Prev Sci
DOI 10.1007/s11121-017-0822-0

Transportability of an Evidence-Based Early Childhood Intervention in a Low-Income African Country: Results of a Cluster Randomized Controlled Study

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Abstract Children in Sub-Saharan Africa (SSA) are burdened by significant unmet mental health needs. Despite the successes of numerous school-based interventions for promoting child mental health, most evidence-based interventions (EBIs) are not available in SSA. This study investigated the implementation quality and effectiveness of one component of an EBI from a developed country (USA) in a SSA country (Uganda). The EBI component, *Professional Development*, was provided by trained Ugandan mental health professionals to Ugandan primary school teachers. It included large-group experiential training and small-group coaching to introduce and support a range of evidence-based practices (EBPs) to create nurturing and predictable classroom experiences. The study was guided by the Consolidated Framework for Implementation Research, the Teacher Training Implementation Model, and the RE-AIM evaluation framework. Effectiveness outcomes were studied using a cluster randomized design, in which 10 schools were randomized to intervention and wait-list control conditions. A total of 79 early childhood teachers participated. Teacher knowledge and the use of EBPs were assessed at baseline and immediately post-intervention (4–5 months later). A sample of 154 parents was randomly selected to report on child behavior at baseline and post-intervention. Linear mixed effect modeling was applied to examine effectiveness outcomes. Findings support the feasibility of training Ugandan mental health professionals to provide *Professional Development* for Ugandan teachers. *Professional Development* was delivered with high levels of fidelity and resulted in improved teacher EBP knowl-

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Published online: 21 July 2017

edge and the use of EBPs in the classroom, and child social competence.

Keywords Mental health · Implementation · Sub-Saharan Africa · Low-income country · Consolidated framework for implementation research · RE-AIM

Background

Children in Sub-Saharan Africa (SSA) countries, comprising about 50% of the total regional population, are burdened by significant unmet mental health needs (WHO 2005, 2011). Most children in this region grow up in disadvantaged environments characterized by a high prevalence of violence, abuse/neglect, infectious diseases, and poverty, and experience a range of child mental health problems (Belfer 2008; WHO 2005). Although numerous EBIs for young children have been implemented in developed countries (Gardner et al. 2015), most are not available in SSA countries. Several reviews strongly indicate that EBIs can be effective for children from different cultural backgrounds if adapted appropriately (Baumann et al. 2015; Gardner et al. 2015). Transporting EBIs to SSA has the potential to address the enormous health needs of a largely underserved pediatric population.

To maximize reach to children, one strategy is to provide EBIs in schools (Huang et al. 2013). This approach has been found to be effective in addressing health problems (e.g., HIV/AIDS) in SSA countries (Kinsman et al. 2001; Sherman and Muehlhoff 2007). School-based implementation is consistent with the Ugandan Child and Adolescent Mental Health Policy Guidelines, which prioritize the engagement of communities and child-serving institutions to contribute to mental health promotion efforts (Ssebunnya et al. 2012).

The Evidence-Based School Mental Health Intervention

ParentCorps is a multi-component school-based EBI for young children that promotes nurturing and predictable environments at home and school. *ParentCorps* was built on an extensive body of cross-cultural parenting and child developmental research (as summarized in Bradley and Corwyn 2005; Lawire 2009), and includes three core components: *Professional Development* (*PD*) for school-based staff to increase knowledge and the use of EBPs in the classroom and to support strong home-school connections; and *Programs for Parents and Students* to promote EBPs at home and children's social emotional and behavior regulation skills. In two school cluster randomized controlled trials (RCTs) in New York City, the multi-component *ParentCorps* has been shown to be highly acceptable to culturally and racially diverse low-income populations and has yielded robust and sustained effects on targeted teacher/classroom, parent, and child outcomes (Cohen's *d*s ranged from .42–.85 for teacher outcomes, .16–.50 for parent outcomes, and .24–.81 for child outcomes) (Brotman et al. 2011; Brotman et al. 2012; Brotman et al. 2016; Dawson-McClure et al. 2014).

In the USA, mental health professionals provide *PD* to teachers, school-based mental health professionals and other school staff; school-based mental health professionals are responsible for implementing the *Program for Parents*; and teachers are responsible for implementing the *Program for Students*. Because SSA countries have limited availability of mental health professionals, relying on professionals to address the full spectrum of child health needs is not feasible. Using a task-shifting strategy (involving redistribution of tasks from professionally trained health workers to those with less training and fewer qualifications (WHO 2007)) to bring *ParentCorps* to Ugandan schools, the long-term plan is for Ugandan mental health professionals to train and support Ugandan teachers to implement both the *Program for Parents* and *Program for Students*. Prior to initiating the current study, we carried out a series of studies with 130 Ugandan teachers, 300 families, 30 school leaders, 12 mental health professionals, and numerous policy makers and key stakeholders. Findings indicated that all three *ParentCorps* components and the use of task shifting are a good fit for the Ugandan context, teachers, and families. For example, the vast majority of teachers were motivated to learn about and implement the EBI and most schools and teachers have experience in child health promotion activities (Huang et al. 2014). In addition, among Ugandan families, positive parenting practices were related to fewer child behavior problems and better school outcomes (Huang et al. 2017).

The Present Study

As the first step in transporting the multi-component *ParentCorps* to Uganda, this study focused on the feasibility and impact of *PD* only. Three research questions are considered: (1) Is it feasible to transport *PD* for early childhood teachers, an EBI developed from the USA, to low-resource Ugandan schools?; (2) Does *PD* improve Ugandan teachers' knowledge and the use of EBPs?; and (3) Do children in classrooms with teachers exposed to *PD* have better mental health outcomes relative to children in control classrooms?

