

Duet: An Exploratory Language Intervention for Toddlers in Low-Income Households

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Preventative parent-coaching programs can improve early interaction quality, language skills, and academic outcomes for children experiencing economic adversity. Using a community-based participatory research framework, we piloted Duet, a preventative, parent-implemented, early language intervention. We assigned home visitors to provide Duet or standard-of-care services to 23 children (aged 1; 0-2; 3; 9 Duet, 14 control) and their parents. We used odds ratios to describe the likelihood of improvement. The Duet group had greater odds of improvement than the control group for parent developmental knowledge (moderate effect size), self-efficacy (moderate effect size), parent-child interaction (moderate effect size), and child's language (weak effect size). The preliminary Duet data are promising. Limitations included

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recruitment and retention in the community setting. Future research will explore Duet's efficacy, effectiveness, and scalability. **Key words:** *child's language, community-based participatory research, early intervention, parent coaching, socioeconomic status*

EARLY LANGUAGE skills robustly predict later language, academic, social, and health outcomes (Pace, Alper, Burchinal, Golinkoff, & Hirsh-Pasek, 2019; Hoff, 2013). Mounting research demonstrates the importance of frequent, high-quality, adult-child interactions in supporting language skills for children younger than 5 years (Cartmill et al., 2013; Romeo et al., 2018; Rowe, 2012; Song, Spier, & Tamis-LeMonda, 2014). As child language trajectories are relatively stable by 4 or 5 years of age (Bornstein, Hahn, & Putnick, 2016), intervention during the birth to 3-year period is critical.

Parent-implemented early language intervention is an evidence-based, family-centered, service delivery model to improve dyadic interaction quality and child's language skills (Roberts, Curtis, Sone, & Hampton, 2019). Involving parents in early language intervention can increase child's engagement, dosage, generalizability, and treatment efficiency by leveraging established relationships and enhancing daily interactions (Roberts et al., 2019). Parent-implemented intervention may be used to treat identified communication delays and disorders as well as preventatively based on child- or family-level risks. Despite potential advantages, families who might benefit most from preventative, parent-implemented intervention (e.g., those experiencing economic adversity) are often systematically underserved (Justice, Chen, Jiang, Tambyraja, & Logan, 2020; Manz, Hughes, Barnabas, Bracaliello, & Ginsburg-Block, 2010). To reduce systemic inequity, the present study describes a community-based participatory research (CBPR) project to design and pilot a preventative, parent-implemented early language intervention, Duet, for families experiencing economic adversity.

Involving parents as agents of intervention to shape early interaction is consistent with a bioecological model of development (Bronfenbrenner & Morris, 2007). Develop-

mentally and individually scaffolded, reciprocal interactions between a child and its environment are critical to language development within bioecological theory. Within a bioecological framework (Bronfenbrenner & Morris, 2007) early language intervention supports the child's interactions with its environment and shapes the developmental trajectory.

Preventative early language interventions need to identify and target children and families with the greatest needs. Research has identified individual characteristics and contextual factors that are negatively associated with early interaction quality and child's language skills (Adamson, Bakeman, Suma, & Robins, 2019; Hoff, 2013; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010; Rowe, 2018). These include characteristics of children (e.g., developmental disorders) and parents (e.g., low developmental knowledge and self-efficacy; Alper, Hurtig, & McGregor, 2020; Rowe, 2008). Contextual factors such as economic adversity—including low household income—have also been associated with discrepancies in interaction quality and child's language skills (Hoff, 2013).

Economic adversity—often quantified by low household income or socioeconomic status (SES)—was the main risk factor of interest for this study because of its high prevalence and long-term, negative impact on group-level language outcomes (Hart & Risley, 2003; Hoff, 2013; Huttenlocher et al., 2010; Rowe, 2018). As of 2016, approximately 22% of children birth to 3 years of age in the United States were living in poverty (i.e., based on 100% of federal poverty level; United States Census Bureau, 2016). Despite family heterogeneity, low SES and associated adversity have been repeatedly linked with group-level low early language interaction quantity and quality (Hart & Risley, 2003; Huttenlocher et al., 2010; Rowe, 2018). Early interaction quality—including language-rich joint engagement and attention—can help buffer against early adversity and support child's

language outcomes regardless of SES (Hirsh-Pasek et al., 2015). There is a significant public health need to support early language interaction quality for families with low SES.

