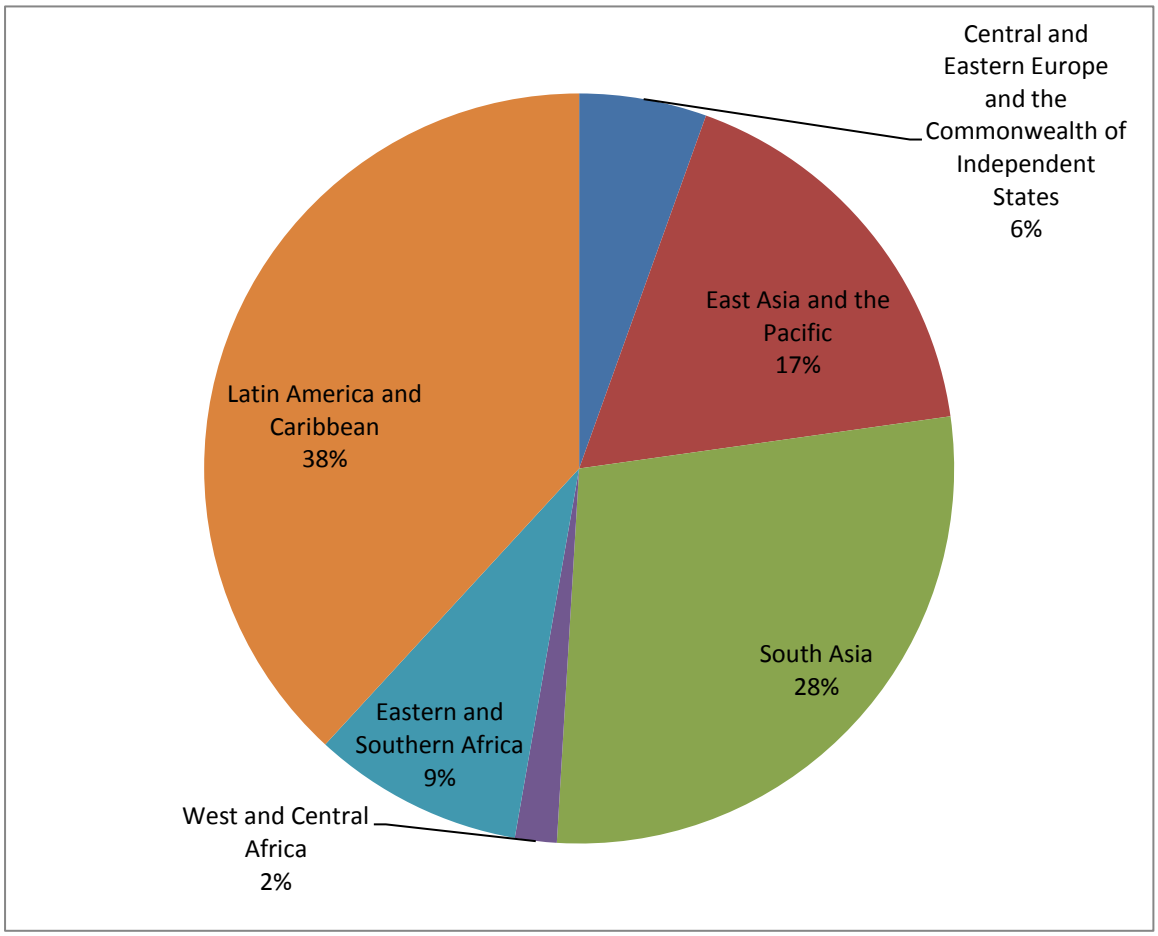
Appendix 6a: Number of developing-country studies included in the final sample (*N* = 111)

Location of Intervention	No. of Studies
Central and Eastern Europe and the Commonwealth of Independent States	*5*
Albania	**1**
Turkey	**4**
East Asia and the Pacific	*20*
Cambodia	**2**
China	**4**
Indonesia	**6**
Myanmar	**1**
Philippines	2
Thailand	1
Vietnam	*4*
South Asia	*31*
Bangladesh	**13**
India	13
Nepal	**5**
West and Central Africa	*2*
Cape Verde and Guinea	**1**
Gambia	**1**
Eastern and Southern Africa	*10*
Botswana	1
Ethiopia	2
Kenya	1
Kenya, Uganda and Tanzania/Zanzibar	2
Mozambique	1
Tanzania/Zanzibar	2
Zambia	**1**
Latin America and the Caribbean	*42*
Bolivia	1
Brazil	2
Chile	5
Colombia	3
Costa Rica	1

