World Health Organization Recommendations on Caregiving Interventions to Support Early Child Development in the First Three Years of Life:

Report of the systematic review of evidence

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Executive summary

An estimated 250 million children are at risk of not achieving their developmental potential in the first 5 years of life. Policies and programmes that enable caregivers to support young children's development are critical. Evidence in the series *Early childhood development: from science to scale* published in the Lancet in 2017 highlighted the importance of nurturing care comprising caregivers' practices with respect to health, nutrition, safety and security, responsive caregiving, and early learning opportunities that support children's healthy development. The health sector plays a critical role in delivering key nurturing care interventions, and there is opportunity to strengthen the nurturing care approach in health services and in partnership with other sectors. In order to guide the health sector, the World Health Organization (WHO) intends to develop evidence-based guidelines for approaches to improve early childhood development (ECD) enabling Member States to make informed decisions about a range of policy and programme actions in their efforts to achieve targets in the Sustainable Development Goals pertaining to health, learning and behaviour for human development. These guidelines will complement and support existing WHO guidelines and tools relevant to nurturing care.

A Guideline Development Group (GDG) comprising experts in the field of ECD and health proposed four[1] key research questions for review of evidence to inform recommendations relating to early learning and responsive care.

1. What is the effectiveness of responsive caregiving on ECD in the first 3 years of life?
2. What is the effectiveness of caregiving interventions that promote early learning on ECD in the first 3 years of life?
3. What is the effectiveness of caregiving to support healthy child socioemotional and behavioural development on ECD in the first 3 years of life?
4. What are the effects of combined caregiving and nutrition programmes on ECD and child growth outcomes in the first 3 years of life?

In many interventions, strategies to promote early learning and responsive caregiving were combined; therefore, it was agreed to carry out additional analysis related to the first two questions:

2.1 What is the effectiveness of caregiving interventions that combine both responsive caregiving and the promotion of early learning on ECD in the first 3 years of life?

[1] A fifth question was addressed in a separate review.

2.2. What is the effectiveness of any caregiving interventions (responsive caregiving, promotion of early learning, or combined responsive caregiving and the promotion of early learning) on ECD in the first 3 years of life.

This report is a synthesis of the evidence undertaken by a systematic review team at the Harvard T.H. Chan School of Public Health. In total, across the four original questions we report on 67 studies (77 records): question 1 (n = 17 studies, 19 records), question 2 (n = 22 studies, 22 records), question 3 (n = 10 studies, 11 records), and question 4 (n = 18 studies, 25 records), were identified for review. Outcomes assessed included ECD, attachment, child behaviour, child growth, child health and nutrition, caregiving knowledge, caregiving practices, caregiver-child interactions, and caregivers' mental health. Quality of evidence was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. The final recommendations based on the quality of the evidence will be determined by the GDG informed by evidence-to-decision making tables for the key research questions.

Acknowledgments

We are grateful to the members of the systematic review team at the Harvard T.H. Chan School of Public Health for their contributions to reviewing studies and synthesizing evidence for analysis: Alastair Fung, Raghbir Kaur, Helen Pitchik, Vijayaragavan Prabakaran, Clariana Vitória Ramos, Mathilda Regan, Katharine Robb, Rucha Shelgikar, and Yu-Cheng Tsai. We thank Carol Mita, librarian at the Francis A. Countway Library of Medicine, Harvard Medical School and Boston Medical Library, for her assistance in the literature search. We also thank the GDG chaired by Jane Fisher, Monash University, for its contributions to the process of the review of evidence. The support and guidance of the WHO team, including Bernadette Daelmans, Tarun Dua and Nigel Rollins, is gratefully acknowledged.

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Abbreviations and acronyms[2]

BSID	Bayley Scale of Infant and Toddler Development
CBCL	Child Behavior Check List
CES-D	Center for Epidemiological Studies Depression Scale
CI	Confidence interval
c-RCT	Cluster randomized controlled trial
ECD	Early childhood development
ES	Effect size
GDG	Guideline Development Group
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HAZ	Height-for-age Z-score
HIC	High-income country
HOME	Home Observation for Measurement of the Environment
ITSEA	Infant-Toddler Social Emotional Assessment
LMIC	Low- and middle-income country
NCAST	Nursing Child Assessment Satellite Teaching
PICO	Population/Problem, Intervention, Comparison/Control, Outcome
PROSPERO	Prospectively registered systematic reviews in health and social care, welfare, public health, education, crime, justice, and international development
RCT	Randomized controlled trial
SDQ	Strengths and Difficulties Questionnaire
WAZ	Weight-for-age Z-score
WHO	World Health Organization
WHZ	Weight-for-height Z-score

[2] See Appendix A for Glossary of terms.

Introduction and scope of the review

An estimated 250 million children are at risk of not achieving their developmental potential in the first 5 years of life (Lu et al., 2016). Policies and programmes that enable caregivers to support young children's development are critical. Evidence in the series *Early childhood development: from science to scale* published in the Lancet highlighted the importance of nurturing care comprising caregiver and family practices in health, nutrition, safety and security, responsive caregiving, and early learning opportunities that support children's healthy development (**Figure 1**) (Black et al., 2017; Britto et al., 2017; Richter et al., 2017). A central tenant of the nurturing care concept is the process of care encompassing caregiving practices such as caregiver sensitivity to children's physical and emotional needs, protection from harm, provision of opportunities for exploration and learning, and interactions with young children that are responsive, emotionally supportive, and cognitively stimulating.

Figure 1. Domains of nurturing care (Black et al., 2017).

While all sectors have roles and responsibilities in promoting policies and programmes for nurturing care, the health sector plays a particularly important role during the first 3 years of life (from conception to 2 years of age). Firstly, the health sector can reach the youngest children and their caregivers in the first 3 years of life to promote protective care and mitigate risk factors in an especially important and sensitive period of brain development (Nelson, 2000). Secondly, health services commonly implement components of nurturing care (e.g. breastfeeding promotion or the Integrated Management of Childhood Illness) that reduce risks for childhood mortality and morbidity as well as support early development but could potentially be strengthened with a holistic approach to the provision of nurturing care (Aboud & Yousafzai,

2016; Britto et al., 2017). Thirdly, the health sector can play a strong role in leveraging partnerships across sectors that enable the coordination of services for young children (Richter et al., 2017).

In order to guide the health sector, WHO intends to develop evidence-based guidelines for approaches to improve ECD enabling Member States to make informed decisions about a range of policy and programme actions in their efforts to achieve targets in the Sustainable Development Goals pertaining to health, learning and behaviour for human development. These guidelines will complement and support existing WHO guidelines and tools relevant to nurturing care (**Table 1**).

Table 1. WHO guidelines and tools that support nurturing care

Nurturing care domain	Guidelines and tools
Nutrition, Health Focus on infant and young child feeding, care for the newborn	Courses • Infant and young child feeding counselling: an integrated course • Combined course on growth assessment and infant and young child feeding counselling • Integrated Management of Childhood Illness • Essential newborn care • Caring for newborns and children in the community: a training course for community health workers (including modules on caring for the newborn at home, caring for the sick child and caring for the child's healthy growth and development) Guidelines • Optimal feeding of low-birth-weight infants in low- and middle-income countries • Guidelines on the management of children with severe acute malnutrition • Protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services (includes updates on the Ten steps to successful breastfeeding) • HIV and infant feeding: framework for priority action
Health Focus on pregnancy, safe delivery and perinatal care	Guidelines • Recommendations on antenatal care for a positive pregnancy experience • Companion of choice during labour and childbirth for improved quality of care • Prevention and treatment of maternal peripartum infections • Interventions to improve preterm birth outcomes • Postnatal care of the mother and newborn
Health, Security and Safety Focus on protection of young children, and well-being of children with disabilities	Guidelines • INSPIRE: seven strategies for ending violence against children • WHO Global disability action plan 2014-2021 • Ten strategies for keeping children safe on the road • Early childhood development and disability
Health, Security and Safety Focus on water, sanitation and hygiene interventions	Guidelines • The impact of the environment on children's health • Investing in water and sanitation: increasing access, reducing inequalities • Progress on drinking water, sanitation and hygiene

While these guidelines and tools support ECD and highlight the importance of the nurturing care domains of responsive caregiving and early learning, there is a need to develop focused guidelines to better integrate a range of caregiving interventions in health and other services.

Aims and objectives of the guideline

The aim of the guideline is to improve ECD. The three objectives of are to:

1. identify ECD-specific interventions that are effective in improving developmental outcomes in children;
2. identify effective, feasible approaches to deliver interventions to improve ECD outcomes;
3. consolidate in one guideline WHO-recommended interventions that promote ECD.

The target audience for the guideline includes district and sub-national health managers, health workers, development agencies and implementing partners, nongovernmental organizations and policy-makers working in the area of maternal and child health.

The guideline will be developed following the process outlined in the WH O Handbook for guideline development, second edition. The Departments of Maternal, Newborn, Child and Adolescent Health and Mental Health and Substance Abuse have identified experts for the GDG. A scoping meeting was convened in September 2017 to formulate questions to be addressed in systematic reviews to inform the recommendations of the GDG (see **Appendix B** for list of GDG members).

Scope of the systematic review

The purpose of the systematic reviews is to determine the level of evidence available to support potential recommendations for Member States on the promotion of ECD. This systematic review presents evidence for a total of six questions (four from the original scoping process, and two additional analyses requested later) formulated using the Population/Problem, Intervention, Comparison/Control, and Outcome (PICO) framework (**Table 2**).

Table 2. PICO questions for systematic review

PICO #	Research question	Population	Intervention	Comparison	Outcomes
1	What is the effectiveness of responsive caregiving interventions on ECD in the first 3 years of life?	Conception to 3 years of life Global	Caregiving interventions that only implement responsive caregiving	Standard of care or control	Primary: ECD Other: child growth, child nutrition, child health, caregiving, caregiver mental health
2	What is the effectiveness of caregiving interventions that promote early learning on	Conception to 3 years of life	Caregiving interventions that only support early	Standard of care or control	Primary: ECD Other: child growth, child

PICO #	Research question	Population	Intervention	Comparison	Outcomes
	ECD in the first 3 years of life?	Global	learning and development		nutrition, child health, caregiving, caregiver mental health
2.1 (additional analysis)	What is the effectiveness of caregiving interventions that combine both responsive caregiving and the promotion of early learning on ECD in the first 3 years of life?	Conception to 3 years of life Global	Caregiving interventions with components of both responsive caregiving and the promotion of early learning	Standard of care or control	Primary: ECD Other: child attachment, child growth, child nutrition, child health, caregiving, caregiver mental health
2.2 (additional analysis)	What is the effectiveness of any caregiving interventions (responsive caregiving, promotion of early learning, or combined responsive caregiving and the promotion of early learning) on ECD in the first 3 years of life?	Conception to 3 years of life Global	All interventions from PICOs 1, 2, and 2.1 are included	Standard of care or control	Primary: ECD Other: child attachment, child growth, child nutrition, child health, caregiving, caregiver mental health
3	What is the effectiveness of caregiving to support healthy child socioemotional and behavioural development on ECD in the first 3 years of life?	Conception to 3 years of life Global	Caregiving to support healthy socioemotional and behavioural development	Standard of care or control	Primary: ECD Other: child growth, child nutrition, child health, caregiving, caregiver mental health
4	What are the effects of combined caregiving and nutrition programmes on ECD and child growth outcomes in the first 3 years of life? • What are the independent and additive effects of caregiving and nutrition interventions on ECD and child growth outcomes in the first 3 years of life? • Do the effects on ECD and child growth outcomes differ between programmes that are targeted for young children with moderate to severe malnutrition compared to general programmes?	Conception to 3 years of life Global	Combined caregiving and nutrition interventions	Standard of care or control	Primary: ECD, child growth Other: child attachment, child nutrition, child health, caregiving, caregiver mental health

The components of nurturing care interventions addressed in this review are responsive caregiving and support for early learning and development. We organized the analysis by whether the intervention focuses only on one component or whether it combines both components (i.e. responsive caregiving and support for early learning and development), which we reference as PICO questions 1, 2 and additional analysis 2.1 and 2.2 respectively.

A challenge in the literature is the wide application of definitions of the nurturing care components (responsive caregiving and support for early learning and development), which are not consistently operationalized in the studies. Therefore, a central aspect to the review process was to establish a clear definition for each nurturing care component, which iteratively evolved over the first weeks of the data extraction process as the team reviewed and discussed each intervention. This categorization is broad and is based on often limited descriptions reported about the interventions in the published studies; however, a degree of delineation was feasible. The purpose of the additional analysis (2.2) which includes all the caregiving interventions together by merging intervention studies under PICO 1, 2 and 2.1 was to acknowledge that broad categorization and the potential for overlap across intervention strategies. A general conclusion may be drawn about the effect of general caregiving interventions to support ECD from the additional analysis.

However, the PICO questions were not framed to ask whether a specific caregiving component had greater or lesser effects on ECD than another, and studies have not been designed to address this question. Thus, the purpose of the additional analysis was not to compare the different components (i.e. support for early learning and responsive caregiving). It is recommended that any comparisons of caregiving components are interpreted with caution given the wide range of applications of these concepts, the diverse approaches to combining these concepts and the variation in the implementation characteristics for the interventions.

Methods

This systematic review protocol was developed in accordance with the process outlined in the WHO Handbook for guidelines development, second edition. A unique protocol was developed for the PICO questions and registered with Prospectively registered systematic reviews in health and social care, welfare, public health, education, crime, justice, and international development (PROSPERO) (https://www.crd.york.ac.uk/PROSPERO) (**Table 3**) .

Table 3. PICO registration on PROSPERO

PICO #	Research question	Protocol registration ID
1	What are the effects of responsive caregiving interventions on ECD in the first 3 years of life?	CRD42018092458 and CRD42018092461
2	What are the effects of caregiving interventions that promote early learning on ECD in the first 3 years of life?	
2.1	What is the effectiveness of caregiving interventions that combine both responsive caregiving and the promotion of early learning on ECD in the first 3 years of life?	
2.2	What is the effectiveness of any caregiving interventions (responsive caregiving, promotion of early learning, or combined responsive caregiving and the promotion of early learning) on ECD in the first 3 years of life?	
3	What are the effects of caregiving to support healthy child socioemotional and behavioural development on ECD in the first 3 years of life?	CRD42018092462
4	What are the effects of integrated caregiving and nutrition programmes on ECD and child growth outcomes in the first 3 years of life? • What are the independent and additive effects of caregiving and nutrition interventions on ECD and child growth outcomes in the first 3 years of life? • Do the effects on ECD and child growth outcomes differ between programmes that are targeted for young children with moderate to severe malnutrition compared to general programmes?	CRD42018092605

The reviews, analysis and report were completed by a team at the Harvard T.H. Chan School of Public Health between 15 January and 5 September 2018 (including a preliminary analysis and report reviewed by the GDG in May 2018).

Inclusion and exclusion criteria for the systematic reviews

The systematic reviews were subject to a common set of inclusion/exclusion criteria across the PICO questions, and a specific set of inclusion and exclusion criteria for each of the different questions. No temporal or regional constraints were imposed.

Inclusion criteria:

- Primary studies from peer-reviewed journals.

- Interventions targeted toward caregivers, which we define using a modified operational definition of a caregiving programme from UNICEF as one that incorporates "activities, programmes, services or interventions, for caregivers, aimed at improving caregiver interaction, behaviors, knowledge, beliefs, attitudes and practices" (Britto et al., 2015). Caregivers were defined as the legal guardian, biological parent, or adult responsible for the well-being of the child.
- Interventions that were evaluated using a randomized controlled study design with at least one control group and one intervention group.
- Interventions that targeted children and their caregivers in the early life course (pregnancy through the first 3 years of life).
- Interventions that assessed at least one measure of ECD (cognition, language, motor, socioemotional development) or behaviour as a primary outcome.
- Evaluations that assessed outcomes immediately after the completion of the intervention (or shortly thereafter).

Exclusion criteria:

- Interventions that targeted children who were preterm or who have a chronic illness, very low birth weight, or disability.[3]
- Interventions conducted with caregivers who have an illness or disability.
- Interventions that were not evaluated using a randomized controlled study design.
- Interventions that were not relevant to caregiving.
- Interventions that did not assess at least one ECD outcome.
- Interventions that enrolled children older than 3 years of age (on average).

Literature search and screening

The research team worked closely with a research librarian with expertise in comprehensive bibliographic database searching. Intervention studies were searched across five electronic bibliographic databases: EMBASE, PubMed, PsycINFO, Cochrane Central Register of Controlled Trials (CENTRAL), and ERIC. Search strategies were developed in accordance with each database. A string of keywords was determined to capture four broad categories: (1) caregiving interventions, (2) targeting children aged from pregnancy through 3 years, (3) that were evaluated using a randomized controlled study design, and (4) assessed an ECD outcome. Keywords were informed by search terms and keywords used in prior systematic reviews related to caregiving interventions (Aboud & Yousafzai, 2015; Britto et al., 2017; Eshel et al., 2006; Mol et al., 2008), as well as through consultations with the research librarian to select relevant MESH terms and search filters. The full list of key search terms is shown in **Box 1**.

[3] Interventions targeting children with low birth weight (< 2500g) were included and interventions targeting children with very low birth weight alone excluded (< 1500g).

Box 1: Key search terms

(Infant[Mesh] OR "Child, Preschool"[Mesh] OR infant[tiab] OR infants[tiab] OR infant's[tiab] OR neonate[tiab] OR neonates[tiab] OR neonatal[tiab] OR newborn*[tiab] OR new born*[tiab] OR baby[tiab] OR babies[tiab] OR toddler[tiab] OR toddlers[tiab] OR toddlerhood[tiab] OR preschool*[tiab] OR pre school*[tiab] OR early childhood[tiab] OR young children*[tiab] OR "Perinatal Care"[Mesh] OR perinatal[tiab] OR antenatal[tiab] OR ante natal[tiab] OR postnatal[tiab] OR post natal[tiab] OR age 0[tiab] OR aged 0[tiab] OR age zero[tiab] OR aged zero[tiab] OR age 1[tiab] OR aged 1[tiab] OR age one[tiab] OR aged one[tiab] OR age 2[tiab] OR aged 2[tiab] OR age two[tiab] OR aged two[tiab] OR 1 year old*[tiab] OR one year old*[tiab] OR 2 year old*[tiab] OR two year old*[tiab] OR 3 year old*[tiab] OR three year old*[tiab] OR 3 years of age[tiab] OR 2 years of age[tiab] OR 1 year of age[tiab] OR under 2 years[tiab] OR under 1 year[tiab]) AND ("Parenting"[Mesh] OR "Child Rearing"[Mesh] OR "Maternal Behavior"[Mesh] OR "Parent-Child Relations"[Mesh] OR "Parents"[Mesh] OR "Caregivers"[Mesh] OR parents[tiab] OR parenting[tiab] OR mother[tiab] OR mothers[tiab] OR maternal behav*[tiab] OR parental behav*[tiab] OR paternal behavior[tiab] OR parent infant[tiab] OR infant parent[tiab] OR father[tiab] OR fathers[tiab] OR caregiv*[tiab] OR care giv*[tiab] OR child rearing[tiab]) OR parent child[tiab] OR child parent[tiab] OR parent training[tiab] OR parent education[tiab] OR parental training[tiab] OR parental education[tiab] AND ("Child Behavior"[Mesh] OR "Child Development"[Mesh] OR "Cognition"[Mesh] OR "Executive Function"[Mesh] OR "Emotional Intelligence"[Mesh] OR "Emotions"[Mesh] OR "Motor Skills"[Mesh] OR attachment[tiab] OR attention[tiab] OR behavior[tiab] OR behavioral[tiab] OR behaviors[tiab] OR behaviour[tiab] OR behavioural[tiab] OR behaviours[tiab] OR child development[tiab] OR cognition[tiab] OR cognitive[tiab] OR communication[tiab] OR communicative[tiab] OR compliance[tiab] OR conduct problem*[tiab] OR executive function*[tiab] OR emotional[tiab] OR emotions[tiab] OR empathy[tiab] OR fine motor[tiab] OR language[tiab] OR mastery[tiab] OR motivation[tiab] OR motor skill*[tiab] OR peer relation*[tiab] OR play skills[tiab] OR prosocial[tiab] OR reading[tiab] OR social[tiab] OR socialization[tiab] OR socio emotion*[tiab] OR socioemotion*[tiab] AND random*[tw] AND English[lang]

Reference lists of relevant studies and reviews were also perused for any additional studies that were not retrieved from the search strategy.

The screening process was completed by authors EF and JJ with support from AKY and another member of the research team experienced in systematic reviews (HP). Initial screening of titles and abstracts was completed in accordance with the inclusion and exclusion criteria. Next, full texts of selected studies were reviewed to determine eligibility and specific reasons were documented for excluding articles at this stage. In all cases, two systematic review team members independently assessed the eligibility of each study to ensure accuracy. Discrepancies were resolved through group discussion with input from author AKY.

Studies that were selected for data extraction were assigned to a graduate research assistant who extracted data using a standardized, pre-piloted form. Quantitative and qualitative data that were extracted included:

- details related to sample characteristics;
- details related to intervention characteristics;
- details related to risk of bias;
- data necessary for effect size calculation for all outcomes of interest (means, standard deviations, sample sizes of pre- and post-scores in intervention and control groups).

All data extraction team members were trained to use the data extraction sheet and received a detailed standard operating protocol that included a set of standardized definitions for intervention characteristics. EF held weekly in-person meetings with all data extractors to monitor team progress and address any discrepancies that arose in the data extraction process. All data extraction forms were reviewed by EF and JJ on a weekly basis. For additional quality assurance, 50% of included articles were subsampled for quality assurance by either EF or JJ during the first three weeks of data extraction while research assistants were familiarizing themselves with the process. During the remaining weeks of the data extraction process, 20% of studies were subsampled for quality assurance by EF, JJ or AKY.[4] The flow of articles from the original search through the final selected studies is shown using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram (**Figure 2**).

The review was submitted mid-April 2018. Following a review of the preliminary analysis by the GDG in May 2018, all excluded articles were rescreened by EF, JJ and AKY, and any additional data extraction was managed by EF and JJ. This was to include interventions targeting children with low birth weight and to include studies with a sample size smaller than 85 that had been excluded in the original analysis. Responses to GDG reviews were submitted on Sept 5th 2018 following the May 2018 GDG meeting.

[4]Data extraction between June and August 2018.

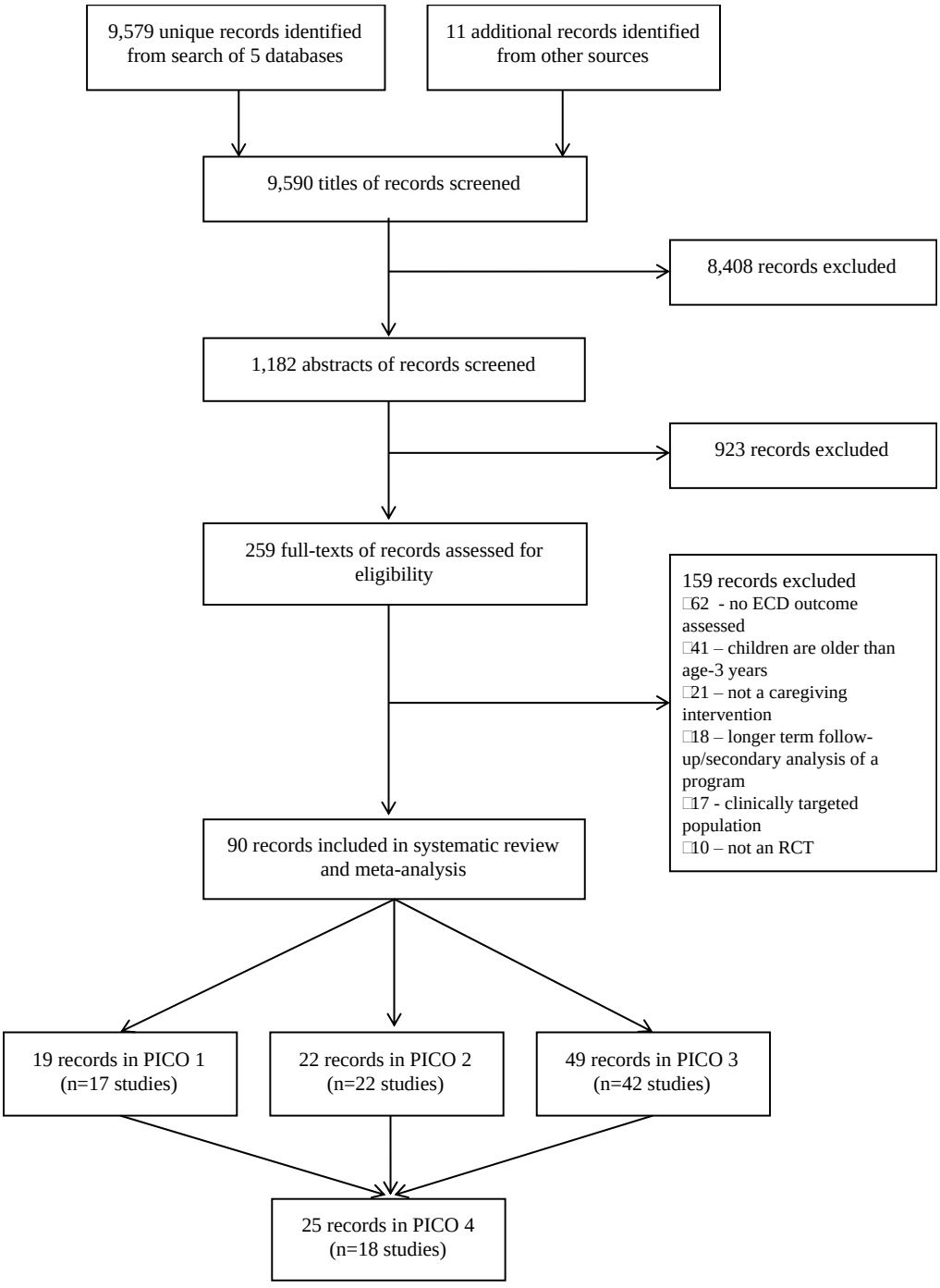

Figure 2. Data screening and selection process[5]

[5] A second search without English language restrictions was completed. This generated 439 unique studies which we did not review due to resource limitations.

Assessment of risk of bias of individual studies

Each individual study selected for the review was assessed for risk of bias using the criteria outlined by the Cochrane risk of bias assessment tool for randomized controlled trials recommended by the Cochrane Handbook version 5.1.0. The risk of bias in the included studies was assessed alongside the data extraction process by considering the following characteristics: (1) randomization sequence generation; (2) concealment of allocation to treatment group; (3) blinding of participants and investigators; (4) reporting of data on all study participants (taking into account attrition and exclusions); (5) complete reporting of all study outcomes that were specified a priori; (6) other sources of bias (including considerations around measurement reliability and validity). Disagreements between the team members over the risk of bias inparticular studies were resolved by group discussion with involvement of AKY where necessary.

Synthesis, analysis, and reporting

A challenge in the literature is the wide application of definitions for caregiving (or parenting) interventions, which are not consistently defined in the literature. Therefore, a central aspect to the review process was to establish a clear definition for each type of intervention, which iteratively evolved over the first weeks of the data extraction process as the team reviewed and discussed each intervention (see **Table 4** describing how each intervention was defined for analysis).

A meta-analysis was conducted for each of the following outcomes: ECD, child behaviour, child attachment, child growth, child nutrition, child health, caregiving (practices, knowledge, and caregiver-child interactions), and caregiver mental health if the number of available studies for the specific outcome was sufficient.

- Standardized tools were selected over non-standardized tools or study-specific tools.
- Comprehensive assessments were selected over screens or single items.

A predetermined decision-making matrix was developed for situations where a study reported more than one result for a specific outcome of interest. This was considered the most parsimonious approach as recommended by statistical advisors. The decision-making matrix was informed by the developmental theory for language and motor development. Across the pool of 80 studies from which data were extracted, this applied to five studies reporting language development and two studies reporting motor development. Given the small number of studies dispersed across the PICO questions and the underlying theoretical rationale, a sensitivity analysis was not conducted.

- For child language, receptive language was selected over expressive language (if a combined score was not possible to ascertain due to the assessment tool used, the degree of adaptation/modification to any tool or limitations in the data reported). Children typically develop receptive language skills first, and this is especially important in the age group of interest (i.e. 0-3 years) in this meta-analysis.

- For child motor development, fine motor was selected over gross motor (if a combined score was not possible to ascertain due to the assessment tool used, the degree of adaptation/modification to any tool or limitations in the data reported). There is evidence in the literature indicating an association between the development of fine motor skills in early life with subsequent learning and development.

For child behavioural problems, separate analyses were undertaken for internalizing and externalizing problem behaviours. If multiple behavioural scores were reported in either category which could not be separated using developmental theory, then the protocol adopted by Tanner-Smith and Tipton (2014) was followed. The robust variance estimation allows adjustment for correlated effect sizes between the different outcomes from the same study for a given domain.

In each PICO question, a sub-analysis was also conducted by regional context: globally, high-income countries (HICs), and low- and middle-income countries (LMICs). PICOs 1 and 2 were predominantly studies from HICs, 2.1 and 2.2 were a mixture of both HICs and LMICs, and PICOs 3 and 4 comprised studies only from HICs.

Quantitative data synthesis was conducted with either fixed or random effects meta-analysis based on a test of heterogeneity. Heterogeneity was evaluated using Cochran's Q test of heterogeneity and the I^2 statistic. Subgroup analyses were conducted to identify potential sources of heterogeneity using random-effect meta-analysis methods to estimate the average effect across groupings of studies. Results from the meta-analyses are presented with a forest plot. The Egger regression asymmetry test for publication bias will be calculated for the outcomes to assess the possibility of publication bias.

Additionally, EF, JJ and AKY summarized the quality of the body of evidence for each outcome of interest listed in the questions, in accordance with the GRADE approach. GRADE evidence profiles, containing the assessment of the quality of the evidence and a summary of findings across studies for each important or critical outcome were created. The quality of the body of evidence for each outcome was categorized as high, moderate, low or very low (see Appendix C for a summary of each intervention study and Appendices D-I for GRADE profiles for each question). In summary, across the questions we report on 81 studies: question 1 (n=17), question 2 (n=22), additional analysis 2.1 (n=42), additional analysis 2.2 (81) question 3 (n=10) and question 4 (n=18), were identified for review.

Table 4. Intervention definitions for PICO questions

Intervention Focus	Description and Type of Interventions	Types of Interventions Excluded
Interventions that only implement responsive caregiving	Responsive caregiving interventions target the caregiver-child dyad to promote responsive caregiver-child interactions and strengthen the parent-child relationship. These interventions encourage and support sensitivity and responsiveness (care that is prompt, consistent, contingent, and appropriate to the child's cues, signals, behaviours and needs) or secure attachment. Interventions that improve caregivers' abilities to incorporate the child's signals and perspective can be undertaken in the context of, but not limited to, play and communication or feeding. They include, but are not limited to, facilitating the caregiver to be attuned to and identify the child's needs and wants, to follow the child's lead, help the child to focus, support the child's exploration and scaffold development	• Interventions that relate to caregiving more generally, but without a primary focus on promoting positive caregiver-child interactions. • Interventions that focus on infant and young child feeding or exclusive breastfeeding, without an emphasis on responsiveness between caregiver and child. • Interventions that exclusively target caregivers (e.g. through provision of information or education), rather than targeting the caregiver-child dyad to facilitate and encourage quality caregiver-child interactions. • Interventions that focus exclusively on the child.
Interventions that only implement early learning and development	Interventions that enhance caregivers' access, knowledge, attitudes, practices, or skills with respect to supporting early learning and development for young children. These interventions may either: a) directly support caregivers in providing new early learning opportunities for their children; or b) build caregiver capacities more generally, providing information and guidance around healthy newborn/child development or a range of nurturing care topics. Interventions may incorporate aspects of responsive caregiving or behaviour management, but the overall goals and activities of interventions to support early learning are broader in scope. Interventions may be supplemented by messages about a variety of different caregiving topics but must include messaging around early learning and development. Intervention goals that relate to caregiving, but are not clearly specified, will be also categorized as general caregiving interventions. Specific examples of caregiving interventions to support early learning may include: • Interventions to promote dialogic caregiver-child book readings or book sharing. • Interventions that provide learning and play materials, such as book gifting or developmentally-appropriate toys, to increase opportunities for early learning. • Interventions that promote general caregiving	• Interventions that focus on supporting the needs of caregivers and families, but do not include a specific objective to support caregiving skills for promoting early learning and child development. • Interventions that focus on reproductive, maternal, newborn and child health, but do not include a specific objective to support caregiving skills for promoting child development. • Interventions that are specifically focused on particular aspects of caregiving (e.g. only behaviour management, only responsive caregiving)

Intervention Focus	Description and Type of Interventions	Types of Interventions Excluded
	competencies to support early learning and development in young children. These interventions primarily focus on and support caregivers themselves, as opposed to enhancing the caregiver-child relationship. Examples include caregiver group meetings to share information and discuss caregiving issues; home-visiting programmes to improve caregiver knowledge of ECD and caregiving skills; or informational sessions providing general advice on caregiving covering discipline, routines, feeding, and child health and development.	
Interventions that promote both responsive caregiving and the promotion of early learning/development	Caregiving interventions that combine features/components of responsive caregiving and the promotion of early learning (as defined above).	
All caregiving interventions categorized above	Recognizing the variation of caregiving intervention descriptions, this category captures all interventions together categorized as either responsive caregiving, early learning promotion, or a combination of responsive caregiving and the promotion of early learning.	
Caregiving to support healthy socioemotional and behavioural development	Interventions that support caregivers in promoting healthy socioemotional and behavioural development for young children and preventing child behaviour problems or child maltreatment. This includes encouraging caregivers to use appropriate and desirable practices, including sensitive discipline and limit-setting; reduce inappropriate behaviour management practices, such as harsh discipline and coercion; or some combination. Positive parenting and behaviour management interventions encourage stable and healthy family relationships and provide for the physical and emotional safety of the child to promote positive behavioural development outcomes for young children. Examples of interventions for caregiving to support healthy child socioemotional and behavioral development include: • Interventions promoting positive behaviour management techniques, such as establishing daily routines, praise and appropriate discipline. • Interventions reducing child maltreatment and associated factors, such as harsh punishment.	• Interventions that relate to caregiving more generally, in which behaviour management or child behavioural development is not the primary focus. • Interventions intended to promote early learning opportunities. • Interventions where the primary goal is secure attachment and supportive, sensitive and responsive interactions between caregivers and children more broadly.
Combined caregiving and nutrition interventions	Interventions that combine a caregiving component with a nutrition component such as: • Caregiving component: interventions that enhance caregivers' access, knowledge, attitudes, practices, or skills with respect to supporting caregiving (responsive caregiving, caregiving to support early learning, healthy socioemotional and behavioural development for	• Interventions that contain only caregiving components or only nutrition components. • Interventions that do not assess a child development outcome.

