Effects of a parenting intervention to address maternal psychological wellbeing and child development and growth in rural Uganda: a community-based, cluster-randomised trial

Daisy R Singla, Elias Kumbakumba, Frances E Aboud

Summary

Background Parenting interventions have been implemented to improve the compromised developmental potential among 39% of children younger than 5 years living in low-income and middle-income countries. Maternal wellbeing is important for child development, especially in children younger than 3 years who are vulnerable and dependent on their mothers for nutrition and stimulation. We assessed an integrated, community-based parenting intervention that targeted both child development and maternal wellbeing in rural Uganda.

Methods In this community-based, cluster randomised trial, we assessed the effectiveness of a manualised, parenting intervention in Lira, Uganda. We selected and randomly assigned 12 parishes (1:1) to either parenting intervention or control (inclusion on a waitlist with a brief message on nutrition) groups using a computer-generated list of random numbers. Within each parish, we selected two to three eligible communities that had a parish office or a primary school in which a preschool could be established, more than 75 households with children younger than 6 years, and at least 15 socially disadvantaged families (ie, maternal education of primary school level or lower) with at least one child younger than 36 months. Participants within communities were mother–child dyads, where the child was 12–36 months of age at enrolment, and the mother had low maternal education. In the parenting intervention group, participants attended 12 fortnightly peer-led group sessions focusing on child care and maternal wellbeing. The primary outcomes were cognitive and receptive language development, as measured with the Bayley Scales of Infant Development, 3rd edn. Secondary outcomes included self-reported maternal depressive symptoms, using the Center for Epidemiologic Studies Depression Scale, and child growth. Theoretically-relevant parenting practices, including the Home Observation for Measurement of the Environment inventory, and mother-care variables, such as perceived spousal support, were also assessed as potential mediators. Baseline assessments were done in January, 2013, and endline assessments were done in November, 2013, 3 months after completion of the programme. Ethics approval was received from Mbarara and McGill universities. This trial is registered with ClinicalTrials.gov, NCT01906606.

Findings Between December, 2012, and January, 2013, 13 communities (194 dyads) were randomly assigned to receive intervention, and 12 communities (154 dyads) were assigned to a waitlist control. 319 dyads completed baseline measures (171 in the intervention group and 148 in the control group), and 291 dyads completed endline measures (160 in the intervention group and 131 in the control group). At endline, children in the intervention group had significantly higher cognitive scores (58·90 *vs* 55·65, effect size 0·36, 95% CI 0·12–0·59) and receptive language scores (23·86 *vs* 22·40, 0·27, 0·03–0·50) than did children in the control group. Mothers in the intervention group reported significantly fewer depressive symptoms (15·36 *vs* 18·61, –0·391, –0·62 to –0·16) than did mothers in the control group. However, no differences were found in child growth between groups.

Interpretation The 12 session integrated parenting intervention delivered by non-professional community members improved child development and maternal wellbeing in rural Uganda. Because this intervention was largely managed and implemented by a local organisation, using local community members and minimal resources, such a programme has the potential to be replicated and scaled up in other low-resource, village-based settings.

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Department of Psychology, McGill University, Montreal, QC, Canada (D R Singla PhD, Prof F E Aboud PhD); **and Department of Paediatrics and Child Health, Mbarara University of Science and Technology, Mbarara, Uganda** (E Kumbakumba MMed)

Correspondence to:
Dr Daisy R Singla, Department of Psychology, McGill University, Montreal, QC H3A 1B1, Canada
daisy.singla@mail.mcgill.ca

Introduction

In low-income and middle-income countries, 39% of children younger than 5 years have compromised mental development,[1] the most common sources of which are inadequate nutrition and stimulation.[2] Because children younger than 3 years are especially vulnerable and dependent on their mothers for nutrition and stimulation, researchers now acknowledge that maternal psychological wellbeing is crucial for child development.[3,4] Brief, integrated interventions that address the psychological

wellbeing of mothers as well as child development and growth might add value to interventions that only address child outcomes.

In low-income and middle-income countries, parenting interventions have combined psychosocial stimulation and nutrition to address co-occurring risk factors.[5] Three delivery models have been used: individual home visits, clinic visits, and community-based group sessions with or without home visits.[6,7] Researchers have identified several successful implementation strategies, including a structured curriculum, demonstrations with materials, the opportunity to practise new skills with relevant feedback, and problem-solving discussions with other parents.[7] The structured curriculum for many of these programmes is informed by theoretical frameworks of responsive parenting that promote child development. Responsive parenting involves the provision of conversation and play materials that are tailored to the child's ability and state of interest. Despite cultural variations, responsive parenting has been shown to enhance cognitive and language development.[8]

Several parenting interventions have assessed the effect of stimulation programmes on maternal mental health.[9–11] Most interventions did not reduce depression or did so under specific conditions. For example, one study reduced maternal depressive symptoms, but only after 25 home visits, which might not be feasible in low-resource settings.[9] Other interventions had effects only when mothers met in groups rather than when they received individual home visits.[10] Another mother-care programme in South Africa that focused on mother–child interactions[11] reduced maternal depression at 6 months, but effects were not sustained at 12 months. Thus, although it is possible that positive interactions with one's child might raise the mother's self-esteem, these interactions by themselves appear insufficient to address broader sources of maternal depression.

Along with stimulation and nutrition, the integration of maternal psychological wellbeing into parenting interventions (ie, integrated intervention) may advance maternal and child health for several reasons. First, despite mixed evidence,[12–14] some investigators have found a link between maternal depression and child cognitive development,[15,16] undernutrition,[17] and illness.[18] Second, whereas the prevalence of maternal depression in low-income and middle-income countries ranges from 18% to 25%,[19] the prevalence of depressive symptoms, which falls within the range of poor psychological wellbeing, could be as much as 55%;[17] thus, child-care problems might extend to a large group of mothers who cannot attend to their child's needs.[9,12] Third, the problem of maternal depression persists beyond the postpartum period, after which symptoms might recur or become chronic[20] and adversely affect the most sensitive years of child development. Fourth, two community-based interventions[21,22] have effectively reduced women's depression, thus minimising the need for professionals and encouraging integration into early childhood programmes. Fifth, a universal programme that is provided to all mothers irrespective of their depression levels and embedded within parenting sessions would take the potentially stigmatising attention away from mothers' mental health, facilitate social support among women, and help mothers to develop a rewarding relationship with their child, husband, and peers.[14,23] Finally, provision of an integrated programme to both mothers and fathers might engage fathers in the care of both child and mother.[24] Thus, addressing maternal psychological wellbeing explicitly within parenting interventions could benefit not only mothers but also their children, spouses, and extended families.

