Integrating a Group-Based, Early Childhood Parenting Intervention into Primary Health Care Services in Rural Bangladesh: A Cluster-Randomised Controlled Trial

Mehrin, Syeda Fardina; Hasan, Mohammed Imrul; Tofail, Fahmida; Shiraji, Shamima; Ridout, Deborah; Grantham-McGregor, Sally; Hamadani, Jena Derakshani; Baker-Henningham, Helen

Frontiers in Pediatrics

DOI: https://doi.org/10.3389/fped.2022.886542

Published: 10/06/2022

Publisher's PDF, also known as Version of record

Cyswllt i’r cyhoeddiad / Link to publication

Dyfnyiad o’r fersiwn a gyhoeddwyd / Citation for published version (APA):
Mehrin, S. F., Hasan, M. I., Tofail, F., Shiraji, S., Ridout, D., Grantham-McGregor, S., Hamadani, J. D., & Baker-Henningham, H. (2022). Integrating a Group-Based, Early Childhood Parenting Intervention into Primary Health Care Services in Rural Bangladesh: A Cluster-Randomised Controlled Trial. Frontiers in Pediatrics, 10, [886542]. https://doi.org/10.3389/fped.2022.886542

Hawliau Cyffredinol / General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal ?

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Integrating a Group-Based, Early Childhood Parenting Intervention Into Primary Health Care Services in Rural Bangladesh: A Cluster-Randomized Controlled Trial

Syeda Fardina Mehrin¹, Mohammed Imrul Hasan¹, Fahmida Tofail², Shamima Shiraji¹, Deborah Ridout², Sally Grantham-McGregor²†, Jena D. Hamadani¹† and Helen Baker-Henningham³*†

¹ International Centre for Diarrhoeal Disease Research, Bangladesh, Dhaka, Bangladesh, ² UCL Great Ormond Street Institute of Child Health, London, United Kingdom, ³ School of Human and Behavioural Sciences, Bangor University, Bangor, United Kingdom

Background: Over 250 million children globally do not reach their developmental potential. We tested whether integrating a group-based, early childhood parenting program into government healthcare clinics improved children's development, growth, and behavior.

Methods: We conducted a cluster-randomized controlled trial in 40 community clinics in the Kishorganj district of Bangladesh. We randomly assigned clinics (1:1) to deliver a group-based parenting interventions or to a comparison group that received no intervention. Participants were children aged 5–24 months, with weight-for-age z-score of ≤ −1.5 SDs of the WHO standards, living within a thirty-minute walking distance from the clinic (n = 419 intervention, 366 control). Government health staff facilitated parenting sessions in the clinic with groups of four mother/child dyads fortnightly for one year as part of their routine duties. Primary outcomes measured at baseline and endline were child development assessed using the Bayley scales, child behaviors during the test by tester ratings, and child growth. The trial is registered at ClinicalTrials.gov, NCT02208531.

Findings: 91% of children were tested at endline (396 intervention, 319 control). Multilevel analyses showed significant benefits of intervention to child cognition (effect size 0.85 SDs, 95% CI: 0.59, 1.11), language (0.69 SDs, 0.43, 0.94), and motor development (0.52 SDs, 0.31, 0.73), and to child behaviors during the test (ranging from 0.36 SDs, 0.14, 0.58, to 0.53 SDs, 0.35, 0.71). There were no significant effects on growth.

Conclusion: A scalable parenting intervention, integrated into existing government health services and implemented by government health staff, led to significant benefits to child development and behavior.

Keywords: parenting, child development, malnutrition, integrating into government services, primary health care, low- and middle-income countries
INTRODUCTION

Poor development in disadvantaged children under 5 years of age is a major problem in low- and middle-income countries (LMIC), leading to lifelong functional and economic consequences (1). There is strong evidence that early childhood development (ECD) parenting interventions, focusing on psychosocial stimulation, benefit these children’s development (2). To extend the reach of ECD parenting interventions, we need information on the best methods of implementing ECD programmes at scale. Many experts recommend integrating into the health services (3). The goal is for health staff to run ECD interventions as well as their routine tasks, which is potentially cost-effective, but there are few evaluations of this approach (4, 5). Moreover, researchers have often funded the health workers (6, 7).