Ecuador	2
Guatemala	4
Honduras	1
Jamaica	8
Mexico	7
Nicaragua	2
Paraguay	1
Peru	2
St Lucia	1
Uruguay	2
More than one region	**1**
Bangladesh, The Democratic Republic of the Congo, Tajikistan and Yemen	1
Total: 40 Countries	**111**

Appendix 6b: Regions where the developing-country studies were conducted

(*N* = 111)



Appendix 7: Number of developed-country studies included in the final sample (*n* = 142)

Location of Intervention	No. of Studies
Australia	7
Canada	6
Finland	1
Germany, Hungary and Spain	1
Hong Kong	4
Hungary	1
Ireland	1
Israel	3
Italy	2
Japan	1
New Zealand	1
Norway	4
Slovenia	1
Spain	2
Sweden	3
Switzerland	1
Taiwan	1
The Netherlands	1
UK	13
USA	88
Total: 20 Countries	**142**

Appendix 8: List of developing-country studies by intervention type

	Doc #	Year	Author	Title	Location
Parent-focused interventions *(n = 25)*					
Parent-focused support/training/education ***(n = 5)***					
	B004*	2007	Aboud, FE	Evaluation of an early childhood parenting program in rural Bangladesh. *Journal of Health, Population and Nutrition,* 25(1): 3–13.	Bangladesh
	B021*	2007	Jin, X, Sun, Y, Jiang, F, Ma, J, Morgan, C, Shen, X	"Care for Development" intervention in rural China: A prospective follow-up study. *Journal of Developmental & Behavioral Pediatrics* 28(3): 213–218.	China
	S006	2008	Pesce, C, Moraga, M, Mingo, V	*Programa de estimulación del desarrollo infantil "Juguemos con nuestros hijos"* (Serie reflexiones: Infancia y Adolescencia N˚7). UNICEF.	Chile
	B022	2004	Klein, PS, Rye, H	Interaction-oriented early intervention in Ethiopia: The MISC Approach. *Infants and Young Children* 17(4); 340–354.	Ethiopia
	B037*	2013	Vazir, S, Engle, P, Balakrishna, N, Griffiths, P L, Johnson, SL, Creed-Kanashiro, H, Fernandez Rao, S, Shroff, MR, Bentley, ME	Cluster-randomized trial on complementary and responsive feeding education to caregivers found improved dietary intake, growth and development among rural Indian toddlers. *Maternal & Child Nutrition* 9(1): 99–117.	India
Parent-focused support/training/education +infant/child stimulation ***(n = 14)***					
	B092*	2012	Aboud, FE, Singla, DR, Nahil, MI, Borisova, I	*Parenting program for birth—3-year-old children in rural Bangladesh to address early childhood health, growth and development*. Unpublished manuscript.	Bangladesh
	B053*	2006	Hamadani, JD, Huda, SN, Khatun, F, Grantham-McGregor, SM	Psychosocial stimulation improves the development of undernourished children in rural Bangladesh. *The Journal of Nutrition* 136(10): 2,645–2,652.	Bangladesh
	B073*	2009	Nahar, B, Hamadani, J D, Ahmed, T, Tofail, F, Rahman, A, Huda, SN, Grantham-McGregor, SM	Effects of psychosocial stimulation on growth and development of severely malnourished children in a nutrition unit in Bangladesh. *European Journal of Clinical Nutrition* 63: 725–731.	Bangladesh