Uganda is a low-income country where 40% of children are stunted and 14% are underweight.[25] Linear growth and weight are important indicators of nutrition, but, unlike weight, linear growth is more reliably related to mental development.[1] The provision of psychosocial stimulation to children younger than 5 years is also low in Uganda, and one stimulation study[24] found that 75–80% of children between 3 and 6 years old did not have toys or were not engaged in learning activities (eg, counting or naming objects). Consequently, child stimulation interventions have been implemented in Uganda,[23,24,26] affecting psychosocial stimulation,[23,26] child development,[26] and maternal mood, but no other hallmark symptoms of depression, such as anhedonia, irritability, and poor sleep.[23] Maternal psychological wellbeing has been successfully addressed in isolation with parenting programmes in Uganda where 25–39% of women reported moderate to severe depressive symptoms.[27] Risk factors included interpersonal stressors such as disputes, poor social support, and intimate partner violence.[22]

In collaboration with the local non-governmental organisation Plan Uganda, we aimed to assess a community-based parenting programme that explicitly addressed both maternal psychological wellbeing and child development and growth in rural Uganda. On the basis of a literature review of common, but problematic parenting practices in Uganda and other low-resource settings,[6] we addressed specific parenting practices related to psychosocial stimulation, dietary diversity, hygiene, and a mother's relationships with herself, her child, and her spouse. Finally, we examined whether theoretically driven parenting practices mediated the effects of the intervention on child development and maternal wellbeing outcomes. We postulated that the integrated intervention would have beneficial effects on children's development, mother's psychological wellbeing, and parenting practices. On the basis of previous literature,[28] we also postulated that psychosocial stimulation would mediate the effects of the intervention on child development.

Methods

Study design and participants

We conducted this community-based, cluster-randomised, effectiveness trial in Lira, a northern district of Uganda,

located 352 km from Kampala. With 403 000 inhabitants, the population of Lira has increased substantially in the past 5 years as civil conflict in the area decreased and families returned to villages. Plan Uganda selected Lira as a study setting because the district is known to be recovering from conflict. Similar to other rural areas of Uganda, Lira continues to have poor maternal and child health.[29] Between December, 2012, and January, 2013, we enrolled and randomly assigned patients to intervention or waitlist. We did baseline assessments between January and February, 2013, and endline assessments in November, 2013, 3 months after the completion of the programme. The intervention programme took place between February and August, 2013.

This study took place in the rural parishes (subdistricts) where 85% of the population resides.[29] Employment mainly involves subsistence farming and semi-skilled and unskilled labour. A parish comprises one to two communities of three to seven contiguous villages led by one elected chairperson. Individual parishes, rather than villages or communities, constituted the unit of randomisation to avoid contamination between units of randomisation. We screened the 12 parishes in which Plan Uganda was starting preschools. Within each parish, two or three communities were identified using a census from 2012. Eligible communities required a parish office or a primary school in which a preschool could be established, more than 75 households with children younger than 6 years, and at least 15 socially disadvantaged families (ie, maternal education of primary school level or lower) with at least one child younger than 36 months.

Participants within villages were mother–child dyads in which the child was 12–36 months of age at enrolment. We identified dyads before data collection and implementation of the programme, using a census done by Plan Uganda in 2012. Although all families with children younger than 3 years were free to participate in the intervention delivered in their village, Plan Uganda specifically invited families with low maternal education. All mothers provided written informed consent (or thumbprint) at the time of data collection after randomisation. No refusals were reported. We obtained ethics approval from Mbarara University of Science and Technology and McGill University.

Randomisation and masking

A three-step procedure was used to identify community clusters. First, before any data collection, we used a simple randomisation method and a computer-generated list of random numbers to randomly assign parishes in a 1:1 ratio to either the parenting intervention programme or waitlist control with a brief message on nutrition. Random assignment was done by two authors who had no role in the direct implementation of the intervention. Second, we identified two or three centrally located communities within each parish that fit the three selection criteria. These communities constituted the clusters. Some communities consisted of two or three geographically contiguous villages if one by itself had insufficient eligible parents. To minimise contamination, communities located on the border of parishes were excluded. Third, from the same census, we identified up to 15 eligible mother–child dyads within each cluster. We provided research assistants with a list of eligible dyads in the clusters and instructed them to interview ten to 15 randomly selected mother–child dyads within each cluster. Because the census was based on parent report that contained some age inaccuracies, we recognised the need to check ages during the data collection. Our caution to prevent loss of children because of age led to slight over-recruitment in the intervention group, which began somewhat later than the recruitment in the control group.

Several measures were taken to keep data collectors as masked to group status as possible. First, the data collection team worked independently from programme implementers and were not in contact during training or interviewing. Next, expectations arising from a measure of message recall did not bias other data collected from that participant because it was intentionally placed at the conclusion of the endline interview. Furthermore, research assistants did the interviews in pairs, in which one assistant interviewed the mother and the other assessed the child. Thus, the research assistant assessing the child did not hear the mother's responses and therefore remained masked to group status. To help with masking, all data collectors were told at endline that all participants had received a programme and were led to assume that there were no systematic differences between parishes. To assess the extent of masking, one author (EK) asked data collectors if they knew who received what programme at the end of data collection. Data collectors were unaware of the programme specifics or which families received the intervention. Fortunately, no data collector mentioned having observed specific programme materials (eg, Activity Booklet among intervention households and nutrition chart among controls) during home-based assessments. Finally, participants (mothers) and implementers were aware of the programme, but implementers did not know which parents were interviewed for data collection.

Procedures

Community volunteers delivered the 12 session integrated intervention programme to groups of parents on a fortnightly basis between February and August, 2013. All measures were adapted and translated into Luo to ensure their usability in the local context. The programme was based on formative research done in 2012 to identify parent goals and practices. It addressed five messages related to child care (play, talk, diet, hygiene, and love and respect) and maternal wellbeing (eg, increasing father involvement); these practices were discussed with Plan Uganda staff in

October, 2012. A booster session was done in September, 2013. Mothers and fathers were invited to participate in the programme, which lasted 60–90 min per session. Through a series of active and interactive activities derived from evidence-based cognitive, behavioural, interpersonal, and stimulation interventions (eg, role-play, games, parent–child interactions, and group-based problem solving), parents were encouraged to learn and enact new practices with their child, spouse, or peers, depending on the specific practice. Parents were assigned homework to practise between sessions. During the session, the volunteer used a series of coloured posters depicting the messages, and families received their own Activity Booklet, which included smaller versions of these posters. The parenting programme included introductory and concluding sessions covering all messages, six sessions on child care, and four sessions for each parent on mother care.

Parents also received one or two home visits by the volunteer to review the five parenting messages, discuss their enactment, resolve barriers to enacting them, and make other relevant observations (eg, the provision of home-made toys and pictures, whether parents talked to one another and their child in a respectful tone). Unlike previous home-visit stimulation programmes,[28] our visits were not used to demonstrate and practise. Home visits were done between group sessions only in the latter half of the programme. On average, home visits lasted 40–50 min, during which volunteers followed a specific checklist.

Child-care sessions were focused on the provision of children with home-based play materials (play); engagement in two-way talk with the child and the use of stories and pictures (talk); a diverse diet, especially animal-source foods, such as eggs, with appropriate quantities and frequencies (diet); handwashing with soap before eating and after using the latrine (hygiene); and use of gentle discipline (love and respect). Discussions and demonstrations of food quantities, play, and talk were designed for children 6–36 months of age. For example, a rattle for a 6–12 month old child was compared with a complex eye–hand coordination material for an older child. The intervention was based on Bandura's social-cognitive learning theory,[30] in which participants heard about the benefits of these practices, enacted the practices with their child through games and activities, and identified and resolved relevant barriers.