Intervention Focus	Description and Type of Interventions	Types of Interventions Excluded
	young children). • Nutrition component: may include breast feeding promotion, agricultural or nutrition education or provision of a macronutrient or micronutrient supplement.	• Interventions that promote nutrition through agriculture only (e.g. livestock, crops). • Interventions that promote water, sanitation and hygiene only.

Evidence and recommendations for responsive caregiving interventions (PICO 1)

Review question

What are the effects of responsive caregiving interventions on ECD in the first 3 years of life?

P – Caregivers and their children in the first 3 years of life
I – Responsive caregiving interventions [alone]
C – Standard of care or comparison groups without responsive caregiving interventions
O – ECD (primary), child attachment, child growth, child health and nutrition, caregiving knowledge, caregiving practices, caregiver-child interactions, and caregivers' mental health.

Summary of evidence

The GRADE table and forest plots for the meta-analyses are shown in Appendix D. We identified 17 responsive caregiving programmes for caregivers and their children during the first 3 years of life. The majority (n=13) of programmes were conducted in HICs, specifically Australia (Wake et al., 2011), Canada (Barrera et al., 1986), Japan (Cheng et al., 2007), the Netherlands (Juffer et al., 1997; Van Zeijl et al., 2006; Velderman et al., 2006), the United Kingdom (McGillion et al., 2017), and the United States (Dozier et al., 2009; Guttentag et al., 2014; Kochanska et al., 2013; Mendelsohn et al., 2007; Spieker et al., 2012; Weisleder et al., 2016). The four remaining programmes were conducted in Bangladesh (Frongillo et al., 2017), Chile (Santelices et al., 2011), Lithuania (Kalinauskiene et al., 2009), and South Africa (Cooper et al., 2009; Murray et al., 2016).

Three programmes used a cluster randomized control trial (c-RCT) study design, and 14 used a randomized control trial (RCT) design with randomization at the individual or household level. Studies ranged in publication date from 1986 to 2017. The programmes evaluated between 43 (Barrera et al., 1986) and 4365 individuals (Frongillo et al., 2017). They varied in the populations that they targeted at enrollment. Three programmes enrolled expectant mothers (Cooper et al., 2009; Guttentag et al., 2014; Santelices et al., 2010), three targeted caregivers and their newborn infants during the first 3 months of life (Weisleder et al., 2016; Juffer et al., 1997; Mendelsohn et al., 2007), five focused on infants during the first year of life (Barrera et al., 1986; Kalinauskiene et al., 2009; McGillion et al., 2017; Velderman et al., 2006; Cheng et al., 2007), and six were conducted with a broader age range of children, from birth to 4 years old (Frongillo et al., 2017; Spieker et al., 2012; Kochanska et al., 2013; Van Zeijl et al., 2006; Wake et al., 2011; Dozier et al., 2009). All programmes focused on engaging mothers and their children.

The programmes also varied in terms of implementation. Dosage and duration ranged from a shorter intervention delivered in weekly sessions over 2.5 months (Spieker et al., 2012) to a longer intervention delivered over three years (Weisleder et al., 2016). Twelve programmes were delivered through individualized home visits, two were delivered through individualized sessions at a research center or clinic, one was delivered through caregiver groups, and two used a combination of both individualized visits and caregiver groups.

Early child outcomes:

The effects of responsive caregiving interventions on early child outcomes are categorized and presented in terms of the following outcome domains: cognitive development, language development, motor development, socioemotional development, attachment, height-for-age (HAZ), and weight-for-age (WAZ).

Cognitive development: Three studies assessed programme impact on cognitive development. All three of these used the Bayley Scale of Infant Development (BSID) (Murray et al., 2016; Mendelsohn et al., 2007; Barrera et al., 1986). Only Mendelsohn and colleagues (2007) presented the unadjusted means and standard deviations which could be extracted for this analysis. Results from this study indicated that the impact on cognitive development was null (SMD = 0.26, 95% CI: -0.14, 0.66; n = 1). The overall quality of evidence was graded as low.

Language development: Five programmes evaluated intervention impact on language development. Two evaluations used the Landry Parent-Child Interaction Scales and Preschool Language Scale (Guttentag et al., 2014; Mendelsohn et al., 2007), one used a measure developed by the investigators (Frongillo et al., 2017), and two used a version of the MacArthur-Bates Communicative Development Inventory (McGillion et al., 2017; Wake et al., 2011). The pooled results showed no significant impacts on language development (SMD = 0.08, 95% CI: -0.07, 0.23; n = 5). The overall quality of evidence was graded as moderate.

Motor development: Two programmes evaluated the impact on motor development. One study used the BSID (Barrera et al., 1992), and the other used a caregiver-reported motor milestone checklist previously adapted by the authors (Frongillo et al., 2017). Frongillo and colleagues (2017), was the only study to present unadjusted means and standard deviations to calculate the effect size, and the results indicated a significant improvement in motor development (SMD = 0.19, 95% CI: 0.12, 0.26; n = 1). The overall quality of evidence was graded as moderate.

Socioemotional development: Four programmes evaluated the impact on socioemotional development -- measured using the Infant–Toddler Social and Emotional Assessment (ITSEA) (Guttentag et al., 2014; Kochanska et al., 2013; and Spieker et al., 2012) and the Behavior Assessment System for Children (Weisleder et al., 2016). The pooled results showed no significant effect on improving socioemotional development (SMD = 0.14, 95% CI: -0.03, 0.30; n = 4). The overall quality of evidence was graded as low.

Behaviour problems: Seven programmes evaluated the impact on behaviour problems measured using the Child Behavior Checklist (CBCL) (Cheng et al., 2007; Mendelsohn et al., 2007; Spieker et al., 2014; Van Zeijl et al., 2006; Wake et al., 2011), the ITSEA (Guttentag et al., 2014), and the BASC (Weisleder et al., 2016). The pooled results showed no significant effect on reducing behaviour problems (SMD = -0.14, 95% CI: -0.29, 0.002; n = 7). The overall quality of evidence was graded as low.

Attachment: Seven studies evaluated the impact of responsive caregiving interventions on attachment outcomes. The measure that was most commonly used to assess attachment outcomes was the Ainsworth Strange Situation procedure (Santelices et al., 2010; Juffer et al., 1997;

Velderman et al., 2006). Pooled results indicated no impacts on attachment outcomes (SMD = 0.13, 95% CI: -0.11, 0.37; n = 3). Three studies which could not be included in the pooled results similarly reported null effects; one reported significant improvements in attachment outcomes (Cooper et al., 2009). The overall quality of evidence was graded as low.

HAZ and WAZ: One programme evaluated the impact on HAZ and WAZ (Frongillo et al., 2017). This study found a positive effect on improving HAZ (SMD = 0.10, 95% CI: 0.03, 0.16; n = 1). The overall quality of evidence on HAZ was graded as moderate. This study found no significant effect on improving WAZ (SMD = 0.03, 95% CI: -0.04, 0.10; n = 1). The overall quality of evidence on WAZ was graded as moderate.

Caregiving outcomes:

The effects of responsive caregiving interventions on caregiving/parenting outcomes are categorized and presented in terms of the following aspects of parenting: caregiving knowledge, caregiving practices, caregiver-child interactions, and caregivers' mental health.

Caregiving knowledge: One programme evaluated the impacts on caregiving knowledge (Spieker et al., 2012). This study used Raising a Baby (RAB), a measure of caregiver knowledge of infant and toddler socioemotional needs and developmentally-appropriate expectations. The results showed no impact on caregiving knowledge (SMD = 0.29, 95% CI: -0.01, 0.58; n=1). The overall quality of evidence was graded as low.

Caregiving practices: Three programmes evaluated the impacts on caregiving practices. One evaluation measured caregiving practices using Home Observation for Measurement of the Environment (HOME) (Barrera et al., 1986), one used a coded video observation measure (Murray et al., 2016), and one study assessed parenting practices using the StimQ. The pooled results showed no impacts on caregiving practices (SMD = 0.53, 95% CI: -0.10, 1.17; n = 2). The overall quality of evidence was graded as low.

Caregiver-child interactions: Eight programmes evaluated impacts on caregiver-child interactions. Caregiver-child interactions were observed and coded using measures including the Landry Parent-Child Interaction Scales (Guttentag et al., 2014), the Nursing Child Assessment Teaching Scale (Spieker et al., 2012), the Ainsworth Scales (Kalinauskiene et al., 2009; Velderman et al., 2006; Juffer et al., 1997), and the Parent/Caregiver Involvement Scale (Cooper et al., 2009). The pooled results showed a significant improvement in the quality of caregiver-child interactions (SMD = 0.34, 95% CI: 0.15, 0.54; n=6). The overall quality of evidence was graded as low.

Caregiver depressive symptoms: Three programmes evaluated the impacts on caregiver depressive symptoms. One study used the Edinburgh Postnatal Depression Scale (Cooper et al., 2009), one used the Beck Depression Inventory (Kalinauskiene et al., 2009), and the third used the Center for Epidemiological Studies Depression Scale (CES-D) (Mendelsohn et al., 2007). The pooled results showed that interventions significantly reduced caregiver depressive

symptoms (SMD = -0.21, 95% CI: -0.39, -0.04, n = 3). The overall quality of evidence was graded as moderate.

Subgroup analyses

Subgroup analyses were conducted to examine possible moderating effects by HIC versus LMIC for outcomes for which it was feasible. Results are presented in **Table 5**; it is noteworthy that only two studies from LMICs had quantitative data available for the analysis.

Table 5. Child and caregiver outcomes for interventions that implement responsive caregiving only, by HICs versus LMICs

Outcome	HICs			LMICs		
	SMD	**95% CI**	**N**	**SMD**	**95% CI**	**N**
Child outcomes						
Language development	0.00	-0.15, 0.15	4	0.23	0.16, 0.30	1
Attachment	0.16	-0.10, 0.43	2	0.00	-0.53, 0.53	1
Caregiver outcomes						
Caregiving practices	0.21	-0.19, 0.61	1	0.86	0.45, 1.28	1
Caregiver-child interactions	0.32	0.07, 0.58	4	0.46	-0.06, 1.00	2
Caregiver depressive symptoms	-0.17	-0.56, 0.23	1	-0.22	-0.42, -0.03	2

Considerations for adverse effects and costs

There were no reported risks of adverse outcomes with responsive caregiving interventions for ECD or parenting outcomes. None of the studies presented data on costs.

In conclusion, the global evidence suggests that responsive caregiving interventions during the first 3 years of life are effective in improving early child motor development and caregiving outcomes, specifically caregiver and child interactions and maternal depressive symptoms. More studies are required from LMICs.

Evidence and recommendations for caregiving interventions that promote early learning (PICO 2)

Review question

What is the effectiveness of caregiving interventions that promote early learning on ECD in the first 3 years of life?

P – Caregivers and their children in the first 3 years of life
I – Interventions that promote early learning [alone]
C – Standard of care or comparison groups without caregiving interventions to support early learning
O – ECD (primary), child attachment, child growth, child health and nutrition, caregiving knowledge, caregiving practices, caregiver-child interactions, and caregivers' mental health

Summary of evidence

GRADE table and forest plots for the meta-analyses are shown in Appendix E. The evidence for caregiving interventions to promote early learning is derived from 22 RCTs. Four trials were conducted in LMICs, including China, India, Uganda, and Zambia. Eighteen were conducted in HICs, including Australia, Bermuda, France, Hong Kong, New Zealand, , the United States and the United Kingdom (see **Appendix C** for full list of PICO 2 programmes and characteristics). The majority were RCTs randomized at the individual level (n = 17), and five studies were c-RCTs. Studies were published between the years 1988 and 2017. The analytic sample sizes at endline ranged from 48 (Wasik et al., 1990) to 2557 participants (Goodson et al., 2000).

Seven of the trials targeted women beginning during pregnancy (Goodson et al., 2000; Guedeney et al., 2013; Jacobs et al., 2016; Love et al., 2005; Norr et al, 2003; Robling et al., 2016; Walkup et al., 2009); four interventions targeted women immediately following childbirth (Caughy et al., 2004; Schwarz et al., 2012; Brooks-Gunn et al., 1992; Nair et al., 2009); three interventions enrolled women and children within the first 3 months of life (Fergusson et al., 2005; Sawyer et al., 2017; Wasik et al., 1990); four targeted children within the first year of life (Jin et al., 2007; Wagner et al., 2002; Rockers et al., 2016; Muhoozi et al., 2017); and four enrolled children within their first 36 months (Hutchings et al., 2016; Leung et al., 2017b; Scarr & McCartney, 1988; Heubner et al., 2000). Most programmes targeted the mother or other female primary caregiver.

In terms of delivery, ten of the programmes were delivered to families individually through home visitations, five were group-based, and seven included a mix of individual and group-based delivery strategies. Programme duration varied extensively, ranging from 1.5 (Heubner et al., 2000) to 60 months (Goodson et al., 2000).

Early child outcomes:

The effects of caregiving interventions to support early learning on early child outcomes are categorized and presented in terms of the following outcome domains: cognitive development, language development, motor development, socioemotional development, child behaviour problems, attachment, HAZ and WAZ.

Cognitive development: Thirteen studies assessed programme impact on cognitive development. Four of these used the BSID. The remaining ones used a variety of measures, including: Wechsler Preschool and Primary Scale of Intelligence (Schwarz et al., 2012), Kaufman Assessment Battery for Children (Goodson et al., 2000), INTERGROWTH-21st NDA tool (Rockers et al., 2016), Preschool Developmental Assessment Scale (Leung et al., 2017b), an author-created measure of standardized checklist items (Robling et al., 2016), McCarthy Scales of Children's Abilities (Wasik et al., 1990), Schedule of Growing Skills II (SGS-II) (Hutchings et al., 2016), Stanford-Binet Test of Intelligence (Scarr & McCartney, 1988), and Developmental Profile II (DPII) (Wagner et al., 2002). The pooled results indicated positive impacts of caregiving interventions on cognitive development (SMD = 0.20, 95% CI: 0.01, 0.39; n = 8). The overall quality of evidence was graded as low.

Language development: Impacts on language development were assessed in nine studies. Three used the Peabody Picture Vocabulary Test-Revised (Goodson et al., 2000; Heubner, 2000; Love et al., 2005). Other measures included the Gesell Development Schedules (Jin et al., 2007), the Stanford-Binet Test of Intelligence (Brooks-Gunn et al., 1992), the BSID (Muhoozi et al., 2017), the Wechsler Preschool and Primary Scale of Intelligence (Schwarz et al., 2012), an Early Language Milestone measure (Robling et al., 2016), and the Developmental Profile II (Wagner et al., 2000). Pooled results indicated that interventions had no significant impacts on language development (SMD = 0.07, 95% CI: -0.11, 0.24; n = 6). The overall quality of the evidence was graded as low.

Motor development: Seven studies evaluated programme effects on motor development. Three used the BSID (Muhoozi et al., 2017; Norr et al., 2003; Nair et al., 2009). Two studies used a caregiver-reported measure (Wagner et al., 2002; Rockers et al., 2016), and two used direct observation measures (Brooks-Gunn et al., 1992; Jin et al., 2007). The pooled results show significant positive effects on motor development (SMD = 0.32, 95% CI: 0.12, 0.52; n = 5). The overall quality of the evidence was graded as low.

Socioemotional development: Nine studies assessed programme impacts on socioemotional development -- measured using the Ages and Stages Questionnaire (Muhoozi et al., 2017; Pontoppidan et al., 2016; and Sawyer et al., 2017), the Adaptive Social Behavior Inventory (Wagner et al., 2002), ITSEA (Barlow et al., 2007; Walkup et al., 2009), the Strengths and Difficulties Questionnaire (SDQ) (Leung et al., 2017b), the Gesell Development Schedules (Jin et al., 2007), and a measure from the NICHD Study of Early Child Care (Love et al., 2005). Pooled results showed positive effects on socioemotional development outcomes (SMD = 0.28, 95% CI: 0.09, 0.48, n = 3). However, there were non-significant differences in five out of the six other studies that could not be meta-analysed. The overall quality of the evidence was graded as very low.

Behaviour problems: Eight programmes evaluated the impact on behaviour problems - measured using the ITSEA (Fergusson et al., 2005; Jacobs et al., 2016; Walkup et al., 2009), the CBCL (Caughy et al., 2004; Goodson et al., 2000; Love et al., 2005), the SDQ (Leung et al., 2017b), and the PSI-DC (Hutchings et al., 2016). The pooled results showed no significant effect on reducing behaviour problems (SMD = -0.25, 95% CI: -0.54, 0.04, n = 3). Of the five studies that could not be meta-analysed, the evidence was mixed: three studies found reductions in children's behaviour problems, and two found no significant differences. The overall quality of evidence was graded as very low.

Attachment outcomes: Two studies assessed programme impacts on attachment outcomes (Caughy et al., 2004; Guedeney et al., 2013). Only one study (Guedeney et al., 2013) contributed to the effect size estimate (measured reductions in social withdrawal using the Alarm Distress Baby Scale; direction of effect size was reversed for analysis). Results indicated significant positive impacts on attachment outcomes (SMD = 0.30, 95% CI: 0.09, 0.51; n = 1). Caughy and colleagues (2004), similarly reported significant improvements in secure attachment relationships for intervention group children (as measured by the Attachment Q-Set). The overall quality of evidence was graded as low.

HAZ and WAZ: Two studies evaluated impacts on HAZ and WAZ (Muhoozi et al., 2017; Rockers et al., 2016). The pooled results showed no effects on child HAZ outcomes (SMD = -0.02, 95% CI: -0.29, 0.24, n = 2). The overall quality of the evidence was graded as moderate. The pooled results showed no effects on child WAZ outcomes (SMD = 0.05, 95% CI: -0.10, 0.19, n = 2). The overall quality of the evidence was graded as moderate.

Caregiving outcomes

The effects of caregiving interventions to support early learning on caregiving outcomes are categorized and presented in terms of the following aspects of parenting: caregiving knowledge, caregiving practices, caregiver-child interactions, and caregivers' mental health.

Caregiving knowledge: Three studies assessed intervention impacts on caregiving knowledge. Two studies used questionnaires created by the authors for the purposes of the study (Jin et al., 2007; Walkup et al., 2009), and one used the Knowledge of Infant Development Inventory (Wagner et al., 2002). Two of the evaluations reported significant improvements in caregiving knowledge (Jin et al., 2007; Walkup et al., 2009), while one study found no programme effects (Wagner et al., 2002). Unadjusted means and standard deviations were not presented in the papers, and therefore it was not possible to calculate a pooled estimate. The overall quality of the evidence was graded as low.

Caregiving practices: Programme impacts on caregiving practices were assessed in eight studies. Only one of the trials found significant improvements in caregiving practices (Love et al., 2005), while the remaining studies reported null effects (Wasik et al., 1990; Walkup et al., 2009; Wagner et al., 2002; Norr et al., 2003; Hutchings et al., 2016; Goodson et al., 2000; Caughy et al., 2004). All of the studies used the HOME. Pooled results indicated no programme impacts on

caregiving practices (SMD = 0.05, 95% CI: -0.04, 0.13; n = 2). The overall quality of evidence was graded as low.

Caregiver-child interactions: Five studies evaluated intervention impacts on caregiver-child interactions. The majority of studies measured interactions using the Nursing Child Assessment Satellite Training (NCAST) measure (Caughy et al., 2004; Goodson et al., 2000; Wagner et al., 2002). Three studies reported positive impacts on caregiver-child interactions (Caughy et al., 2004; Love et al., 2005; Hutchings et al., 2016), while two studies reported no impacts (Goodson et al., 2000; Wagner et al., 2002). It was not possible to calculate a pooled estimate as studies did not present the unadjusted means and standard deviations. Overall quality of evidence was rated as low.

Caregiver depressive symptoms: Four studies assessed programme impacts on caregiver depressive symptoms. Two studies used the Beck Depression Inventory (Schwarz et al., 2012; Hutchings et al., 2016); one study used the WHO Self-Reporting Questionnaire (SRQ) z-score (Rockers et al., 2016); and the fourth used the CES-D (Walkup et al., 2009). The pooled results showed no effect on caregiver depressive symptoms (SMD = 0.07, 95% CI: -0.08, 0.22, n = 2). The overall quality of the evidence was graded as moderate.

Subgroup analyses

Subgroup analyses were conducted to examine possible moderating effects by HICs versus LMICs. Results are presented in **Table 6**. The impact on ECD and caregiver mental health appears greater in LMICs; however, more studies measuring this outcome in both HICs and LMICs are required, as currently we draw findings from only one study in each context.

Table 6. Child and caregiver outcomes for interventions that promote early learning and development, by HICs versus LMICs

Outcome	**HICs**			**LMICs**		
	SMD	**95% CI**	**N**	**SMD**	**95% CI**	**N**
Child outcomes						
Cognitive development	0.08	-0.02, 0.18	5	0.32	-0.11, 0.75	3
Language development	0.03	-0.09, 0.15	4	0.30	-0.67, 1.27	2
Motor development	0.08	-0.10, 0.26	1	0.39	0.17, 0.60	4
Caregiving outcomes						
Caregiver depressive symptoms	0.13	-0.11, 0.37	1	0.03	-0.16, 0.22	1

Considerations for adverse effects and costs:

There were no indications of adverse effects caused by caregiving interventions to support development and early learning. Costing data for these interventions were not readily available in the literature.

In conclusion, the intervention studies on caregiving to support early learning suggest these are promising interventions with significant (modest) effects found on child cognition, motor development and attachment. Evidence for effectiveness on caregiving outcomes was not observed in the pooled data. However, more studies from LMICs and more data on caregiver-level outcomes are needed.

Evidence and recommendations for caregiving interventions that combine responsive caregiving and promotion of early learning: additional analysis 2.1

Review Question

What is the effectiveness of caregiving interventions that combine both responsive caregiving and the promotion of early learning on ECD in the first 3 years of life?

P – Caregivers and their children in the first 3 years of life
I – Caregiving interventions that combine responsive caregiving and the promotion of early learning
C – Standard of care or comparison groups without caregiving interventions to support responsive caregiving and the promotion of early learning
O – ECD (primary), child attachment, child growth, child health and nutrition, caregiving knowledge, caregiving practices, caregiver-child interactions, and caregivers' mental health

Summary of evidence

The GRADE table and forest plots for the meta-analyses are shown in **Appendix F**. We identified 42 caregiving interventions that had components of both responsive caregiving and the promotion of early learning for caregivers and their children during the first 3 years of life. Approximately half (n=22 or 52.4%) of these programmes were conducted in LMICs. A total of 14 programmes used a c-RCT study design, and 28 programmes used a RCT design with randomization at the individual level. Studies ranged in publication date from 1974 (Johnson et al., 1974) to 2017 (Fernald et al., 2017; Helmizar et al., 2017; Leung et al., 2017a). The programmes evaluated between 32 (Johnson et al., 1974; Pontoppidan et al., 2016; Whitt & Casey, 1982) and 1411 individuals (Yousafzai et al., 2014). These programmes varied in targeted population at enrollment. Seven programmes (16.7%) focused on expectant mothers beginning during pregnancy, 13 rogrammes (31.0%) targeted caregivers and their newborn infants during the first 3 months of life, six (14.3%) focused on infants during the first year of life, and the remaining 16 (38.1%) were conducted either after the first year or among a broader age range of children from birth to 4 years old. Nearly all programmes (n=38 or 90%) targeted mothers and their children. Four notable programmes (10%) engaged both mothers and fathers (Johnson et al., 1974; Kaaresen et al., 2008; Kyno et al., 2012; Singla et al., 2015).

The programmes also varied in terms of implementation. Dosage and duration ranged from as short as fewer than 10 sessions over two months (Aboud & Ahkter, 2011; Vally et al., 2015; Murray et al., 2016) to as long as weekly (Kaminski et al., 2013) or biweekly sessions (Wallander et al., 2014) over three years. A total of 25 (60%) were individualized programmes, six (14%) were delivered through caregiver groups, and 11 (26%) used a combination of both home visits and caregiver groups.

Early child outcomes:

Cognitive development: Thirty-six studies assessed programme impact on cognitive development. Twenty-one of these used the BSID. Six studies used the Griffith's scales of Mental Development (Waber et al., 1981; Walker et al., 2004; Powell & Grantham-McGregor, 1989; Powell et al., 2004; Gardner et al., 2005; Grantham-McGregor et al., 1991). The remaining studies utilized a variety of measures, including the Kaufman Assessment Battery for Children (Drotar et al., 2009), Preschool Developmental Assessment Scale (PDAS) (Leung et al., 2017a), McCarthy Scales of Children's abilities (Fernald et al., 2017), a nationally validated author-created checklist measure (Hartinger et al., 2017), Stanford-Binet Test of Intelligence (Johnson et al., 1974; Madden et al., 1984), Cattell Scales (Olds et al., 1986), Bracken Basic Concept Scale (Cronan et al., 1996), and Mullen Scale of Early Learning (Kyno et al., 2012). The pooled results showed positive impacts of caregiving interventions on cognitive development (SMD = 0.45, 95% CI: 0.25, 0.65; n = 20). The overall quality of evidence was graded as low.

Language development: Seventeen studies assessed the effects on language development. Six used the BSID. Four used the Griffiths Mental Development Scales (Chang et al., 2015; Gardner et al., 2005; Grantham-McGregor et al., 1991; Powell et al., 2004). The MacArthur-Bates Communicative Development Inventory was used in three studies (Vally et al., 2015; Goldfeld et al., 2011; Cronan et al., 1996). Remaining studies used other measures of direct observation. The pooled results indicated positive impacts on language outcomes (SMD = 0.38, 95% CI: 0.16, 0.60; n = 14). The overall quality of evidence was graded as low.

Motor development: Eighteen studies assessed programme impacts on motor development. Twelve measured motor development using the BSID (Attanasio et al., 2014; Field et al., 1982; Hamadani et al., 2006; Heinicke et al., 1999; Helmizar et al., 2017; Kaaresen et al., 2008; Lozoff et al., 2010; Nahar et al., 2012a; Tofail et al., 2013; Vazir et al., 2013; Wallander et al., 2014; Yousafzai et al., 2014). Five studies used the Griffith Mental Development Scale (Chang et al., 2015; Gardner et al., 2005; Grantham-McGregor et al., 1991; Grantham-McGregor et al., 1989; Powell et al., 2004), and one study used the Mullen Scales of Early Learning (Kyno et al., 2012). Pooled results indicated significant positive effects on motor development outcomes (SMD = 0.25, 95% CI: 0.09, 0.40; n = 13). The overall quality of evidence was rated as low.

Socioemotional development: Four studies assessed programme impacts on socioemotional development -- measured using the ASQ (Kyno et al., 2012), the SDQ (Kaminski et al., 2013), the Social Skills Rating System (Drotar et al., 2008), and the BSID (Yousafzai et al., 2014). Pooled results showed null effects on socioemotional development outcomes (SMD= 0.06, 95% CI: -0.18, 0.28, n=2). The studies that could not be meta-analysed similarly found no statistically significant differences for socioemotional development. The overall quality of the evidence was graded as moderate.

Behaviour problems: Seven programmes evaluated the impact on behaviour problems measured using the CBCL (Constantino et al., 2001; Kaaresen et al., 2008; Kitzman et al., 1997; Kyno et al., 2012; Olds et al., 2002), the Devereux Early Childhood Assessment (Kaminski et al., 2013), and the Eyberg Child Behavior Inventory (Leung et al., 2017a). The pooled results showed no significant effect on reducing behaviour problems (SMD = -0.18, 95% CI: -0.40, 0.04, n = 2). Of

the five studies that could not be meta-analysed, four found no significant differences. The overall quality of evidence was graded as low.

Attachment outcomes: Two studies evaluated programme impacts on attachment outcomes. Measures included the Ainsworth Strange Situation procedure (Heinicke et al., 1999) and the Attachment Q-Set (Roggman et al., 2009). Both studies reported significant positive impacts on attachment outcomes, although a pooled effect size could not be calculated. Overall quality of evidence was graded as moderate.

HAZ and WAZ: Eight studies evaluated impacts on HAZ and WAZ. Two other studies assessed height and weight but did not present a z-score; therefore, they were excluded from the meta-analysis (Attanasio et al., 2014; Nair et al., 2009). The pooled results showed no effects on child HAZ outcomes (SMD = -0.04, 95% CI: -0.15, 0.07, n = 8). The overall quality of the evidence was graded as moderate. The pooled results showed no effects on child WAZ outcomes (SMD = 0.02, 95% CI: -0.07, 0.11, n = 6). The overall quality of the evidence was graded as high.

Caregiving outcomes:

Caregiving knowledge: Seven studies examined programme impact on caregiving knowledge. Four studies used caregiver self-report questionnaires developed by the authors (Hamadani et al., 2006; Vazir et al., 2013; Powell et al., 2004; Singla et al., 2015). Pooled results indicated that programmes had a significant positive impact on caregiving knowledge (SMD = 0.73, 95% CI: 0.57, 0.89; n = 6). The overall quality of evidence was rated as low.

Caregiving Practices: Eighteen studies assessed intervention effects on caregiving practices. The majority of studies used the HOME (Aboud & Akhter, 2011; Aboud et al., 2013; Barlow et al., 2007; Chang et al., 2015; Heinicke et al., 1999; Helmizar et al., 2017; Johnson et al., 1974; Kitzman et al., 1997; Nahar et al., 2012b; Singla et al., 2015; Walker et al., 2004; Yousafzai et al., 2015; Olds et al., 1986; Field et al., 1982). Two studies used the Family Care Indicators (Attanasio et al., 2014; Tofail et al., 2013). Pooled results indicated that interventions had a significant positive effect on caregiving practices (SDM = 0.48, 95% CI: 0.20, 0.76; n = 10). The overall quality of evidence was rated as low.

Caregiver-child interactions: Programme impacts on caregiver-child interactions were assessed in 12 studies. Measures to assess the quality of mother-child interactions included the NCAST (Kitzman et al., 1997) and the Observation of Mother and Child Interaction (OMCI) (Yousafzai et al., 2015). Other measures of caregiver-child interactions included assessments of responsive talk (Aboud & Akhter, 2011) and reciprocity during book-sharing activities (Murray et al., 2016). The pooled results indicated that interventions had a significant positive effect on caregiver-child interactions (SMD = 0.74, 95% CI: 0.39, 1.10; n = 5). Overall quality of evidence was rated as moderate.

Caregiver depressive symptoms: Nine studies assessed programme impacts on caregiver depressive symptoms. Six used the CES-D (Chang et al., 2015; Aboud et al., 2013; Singla et al., 2015; Nahar et al., 2015; Attanasio et al., 2014; Baker-Henningham et al., 2005). Of the remaining studies, one used the SRQ (Yousafzai et al., 2015), one used the Major Depression

Inventory (Pontoppidan et al., 2016), and one used a study-specific measure (Heinicke et al., 1999). Pooled results indicated that interventions did not significantly impact caregiver depressive symptoms (SMD = -0.08, 95% CI: -0.31, 0.15; n=7). The overall quality of the evidence was graded as low.