In Bangladesh, children living in poverty show a rapid decline in cognitive and language development from 7-months through to 5-years of age (8). We have previously evaluated an ECD home-visiting, parenting program in Bangladesh (adapted from the Jamaican home-visiting program, now called Reach-Up) and conducted four randomized controlled trials in which locally-hired women conducted weekly parenting sessions with mother/child dyads at home or in a clinic setting (9–12). The benefits to child development from this approach were small-to-moderate (ES = 0.21–0.38 SD). However, individual sessions are costly and it is difficult to reach large numbers of disadvantaged children.

We developed an ECD parenting intervention that could be integrated into the primary health care clinics and thus facilitate scaling-up ECD interventions for at-risk children and we conducted a trial using the health care workers (HCW) to deliver the parenting sessions as part of their usual tasks. In addition, instead of mother/child dyads attending individual sessions every week, they attended in pairs every 2 weeks. Surprisingly, the children showed much larger benefits to cognition and language development (1.1–1.3 SD) than previously found in Bangladesh (13). Given the exceptionally large benefits to child outcomes compared with individual home-visiting interventions, or most other parenting interventions elsewhere (2), it was important to investigate the robustness of the findings (14, 15). We decided to replicate the intervention in another trial, but with several modifications to make it more suitable for wide scale dissemination. Firstly, groups of four mothers and children attended the session, potentially doubling the coverage per HCW. Groups of four were the largest number that could be accommodated inside the clinics due to space constraints. Secondly, we adapted the Reach-Up intervention to make it suitable for use with a wider age-range of children at each session by presenting play activities in six- or twelve-month age bands rather than into monthly age bands used in the pair curriculum. Thirdly, we reduced the variety of play materials used in the intervention by half, with children participating in one toy activity per session rather than two. Full details of the process of adaptation have been published previously (16).

In this study, we evaluated the effects of the ECD group-based parenting program on child cognition, language and motor development, behavior, and nutritional status.

METHODS

Study Design and Participants

In Bangladesh, there are more than 13,000 community clinics that deliver primary health care across the country. We conducted a two-arm, single-blind, cluster randomized trial with parallel assignment in forty clinics in the rural Kishorganj district of Bangladesh, located approximately 100 km from Dhaka city. Clinic was the unit of randomization to reduce contamination between the groups as the intervention was integrated into clinic services and was implemented by existing clinic staff. We selected two rural subdistricts in Kishorganj with a total of seventy-four community clinics. An independent statistician randomly selected twenty clinics from each subdistrict (n = 40 clinics) to participate in this study. No clinics refused to participate.

Inclusion criteria for children were: weight for age (WAZ) ≤ −1.5 SD, singleton birth, no obvious disability, no known chronic disease (e.g., epilepsy), not hospitalized or requiring ongoing monitoring for acute malnutrition and parental consent. We conducted a house-to-house survey around each clinic and all children aged 5–23 months, living within a thirty-minute walking distance from the clinic, were screened for inclusion. We limited the sample to mothers and children living within a 30-min walk from the clinic based on prior piloting that demonstrated poor attendance among mothers living farther away (16). Children were weighed using standard methods and those with weights for age ≤ −1.5 SD of WHO standards (17) and meeting all other inclusion criteria were invited to participate in the study. We initially aimed to recruit children with a WAZ < −2.0 SD but fewer children met the criteria than anticipated. We recruited up to twenty-four children in each clinic. In clinics with more than twenty-four eligible children, a simple random sample of twenty-four children was selected. Written informed consent of mothers was collected at enrollment. Ethical approval was given by the institutional review board of the International Centre for Diarrhoeal Diseases Research, Bangladesh (icddr,b).

Randomization

The forty clinics were stratified by subdistrict and then randomly assigned 1:1 to intervention or control by an independent statistician, using a computer-generated randomization sequence. All clinics and mother/child dyads were recruited prior to randomization. Baseline measurements were conducted after randomization. Data collectors were masked to group allocation at baseline and endline.