Aspects of the theory of change (Fig. 1) which guides this work build on the Teacher Training Implementation Model (TTIM) (Reinke et al. 2013) and the Consolidated Framework for Implementation Research (CFIR) (Damschroder and Lowery 2013). TTIM focuses on multidimensional aspects of intervention fidelity as related to implementation outcomes, and CFIR focuses on five domains of contextual factors that may impact implementation outcomes. We consider two aspects of implementation quality—fidelity and exposure. As per the TTIM, the extent to which Ugandan mental health professionals deliver *PD* with fidelity (e.g., adhere to content, present with

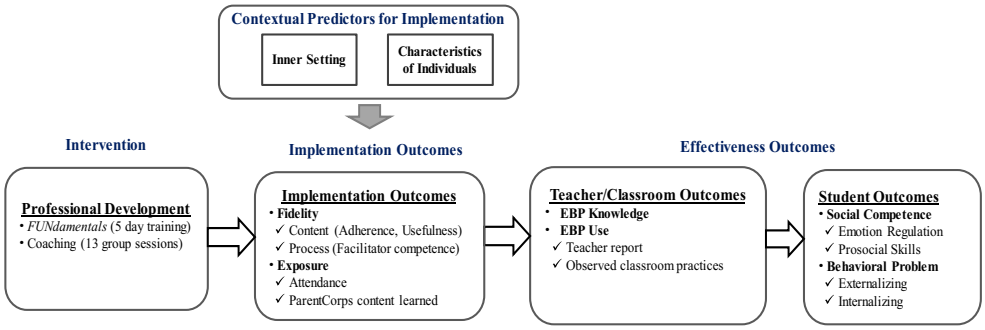

Fig. 1 Theory of change. Note. The figure illustrates the expected relationships among two of five contextual factors, *inner setting* (school contexts such as structural characteristics, cultural norms, readiness for implementation, leadership) and *characteristics of individuals* (implementer/consumer characteristics such as knowledge, EBI attitude, beliefs about the intervention, self-efficacy) from the CFIR, implementation outcomes from the TTIM (multidimensional implementation quality and process indicators) and effectiveness outcomes

competence) and the degree of teacher exposure (e.g., attend sessions, learn concepts) are expected to influence teacher knowledge and the use of EBPs and ultimately student outcomes. In addition, we consider two of the five CFIR contextual factors as potential predictors of implementation outcomes—inner setting and characteristics of individuals. We consider the school inner context for implementation of the EBI (e.g., readiness, leadership engagement) and characteristics of the teachers receiving the *PD* (e.g., EBI attitude) and children/families as potential influences on implementation outcomes.

Methods

Overview of the Study Design

The study aims to evaluate implementation and effectiveness outcomes of ParentCorps *PD* as delivered by Ugandan mental health professionals. The study of implementation outcomes examines fidelity of delivery (content and process) and exposure (attendance and content learned) among teachers in five intervention schools. The study of effectiveness outcomes applies a cluster randomized wait-list controlled design in 10 Ugandan schools. In the five schools randomized to intervention, teachers were offered *PD*. Teachers/classrooms and a randomly selected sample of children were assessed at baseline and immediately post-intervention (4 to 5 months after baseline). Teachers were assessed on EBP knowledge and use (based on self-report and observation), and children were assessed on social competence and behavior problems (based on parental report).

Participants and Procedures

Ten Ugandan mental health professionals were recruited from universities and mental health facilities. The inclusion criteria were master's level psychologists/social workers/mental health counselors, or bachelor's level with at least 3 years of clinical experience. Three of the professionals spent 10 days in the USA at *ParentCorps Academy* to observe and learn about *ParentCorps* philosophy and the multi-component EBI. Upon return to Uganda, they helped facilitate distance training of their seven peers which included 10 hours of video conferencing support from *ParentCorps Academy*. The 10 professionals were then responsible for delivering *PD*—a 5-day *ParentCorps FUNdamentals* and 13 *Coaching sessions* (described below). They participated in weekly video conferencing supervision calls with *ParentCorps Academy* over a 3.5-month period to support the facilitation of the initial training and the 13 weekly *Coaching sessions.*

Schools were selected from a previous needs assessment study, which included 30 schools randomly selected from those registered under the Ministry of Education in Kampala, Uganda, and all indicated interest in participation if EBIs were available. Five matched pairs of schools (matched on the number of teachers and studetns) were identified and then randomly assigned to intervention or control conditions. Leaders from the selected schools were contacted and informed about the study, and interest was reconfirmed. All 10 leaders who were approached agreed to participate in the current study and provided written consent.

Early childhood teachers (serving students between 4 and 8 years of age or nursery to third grade) from participating schools were then approached to assess their interest. Teachers were informed of their right to decline participation with no negative consequences to their position or job. Among the recruited schools, 85 teachers were eligible (see participant flow in Fig. 2). The final consented sample included 79 teachers (93% of eligible).