Mother-care sessions dealt with love and respect in three primary relationships: the mother's relationship with herself, her child, and her spouse, as in other maternal mental health interventions.[21] Two mother-care sessions were delivered to mothers only, two to fathers only, and two were delivered to mothers and fathers together. In these sessions, scenarios of mothers and fathers in supportive and unsupportive situations were used to facilitate a discussion about various interpersonal conflicts[21] as well as practised appropriate conflict resolution strategies and communication through activities such as role-play.[31] Sessions were delivered in a similar format for fathers only, discussing issues related to their involvement in child care, emotion regulation, and the types of emotional support that they could provide to their spouses to facilitate the health and development of their children.

The intervention was delivered to groups of parents within the village by trained community volunteers. Volunteers were selected by the community and Plan Uganda staff on the basis of three criteria: their reputation in the community, communication and language skills (eg, fluency in local Luo dialect), and a minimum of sixth grade education. In total, 13 community volunteers, seven men and six women, were trained. Their average age was 36 years and education level was with eighth grade education levels. Community volunteers were trained by four Plan Uganda staff and two authors (DRS and EK). Training focused on the programme content and effective communication skills that emphasised both common skills (eg, a non-judgmental, empathic stance) and motivational interviewing[32] (eg, open-ended questions and rolling with resistance). Training occurred during 14 days at the beginning and middle of the intervention and covered the programme content along with group communication skills. Manuals were available in both English and Luo; however, most of the training was delivered in Luo.

The quality of the intervention was monitored through weekly supervision by the same four staff members of Plan Uganda who trained the volunteers and by regular discussions between supervisors and one of the authors (DRS). Supervision entailed the assistance of community volunteers to prepare their session, discussion of problems encountered in previous sessions, and provision of feedback through a structured monitoring form for those sessions attended by supervisors. On average, supervisors attended six sessions, and all supervisors attended the first three sessions of the programme.

Communities that had been assigned to the control group were on a waitlist to receive the intervention programme if found to be effective. While on a waitlist, these communities focused on creating preschools for older children supported by Plan Uganda. At the end of the baseline interview, participants also received nutrition information, which included a coloured poster to identify what local foods constitute a diverse diet.

Data collection measures

Eight local research assistants with undergraduate degrees were recruited and given 6–10 days of intensive training for data collection. On the basis of their competency during training and field tests, half of the assistants were selected to assess children according to the Bayley Scales of Infant Development, 3rd edn,[33] and the other half were selected to assess the mother measures. Additionally, the Bayley Scales were used at

endline only and involved 4 additional days of training. Field tests confirmed good inter-rater reliability (r=0·752–0·854, p<0·0001). Assistants collected data over the course of 4 weeks at baseline (in January, 2013) and again at endline (in November, 2013). Interviews took place in participants' homes and lasted about 60 min. Research assistants administered interviews in pairs as described above. Data quality was maintained over the brief testing period by providing detailed feedback on interview styles and data records.

Outcomes

Our primary outcome was child cognitive and receptive language development 3 months after the completion of the programme, as measured by the Bayley Scales of Infant Development, 3rd edn.[33] These scales are the best conventionally and internationally used measure of cognitive and language development for children up to 42 months of age. Similar to other researchers,[13,34] we adapted the Bayley Scales to our context, including modifications to the picture and stimulus booklets with attire and objects that are appropriate for children in rural Uganda. For example, pictures of sneakers and oranges were replaced with pictures of sandals and tomatoes. Most of the manipulatives for the cognitive test were retained. Administrator instructions were followed with the exception of time limitations, which were not strictly applied. The fine-motor subscale was not used because it made testing take too long and was previously shown to overlap extensively with cognitive performance.[10] The expressive language items were too difficult to administer and score because children were shy to speak to unfamiliar adults. Thus, we administered only cognitive and receptive language subscales. At baseline, a brief language test, based on the receptive subscale of the Bayley Scales, was used and included a picture booklet (eg, "point to the goat"). The language test showed good convergent validity with Bayley receptive language and cognitive scores (r=0·528 *vs* r=0·516, p<0·0001).

Our secondary outcomes were maternal depressive symptoms, as measured by the Center for Epidemiologic Studies Depression Scale (CES-D) and child growth.[35] The CES-D has been previously used in Uganda.[36] Similar to other studies,[37] we modified the scoring of our scale to recode 0 and 1 day as a score of 0, whereas 2 days was scored 1, 3 to 4 days was scored 2, and 5 to 7 days was scored 3 (α=0·869).

Height was assessed by asking the child to stand beside a flat surface while research assistants measured height with a tape measure. The average of two readings was used to derive height-for-age Z scores using international WHO standards.[38] Sickness was based on mother's report ("Has your child been sick in the past 2 weeks?") and had good concurrent validity with preventive health practices (r=–0·181, p<0·003). Inter-rater reliability for these measures was high (r=0·882–0·946, p<0·0001). Data on household demographic and socioeconomic status were collected at baseline with previously validated measures.[39] Demographic variables included child age and sex; maternal and paternal education, age, and occupation; religion; household size; and birth order of the target child. To indicate family socioeconomic status, we created a composite score of 11 assets (eg, table, chair, bed, watch, latrine).

As secondary outcomes, we examined four parenting practices: preventive health practices, dietary diversity, psychosocial stimulation, and mother's knowledge of child development. Preventive health practices were calculated using a composite score of nine items (each scored 0 or 1): access to safe water, use of latrine for disposal of children's faeces, four immunisations (bacille Calmette-Guerin; diphtheria, pertussis, and tetanus; polio; and measles), vitamin A drops, de-worming, and use of iodised salt. Whenever possible, the child's immunisation card was used to collect these data; however, self-report was used by 16% of the sample at baseline and 23% of the sample at endline by those who reported losing the card. Other preventive health data (ie, access to safe water, use of latrine, and iodised salt) were based on mothers' report. Dietary

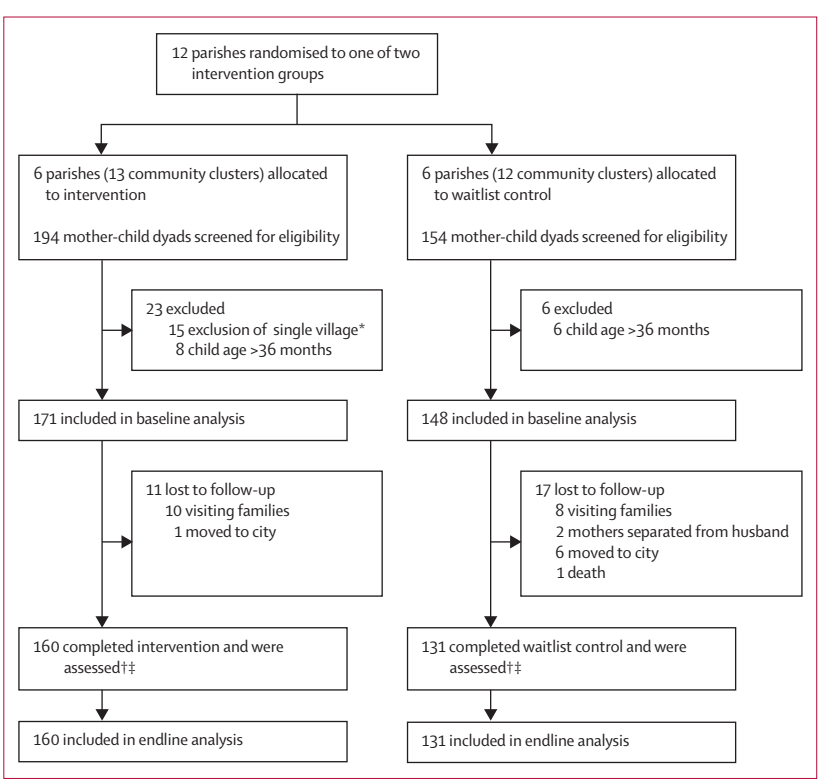

Figure: **Trial profile**

*Removed from intervention because this community volunteer completed less than half of the programme because he left his community. †Three children (one in the intervention group and two in the control group) did not complete the Bayley assessment although their mothers were interviewed. ‡Nine mothers in the intervention group and 18 mothers in the control group did not answer some variables but their children completed the Bayley assessment.