Intervention

Mothers and children attending clinics allocated to the intervention group were invited to fortnightly parenting sessions for one year, held inside the clinic. The parenting sessions were facilitated by the clinic health workers. Each community clinic has three health staff: a Community Health Care Provider (CHCP) who works full time in the clinic and a Health Assistant (HA) and a Family Welfare Assistant (FWA) who work half-time
in the clinic and half-time in the community. CH and HAs have
masters’ degrees and most FWAs have completed high school.
To promote co-ordination and cooperation, all three cadres
of health staff conducted parenting sessions: CHCPs conducted 1–2
sessions per week, while HAs and FWAs who spend fewer days in
the clinic conducted one session per week. Where necessary the
CHCPs gave support to the FWAs. There was an average of four
mother/child dyads in each group, with group size constrained
by the available space within the clinic. The Group Reach-Up
and Learn curriculum was used in the parenting sessions. This
curriculum was adapted from the Jamaican Reach-Up home
visiting program (16). The health workers were trained and
supervised by the research team. See Box 1 for further details of
the intervention. Mothers and children in control clinics were not
invited to parenting sessions, but they used the clinic as usual for
health care. We recorded attendance at parenting sessions.

Quality Control of Measurements
Before the study assessments began, interobserver reliabilities
were measured between each tester and the trainer on 8–16
tests per tester. Inter-observer reliabilities were acceptable for
all measures: intraclass correlation coefficients (ICC) > 0.98
on Bayley composite scores, range of ICC = 0.62–1.00 on
behavior ratings, and ICC > 0.95 on anthropometric measures.
Interobserver reliabilities were conducted on approximately
10% of all Bayley tests during the study and reliabilities were
ICC > 0.95 for all Bayley composite scores and ICC = 0.67–0.99
for behavior ratings.

All maternal questionnaires had good internal consistency at
baseline (Cronbach’s α mean 0.82, range: 0.68–0.89) and endline
(Cronbach’s α mean 0.84, range: 0.79–0.88; webtable 1). The
Bayley Scales scores at baseline and endline were significantly
correlated with height-for-age (r = 0.18–0.30), weight-for-age
(r = 0.21–0.28) and with maternal education (r = 0.10–0.19) and
paternal education (r = 0.12–0.24), indicating good discriminant
validity (webtable 2).

Statistical Analysis
The primary outcomes of the study were child development
(3 scores: cognitive, language and motor development), child
behavior (4 scores: approach, emotional tone, cooperativeness,
vocalizations) and child nutritional status (3 scores: weight-for-
age, weight-for-height, height-for-age). To calculate the sample
size, we used a significance level of 0.005 (instead of 0.05)
to account for 10 primary outcomes and we assumed an
intracluster correlation coefficient of 0.05 (5). With an average
of 21 mother/child dyads per clinic (378 mother/child dyads),
and allowing for a loss of two clinics per group, (given 18 clinics in
each group), we had 80% power to detect an effect of 0.38 SD on
the primary outcomes.

All analyses were prespecified. For each outcome, we fitted a
multi-level random effects model that accounted for clustering at
the clinic level. We adjusted for child age and sex, the relevant
baseline score and tester/interviewer. Study group was entered as
a binary variable. For child development and behavior outcomes,
as children were tested either in the community clinic or in
an alternative location in the community, we also entered place
of test and an interaction term of place x group as

Measurements
Outcome measurements included child development, behavior,
and nutritional status and mothers’ parenting knowledge and
depressive symptoms, and stimulation in the home. All outcomes
were measured at baseline (from September to December 2015)
and after one year of intervention (from October to December
2016) and have been used previously in Bangladesh (9, 11, 18,
19). Children were tested in the presence of the mother either in
a private room at the community clinic or an alternative location
in the community.

Primary Outcomes
The primary outcomes were child development, behavior, and
nutritional status. Children’s development was measured using
the Bayley Scales of Infant and Toddler Development (20).
We used three composite scores: (1) cognition, (2) language
(combined score of the expressive and receptive language scales),
and (3) motor (combined score of the fine and gross motor
scales). Child behavior was rated during the test using four
Wolke’s behavior rating scales: approach to examiner, emotional
tone, cooperativeness, and vocalizations (21). Approach was
rated during the first 10 min of the test; the remaining
tests were based on the child’s behavior throughout
the test. Behaviors were rated on an 8-point scale with
higher scores representing more of the characteristic. Child
weight and length/height were measured by the testers after
the Bayley test using WHO standard methods (22). The z
scores of weight-for-age, weight-for-height, and height-for-age
were calculated using WHO anthroplus (17). Children were
tested at baseline and endline by one of eight testers. All
testers had a Masters’ degree in Psychology or a related field.
Testers received one month training and they were masked to
group allocation.