Teachers were asked to randomly select 10–15 parents or primary caregivers of students to complete ratings on child behavior. All families approached by teachers agreed to participate (N = 154 families). All consents and assessments for

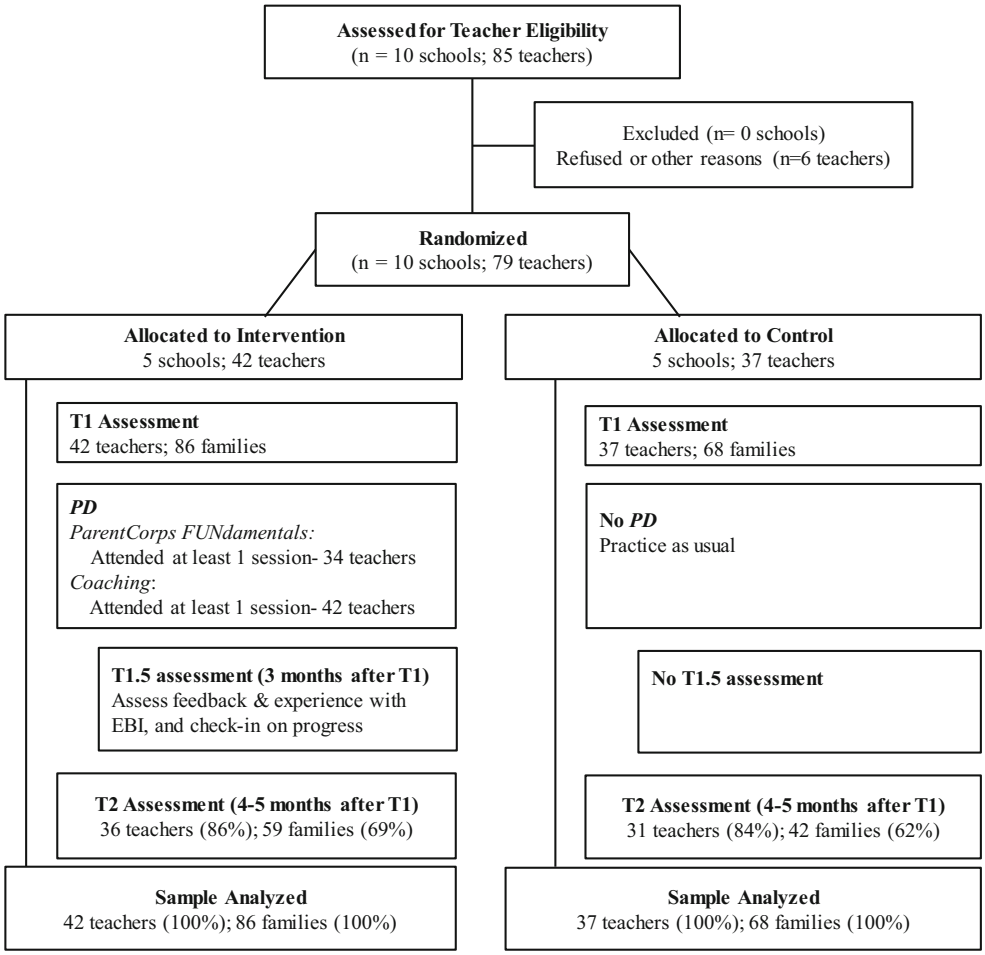

Fig. 2 Flow of schools, teachers, and families from enrollment, randomization, and follow-up. Note. Assessment timeline was planned according to Ugandan public school schedule. An academic year in Uganda is from January to December. Each academic year has three terms, and each term includes about 90 school days. We recruited and consented schools/teachers in the last school term in 2013. So as not to interrupt school activities, *PD* was provided in late January 2014, a week before students start education development in the new school year. Baseline teacher self-report data were collected before PD (1–2 weeks before school started). Observation of teachers' use of EBPs in classroom and family data collection for child behaviors were scheduled in the 1st 2–4 weeks of the school term after new students enrolled. We chose to consider February data as baseline because this would allow for examination of change in the same classrooms of children. We also collected observational data in October 2013 (but with a different cohort of students) and these measures were similar across conditions

teachers were in English (the official language in schools). Consents and assessments for parents were available in English and the local language (Luganda). About 40% of parents chose to be interviewed in English.

Intervention: Professional Development

PD includes two components: *ParentCorps FUNdamentals* and *Coaching*. As in the US version, *FUNdamentals* is a large-group experiential training series aimed at building knowledge of and a shared language about EBPs, motivation for change, confidence in trying out new practices, and a sense of community. Over 5 days, teachers from the five participating schools gathered together at a university site. Teachers were asked to reflect on their assumptions about students and families and to connect those assumptions to their current practices and capacity to help children succeed. Within this context of reflection about values and goals, teachers also learned a set of EBPs to choose from that are consistent with their own values that will enable them to meet goals for themselves and the students in their classrooms. Because the training was provided during non-school days and outside of the school, each teacher received funds (i.e., US$50) to compensate for travel and time. Thirteen weekly group *Coaching* sessions (1–1.5 h) were planned at the school to help teachers use EBPs effectively in the classroom. The *Coaching* model (1:1 in the USA) was revised to be delivered by a pair of mental health professionals to groups of early childhood teachers during school breaks or after school hours because of the lower cost and potential benefits in working as a group in the Ugandan "collective culture."

Study Measures

The evaluation was guided by the CFIR, the TTIM, and the RE-AIM frameworks (Glasgow et al. 1999) which conceptualizes the public health impact of an intervention as a function of five dimensions—*Reach*, *Effectiveness*, *Adoption*, *Implementation*, and *Maintenance*. Below, we describe implementation and effectiveness outcome measures and additional measures used to characterize the inner and individual contexts (as per the CFIR) and to estimate aspects of adoption and reach (as per the RE-AIM). Where possible, we employed measures with demonstrated reliability and validity in Uganda (Nakigudde et al. 2016). Psychometric properties using data from the current sample are reported below. For parent-reported measures, assessments were completed in English and Luganda. The Lugandan measures were translated and back-translated, and a team review approach was used to resolve any discrepancies between the versions (Alegria et al. 2004).