To address the SES-related risk, preventative parent-implemented interventions have been developed to improve parents' awareness and support of early language development. Some interventions focus on language input quantity by encouraging parents to talk more with their children. Parents in these interventions receive feedback on the amount of child-directed language they produce (e.g., Thirty Million Word Initiatives; Suskind et al., 2016). Other interventions focus on engaging parent-child dyads in language-learning activities such as shared reading (Levin & Aram, 2012). Recently, interventions increasingly emphasize the quality of early language interactions. Typically, these interventions target parent's language input that is contingent and responsive to children's communication attempts (e.g., Play and Learning Strategies [PALS] intervention, Landry, Smith, & Swank, 2006; Landry, Smith, Swank, & Guttentag, 2008; Video Interaction Project, Mendelsohn et al., 2007, Weisleder et al., 2016) as well as rich in cognitive stimulations such as open-ended questions (e.g., Dialogic Reading; Lonigan & Whitehurst, 1998; Valdez-Menchaca & Whitehurst, 1992).

Despite the potential benefits, there is evidence that early language interventions may be less effective for families experiencing economic adversity. Many family-based, early language and literacy interventions have shown large effect sizes for children in middle-income households but negligible effects for those in minoritized groups or low-income households (Justice et al., 2020; Manz et al., 2010). Early interventions must be responsive to the specific strengths and needs of families, including SES, cultural, and linguistic differences, to ensure intervention effectiveness. Often, families who might have the greatest need for support encounter the greatest barriers to accessing services. A recent implementation science study using survival analysis showed that families

with lower income were less likely to complete the entire training (Justice et al., 2020). These findings demonstrate the critical need for researchers and interventionists to access hard-to-reach families, construct ecologically valid training targets, and deliver culturally appropriate services (Dumas, Arriaga, Begle, & Longoria, 2010; Prinz & Sanders, 2007).

One innovative approach to address this need is CBPR. Traditional interventions are often designed by researchers and carried out in the community. Conversely, the CBPR model requires researchers and community members to jointly engage on all the stages of the project from intervention design, materials development, implementation, and dissemination (Community Health Scholars Program, 2002). CBPR is done *with* rather than *on* the community. Community members work with the academic team to identify strengths and needs, generate research questions, develop protocols, and interpret findings. Benefits of CBPR can include enhancing the trust between researchers and the community, facilitating stakeholder participation, and increasing the cultural relevance, effectiveness, and sustainability of the intervention (O'Fallon & Deary, 2002; Shalowitz et al., 2009). The CBPR approach has been adopted in various public health programs (e.g., smoking cessation, HIV and obesity/diabetes prevention; Andrews et al., 2012; Davison, Jurkowski, Li, Kranz, & Lawson, 2013; Rhodes et al., 2011), but it is novel to early language intervention studies (Luo et al., 2019).

In the present study, we developed and implemented an early language intervention, Duet, through the CBPR process. Duet was designed as a preventative intervention for children whose language development was at risk due to low SES. Duet is similar to other early interventions, such as PALS (Landry et al., 2012), and the Thirty-Million Words Project (Suskind et al., 2016), in that it targeted 1- to 2-year-old children in low-SES households and provided a relatively low dose of parent training. Like PALS and Thirty-Million Words Project,

Duet was implemented in homes, delivered content via video-based educational modules, and provided opportunities to practice trained strategies and receive interventionist feedback (Landry et al., 2012; Suskind et al., 2016).

Nonetheless, its CBPR approach distinguishes Duet from traditional interventions (Luo et al., 2019). The Duet research-community team jointly obtained funding, designed the study, developed materials, implemented the intervention, and is disseminating the findings. For example, community partners provided extensive feedback on the parent-training modules so that the content would be relevant to the target population. Families with low SES from the community also contributed videos for the training materials (Luo et al., 2019). Moreover, Duet's integration into the community organization's services allowed it to reach families experiencing significant early adversity. An extensive description of the CBPR process and lessons learned during is provided in Luo et al. (2019).