Secondary Outcomes
The secondary outcomes were mothers’ parenting knowledge,
stimulation provided in the home and mothers’ depressive
symptoms. Parenting knowledge was measured using a specially
designed instrument consisting of 20 questions. Stimulation
in the home was measured using an extended version of the

Family Care Indicators (FCI) (23). The FCI consisted of 24
questions including questions on the availability of play materials
and the extent to which the mother and other adults in the
home engaged the child in play activities. The FCI has been
previously validated in Bangladesh and the items used in this
study (variety of play materials and play activities) were shown
to be highly correlated with the HOME (r = 0.72 and r = 0.73)
and correlated with children’s receptive and expressive language
(r = 0.37 to r = 0.48) and Bayley scores (r = 0.19 to r = 0.29)
(19). Maternal depressive symptoms were measured using six
questions that are included in the FCI, taken from the Center
for Epidemiological Studies Depression Scale (24). All interviews
with mothers were interviewer-administered and conducted after
card measurements were completed.

Web Table 1

| Measure                  | Baseline | Endline |
|--------------------------|----------|---------|
| Child Development        |          |         |
| Bayley Scales            |          |         |
| Cognitive                |          |         |
| Language                 |          |         |
| Motor                    |          |         |
| Behavior                 |          |         |
| Emotional Tone           |          |         |
| Cooperativeness          |          |         |
| Vocalizations            |          |         |
| Nutritional Status       |          |         |
| Weight-for-age           |          |         |
| Weight-for-height        |          |         |
| Height-for-age           |          |         |

Web Table 2

| Measure                  | Baseline | Endline |
|--------------------------|----------|---------|
| Child Development        |          |         |
| Bayley Scales            |          |         |
| Cognitive                |          |         |
| Language                 |          |         |
| Motor                    |          |         |
| Behavior                 |          |         |
| Emotional Tone           |          |         |
| Cooperativeness          |          |         |
| Vocalizations            |          |         |
| Nutritional Status       |          |         |
| Weight-for-age           |          |         |
| Weight-for-height        |          |         |
| Height-for-age           |          |         |
and we controlled for multiple primary outcomes using Holm separately. We used intention-to-treat analyses for all outcomes standardization of the whole sample at baseline and endline across outcomes, effect sizes were calculated by using an internal multi-level model with all the above factors, and estimates were combined using Rubin’s rules (25). To allow for comparability across outcomes, effect sizes were calculated by using an internal standardization of the whole sample at baseline and endline separately. We used intention-to-treat analyses for all outcomes and we controlled for multiple primary outcomes using Holm step-down procedure. All analyses were carried out using Stata version 15. In post hoc analyses, we examined whether parenting outcomes (home stimulation, child-rearing knowledge, mothers' depressive symptoms) mediated the effect of the intervention on child development and behavior. Baseline and endline score for each parenting outcome were entered into the multilevel regressions on child outcomes and we used a Sobel test to assess the significance of the mediation effect. The trial registration number is NCT02208531.

RESULTS

We weighed 2,640 children aged 6–24 months living within a 30 min walking distance from forty community clinics. We identified 1,193 (45%) children with a weight-for-age $z$-score $\leq -1.5$ SD of the WHO standard (Figure 1). We
randomly selected up to 24 children from each clinic who met the inclusion criteria for the study to give a total of 846 children. Forty-six mothers (5.4%) refused to participate in the study and a further 15 children (1.8%) were more than 24-months-old by the time of randomization (due to a delay in official procedures), leaving a total of 785 children in forty clinics. Clinics were then randomly assigned to the intervention (20 clinics, 419 children) or control group (20 clinics, 366 children). All clinics were retained in the study. 70 children (8.9%) were lost at endline [23 (5.5%) intervention, 47 (12.8%) control]. Reasons for loss are shown in Figure 1. The only differences between children lost and those retained (webtable 3) were in nutritional status: children tested had lower height-for-age [Mean (SD): tested = −2.44 (1.12) vs lost = −2.03 (1.67), \( p = 0.004 \)] and higher weight-for-height [Mean (SD) tested = −1.34 (0.10) vs lost = −1.65 (0.99), \( p = 0.02 \)] than those lost. Groups were reasonably well-balanced at baseline with the only significant differences being higher scores for the control group on approach (\( p < 0.001 \)), emotional tone (\( p = 0.003 \)), and cooperation (\( p = 0.005 \); Table 1).