Subgroup analyses:

Subgroup analyses were conducted to examine possible moderating effects by HICs versus LMICs. Results are presented in **Table 7**. The number of studies in LMICs is higher, and a greater impact on outcomes is observed in these contexts, with the exception of caregiver-child interactions.

Table 7. Child and caregiver outcomes for interventions that combine responsive caregiving and promotion of early learning by HICs versus LMICs

Outcome	HICs			LMICs		
	SMD	95% CI	N	SMD	95% CI	N
Child outcomes						
Cognitive development	0.23	-0.11, 0.58	4	0.49	0.27, 0.71	16
Language development	0.08	-0.24, 0.40	3	0.47	0.24, 0.70	11
Motor development	-0.11	-0.60, 0.38	1	0.27	0.11, 0.42	12
Caregiving outcomes						
Caregiving practices	0.13	-0.38, 0.64	2	0.56	0.30, 0.83	8
Caregiver-child interactions	0.95	0.52, 1.38	2	0.64	0.16, 1.12	3
Caregiver depressive symptoms	0.40	-0.09, 0.89	1	-0.13	-0.37, 0.11	6

Considerations for adverse effects and costs:

There appears to be no undue risk of adverse outcomes with interventions for combined responsive caregiving and promotion of early learning. Few interventions evaluate cost. A cost-effectiveness study conducted in Pakistan (Yousafzai et al., 2014) indicated US$ 48 per child per year when delivered bundled with basic health and nutrition services (Gowani et al., 2014). In settings where home visiting services or community groups do not already exist or where resources are not being adequately allocated for ECD, such interventions are likely to increase costs.

In situations where this type of intervention (e.g. psychosocial stimulation) is being integrated within existing primary care and health services, care must be taken to ensure that there are no adverse effects of adding the intervention on other child outcomes for health and nutrition,

particularly in low-resource contexts where health service capacities may be limited. A study from the Caribbean explored these issues and found no negative impacts of integrating a psychosocial stimulation intervention within existing health services on child nutrition or immunization (Chang et al., 2015).

In conclusion, interventions that combine both features of caregiving (i.e., responsive care and support for early learning) had significant positive effects for cognitive, language and motor development, as well as caregiving knowledge, caregiver practices, and caregiver-child interactions. Studies in 2.1 had global representation from both HICs and LMICs.

Evidence and recommendations for all caregiving interventions that deliver responsive caregiving, promotion of early learning, or combined responsive caregiving and promotion of early learning: additional analysis 2.2

Review question

What is the effectiveness of any caregiving interventions (responsive caregiving, promotion of early learning, or combined responsive caregiving and the promotion of early learning) on ECD in the first 3 years of life.

P – Caregivers and their children in the first 3 years of life
I – Any caregiving interventions (responsive caregiving, promotion of early learning or combined responsive caregiving and the promotion of early learning)
C – Standard of care or comparison groups without caregiving interventions
O – ECD (primary), child attachment, child growth, child health and nutrition, caregiving knowledge, caregiving practices, caregiver-child interactions, and caregivers' mental health

Summary of evidence

The GRADE table and forest plots for the meta-analyses are shown in **Appendix G**. Here we explore the effectiveness of caregiving interventions included in PICO questions 1, 2 and and 2.1. We describe the effectiveness of any caregiving interventions (responsive caregiving, promotion of early learning, or combined responsive caregiving and the promotion of early learning) on ECD in the first 3 years of life.

<u>Early child outcomes:</u>

Cognitive development: Fifty-two studies assessed programme impact on cognitive development. Over half of these used the BSID. Remaining studies used a variety of measures, the majority of which were direct observation. The pooled results showed positive impacts of caregiving interventions on cognitive development (SMD = 0.37, 95% CI: 0.22, 0.52, n = 29). The overall quality of evidence was graded as low.

Language development: Overall, 31 studies evaluated intervention effects on language development. The pooled results indicated positive effects of caregiving interventions on language outcomes (SMD = 0.24, 95% CI: 0.11, 0.36; n = 25). The overall quality of evidence was graded as low.

Motor development: Twenty-seven studies assessed programme impacts on child motor development outcomes. Pooled results indicated significant positive effects (SMD = 0.27, 95% CI: 0.17, 0.37; n = 19). The overall quality of evidence was graded as moderate.

Socioemotional development: Seventeen studies assessed programme impacts on socioemotional development. Pooled results indicated significant positive effects on socioemotional development outcomes (SMD = 0.15, 95% CI: 0.04, 0.27, n = 9). The overall quality of the evidence was graded as low.

Behavioural development: Twenty-two studies assessed programme impacts on behavioural problems. Pooled results indicated significant reductions in behavioural problems (SMD = -0.17, 95% CI: -0.28, -0.06, n = 12). However, the majority of studies that could not be meta-analysed found non-significant differences in behavioural problems. The overall quality of the evidence was graded as low.

Attachment outcomes: Eleven studies evaluated the effects of caregiving interventions on attachment outcomes. Pooled results indicated significant positive impacts of caregiving interventions on attachment outcomes (SMD = 0.23, 95% CI: 0.07, 0.38; n = 4). The overall quality of evidence was graded as low.

HAZ and WAZ: Eleven studies evaluated impacts on HAZ and WAZ. The pooled results showed no effects on child HAZ outcomes (SMD = -0.02, 95% CI: -0.10, 0.07, n = 11). The overall quality of the evidence was graded as high. The pooled results showed no effects on child WAZ outcomes (SMD = 0.03, 95% CI: -0.02, 0.08, n = 9). The overall quality of the evidence was graded as high.

Child health outcomes: Four programmes evaluated the impact on child sickness, as reported by the child's primary caregiver. Three studies found no effects on reducing sickness (Aboud et al., 2013; Menon et al., 2016; Singla et al., 2015), whereas another study found reductions in diarrhoea and acute respiratory illness (Yousafzai et al., 2014).

<u>Caregiving outcomes:</u>

Caregiving knowledge: Eleven studies measured the impact of interventions on caregiving knowledge. Over half used a study-specific questionnaire developed by the authors. Pooled results indicated that interventions had a significant positive effect on caregiving knowledge (SMD = 0.68, 95% CI: 0.51, 0.85; n = 7). The overall quality of the evidence was graded as low.

Caregiving practices: Overall, 29 studies assessed programme impact on caregiving practices. The majority of these (n = 23) measured caregiving practices using the HOME. Pooled results indicated that interventions significantly improved caregiving practices (SMD = 0.44, 95% CI: 0.21, 0.67; n = 14). The overall quality of evidence was graded as low.

Caregiver-child interactions: Across all caregiving interventions, 25 studies assessed the effects on caregiver-child interactions. All of these used a measure for coding video- or live-observations of the mother-child dyad. The pooled results for intervention effects on interactions

indicated that programmes significantly improved outcomes for caregiver-child interactions (SMD = 0.54, 95% CI: 0.30, 0.78; n = 11). The overall quality of the evidence was rated as low.

Caregiver depressive symptoms: Sixteen evaluations assessed programme impacts on caregiver depressive symptoms. The majority of studies used either the CES-D or the Beck Depression Inventory. The pooled results indicated that interventions did not significantly reduce caregiver depressive symptoms (SMD = -0.07, 95% CI: -0.22, 0.07; n = 12). The overall quality of evidence was rated as low.

Subgroup analyses:

Subgroup analyses were conducted to examine possible moderating effects by HICs versus LMICs. Results are presented in **Table 8**. In LMICs a greater impact on outcomes is observed, with the exception of attachment.

Table 8. Child and caregiver outcomes across all included caregiving interventions by HICs versus LMICs

Outcomes	**HICs**			**LMICs**		
	SMD	**95% CI**	**N**	**SMD**	**95% CI**	**N**
Child outcomes						
Cognitive development	0.12	0.01, 0.23	10	0.46	0.26, 0.65	19
Language development	0.02	-0.07, 0.11	11	0.42	0.23. 0.61	14
Motor development	0.06	-0.11, 0.23	2	0.29	0.19, 0.40	17
Attachment	0.25	0.08, 0.41	3	0.00	-0.53, 0.53	1
Caregiving outcomes						
Caregiver knowledge	0.29	-0.01, 0.58	1	0.73	0.57, 0.89	6
Caregiving practices	0.05	-0.07, 0.17	5	0.59	0.35, 0.84	9
Child-caregiver practices	0.48	0.20, 0.76	6	0.58	0.20, 0.95	5
Caregiver depressive symptoms	0.10	-0.16, 0.37	3	-0.12	-0.29, 0.05	9

In conclusion, benefits of caregiving interventions are observed on multiple outcomes of ECD (with significant impacts on cognition, language, motor and behavioural development, and attachment) as well as caregiving knowledge and practices, and caregiver and child interactions.

Evidence and recommendations for caregiving interventions to support healthy child socioemotional and behavioural development (PICO 3)

Review question

What are the effects of caregiving interventions to support child socioemotional and behavioural development on ECD?

P – Caregivers and their children in the first 3 years of life
I – Caregiving interventions that support socioemotional and behavioural development
C – Standard of care or comparison groups without caregiving interventions to support healthy child socioemotional and behavioural development
O – ECD (primary), child growth, child health and nutrition, caregiving knowledge, caregiving practices, caregiver-child interactions, and caregivers' mental health.

Summary of Evidence[6]

The GRADE table and forest plots for the meta-analyses are shown in Appendix H. We identified 10 caregiving studies to support healthy socioemotional development and behaviour for children during the first 3 years of life. The evidence for the impact of caregiving interventions to support socioemotional and behavioural development for children under 3 years of age is derived from 10 RCTs representing 11 interventions. All 10 studies were conducted in HICs, including Australia (n = 2), the Netherlands (n = 1), New Zealand (n = 1) and the United States (n = 6). The majority were two-arm RCTs randomized at the individual level (n = 8), with one two-armed c-RCT (Hiscock et al., 2008) and one three-armed c-RCT (Hiscock et al., 2018). Studies were published between the years 2005 and 2018. The analytic sample sizes at endline ranged from 237 (Van Zeijl et al., 2006) to 1353 (Hiscock et al., 2018). The median sample size across all studies was 388 individuals.

Programmes varied in terms of the targeted caregivers. Most interventions (n = 7) primarily targeted mothers or the primary caregiver of the child (Caldera et al. 2007; Gross et al., 2009; Breitenstein et al., 2012; Fergusson et al., 2005; Hiscock et al., 2008; Hiscock et al., 2018; Dishion et al., 2008). One programme restricted enrollment to children from dual-caregiver families (i.e., biological mothers and father-figures) (Van Ziejl et al., 2006). Two programmes specifically targeted adolescent and young mothers (Barlow et al., 2015; Jacobs et al. 2016).

Programmes also differed in the age of the child targeted for enrollment. Three programmes targeted pregnant mothers, but the window for enrollment varied, through 32-weeks gestation (Barlow et al., 2015), birth (Caldera et al., 2007), and the child's first year of life

[6] The terms 'programmes' and 'studies' are used interchangeably. The term 'programme' does not refer to routine service delivery in this report.

(Jacobs et al., 2016). One programme targeted children aged 0-3 months (Fergusson et al., 2005); one enrolled children aged 1-3 years (Van Ziejl et al., 2006); one enrolled children aged 2-3 years (Dishion et al., 2008); two targeted caregivers with children aged 2-4 years (Gross et al., 2009; Breitenstein et al., 2012); and three enrolled infants at their 8-month well-child visits (Hiscock et al., 2008; Hiscock et al., 2018).

The majority of programmes were home visitation (n = 6) delivered to individual families. Two studies evaluated group caregiver-training programmes affiliated with day-care centres (Gross et al., 2009; Breitenstein et al., 2012). Two programmes contained both group and individualized components, one of which was clinic-based only while the other also incorporated in-home visitation (Hiscock et al., 2008; Hiscock et al., 2018).

There was a wide range in programme duration and dosage, from two-hour visits over seven months (Hiscock et al., 2008) to home visiting interventions with up to 40 visits through the child's third birthday (Barlow et al., 2015). Median programme duration was 19.35 months.

Early child outcomes:

The effects of interventions to support healthy socioemotional development and behaviour on early child outcomes are categorized and presented in terms of the following outcome domains: cognitive development, motor development, socioemotional development, behavioural problems, and any other child nutrition or health outcome. None of the studies assessed outcomes for language development or growth outcomes, and therefore these child outcomes have also been excluded from the meta-analysis.

Cognitive development: Only one study assessed cognitive development. Cognition was measured using the Mental Development Index score from the BSID. Mean scores for intervention group children were significantly higher compared to children in the control group ($p<0.05$) (Caldera et al., 2007). Unadjusted means and standard deviations were not presented so the unadjusted effect size could not be calculated, although the authors indicate an adjusted effect size of 0.29. The overall quality of evidence was graded as very low.

Motor development: One study assessed motor development (Caldera et al., 2007). Motor development was measured using the Psychomotor Development Index score from the BSID. Unadjusted effect sizes could not be calculated, but authors presented an adjusted effect size of 0.19, although the difference between groups was not statistically significant ($p = 0.16$). The overall quality of evidence was graded as very low.

Socioemotional development: Barlow and colleagues (2015) was the only study to assess socioemotional development. This was measured using the parental-reported Competence score from the ITSEA. No significant effects were found (adjusted mean difference in intervention

group versus control scores: 0.04; p = 0.09; adjusted ES = 0.14). The overall quality of the evidence was graded as very low.

Child behaviour problems: All 10 studies evaluated child behaviour problems. The pooled results showed no effect on reductions in child behaviour problems (SMD = -0.02, 95% CI: -0.07, 0.02, n = 5). Five studies used the parent-reported CBCL; two studies used the parent-reported ITSEA (Barlow et al., 2015, Fergusson et al., 2005); one study used the Brief-ITSEA (Jacobs et al., 2016); and two used the parent-reported Eyberg Child Behavior Inventory, teacher-reported Caregiver-Teacher Report Form, and direct observation of child behaviour problems assessed from videotaped play sessions (Gross et al., 2009; Breitenstein et al., 2012). The overall quality of the evidence was graded as moderate.

Child health: Two studies examined programme impacts on indicators for child health and medical outcomes. Outcomes were assessed through maternal interviews and review of medical records. Caldera and colleagues (2007) indicated significant improvements in the number of families with health care coverage for the child, but no effects on immunizations, receipt of well-child visits, incidence of injuries requiring medical care, or number of hospitalizations and emergency department visits. Fergusson and colleagues (2005) found intervention effects on children being up-to-date on well-child visits, experiencing fewer hospitalizations for accidents and injuries, and having higher rates of preschool dental services enrollment, but no effects were observed on immunization rates. Child health outcomes were not commonly or consistently measured across studies; therefore, child health was not included in the meta-analysis.

Caregiving outcomes:

The effects of interventions to support healthy socioemotional development and behaviour on caregiving outcomes are categorized and presented in terms of the following aspects of parenting: caregiving knowledge, caregiving practices, caregiver-child interactions, child maltreatment, caregivers' mental health, and caregivers' self-efficacy.

Caregiving knowledge: Two studies assessed programme impacts on caregiving knowledge. Caldera and colleagues (2007) assessed maternal knowledge of infant development using the Knowledge of Infant Development Inventory, and Barlow and colleagues (2015) assessed caregiving knowledge through an author-designed maternal-reported questionnaire. Caldera and colleagues (2007) found no significant effects on maternal knowledge, while Barlow and colleagues (2015) observed significant improvements in caregiving knowledge among intervention mothers. Unadjusted means and standard deviations were not presented, so pooled results could not be calculated. The overall quality of evidence was graded as very low.

Caregiving practices: Eight evaluations examined programme impacts on caregiving practices. Two studies used the HOME (Caldera et al., 2007; Barlow et al., 2015). Seven studies examined parenting discipline strategies, two using the self-reported Parent Questionnaire (Breitenstein et al., 2012; Gross et al., 2009), two using the self-reported Parent Behavior Checklist (Hiscock et al., 2008; Hiscock et al., 2018), and three using the self-reported Parent-Child Conflict Tactics Scale (Jacobs et al. 2016; Fergusson et al., 2005; Caldera et al., 2007). One study additionally generated two parenting practices scores through factor analysis of the caregiver self-reported Child Rearing Practices Report and the Adult-Adolescent Parenting Inventory measures (Fergusson et al., 2005). The pooled results showed no effect on reductions in child behaviour problems (SMD= 0.01, 95% CI: -0.04, 0.06, n=2). The overall quality of evidence was graded as low.

Caregiver-child interactions: Five evaluations assessed programme effects on caregiver-child interactions. One programme used the NCAST scale (Caldera et al., 2007). Two studies assessed caregiver use of praise and commands during observed play and clean-up sessions, coded with the Dyadic Parent-Child Interactive Coding System-Revised (Breitenstein et al., 2012; Gross et al., 2009). Dishion and colleagues (2008) created a composite positive behaviour support score, drawing items from HOME's involvement subscale and direct observation measures. Van Ziejl and colleagues (2006) assessed sensitivity, positive and negative discipline scores through three direct observation measures during laboratory tasks. The pooled results showed no significant effect on improving caregiver-child interactions (SMD = 0.14, 95% CI: -0.07, 0.34, n = 1). The overall quality of evidence was graded as very low.

Child maltreatment: Two studies assessed programme impacts on child maltreatment. One study examined parental report of contact with the Child, Youth and Family Service for issues relating to child abuse and neglect (Fergusson et al., 2005) but did not see reductions in agency contacts. The other (Jacobs et al., 2016) examined records from Child Protective Services to assess whether substantiated child maltreatment reports had been filed, but also did not observe any significant effects.

Caregiver mental health: Four studies assessed intervention impacts on caregiver mental health. Two studies used the maternal self-reported CES-D (Barlow et al., 2015; Shaw et al., 2009) and two studies used the primary caregiver-reported Depression Anxiety and Stress Scales (Hiscock et al., 2008; Hiscock et al., 2018). The pooled results showed no effect on reductions in maternal depressive symptoms (SMD = -0.05, 95% CI: -0.11, 0.01, n = 3). The overall quality of the evidence was graded as low.

Self-efficacy: Three studies assessed intervention impacts on caregiver self-efficacy. Caldera and colleagues (2007) measured maternal self-efficacy using the Teti Maternal Self-efficacy scale; Breitenstein and colleagues (2012) and Gross and colleagues (2009) used the Toddler Care Questionnaire. Both Caldera and colleagues (2007) and Breitenstein and colleagues (2012) found

intervention group mothers to have significantly higher self-reported self-efficacy scores compared to control groups; however, Gross and colleagues (2009) found no effects. Unadjusted means and standard deviations were not presented so pooled results could not be calculated. The overall quality of evidence was graded as low.

Subgroup analyses:

Subgroup analyses were conducted to examine possible moderating effects by intended programme intensity (infrequent contacts or for less than 3 months versus regular contacts and longer than 3 months) and programme delivery (individual versus group-based/mixed contacts). None of the pooled effect sizes on child and caregiver outcomes differed by programme intensity or programme delivery. It is likely that statistical power to detect differences by subgroup was limited due to the small number of studies for many of the caregiver and child outcomes.

Considerations for adverse effects and costs:

There were no indications of adverse effects caused by caregiving interventions to support child socioemotional and behavioural development. Costing data were not readily available. One study reported data on intervention costs (Hiscock et al., 2018). Mean costs of this trial intervention programme were AUS$ 218 (AUS$ 208 costs to government and AUS$ 10 costs to family) and AUS$ 682 (AUS$ 516 costs to government and AUS$ 166 costs to family) per family in the targeted and combined arms of the intervention respectively.

In conclusion, the global evidence on caregiving interventions to support children's socioemotional wellbeing and behaviour during the first three years of life is from HICs. Therefore, these findings cannot be generalized to LMICs.

Evidence and recommendations for combined caregiving and nutrition interventions (PICO 4)

Research questions

What are the effects of combined caregiving and nutrition programmes on ECD and child growth outcomes in the first 3 years of life?

- What are the independent and additive effects of caregiving and nutrition interventions on ECD and child growth outcomes in the first 3 years of life?
- Do the effects on ECD and child growth outcomes differ between programmes that are targeted for young children with moderate to severe malnutrition compared to universal programmes?

P – Caregivers and their children in the first 3 years of life
I – Combined caregiving (responsive caregiving, early learning promotion, or combined responsive caregiving and early learning promotion) and nutrition programmes
C – a) standard of care; b) caregiving intervention alone; c) nutrition intervention alone
O – ECD (primary), child attachment, child growth, child health and nutrition, caregiving knowledge, caregiving practices, caregiver-child interactions, and caregivers' mental health

Summary of Evidence[7]

The GRADE table and forest plots for the meta-analyses are shown in Appendix I. We identified 18 combined caregiving and nutrition interventions delivered to caregivers and their young children during the first 3 years of life. **Table 9** shows all 18 interventions (see Appendix C for further details of programmes and characteristics). All 18 studies were conducted in LMICs: Bangladesh (n = 6), Chile (n = 1), Colombia (n = 2), India (n = 1), Indonesia (n = 1), Jamaica (n = 3), Pakistan (n = 1), Uganda (n = 2) and Zambia (n = 1). The RCTs varied in the number of trial arms: 2-arms (n = 9), 3-arms (n = 2), 4-arms (n = 5), 5-arms (n = 1) and 6-arms (n = 1). The majority of studies enrolled children from 6 months of age; however, Waber and colleagues (1981) recruited caregivers during pregnancy, and Vazir and colleagues (2013) and Yousafzai and colleagues (2014) enrolled children less than 6 months old.

With respect to the nutrition component of the intervention, nine studies provided nutrition supplementation, typically with nutrition education, and the remainder focused on nutrition education alone. Seven studies specifically targeted undernourished children (Gardner

[7] The terms 'programmes' and 'studies' are used interchangeably. The term 'programme' does not refer to routine service delivery in this report.

et al., 2005; Grantham-McGregor et al., 1991; Hamadani et al., 2006; Lozoff et al., 2010; Nahar et al., 2012a; Powell et al., 2004; Tofail et al., 2013). With respect to the studies by Lozoff and colleagues (2010) and Tofail and colleagues (2013) from Chile and Bangladesh respectively, only the iron-deficient anemia arms of the trials were analysed. No studies were retrieved combining caregiving and over-nutrition meeting the specified inclusion criteria in the initial search.

Most interventions targeted mothers and children, with the exception of Singla and colleagues (2015) where the targeting of mothers and fathers as caregivers was specified. The interventions largely employed individual contacts or combined group and individual contacts, with only two interventions using a group-only contact mode of delivery (Aboud & Akhter, 2011; Muhoozi et al., 2017). The average duration of implementation was 14 months, ranging from two months (with a booster at six months) (Aboud & Akhter, 2011) to 36 months (Waber et al., 1981).

Table 9. Overview of study design, intervention and comparison arms

Author	Study design	Combined intervention	Caregiving intervention	Nutrition intervention	Standard of care
Aboud et al., 2013	2 arm	Messages + illustrative card provided around hygiene, responsive feeding, play, communication, gentle discipline, and nutritious foods/dietary diversity. Addressed parenting practices related to health, nutrition, communication and play.			Standard care - home visits by government-paid family welfare assistants with messages about feeding and hygiene
Aboud & Akhter, 2011	3-arm RCT	The Responsive Feeding and Stimulation (RFS) + group received the RFS intervention, plus Sprinkles micronutrient powder for 6 months.	The RFS component of the intervention comprised of 6 sessions that delivered 6 messages on "responsive feeding and stimulation". In the sessions, mothers could participate in discussions and practice sessions with their children, while being coached by the peer educator. The peer educator also demonstrated one stimulation and responsive feeding activity in each session.		The control group received 12 sessions on health and nutrition education and information on child development
Attanasio et al, 2014	4 arms (2x2 factorial)	Psychosocial stimulation and micronutrient supplementation	Psychosocial stimulation: home visitors demonstrated play activities using low-cost or homemade toys, picture books, and form boards. These materials were left in the homes for the week after the visit and were changed weekly.	The micronutrient supplementation consisted of Sprinkles delivered to households every two weeks.	Standard of care

Author	Study design	Combined intervention	Caregiving intervention	Nutrition intervention	Standard of care
Frongillo et al., 2017 Menon et al., 2016	2 arm	Included intensive interpersonal counselling on infant and young child feeding, responsive feeding, mass media campaign, and community mobilization		Alive and thrive usual package (nutrition counselling and mass media campaign)	
Gardner et al., 2005	4 arm (2X2 factorial design; plus a second non-stunted control group, not included in this analysis)	Participants in the integrated group received both psychosocial stimulation and zinc supplementation	Weekly, 30-minute psychosocial stimulation sessions were conducted by trained community health workers and focused on improving maternal-child interactions. In these sessions, mothers learned about activities to engage with their child in an age-appropriate fashion and received simple toys from the programme.	The nutrition component of the intervention comprised weekly zinc supplementation	The control group received placebo and routine care but no stimulation
Grantham-McGregor et al., 1991 Walker et al., 1991	4 arm (2X2 factorial design, plus non-stunted control group)	Participants received both the supplementation and stimulation services	In the stimulation component of the intervention, stunted children received weekly hour-long home visits from community health aides that focused on play and stimulation. Mothers in this group were instructed on how to play with children and impact their development. Toys left behind after the visit facilitated mother-child play and interactions in-between two visits.	The supplementation component of the intervention comprised of weekly distribution of 1kg of milk-based formula for the duration of the intervention.	The participants in the control group of stunted children received weekly health visits from health workers and free medical care.

Author	Study design	Combined intervention	Caregiving intervention	Nutrition intervention	Standard of care
Hamadani et al., 2006	2 arm	Psychosocial stimulation (improving the mother-child interaction; and providing developmentally appropriate activities for the child) and nutrition supplementation through community nutrition centres			Bangladesh Integrated Nutrition Program standard of care, including nutrition supplementation through community nutrition centers
Helmizar et al., 2017	4 arm (2X2 factorial)	Received both the parenting and the nutrition interventions.	Mothers participated in weekly parenting classes, based on a handbook for psychosocial stimulation containing 24 age-appropriate play sessions to enable mothers to play with their infants. The main focus of the play session programme was to improve maternal responsivity and mother-child interaction. Mothers were expected to practise the play activities at home every day. Toys and picture books were provided to facilitate this activity at home.	Participants in the nutrition component received a formula food created from local food sources. Packets of formula were adjusted for age group with 200-250 kcal of energy and 6-8 g of protein. Caregivers were provided a handbook with instructions for preparing supplements and information on complementary feeding.	The control group received standard of care.
Lozoff et al., 2010	2-arm RCT (parallel design)	Home visits were conducted for infants in the intervention group by trained professional educators called 'monitors'. In the weekly, 1-hour sessions, the monitors assessed the family strengths and challenging areas, set goals along with the mother, discussed ECD issues, offered feedback as mothers practised activities and		Children in the control group were administered iron treatments (30 mg per day) and had their health, iron intake and nutrition data collected in the follow-up period.	

Author	Study design	Combined intervention	Caregiving intervention	Nutrition intervention	Standard of care
		helped address any concerns that the mothers may have had. All infants received oral iron treatments (30 mg per day).			
Muhoozi et al., 2017	2 arm	Nutritious cooking demonstrations based on a nutrition education curriculum; sanitation and hygiene activities (handwashing, use of toothbrush, etc); and child stimulation and play.			Standard of care
Nahar et al, 2012 Nahar et al, 2012b Nahar et al, 2015	5 arms (2x2 factorial with two control groups)	Psychosocial stimulation and food supplementation	Psychosocial stimulation: play sessions and parental education using a semi-structured curriculum	Food supplementation: food packets were distributed to children when leaving the hospital and at each of the follow-up visits for the first 3 months. The caregivers were taught about preparation of the packets.	(1) clinic-control (2) hospital-control
Powell et al., 2004 Baker-Henningham et al., 2005	2 arm	Stimulation (weekly home visits by community health aides; demonstrate play activities involving the mother and child; exchange toys each visit) and nutrition education			Standard of care (with nutrition education)

Author	Study design	Combined intervention	Caregiving intervention	Nutrition intervention	Standard of care
Rockers et al., 2016	2 arm	(1) Screening and referral for symptoms of infectious disease; (2) screening and referral for acute malnutrition; (3) encouragement of the use of routine health care services for children; (4) group meetings addressed different topics each month, including parenting skills, child nutrition and cooking demonstrations, forms of play, cognitive stimulation and language development activities.			Standard of care
Singla et al., 2015	2 arm	12 60-90 minute-long group sessions were held that targeted key messages on children and maternal well-being. Topics included use of play materials, gentle discipline, consumption of a diverse diet, hygiene and sanitation messages. Along with these discussions, there were demonstrations for ways to play and talk to the child and of food quantities. Topics for maternal well-being included strengthening primary relationships, and there were sessions for mothers and fathers, independently as well as together.			The waitlist control group received services from Plan Uganda as well as nutrition information around dietary diversity.

Author	Study design	Combined intervention	Caregiving intervention	Nutrition intervention	Standard of care
Tofail et al, 2013 – Iron Deficiency Anaemia (IDA)	2 arm	Psychosocial stimulation: weekly home visits by play leaders, demonstrations on how to play with toys and interact with children; families receive toys and books. Nutrition: one bottle of 35 mL ferrous sulfate syrup was supplied weekly to the homes of all children with IDA for the first 6 months.		Nutrition: one bottle of 35 mL ferrous sulfate syrup was supplied weekly to the homes of all children with IDA for the first 6 months.	
Vazir et al., 2013	3 arm	The integrated arm of the trial comprised of a Responsive Complementary Feeding and Play Group programme. Along with the services that the children were receiving from Integrated Child Development Services, mothers of children received 11 messages on nutrition education, 8 on responsive feeding and 8 on age-appropriate play-based stimulation, along with toys, through 30 home visits.		The nutrition arm of the trial comprised of a Complementary Feeding Group: along with the services that the children were receiving from ICDS, mothers of children in this arm received 11 messages on nutrition education through home visits.	Mothers and infants in the control group received the routine Integrated Child Development Services services (operating across all study arms), which includes centre-based nutritional supplementation, home-visit counseling on breastfeeding and complementary feeding, monthly growth monitoring, and non-formal preschool education for children 3 to 5 years of age.
Waber et al., 1981 Mora et al., 1981	6 arm trial (4 arms constituted a 2X2 factorial design: A, D, A1, D1)	The integrated arm (Arm D1) received both i) the maternal education programme and ii) the weekly food supplements, beginning in the 3rd trimester of pregnancy until the child reached 3 years of age.	One group (Arm A1) did not receive supplementation, but was enrolled in a maternal education programme with the goal of increasing environmental stimulation of the child group.	Three arms received weekly food supplementation over varying increments (Arm B: from age 6 months to 3 years; Arm C: during 3rd trimester of pregnancy through child age 6 months; Arm D: from beginning of the 3rd trimester until child age 3 years). Food supplements included bread,	

Author	Study design	Combined intervention	Caregiving intervention	Nutrition intervention	Standard of care
				milk, protein, vitamins, and minerals.	
Yousafzai et al., 2014 Yousafzai et al., 2015	4 arms (2x2 factorial)	Responsive Stimulation and Enhanced Nutrition	Responsive stimulation intervention: Home visits and group sessions to promote caregivers' sensitivity and responsiveness by use of developmentally-appropriate play activities.	Enhanced nutrition intervention: responsive feeding messages, distribution of a multiple micronutrient powder for children aged 6–24 months to address the prevalent micronutrient deficiencies in the population, nutrition/heath messages	Lady Health Worker Programme - standard of care

The meta-analyses for child outcomes are organized in three GRADE tables: (1) combined nutrition and caregiving interventions versus standard of care; (2) combined nutrition and caregiving versus caregiving interventions alone; and (3) combined nutrition and caregiving interventions versus nutrition interventions alone. The child outcomes are cognitive development, language development, motor development, socioemotional development, HAZ, WAZ, weight-for-height (WHZ), and any other child nutrition or health outcome.

Early child outcomes:

For child cognitive, language and motor development outcomes the majority of the evaluations employed BSID. Three studies from Jamaica employed the Griffiths Mental Development Scale (Powell et al., 2004; Gardner et al., 2005; Grantham-McGregor et al., 1991). Two studies used caregiver reports (Muhoozi et al., 2017; Rockers et al., 2016). Only two programmes evaluated impact on socioemotional development, and both used the BSID.

Cognitive development:

- For combined nutrition and caregiving interventions versus standard of care, the pooled results showed a significant improvement in cognitive development (SMD = 0.57, 95% CI: 0.32 to 0.88, n = 14). The overall quality of evidence was graded as low.
- For combined nutrition and caregiving versus caregiving interventions alone, the pooled results showed no significant improvement in cognitive development (SMD = 0.10, 95% CI: -0.12 to 0.32, n = 6). The overall quality of evidence was graded as low.
- For combined nutrition and caregiving versus nutrition interventions alone, the pooled results showed a significant improvement in cognitive development (SMD = 0.45, 95% CI: 0.22 to 0.67, n = 9). The overall quality of evidence was graded as low.