OBJECTIVES

The present study is a pilot, proof-of-concept intervention. Its purpose is to describe preliminary assessments of the efficacy of Duet, a home-based, early intervention for children 12–24 months of age who were at risk for poor language development based on low SES. We compared Duet with the standard-of-care home-visiting services. Specifically, we asked whether participating in Duet improved (a) parent's knowledge of child's development and self-efficacy, (b) parent-child interaction quality, and (c) child's language. We predicted that dyads in the Duet group would make greater gains in knowledge of child's development, self-efficacy, interaction quality, and child's language and personal-social skills than the standard-of-care group. Finally, we evaluated parent's satisfaction with participation in Duet.

METHODS

This study was a pilot, randomized clinical trial conducted using CBPR. Specifically, the research team included developmental and clinical scientists with academic appointments as well as members of a local community organization providing home-visiting services. The community partner members of the research team included staff across organizational levels (i.e., administrators, program directors, and home visitors). The community organization's services outside of the study focused on support for caregivers—especially mothers—and children from pregnancy through 2 years of age. The CBPR team was formed to write the initial grant proposal. The full research team (i.e., community partners and university-affiliated scientists) participated in all phases of the project including obtaining funding, intervention and study design, materials development, implementation, and evaluation. For example, all intervention modules were reviewed jointly by the full research team to ensure cultural appropriateness of the interaction examples provided. The collaboration and development process is described in depth in a cowritten article about lessons learned (Luo et al., 2019).

The research was approved by the masked institutional review board (#22638) and parents provided informed consent before enrolling. We followed the CONSORT guidelines for describing the trial and its outcomes (see Supplemental Digital Content materials (S3), available at: <http://links.lww.com/IYC/A30>, for checklist; Schulz, Altman, Moher, & CONSORT Group, 2010).

Participants

Thirty-nine families were recruited from a community-based, home-visiting organization that provides services to families in low-income, high-risk neighborhoods in Philadelphia, Pennsylvania. To be eligible, parents had to be either English-speaking or Spanish-English bilingual and be able to receive services in English. We asked parents

the extent to which they had difficulty reading newspapers, medication directions, food labels, and receipts in English (one: yes, two: sometimes, and three: no). Most participants reported no difficulty (average score across the four items: $M [SD] = 2.85 [0.46]$). One parent reported having difficulty on all the items; one parent reported difficulty reading medication directions; and three parents reported sometimes having difficulty reading newspapers. All written materials were presented with audio, in-person explanations, or both to support comprehension regardless of reading skills. Based on the feedback we received from MCC advocates, our intervention materials met the participants at their level of English-listening skills.

Children had to be at least 12 months of age at enrollment (enrollment and data collection occurred from 2016 to 2018). All participating parents were mothers, which was representative of the existing home-visiting services, although our criteria did not exclude other primary caregivers.

Advocates and Duet-standard care assignment

Our intent was to assign about half the families to receive Duet, half to receive standard care, with the constraint that families in the two groups and their advocates—the term used by the community organization for the home visitors—would have similar characteristics. Advocates typically provided services to several families. Consequently, we assigned advocates and the families they served to either Duet or standard-of-care groups. Family-level assignment was neither realistic nor acceptable within the culture of the existing home-visiting model because it would have required an advocate to use their Duet training for some families and not others on their caseload.

To select which advocates would receive Duet training, one of the authors (R.B.) wrote a computer program that generated all possible assignments of advocates to the Duet and standard-of-care groups and then selected the assignment that made family and advocate characteristics—including the family's

ethnicity, the language the mother used with the child, the mother's age and educational level, and the advocate's years of training—most comparable across the two groups. The data provided by the computer program were based on advocates' estimates of their eligible families and those families' characteristics. Initially (September 2016), we provided the program with details for 21 advocates and their 57 families. The program then selected the most optimal of the 352,716 possible Duet-standard care assignments, which allowed us to begin advocate training. We then turned to family recruitment, but several circumstances thwarted our intent to assemble comparable groups. Not all families met our inclusion criteria and of those who did, some had dropped out of the home-visiting program and others chose not to participate. Some advocates were left with no eligible and interested families; other advocates had left the agency. These circumstances necessitated a second round of enrollment. In March 2017, we provided the program with details for an additional 20 advocates and their 106 families (184,756 possible assignments). Again, the same challenges thwarted our intent for balance, but we had sufficient advocates and families to continue.