	B007*	2003	Eickmann, SH, Lima, ACV, Guerra, MQ, Lima, MC, Lira, PIC, Huttly, SRA, Ashworth, A	Improved cognitive and motor development in a community-based intervention of psychosocial stimulation in northeast Brazil. *Developmental Medicine & Child Neurology* 45(8): 536–541.	Brazil
	B081	2010	Lozoff, B, Smith, JB, Clark, KM, Perales, CG, Rivera, F, Castillo, M	Home intervention improves cognitive and social-emotional scores in iron-deficient anemic infants. *Pediatrics* 126(4): e884-e894.	Chile
	B018*	2003	Gardner, JM, Walker, SP, Powell, CA, Grantham-McGregor, S	A randomized controlled trial of a home-visiting intervention on cognition and behavior in term low birth weight infants. *The Journal of Pediatrics*, 143(5): 634–639.	Jamaica
	B036*	2010	Walker, S P, Chang, SM, Younger, N, Grantham-McGregor, SM	The effect of psychosocial stimulation on cognition and behavior at 6 years in a cohort of term, low-birthweight Jamaican children. *Developmental Medicine & Child Neurology* 52(7): e148–e154.	Jamaica
	B042*	2004	Walker, SP, Chang, SM, Powell, CA, Grantham-McGregor, SM	Psychosocial intervention improves the development of term low-birth-weight infants. *The Journal of Nutrition* 134(6): 1,417–1,423.	Jamaica
	B074*	2004	Powell, C, Baker-Henningham, H, Walker, S, Gernay, J, Grantham-McGregor, S	Feasibility of integrating early stimulation into primary care for undernourished Jamaican children: Cluster randomised controlled trial. *BMJ: British Medical Journal* 329(89).	Jamaica
	B066	2012	Janssens, W, Rosemberga, C	*The impact of a Caribbean home-visiting child development program on cognitive skills*. Amsterdam, The Netherlands: Amsterdam Institute for International Development (AIID).	Saint Lucia
	B109*	2008	Kotaman, H	Impacts of dialogical storybook reading on young children's reading attitudes and vocabulary development. *Reading Improvement* 45(2): 55–61.	Turkey
	B045	2001	Kagitcibasi, C, Sunar, D, Bekman, S	Long-term effects of early intervention: Turkish low-income mothers and children. *Journal of Applied Developmental Psychology* 22(4), 333–361.	Turkey
	B083	2009	Kagitcibasi, C, Sunar, D, Bekman, S, Baydar, N, Cemalcilar, Z	Continuing effects of early enrichment in adult life: The Turkish Early Enrichment Project 22 years later. *Journal of Applied Developmental Psychology* 30(6): 764–779.	Turkey

	B001*	2005	Watanabe, K, Flores, R, Fujiwara, J, Tran, LTH	Early childhood development interventions and cognitive development of young children in rural Vietnam. *The Journal of Nutrition* 135(8): 1,918–1,925.	Vietnam
Parent-focused support/training/education + infant/child stimulation + nutrition ***(n = 6)***					
	B068	2004	de Figueroa, CN, Ramirez, MIM, Urquía, JBM	*The future will be better: A tracer study of CCF's Early Stimulation Programme in Honduras*. The Hague: Bernard van Leer Foundation.	Honduras
	B046*	2005	Gardner, JM, Powell, CA, Baker-Henningham, H, Walker, SP, Cole, TJ, Grantham-McGregor, SM	Zinc supplementation and psychosocial stimulation: Effects on the development of undernourished Jamaican children. *The American Journal of Clinical Nutrition* 82(2): 399–405.	Jamaica
	B050*	2000	Walker, SP, Grantham-McGregor, SM, Powell, CA, Chang, SM	Effects of growth restriction in early childhood on growth, IQ, and cognition at age 11 to 12 years and the benefits of nutritional supplementation and psychosocial stimulation. *The Journal of Pediatrics* 137(1): 36–41.	Jamaica
	B051*	2005	Walker, SP, Chang, SM, Powell, CA, Grantham-McGregor, SM	Effects of early childhood psychosocial stimulation and nutritional supplementation on cognition and education in growth-retarded Jamaican children: Prospective cohort study. *The Lancet*, 366(9499):1804-1807.	Jamaica
	B052*	1997	Grantham-McGregor, SM Walker, SP, Chang, SM, Powell, CA	Effects of early childhood supplementation with and without stimulation on later development in stunted Jamaican children. *The American Journal of Clinical Nutrition* 66(2): 247–253.	Jamaica
	B035*	2011	Aboud, FE, Akhter, S	A cluster-randomized evaluation of a responsive stimulation and feeding intervention in Bangladesh. *Pediatrics* 127(5): e1,191–e1,197.	Bangladesh
Child-focused educational interventions *(n = 32)*					
Pre-primary or other ECE programme ***(n = 26)***					
	B057*	2012	Rao, N, Sun, J, Pearson, V, Pearson, E, Liu, H, Constas, MA, Engle, PL	Is something better than nothing? An evaluation of early childhood programs in Cambodia. *Child Development* 83(3): 864–876.	Cambodia
	B071*	2009	Nonoyama-Tarumi, Y, Bredenberg, K	Impact of school readiness program interventions on children's learning in Cambodia. *International Journal of Educational Development* 29(1): 39–45.	Cambodia