Implementation Outcomes were assessed prior to, during, and after *PD*. Assessments considered two broad domains of fidelity (content and process) and exposure (attendance and content learned). *Fidelity of Content* considered the extent to which mental health professionals delivered the core content per program manuals. Professionals completed *ParentCorps* checklists after each *FUNdamentals* day and *Coaching* session. Professionals also reflected on their own *Competence* during the 13 coaching sessions by completing a 4-item measure (α = .77). Teachers rated *Content Usefulness* and *Facilitator Competence* via a satisfaction questionnaire (completed anonymously) after each *FUNdamentals* day (10 items) and *Coaching* session (8 items). In addition, teachers completed a longer feedback survey after the final *FUNdamentals* day, which asks about *Facilitator Competence* (9 items, α = .69; e.g., knowledge, preparation, ability to control discussion), *Usefulness of the EBPs* (6 items, α = .72), and *Training Experience* (8 items, α = .66; e.g., interesting, useful, enjoyable). After the final *Coaching* session (at the end of the school semester), teachers completed an *EBP Practice and Feedback Survey* with questions about the use of the EBPs outside of the classroom, sharing EBP knowledge with other non-trained teachers and parents, perceive benefits of *PD*, and feedback.

Exposure was measured by *Attendance* and *Content Learned* (during 5 training days only). Two knowledge measures were completed prior to the first day and after the final day of training—*Evidence-based Practices Knowledge* (10 items) and *ParentCorps Strategy Knowledge* (50 items) (Brotman et al. 2008). Both scales were related (r = .58 in the Ugandan sample) and have shown to be sensitive to intervention in US studies. An increase in *ParentCorps* and EBP knowledge was interpreted as being engaged and fully exposed to the EBI.

Effectiveness Outcomes were assessed at baseline (T1) and post-intervention (T2), and procedures were identical in intervention and control schools. For T1 assessments, all teacher measures except classroom observations were conducted prior to any *PD*. Classroom observation, which was conducted by raters masked to intervention condition, was carried out immediately after *FUNdamentals* but prior to any *coaching* (see Fig. 2, school and assessment timeline).

Teacher EBP Knowledge was evaluated using the *Evidence-based Practices Knowledge* (10 items, described above). *Teacher EBP Use* was assessed via self-report and independent observations of the classroom. The *Teacher Strategies Questionnaire* (TSQ; 14 items, self-report 1–4 point scale, α = .79 and .84 at T1 and T2 in this study) (Webster-Stratton et al. 2001) assesses the frequency that teachers apply a range of evidence-based behavioral management strategies (e.g., praise, proactive strategies). The *Teacher Instructional Practices and Processes System* (TIPPS) (Seidman et al. 2014) is a behavioral observation coding system designed to assess teacher practices and classroom processes specifically designed for use in developing countries. Two Ugandan observers trained by the developers conducted live observations of teachers/classrooms over a 20-min period during a lesson. Observers rated the teacher/classroom independently on a double-dichotomous scale to decide which statement is most like what was observed in the classroom. This "structured alternative format" of rating is designed to offset the tendency to provide socially desirable responses (Harter 1982). Once the decision is made, the observer then decides whether the statement is "Very Accurate" or "Somewhat Accurate." These choices are then scored on a 1–4 point scale. Two of the 16 global ratings that are relevant to the intervention were applied. *Positive Environment* captures classroom behaviors related to the level of warmth/encouragement, respectful talk and turn taking, politeness/courtesy, positive body language, active listening, and fairness, while *Negative Environment* captures classroom behaviors related to the level of discouragement, coldness, insensitivity, unhappiness of students, disorder of classroom, bullying, irritability, and anger. Inter-rater agreement ICCs ranged from .77 to .79. Because the negative and positive environment ratings were related (r = −.39, p < .001), a composite score was created.

Child Outcomes were assessed using two parent-reported measures. The *Social Competence Scale* (12 items; α = .80 and .87 at T1 and T2 for Ugandan sample) (Conduct Problem Prevention Research Group (CPPRG) 1995) evaluates children's emotion regulation (6 items; α = .66 and .77) and prosocial/communication skills (6 items; α = .75 and .79). *The Pictorial Pediatric Symptom Checklist* (*PPSC*) (W. Gardner et al. 1999) measures internalizing problems (3 items, α = .68 and .67) and externalizing problems (3 items, α = .59 and .62). These measures have been shown to discriminate normative and high-risk samples of Ugandan children (Nakigudde et al. 2016).

Contexts: Characteristics of School Inner Setting and Individuals At baseline only, school leaders completed a *School Environment Questionnaire* (Huang et al. 2014) that

assesses school demographics and resources. Teachers completed a *School Climate Questionnaire*, which includes two subscales derived from the *TCU-Organizational Readiness for Change Scale* (Simpson et al. 2002). The *Organizational Climate for EBP Subscale* (24 items; α = .85 for Ugandan sample) measures organizational leadership, communication, cohesion, staff stress, autonomy, and change. The *Director Leadership Subscale* (8 items; α = .84) measures school leader's positive leadership style.

Teachers were characterized in terms of baseline demographics, *teaching stress* (2 items; α = .64), *job satisfaction* (2 items; α = .66), *confidence in managing child behavior* (4 items, α = .70) (Brotman et al. 2008), *negative attitudes toward reward* (6 items, α = .62), and *evidence-based practice attitude* (15 items, α = .74; 4 of the 8 subscales: fit, monitoring, burden, and feedback), derived from the *Evidence-Based Practice Attitude Scales* (Aarons et al. 2012). Children were characterized in terms of baseline demographic characteristics and *Food insecurity* (3 items; α = .85), assessed by the *Household Hunger Scale* (Ballard et al. 2011) and parent report of child outcomes (described above).