diversity was assessed by asking mothers what their child had eaten the day before. The dietary diversity score was calculated by the mother's report of all foods eaten by her child and later coded into seven food categories: grains or tubers, legumes, fish or meat, egg, vegetables, fruit, and cow's milk.[40] Quantities were not recorded. Psychosocial stimulation was assessed by the Home Observation for Measurement of the Environment (HOME) inventory, a 45 item structured interview and observation in the mother's home.[41] Mother's knowledge of child development involved six questions asking mothers at what age children generally acquire social and cognitive skills (ie, recognise their mother, understand spoken words, communicate hunger, enjoy colourful moving objects, self-feed, and learn things from playing with objects).[10] Expected ages (reversed to calculate the score for this measure) were used as the indicator of the mother's knowledge, where high scores indicated more appropriate estimated ages for child development.

We assessed four mother-care variables, including programme-relevant subscales of the original measures to examine the mother's daily stressors;[42] her ways of coping[43] with interpersonal conflicts; and perceived positive and negative support,[44] which indicates a mother's perceptions of her spouse's expressions of warmth, sympathy, and caring versus negative support, such as criticism, high demands, and arguments. We found good predictive validity for all four mother-care variables at baseline with endline maternal depressive symptoms: daily stressors (r=0·507, p<0·0001), perceived positive support (r=–0·327, p<0·0001), and perceived negative support (r=0·382, p<0·0001). A new variable called active ways of coping was created from a subset of coping items using factor analysis and included nine behaviours (eg, making a plan, talking to someone else, using multiple strategies); these were explicitly practised during sessions and also positively related to ways of coping (r=0·936, p<0·0001) and daily stressors (r=0·460, p<0·0001).These mother-care variables, like parenting practices, were viewed as components that were addressed by the intervention.

Finally, message recall was assessed at endline to determine how many of the five practices mothers spontaneously remembered. Mothers from both control and intervention groups were asked if they recalled receiving any messages about child care. Because there were three messages within each of the five practices, scores ranged from 0 to 15.

	Intervention (n=171)	Control (n=148)
Child		
Child's age, months	22·44 (6·4)	22·23 (6·2)
Female	79 (46%)	81 (55%)
Birth order of target child	3·88 (2·4)	3·27 (2·2)
Height-for-age (Z-score)	–1·76 (1·41)	–1·81 (1·56)
Sickness in the 2 weeks preceding assessment	131 (76·6%)	118 (79·7%)
Language score*	14·49 (11·11)	13·03 (10·51)
Mother		
Age, years	28·04 (7·0)	26·57 (7·2)
Level of education, years	3·91 (2·9)	4·02 (2·8)
Occupation (farmer)	158 (94%)	141 (95%)
Maternal depressive symptoms†	15·13 (9·58)	12·84 (7·88)
Father		
Age, years‡	32·82 (9·7)	30·44 (11·0)
Level of education, years‡	6·73 (2·8)	6·29 (3·0)
Family		
Family assets (0–11)	4·74 (1·6)	4·78 (1·6)
Household size, number of people	6·08 (2·2)	5·53 (2·1)
Access to latrine (%)	113 (66%)	107 (72%)
Access to clean drinking water (%)	137 (80%)	110 (74%)
Parenting practices		
Dietary diversity (0–7)	1·78 (0.86)	1·77 (0·97)
Preventive practices (0–9)	7·46 (1·37)	7·27 (1·47)
Psychosocial stimulation§	25·65 (4·2)	25·07 (4·4)
Mother's knowledge of milestones (maximum 12)	2·48 (4·2)	3·38 (2·9)
Mother-care variables		
Daily stressors (0–30)	10·87 (4·5)	9·35 (7·8)
Ways of coping (0–16)	7·46 (3·9)	6·83 (3·9)
Active ways of coping (0–9)	5·18 (2·9)	4·57 (2·9)
Perceived positive support (0–10)	4·43 (3·0)	4·93 (3·0)
Perceived negative support (0–10)	2·02 (2·2)	1·25 (2·2)

Data are raw means (SD) or n (%). Analyses are adjusted for clustering effects. *Scored according to the Bayley receptive language score subscale, 3rd edn; maximum score is 49. †Scored according to the Center for Epidemiologic Studies Depression Scale (maximum score 60). ‡Three dyads in the intervention group had missing father-related variables (eg, age of father, education and occupation). §Scored according to the Home Observation for Measurement of the Environment Inventory, maximum score of 45.

Table 1: **Baseline characteristics of participants in the intervention and control groups**

Statistical analysis

The sample size was calculated based on one primary outcome, child cognitive and receptive language development, measured on the Bayley Scales of Infant Development, 3rd edn. The mean score of this measure is normally 100 (SD 15). Based on a group difference of 0·5 SD on receptive language, an α error of 0·05, and a 90% power, the required sample size was 84. We multiplied the sample size by 1·44 to account for clustering with an intraclass correlation estimate of 0·04, as determined by previous interventions using mental development outcomes.[10] This required a total of 144 mother–child dyads per group.

We did all statistical analyses with SAS version 9.3. All analyses are adjusted for community clustering effects using SAS PROC MIXED and covarying child's age. Significance was defined as p<0·05. Using intention-to-treat analysis, we assessed whether child and maternal care outcomes differed between the intervention and control groups. We controlled for potential confounding variables (maternal education, child's age, family assets), differences between groups at baseline, the corresponding baseline score for that

outcome, and cluster. Thus, the analyses were based on individual participants, adjusting for clusters. Next, we calculated effect sizes (Cohen's *d*) for significant outcomes. Finally, we identified theoretically relevant mediators. First, we calculated Pearson correlations (*r*) between parenting practices and those primary and secondary outcomes significantly affected by the intervention. Second, we determined whether parenting practices had a significant effect on the outcome of choice (cognitive and language, and maternal depressive symptoms). The same procedure was used for mother-care variables. Mediators were identified using multiple regression analyses,[45] covarying baseline scores in order to account for change. Bootstrapping procedures were used to analyse mediation. Unstandardised indirect effects were computed for each of 1000 bootstrapped samples, along with the 95% CI. The trial was registered at ClinicalTrials.gov, NCT01906606.

Role of the funding source

Plan Uganda had no role in the study design, data collection, data analysis, interpretation, or writing of findings. The authors had access to all the data and DRS had final responsibility for the decision to submit for publication. All authors approved the final submission.