Language development:

- For combined nutrition and caregiving interventions versus standard of care, the pooled results showed a significant improvement in language development (SMD = 0.40, 95% CI: 0.17, 0.63, n = 10). The overall quality of evidence was graded as low.
- For combined nutrition and caregiving versus caregiving interventions alone, the pooled results showed no significant improvement in language development (SMD = 0.01, 95% CI: -0.09 to 0.10, n = 6). The overall quality of evidence was graded as moderate.
- For combined nutrition and caregiving intervention versus nutrition interventions alone, the pooled results showed a significant improvement in language development (SMD = 0.21, 95% CI: 0.13 to 0.28, n = 6). The overall quality of evidence was graded as moderate.

Motor development:

- For combined nutrition and caregiving interventions versus standard of care, the pooled results showed a significant improvement in motor development (SMD = 0.4, 95% CI: 0.26 to 0.53, n = 10). The overall quality of evidence was graded as low.
- For combined nutrition and caregiving versus caregiving interventions alone, the pooled results showed no significant improvement in motor development (SMD = 0.18, 95% CI: -0.06 to 0.42, n = 6). The overall quality of evidence was graded as low.
- For combined nutrition and caregiving interventions versus nutrition interventions alone, the pooled results showed no significant improvement in motor development (SMD = 0.14, 95% CI: 0.07 to 0.22, n = 9). The overall quality of evidence was graded as high.

Socioemotional development:

- For combined nutrition and caregiving interventions versus standard of care, the pooled results showed no significant improvement in socioemotional development (SMD = 0.09, 95% CI: -0.11, 0.30, n = 2). The overall quality of evidence was graded as low.
- For combined nutrition and caregiving versus caregiving interventions alone, Yousafzai and colleagues (2014) had an effect size of 0.11, 95% CI: -0.04 to 0.26. The overall quality of evidence was graded as low.
- For combined nutrition and caregiving interventions versus nutrition interventions alone, Yousafzai and colleagues (2014) had an effect size of -0.09, 95% CI: 0.24 to 0.07. The overall quality of evidence was graded as low.

Overall, no significant benefits were found on child growth outcomes.

HAZ:

- For combined nutrition and caregiving interventions versus standard of care, the pooled results showed SMD = -0.13, 95% CI: -0.31 to 0.05, n = 9. The overall quality of evidence was graded as low.
- For combined nutrition and caregiving versus caregiving interventions alone, the pooled results showed SMD = -0.21, 95% CI: -0.60 to 0.19, n = 4. The overall quality of evidence was graded as low.
- For combined nutrition and caregiving interventions versus nutrition interventions alone, the pooled results showed SMD = -0.42, 95% CI: -0.85 to 0.01, n = 4. The overall quality of evidence was graded as low.

WAZ:

- For combined nutrition and caregiving interventions versus standard of care, the pooled results showed SMD = 0.06, 95% CI: -0.02 to 0.13, n = 7. The overall quality of evidence was graded as high.

- For combined nutrition and caregiving versus caregiving interventions alone, the pooled results showed SMD = 0.07, 95% CI: -0.04 to 0.17, n = 3). The overall quality of evidence was graded as moderate.
- For combined nutrition and caregiving interventions versus nutrition interventions alone, the pooled results showed SMD = 0.06, 95% CI: -0.02 to 0.14, n = 4. The overall quality of evidence was graded as moderate.

WHZ:

- For combined nutrition and caregiving interventions versus standard of care, the pooled results showed SMD = 0.20, 95% CI: 0.05 to 0.34, n = 6. The overall quality of evidence was graded as moderate.
- For combined nutrition and caregiving versus caregiving interventions alone, the pooled results showed SMD = 0.16, 95% CI: 0.03 to 0.29, n = 4. The overall quality of evidence was graded as moderate.
- For combined nutrition and caregiving interventions versus nutrition interventions alone, the pooled results showed SMD = 0.17, 95% CI: -0.04 to 0.38, n = 5. The overall quality of evidence was graded as low.

Impact on other child nutrition and child health outcomes: In general, child nutrition and health outcomes were not commonly or consistently measured across studies; therefore, these outcomes were not included in the meta-analysis. Aboud and Akhter (2011) reported significant improvements in the intervention groups (receiving combined nutrition and caregiving interventions) on mouthfuls eaten and handwashing practices. Vazir and colleagues (2013) found children in the nutrition arms (with or without early learning interventions) of the trial significantly improved dietary intake as a result of nutrition education intervention exposure. Yousafzai and colleagues (2015) reported children exposed to nutrition interventions (with or without responsive caregiving and early learning) had significantly improved age-appropriate breast feeding practices, and children exposed to the caregiving interventions (with or without the nutrition interventions) had significantly improved minimal acceptable diet and meal frequency . Three studies found no effects on reducing sickness (Aboud et al., 2013; Menon et al., 2016; Singla et al., 2015), while another study found reductions in diarrhoea and acute respiratory illness (with or without responsive caregiving and early learning) (Yousafzai et al., 2014).

Subgroup analyses

We analysed the interventions by whether they targeted malnourished children compared with universal implementation (no targeting). The findings are shown in **Tables 10-12**. In each

comparison, we find the effect size for development outcomes are higher for malnourished children than the universally-implemented studies, with mixed results on growth outcomes.

Table 10. Combined responsive caregiving and early learning versus standard of care

Outcome	Overall			Targeted: malnourished			Universal		
	SMD	95% CI	N	SMD	95% CI	N	SMD	95% CI	N
Cognitive development	0.57	0.32, 0.82	13	0.63	0.34, 0.92	6	0.52	0.15, 0.88	7
Language development	0.40	0.17, 0.63	10	0.56	0.32, 0.81	3	0.35	0.07, 0.63	7
Motor development	0.40	0.26, 0.53	10	0.38	0.13, 0.64	5	0.41	0.25, 0.58	5
Attachment									
Socioemotional development	0.09	-0.11, 0.30	1						
HAZ	-0.13	-0.31, 0.05	9	-0.36	-0.88, 0.15	2	-0.07	-0.25, 0.11	7
WAZ	0.06	-0.02, 0.13	7	0.00	-0.14, 0.14	2	0.08	-0.01, 0.17	5
WHZ	0.20	0.05, 0.34	6	0.11	-0.10, 0.31	3	0.25	0.04, 0.46	3

Table 11. Combined responsive caregiving and early learning versus caregiving alone

Outcome	Overall			Targeted: malnourished			Universal		
	SMD	95% CI	N	SMD	95% CI	N	SMD	95% CI	N
Cognitive development	0.10	-0.12, 0.32	6	0.32	-0.03, 0.66	4	-0.13	-0.24, -0.02	2
Language development	0.01	-0.09, 0.10	6	0.26	-0.12, 0.63	2	-0.01	-0.11, 0.09	4
Motor development	0.18	-0.06, 0.42	6	0.42	-0.26, 1.09	3	0.06	-0.14, 0.25	3
Attachment									
Socioemotional development	0.11	-0.04, 0.26	1						
HAZ	-0.21	-0.60, 0.19	4	-0.83	-1.19, -0.46	1	0.00	-0.25, 0.25	3
WAZ	0.07	-0.04, 0.17	3	0.00	-0.15, 0.15	1	0.12	-0.02, 0.27	2
WHZ	0.16	0.03, 0.29	4	0.09	-0.19, 0.38	2	0.18	0.03, 0.32	2

Table 12. Combined responsive caregiving and early learning versus nutrition alone

Outcome	Overall			Targeted: malnourished			Universal		
	SMD	95% CI	N	SMD	95% CI	N	SMD	95% CI	N
Cognitive development	0.45	0.22, 0.67	9	0.61	0.18, 1.05	6	0.23	0.13, 0.33	3
Language development	0.21	0.13, 0.28	6	0.43	-0.20, 1.07	2	0.21	0.15, 0.27	4
Motor development	0.14	0.07, 0.22	9	0.07	-0.16, 0.30	4	0.17	0.11, 0.23	6

Outcome	Overall			Targeted: malnourished			Universal		
	SMD	95% CI	N	SMD	95% CI	N	SMD	95% CI	N
Attachment									
Socioemotional development	-0.08	-0.24, 0.07	1						
HAZ	-0.42	-0.85, 0.01	4	-1.28	-1.65, -0.91	1	-0.14	-0.41, 0.14	3
WAZ	0.06	-0.02, 0.14	4	0.15	-0.00, 0.31	1	0.04	-0.03, 0.10	3
WHZ	0.17	-0.04, 0.38	5	0.13	-0.14, 0.40	2	0.20	-0.09, 0.48	3

Considerations for adverse effects and costs:

While there is no consistent evidence for additive benefits on single outcomes, combined caregiving and nutrition can impact a number of child and caregiving outcomes. There does not appear to be any significant evidence for adverse effects. Cost of interventions is not reported, but potential cost savings for programmes may be possible when using the same platform and delivery agent to deliver integrated nurturing care for children.

In conclusion, the evidence from LMICs suggests that combined caregiving and nutrition interventions are significantly effective on child cognitive, language and motor development compared with usual care, and on child cognitive and language development compared with nutrition alone. No benefits are observed on growth outcomes. Among malnourished populations, combined caregiving and nutrition interventions are significantly effective on child cognitive, language and motor development compared with usual care, and on child cognitive development compared with nutrition alone. More research is needed on how to optimize the combined nutrition and caregiving strategies.

Research gaps

In undertaking the systematic reviews, the following research gaps were identified by the research team.

1. The largest group of studies were for (additional analysis) 2.1 (combined responsive caregiving and promotion of early learning) with good global representation. However, PICO 1 (responsive caregiving alone) had limited intervention research in LMICs. Similarly, PICO 4 (integrated caregiving and nutrition programmes) was largely focused on undernutrition in LMICs and did not address the growing challenges in many countries on child overnutrition.

2. Few studies report on caregiving-related outcomes, which are critical for understanding processes for the effectiveness of caregiving/parenting programmes on child outcomes (Jeong et al., 2018).

3. Few studies reported adequate information on programme characteristics to enable analysis on actual implementation processes, rather than intended implementation processes (e.g. dosage, behaviour change techniques). These data are essential to inform evidence-based implementation planning of nurturing care programmes.
4. There is little information on caregiving and overnutrition.

5. Few studies reported findings on subgroups to determine whether interventions were more or less effective for particular groups within the population (e.g. child and caregiver characteristics).

6. Limited data on cost were reported in relation to the interventions. Policy makers require cost information to plan programmes, and more research is required on costing of interventions.

7. Many tools employed to assess both child and caregiving outcomes are unstandardized, making it difficult to assess a specific construct of development. Reporting about the reliability and validity of adapted tools is limited.

8. Definitions for interventions are variable, making comparisons challenging. The systematic review team defined common characteristics for interventions categorized as responsive caregiving, early learning promotion, and support for socioemotional and behavioural development. Clear intervention reporting guidelines would be helpful for the multi-disciplinary research community working in the field of ECD.

9. Data from large scale studies are limited.

10. Data that report on caregivers, other than mothers, and measure outcomes on other caregivers are limited.

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Appendix A: Glossary

- **Attachment:** an emotional bond between an infant and one or more adults. The infant will approach these individuals in times of distress, particularly during the phase of infant development when the presence of strangers induces anxiety. In addition, the infant is distressed if separated from attachment figures.[1]
    - **Attachment status:** a description of an infant's attachment as being either secure or insecure.
        - **Secure attachment:** a child who is securely attached actively explores the environment in the presence of the caregiver, is visibly upset by separation, and greets the mother warmly when they are reunited.
        - **Insecure attachment:** attachment that takes one of three forms: avoidant attachment, anxious-resistant attachment and disorganized/disoriented attachment.
- **Attunement:** an empathic responsiveness between two individuals, described by Daniel Stern as the 'performance of behaviours that express the quality of feeling of a shared affect state.'[2]
- **Behaviour problems:**
    - **Externalizing: "**behaviour problems that are manifested in children's outward behaviour and reflect the child negatively acting on the *external* environment. Other terms to describe externalizing behaviour problems include 'conduct problems,' 'antisocial,' and 'under-controlled.'[3]
    - **Internalizing:** "behaviour problems such as withdrawn, anxious, inhibited, and depressed behaviours that more centrally affect the child's internal psychological environment rather than the external world."[3]
- **Bundling:** combining two or more services in a single programme, with the goal of maintaining or enhancing the benefits of existing services and gaining additional benefits from the new intervention.[4]
- **Developmental potential:** ability to think, learn, remember, relate, and articulate ideas appropriate to age and level of maturity; an estimated 39% of the world's children under age five years do not attain this potential.[5]

[1] Richter L. *The importance of caregiver-child interactions for the survival and health development of young children: a review*. Geneva: World Health Organization; 2004.
[2] Stern DN. The interpersonal world of the infant: a view from psychoanalysis and developmental psychology. New York: Basic Books; 1985, p. 142; cited in Richter L. 2004.
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[5] Grantham-McGregor S. et al. Developmental potential in the first 5 years for children in developing countries. Lancet. 2007; 369:9555:60-70.

- **Dialogic book-sharing (dialogic reading):** stimulation package designed according to the following three principles: (a) use of techniques by the parent to encourage the child to talk about pictured materials; (b) informative feedback by incorporating expansions, corrective modelling, and other forms that highlight differences between what the child has said and what he/she might have said; and (c) an adaptive parent sensitive to the child's developing abilities.[1]
- **Depression:** an affective disorder characterized by a sense of inadequacy, feelings of despondency or hopelessness, a decrease in activity and/or reactivity, pessimism, sadness, irritability, changes in appetite and sleep patterns, and poor concentration.
- **Early childhood development** (ECD): refers to the physical, socioemotional, cognitive, and motor development between 0-8 years of age.
- **Emotional availability:** refers to the ability of the caregiver and child to share a healthy emotional connection and the quality of emotional exchanges between caregivers and children. Encompasses both emotional signaling and emotional understanding, as well as the emotional accessibility of one to the other. The emotionally available dyad is one in which both mother and infant recognize the other partner's signals and affirm them.[2]
- **Home visiting programmes:** involve visits by nurses to parents and children in their homes to prevent child maltreatment and promote positive infant, child and parental development by providing support, education and information.[3]
- **Integration:** same as *bundling;* combining two or more services in a single intervention, with the goal of maintaining or enhancing the benefits of existing services and gaining some benefit from the new programme.
- **Interventions:** attempts to influence or change the course of events by providing care or information or otherwise manipulating a situation.
- **Macronutrients:** include carbohydrates, proteins, and fats. Consumed in relatively large quantities and are important to child linear growth and mental development.[4]
- **Malnutrition:** results from deficiencies, excesses or imbalances in the consumption of macro- and/or micronutrients. Malnutrition may be an outcome of food insecurity, or it may relate to non-food factors, such as inadequate care practices for children, insufficient health services, and/or an unhealthy environment.[5]
    - **Pediatric malnutrition (undernutrition):** an imbalance between nutrient requirements and intake that results in cumulative deficits of energy, protein or

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micronutrients that may negatively affect growth, development and other relevant outcomes.[1]

- **(Child) Maltreatment:** the abuse and neglect of children under 18 years of age. It includes all types of physical and/or emotional ill-treatment, sexual abuse, neglect, negligence and commercial or other exploitation, which results in actual or potential harm to the child's health, survival, development or dignity in the context of a relationship of responsibility, trust or power.[2]
- **Maternal-infant bonding**: While widely defined in the literature, a general definition describes maternal–infant bonding as a process that includes the emotional tie of a mother to her infant, occurring in the first week or year of an infant's life and that is influenced by signals and cues from the child as well as the maternal-driven processes.[3]
- **Micronutrients:** minerals and vitamins that enable the body to produce enzymes, hormones and other substances essential for proper growth and development. Consumed in minuscule amounts, but the consequences of their absence are severe. Iodine, vitamin A and iron are most important in global public health terms; their lack represents a major threat to the health and development of populations the world over, particularly children and pregnant women in low-income countries.[4]
- **Nurturing care:** characterized by a caregiving environment that is sensitive to children's health and nutritional needs, responsive, emotionally supportive, and developmentally stimulating and appropriate, with opportunities for play and exploration and protection from adversities.[5]
- **Nutritional supplementation:**
    - **Multiple vitamin and mineral supplements:** multiple micronutrients constitute the common nutritional supplement provided to young children. Children are often deficient in many minerals, such as iron and zinc, as well as vitamins. All are critical for health and growth, and their effects on mental development are becoming clear.[9]
- **Play:** a central component of early childhood stimulation and quality parent-child interactions that is essential to the social, emotional, cognitive, and physical wellbeing of children beginning in early childhood.[6]
    - **Child-led (-driven, -centred) play:** play that is directed by the child (though caregivers may observe or join in), in which children are able to practice decision-making skills, move at their own pace, and discover their own areas of interest.[7]

[1] Becker et al. Consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: indicators recommended for the identification and documentation of pediatric malnutrition (undernutrition). 2015.
[2] World Health Organization.
[3] Bicking Kinsey C, Hupcey JE . State of the science of maternal-infant bonding: a principle-based concept analysis. Midwifery. 2013;29(12), 10.1016/j.midw.2012.12.019. http://doi.org/10.1016/j.midw.2012.12.019.
[4] World Health Organization.
[5] Black MM et al. Early childhood development coming of age: science through the life course. Lancet. 2017;389(10064):77-90.
[6] Milteer RM. The importance of play in promoting healthy child development and maintaining strong parent-child bond: focus on children in poverty. Pediatrics. 2012;129(1).
[7] Ginsburg et al. The importance of play in promoting healthy child development and maintaining strong parent-child bonds. Pediatrics. 2007;19(1).

- **Positive parenting:** consists of five core principles for parents to promote social competence and emotional self-regulation in children: (1) ensuring a safe, engaging environment, (2) promoting a positive learning environment, (3) using assertive discipline, (4) maintaining reasonable expectations, and (5) taking care of oneself as a parent. The emphasis is on parents learning how to apply these skills to different behavioural, emotional and developmental issues in children, ranging from common child-rearing challenges (e.g. toileting, mealtime behaviour, bedtime, behaviour in public) to more intense challenges (e.g. child aggressive behaviour, fears and anxiety, ADHD difficulties).[1]
- **Psychosocial Stimulation**: refers to an external object or event that elicits a physiological and psychological response in the child.
- **Responsiveness:** the capacity of the caregiver to respond contingently and appropriately to the infant's signals.
- **Scaffolding:** a concept derived from Vygotsky's theory of mediated learning, scaffolding is the process by which someone organizes an event that is unfamiliar or beyond a learner's ability in order to assist the learner in carrying out that event.
- **Sensitivity:** the capacity of the caregiver to be aware of the infant and aware of the infant's acts and vocalizations as signals communicating needs and wants.
- **Sensitive Discipline:** parents' ability to take into account the child's perspective and signals when discipline is required.[2]
- **Stunting**: a commonly used indicator of chronic undernutrition, defined as more than two standard deviations below the age- and gender-specific norm.
- **Temperament**: an individual's characteristic mode of responding emotionally and behaviourally to environmental events. Temperament includes the dimensions of irritability, activity level, fearfulness and sociability.
- **Violent Discipline**: actions taken by a parent or caregiver that are intended to cause a child physical pain or emotional distress as a way to correct behaviour and act as a deterrent. Violent discipline can take two forms: psychological aggression and physical, or corporal, punishment. The former includes shouting, yelling and screaming at the child, and addressing her or him with offensive names. Physical or corporal punishment comprises actions intended to cause the child physical pain or discomfort but not injuries. Minor physical punishment includes shaking the child and slapping or hitting him or her on the hand, arm, leg or bottom. Severe physical punishment includes hitting the child on the face, head or ears, or hitting the child hard or repeatedly.[3]

[1] Prinz RJ, Sanders MR, Shapiro CJ, Whitaker DJ, Lutzker JR Population-based prevention of child maltreatment: The U.S. Triple P System Population Trial. Prevention Science. 2009;10:1–12.
[2] Van Zeijl J et al. Attachment-based intervention for enhancing sensitive discipline in mothers of 1- to 3-year-old children at risk for externalizing behavior problems: a randomized controlled trial. Journal of Consulting and Clinical Psychology. 2006;74(6): 994-1005.
[3] UNICEF.

Behaviour Change Techniques

- **Information**: provision of new information about the link between behaviour and child development, causes and consequences, and instruction on how to perform the behaviour.[1]
- **Materials**: materials that beneficiary families would not normally possess or buy on their own are provided in order to facilitate behaviour change.
- **Media**: use of any form of media to bring about behaviour change, including TV advertisements, flashcards, and organization of role plays and dramas.
- **Performance**: includes modelling or providing demonstrations, actual rehearsal or practice of a targeted behaviour in the intervention setting, providing feedback on performance, contingent rewards, and/or identification of cues to action.
- **Problem Solving:** includes identifying facilitators and barriers of a targeted behaviour, as well as solutions to overcoming barriers.
- **Social Support:** leveraging support from various members of the society/community to bring about behaviour change; includes motivating peers, family members or authority figures to encourage parents to engage in behaviour change.

[1] Briscoe & Aboud. Behaviour change communication targeting four health behaviours in developing countries: a review of change techniques. Social Science and Medicine. 2012;75(4); 612-21; Aboud FE, Yousafzai AK. Global health and development in early childhood. Annual Review of Psychology. 2015; 66(1): 433-57.

Appendix B: List of Guideline Development Group members

#	Name	Institution
1	Frances Aboud	McGill University, Montreal, Canada
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3	Jane Fisher (Chair)	Monash University, Melbourne, Australia
4	Subodh Gupta	Dr Sushila Nayar School of Public Health, Maharashtra, India
5	Ghassan Issa	Arab Network for Early Childhood Care and Development (ANECD), Beirut, Lebanon
6	Stewart Kabaka	Ministry of Health, Nairobi, Kenya
7	Betty Kirkwood	London School of Hygiene & Tropical Medicine, United Kingdom
8	Vibha Krishnamurthy	Ummeed Child Development Center, Mumbai, India
9	Kofi Marfo	Institute for Human Development (IHD), Aga Khan University, Nairobi, Kenya
10	Joerg Meerpohl	Cochrane Collaboration, Germany
11	Linda Richter	Human Sciences Research Council, University of the Witwatersrand, Johannesburg, South Africa
12	Fahmida Tofail	ICDDR, Bangladesh
13	Mark Tomlinson	Department of Psychology, Stellenbosch University, South Africa
14	Susan Walker	Tropical Medicine Research Institute, Jamaica
United Nations Partners		
15	Pia Britto	UNICEF, New York, US
16	Amanda Devercelli	World Bank, US
WHO		
17	Betzabe Butron	Regional Office
18	Teshome Desta	IST
19	Martin Weber	Regional Office

Appendix C: Summary of interventions for all included studies in the systematic reviews

See PDF supplement - Appendix C Jeong, Franchett, Yousafzai.

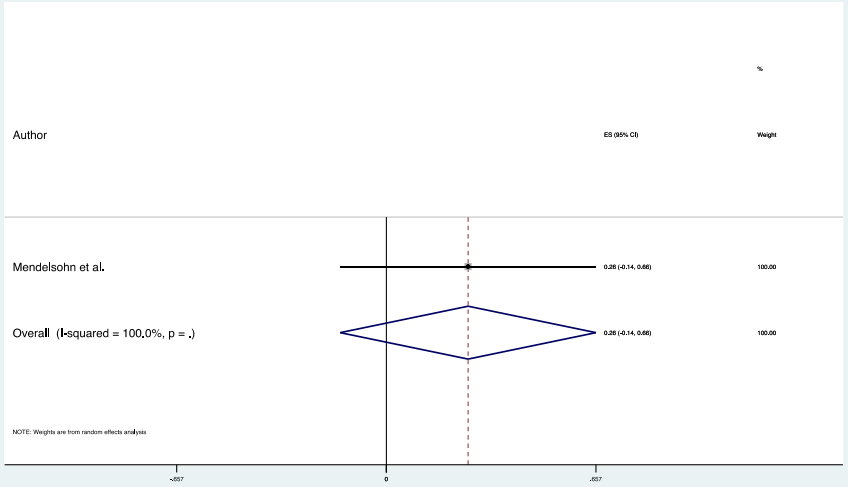
Appendix D: GRADE tables and analysis for responsive caregiving interventions (n=17)

Quality of assessments								**Summary of findings**	
Child outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Cognitive development	3	RCTs	**No serious limitations**	**Serious limitations** Positive effects reported by Barrera et al., 1986; null effects observed in remaining studies.	**No serious limitations**	**Serious limitations** Pooled effect size has wide CI	**No serious limitations**	**Low**	0.26 (-0.14, 0.66); n=1
Language development	5	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Moderate**	0.08 (-0.07, 0.23); n=5
Motor development	2	RCTs	**No serious limitations**	**Serious limitations** Positive impacts found by Frongillo et al., 2017, but no impact found by Barrera et al., 1992.	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Moderate**	0.19 (0.12, 0.26); n=1
Socioemotional development	4	RCTs	**No serious limitations**	**No serious limitations**	**Serious limitations** Studies are all from HICs	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Low**	0.14 (-0.03, 0.30); n=4

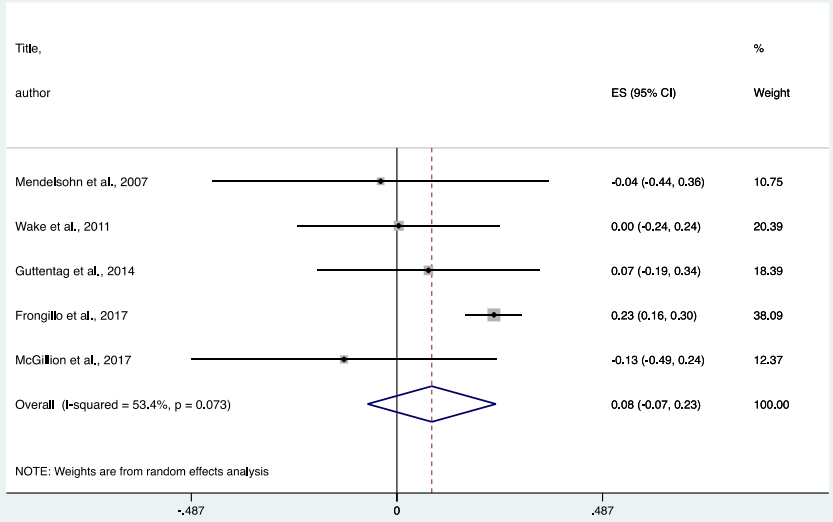
Behaviour problems	7	RCTs	**No serious limitations**	**No serious limitations**	**Serious limitations** Studies are all from HICs.	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Low**	-0.14 (-0.29, 0.002); n=7
Attachment outcomes	7	RCTs	**No serious limitations**	**Serious limitations** Six studies found null effects; one found positive effects (Cooper et al., 2009).	**No serious limitations**	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Low**	0.13 (-0.11, 0.37); n=3
HAZ	1	RCTs	**No serious limitations**	**No serious limitations**	**Serious limitations** This intervention was a unique aspect of responsive caregiving as it focused on responsive feeding.	**No serious limitations**	**No serious limitations**	**Moderate**	0.10 (0.03, 0.16); n=1
WAZ	1	RCTs	**No serious limitations**	**No serious limitations**	**Serious limitations** This intervention was a unique aspect of responsive caregiving as it focused on responsive feeding.	**No serious limitations**	**No serious limitations**	**Moderate**	0.03 (-0.04, 0.10); n=1

Caregiving outcome	No. of studies	Design	Limitations in study design and execution	Inconsistency	Indirectness	Imprecision	Publication bias	Overall quality of evidence	Pooled effect size (95% CI)
Caregiving knowledge	1	RCT	**No serious limitations**	**No serious limitations**	**Serious limitations** Only HICs represented.	**Serious limitations** Wide CI.	**No serious limitations**	**Low**	0.29 (-0.01, 0.58); n=1
Caregiving practices	3	RCTs	**No serious limitations**	**Serious limitations** Two studies found positive impacts (Murray et al., 2016; Barrera et al., 1986); one study found no impacts (Mendelsohn et al., 2007).	**No serious limitations**	**Serious limitations** Wide CI around the pooled estimate.	**No serious limitations**	**Low**	0.53 (-0.10, 1.17); n=2
Caregiver-child interaction	8	RCTs	**No serious limitations**	**Serious limitations** Two studies found no impacts (Barrera et al., 1986; Van Zeijl et al., 2006); remaining studies found significant positive impacts.	**No serious limitations**	**Serious limitations** Wide CI around the pooled estimate.	**No serious limitations**	**Low**	0.34 (0.15, 0.54); n=6
Caregiver depressive symptoms	3	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Wide CI around the pooled estimate.	**No serious limitations**	**Moderate**	-0.21 (-0.39, -0.04); n=3