Analytic Approach

To study implementation outcomes, we carried out a series of descriptive analyses of fidelity and exposure within the intervention schools. To evaluate effectiveness outcomes, the intention-to-treat (ITT) principle was applied. We examined the intra-class correlations (ICCs) for schools to understand and account for the nesting. We did not account for child nesting within teachers because (i) most teachers in Ugandan schools teach more than one grade, and most students interact with multiple teachers; and (ii) teachers did not provide outcome assessment data for children. Effectiveness outcomes were evaluated with a multivariate analysis of variance-type analysis using linear mixed effect models (using SAS PROC MIXED) (Diggle et al. 2005; SAS Institute Inc 2011). We modeled post-intervention teacher or child outcomes as a function of intervention and adjusted for the corresponding baseline outcome measure. To account for potential correlations among outcomes of teachers/children, a random effect for schools was included in the mixed effect model. The model was expressed as $Y_{ij} = \beta_1 I_j + \beta_2 X_{ij} + \gamma_j + \epsilon_{ij}$, where Y_{ij} is the outcome for the student i in school j, I_j is intervention status for school j, X_{ij} is the baseline value of the corresponding outcome for student i in school j, γ_j is the school level random effect, and ϵ_{ij} is the error term for student i in school j.

To consider partial missing data, we first inspected missing data patterns (see Fig. 2), which found available parent sources (62–69%) and teacher sources of follow-up data (84–86%) were within the recommended follow-up thresholds of 60–80% (suggesting notable biases are less likely to occur when data are missing completely at random or missing at random) (Little and Rubin 2002; Vicki et al. 2004). Teachers with and without follow-up data did not differ by condition or baseline characteristics (e.g., stress, year of experience) and initial levels of outcomes (EBP knowledge and use). Similarly, the followed and non-followed families did not differ by condition or on family demographic characteristics (i.e., food insecurity status, household size), and baseline child effectiveness outcome measures. Therefore, we assumed data were missing completely at random. A multiple imputation strategy was applied to account for missing data, in which analyses were replicated in 10 imputed datasets. SAS PROC MIANALYZE was used to combine the results for the final inference (SAS Institute Inc 2011).

Results

Baseline Characteristics and Equivalence

Characteristics of School Inner Setting As shown in Tables 1 and 2, there were no differences between intervention and control conditions on any school, teacher, child, or family characteristics (all $p > .05$). Schools had an average of 7.50 (SD = 2.92) early childhood teachers; the majority of teachers were female (79%) and were parents themselves (80%). Based on leader and teacher responses to standardized measures, the schools were moderately "ready" for EBP implementation (M (SD) = 2.64 (.51) on a 0–4 point scale) and had high positive leadership (M (SD) = 3.14 (.65) on a 0–4 point scale).

Characteristics of Individuals Teachers tended to have relatively low EBP knowledge (37% correct) compared to the paraprofessionals and teachers in the USA (53–66% on the same measure) (Brotman et al. 2008). They tended to have positive attitudes toward EBPs (M (SD) = 3.24 (.43) on a 0–4 point scale). Teachers tended to have low to moderate levels of confidence in managing students' behavior (M (SD) = 2.76 (.56) on a 0–4 point scale) and low quality of classroom (estimated by observed EBP use; M (SD) = 2.20 (.29) on a 1–4 point scale).

About one third of families were single-parent households and half of parents had less than primary education. More than one-third experienced food insecurity, and the majority reported spanking their children. Based on publically available data (Child et al. 2014; The World Bank 2016; Ugandan Ministry of Education and Sports 2014), the sample was representative of Ugandan schools, teachers, and families (see Table 1).

Implementation Outcomes (in Intervention Schools)

Fidelity: Content Adherence and Usefulness The 10 mental health professionals delivered the content of *ParentCorps FUNdamentals* and *Coaching* in accord with the program manuals (>90% of core content was delivered). Teachers

Table 1 Baseline characteristics

	Intervention 5 schools	Control 5 schools	Total 10 schools	Registered 22,600 Ugandan primary schools
Schools characteristics	*M* (SD) or %	*M* (SD) or %	*M* (SD) or %	
Number of students	639.20 (450.81)	614.40 (373.02)	626.80 (390.30)	8.26 million students enrolled
Number of early childhood teachers	7.80 (3.96)	7.20 (1.79)	7.50 (2.92)	192,566 teachers (46% schools suffered from teacher deficit)
Number of teachers in school	20.00 (12.10)	18.20 (5.40)	19.10 (8.89)	
Average number of student in each class	60.20 (39.40)	49.00 (25.35)	54.60 (31.79)	45–63 per classroom
School has nursery classes	40%	40%	40%	5763 with pre-primary program (26%)
Organizational climate for EBP (0–4)	2.73 (.48)	2.54 (.52)	2.64 (.51)	–
Director leadership (0–4)	3.22 (.66)	3.05 (.64)	3.14 (.65)	–
Teacher characteristics	*N* = 42	*N* = 37	*N* = 79	
Gender—female	76.2%	61.1%	69.2%	(i) Teacher absenteeism is an issue (45% often late arrival, 41% often absent); (ii) 93% students reported experiencing violence from teachers; (iii) only 64% students reached defined level of competency in literacy at primary 3, and 38% at primary 6; (iv) teacher professional satisfaction rate is low (47% dissatisfy, mainly attribute to low salary and opportunity for growth)
Is a parent	80.5%	77.8%	79.2%	
Years of teaching	14.12 (9.74)	12.75 (9.37)	13.49 (9.53)	
Teaching stress (0–4)	1.68 (1.12)	1.74 (1.05)	1.71 (1.08)	
Job satisfaction (0–4)	3.17 (.90)	2.64 (1.01)*	2.93 (.99)	
Negative attitude toward reward(0–4)	1.54 (.67)	1.36 (.70)	1.45 (.69)	
Attitude toward EBP (0–4)	3.20 (.47)	3.29 (.38)	3.24 (.43)	
Confidence in managing behavior (0–4)	2.93 (.52)	2.58 (.56)	2.76 (.56)	
Child/family characteristics	*N* = 86	*N* = 68	*N* = 154	
Food insecurity	39.5%	29.4%	35.1%	30% undernourished
Single parent	30.6%	27.9%	29.4%	27% female-headed household
Caregiver education status				
Primary or less	41.8%	35.3%	39.0%	44% ≤ primary education
Non-standard	12.8%	17.6%	14.9%	
Secondary or higher	45.3%	47.1%	46.1%	
Caregiver never spanked child	10.5%	4.4%	7.8%	<10%
Number of household members (2–16)	6.22 (2.67)	5.88 (2.00)	6.07 (2.39)	Average household size of 4.9
Number of children <18 years old	3.54 (1.97)	3.41 (1.51)	3.48 (1.78)	–
Child sex—male	45.3%	54.4%	49.4%	4.12 million boys in primary (49.9%)
Child age in years	6.63 (.92)	6.57 (1.05)	6.60 (.98)	–