Ultimately, we were left with seven advocates and their 17 families assigned to Duet and 12 advocates and their 22 families assigned to standard of care. Usually, one caregiver and one child in each family was enrolled, except for twins, in which case both children were enrolled (one set in each group). Thus, there were 18 children in the Duet group and 23 children in the standard-of-care group.

Attrition and characteristics of final sample

Of the baseline sample, eight families with nine children in the Duet group (with six advocates) and 13 families with 14 children in the standard-of-care group (with 10 advocates) finished the study; analyses of their data are reported here. On average, each advocate worked with 2.2 families (range = 1–5).

Attrition was due to families dropping out of the home-visiting services, moving, or using a language other than English or Spanish (see participant flow in Supplemental Digital Content materials (S1), available at: <http://links.lww.com/TYC/A28>). The research team was in direct contact with the advocates, but not the participating families, which limited our ability to do direct outreach for retention. A full-time research staff maintained detailed records on each home visit between the baseline and the follow-up

data collection and provided support to advocates when they had questions about the delivering the intervention or any concerns about the families.

Descriptive statistics for the final sample of 23 children and 21 parents are given in Table 1. All families reported household income below 200% of the federal poverty line. More than half of the families in each group reported household income that also fell below 100% of the federal poverty line (United States Census Bureau, 2019).

Table 1. Demographic Characteristics for Families That Completed Follow-Up

Variable	Group ^a		Statistic		
	Duet	Standard-of-Care	<i>p</i>	Effect Size ^b	Effect Category
Mother baseline age (years)	29.0 (8.72)	31.4 (12.0)	.62	.11	Small
Child baseline age (months)	21.9 (4.85)	18.4 (3.50)	.057	.40	Medium
Child follow-up age (months)	30.3 (4.32)	24.8 (5.03)	.013	.51	Large
Male child (<i>df</i> = 1)	4 of 9 (44%)	9 of 14 (64%)	.35	.20	Small
Mother married (<i>df</i> = 1)	3 of 8 (38%)	4 of 13 (31%)	.49	.34	Medium
Mother employed (<i>df</i> = 1)	0 of 8 (0%)	3 of 13 (23%)	.22	.38	Medium
Mother foreign born (<i>df</i> = 1)	6 of 8 (75%)	4 of 13 (31%)	.049	.43	Medium
Mother's education (<i>df</i> = 3)	-	-	.97	.09	Nil
Less than high school	2 (25%)	3 (23%)			
High school	3 (38%)	5 (38%)			
GED or some college	2 (26%)	4 (31%)			
Associate's or bachelor's degree	1 (13%)	1 (8%)			
Annual household income (<i>df</i> = 2)	-	-	.30	.34	Medium
<\$25,000	4 (50%)	8 (62%)			
\$25,000 to \$50,000	4 (50%)	3 (23%)			
Unknown/did not answer	0	2 (15%)			
Race and ethnicity (<i>df</i> = 3)	-	-	.17	.49	Medium
African American	1 (13%)	6 (46%)			
Non-White Hispanic	7 (88%)	5 (38%)			
White	0	1 (8%)			
White Hispanic	0	1 (8%)			
Home language (<i>df</i> = 2)	-	-	.18	.40	Medium
Only/mostly English	2 (25%)	8 (62%)			
Only/mostly Spanish	5 (63%)	3 (23%)			
English and Spanish	1 (12%)	2 (15%)			

Note. For Duet and Control groups, respectively, *n* = 8 and 13 for mother and household variables and 9 and 14 for child variables (i.e., statistics are for families that completed follow-up).

^aGroup statistics are means (*M*s) with standard deviations (*SD*s) within parentheses for age variables, frequencies, and percentages otherwise.

^bEffect sizes are point-biserial correlations for ages, phi correlations for *df* = 1 variables, and Cramer's V otherwise.