Mothers in intervention clinics attended a mean of 22.2 (SD = 5.9) parenting sessions. 215 mothers (51.3%) attended all twenty-five sessions; only 11 mothers (2.6%) attended zero sessions. Out of 56 health workers trained to conduct parenting sessions, 47 (84%) conducted all sessions. Two (3.5%) refused (both HAs) and their sessions were conducted by the CHCP at their respective CC. Seven health workers (12.5%) missed one or more sessions due to sickness, leave, or competing duties.

Primary Outcomes

We found significant benefits of intervention to children’s score on the Bayley Scales across all developmental domains: cognitive [effect size (ES) = 0.85, 95% confidence interval (CI): 0.59, 1.11], language (ES = 0.69 95% CI: 0.43, 0.94), and motor (ES = 0.52, 95% CI: 0.31, 0.73; Table 2). We also found significant benefits of intervention for child behavior during the test, including approach (ES = 0.53, 95% CI: 0.35, 0.71), positive emotional tone (ES = 0.36, 95% CI: 0.14, 0.58), cooperativeness (ES = 0.43, 95% CI: 0.20, 0.66), and vocalizations (ES = 0.40, 95% CI: 0.26, 0.55). Children’s anthropometric measurements were not different between the groups (Table 2).

Secondary Outcomes

Mothers in intervention clinics had significantly better parenting knowledge (ES = 1.27, 95% CI: 1.13, 1.41) and fewer depressive symptoms (ES = −0.18, 95% CI: −0.34, −0.03), than mothers in control clinics (Table 2). We also found significant benefits of intervention for home stimulation as measured by the FCI (ES = 0.77, 95% CI: 0.60, 0.94).

Post hoc Analyses

In mediation analyses, home stimulation and mothers’ child-rearing knowledge significantly mediated the effect of intervention on child development (Bayley Scales) and behavior (Wolke behavior ratings; webtables 4 and 5), whereas maternal depressive symptoms was not a significant mediator of child outcomes (webtable 6).

DISCUSSION

We integrated an ECD, group-based parenting program into government primary health care clinics in rural Bangladesh, with parenting sessions conducted by existing health workers as part of their usual duties. Many of the enrolled children were moderately malnourished and at high risk for poor development. We found significant benefits to child cognitive, language and motor development, and to child behavior with children in the intervention group rated as happier, more sociable, more cooperative and more vocal during the developmental test session. There were no benefits to children’s nutritional status. Mothers in the intervention clinics reported higher levels of stimulation in the home, better parenting knowledge and fewer depressive symptoms than mothers from control clinics.

The moderate to large benefits to child development and behavior found in this study are considerably larger than those found in Bangladeshi studies that used a similar curriculum, but delivered by local women, in individual home or clinic sessions (9–12). The benefits are also larger, (approximately double), than those reported in a recent meta-analysis of childhood parenting interventions that reported mean effect sizes and 95% CI of 0.41 (0.29, 0.53), 0.35 (0.21, 0.48), 0.26 (0.16, 0.36) for child cognitive, language and motor development, respectively, from studies in LMIC (2). The behavior ratings in the present study are not strictly comparable to the socio-emotional development measures but they also tended to have higher impacts.

In the previous Bangladeshi trial (pair study) using a similar delivery model but where pairs of mothers and children participated in the sessions, treatment effects were even larger on child development (ranging from 1.1 to 1.3 SD) and child behavior (ranging from 0.7 to 1.1 SD) (13). The moderate to large treatment effects found in the present trial partially replicates those findings but are somewhat smaller. The difference in treatment effects may reflect differences in delivery of the intervention. It is likely that groups of four are more challenging to handle than groups of two. Also in the pair study, play activities were more closely targeted to each individual child’s developmental level and staff used a more detailed curriculum. To make the program more feasible at scale, the groups of four used fewer play materials and play activities were adapted for use across a wider age range. Another possibility is that children in the pair study were slightly more disadvantaged with more children being moderately undernourished and the parents being less educated compared with the present study. There is some evidence that interventions benefit disadvantaged children more than less disadvantaged ones (26).