	Intervention (n=160)	Control (n=131)	*F**	Effect size (95% CI)	Intraclass correlation coefficient
Primary outcomes					
Bayley cognitive score (raw)†‡	58·90 (8·11)	55·65 (10·73)	9·84; p=0·002	..	..
Bayley cognitive score (standardised; 0–19)†§	6·08 (2·27)	5·23 (2·38)	9·18; p=0·003	0·36 (0·12 to 0·59)	0·169
Bayley receptive language score (raw)†‡	23·86 (5·68)	22·40 (6·77)	3·17; p=0·076	..	..
Bayley receptive language score (standardised; 0–19)†§	6·75 (2·22)	6·13 (2·09)	4·97; p=0·027	0·27 (0·03 to 0·50)	0·229
Secondary outcomes					
Height-for-age (Z score)	–1·69 (1·13)	–1·66 (1·16)	0·72; p=0·400	..	..
Sickness in the 2 weeks preceding assessment	121 (76%)	110 (84%)	2·29; p=0·130	..	..
Maternal depressive symptoms¶	15·36 (12·51)	18·61 (10·44)	10·82; p=0·010	–0·39 (–0·62 to –0·16)	0·456

Data are means (SD) or n (%). *Adjusted for corresponding baseline scores, covariates (child's age, mother's age and education, assets, and birth order) and clusters (*F*, p value), effect sizes (Cohen's *d*), and intraclass correlation coefficient. †Scored according to the Bayley scales (3rd edn); maximum score for cognitive 91; maximum score for receptive language 49. ‡Measured at baseline by a language scale based on Bayley (3rd edn) items, maximum score 49, and adjusted for at endline Bayley (3rd edn) cognitive and receptive language scores. §Standardised scores shown for comparison purposes. ¶Scored according to the Center for Epidemiologic Studies Depression Scale, maximum score 60.

Table 2: **Effects of intervention on child development, child growth, and maternal depression outcomes**

	Intervention (n=160)	Control (n=131)	*F**	Effect size (95% CI*)
Parenting practices				
Dietary diversity (0–7)	2·55 (0·92)	2·06 (0·82)	21·05; p<0·0001	0·54 (0·30–0·78)
Preventive practices (0–9)	7·88 (1·15)	7·26 (1·43)	14·96; p=0·0001	0·38 (0·22–0·69)
Psychosocial stimulation†	30·94 (4·32)	26·58 (3·74)	88·30; p<0·0001	1·11 (0·85–1·35)
Mother's knowledge of milestones (max=12)	3·56 (2·31)	2·72 (2·93)	9·09; p=0·003	0·36 (0·13–0·59)
Mother-care variables				
Daily stressors (0–30)	12·63 (5·09)	11·71 (4·46)	0·00; p=0·976	..
Ways of coping (0–16)	9·60 (2·17)	8·98 (2·32)	2·34; p=0·127	..
Active ways of coping (0–9)	7·14 (1·92)	6·05 (2·16)	12·74; p<0·0001	0·47 (0·18–0·67)
Perceived positive support (0–10)	5·21 (2·78)	4·53 (2·20)	8·01; p=0·005	0·36 (0·09–0·58)
Perceived negative support (0–10)	2·17 (2·38)	1·48 (1·89)	1·47; p=0·227	..
Message recall (0–15)	4·24 (3·28)	0·88 (1·49)	121·82; p<0·0001	1·07 (1·05–1·56)
Food	0·87 (0·9)	0·40 (0·8)	..	..
Hygiene	1·03 (0·2)	0·12 (0·4)	..	..
Play	0·50 (0·7)	0·09 (0·3)	..	..
Talk	0·80 (0·8)	0·04 (0·2)	..	..
Respect	1·05 (1·1)	0·23 (0·6)	..	..

Data are mean (SD). *Adjusted for baseline scores, covariates (child's age, mother's age and education, assets, and birth order) and clusters (*F*, p value), and effect sizes (Cohen's *d*). †HOME Inventory (maximum score of 45).

Table 3: **Effects of intervention on parenting practices and mother-care variables**

	Regression result (n=291)		Bootstrap 95% CI
	β	SE	
Model 1a: Mediating effects of HOME on cognitive development			0·117–0·721
c (Intervention → cognitive)	0·782†	0·264	
a (Intervention → HOME)	4·183‡	0·465	
b (HOME → cognitive)	0·087†	0·032	
c'	0·411	0·294	
a×b	0·363	..	
Model 1b: Mediating effects of HOME on receptive language development			0·053–0·550
c (Intervention → receptive)	0·549*	0·242	
a (Intervention → HOME)	4·134‡	0·465	
b (HOME → receptive)	0·063*	0·030	
c'	0·315	0·271	
a×b	0·260	..	
Model 2a: Mediating effects of HOME on maternal depressive symptoms			0·150–0·633
c (Intervention → CES-D)	–3·979†	0·264	
a (Intervention→ HOME)	4·239‡	0·469	
b (HOME → CES-D)	–0·595†	0·161	
c'	–1·460	1·492	
a×b	–2·522	..	
Model 2b: Mediating effects of perceived positive support on maternal depressive symptoms			–2·774 to –0·177
c (Intervention → CES-D)	–3·979†	0·264	
a (Intervention → Positive Support)	0·804*	0·320	
b (Positive Support → CES-D)	–1·761‡	0·252	
c'	–1·460	1·330	
a×b	–1·415	..	
Model 2c: Mediating effects of active ways of coping on maternal depression			0·318–2·739
c (Intervention → CES-D)	–3·979†	0·264	
a (Intervention → Active Coping)	0·949‡	0·259	
b (Active Coping → CES-D)	1·190†	0·374	
c'	–1·617	1·555	
a×b	1·129	..	

Estimates are standardised. Cognitive=standardised cognitive scores. Receptive=standardised receptive scores. CES-D=Center for Epidemiologic Studies Depression Scale. HOME=Home Observation for Measurement of the Environment inventory. Positive Support=perceived positive spousal support. Active Coping=active ways of coping.
* p<0·05. † p<0·01. ‡ p<0·001.

Table 4: **Regression and bootstrap mediation results**

Results

Between December, 2012, and January, 2013, we randomly assigned 12 parishes to either the parenting programme (n=6) or waitlist control (n=6). Within the parishes assigned to receive intervention, we identified 13 communities, and within the parishes assigned to control, we identified 12 control communities (figure). We screened 348 mother–child dyads for eligibility, and319 (92%) were enrolled and interviewed at baseline. 14 dyads (eight in the intervention group and six in the control group) were excluded because the children did not meet inclusion criteria for age, and one village (15 participants) was removed from the intervention group because the community volunteer only implemented three sessions before leaving his community. Between baseline and endpoint, 28 dyads were lost to follow-up because they were visiting their families (ten from the intervention group and eight from the control group), separated from husband (two in the control group), moved to the city (one from the intervention group, six from the control group), or died (one in the control group). Three children (one in the intervention group and two in the control group) did not complete the Bayley assessment although their mothers were interviewed. Additionally, 27 mothers (nine in the intervention group, 18 in the control) were unable to respond to several mother-care variables (ie, ways of coping, perceived positive and negative support) because they reported no interpersonal conflict or were either separated or divorced from their husbands; however, their children completed the Bayley assessment and therefore remained in the sample. At endline, our final sample included 291 (84%) mother–child dyads (160 [55%] in the intervention group and 131 [45%] in the control group). An attrition analysis showed that, among all baseline variables, mothers who remained in the trial were older (27·6 *vs* 24·9 years, p<0·05) and their children were born later than participants lost to follow-up (3·69 *vs* 2·69 years; n=28). Thus, there were few differences between those retained and those lost to follow-up.