	B056*	2012	Rao, N, Sun, J, Zhou, J, Zhang, L	Early achievement in rural China: The role of preschool experience. *Early Childhood Research Quarterly* 27(1): 66–76.	China
	S004	1998	Bralic Escribar, S	*Evaluación de Programas de Educación Parvularia en Chile Resultados y Desafíos*. Chile: Republica de Chile—Ministerio de Education Division de Education.	Chile
	B085*	2006	Rolla, A, Arias, M, Villers, R, Snow, C	Evaluating the impact of different early literacy interventions on low-income Costa Rican kindergarteners. *International Journal of Educational Research* 45(3): 188–201.	Costa Rica
	B059	2009	He, F, Linden, LL, MacLeod, M	*A better way to teach children to read? Evidence from a randomized controlled trial*. Unpublished manuscript, Columbia University, USA.	India
	B065*	2010	Piramal, R, Law, J	Evaluating a programme to enhance vocabulary development in pre-schoolers. *International Journal of Language & Communication Disorders* 36(s1): 222–227.	India
	B005*	2006	Aboud, FE	Evaluation of an early childhood preschool program in rural Bangladesh. *Early Childhood Research Quarterly* 21(1): 46–60.	Bangladesh
	B006*	2008	Moore, AC, Akhter, S, Aboud, FE	Evaluating an improved quality preschool program in rural Bangladesh. *International Journal of Educational Development* 28(2): 118–131.	Bangladesh
	B015*	2009	Opel, A, Ameer, SS, Aboud, FE	The effect of preschool dialogic reading on vocabulary among rural Bangladeshi children. *International Journal of Educational Research* 48(1): 12-20.	Bangladesh
	B084*	2008	Aboud, FE, Hossain, K, O'Gara, C	The Succeed Project: Challenging early school failure in Bangladesh. *Research in Comparative and International Education, 3*(3), 295–307.	Bangladesh
	B087*	2011	Aboud, FE, Hossain, K	The impact of preprimary school on primary school achievement in Bangladesh. *Early Childhood Research Quarterly* 26(2): 237–246.	Bangladesh
	B063*	2012	American Institutes for Research	*Getting Ready for School: A child-to-child approach, programme evaluation for year one grade one outcomes*. New York: UNICEF.	Bangladesh, the Democratic Republic of the Congo, Tajikistan and Yemen

	B008*	2008	Mwaura, PAM, Sylvab, K, Malmberg, L-E	Evaluating the Madrasa preschool programme in East Africa: A quasi-experimental study. *International Journal of Early Years Education* 16(3): 237–255.	Kenya, Uganda, and Tanzania/ Zanzibar
	B041*	2011	Malmberg, L-E, Mwaura, P, Sylva, K	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): 124–133.	Kenya, Tanzania/ Zanzibar and Uganda
	B091*	2009	Education Development Center, Inc. (EDC)	*Radio Instruction to Strengthen Education (RISE) in Zanzibar*. Boston: EDC.	Tanzania/ Zanzibar
	B095	2008	Baydar, N, Kağitçibaşi, C, Küntay, AC, Gökşen, F	Effects of an educational television program on preschoolers: Variability in benefits. *Journal of Applied Developmental Psychology* 29: 349–360.	Turkey
	B072	2001	Jaramillo, A, Tietjen, K.	*Early childhood development in Africa: Can we do more for less?* (Working Paper Series). World Bank Africa Region Human Development.	Cape Verde and Guinea
	B029*	2012	Martinez, S, Naudeau, S, Pereira, V	*The promise of preschool in Africa: A randomized impact evaluation of ECD in rural Mozambique*. New Delhi, India: International Initiative for Impact Evaluation (3ie).	Mozambique
	B107*	2002	Taiwo, AA, Tyolo, JB	The effect of pre-school education on academic performance in primary school: A case study of grade one pupils in Botswana. *International Journal of Educational Development* 22(2): 169–180.	Botswana
	B108*	2011	Woldehanna, T	The effects of early childhood education attendance on cognitive development: Evidence from urban Ethiopia. Paper for the CSAE Conference 2011 on Economic Development in Africa at St Catherine's College, Oxford, 20–22 March 2011.	Ethiopia
	B110	2008	Berlinski, S, Galiani, S, Manacorda, M	Giving children a better start: Preschool attendance and school-age profiles. *Journal of Public Economics* 92(5–6): 1,416–1,440.	Uruguay
	S001	2000	Mara, S, Erramouspe, R, Pazos, L, Cabrio, S, Alesina, L, Ibañez, W	*Estudio de evaluación de impacto de la educación inicial en el Uruguay*. Uruguay: Administración Nacional de Educación Primaria.	Uruguay