Otherwise, the groups differed, although the only demographic difference that reached statistical significance at baseline was foreign-born status. Table 1 reports baseline and follow-up characteristics of the analysis sample (i.e., families who completed follow-up). Thus, for Duet and Control groups, $n = 8$ and 13 for mother and household variables; $n = 9$ and 14 for child variables.

In the Duet group, on average and compared with the standard-of-care group, children were older (medium effect at baseline, strong effect at follow-up): less often male (weak effect). Mothers in the Duet group, on average and compared with the standard-of-care group, were younger (small effect), more often married, less often employed, more often foreign born, reported less household income, were primarily non-White Hispanic (the standard-of-care group was almost evenly split between African American and non-White Hispanic), and spoke mostly Spanish in home (all medium effects). However, the mothers' education levels were similar (see Table 1). The difference in foreign born (75% vs. 31%) was statistically significant. The other statistically significant effect is of concern; at follow-up the average age of children in the Duet group was 30.3 months compared with 24.8 months for the standard-of-care group (and the effect at baseline was marginally significant, $p = .057$). Individual differences in follow-up time lines contributed to the smaller age gap at baseline. Thus, where warranted, we included child's age as a covariate in subsequent analyses. All families had to be English monolingual or English–Spanish bilingual and able to receive services in English. Five of 8 parents in the Duet group reported that they used only or mostly Spanish when interacting at home with their families. The Duet parent-training modules for the advocates were in English, but we assessed children in English or English and Spanish based on parent-reported home language exposure.

Attrition analyses using t tests and χ^2 tests indicated that families with and without follow-up data did not differ in child age, child gender, language spoken by the

child, parent age, ethnicity, educational level, marital status, employment status, or annual household income. However, parents with follow-up data were more likely to be foreign born (48% vs. 13%) and speak Spanish (38% vs. 0%) or both English and Spanish (14% vs. 0%) at home, compared with those who dropped out of the study.

Advocate characteristics

All 16 advocates were female. Approximately 47% of them self-identified as African American, 40% as Hispanic/Latina, and 13% as White. More than two-thirds (73%) of the advocates were born in the United States. Most advocates had a bachelor's degree (53%) or a graduate degree (23%) and the rest had some college or lower level of education. On average, the advocates had been working at the home-visiting organization for 2 years ($M = 2.04$, $SD = 2.70$) and had been working in the field of early childhood education/parent education for 10 years ($M = 10.3$, $SD = 8.82$). Advocates in the Duet and standard-of-care groups did not differ statistically on any of the background variables just mentioned (p values $> .45$).

Duet design and advocate training

Duet was designed to be implemented over six, 45-min sessions during regularly scheduled home visits every 2 weeks. This was consistent with the usual visit schedule for the standard-of-care home visits. Compared with many parent-implemented interventions (Heidlage et al., 2020; Roberts et al., 2019), Duet was designed as a low-dosage intervention with only around 5 hr of contact time across six sessions. Duet focuses on five principles, which were developed by synthesizing extensive evidence on high-quality early communication and how it supports language development. Specifically, the parent-training modules aim to increase parent developmental knowledge (General Awareness module); encourage frequent, contingent, and reciprocal interaction across contexts (Creating Opportunities and Conversational Duets modules); and promote individualized scaffolding to support child's

language development (Scaffolding and Harmonizing modules; e.g., Hirsh-Pasek et al., 2015; Romeo et al., 2018; Tamis-LeMonda, Custode, Kuchirko, Escobar, & Lo, 2019). Session order, principles, and strategies are described in the Supplemental Digital Content materials (S2), available at: <http://links.lww.com/TYC/A29>.

One video module was designed to demonstrate each principle, except for “Conversational Duets,” which was split in two. The modules were shown to parents on electronic tablets during home visits. Copies of Duet intervention video modules are available upon request. Furthermore, the authorship team is developing a publicly available website to share the intervention modules.