No baseline difference on all measures, with the exception for teacher job satisfaction (* $p < .05$). Number in bracket (0–4) indicates range of the score for the scale. National school/teacher/family demographic statistics were derived from the Ministry and published reports (Child et al. 2014; The World Bank 2016; Ugandan Ministry of Education and Sports 2014)

indicated that they were highly satisfied with *FUNdamentals* *M* (SD) = 4.47 (.37) and *Coaching M* (SD) = 4.63 (.31) (1–5) as delivered by Ugnadan mental health professionals, and found the EBPs discussed to be useful and helpful *M* (SD) = 4.53 (.34) (1–5).

Fidelity: Facilitator Competence Teachers rated the Ugandan mental health professionals as highly competent in providing *FUNdamentals* and *Coaching*, *M* (SD) = 4.58 (.42) and 4.73 (.33), respectively (1–5); and the mental health professionals rated themselves as competent Coaches of teachers during *Coaching*, *M* (SD) = 4.82 (.72) (0–6).

Exposure: Attendance Of the 42 intervention teachers, 34 (81%) attended at least one of the 5 days of *FUNdamentals*. The average number of days attended was 4.25 (SD = 1.07), with 79% of teachers attending 4 or 5 days. All teachers participated in at least one *Coaching* session, even the eight teachers who did not attend *FUNdamentals*. Across the five intervention schools, the number of *Coaching* sessions delivered ranged from 9 to 13 (some sessions were canceled due to weather or other school activities). Among the 42 teachers, the average number of *Coaching* sessions attended was 7.79 (SD = 3.22); 79% of teachers attended more than 7 sessions.

Table 2 Intervention effectiveness on teachers and students

	Mean score from T1 raw data		Mean score from T2 raw data		Model-based inference		
	Intervention Mean (SD)	Control Mean (SD)	Intervention Mean (SD)	Control Mean (SD)	Difference (SE)	[95% CI]	*p*
Teacher outcomes							
EBP Knowledge	35.50 (13.39)	39.39 (12.98)	46.86 (17.28)	33.21 (16.11)	13.68 (5.80)	[2.29, 25.08]	.019
EBP use—observed	2.18 (.35)	2.22 (.23)	2.16 (.23)	2.03 (.22)	.16 (.07)	[.02, .30]	.024
EBP use—self-reported	2.70 (.67)	2.47 (.58)	2.97 (.67)	2.72 (.53)	.02 (.19)	[−.36, .40]	.919
Child outcomes							
Social competence	2.34 (.63)	2.35 (.67)	3.04 (.72)	2.53 (1.09)	.66 (.22)	[.23, 1.08]	.003
Emotion regulation	2.24 (.73)	2.14 (.73)	2.96 (.87)	2.29 (1.21)	.79 (.25)	[.30, 1.28]	.002
Prosocial skills	2.44 (.73)	2.55 (.74)	3.12 (.70)	2.78 (1.08)	.54 (.21)	[.12, .96]	.012
Behavior problems							
Externalizing	1.30 (1.51)	.96 (1.14)	1.02 (1.50)	1.31 (1.57)	−.50 (.30)	[−1.10, .11]	.11
Internalizing	.87 (1.32)	1.04 (1.20)	.59 (1.16)	.55 (1.23)	.11 (.32)	[−.53, .75]	.74

There were no significant differences at baseline. The mean scores in table are average scores from raw (non-imputed) data. Baseline means and SDs for the full sample were 37.26 (13.26) for EBP knowledge, 2.20 (0.29) for EBP use—observed, 2.59 (0.64) for EBP use—self-reported, 2.34 (0.64) for total child social competence, 2.20 (0.73) for emotion regulation, 2.49 (0.73) for prosocial skills subscales, 1.15 (1.37) for child externalizing problems, and 0.95 (1.27) for child internalizing problems. The model-based inferences are based on linear mixed effect models and the ITT principle from imputed data, with the exception for the EBP Use-observed. Observations were limited to 63 teachers/classrooms (excluded 6 school leaders/administrators). Also, 10 teachers (5 from intervention and 5 from control schools) who were not in schools during the observation periods at T1 and T2 were excluded because we could not impute observational data for cases without any observation. For all study outcomes, using imputed and non-imputed data yield similar results

Exposure: Content Learned Teachers significantly increased knowledge on two measures completed before and after *FUNdamentals*. *EBP Knowledge* scores significantly increased (*M* (SD) = 35.50 (13.39) to 46.86 (17.28), paired $t = -4.89$, $p < .001$) as well as *ParentCorps Strategy Knowledge*, (*M* (SD) = 42.95 (8.06) to 55.80 (12.42), paired $t = -4.95$, $p < .001$).