On average, intervention mothers attended 9·65 (SD 2·52) group sessions, with 75% of mothers attending eight sessions or more. Each group session hosted an average of 28·6 mothers and fathers (SD 6·54; range 21–37), with more mothers (18·1 [SD 4·74]) than fathers (10·5 [1·80]). These data, however, were not consistently collected across intervention communities. Numbers of attending children corresponded to the number of mothers. Fathers were more likely to attend parent-only sessions than were mothers, with attendance of 18–26 fathers per session.

At baseline, child age, family assets, and child outcomes such as child's height-for-age and developmental scores did not differ between groups (table 1). However, we noted that the average age of mothers and fathers, household size, and children's birth order were higher in the intervention group than in the control group. Reported maternal depressive symptoms, daily stressors, and perceived negative support from spouses was also higher in the intervention group (table 1). Because the age of mothers and fathers correlated, only age of mothers was entered as a covariate in all analyses; similarly, birth order and household size were correlated, so birth order was used as a covariate.

Additionally, Bayley cognitive and receptive language development showed good concurrent validity with the psychosocial stimulation in the home environment (r=0·238 *vs* r=0·201, p<0·0001). Our primary outcome

analysis showed that 3 months after completion of the programme, children in the intervention group had significantly higher cognitive and receptive language scores at endline than children in the control group (table 2).

Mothers in the intervention group reported lower maternal depressive symptoms than did mothers in the control group (table 3). No differences were found on outcomes of height-for-age and reported sickness in the 2 weeks preceding the assessment between groups. Overall, children's mean height-for-age *Z* score was –1·67, and 47% of children were moderately to severely stunted (table 2).

Additionally, scores for parenting practices related to preventive health, dietary diversity, psychosocial stimulation, as measured by the HOME inventory, a mother's knowledge of milestones, and perceived positive support were significantly higher among mothers in the intervention group than in the control group (table 3). A post hoc correlation between specific preventive health practices and sickness showed that only latrine, which remained unchanged within and between both groups (χ^2=0·610, p=0·435), was significantly related to less illness (r=–0·148, p=0·012).

We found no differences in mothers' reported daily stressors or perceived negative support; however, mothers in the intervention group were more likely to use active means of coping (table 3). As expected, mothers who had received intervention had significantly higher message recall (table 3).

We tested the mediating role of specific, theoretically relevant practices that correlated with the intervention and with outcomes (table 4). Results of multiple regressions and bootstrapping analyses showed that HOME scores partly mediated the effect of the intervention on cognitive development, receptive language development, and maternal depressive symptoms. Furthermore, the effect of the intervention on maternal depressive symptoms was partly mediated by mothers' perceived positive support and active ways of coping. Tests of heterogeneity found no differences in child growth or development outcomes between subgroups of sex, maternal education or age, family assets, or maternal depression levels on.

Discussion

Our study examined the effects of a manualised parenting intervention on the mental development of children younger than 3 years in rural community settings in northern Uganda. Children in the intervention group attained higher cognitive and language development than children in the control group, and, in prespecified exploratory analyses, their mothers reported fewer depressive symptoms than mothers in the control group. The intervention effectively improved all five parenting practices addressed by the programme, including home stimulation, which partly mediated benefits to child development, and raised perceived positive support, which partly mediated maternal depressive symptoms.

The most novel contribution of our study is the effects of parenting intervention on maternal depressive symptoms, active ways of coping, and perceived positive support from spouses by explicitly addressing maternal psychological wellbeing and child development. This is important because of the high prevalence of maternal depression in low-income and middle-income countries and the potential effect of maternal wellbeing on child health and development. Our effect size was comparable to assessments of programmes that focus solely on maternal depression.[46] Significant differences in maternal depressive symptoms at endline show that our intervention only prevented the worsening of symptoms in intervention mothers. This is important because other studies have shown that mothers report increasing levels of symptoms as their child grows.[20]

Our effect size was greater than psychosocial stimulation interventions that target child development and measure depression as a side-effect.[9–11,23,27] Similar to some, we found that maternal depressive symptoms were related to reported child morbidity[18] but not linear growth or development.[12–14] The evidence for these links between maternal depression and child outcomes is mixed. For example, a significant association between maternal depression and child development was found in primary care settings[15,16] but not community studies,[16,17] except when children were perceived by their mother as irritable.[12] Maternal depression is therefore likely to affect children's mental development only if it reduces mother–child responsive stimulation. However, in many settings, responsive parenting is low for other reasons, such as absence of awareness, and so is found with non-depressed mothers.

Perceived positive support and active ways of coping partly mediated the effects of the intervention on maternal psychological wellbeing. Mothers with more positive support from spouses reported fewer depressive symptoms.[47] Although the intervention increased active coping and prevented an increase in depressive symptoms, these two variables were positively correlated both before and after the intervention. One interpretation is that both variables might be positively related by way of a third variable, such that positive spousal support prevents depressive symptoms and the need for active coping. This interpretation is speculative and awaits further replication. Additionally, the evidence that HOME stimulation and perceived positive support partly mediated depressive symptoms suggests that rewarding experiences with child and husband are associated with maternal mental health. In sum, the inclusion of six mother and father sessions in an integrated programme showed the value of a parenting intervention that explicitly addresses maternal psychological wellbeing.

Effect sizes for cognitive and language development were similar to studies assessing group sessions and home visits to promote stimulation.[6] The advantage of the current intervention was that it included 12 group sessions

Panel: **Research in context**

Systematic review

We reviewed three recently published systematic reviews on psychosocial stimulation, nutrition, or both, to improve child development in developing countries.[5-7] None specifically targeted maternal mental health along with stimulation and nutrition. The psychosocial stimulation interventions, using mainly home visits, groups sessions, or both, to enhance learning through play and mother–child verbal interactions, improved child development with an overall moderate effect size. Nutrition by itself or integrated with stimulation typically included supplementation, and nutrition did not have additive effects on development or nutritional indicators such as stunting. One stimulation intervention had effects on maternal depression at 6 months, which were not sustained at 12 months;[14] another required a minimum of 25 group sessions;[9] and a third found effects only on mood but no other depression symptoms.[11]

Additionally, we examined two recent systematic reviews of maternal mental health.[46,49] Because these reviews focused on perinatal depression, we searched GlobalHealth and PubMed databases using search terms "interventions" or "evaluation", and "women" or "mothers", and "depression", or "postpartum depression", or "perinatal depression", or "maternal mental health". Our inclusion criteria were interventions that were done in low-income and middle-income countries, targeting maternal depression or depressive symptoms, and using reliable and validated measures. We examined studies between 2002 and 2014 and found four additional depression interventions that effectively reduced depressive symptoms using group interpersonal psychotherapy in Uganda[27] or cognitive-behavioural techniques in Pakistan[50] and China,[51] and among mothers living with HIV in South Africa.[52] These studies were included because they involved community samples, with similarly aged women (average age across studies was 27·6 years) who experienced relevant interpersonal issues related to spouses and young children. Effective maternal wellbeing interventions included cognitive, behavioural, and interpersonal techniques to improve a young mother's relations with her spouse, community, or child as well as change her thoughts and means of coping and with an overall moderate effect size. No maternal mental health interventions measured or targeted child development outcomes.