Each session included review of previously discussed strategies and goals (5 min), a new module (15 min), practice during naturalistic interaction (10 min), individualized video feedback (10 min), and goal setting (5 min) using motivational interviewing techniques (Miller & Rollnick, 2013). For example, during the first Conversational Duets session, the advocate would review the content and goals identified during the prior Creating Opportunities practice with the parent. The advocate and the parent would then jointly view the Conversational Duets: Part I module on a tablet. The modules have built-in stopping points, when advocates asked the parents comprehension questions, discussed the content, and posed prompting questions (e.g., “How do you know if your child is interested in something?”). The advocates and researchers formulated these questions during training. After viewing the module, the advocate would record the parent and the child practicing the Conversational Duets strategies during an activity of the family’s choice (e.g., snack time). The advocate and the parent would then review the video footage to identify successful use of the target strategies and opportunities to try for the next time. Finally, the advocate and the parent would work together to identify opportunities for practice of the Con-

versational Duets strategies before the next session.

The modules follow an animated, stick figure family of a toddler, older sibling, and several adult caregivers who modeled high-quality interactions during daily activities. The first module, General Awareness, is narrated by the mother character, who is voiced by one of the community partners. The other modules are narrated by the older sibling, who describes the interactions between the caregivers and the toddler. We chose the sibling as the primary narrator, because we thought that participants might see this character as less prescriptive than a mother (Luo et al., 2019).

The modules include real-life video examples (e.g., a discussion about cereal during breakfast) and interactive activities (e.g., selecting the next response in a caregiver-child exchange) that do not require specific books or toys. During module development, we collaborated with our community partners to ensure that the videos and activities would be ecologically valid and culturally relevant for participant families. For example, we developed examples of high-quality, caregiver-child interaction on public transit because this was a common daily activity reported by our community partners.

During the naturalistic interaction practice, the advocates helped parents incorporate the strategies they just learned into an everyday activity such as snack time. The specific interaction context was selected on the basis of the family’s preference. These interactions were recorded on a tablet and used for video feedback during the session. The parents also had opportunities to ask questions and reflect on their own behaviors while reviewing the recording with the advocates. At the end of the session, advocates left the family with a one-page handout that included a sentence summarizing the module key points, a module snapshot, and a goal to target. Advocates and parents worked together to create individualized goals focusing on how that week’s strategies could be implemented during daily interactions outside of the visit.

Training for advocates in the Duet group was jointly delivered by researchers and community partners over three to four, 4-hr days. During training, the advocates learned the importance of and strategies to support early language skills. Training included reviewing the Duet modules as well as engaging in discussion with the researchers, community partners, and other advocates. For each Duet module, the advocates practiced introducing the key principles in their own words and developed a list of prompting questions to engage the families. This process ensured that the advocates had adequate knowledge about the intervention principles, as well as allowed them to make the intervention materials relatable to the participating families. The advocates further learned and practiced how to provide individualized, constructive feedback on parent–child interactions. They watched videos of parent–child interactions, discussed how to apply the intervention principles to the specific interactive context, and role-played their interactions with the caregivers. The trainers observed and moderated the role-play sessions. For each Duet module, there were multiple rounds of role-play sessions until both the advocates and the trainers agreed that the advocates correctly identified the caregivers' strengths and areas for improvement and provided feedback consistent with the intervention principles. Finally, the advocates learned motivational interviewing techniques to facilitate goal setting with the parents.

Standard of care services

The control group received the standard-of-care home-visiting services from the community organization. The specific content of these services varied by program (e.g., Healthy Start, Early Head Start, and Healthy Families America) and individual needs. However, common topics included breastfeeding, general developmental expectations, parent–child relationships, and connecting families with resources (e.g., health care, food, and housing). Sessions generally followed the same schedule as Duet (i.e., every 2 weeks)

and lasted around 1 hr each. Upon study completion, we provided the Duet materials to the community organization to share with all families.

Importantly, all families—Duet and standard of care—were enrolled in the community organization's home-visiting services prior to their study participation. During the study, the Duet group also continued receiving their standard home-visiting content. Specifically, the advocates, with the research team's help, integrated the Duet content into ongoing home-visiting sessions. The content was designed to be integrated to fit into the same amount of time as a standard-of-care visit. Thus, both groups experienced the variability in content of the standard-of-care services.