The larger benefits in both the present and the pair studies compared with individual intervention sessions may be due to several factors. The parenting sessions were delivered by government health workers who were better educated than paraprofessional facilitators and are well respected in the community, which may enhance credibility. Group sessions provide mothers with the opportunity to engage in peer learning and gain social support and may reduce feelings of isolation and promote group norms that support responsive and playful parenting (27–29). We also placed strong emphasis on making...
the sessions fun and interactive for mothers and children and group sessions may be more enjoyable than individual sessions in this context, thus leading to higher participant engagement and motivation (30–32). Group-based ECD parenting interventions have been shown to be effective in other contexts, including when integrated into existing services and delivered by existing staff (7, 33, 34), and when implemented by community volunteers trained specifically to deliver the program (35–37). In addition, there is some evidence that group-based parenting interventions are more cost-effective than individual home-visiting and mixed group and home-visiting delivery models, leading to increased scalability (38, 39). Benefits to child development and parenting
TABLE 1 | Child and family characteristics and child and maternal outcomes at baseline and endline by study group.

| Child and family characteristics | Baseline | Endline |
|----------------------------------|----------|---------|
| | Intervention n = 419 | Control n = 366 | Intervention n = 396 | Control n = 319 |
| Child sex: n (%) female | 206 (49.2) | 178 (48.6) | – | – |
| Child age (months) n (%) | 16.89 (4.82) | 17.16 (5.13) | – | – |
| Height-for-age < −2 z-scores n (%) | 264 (63.5%) | 229 (62.7%) | – | – |
| Weight-for-height < −2 z-scores n (%) | 95 (22.7%) | 80 (21.9%) | – | – |
| Weight-for-age < −2 z-scores | 244 (58.5%) | 214 (58.5%) | – | – |
| Maternal education: grade 5 n (%) | 272 (64.9%) | 227 (62.0%) | – | – |
| Mother’s BMI | 20.30 (3.07) | 20.21 (3.16) | – | – |
| Housing | 8.37 (1.78) | 8.21 (1.59) | – | – |
| Crowding index | 0.29 (0.16) | 0.29 (0.18) | – | – |
| Monthly income ≥ 6000 BDT n (%) | 258 (61.6%) | 198 (54.1%) | – | – |
| Cognitive composite score | 91.17 (11.18) | 91.75 (10.93) | 89.32 (6.63) | 83.32 (6.63) |
| Language composite score | 85.17 (10.39) | 86.20 (10.01) | 90.29 (8.55) | 85.48 (7.61) |
| Motor composite score | 90.67 (11.32) | 90.83 (10.58) | 93.29 (9.56) | 88.76 (8.31) |
| Approach | 5.66 (0.92) | 5.87 (0.84) | 5.58 (0.91) | 5.19 (0.87) |
| Positive emotional tone | 5.26 (0.79) | 5.43 (0.82) | 5.50 (0.80) | 5.28 (0.74) |
| Cooperativeness | 5.14 (0.89) | 5.32 (0.92) | 5.46 (0.84) | 5.18 (0.78) |
| Vocalization | 3.72 (1.64) | 3.88 (1.70) | 4.74 (1.35) | 4.34 (1.29) |
| Height for age z-score | −2.43 (1.15) | −2.38 (1.12) | −2.57 (0.94) | −2.45 (1.00) |
| Weight for age z-score | −2.24 (0.85) | −2.23 (0.81) | −2.21 (0.77) | −2.26 (0.81) |
| Weight for height z-score | −1.36 (1.02) | −1.37 (0.94) | −1.12 (0.90) | −1.29 (0.91) |
| Knowledge on child rearing practices | 22.55 (4.98) | 22.75 (5.55) | 31.22 (4.49) | 23.24 (5.06) |
| Home stimulation | 20.75 (8.12) | 21.26 (7.08) | 20.30 (6.36) | 14.88 (6.44) |
| Maternal depression | 8.23 (8.44) | 8.17 (7.91) | 6.95 (7.36) | 8.22 (7.63) |

Values are mean (SD) unless otherwise stated. Housing index is the sum of ratings the quality of wall, roof and floor condition, and the presence of electricity. Children’s cognitive, language and motor scores were measured using the Bayley Scales of Infant and Toddler Scale-version III. Response to examiner, emotional tone, cooperativeness, and vocalization were rated during the test using the Wolk’s behavior rating scales (8-point scale: 1 = low, 8 = high). Knowledge of child rearing practices was measured with a structured questionnaire used in previous studies (20 questions, potential range of scores: 0–60). Maternal depressive symptoms were measured using a shortened Center for Epidemiological Studies Depression Questionnaire (CES-D) scale (6 questions, potential range of scores: 0–42), home stimulation was assessed using Family Care Indicators (24 questions, potential range of scores: 0–24). For maternal outcomes at baseline: parenting knowledge and maternal depression: n = 417 intervention, n = 322 control. At endline: parenting knowledge: n = 396 intervention, n = 318 control; parenting practices: n = 393 intervention, n = 322 control; maternal depression: n = 391 intervention, n = 312 control.