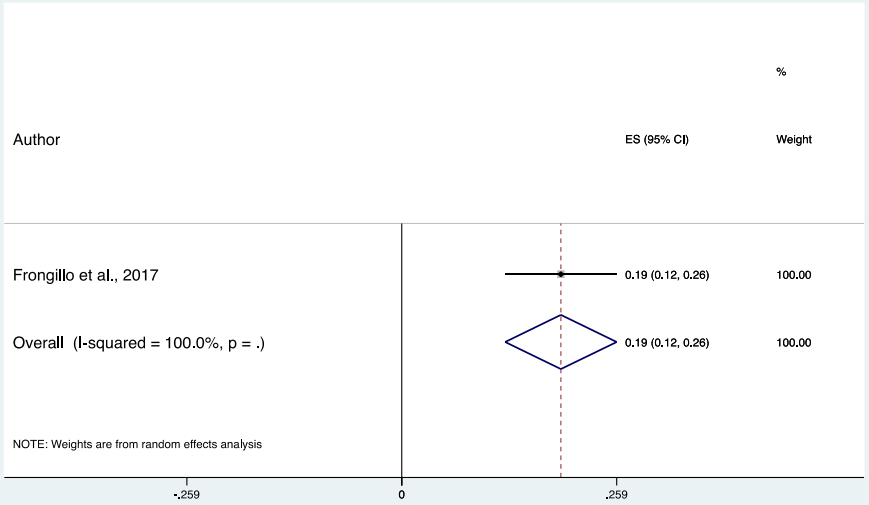
Cognitive Development



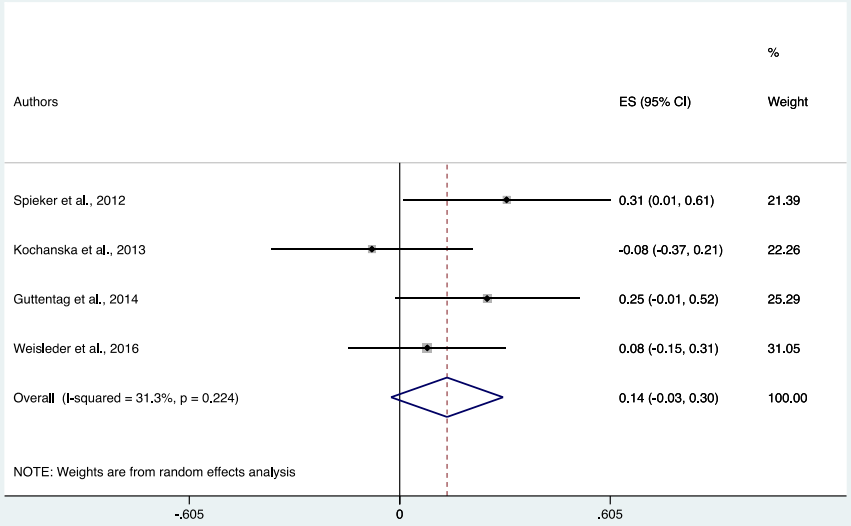
Language Development



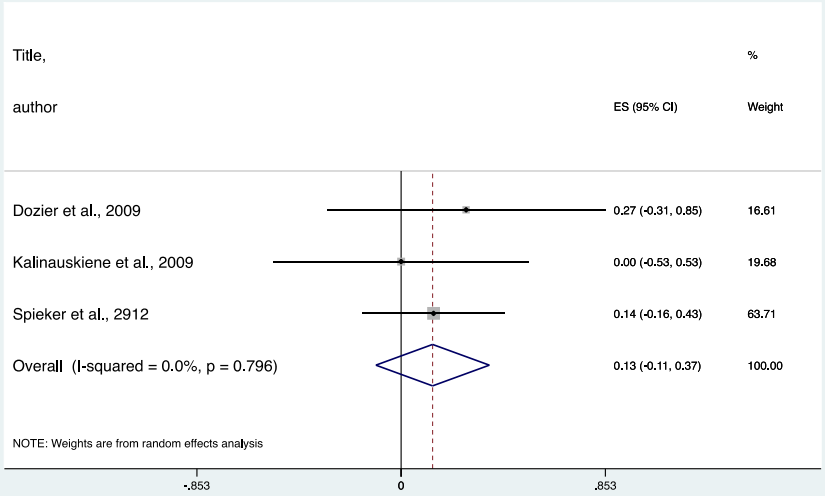
Motor Development



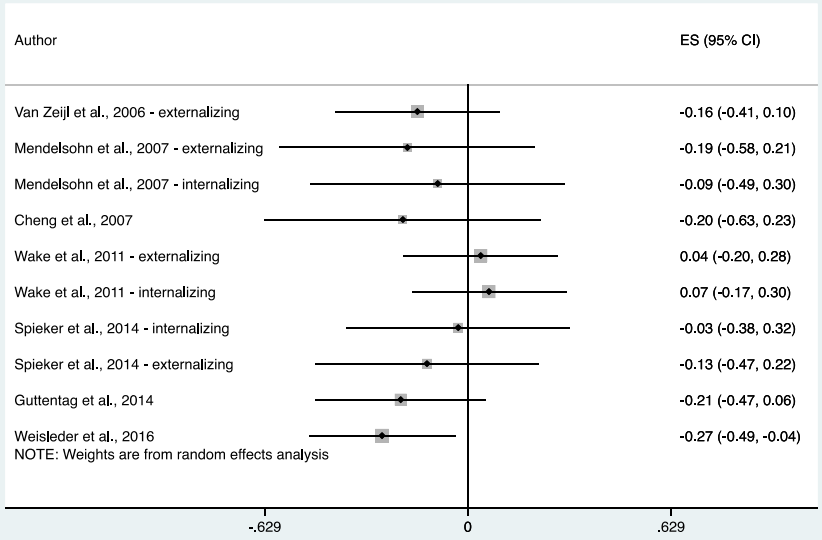
Socioemotional Development

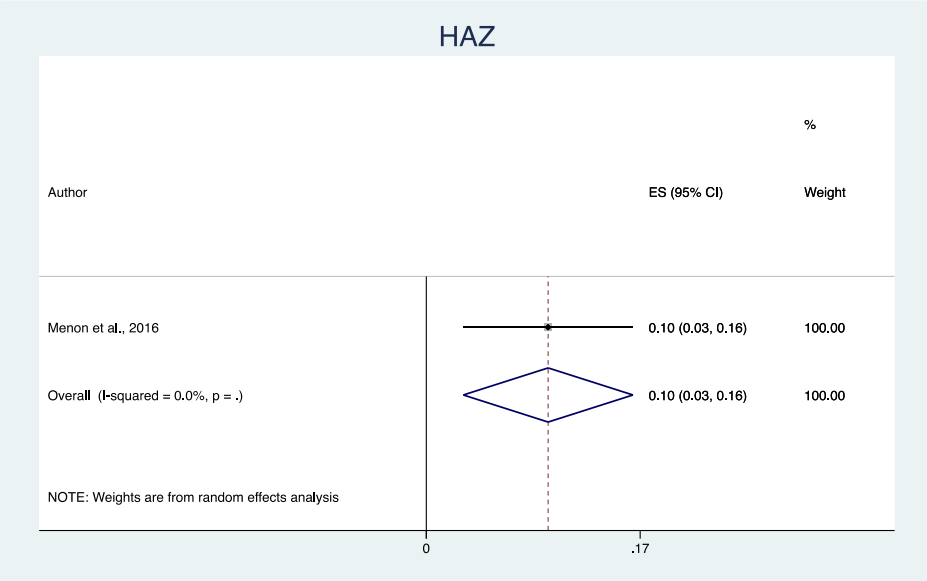


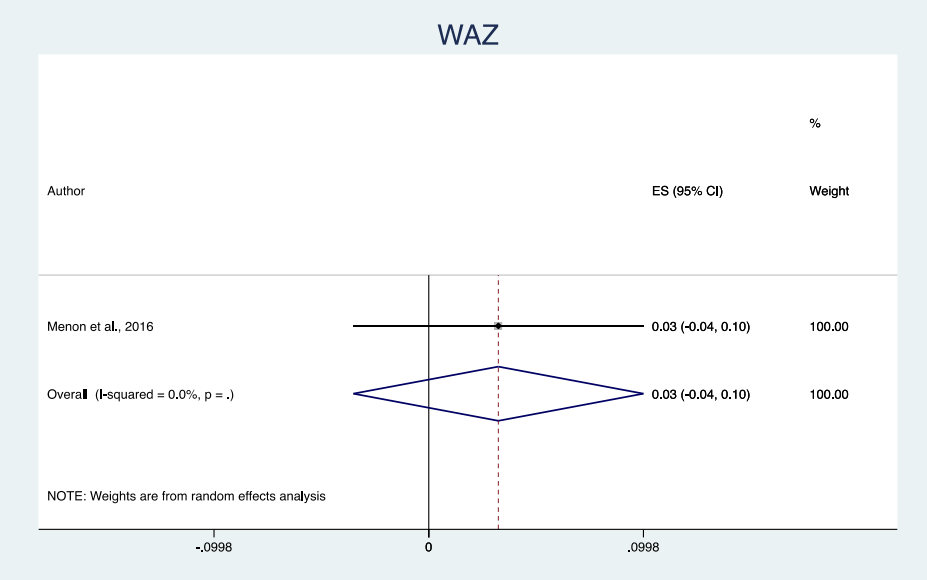
Attachment



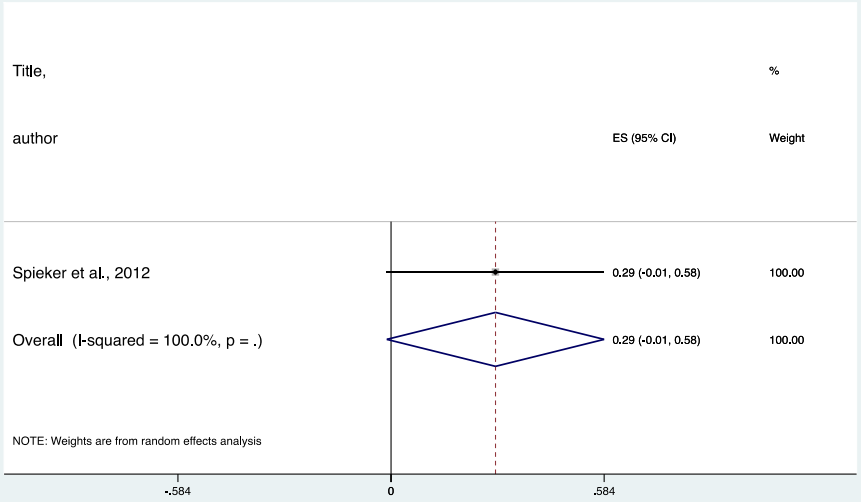
Behavior Problems



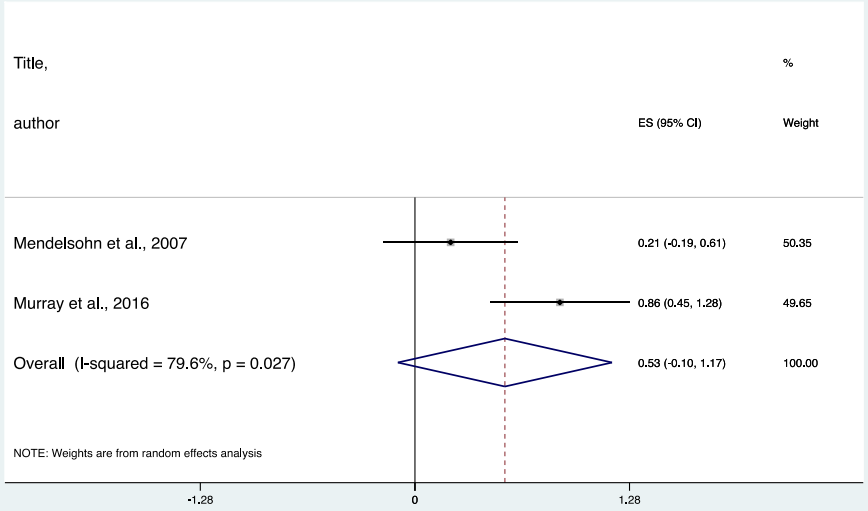

HAZ
Author
ES (95% CI)
%
Weight
Menon et al., 2016
0.10 (0.03, 0.16)
100.00
Overall (I-squared = 0.0%, p = .)
0.10 (0.03, 0.16)
100.00
NOTE: Weights are from random effects analysis
0
.17


WAZ
Author
ES (95% CI)
%
Weight
Menon et al., 2016
0.03 (-0.04, 0.10)
100.00
Overall (I-squared = 0.0%, p = .)
0.03 (-0.04, 0.10)
100.00
NOTE: Weights are from random effects analysis
-.0998
0
.0998

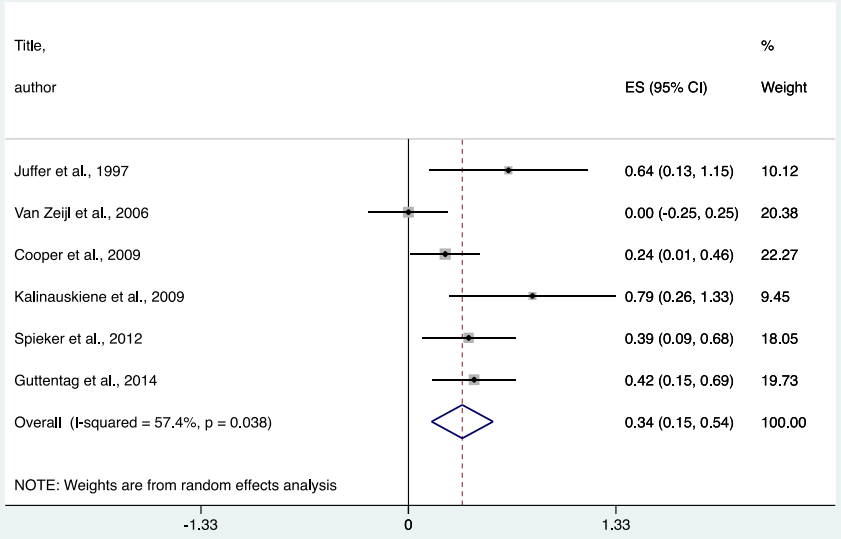
Caregiving Knowledge



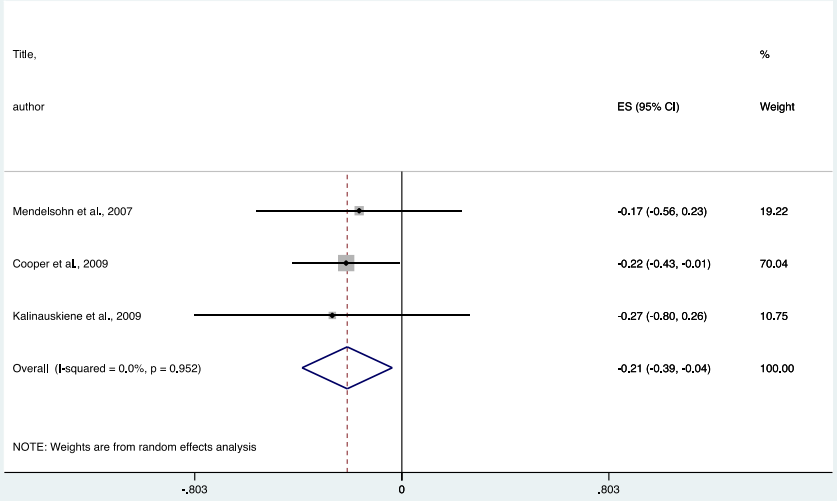
Caregiving Practices



Caregiver-child Interactions



Caregiver Depressive Symptoms



Appendix E: GRADE tables and analysis for caregiving interventions to support early learning opportunities (n=22)

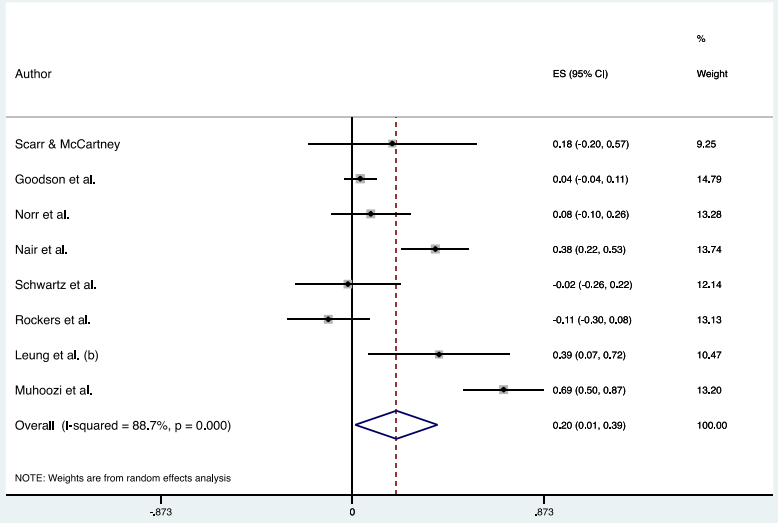
Quality of assessments								**Summary of findings**	
Child outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Cognitive development	13	RCTs	**No serious limitations**	**Serious limitations** Positive effects in some (Muhoozi et al., 2017); null effects in others (Norr et al., 2003).	**No serious limitations**	**Serious limitations** Pooled effect size has wide CI.	**No serious limitations**	**Low**	0.20 (0.01, 0.39); n=8
Language development	9	RCTs	**No serious limitations**	**Serious limitations** Muhoozi et al., 2017 & Schwarz et al., 2012: null effects; Jin et al., 2007: positive impacts.	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	0.07 (-0.11, 0.24); n=6
Motor development	7	RCTs	**No serious limitations**	**Serious limitations** Variation in direction and magnitude of effects: null effects in some (Rockers et al., 2016) and positive effects in others (Jin et al., 2007).	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	0.32 (0.12, 0.52); n=5

Socioemotional development	9	RCTs	**No serious limitations**	**Serious limitations** In five out of the six other studies that could not be meta-analysed, there are no statistical differences.	**Serious limitations** All HICs.	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Very low**	0.28 (0.09, 0.48), n=3
Behaviour problems	8	RCTs	**No serious limitations**	**Serious limitations** Mixed evidence with some studies finding differences (e.g. Leung et al., 2017b; and Caughy et al., 2004) versus others finding no significant differences (e.g. Goodson et al., 2000; and Jacobs et al., 2016).	**Serious limitations** All HICs.	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Very low**	-0.25 (-0.54, 0.04), n=3
Attachment outcomes	2	RCTs	**No serious limitations**	**No serious limitations** Both studies reported significant improvements.	**Serious limitations** All HICs.	**Serious limitations** Wide CI.	**No serious limitations**	**Low**	0.30 (0.09, 0.51); n=1
HAZ	2	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Moderate**	-0.02 (-0.29, 0.24); n=2
WAZ	2	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations**	**No serious limitations**	**Moderate**	0.05 (-0.10, 0.19); n=2

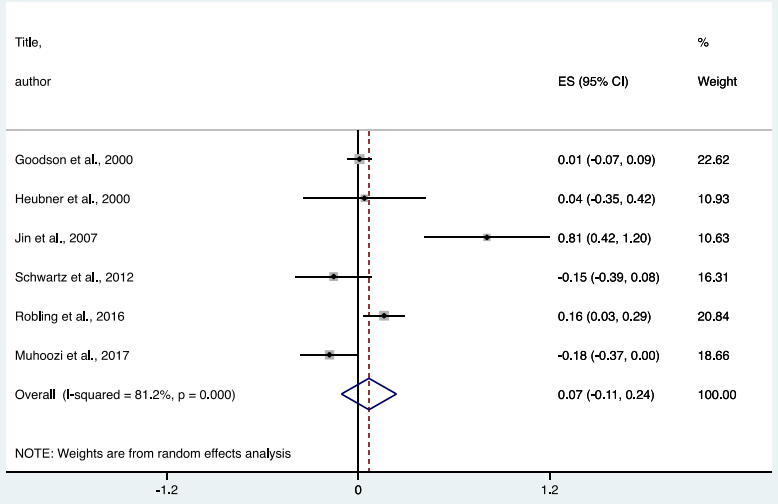
						Pooled results have a wide CI.			
Caregiving outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Caregiving knowledge	3	RCTs	**No serious limitations**	**Serious limitations** Two studies found significant improvements (Jin et al., 2007; Walkup et al., 2009); one study found no effects (Wagner et al., 2002).	**No serious limitations**	**Serious limitations** Zero studies contributing to pooled estimate.	**No serious limitations**	**Low**	N.A.
Caregiving practices	8	RCTs	**No serious limitations**	**Serious limitations** One study (Love et al., 2005) found statistically significant improvements; the other studies reported no impact.	**Serious limitations** Only HICs represented.	**Serious limitations** Over half the studies have a small sample size.	**No serious limitations**	**Low**	0.05 (-0.04, 0.13); n=2
Caregiver-child interactions	5	RCTs	**No serious limitations**	**Serious limitations** Some studies reported positive effects (Caughy et al., 2004; Love et al., 2005); other studies reported no impact (Goodson et al., 2000; Wagner et al., 2002).	**Serious limitations** Only HICs represented.	**Serious limitations** Zero studies contributing to pooled estimate.	**No serious limitations**	**Low**	N.A.

Caregiver depressive symptoms	4	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** CI around pooled estimate is wide.	**No serious limitations**	**Moderate**	0.07 (-0.08, 0.22); n=2)

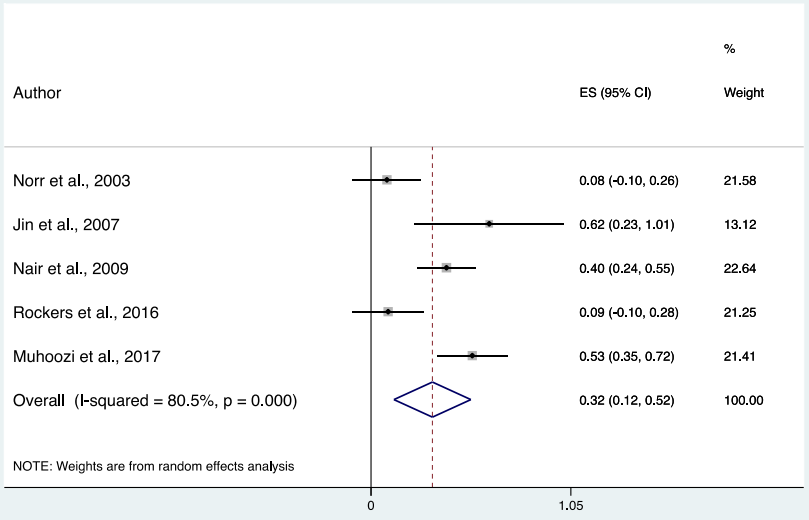
Cognitive Development



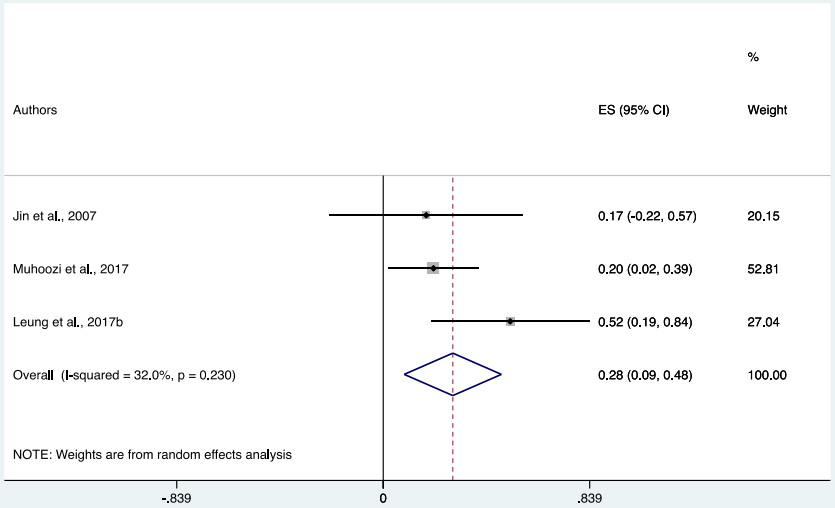
Language Development



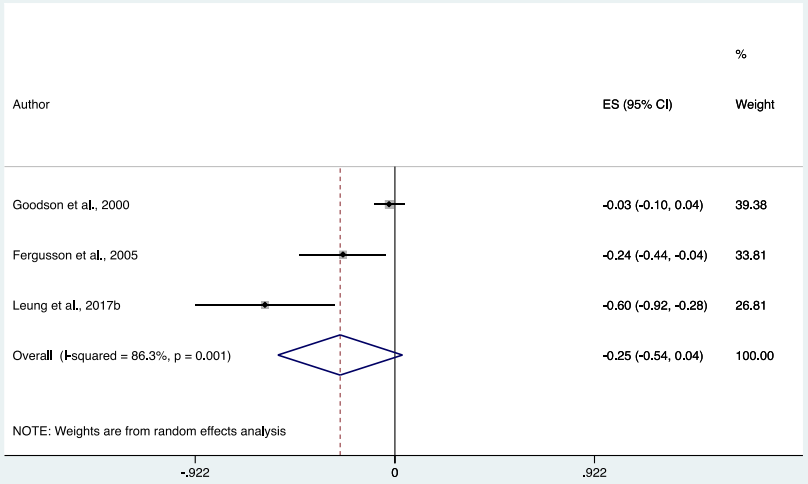
Motor Development



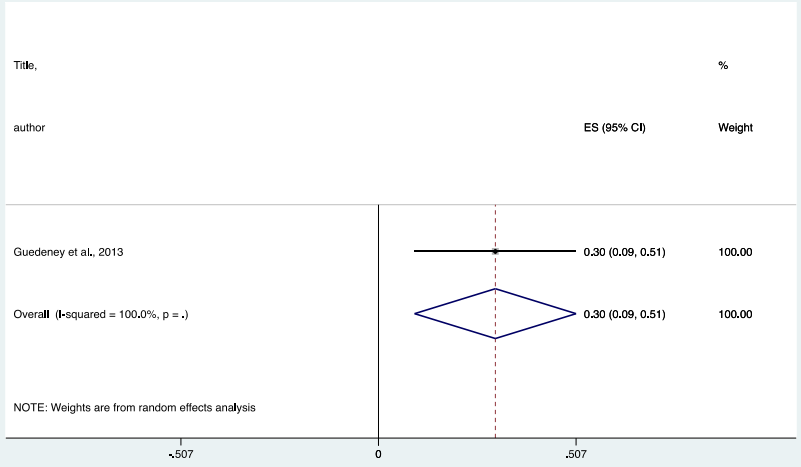
Socioemotional Development



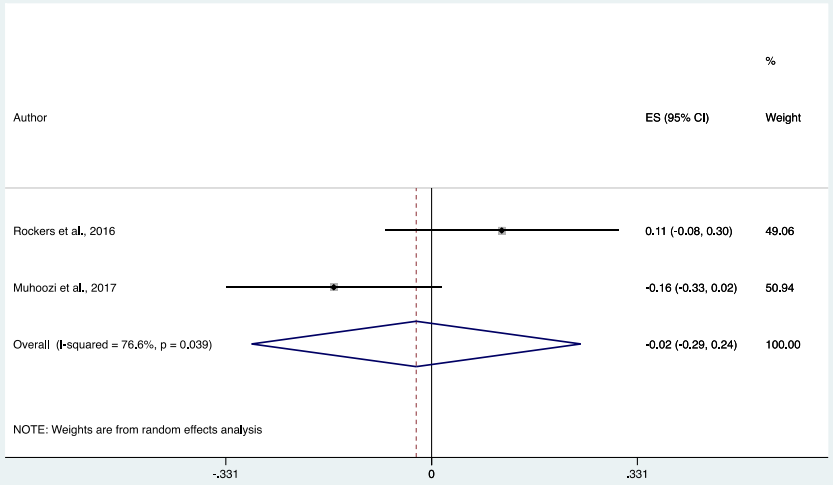
Behavior Problems



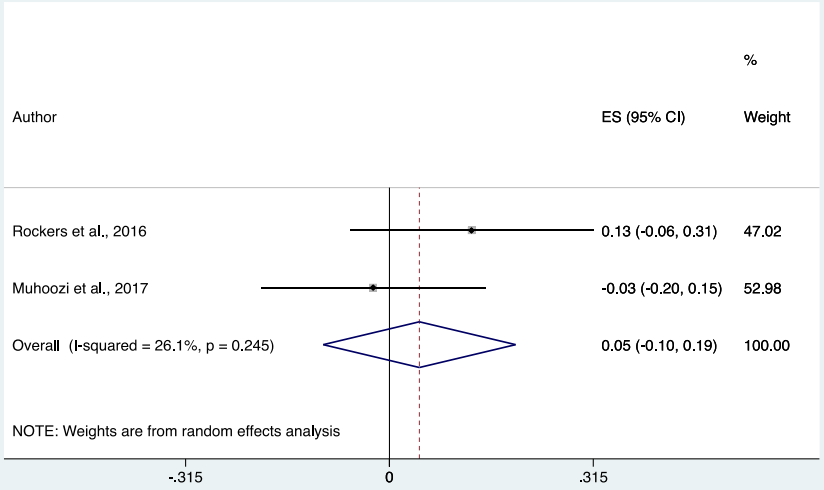
Attachment



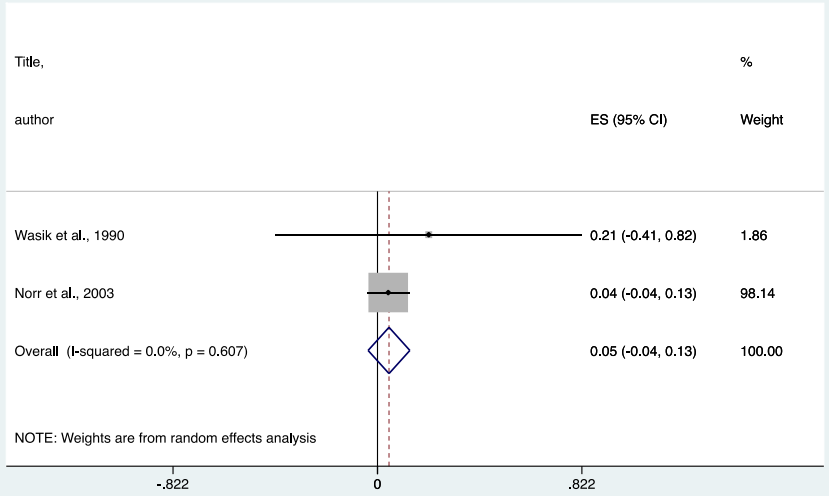
HAZ


Author
ES (95% CI)
%
Weight
Rockers et al., 2016
0.11 (-0.08, 0.30)
49.06
Muhoozi et al., 2017
-0.16 (-0.33, 0.02)
50.94
Overall (I-squared = 76.6%, p = 0.039)
-0.02 (-0.29, 0.24)
100.00
NOTE: Weights are from random effects analysis
-.331
0
.331

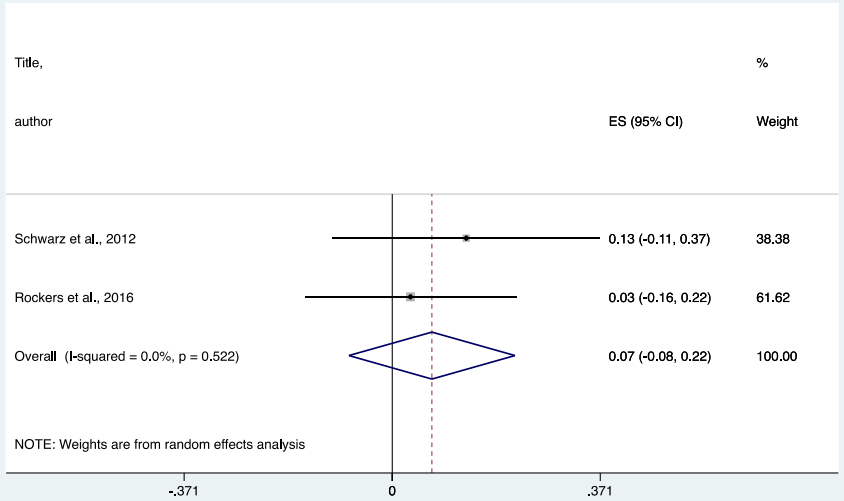
WAZ


Author
ES (95% CI)
%
Weight
Rockers et al., 2016
0.13 (-0.06, 0.31)
47.02
Muhoozi et al., 2017
-0.03 (-0.20, 0.15)
52.98
Overall (I-squared = 26.1%, p = 0.245)
0.05 (-0.10, 0.19)
100.00
NOTE: Weights are from random effects analysis
-.315
0
.315

Caregiving Practices



Caregiver Depressive Symptoms



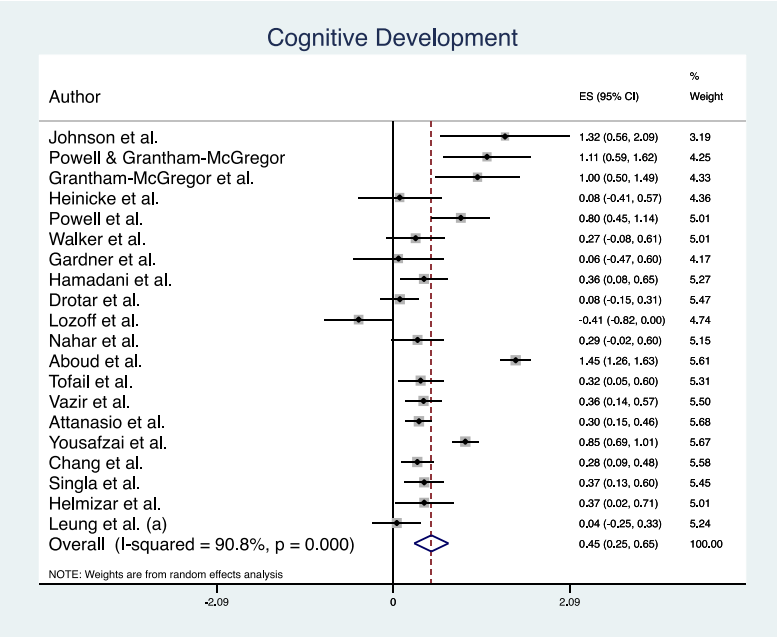
Appendix F: GRADE tables and analysis for combined responsive caregiving and the promotion of early learning interventions (n=42)

Quality of assessments								**Summary of findings**	
Child outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Cognitive development	36	RCTs	**No serious limitations**	**Serious limitations** Variation in direction and magnitude of effects: some studies have positive impacts (Aboud et al., 2013); others had null effects (Leung et al., 2017a; Drotar et al., 2008).	**No serious limitations**	**Serious limitations** Pooled effect size has wide CI.	**No serious limitations**	**Low**	0.45 (0.25, 0.65); n=20
Language development	17	RCTs	**No serious limitations**	**Serious limitations** Variation in direction and magnitude of effects: some studies have positive impacts (Powell et al., 2004; Vally et al., 2015); others had null effects (Goldfeld et al., 2011).	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	0.38 (0.16, 0.60); n=14
Motor development	18	RCTs	**No serious limitations**	**Serious limitations** Some studies found positive impacts (Yousafzai et al., 2014); others reported no impacts (Heinicke et al., 1999).	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	0.25 (0.09, 0.40); n=13

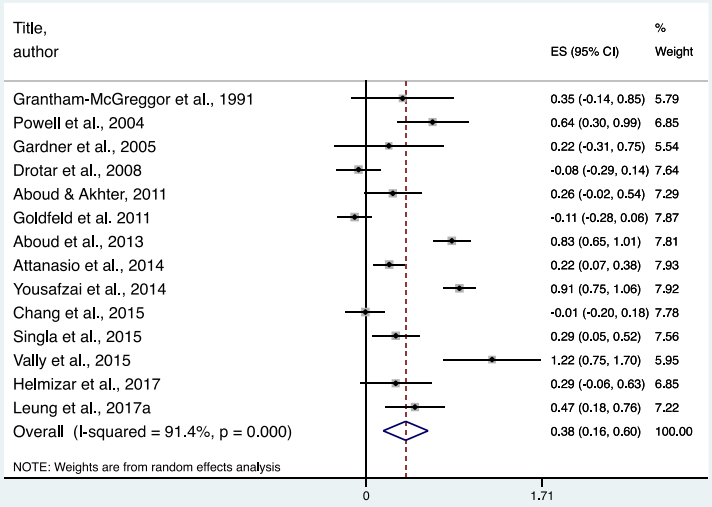
Socioemotional development	4	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Moderate**	0.06 (-0.18, 0.28); n=2
Behaviour problems	7	RCTs	**No serious limitations**	**No serious limitations**	**Serious limitations** All HICs.	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Low**	-0.18 (-0.40, 0.04); n=2
Attachment outcomes	2	RCTs	**No serious limitations**	**No serious limitations** All studies found positive impacts on attachment outcomes.	**No serious limitations**	**Serious limitations** Zero studies contributing to pooled estimate.	**No serious limitations**	**Moderate**	N.A.
HAZ	8	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Moderate**	-0.04 (-0.15, 0.07); n=8
WAZ	6	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**High**	0.02 (-0.07, 0.11); n=6

Caregiving outcome	No. of studies	Design	Limitations in study design and execution	Inconsistency	Indirectness	Imprecision	Publication bias	Overall quality of evidence	Pooled effect size (95% CI)
Caregiving knowledge	7	RCTs	**No serious limitations**	**Serious limitations** Differences in magnitude of effects; CIs for Powell et al., 2004, and Chang et al., 2015, do not overlap.	**No serious limitations**	**Serious limitations** Wide CI around the pooled estimate.	**No serious limitations**	**Low**	0.73 (0.57, 0.89); n=6
Caregiving practices	18	RCTs	**No serious limitations**	**Serious limitations** Differences in magnitude and direction of effects. Some studies find positive impacts (Singla et al., 2015; Yousafzai et al., 2015); others report null effects (Chang et al., 2015; Goldfeld et al., 2011).	**No serious limitations**	**Serious limitations** Wide CI around the pooled estimate.	**No serious limitations**	**Low**	0.48 (0.20, 0.76); n=10
Caregiver-child interactions	12	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Wide CI around the pooled estimate.	**No serious limitations**	**Moderate**	0.74 (0.39, 1.10); n=5
Caregiver depressive symptoms	9	RCTs	**No serious limitations**	**Serious limitations** Some studies found significant reductions (Singla et al., 2015),	**No serious limitations**	**Serious limitations** Wide CI around the	**No serious limitations**	**Low**	-0.08 (-0.31, 0.15); n=7

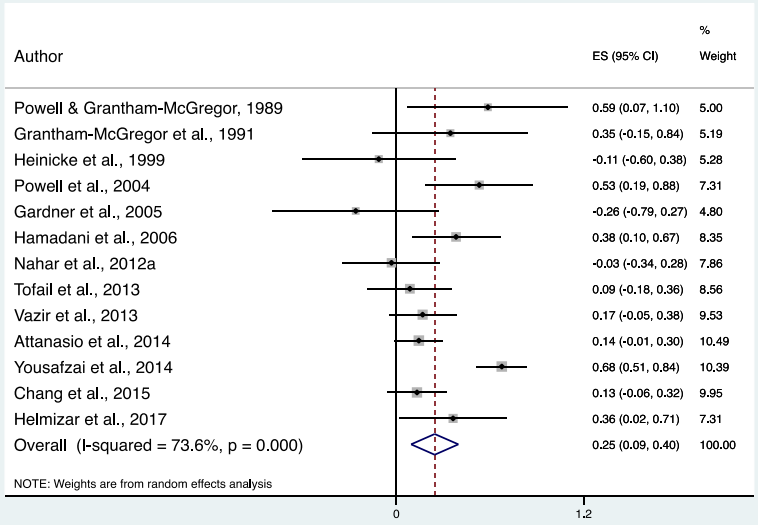
				while others reported null effects (Heinecke et al., 1999).		pooled estimate.			