Measures

Research assistants, who were masked to group membership, collected baseline and follow-up data in participants' homes. All research assistants had experience working with young children and their families, received rigorous training on the data collection protocol, and were observed in practice sessions by some of the authors. All listed measures were collected at both baseline and follow-up. For Duet and standard-of-care groups, respectively, the time between visits averaged 8.8 and 6.7 months, a medium effect ($d = 0.70$; thresholds for small, medium, and large effects are 0.20, 0.50, and 0.80; Cohen, 1988).

Developmental knowledge

We used a 58-item adaptation (Center for Prevention Research and Development, 2016) of the Knowledge of Infant Development Inventory (KIDI; MacPhee, 1981). This true–false questionnaire assesses developmental knowledge across domains—language, motor, cognitive, social, and behavior. KIDI scores have been associated with child's language outcomes in racially, ethnically, and socioeconomically diverse samples (Huang, O'Brien Caughy, Genevro, & Miller,

2005; Rowe, 2008). Higher scores correspond to greater developmental knowledge.

Self-efficacy

We used the “teaching” and “play” subscales of the Self-Efficacy for Parenting Tasks-Toddler Scale (SEPTI-TS; Coleman & Karraker, 2003) to assess efficacy perceptions. The subscales contain 16 statements (e.g., “I find it hard to loosen up and just play with my child”) that parents rated on a five-point Likert scale from strong disagreement to strong agreement. Inverted statements were reversed for scoring; a higher score corresponds to greater self-efficacy (Coleman & Karraker, 2003). Cronbach’s α value for the SEPTI-TS across subscales in our sample was 0.81 (95% confidence interval [0.72–0.91]; Alper et al., 2021). Thus, our observed internal consistency was comparable with the α values of 0.73 for teaching and 0.92 for play reported from the original scale development (Coleman & Karraker, 2003).

Interaction quality

We assessed parent-child interaction quality, including use of trained Duet strategies, using an adaptation of the three-boxes task (Hirsh-Pasek et al., 2015). The task included three, 5-min segments—book sharing, imaginative play, and a daily life activity. First, we gave dyads a minimal-text picture book and instructed them to engage as they normally would. Then, we provided them a toy food and kitchen set and instructed them to play with it, however, they wanted. Finally, we instructed them to put away the toys with which they had been playing. This task was designed to simulate the daily activity of cleaning up, which community partners described as a common interaction.

Observers rated parent-child interaction using four items from the Joint Engagement Rating Inventory (JERI; Adamson, Bakeman, & Suma, 2020). These four items were selected because they were foundational to the development of the Duet principles—thus, the JERI item ratings reflected parents’ use of trained strategies. Each item was rated during each of the three tasks on a 1–7 scale

where higher ratings reflect more time spent in high-quality interaction. The *total joint engagement* rating assesses the amount of time the parent-child dyad shares attention to an object or event (e.g., book sharing). The *symbol-infused joint engagement* rating characterizes the quantity and quality of bouts of joint engagement during which the child and the parent focus on the shared event as well as words or iconic gestures (e.g., saying “cat” while sharing a cat picture). The *routines and rituals* rating reflects the extent to which dyads engage in scripted interactions (e.g., preparing breakfast). The *fluency and connectedness* rating describes flow between turns and the balance between the partners’ contributions (e.g., the child and the parent take turns while cooking pancakes). The total score was the sum of the four ratings after averaging across the three tasks (range = 4–28).

To assess agreement, two observers, who were researchers in the field of early language development and received more than 40 hr of training, rated the four JERI items. Both observers were masked to group membership and time point. Twenty-four videos (20% of the corpus) were double coded for reliability. The raw agreement was 79% for *total joint engagement*, 100% for *symbol-infused joint engagement*, 88% for *routines and rituals*, and 83% for *fluency and connectedness*. We calculated weighted kappa (Cohen, 1968) and its corresponding estimated observer accuracy pooling over the four items (because the score we analyzed was the sum of the four ratings). Consistent with previous articles with these items (Hirsh-Pasek et al., 2015), we coded ratings within one scale point as an agreement. The overall weighted kappa across the 96 reliability ratings was 0.75, with an estimated observer accuracy of 93%. This means that simulated observers would need to be 93% accurate to produce a kappa of this magnitude under these circumstances (see Bakeman, 2023).