There were no benefits from the parenting intervention on children’s nutritional status. The parenting sessions included a nutrition education component and mothers were provided with a recipe booklet with low-cost, nutritious recipes suitable for undernourished children. Over 62% of children were moderately stunted and 58% moderately underweight at baseline. For gains to children’s nutritional status, food supplementation is likely to be necessary and is more effective if begun in the first year before undernutrition develops (43, 44).

The study has several strengths including the use of a cluster-randomized study design leading to well-balanced groups, prespecified analyses, masked assessors, intention-to-treat analyses, adjustment for multiple outcomes, the use of direct assessments of child development and observational measures of child behavior. The outcome measures had good psychometric properties and although the Bayley scales are not standardized for Bangladesh, they have good concurrent and predictive validity and scores correlate with child nutritional status and maternal development and behavior during the test were mediated by increases in mothers’ parenting knowledge and stimulation in the home. This is expected as the intervention aims to promote child development by supporting mothers in responsive and playful parenting practices (41). Although we found significant reductions in maternal depressive symptoms, this reduction did not mediate the impact on child outcomes. Maternal depression is less commonly measured in evaluations of ECD programmes, but the studies available indicate that these programs have potential to benefit maternal mental health, further strengthening their value (42). However, benefits have not been found consistently (2).
and paternal education in a logical way in this population (8, 13). The study also had some limitations. Stimulation in the home was assessed through self-report and hence may be subject to bias. Although assessors were masked to intervention group, it is possible that some mothers may have mentioned the intervention during endline data collection.

The intervention was implemented in government community clinics by government health workers, used low-cost play materials and activities, and was acceptable to mothers and health staff as shown by the high compliance and engagement in the intervention. These factors make it suitable for wider dissemination within Bangladesh. The community clinics that participated in this study are similar to those in other areas of rural Bangladesh and hence the results should generalize to clinics across the country. However, there are some limitations to consider as the program is scaled-up. Firstly, the research team trained and supervised the health staff which helped ensure high quality intervention implementation. In future, it will be important to test if implementation quality is maintained when government health supervisors provide the training and supervision or if it is necessary to hire new supervisors for child development. Secondly, health staff participated in 10 days initial training and quarterly 1-day refresher trainings. This is lower than reported in many other group-based ECD programmes (33–35, 38), although longer than may be readily available in many government programs. High quality training and ongoing supervision is a key requirement for quality implementation and we need to advocate for sufficient training as ECD programmes are scaled-up. Thirdly, provision of play materials is a core component of Reach-Up and Learn and is essential to maintain effectiveness of the intervention as suggested by a Madagascan study, which used the Reach Up curriculum without leaving toys with the mothers, and found no impact on child development (45). In this and previous studies, toys have been provided by the research team. Others have implemented effective program

that require parents to provide home-available playthings for their children (4, 7, 33, 46). Hence, we can explore to what extent the play materials can be made by the mothers or communities. Another limitation is the relatively small number of children who can be reached through this model. The existing 13,000 clinics could reach approximately 416,000 children a year. Therefore, this approach is targeted to the highest risk children only and there remains a need to explore ways of increasing coverage, including increasing the group size where practical. In this study and the pair study, we targeted undernourished children because undernutrition is an important risk factor for poor child development. Alternative strategies would be required for high-risk children living farther from the clinic. For example, ECD content could be integrated into the home visits and community health sessions conducted by FWAs and HAAs as has been reported in other studies in Bangladesh (37, 47).

In conclusion, our results suggest that integrating an ECD parenting intervention into government primary health care services in rural Bangladesh was feasible and effective for groups of four mothers and children making the program most suitable for targeting high-risk children. The intervention has the potential to be scaled up to other areas thus increasing the coverage of ECD programming for disadvantaged children.

### DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

### ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Board of International Centre
for Diarrhoeal Disease Research, Bangladesh. Written informed consent to participate in this study was provided by the participants’ legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

JH, SG-M, HB-H, and SFM contributed to the conceptualisation of the study and funding acquisition. SFM and JH contributed to the project administration. SFM, JH, MH, SS, FT, HB-H, and SG-M contributed to the investigation. DR was responsible for data analysis. SFM and HB-H were responsible for writing the original draft. All authors reviewed and edited the manuscript.

FUNDING

This work was funded by the Saving Brains programme of Grand Challenges Canada. The data was analysed and the manuscript written with support from British Academy Early Childhood Development Programme, Grant number: EC170101.

REFERENCES

1. Black MM, Walker SP, Fernald LCH, Andersen CT, DiGirolamo AM, Lu C, et al. Early childhood development coming of age: science through the life course. Lancet. (2017) 389:77–90. doi: 10.1016/S0140-6736(16)31389-7

2. Jeong J, Franchett EE, Ramos de Oliveira CV, Rehmani K, Youssafzai AK. Parenting interventions to promote early child development in the first three years of life: a global systematic review and meta-analysis. PLoS Med. (2021) 18:e1003602. doi:10.1371/journal.pmed.1003602

3. Richter LM, Daelmans B, Lombardi J, Heymann J, Boo FL, Behrman JR, et al. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. Lancet. (2017) 389:103–18. doi: 10.1016/S0140-6736(16)31698-1

4. Youssafzai AK, Rashid A, Razvi A, Armstrong R, Bhutta ZA. 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) 384:1282–89. doi: 10.1016/S0140-6736(14)60455-4

5. Chang SM, Grantham-McGregor SM, Powell CA, Vera-Hernandez M, Lopez-Boo F, Baker-Henningham H, et al. Integrating a parenting intervention with routine primary health care: a cluster randomized trial. Pediatrics. (2015) 136:722–80. doi: 10.1542/peds.2015-0119

6. Grantham-McGregor S, Smith J. Extending the Jamaican Early Childhood Development Intervention. J Appl Res Child. (2016) 7:4.

7. Luoto JE, Garcia IL, Aboud FE, Singla DR, Fernald LC, Pitchik HO, et al. Measuring Change in Nutritional Status: Guidelines for Assessing the Nutritional Impact of Supplementary Feeding. Frontiers in Pediatrics. (2013) 5:15.2.237

8. Richter LM, Daelmans B, Lombardi J, Heymann J, Boo FL, Behrman JR, et al. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. Lancet. (2017) 389:103–18. doi: 10.1016/S0140-6736(16)31698-1

9. Luoto JE, Garcia IL, Aboud FE, Singla DR, Fernald LC, Pitchik HO, et al. Measuring Change in Nutritional Status: Guidelines for Assessing the Nutritional Impact of Supplementary Feeding. Frontiers in Pediatrics. (2013) 5:15.2.237

10. Tofail F, Hamadani JD, Mehrin F, Ridout DA, Huda SN, Grantham-McGregor SM. Psychosocial stimulation benefits development in nonanemic children but not in anemic, iron-deficient children. J Nutr. (2013) 143:885–93. doi: 10.3945/jn.112.160473

11. Bosman MJ, Roy BR, Sujon HM, Tran T, Fisher J, Tofail F, et al. Effects of integrated psychosocial stimulation and unconditional cash transfer (UCT) on Children’s development in rural Bangladesh: a cluster randomized controlled trial. Soc Sci Med. (2021) 293:114657. doi: 10.1016/j.socscimed.2021.114657

12. Hamadani JD, Mehrin SF, Tofail F, Hasan MI, Huda SN, Baker-Henningham H, et al. Integrating an early childhood development programme into Bangladeshi primary health-care services: an open-label, cluster-randomised controlled trial. Lancet Glob Health. (2019) 7:e366–75. doi: 10.1016/S2214-109X(18)30535-7

ACKNOWLEDGMENTS

This work was conducted at icddr,b. We thank the Government of Bangladesh for allowing us to conduct this project using their health infrastructure. We are grateful to personnel of Directorate General Health Service (DGHS) and Directorate General of Family Planning (DGFP) under the Ministry of Health and Family Welfare of the Government of Bangladesh for their kind cooperation, all government health staff, parents and children who participated in this study and community leaders for their support. This work was supported by the Grand Challenges Canada. icddr,b is also grateful to the Governments of Bangladesh, Canada, Sweden and the United Kingdom for providing core/unrestricted support.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fped.2022.886542/full#supplementary-material