Effectiveness Outcomes

Teachers: EBP Knowledge EBP knowledge was significantly greater among teachers in intervention schools relative to teachers in control schools (Cohen's *d* (*d*) = 1.03) (see Table 2).

Teachers/Classrooms: EBP Use Based on independent global ratings made by observers blind to the intervention assignment of the school, EBP use in the classrooms was significantly greater among teachers in intervention schools relative to control schools ($d = .55$). There was no difference, however, in teachers' self-reported use of specific EBPs ($d = .03$).

Child Outcomes Based on parent reports, children in intervention schools had greater levels of social competence than children from control schools ($d = 1.03$, with significant slope change for intervention [Est (SE) = .69 (.19), $p < .001$] and no slope change for control [Est (SE) = −.06 (.21), $p = .77$]). Post hoc consideration of the two subscales found benefits in both domains of emotion regulation ($d = 1.08$) and prosocial skills ($d = .74$). Although the impact of the intervention on externalizing problems did not reach significance ($p = .11$), the effect size was meaningful ($d = .39$), and patterns of change were in the expected direction. Children in control schools increased in problem behaviors over 4–5 months (slope change Est (SE) = +.37 (.29)), while children in intervention schools decrease in problem behaviors (slope change Est (SE) = −.21 (.23)). There were no differences on parent-rated internalizing problems.

Teacher Feedback of Implementation

Implementation feedback gathered from intervention school teachers at the final *Coaching* session was analyzed to further understand teachers' experiences and perceived impacts of *PD*. More than 90% of teachers described actively applying all of the newly learned EBPs. Teachers reported using most of the newly learned strategies frequently (*M* (SD) = 2.10 (.44) on a scale of 0 [no use] to 3 [use everyday]) and with moderate confidence in the use of the EBP (*M* (SD) = 2.69 (.51) on a scale of 0 [not at all confident] to 4 [extremely confident]). Teachers reported the most challenges in "ignoring mild misbehavior" (with below mean level of confidence in applying such strategy: *M* (SD) = 1.78). Although reliance on the commonly used cane or stick for discipline was reduced (used by more than 90% of Ugandan teachers from the Kampala region (Devries et al. 2014)), Fifty-nine percent of teacher still relied on this strategy on occasion.

Nearly all teachers (98%) reported that their relationship with students had improved due to applying new EBPs. A majority of teachers also reported that other teachers (92%) and parents (76%) noticed that they made positive changes during the school term. A majority of teachers (70%) indicated they gained valuable, practical, and emotional support from fellow teachers through the group *Coaching* model. Although the teachers were not actively encouraged to use or discuss the use of EBPs outside the classroom, the majority did so on their own. Teachers indicated that they applied a range of EBPs outside of the classroom and shared EBP knowledge with others. All teachers reported that they had talked about the EBPs with other non-trained teachers (70% shared with more than six teachers). Of these, 97% reported that their non-trained teacher colleagues reporting trying out new EBPs and had positive experiences. In addition, half of the teachers (51%) reported that they shared EBPs with more than six parents; and 76% reported that parents tried the practices at home and had positive experiences.

Discussion

This study evaluated implementation and effectiveness outcomes of one component of a multi-component early childhood EBI that has been shown in replicated trials in the USA to promote child mental health in low-income populations. We examined key constructs and interpret findings from three related implementation science frameworks. Overall, findings suggest the feasibility of transporting *ParentCorps*, a US-developed EBI, to Ugandan schools. Ugandan mental health professionals were able to deliver the *PD* component to Ugandan teachers with high levels of fidelity. There was a high level of adherence to content and teachers rated the content as useful and the facilitators as competent. With a few modifications to the delivery model, the teachers were able to participate in the majority of initial training days and group coaching sessions. *PD* resulted in significant greater teacher EBP knowledge, EBP use based on observations of classrooms and parent-reported child social competence among intervention schools than control schools. Although the impact on externalizing problems by parent report did not reach statistical significance, the effect size was meaningful and the change was in the desired direction.

PD introduced Ugandan teachers to a range of new EBPs. *ParentCorps*' approach to focusing on teacher values, beliefs, and attitudes toward EBPs and respect for questioning the fit of the practices for individual teachers and their classrooms appears to be a promising approach in this SSA context. Teachers gained knowledge of EBPs, as evidenced in a test of knowledge application (i.e., selecting the most appropriate response to hypothetical scenarios). In turn, observations of classrooms found greater application of EBPs (e.g., encouragement of positive behavior, active listening) and more positive and less negative interactions between teachers and students and among students. Further inspection of patterns across conditions suggests that intervention classrooms became more positive (e.g., warmth, politeness, positive body language, fairness) than control classrooms over the semester. The environemnts of intervention classrooms remained relatively stable over 4-5 months, while the environments of control classrooms became more negative over time (e.g., discouragement, student unhappiness, irritability/anger). These patterns are consistent with those reported from schools working with high-risk populations in the USA, which find deterioration in classroom environment over the school year without intervention, and maintenance of classroom environment for schools with intervention (Learning 2013; Raver et al. 2008). Possible reasons might be due to inadequate support and classroom management strategies for teachers to cope with demands of high-need students. Without intervention, teachers are more likely to lose motivation and become stressed. Because Ugandan teachers struggle with large classroom size and the lack of classroom resources, providing intervention and peer support, can disrupt the deterioration process. Future research is needed to observe whether the EBI and the support structure that we put in place have sustainable and long-term effects on classroom environment.