	B093	2003	Save the Children	*What's the difference? The impact of early childhood development programs. A study from Nepal of the effects for children, their families and communities.* Kathmandu, Nepal: Save the Children.	Nepal
	B094	2004	Save the Children	*Early childhood care and development: A positive impact, Myanmar. A study from Myanmar of the effects for children, their families and communities.* Myanmar: Save the Children.	Myanmar
	B104*	2012	Zuilkowski, SS, Fink, G, Moucheraud, C, Matafwali, B	Early childhood education, child development and school readiness: Evidence from Zambia. *South African Journal of Childhood Education* 2(2): 117–136.	Zambia
Infant/toddler stimulation (n = 5)					
	B019	2002	Taneja, V, Sriram, S, Beri, R S, Sreenivas, V, Aggarwal, R, Kaur, R, Puliyel, JM	"Not by bread alone:" Impact of a structured 90-minute play session on development of children in an orphanage. *Child: Care, Health & Development* 28(1): 95–100.	India
	B020	2005	Taneja, V, Aggarwal, R, Beri, RS, Puliyel, JM	Not by Bread Alone project: A 2-year follow-up report. *Child: Care, Health & Development* 31(6): 703–706.	India
	B082*	2009	Nair, MKC, Philip, E, Jeyaseelan, L, George, B, Mathews, S, Padma, K	Effect of Child Development Centre model early stimulation among at-risk babies—A randomized controlled trial. *Indian Pediatrics,* 46(Supplement): S20–S26.	India
	B060*	2012	Leroy, JL, Gertler, P, Martinez, S	*The impact of day care on maternal labor supply and child development in Mexico: Final data analysis report*. Mexico: Instituto Nacional de Salud Pública.	Mexico
	B033*	2011	Berument, SK, Sönmez, D, Eyüpog˘lu, H	Supporting language and cognitive development of infants and young children living in children's homes in Turkey. *Child: Care, health and development* 38(5): 743–752.	Turkey
Pre-primary education + infant/toddler stimulation (n = 1)					
	B058	2012	Hasan, A., Jung, H.	*The Indonesia Early Childhood Education and Development (ECED) Project: Findings and Policy Recommendations* (Policy Brief). Jakarta, Indonesia: World Bank.	Indonesia
Nutrition and health interventions *(n = 32)*					
	B002	2003	Li, H, Barnhart, HX, Stein, AD, Martorell, R	Effects of early childhood supplementation on the educational achievement of women. *Pediatrics* 112(5): 1,156–1,162.	Guatemala

1.	B009*	1993	Pollitt, E, Gorman, KS, Engle, P L, Martorell, R, Rivera, J, Wachs, TD, Scrimshaw, NS	Early supplementary feeding and cognition: Effects over two decades *Monographs of the Society for Research in Child Development* 58(7, Serial No. 253): 1–118.	Guatemala
2.	B011*	2009	Maluccio, JA, Hoddinott, J, Behrman, JR, Martorell, R, Quisumbing, AR, Stein, AD	The impact of improving nutrition during early childhood on education among Guatemalan adults. *The Economic Journal* 119(537): 734–763.	Guatemala
3.	B098	2008	Stein, AD, Wang, M, DiGirolamo, A, Grajeda, R, Ramakrishnan, U, Ramirez-Zea, M, Yount, K, Martorell, R	Nutritional supplementation in early childhood, schooling, and intellectual functioning in adulthood: A prospective study in Guatemala. *Achieve of Pediatrics & Adolescent Medicine* 162(7): 612–618.	Guatemala
4.	B024	2004	Attanasio, OP, Vera-Hernández, M	*Medium and long run effects of nutrition and child care: Evaluation of a community nursery programme in rural Colombia*. London: The Institute for Fiscal Studies.	Columbia
5.	B017*	2010	Caulfield, LE, Putnick, DL, Zavaleta, N, Lazarte, F, Albornoz, C, Chen, P, DiPietro, JA, Bornstein, MH	Maternal gestational zinc supplementation does not influence multiple aspects of child development at 54 mo of age in Peru. *The American Journal of Clinical Nutrition* 92(1): 130–136.	Peru
6.	B030	2012	Mitter, SS, Oriá, RB, Kvalsund, MP, Pamplona, P, Joventino, ES, Mota, R MS, Goncalves, DC, Patrick, PD, Guerrant, RL, Lima, AAM	Apolipoprotein E4 influences growth and cognitive responses to micronutrient supplementation in shantytown children from northeast Brazil. *Clinics* 67(1): 11-18.	Brazil
7.	B049*	2001	Castillo-Durán, C, Perales, C G, Hertrampf, ED, Marín, VB, Rivera, FA, Icaza, G	Effect of zinc supplementation on development and growth of Chilean infants. *The Journal of Pediatrics* 138(2): 229–235.	Chile