Both stimulation and maternal mental health interventions were effectively implemented by community volunteers or lay health workers despite no formal training on aspects of child development and maternal mental health. In sum, past research shows that mother or child interventions by themselves do not appear to have sufficient effect on both mother and child.

Interpretation

Our findings add to this evidence base by showing that an integrated intervention can simultaneously enhance both child development and maternal mental health. It therefore has potential to be cost effective and synergistic. As in previous research, the addition of a nutrition-education component did not improve linear growth although it did improve dietary diversity. We also found marked differences between groups in parenting practices that mediated primary and secondary outcomes. Our results have implications for the delivery of mother–child programmes in low-resource settings using group sessions with few home visits and trained local men and women. In sum, integration of maternal and child care programmes benefits both children and mothers.

along with one of two home visits within a 10 month period, and is thus appropriate for low-resource, community-based settings that are similar to rural Uganda. Programmes that target malnourished or high-risk children might find a large number of home visits more beneficial.[48] The effects of the intervention on child development (cognitive and language) were in part mediated by home stimulation. The mediating role of the home is consistent with the view that interventions will enhance development if they improve home stimulation, although only a few intervention studies have actually tested mediation.[28] Mediation results should be interpreted with caution because they are correlational in nature.

Child outcomes of sickness and height-for-age at endline were not affected by the intervention, despite significant differences in preventive health practices and dietary diversity. One interpretation is that preventive health practices were insufficient to reduce reported child illness; however, the post hoc correlation between specific preventive health practices and sickness showed that only latrine use, which remained unchanged in both groups, was significantly related to less illness. In relation to dietary diversity, either the quantities or frequencies were too small to spur linear growth. Furthermore, the overall effect size of nutrition education on linear growth is modest and known to be less in food-insecure sites (panel).[53]

Generalisability of the current intervention to other locations requires consideration of several variables. One is the high prevalence of depressive symptoms among mothers and developmental delays among their children. At baseline, almost half of the mothers in the intervention group met cutoff scores for depression (CES-D≥16), and most children did not have stimulating talk and toys; thus, this universal programme might be most generalisable to communities where many mothers and children are at risk. Another variable to consider is the availability of delivery agents who are closely tied to their communities and have an aptitude to learn from training and supervision.

Our intervention has several strengths. First, we effectively integrated child development and maternal

psychological wellbeing in a parenting intervention. The programme was largely managed and implemented by a local organisation, using local community members and minimal resources. Thus it has the potential to be replicated and scaled up in other low-resource, village-based settings. Finally, we engaged fathers by providing some father-only and couple sessions dealing with relationships between husbands, wives, and children.

Despite the many strengths of the study, there are clear limitations in design and measurement. We used one intervention group that combined child and maternal issues rather than a factorial design where the combination could be directly compared with a child programme and a mother programme. Such a design would answer the question of whether the combination provided better synergies than either by itself. However, in view of the mixed but restricted effects of child-stimulation interventions on maternal depression,[9–11] we found little justification for including such a cell. Second, more objective measures of maternal wellbeing and parenting practices would strengthen the findings. Although the HOME inventory and preventive health items entailed considerable observation, we relied on mother reports for other variables, which are subject to the usual biases. Third, although fathers attended sessions, we did not directly assess their practices. Fourth, while recumbent scores are typically used for children younger than 18 months, we used WHO so-called standing scores to calculate height-for-age in all children because length scales were not available. Finally, although we addressed child discipline in the intervention, we did not directly assess whether mothers modified harsh disciplinary practices.

Our findings show that an integrated child development and maternal psychological wellbeing programme can have significant benefits for the child and perhaps also the mother. Our results support a promising direction to address both mothers and children in one intervention in low-resource, community-based settings.

Contributors

Plan Uganda played a part in the training and supervision of the community volunteers who implemented the programme. DRS and FEA did the literature search, developed the programme, designed the full study, and conducted statistical analyses. DRS and EK were responsible for conduct of the research study and data management. All authors contributed to the trial design, conduct, and analysis and were involved in preparing the report.

Declaration of interests

We declare no competing interests.

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References

1 Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. Developmental potential in the first 5 years for children in developing countries. *Lancet* 2007; **369:** 60–70.

2 Walker SP, Wachs TD, Meeks Gardner J, et al. Child development: risk factors for adverse outcomes in developing countries. *Lancet* 2007; **369:** 145–57.

3 Rahman A, Surkan PJ, Cayetano CE, Rwagatare P, Dickson KE. Grand challenges: integrating maternal mental health into maternal and child health programmes. *PLoS Med* 2013; **10:** e1001442.

4 Walker SP, Wachs TD, Grantham-McGregor S, et al. Inequality in early childhood: risk and protective factors for early child development. *Lancet* 2011; **378:** 1325–38.

5 Grantham-McGregor SM, Fernald LC, Kagawa RM, Walker S. Effects of integrated child development and nutrition interventions on child development and nutritional status. *Ann N Y Acad Sci* 2014; **1308:** 11–32.

6 Aboud FE, Yousafzai AK. Global health and development in early childhood. *Annu Rev Psychol* 2015; **66:** 433–57.

7 Yousafzai A, Aboud F. Review of implementation processes for integrated nutrition and psychosocial stimulation interventions. *Ann N Y Acad Sci* 2014; **1308:** 33–45.

8 Black MM, Aboud FE. Responsive feeding is embedded in a theoretical framework of responsive parenting. *J Nutr* 2011; **141:** 490–94.

9 Baker-Henningham H, Powell C, Walker S, Grantham-McGregor S. The effect of early stimulation on maternal depression: a cluster randomised controlled trial. *Arch Dis Child* 2005; **90:** 1230–34.

10 Aboud FE, Singla DR, Nahil MI, Borisova I. Effectiveness of a parenting program in Bangladesh to address early childhood health, growth and development. *Soc Sci Med* 2013; **97:** 250–58.

11 Cooper PJ, Tomlinson M, Swartz L, et al. Improving quality of mother-infant relationship and infant attachment in socioeconomically deprived community in South Africa: randomised controlled trial. *BMJ* 2009; **338:** b974.

12 Black MM, Baqui AH, Zaman K, et al. Depressive symptoms among rural Bangladeshi mothers: implications for infant development. *J Child Psychol Psychiatry* 2007; **48:** 764–72.

13 Servili C, Medhin G, Hanlon C, et al. Maternal common mental disorders and infant development in Ethiopia: the P-MaMiE Birth Cohort. *BMC Public Health* 2010; **10:** 693.

14 Harpham T, Huttly S, De Silva MJ, Abramsky T. Maternal mental health and child nutritional status in four developing countries. *J Epidemiol Community Health* 2005; **59:** 1060–04.