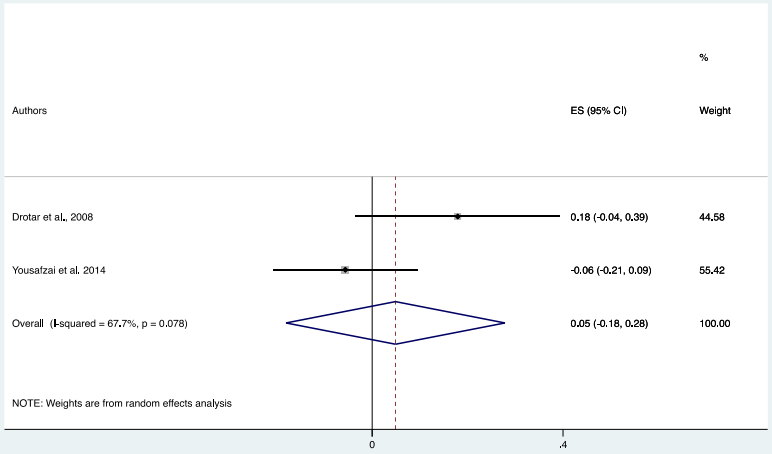
Language Development



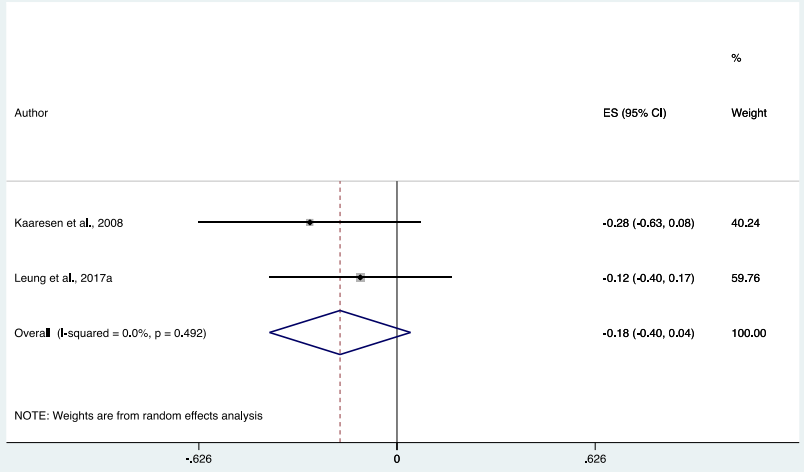
Motor Development



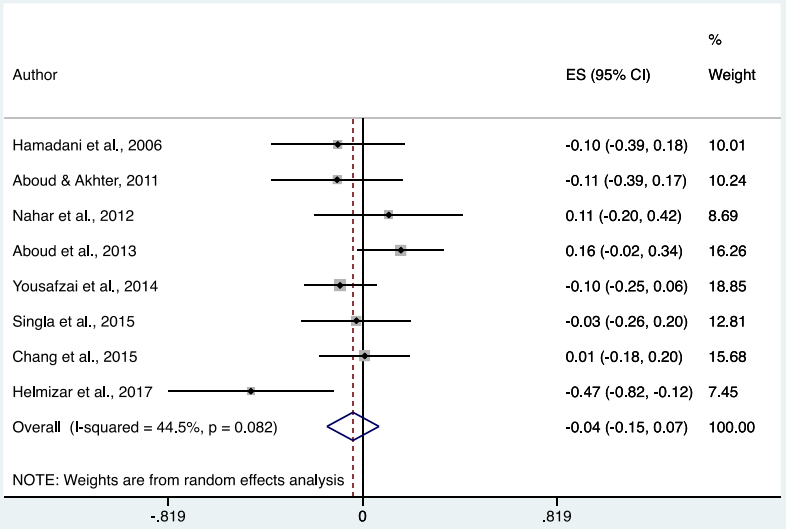
Socioemotional Development



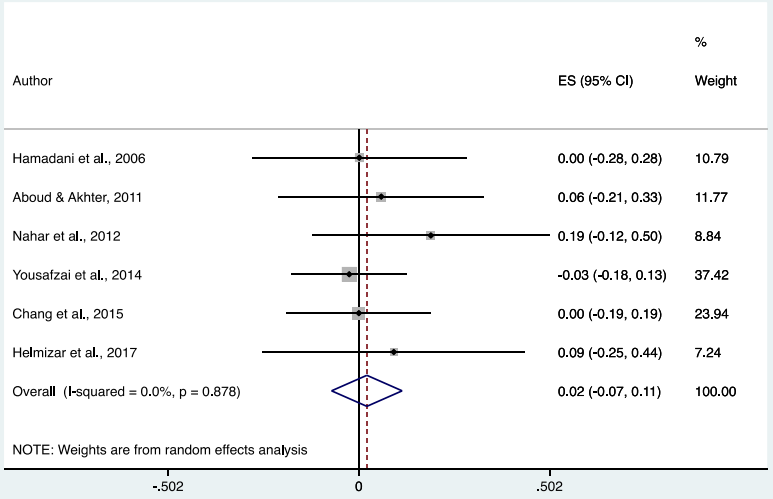
Behavior Problems



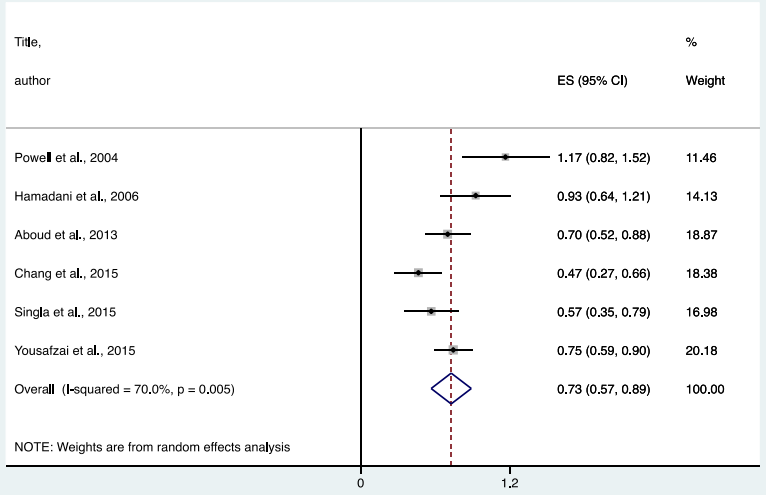
HAZ


Author
ES (95% CI)
%
Weight
Hamadani et al., 2006
-0.10 (-0.39, 0.18)
10.01
Aboud & Akhter, 2011
-0.11 (-0.39, 0.17)
10.24
Nahar et al., 2012
0.11 (-0.20, 0.42)
8.69
Aboud et al., 2013
0.16 (-0.02, 0.34)
16.26
Yousafzai et al., 2014
-0.10 (-0.25, 0.06)
18.85
Singla et al., 2015
-0.03 (-0.26, 0.20)
12.81
Chang et al., 2015
0.01 (-0.18, 0.20)
15.68
Helmizar et al., 2017
-0.47 (-0.82, -0.12)
7.45
Overall (I-squared = 44.5%, p = 0.082)
-0.04 (-0.15, 0.07)
100.00
NOTE: Weights are from random effects analysis
-.819
0
.819

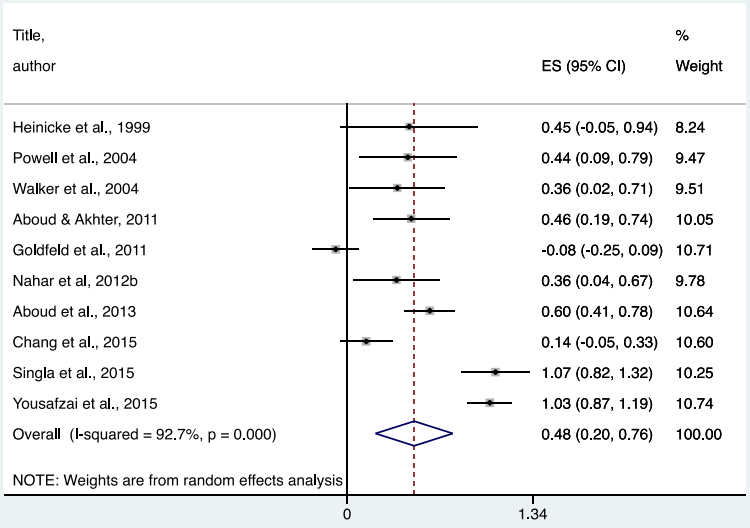
WAZ


Author
ES (95% CI)
%
Weight
Hamadani et al., 2006
0.00 (-0.28, 0.28)
10.79
Aboud & Akhter, 2011
0.06 (-0.21, 0.33)
11.77
Nahar et al., 2012
0.19 (-0.12, 0.50)
8.84
Yousafzai et al., 2014
-0.03 (-0.18, 0.13)
37.42
Chang et al., 2015
0.00 (-0.19, 0.19)
23.94
Helmizar et al., 2017
0.09 (-0.25, 0.44)
7.24
Overall (I-squared = 0.0%, p = 0.878)
0.02 (-0.07, 0.11)
100.00
NOTE: Weights are from random effects analysis
-.502
0
.502

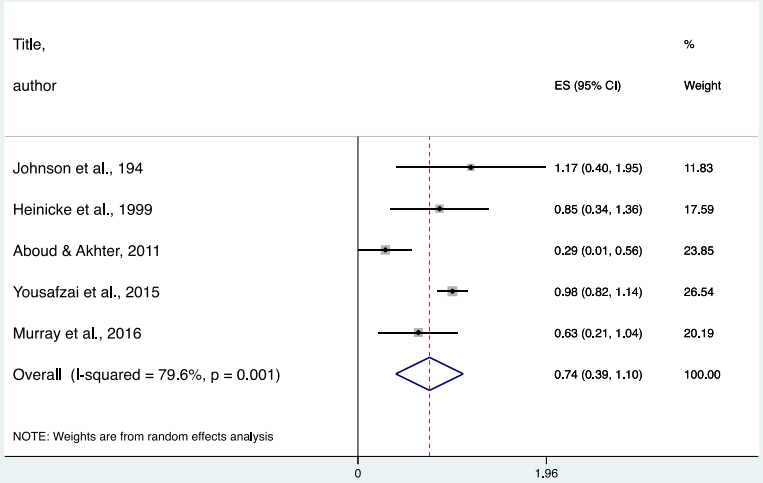
Caregiving Knowledge



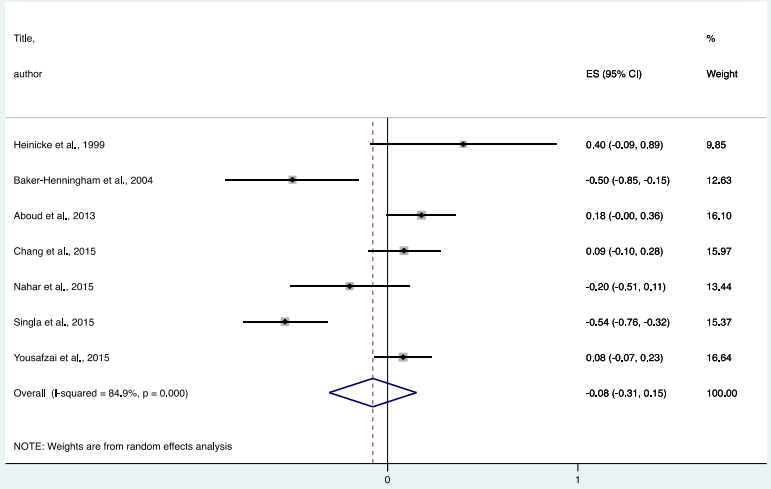
Caregiving Practices



Caregiver-child Interactions



Caregiver Depressive Symptoms



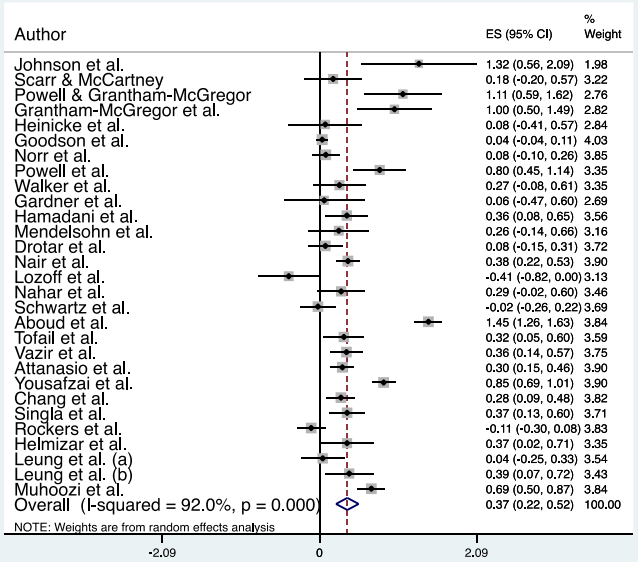
Appendix G: GRADE tables and analysis for caregiving interventions for responsive caregiving, early learning, or a combined responsive caregiving and promotion of early learning intervention (n=81)

Quality of assessments								**Summary of findings**	
Child outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Cognitive development	52	RCTs	**No serious limitations**	**Serious limitations** Variation in magnitude and direction of effects: positive effects observed in some studies and null effects in others.	**No serious limitations**	**Serious limitations** Pooled effect size has wide CI.	**No serious limitations**	**Low**	0.37 (0.22, 0.52); n=29
Language development	31	RCTs	**No serious limitations**	**Serious limitations** Positive impacts for some (Vally et al., 2015; Powell et al., 2004) and null effects for others (Chang et al., 2015; Guttentag et al., 2014).	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	0.24 (0.11, 0.36); n=25
Motor development	27	RCTs	**No serious limitations**	**Serious limitations** Positive impacts in some studies (Yousafzai et al., 2014); null effects in others (Gardner et al., 2005).	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Moderate**	0.27 (0.17, 0.37); n=19

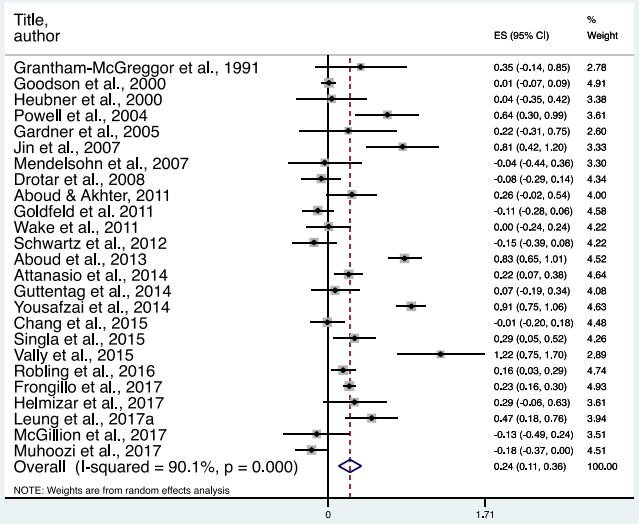
Socioemotional development	17	RCTs	**No serious limitations**	**Serious limitations** No statistical differences in many studies that could not be meta-analysed.	**No serious limitations**	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Low**	0.15 (0.04, 0.27); n=9
Behaviour problems	22	RCTs	**No serious limitations**	**Serious limitations** Mixed findings: many studies that could not be meta-analysed found null impacts.	**No serious limitations**	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Low**	-0.17 (-0.28, -0.06); n=12
Attachment outcomes	11	RCTs	**No serious limitations**	**Serious limitations** Positive effects in some studies (Cooper et al., 2009; Guedeney et al., 2013); null effects in others (Kalinauskiene et al., 2009).	**No serious limitations**	**Serious limitations** Pooled results have a wide CI.	**No serious limitations**	**Low**	0.23 (0.07, 0.38); n=4
HAZ	11	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**High**	-0.02 (-0.10, 0.07); n=11
WAZ	9	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**High**	0.03 (-0.02, 0.08); n=9
Caregiving outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Caregiving knowledge	11	RCTs	**No serious limitations**	**Serious limitations**	**No serious limitations**	**Serious limitations**	**No serious limitations**	**Low**	0.68 (0.51, 0.85); n=7

				Differences in magnitude of effects; CIs for Powell et al., 2004, and Chang et al., 2015, do not overlap. Wagner et al., 2002, reported null effects.		Wide CI around the pooled estimate.			
Caregiving practices	29	RCTs	**No serious limitations**	**Serious limitations** Some studies reported null effects (Wasik et al., 1990; Goldfeld et al., 2011); others found significant improvements (Singla et al., 2015; Yousafzai et al., 2015).	**No serious limitations**	**Serious limitations** Wide CI around the pooled estimate.	**No serious limitations**	**Low**	0.44 (0.21, 0.67); n=14
Caregiver-child interactions	25	RCTs	**No serious limitations**	**Serious limitations** Some studies reported null effects (Van Zeijl et al., 2006; Wagner et al., 2002); others found significant improvements (Murray et al., 2016; Guttentag et al., 2014).	**No serious limitations**	**Serious limitations** Wide CI around the pooled estimate.	**No serious limitations**	**Low**	0.54 (0.30, 0.78); n=11
Caregiver depressive symptoms	16	RCTs	**No serious limitations**	**Serious limitations** Some studies found significant reductions (Baker-Henningham et al., 2004); others found no effects (Heinicke et al., 1999).	**No serious limitations**	**Serious limitations** Wide CI around the pooled estimate.	**No serious limitations**		-0.07 (-0.22, 0.07); n=12

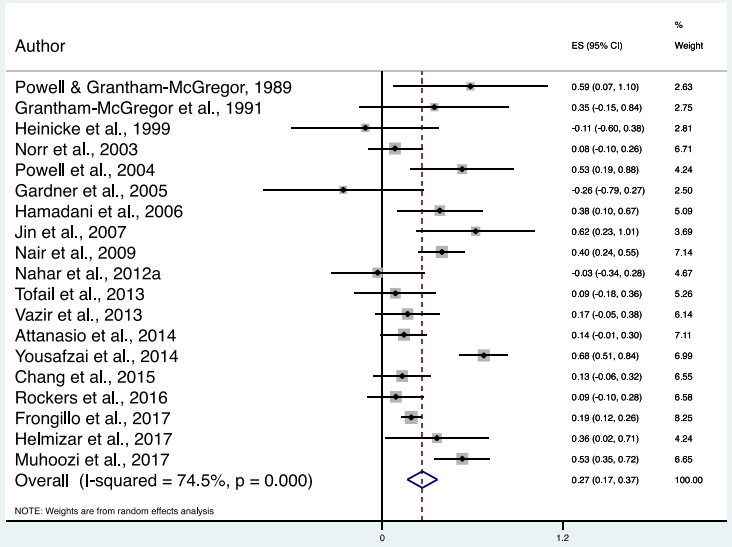
Cognitive Development



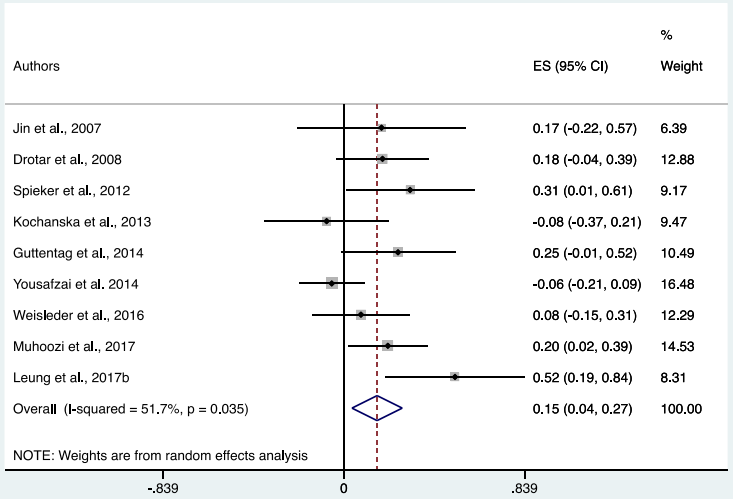
Language Development



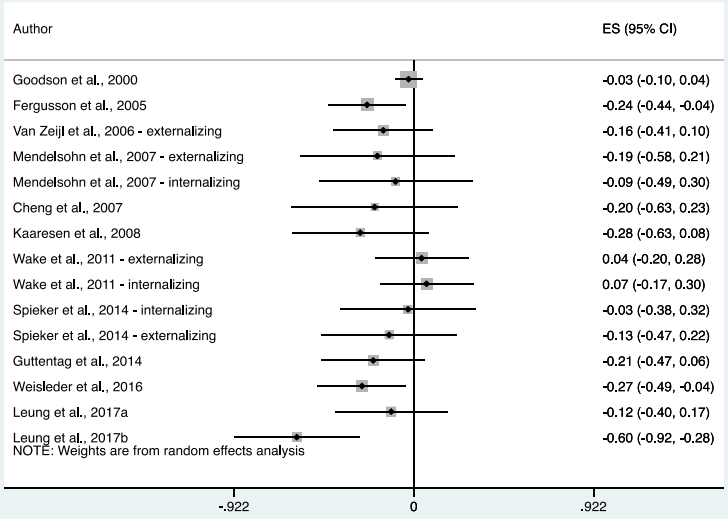
Motor Development



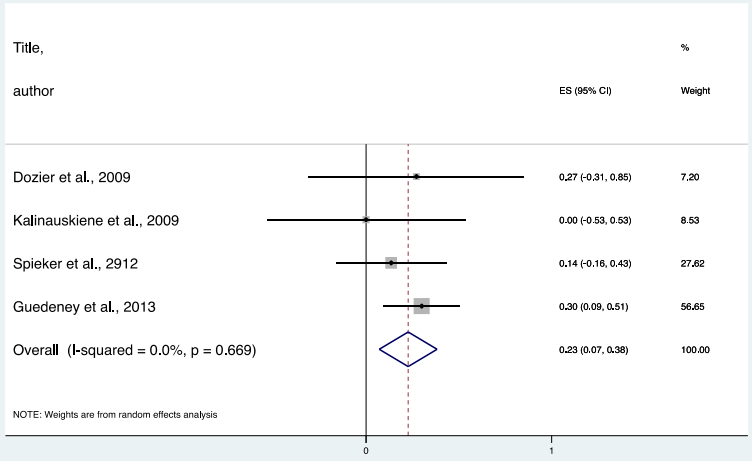
Socioemotional Development



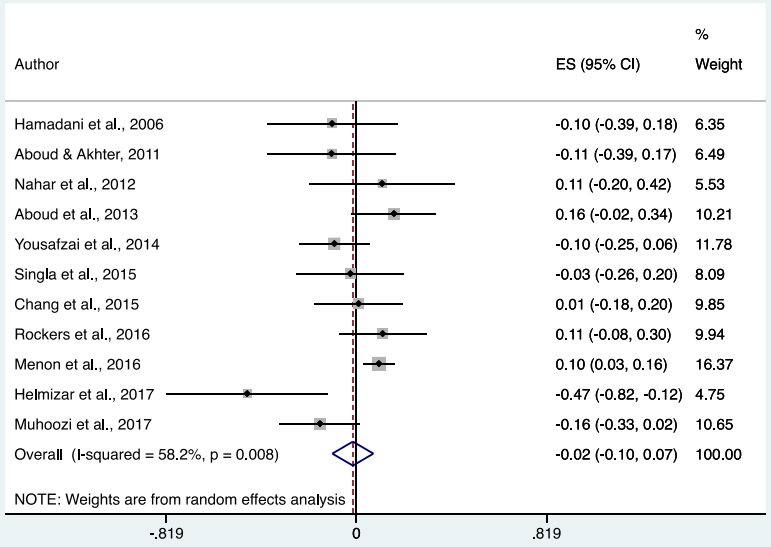
Behavior Problems



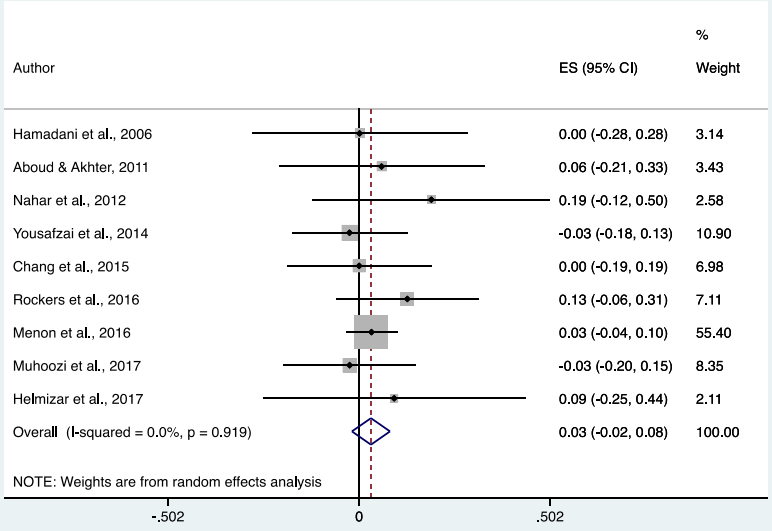
Attachment



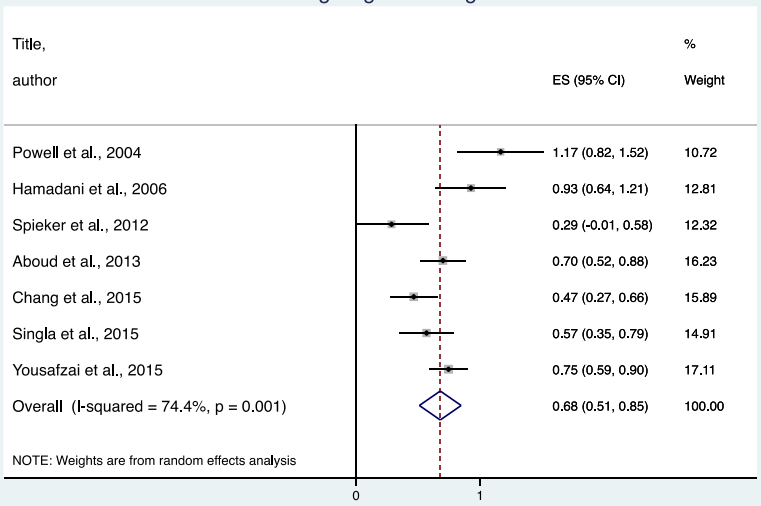
HAZ


Author
ES (95% CI)
% Weight
Hamadani et al., 2006 -0.10 (-0.39, 0.18) 6.35
Aboud & Akhter, 2011 -0.11 (-0.39, 0.17) 6.49
Nahar et al., 2012 0.11 (-0.20, 0.42) 5.53
Aboud et al., 2013 0.16 (-0.02, 0.34) 10.21
Yousafzai et al., 2014 -0.10 (-0.25, 0.06) 11.78
Singla et al., 2015 -0.03 (-0.26, 0.20) 8.09
Chang et al., 2015 0.01 (-0.18, 0.20) 9.85
Rockers et al., 2016 0.11 (-0.08, 0.30) 9.94
Menon et al., 2016 0.10 (0.03, 0.16) 16.37
Helmizar et al., 2017 -0.47 (-0.82, -0.12) 4.75
Muhoozi et al., 2017 -0.16 (-0.33, 0.02) 10.65
Overall (I-squared = 58.2%, p = 0.008) -0.02 (-0.10, 0.07) 100.00
NOTE: Weights are from random effects analysis
-.819
0
.819

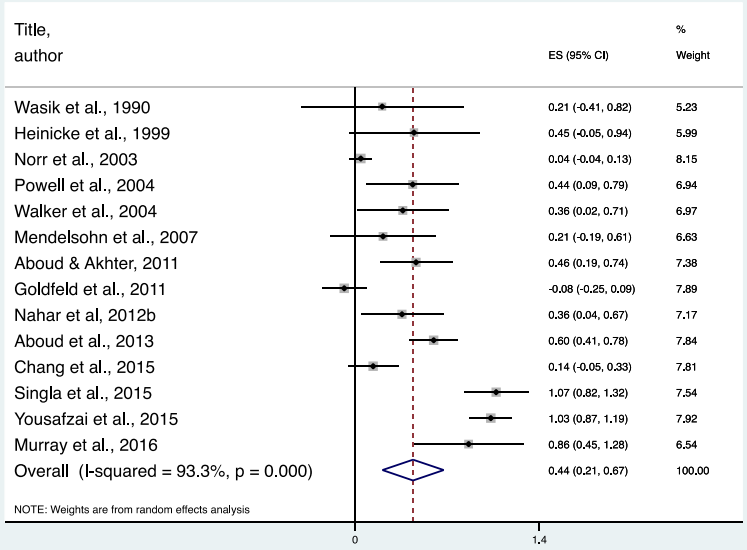
WAZ

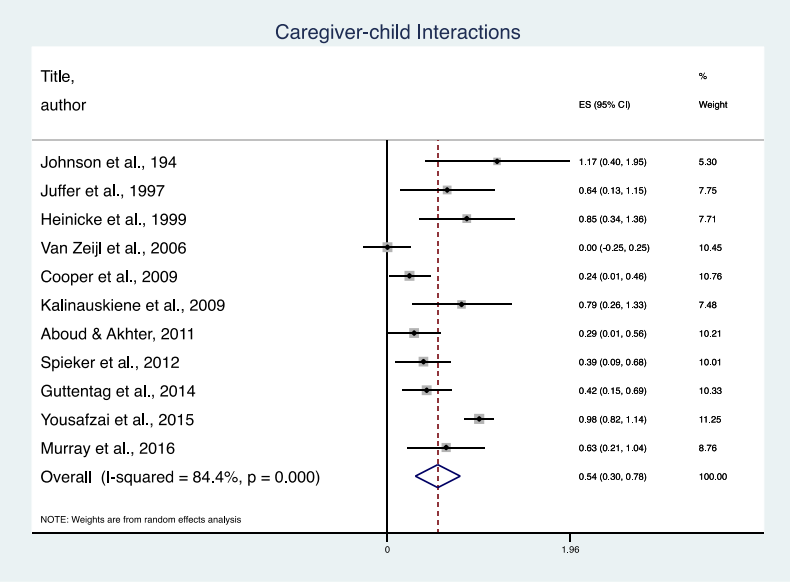

Author
ES (95% CI)
% Weight
Hamadani et al., 2006 0.00 (-0.28, 0.28) 3.14
Aboud & Akhter, 2011 0.06 (-0.21, 0.33) 3.43
Nahar et al., 2012 0.19 (-0.12, 0.50) 2.58
Yousafzai et al., 2014 -0.03 (-0.18, 0.13) 10.90
Chang et al., 2015 0.00 (-0.19, 0.19) 6.98
Rockers et al., 2016 0.13 (-0.06, 0.31) 7.11
Menon et al., 2016 0.03 (-0.04, 0.10) 55.40
Muhoozi et al., 2017 -0.03 (-0.20, 0.15) 8.35
Helmizar et al., 2017 0.09 (-0.25, 0.44) 2.11
Overall (I-squared = 0.0%, p = 0.919) 0.03 (-0.02, 0.08) 100.00
NOTE: Weights are from random effects analysis
-.502
0
.502