8.	B080*	2003	Lozoff, B, De Andraca, I, Castillo, M, Smith, JB, Walter, T, Pino, P	Behavioral and developmental effects of preventing iron-deficiency anemia in healthy full-term infants. *Pediatrics* 112(4): 846–854.	Chile
9.	B027	2004	Vermeersch, C, Kremer, M	*School meals, educational achievement and school competition: Evidence from a randomized evaluation*. Unpublished manuscript.	Kenya
10.	B102*	2013	van der Merwe, LF, Moore, SE, Fulford, AJ, Halliday, KE, Drammeh, S, Young, S, Prentice, AM	Long-chain PUFA supplementation in rural African infants: A randomized controlled trial of effects on gut integrity, growth, and cognitive development. *American Journal of Clinical Nutrition* 97(1): 45–57.	Gambia
11.	B044	2001	Stoltzfus, RJ, Kvalsvig, JD, Chwaya, HM, Montresor, A, Albonico, M, Tielsch, JM, Savioli, L, Pollitt, E	Effects of iron supplementation and anthelmintic treatment on motor and language development of preschool children in Zanzibar: Double blind, placebo controlled study. *BMJ: British Medical Journal 323*: 1,389–1,393.	Tanzania/ Zanzibar
12.	B012*	2011	Christian, P, Morgan, ME, Murray-Kolb, L, LeClerq, SC, Khatry, SK, Schaefer, B, Cole, PM, Katz, J, Tielsch, JM	Preschool iron-folic acid and zinc supplementation in children exposed to iron-folic acid in utero confers no added cognitive benefit in early school-age. *The Journal of Nutrition* 141(11): 2,042–2,048.	Nepal
13.	B096*	2010	Christian, P, Murray-Kolb, LE, Khatry, SK, Katz, J, Schaefer, BA, Cole, PM, Leclerq, SC, Tielsch, JM	Prenatal micronutrient supplementation and intellectual and motor function in early school-aged children in Nepal. *The Journal of the American Medical Association* 304(24): 2,716–2,723.	Nepal
14.	B013*	2012	Murray-Kolb, LE, Khatry, S K, Katz, J, Schaefer, BA, Cole, PM, LeClerq, SC, Morgan, ME, Tielsch, JM, Christian, P	Preschool micronutrient supplementation effects on intellectual and motor function in school-aged Nepalese children. *Archives of Pediatrics & Adolescent Medicine* 166(5): 404–410.	Nepal

15.	B014	2011	Siegel, EH, Kordas, K, Stoltzfus, RJ, Katz, J, Khatry, SK, LeClerq, SC, Tielsch, JM	Inconsistent effects of iron-folic acid and/or zinc supplementation on the cognitive development of infants. *Journal of Health, Population and Nutrition* 29(6): 593–604.	Nepal
16.	B003*	2011	Pongcharoen, T, DiGirolamo, AM, Ramakrishnan, U, Winichagoon, P, Flores, R, Martorell, R.	Long-term effects of iron and zinc supplementation during infancy on cognitive function at 9 y of age in northeast Thai children: A follow-up study. *The American Journal of Clinical Nutrition* 93(3): 636–643.	Thailand
17.	B016*	2009	Li, Q, Yan, H, Zeng, L, Cheng, Y, Liang, W, Dang, S, Wang, Q, Tsuji, I	Effects of maternal multimicronutrient supplementation on the mental development of infants in rural Western China: Follow-up evaluation of a double-blind, randomized, controlled trial. *Pediatrics* 123: e685–e692.	China
18.	B099*	2010	Chen, C-M, Wang, Y-Y, Chang, S-Y	Effect of in-home fortification of complementary feeding on intellectual development of Chinese children. *Biomedical and Environmental Sciences* 23(2): 83–91.	China
19.	B031*	2011	Nga, TT, Winichagoon, P, Dijkhuizen, MA, Khan, NC, Wasantwisut, E, Wieringa, FT	Decreased parasite load and improved cognitive outcomes caused by deworming and consumption of multi-micronutrient fortified biscuits in rural Vietnamese schoolchildren. *The American Journal of Tropical Medicine and Hygiene* 85(2); 333–340.	Vietnam
20.	B032	2009	Lien, DTK, Nhung, BT, Khan, NC, Hop, LT, Nga, NTQ, Hung, NT, Kiers, J, Shigeru, Y, te Biesebeke, R	Impact of milk consumption on performance and health of primary school children in rural Vietnam. *Asia Pacific Journal of Clinical Nutrition 18(3)*: 326–334.	Vietnam
21.	B038*	2004	Schmidt, MK, Muslimatun, S, West, CE, Schultink, W, Hautvast, JGAJ	Mental and psychomotor development in Indonesian infants of mothers supplemented with vitamin A in addition to iron during pregnancy. *British Journal of Nutrition* 91: 279–285.	Indonesia
22.	B043	1997	Pollitt, E, Watkins, WE, Husaini, MA	Three-month nutritional supplementation in Indonesian infants and toddlers benefits memory function 8 y later. *The American Journal of Clinical Nutrition* 66(6): 1,357–1,363.	Indonesia
23.	B077*	2004	Lind, T, Lönnerdal, B, Stenlund, H, Gamayanti, IL, Ismail, D, Seswandhana, R, Persson, L-Å	A community-based randomized controlled trial of iron and zinc supplementation in Indonesian infants: Effects on growth and development. *The American Journal of Clinical Nutrition* 80(3): 729–736.	Indonesia