15 Quevedo LA, Silva RA, Godoy R, et al. The impact of maternal post-partum depression on the language development of children at 12 months. *Child Care Health Dev* 2012; **38:** 420–24.

16 Patel V, DeSouza N, Rodrigues M. Postnatal depression and infant growth and development in low income countries: a cohort study from Goa, India. *Arch Dis Child* 2003; **88:** 34–37.

17 Surkan PJ, Kennedy CE, Hurley KM, Black MM. Maternal depression and early childhood growth in developing countries: systematic review and meta-analysis. *Bull World Health Organ* 2011; **89:** 608–15.

18 Nguyen PH, Saha KK, Ali D, et al. Maternal mental health is associated with child undernutrition and illness in Bangladesh, Vietnam and Ethiopia. *Public Health Nutr* 2014; **17:** 1318–27.

19 Fisher J, Cabral de Mello M, Patel V, et al. Prevalence and determinants of common perinatal mental disorders in women in low- and lower-middle-income countries: a systematic review. *Bull World Health Organ* 2012; **90:** 139G–49G.

20 Evans J, Melotti R, Heron J, et al. The timing of maternal depressive symptoms and child cognitive development: a longitudinal study. *J Child Psychol Psychiatry* 2012; **53:** 632–40.

21 Rahman A, Malik A, Sikander S, Roberts C, Creed F. Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: a cluster-randomised controlled trial. *Lancet* 2008; **372:** 902–09.

22 Bolton P, Bass J, Neugebauer R, et al. Group interpersonal psychotherapy for depression in rural Uganda: a randomized controlled trial. *JAMA* 2003; **289:** 3117–24.

23 Morris J, Jones L, Berrino A, Jordans MJ, Okema L, Crow C. Does combining infant stimulation with emergency feeding improve psychosocial outcomes for displaced mothers and babies? A controlled evaluation from northern Uganda. *Am J Orthopsychiatry* 2012; **82:** 349–57.

24 Britto PR, Engle PL, Alderman H. Early Intervention and caregiving: evidence from the Uganda Nutrition and Early Child Development Program. *Child Health Educ* 2013; **1:** 112–33.

25 UNICEF. The state of the world's children. New York: Oxford University Press for UNICEF, 2013.

26 Boivin MJ, Bangirana P, Nakasujja N, et al. A year-long caregiver training program improves cognition in preschool Ugandan children with human immunodeficiency virus. *J Pediatr* 2013; **163:** 1409–16.

27 Ovuga E, Boardman J, Wasserman D. The prevalence of depression in two districts of Uganda. *Soc Psychiatry Psychiatr Epidemiol* 2005; **40:** 439–45.

28 Walker SP, Chang SM, Powell CA, Grantham-McGregor SM. Psychosocial intervention improves the development of term low-birth-weight infants. *J Nutr* 2004; **134:** 1417–23.

29 Uganda Bureau of Statistics. Uganda National Household Survey Findings 2009/2010 2010. http://www.ubos.org (accessed Oct 1, 2013).

30 Bandura A. Social foundations of thought and action: a social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall, 1986.

31 Gao LL, Chan SW, Li X, Chen S, Hao Y. Evaluation of an interpersonal-psychotherapy-oriented childbirth education programme for Chinese first-time childbearing women: a randomised controlled trial. *Int J Nurs Stud* 2010; **47:** 1208–16.

32 Rollnick S, Miller WR. What is motivational interviewing? *Behav Cogn Psychother* 1995; **23:** 325–34.

33 Bayley N. Bayley scales of infant and toddler development, 3rd edn. San Antonio, TX: Psychological Corporation, 2006.

34 Yousafzai A, Rasheed M, Rizvi A, Armstrong R, Bhutta Z. Effect of integrated responsive stimulation and nutrition interventions in the Lady Health Worker programme in Pakistan on child development, growth, and health outcomes: a cluster-randomised factorial effectiveness trial. *Lancet* 2014; **384:** 1282–93.

35 Radloff LS. The CES-D scale a self-report depression scale for research in the general population. *Appl Psychol Meas* 1977; **1:** 385–401.

36 Nakasujja N, Skolasky RL, Musisi S, et al. Depression symptoms and cognitive function among individuals with advanced HIV infection initiating HAART in Uganda. *BMC Psychiatry* 2010; **10:** 44.

37 Kim J, Lee J. Prospective study on the reciprocal relationship between intimate partner violence and depression among women in Korea. *Soc Sci Med* 2013; **99:** 42–48.

38 WHO. WHO child growth standards. Geneva: World Health Organization, 2006.

39 Uganda Demographic and Health Surveys 2011. Uganda Bureau of Statistics, Kampala Uganda. Calverton, MA: ICF International, 2012.

40 Daelmans B, Dewey K, Arimond M. New and updated indicators for assessing infant and young child feeding. *Food Nutr Bull* 2009; **30** (Suppl 2)**:** S256–62.

41 Bradley RH, Caldwell BM. The HOME Inventory and family demographics. *Dev Psychol* 1984; **20:** 315.

42 Bolger N, DeLongis A, Kessler RC, Schilling EA. Effects of daily stress on negative mood. *J Pers Soc Psychol* 1989; **57:** 808–18.

43 Folkman S, Lazarus RS, Dunkel-Schetter C, DeLongis A, Gruen RJ. Dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes. *J Pers Soc Psychol* 1986; **50:** 992.

44 Newsom JT, Mahan TL, Rook KS, Krause N. Stable negative social exchanges and health. *Health Psychol* 2008; **27:** 78–86.

45 Baron RM, Kenny DA. The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* 1986; **51:** 1173.

46 Rahman A, Fisher J, Bower P, et al. Interventions for common perinatal mental disorders in women in low- and middle-income countries: a systematic review and meta-analysis. *Bull World Health Organ* 2013; **91:** 593–601I.

47 Qadir F, Khalid A, Haqqani S, Zill-e-Huma, Medhin G. The association of marital relationship and perceived social support with mental health of women in Pakistan. *BMC Public Health* 2013; **13:** 1150.

48 Gardner JM, Walker SP, Powell CA, Grantham-McGregor S. A randomized controlled trial of a home-visiting intervention on cognition and behavior in term low birth weight infants. *J Pediatr* 2003; **143:** 634–39.

49 Clarke K, King M, Prost A. Psychosocial interventions for perinatal common mental disorders delivered by providers who are not mental health specialists in low- and middle-income countries: a systematic review and meta-analysis. *PLoS Med* 2013; **10:** e1001541.

50 Ali BS, Rahbar MH, Naeem S, Gul A, Mubeen S, Iqbal A. The effectiveness of counseling on anxiety and depression by minimally trained counselors: a randomized controlled trial. *Am J Psychother* 2003; **57:** 324–36.

51 Jiang L, Wang ZZ, Qiu LR, Wan GB, Lin Y, Wei Z. Psychological intervention for postpartum depression. *J Huazhog Univ Sci Techolog Med Sci* 2014; **34:** 437–42.

52 Rotheram-Borus MJ, Tomlinson M, le Roux IM, et al. A cluster randomised controlled effectiveness trial evaluating perinatal home visiting among South African mothers/infants. *PLoS One* 2014; **9:** e105934.

53 Dewey KG, Adu-Afarwuah S. Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries. *Matern Child Nutr* 2008; **4** (suppl 1)**:** 24–85.