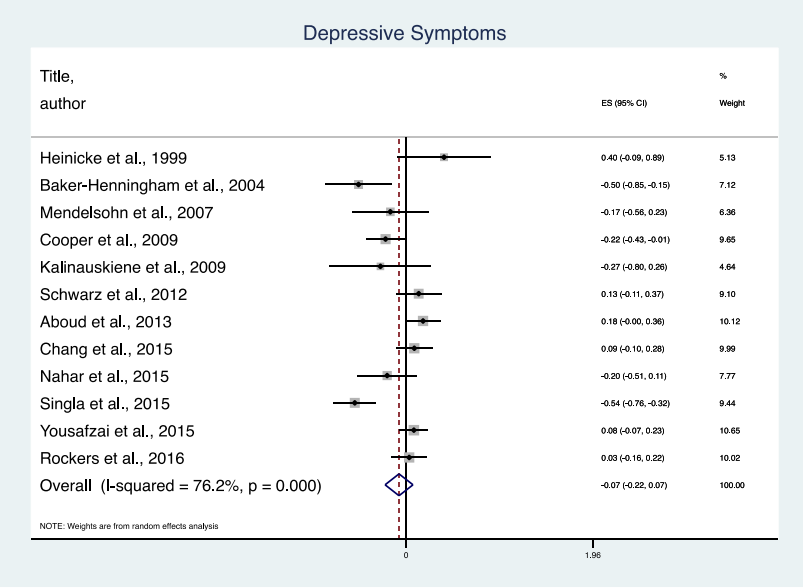
Caregiving Knowledge



Caregiving Practices




Caregiver-child Interactions
Title, author
ES (95% CI)
%
Weight
Johnson et al., 194 1.17 (0.40, 1.95) 5.30
Juffer et al., 1997 0.64 (0.13, 1.15) 7.75
Heinicke et al., 1999 0.85 (0.34, 1.36) 7.71
Van Zeijl et al., 2006 0.00 (-0.25, 0.25) 10.45
Cooper et al., 2009 0.24 (0.01, 0.46) 10.76
Kalinauskiene et al., 2009 0.79 (0.26, 1.33) 7.48
Aboud & Akhter, 2011 0.29 (0.01, 0.56) 10.21
Spieker et al., 2012 0.39 (0.09, 0.68) 10.01
Guttentag et al., 2014 0.42 (0.15, 0.69) 10.33
Yousafzai et al., 2015 0.98 (0.82, 1.14) 11.25
Murray et al., 2016 0.63 (0.21, 1.04) 8.76
Overall (I-squared = 84.4%, p = 0.000) 0.54 (0.30, 0.78) 100.00
NOTE: Weights are from random effects analysis
0
1.96


Depressive Symptoms
Title, author
ES (95% CI)
%
Weight
Heinicke et al., 1999 0.40 (-0.09, 0.89) 5.13
Baker-Henningham et al., 2004 -0.50 (-0.85, -0.15) 7.12
Mendelsohn et al., 2007 -0.17 (-0.56, 0.23) 6.36
Cooper et al., 2009 -0.22 (-0.43, -0.01) 9.65
Kalinauskiene et al., 2009 -0.27 (-0.80, 0.26) 4.64
Schwarz et al., 2012 0.13 (-0.11, 0.37) 9.10
Aboud et al., 2013 0.18 (-0.00, 0.36) 10.12
Chang et al., 2015 0.09 (-0.10, 0.28) 9.99
Nahar et al., 2015 -0.20 (-0.51, 0.11) 7.77
Singla et al., 2015 -0.54 (-0.76, -0.32) 9.44
Yousafzai et al., 2015 0.08 (-0.07, 0.23) 10.65
Rockers et al., 2016 0.03 (-0.16, 0.22) 10.02
Overall (I-squared = 76.2%, p = 0.000) -0.07 (-0.22, 0.07) 100.00
NOTE: Weights are from random effects analysis
0
1.96

Appendix H: GRADE tables and analysis for caregiving interventions to support healthy child socioemotional and behavioural development (n=10)

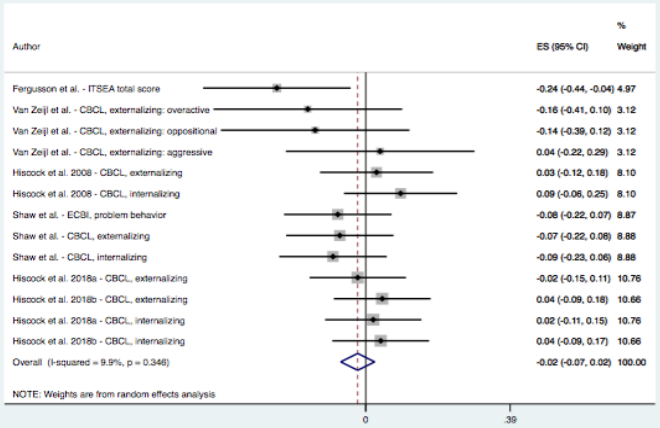
Quality of assessments								**Summary of findings**	
Child outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Cognition development	1	RCT	**No serious limitations**	**No serious limitations**	**Serious limitations** n=1 study from HIC.	**Very serious limitations** n=1 study; pooled ES NA.	**No serious limitations**	**Very low**	No pooled ES. *From Caldera et al., 2007:* Adjusted ES for BSID Mental Development Index = 0.29; p<0.05
Motor development	1	RCT	**No serious limitations**	**No serious limitations**	**Serious limitations** n=1 study from HIC.	**Very serious limitations** n=1 study; pooled ES NA.	**No serious limitations**	**Very low**	No pooled ES. *From Caldera et al., 2007:* Adjusted ES for BSID Psychomotor Development Index = 0.19; p=0.16
Prosocial behavior/ Socioemotional development	1	RCT	**No serious limitations**	**No serious limitations**	**Serious limitations** n=1 study from HIC.	**Very serious limitations** n=1 study; pooled ES NA.	**No serious limitations**	**Very low**	No pooled ES. *From Barlow et al., 2015:* Adjusted ES for ITSEA= 0.14; p=0.09.
Behaviour problems	10	RCT	**No serious limitations**	**No Serious limitations**	**Serious limitations**	**No serious limitations**	**No Serious limitations**	**Moderate**	-0.02 (-0.07, 0.02)

Quality of assessments								Summary of findings	
Child outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
				I2 = 9.9% 95% CIs are overlapping. *Additional n=5 studies:* n=1: no effects; n=1: significant reductions in mean scores for child behaviour problems; n=3: significant reductions on some domains but not all.	n=10 studies from HICs.				n=5

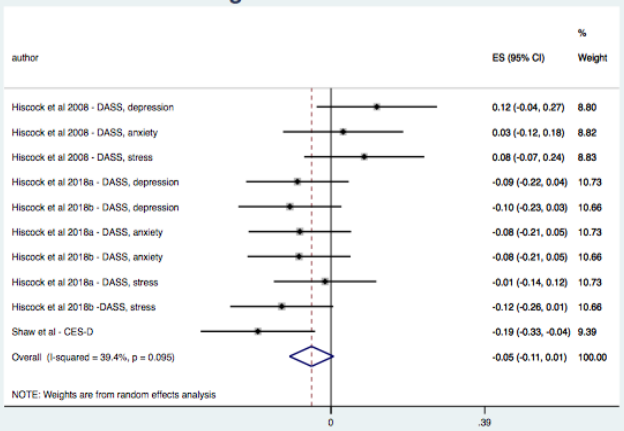
Quality of assessments								Summary of findings	
Caregiver outcome	**No. of studies**	**Design**	**Limitations in study design and dxecution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Caregiving practices	8	RCT	**No serious limitations**	**Serious limitations** n=4 no effects; n=3 mixed effects by subscale; n=1 significant improvements.	**Serious limitations** n=8 studies from HICs.	**Serious limitations**	**No serious limitations**	**Low**	0.01 (-0.04, 0.06) n=2
Caregiver mental health	4	RCT	**No serious limitations**	**Serious limitations** 95% CIs for Shaw et al., 2009 & Hiscock et al., 2008 are not overlapping. Shaw et al., 2009 and Barlow et al., 2015 found significant declines; Hiscock et al., 2008 & Hiscock et al., 2018 found no effects.	**Serious limitations** n=4 studies from HICs.	**No Serious limitations** All studies >85/arm 95% CI for pooled ES is relatively tight.	**No serious limitations**	**Low**	-0.05 (-0.11, 0.01) n=3
Caregiving knowledge	2	RCT	**No serious limitations**	**Serious limitations** Barlow et al., 2015 found significant improvements; Caldera et al., 2007 found no effects.	**Serious limitations** n=2 studies from HICs.	**Serious limitations** Sample size is adequate (>85 per group) Data cannot be meta-analysed.	**No serious limitations**	**Very Low**	
Caregiver-child interactions	5	RCT	**No serious limitations**	**Serious limitations** n=2 found no effects; n=1 found significant	**Serious limitations**	**Serious limitations**	**No serious limitations**	**Very Low**	0.14 (-0.07, 0.34); n=1

				improvements; n=1 found mixed results across measures.	n=5 studies from HICs.	Sample size is adequate (>85 per group) Only n=1 study included in pooled results.			
Self-efficacy	3	RCT	**No serious limitations**	**Serious limitations** Breitenstein et al., 2012 & Caldera et al., 2007 found significant improvements; Gross et al., 2009 found no effects.	**Serious limitations** n=3 studies from HICs.	**Serious limitations** Sample size is adequate (>85 per group) Data cannot be meta-analysed (unadjusted means and SDs are not presented).	**No serious limitations**	**Low**	

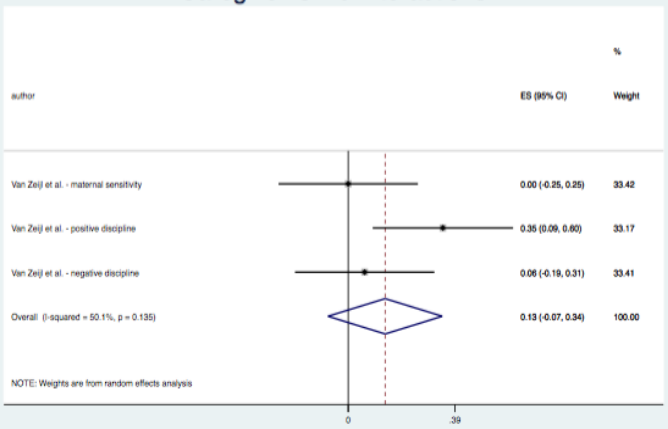
Effect of Caregiving Interventions to Support Child Socio-Emotional & Behavioral Development on Child Behavior Problems



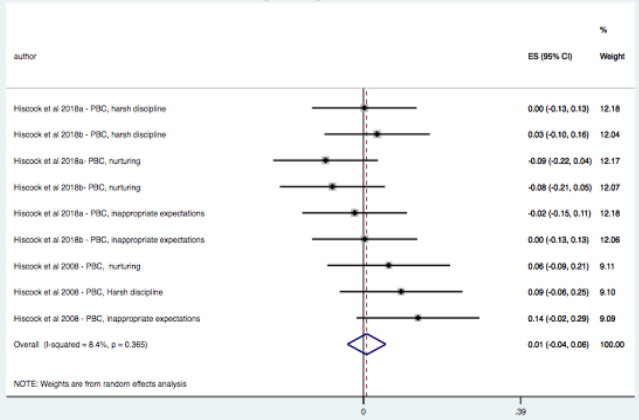
Effect of Caregiving Interventions to Support Child Socio-Emotional & Behavioral Development on Caregiver Mental Health



Effect of Caregiving Interventions to Support Child Socio-Emotional & Behavioral Development on Caregiver-Child Interactions



Effect of Caregiving Interventions to Support Child Socio-Emotional & Behavioral Development on Caregiving Practices



Appendix I: GRADE tables and analysis for integrated caregiving and nutrition interventions (n=18)

Combined nutrition and caregiving interventions versus standard of care

Quality of assessments								Summary of findings	
Child outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Cognitive development	14	RCTs	**No serious limitations**	**Serious limitations** Variation in magnitude and direction of effects; some studies have null effects (Rockers et al., 2016; Nahar et al., 2012), while others have positive effects (Aboud et al., 2013; Grantham-McGregor et al., 1991).	**No serious limitations**	**Serious limitations** Pooled effect size has wide CI.	**No serious limitations**	**Low**	0.57 (0.32, 0.82); n=13
Language development	10	RCTs	**No serious limitations**	**Serious limitations** Variation in magnitude and direction of effects: Muhoozi et al., 2017, found negative impacts; Aboud et al., 2013 & Yousafzai et al., 2014 found positive impacts.	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	0.40 (0.17, 0.63); n=10
Motor development	10	RCTs	**No serious limitations**	**Serious limitations**	**No serious limitations**	**Serious limitations**	**No serious limitations**	**Low**	0.4 (0.26, 0.53); n=10

				Variation in magnitude and direction of effects. Nahar et al., 2012, and Vazir et al., 2013 found null effects, whereas others found positive impacts (Yousafzai et al., 2014; Muhoozi et al., 2017).		5 of the 10 studies have small sample sizes. Pooled effect size has wide CI.			
Socioemotional development	2	RCTs	**No serious limitations**	**Serious limitations** Yousafzai et al., 2015 – no impacts; Muhoozi et al., 2017 – positive impacts.	**No serious limitations**	**Serious limitations** Pooled effect size has wide CI.	**No serious limitations**	**Low**	0.09 (-0.11, 0.30); n=2
HAZ	9	RCTs	**No serious limitations**	**Serious limitations** Nahar et al., 2012, and Helmizar et al., 2017, found negative impacts; others found null effects.	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	-0.13 (-0.31, 0.05); n=9
WAZ	7	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**High**	0.06 (-0.02, 0.13); n=7
WHZ	6	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Moderate**	0.20 (0.05, 0.34); n=6

Combined nutrition and caregiving interventions versus caregiving interventions

Quality of assessments								Summary of findings	
Child outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Cognitive development	7	RCTs	**No serious limitations**	**Serious limitations** Yousafzai et al., 2014: negative effects; Gardner et al., 2005 & Grantham-McGregor et al., 1991: positive effects.	**No serious limitations**	**Serious limitations** Pooled effect size has wide CI.	**No serious limitations**	**Low**	0.10 (-0.12, 0.32); n=6
Language development	10	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Moderate**	0.01 (-0.09, 0.10); n=6
Motor development	10	RCTs	**No serious limitations**	**Serious limitations** Gardner et al., 2005, found positive impacts; other studies (Yousafzai et al., 2014; Nahar et al., 2012a) found no impacts.	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	0.18 (-0.06, 0.42); n=6)

Socioemotional development	1	RCTs	**No serious limitations**	**Serious limitations**	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	0.11 (-0.04, 0.26); n=1
HAZ	9	RCTs	**No serious limitations**	**Serious limitations** Nahar et al., 2012a, found negative effects; Aboud & Akhter, 2011, and Yousafzai et al., 2014, found null effects.	**No serious limitations**	**Serious limitations** Pooled results have wide CI.	**No serious limitations**	**Low**	-0.21 (-0.60, 0.19); n=4
WAZ	3	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** 2 of the 3 studies have small sample sizes.	**No serious limitations**	**Moderate**	0.07 (-0.04, 0.17); n=3
WHZ	4	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Wide CI; 3 of the 4 studies have small sample sizes.	**No serious limitations**	**Moderate**	0.16 (0.03, 0.29); n=4

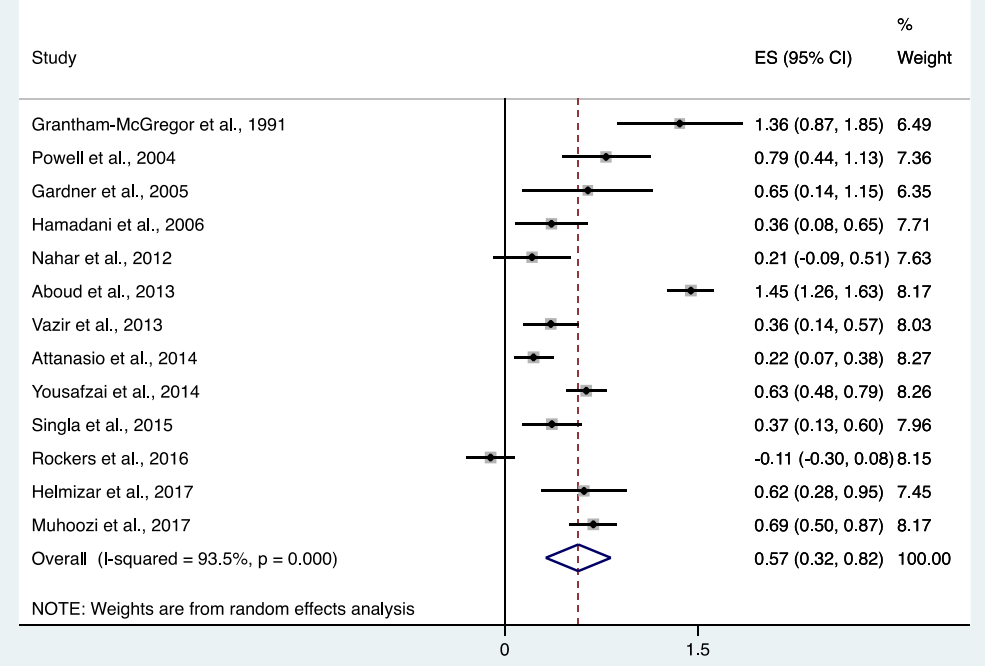
Combined nutrition and caregiving interventions versus nutrition interventions

Quality of assessments								Summary of findings	
Child outcome	**No. of studies**	**Design**	**Limitations in study design and execution**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication bias**	**Overall quality of evidence**	**Pooled effect size (95% CI)**
Cognitive development	10	RCTs	**No serious limitations**	**Serious limitations** Variation in direction and magnitude of effects: Lozoff et al., 2010, found positive effects; Nahar et al., 2013, found null effects. CIs for Lozoff et al., 2010, and Nahar et al, 2013, do not overlap.	**No serious limitations**	**Serious limitations** 5 of the 9 studies have small sample sizes. Pooled effect size has wide CI.	**No serious limitations**	**Low**	0.45 (0.22, 0.67); n=9
Language development	6	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** 3 of the 6 studies have small sample sizes.	**No serious limitations**	**Moderate**	0.21 (0.13, 0.28); n=6
Motor development	9	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**No serious limitations**	**High**	0.14 (0.07, 0.22); n=9

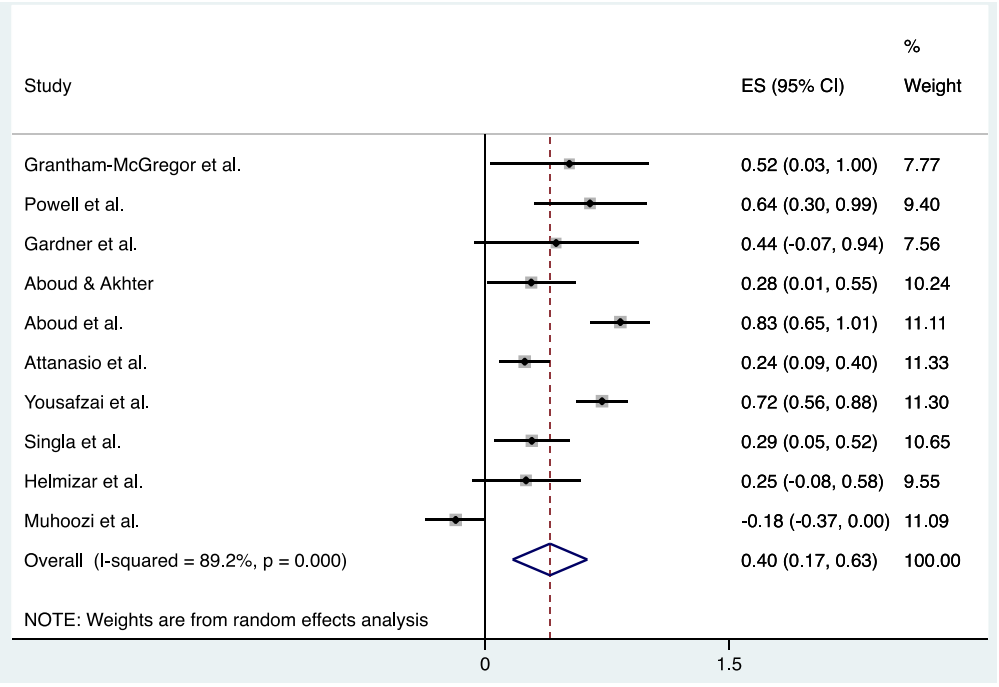
Socioemotional development	1	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** Pooled results have wide CIs.	**No serious limitations**	**Low**	-0.09 (-0.24, 0.07); n=1
HAZ	4	RCTs	**No serious limitations**	**Serious limitations** Variation in magnitude and direction of effects: Nahar et al., 2012, found negative impacts; Menon et al., 2016, found positive impacts.	**No serious limitations**	**Serious limitations** 2 of the 4 studies have small sample sizes. Pooled results have wide CI.	**No serious limitations**	**Low**	-0.42 (-0.85, 0.01); n=4
WAZ	4	RCTs	**No serious limitations**	**No serious limitations**	**No serious limitations**	**Serious limitations** 2 of the 4 studies have small sample sizes.	**No serious limitations**	**Moderate**	0.06 (-0.02, 0.14); n=4
WHZ	5	RCTs	**No serious limitations**	**Serious limitation** Helmizar et al., 2017, found positive impacts, while the other studies did not.	**No serious limitations**	**Serious limitations** 3 of the 5 studies have small sample sizes.	**No serious limitations**	**Low**	0.17 (-0.04, 0.38); n=5

Combined nutrition and caregiving interventions versus standard of care

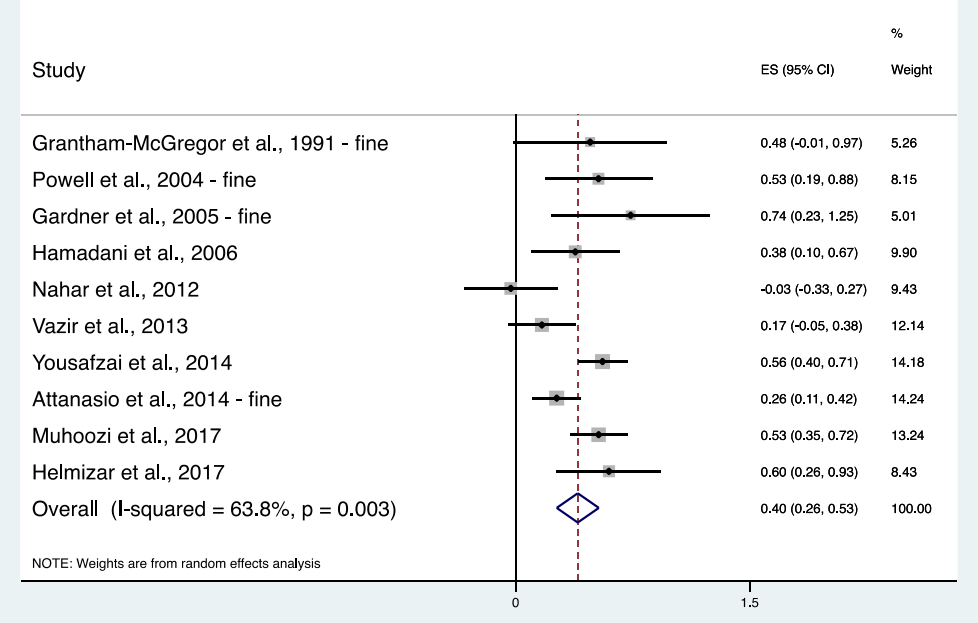
Cognitive Development



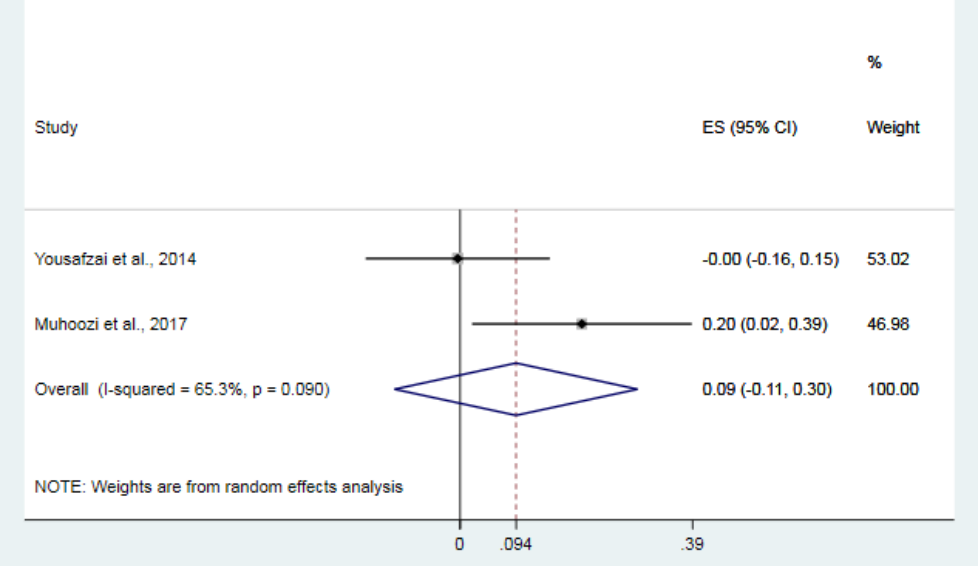
Language



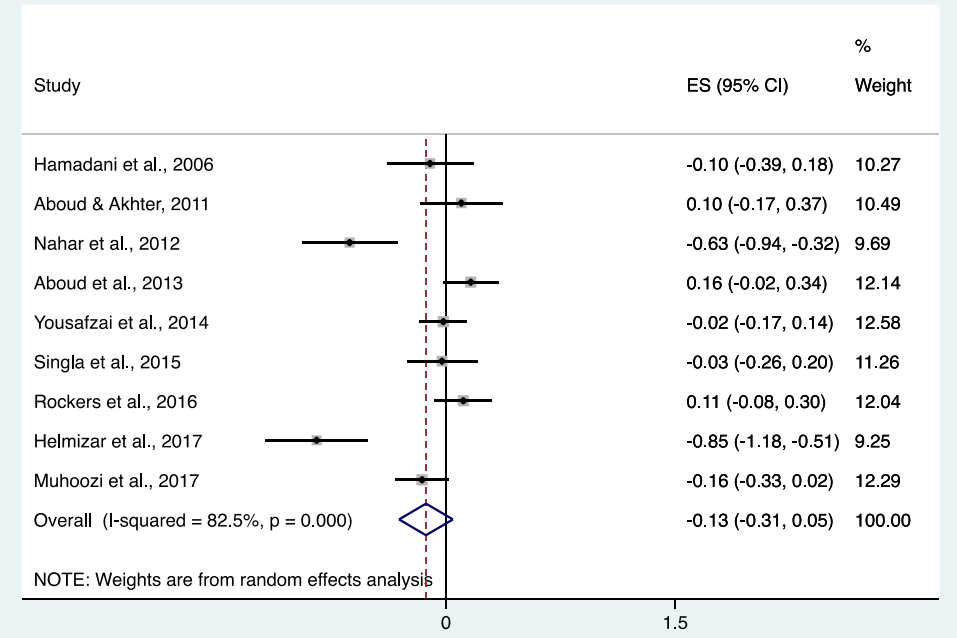
Motor



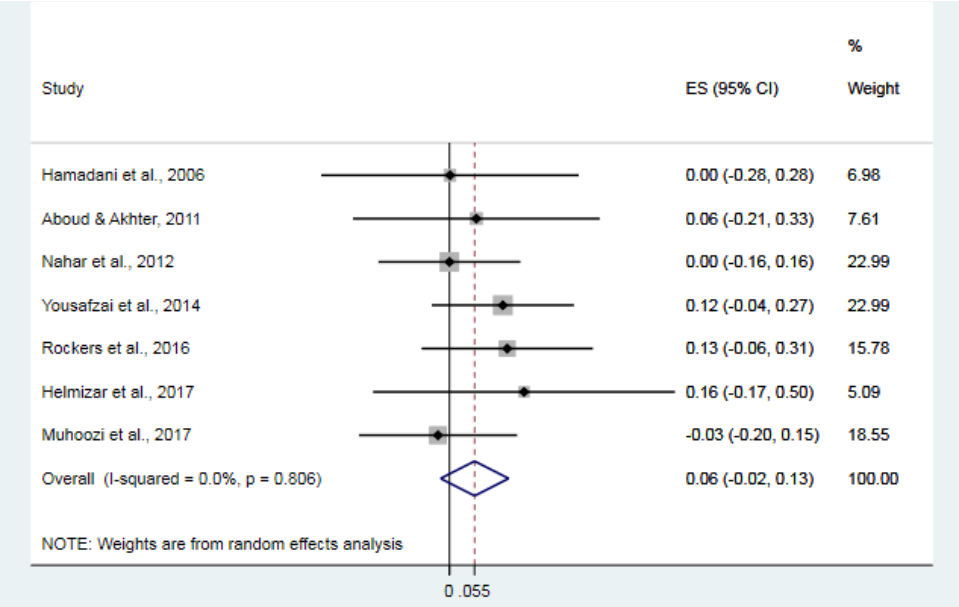
Socioemotional



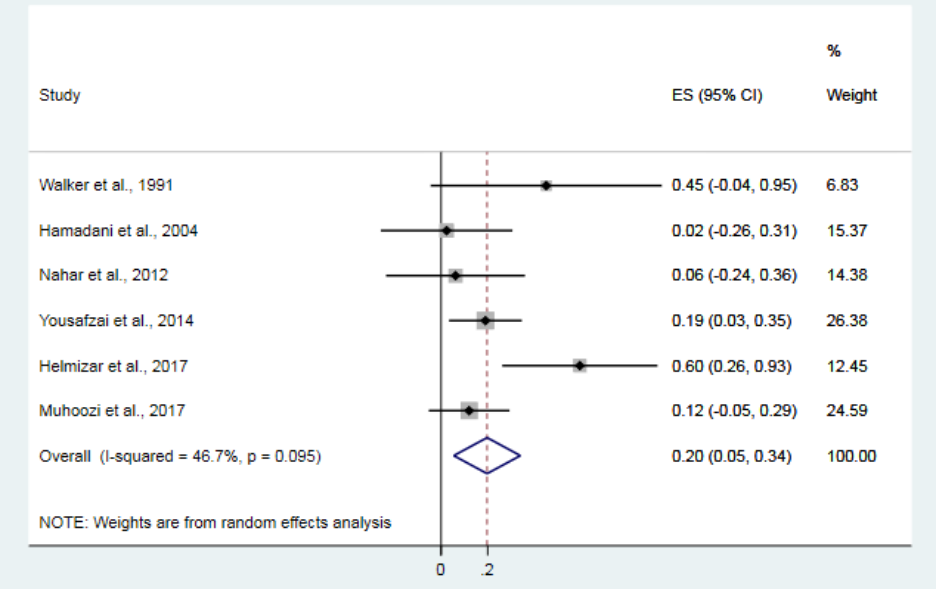
HAZ


Study
ES (95% CI)
%
Weight
Hamadani et al., 2006
-0.10 (-0.39, 0.18)
10.27
Aboud & Akhter, 2011
0.10 (-0.17, 0.37)
10.49
Nahar et al., 2012
-0.63 (-0.94, -0.32)
9.69
Aboud et al., 2013
0.16 (-0.02, 0.34)
12.14
Yousafzai et al., 2014
-0.02 (-0.17, 0.14)
12.58
Singla et al., 2015
-0.03 (-0.26, 0.20)
11.26
Rockers et al., 2016
0.11 (-0.08, 0.30)
12.04
Helmizar et al., 2017
-0.85 (-1.18, -0.51)
9.25
Muhoozi et al., 2017
-0.16 (-0.33, 0.02)
12.29
Overall (I-squared = 82.5%, p = 0.000)
-0.13 (-0.31, 0.05)
100.00
NOTE: Weights are from random effects analysis
0
1.5