24.	B100*	2012	Prado, EL, Alcock, KJ, Muadz, H, Ullman, MT, Shankar, AH	Maternal multiple micronutrient supplements and child cognition: A randomized trial in Indonesia. *Pediatrics* 130(3): e536–e546.	Indonesia
25.	B103*	1993	Idjradinata, P, Pollitt, E	Reversal of developmental delays in iron-deficient anaemic infants treated with iron. *The Lancet* 341: 1–4.	Indonesia
26.	B062	2006	Bobonis, GJ, Miguel, E, Puri-Sharma, C	Anemia and school participation. *Journal of Human Resources* XLI(4): 692–721.	India
27.	B075	2004	Black, MM, Sazawal, S, Black, RE, Khosla, S, Kumar, J, Menon, V	Cognitive and motor development among small-for-gestational-age infants: Impact of zinc supplementation, birth weight, and caregiving practices. *Pediatrics* 113(5): 1,297–1,305.	India
28.	B078*	2005	Taneja, S, Bhandari, N, Bahl, R, Bhan, MK	Impact of zinc supplementation on mental and psychomotor scores of children aged 12 to 18 months: A randomized, double-blind trial. *The Journal of Pediatrics* 146(4): 506–511.	India
29.	B097*	2008	Tofail, F, Persson, LA, El Arifeen, S, Hamadani, JD, Mehrin, F, Ridout, D, Ekström EC, Huda SN, Grantham-McGregor, SM	Effects of prenatal food and micronutrient supplementation on infant development: A randomized trial from the Maternal and Infant Nutrition Interventions, Matlab (MINIMat) study *The American Journal of Clinical Nutrition* 87(3): 704–711.	Bangladesh
30.	B076*	2001	Hamadani, JD, Fuchs, GJ, Osendarp, SJM, Khatun, F, Huda, SN, Grantham-McGregor, SM	Randomized controlled trial of the effect of zinc supplementation on the mental development of Bangladeshi infants. *The American Journal of Clinical Nutrition* 74(3): 381–386.	Bangladesh

31.	B079*	2002	Hamadani, JD, Fuchs, GJ, Osendarp, SJM, Huda, SN, Grantham-McGregor, SM	Zinc supplementation during pregnancy and effects on mental development and behaviour of infants: A follow-up study. *The Lancet* 360: 290–294.	Bangladesh
Interventions with income supplementation *(n = 11)*					
Cash transfers *(n = 6)*					
32.	B039*	2011	Fernald, LCH, Hidrobo, M	Effect of Ecuador's cash transfer program (Bono de Desarrollo Humano) on child development in infants and toddlers: A randomized effectiveness trial. *Social Science & Medicine* 72(9): 1,437–1,446.	Ecuador
33.	B040*	2010	Paxson, C, Schady, N	Does money matter? The effects of cash transfers on child development in rural Ecuador. *Economic Development and Cultural Change* 59(1): 187–229.	Ecuador
34.	B028	2012	Macours, K, Schady, N, Vakis, R	Cash transfers, behavioral changes, and cognitive development in early childhood: Evidence from a randomized experiment. *American Economic Journal: Applied Economics* 4(2): 247–73.	Nicaragua
35.	B090	2008	Macours, K, Schady, N, Vakis, R	*Can conditional cash transfer programs compensate for delays in early childhood development?* Unpublished manuscript, World Bank.	Nicaragua
36.	B047*	2008	Fernald, LCH, Gertler, PJ, Neufeld, LM	Role of cash in conditional cash transfer programmes for child health, growth, and development: An analysis of Mexico's Oportunidades. *The Lancet* 371: 828–837.	Mexico
37.	B048*	2009	Fernald, LCH, Gertler, PJ, Neufeld, LM	10-year effect of Oportunidades, Mexico's conditional cash transfer programme, on child growth, cognition, language, and behaviour: A longitudinal follow-up study. *The Lancet* 374: 1997–2005.	Mexico
Cash transfers + parent-focused interventions + nutrition ***(n = 4)***					
38.	B025	2004	Behrman, JR, Parker, SW, Todd, PE	*Medium-term effects of the Oportunidades Program package, including nutrition, on education of rural children age 0-8 in 1997* (Technical document number 9 on the evaluation of Oportunidades 2004). Mexico: Instituto Nacional de Salud Publica (INSP).	Mexico
39.	B026*	2004	Gertler, PJ, Fernald, LC	*The medium term impact of Oportunidades on child development in rural areas*. Unpublished manuscript.	Mexico