Of note, there was no impact on teacher self-reports of EBP use on the Teachers Strategy Questionnaire (TSQ), an instrument used in US studies inquiring about the frequency with which teachers apply a range of evidence-based behavioral management strategies. This finding is inconsistent not only with the classroom observations described above but also with the end of coaching feedback provided by teachers in intervention schools where they described important changes in their relationships with students. Although many intervention studies in the USA find consistency across teacher-reported EBP use and classroom observations (Koziol et al. 1986; Raver et al. 2008), others do not (Carlson et al. 2014; Newfield 1980). It is possible that the TSQ definitions of EBPs were not familiar to Ugandan teachers; therefore, teachers' self-report of the use of EBPs might be less accurate before the training. Previous research found participants tend to hold "overly favorable" views of their ability in many social and behavioral domains when they are unskilled in these domains. As participants' skills improved, their metacognitive competence improved, and biases toward their perceived self-ability decreased (Justin and Dunning 1999). Given relatively low EBP knowledge at baseline in Ugandan teachers compaired with US samples, it is possible teachers might have overestimated their utilization of EBPs at baseline, which may have contributed to the finding of no discernible change on the self-report measure. Alternatively, the impact of *PD* may influence teachers' beliefs/attitudes about students and a judicious use of select EBPs may have result in improved relationships with students and more positive classroom environments. This may not be captured adequately by the TSQ.

PD led to significant differences on parent-reported social competence in two domains—prosocial skills and emotion

regulation. Children in both conditions increased in skills over the course of the school semester, but children in intervention schools increased to a greater extent than controls. In contrast, there were no significant differences in parent-reported problem behaviors. For externalizing, patterns were in the expected direction, with intervention children decreasing in problem behaviors and controls increasing over time. Our studies of *ParentCorps* in the USA find that difference in parent-reported behavior problems are found in early childhood only among the highest-risk children; differences are not found across conditions until 2 years later, when children in control schools develop behavior problems. It is possible, therefore, that if followed over a longer period of time, differences on externalizing and internalizing problems may be found. It is also possible that *PD* alone (without the *Programs for Parents and Students*) might be insufficient to reduce mental health problems among Ugandan children.

In addition to these issues of timing and measurement, we note several additional limitations. First, the study randomized a small number of schools and includes only a subset of students/families. Schools expressed interest in the EBI and had relatively high positive leadership scores. Therefore, future studies need to consider a broader range of school resources and leadership support to better understand the generalizability to the larger school system. *Second*, the family sampling approach was based on "random" selection procedure conducted by teacher and was not based on a true random sampling procedure, which could not fully exclude potential sample selection bias. *Finally*, although teachers described less reliance on severe physical discipline practices after *PD* (compared to cultural norm), we did not systematically measure physical discipline use (i.e., hitting with cane or stick) across both conditions. Given that violence against children is an important problem in Uganda, future studies should more comprehensively evaluate EBI on this common cultural practice.

Implications for Implementation Science This study addresses critical mental health service and implementation research gaps in SSA settings in several ways. First, this study addresses critical teachers' knowledge, practice, and school mental health resources gaps. This study was conceptualized with an ultimate goal of providing a multi-component early childhood mental health EBI in low-income country communities, and systematically building Ugandan mental health professional and teacher capacity for service implementation. As the first step in transporting the EBI, this study tested one component of the intervention and simultaneously evaluated the feasibility of a distance capacity-building approach to support Ugandan mental health professionals and teachers. Results support the feasibility of our approach and teachers' capability of utilizing EBPs within and outside of the classroom. We are currently testing a task-shifting approach to the facilitation of the *Program for Parents* in Uganda.

Second, this is one of the few studies to evaluate the applicability of implementation constructs in low-income countries. Our study not only provides new psychometric evidence for applying such constructs but also contributes to characterizing implementation environments in low-income country settings. For example, we found most teachers had positive attitudes toward EBPs, suggesting acceptability of EBPs in Ugandan communities, and likelihood of successfully transporting EBIs to low-income country contexts.

This study was guided by the Ugandan Child and Adolescent Mental Health Policy (in collaboration with the Ugandan Ministry of Health and Ministry of Education) and implementation science frameworks. This allowed us to capture rich data on implementation contexts, and provides the foundation for systematic evaluation of impacts of implementation contexts on EBP implementers (teacher) and consumers (children and families). Considering the context of local mental health policy has also ensured our capacity and implementation approaches are in line with country policy and needs. Although the focus of this study was mainly on impact evaluation, the contextual data on CFIR domains will enable us to study the influence of contextual factors on implementation outcomes and to test mechanisms of implementation in future studies.

Conclusion

Findings of this study support the feasibility of transporting existing early childhood mental health promotion EBIs to low-income country settings. Lessons learned from this study can be applied to implemenation of similar public health approaches toward EBIs in other low-income countries.

Compliance with Ethical Standards

Funding This study was funded by the National Institutes of Health (R21MH097115-01A1).

Conflict of Interest The authors declare that they have no competing interests.

Ethical Approval The ethics related to this study was approved by the Institutional Review Boards of New York University School of Medicine (IRB No. S13-00362), Makerere University (IRB No. SBS110), and Ugandan National Science and Technology (IRB Nos. SS3194 and SBS132).

Informed Consent The study involved human participants. All participants, including mental health professionals, school principals, teachers, and parents, were consented prior to the study.

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