WAZ

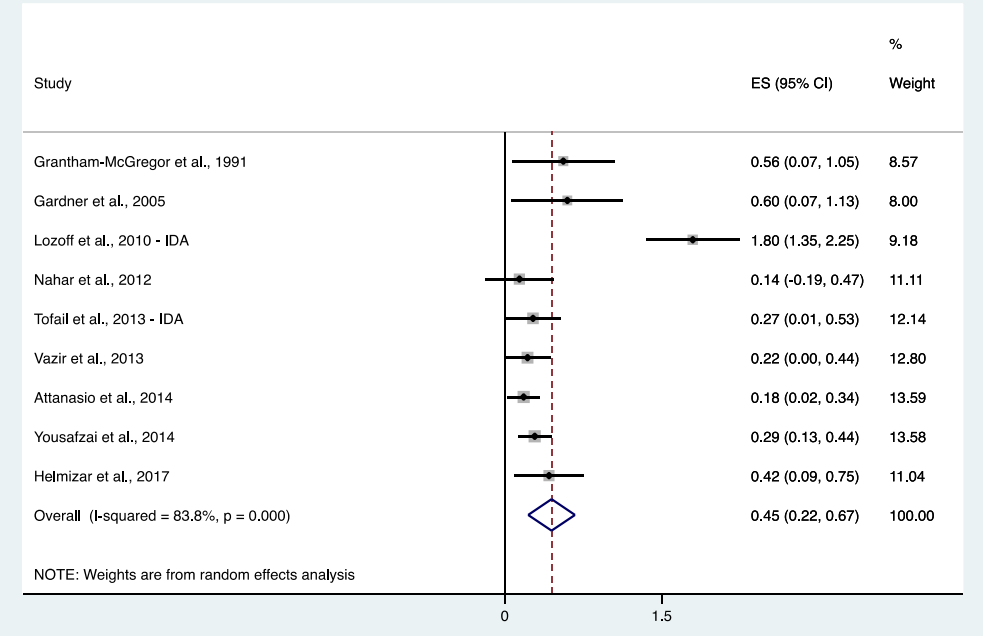

Study
ES (95% CI)
%
Weight
Hamadani et al., 2006
0.00 (-0.28, 0.28)
6.98
Aboud & Akhter, 2011
0.06 (-0.21, 0.33)
7.61
Nahar et al., 2012
0.00 (-0.16, 0.16)
22.99
Yousafzai et al., 2014
0.12 (-0.04, 0.27)
22.99
Rockers et al., 2016
0.13 (-0.06, 0.31)
15.78
Helmizar et al., 2017
0.16 (-0.17, 0.50)
5.09
Muhoozi et al., 2017
-0.03 (-0.20, 0.15)
18.55
Overall (I-squared = 0.0%, p = 0.806)
0.06 (-0.02, 0.13)
100.00
NOTE: Weights are from random effects analysis
0
.055

WHZ

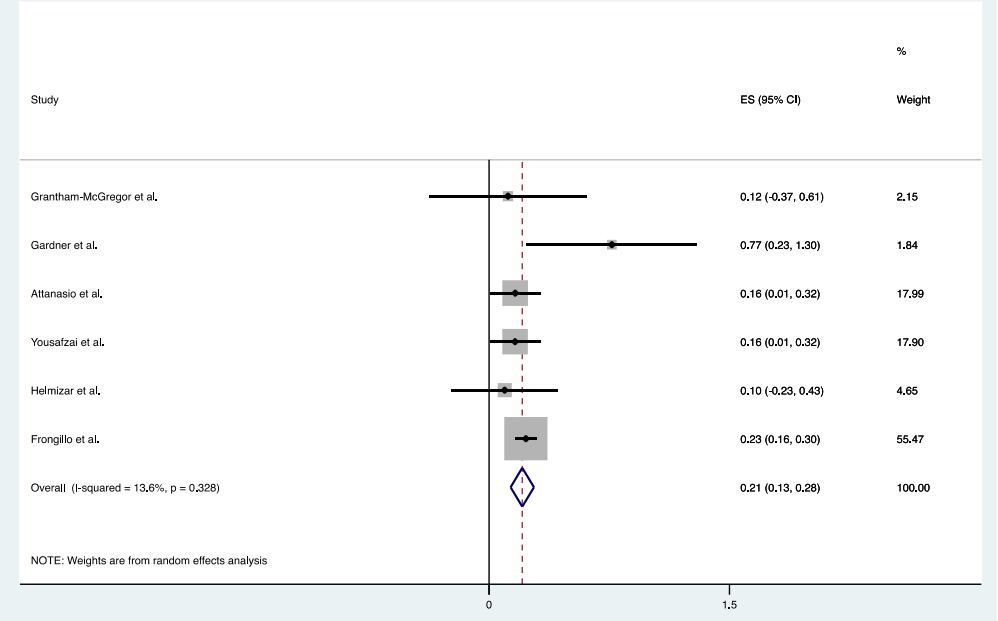

Study
ES (95% CI)
%
Weight
Walker et al., 1991
0.45 (-0.04, 0.95)
6.83
Hamadani et al., 2004
0.02 (-0.26, 0.31)
15.37
Nahar et al., 2012
0.06 (-0.24, 0.36)
14.38
Yousafzai et al., 2014
0.19 (0.03, 0.35)
26.38
Helmizar et al., 2017
0.60 (0.26, 0.93)
12.45
Muhoozi et al., 2017
0.12 (-0.05, 0.29)
24.59
Overall (I-squared = 46.7%, p = 0.095)
0.20 (0.05, 0.34)
100.00
NOTE: Weights are from random effects analysis
0
.2

Combined nutrition and caregiving interventions versus nutrition

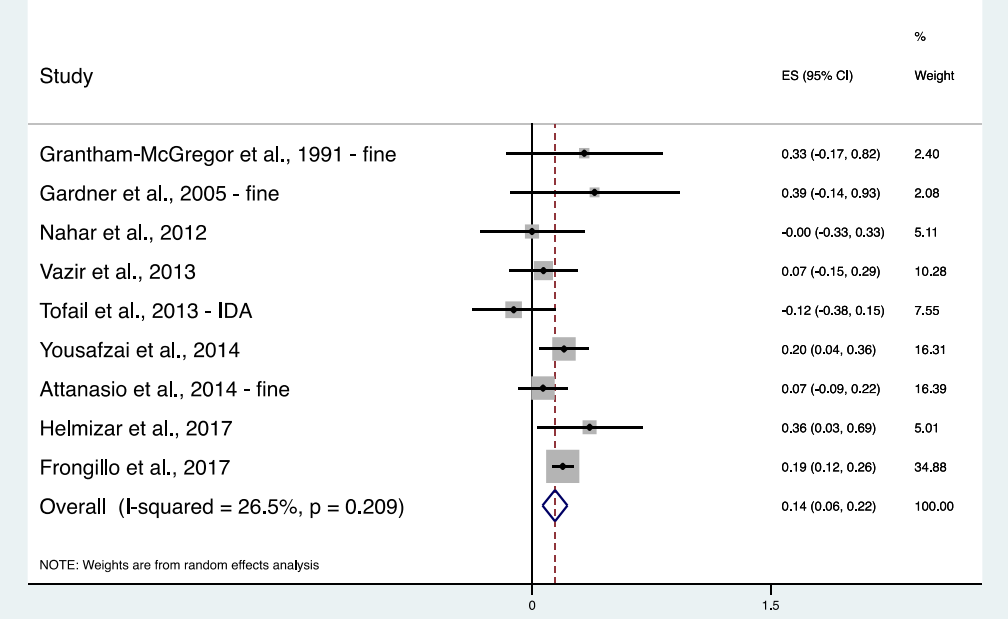
Cognitive Development



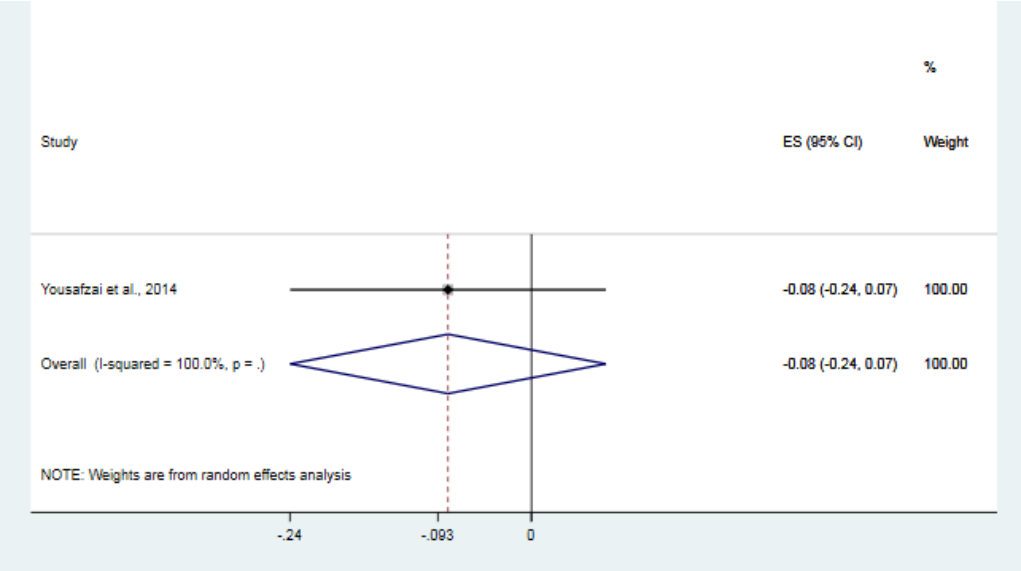
Language



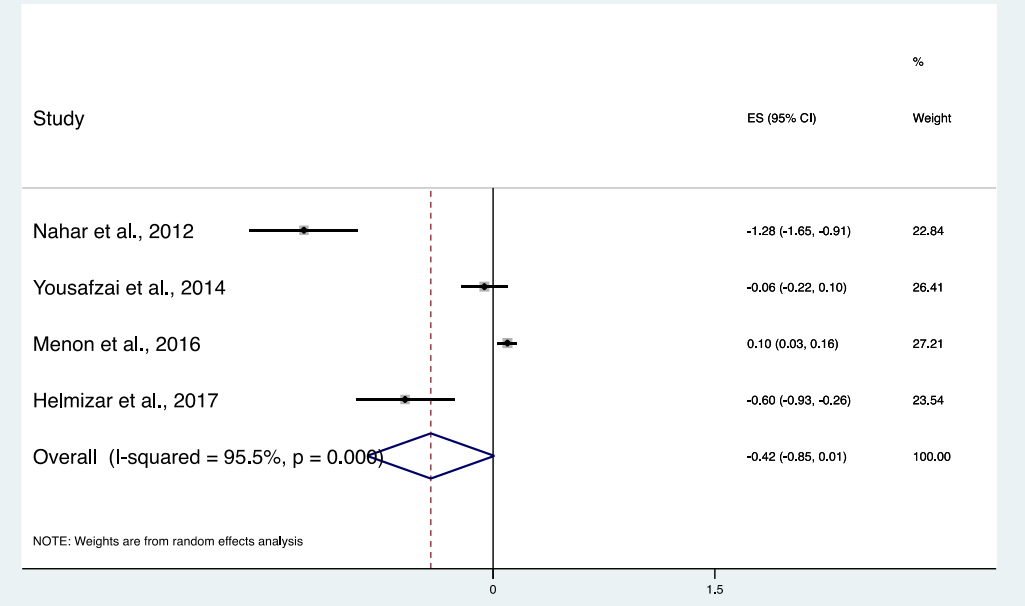
Motor



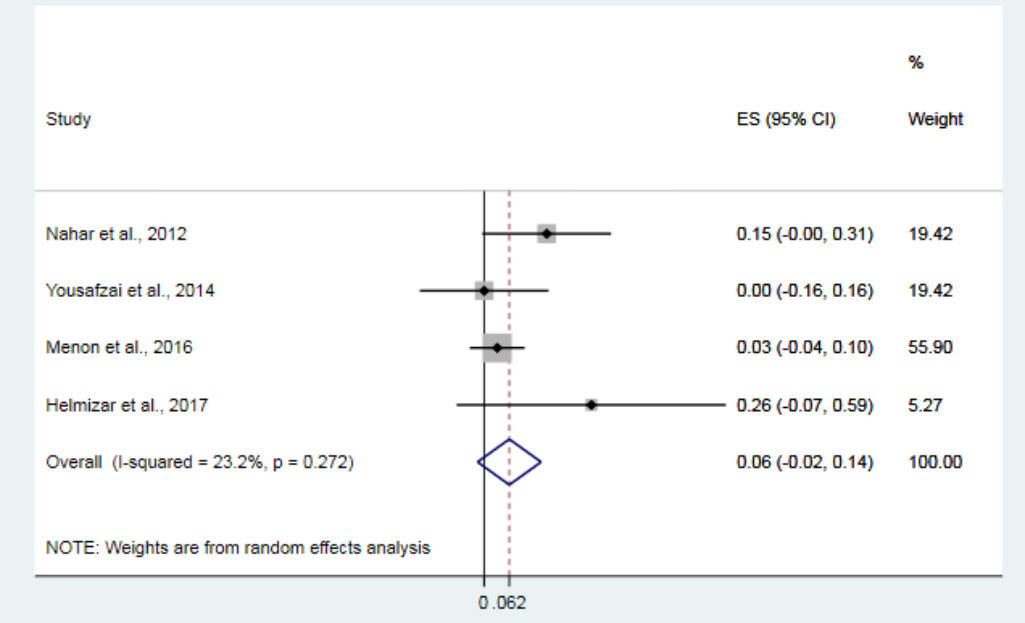
Socioemotional



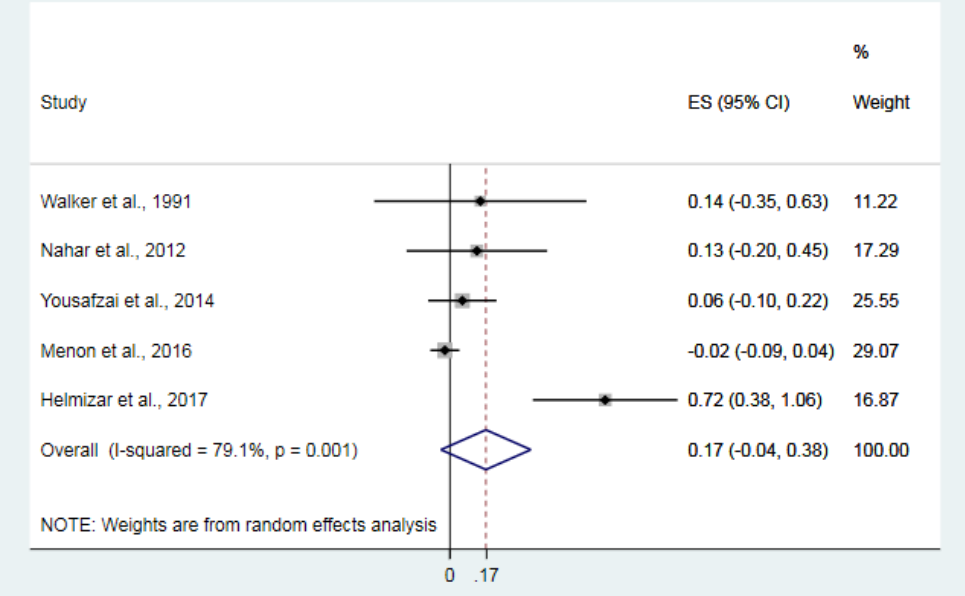
HAZ


Study
ES (95% CI)
%
Weight
Nahar et al., 2012
-1.28 (-1.65, -0.91)
22.84
Yousafzai et al., 2014
-0.06 (-0.22, 0.10)
26.41
Menon et al., 2016
0.10 (0.03, 0.16)
27.21
Helmizar et al., 2017
-0.60 (-0.93, -0.26)
23.54
Overall (I-squared = 95.5%, p = 0.000)
-0.42 (-0.85, 0.01)
100.00
NOTE: Weights are from random effects analysis
0
1.5

WAZ

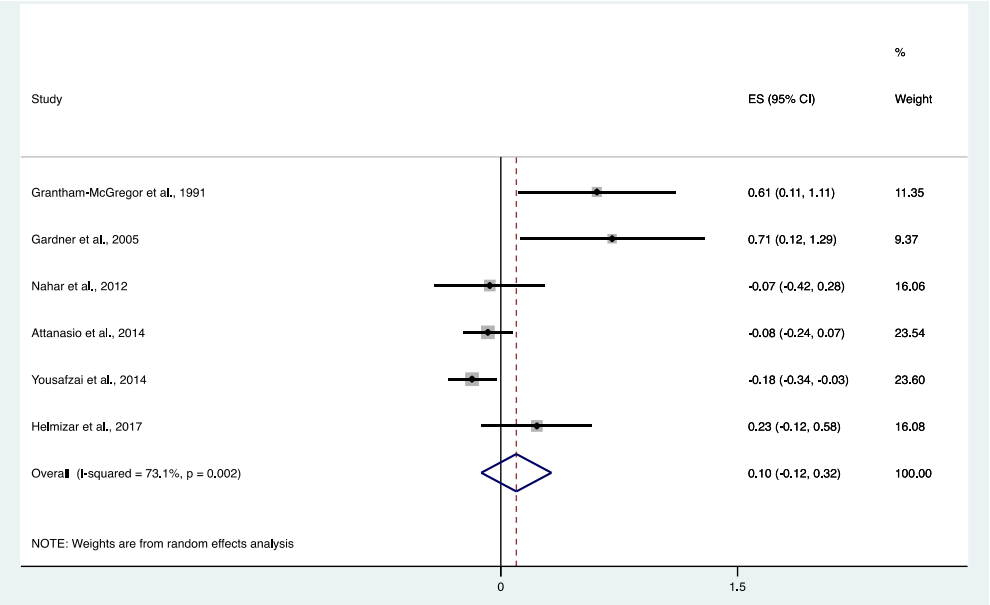

Study
ES (95% CI)
%
Weight
Nahar et al., 2012
0.15 (-0.00, 0.31)
19.42
Yousafzai et al., 2014
0.00 (-0.16, 0.16)
19.42
Menon et al., 2016
0.03 (-0.04, 0.10)
55.90
Helmizar et al., 2017
0.26 (-0.07, 0.59)
5.27
Overall (I-squared = 23.2%, p = 0.272)
0.06 (-0.02, 0.14)
100.00
NOTE: Weights are from random effects analysis
0 .062

WHZ

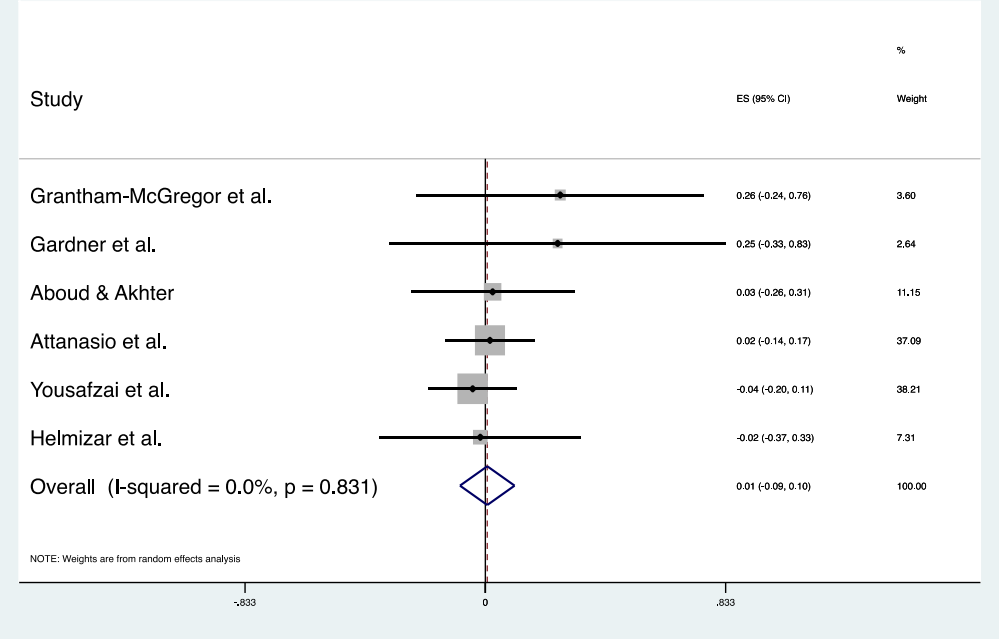

Study
ES (95% CI)
%
Weight
Walker et al., 1991
0.14 (-0.35, 0.63)
11.22
Nahar et al., 2012
0.13 (-0.20, 0.45)
17.29
Yousafzai et al., 2014
0.06 (-0.10, 0.22)
25.55
Menon et al., 2016
-0.02 (-0.09, 0.04)
29.07
Helmizar et al., 2017
0.72 (0.38, 1.06)
16.87
Overall (I-squared = 79.1%, p = 0.001)
0.17 (-0.04, 0.38)
100.00
NOTE: Weights are from random effects analysis
0
.17

Combined caregiving and nutrition interventions versus caregiving

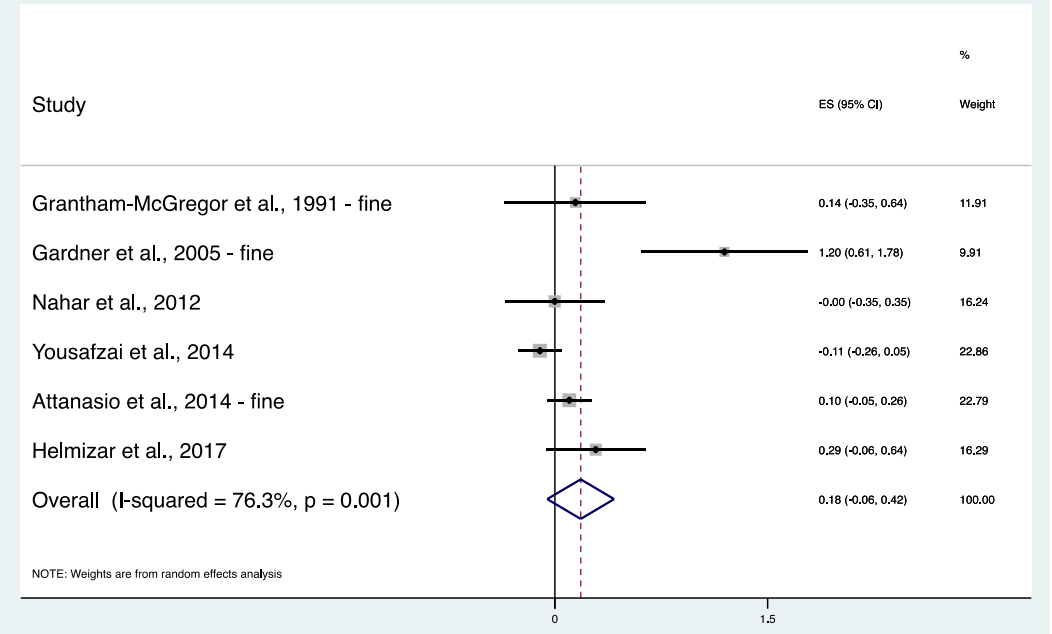
Cognitive Development



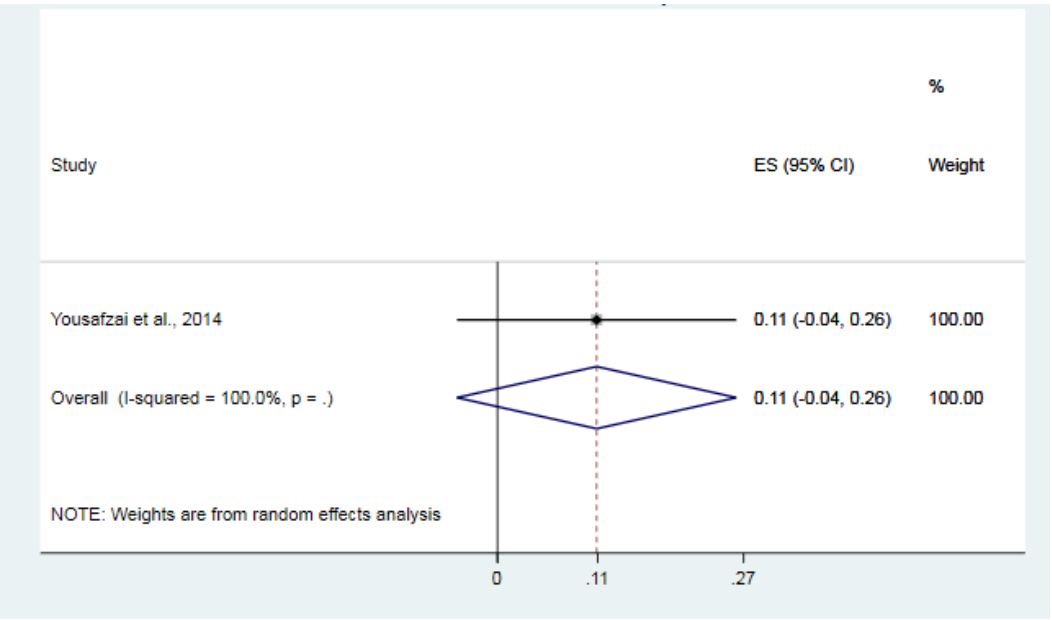
Language



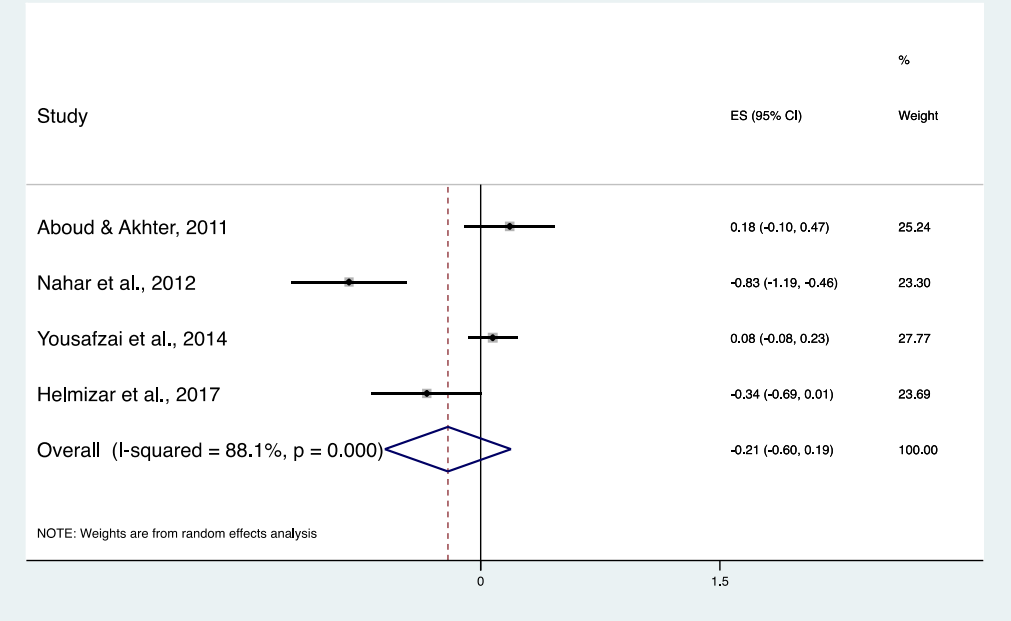
Motor



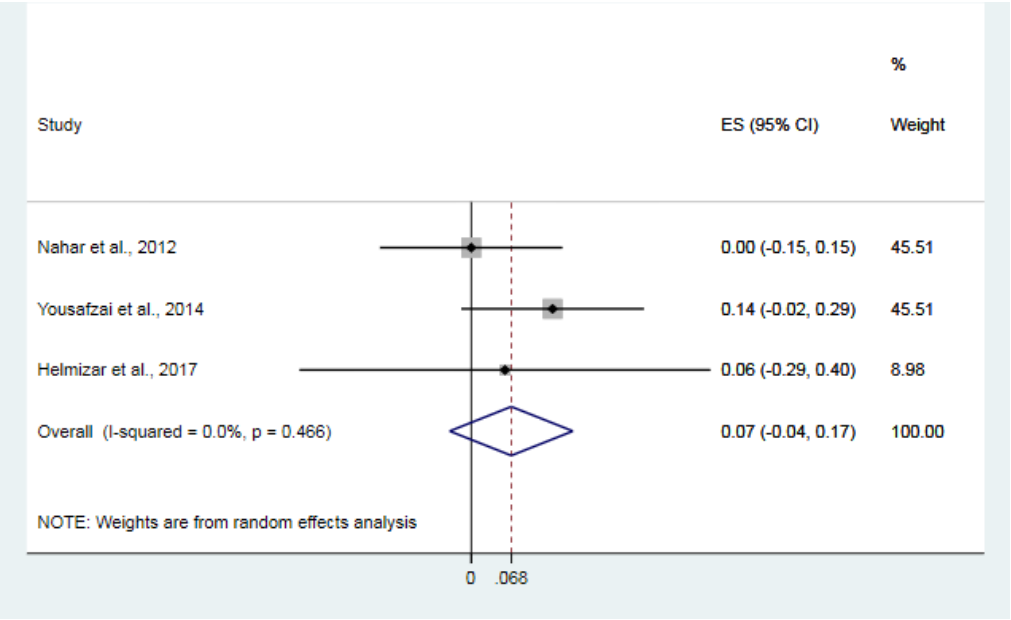
Socioemotional



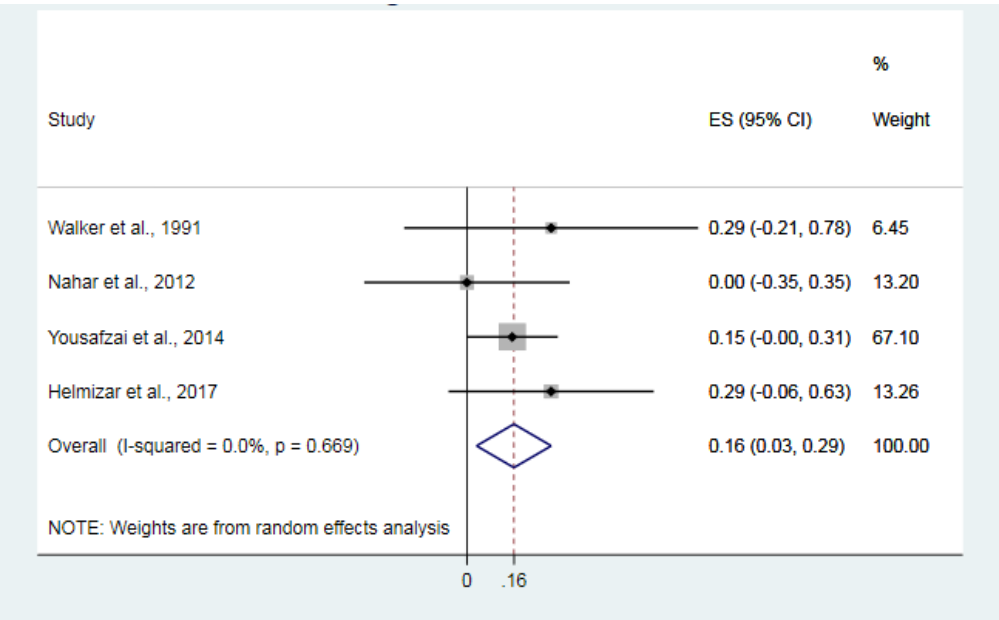
HAZ


Study
ES (95% CI)
%
Weight
Aboud & Akhter, 2011
0.18 (-0.10, 0.47)
25.24
Nahar et al., 2012
-0.83 (-1.19, -0.46)
23.30
Yousafzai et al., 2014
0.08 (-0.08, 0.23)
27.77
Helmizar et al., 2017
-0.34 (-0.69, 0.01)
23.69
Overall (I-squared = 88.1%, p = 0.000)
-0.21 (-0.60, 0.19)
100.00
NOTE: Weights are from random effects analysis
0
1.5

WAZ


Study
ES (95% CI)
%
Weight
Nahar et al., 2012
0.00 (-0.15, 0.15)
45.51
Yousafzai et al., 2014
0.14 (-0.02, 0.29)
45.51
Helmizar et al., 2017
0.06 (-0.29, 0.40)
8.98
Overall (I-squared = 0.0%, p = 0.466)
0.07 (-0.04, 0.17)
100.00
NOTE: Weights are from random effects analysis
0
.068

WHZ


Study
ES (95% CI)
%
Weight
Walker et al., 1991
0.29 (-0.21, 0.78)
6.45
Nahar et al., 2012
0.00 (-0.35, 0.35)
13.20
Yousafzai et al., 2014
0.15 (-0.00, 0.31)
67.10
Helmizar et al., 2017
0.29 (-0.06, 0.63)
13.26
Overall (I-squared = 0.0%, p = 0.669)
0.16 (0.03, 0.29)
100.00
NOTE: Weights are from random effects analysis
0
.16