40.	B088	2009	Behrman, JR, Parker, SW, Todd, PE	Schooling impacts of conditional cash transfers on young children: Evidence from Mexico. *Economic Development and Cultural Change* 57(3): 439–477.	Mexico
41.	B089	2011	Todd, JE, Winters, P	The effect of early interventions in health and nutrition on on-time school enrollment: Evidence from the *Oportunidades* program in rural Mexico. *Economic Development and Cultural Change* 59(3): 549–81.	Mexico
Cash transfers + parent-focused interventions + child-focused educational interventions + nutrition *(n = 1)*					
42.	B055*	2004	Behrman, JR, Cheng, Y, Todd, PE	Evaluating preschool programs when length of exposure to the program varies: A nonparametric approach. *The Review of Economics and Statistics* 86(1): 108–132.	Bolivia
Other comprehensive programmes *(n = 11)*					
43.	B070	2004	National Albanian Center for Social Studies	*Mid-term evaluation of promoting social cohesion and conflict prevention and improving ECD in northern Albania*. UNICEF, Christian Children's Fund, and the World Bank.	Albania
44.	B067	2004	Arango, M, Nimnicht, G, Peñaranda, F	*Twenty years on: A report of the PROMESA programme in Colombia*. The Hague: Bernard van Leer Foundation.	Colombia
45.	S002	2009	Bernal R, Fernández, C, Flórez, CE, Gaviria, A, Ocampo, PR, Samper B, Sánchez, F	*Evaluacion de impacto del Programa Hogares Comunitarios de Bienestar del ICBF*. Colombia: Universidad de los Andes–Facultad de Economía–Cede.	Colombia
46.	B061	2009	Cueto, S, Guerrero, G, Leon, J, Zevallos, A, Sugimaru, C	*Promoting early childhood development through a public programme: Wawa Wasi in Peru* (Working Paper No. 51). Oxford, UK: Young Lives.	Peru
47.	B010*	2006	Armecin, G, Behrman, JR, Duazo, P, Ghuman, S, Gultiano, S, King, EM, Lee, N	*Early childhood development through an integrated program: Evidence from the Philippines* (Policy Research Working Paper 3922). Washington, DC: World Bank.	Philippines
48.	B023	2006	Gultiano, SA, King, EM	A better start in life: Evaluation results from an early childhood development program. *Philippine Journal of Development* 33(1&2): 101–128.	Philippines
49.	B034*	2008	Peairson, S, Austin, AMB, de Aquino, CN, & de Burró, EU	Cognitive development and home environment of rural Paraguayan infants and toddlers participating in Pastoral del Niño, an early child development program. *Journal of Research in Childhood Education* 22(4): 343–362.	Paraguay

	B064	2010	Hazarika, G, Viren, V	*The effect of early childhood developmental program attendance on future school enrollment and grade progression in rural north India* (IZA DP No. 5209). Bonn, Germany: The Institute for the Study of Labor (IZA).	India
	B086*	2010	Ade, A, Gupta, SS, Maliye, C, Deshmukh, PR, Garg, BS	Effect of improvement of pre-school education through Anganwadi center on intelligence and development quotient of children. *Indian Journal of Pediatrics* 77(5): 541–546.	India
	B105*	2010	Rao, N	Preschool quality and the development of children from economically disadvantaged families in India. *Early Education and Development* 21(2): 167–185	India
	B106	1992	National Institute of Public Cooperation and Child Development (NIPCCD)	*National evaluation of Integrated Child Development Services*. India: NIPCCD.	India

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