Child’s language

We used direct assessment to characterize children’s language skills. The Preschool

Language Scales-Fifth Edition—English and Spanish versions (PLS-5; Zimmerman, Steiner, & Pond, 2011, 2012)—is a norm-referenced, standardized, direct child language assessment of receptive and expressive language. English monolingual children were assessed using the English version (Zimmerman et al., 2011). Research assistants assessed children who were exposed to only Spanish or Spanish and English at home using the bilingual protocol (Zimmerman et al., 2012). We used the total language standard scores in our analyses.

Duet satisfaction ratings

Parents who completed Duet training were asked to complete a study-specific satisfaction survey. Parents were asked to rate their agreement with eight statements on a 5-point Likert scale from 1 = “strongly disagree” to 5 = “strongly agree.” Specifically, parents rated their agreement with the following statements: (1) “I enjoyed participating in The Duet Project”; (2) “My child enjoyed participating in The Duet Project”; (3) “I learned new things about the importance of talking and communicating for my child’s development through The Duet Project”; (4) “I learned new ways to talk and communicate with my child by participating in The Duet Project”; (5) “It is easier for me to find ways to communicate with my child during daily activities (e.g., cooking, doing laundry) after participating in The Duet Project”; (6) “I have more fun playing with my child after participating in The Duet Project”; (7) “My child benefitted from participating in The Duet Project”; and (8) “The things I have learned while participating in The Duet Project have improved how I communicate and talk with my other children.”

Statistical methods

We report effect sizes for all statistical tests because it is a recommended practice (Wilkinson & The Task Force on Statistical Inference, 1999), and because small *N*s—as in this study—make small *p* values unlikely. For group comparisons, we report point-biserial correlations (equivalent to *t* tests) for continu-

ous variables, phi for single degree of freedom (*df*) categorical variables, and Cramer’s *V* for other categorical variables. Thresholds for small, medium, and large effects are .10, .30, and .50 absolute for correlations (including phi; Cohen, 1988) and for Cramer’s *V* when the number of rows or columns is 2, as here (see Zaiontz, 2021).

Because children in the Duet group were older at both baseline and follow-up than children in the standard-of-care group, on average, child’s age was used as a covariate. Age correlated .56 and .46 with parent-child interaction and $-.60$ and $-.25$ with child’s language at baseline and follow-up, respectively (the negative correlations indicate that on this standardized language measure children in this sample were falling further behind with age). Mothers’ developmental-knowledge and self-efficacy scores were not adjusted; child’s age correlated .01 and $-.06$ with developmental knowledge and $-.03$ and .04 with self-efficacy, at baseline and follow-up, respectively.

To examine group differences in the likelihood of improvement from baseline to follow-up, we report odds ratios—an effect-size statistic much used in epidemiology but less so in psychology—here that compare the odds of improving given Duet to the odds of improving given standard of care. Odds ratios greater than 1.25, 2.00, and 3.00 (or <0.080 , 0.50, and 0.33) represent small, medium, and large effects, respectively (Bakeman & Quera, 2011).

Treatment fidelity

Advocates in both groups recorded the date of, general content covered during, duration of, and any notes related to each visit in a paper log. Duet advocates also recorded which module they covered and whether they completed the associated activities (e.g., practice and video feedback). Advocates reported that families who finished the study completed on average five of six Duet modules. To check the validity of advocates’ logs, we asked advocates to audio record one visit with each of their enrolled families. Of

the seven recordings we collected, the agreement between paper logs and recordings was high (89%, 31 of 35 tasks; seven recordings \times five activities per session), confirming the accuracy of advocates' logs.

RESULTS

Our hope for this pilot study was to show that mothers and children who received Duet improved more than those who received standard-of-care services. Given the small number of mothers and children ultimately involved, conventional statistical significance was highly unlikely. Thus, we focused on the size of the effects we observed with respect to four variables—developmental knowledge, self-efficacy, interaction quality, and child's language. We focused on individual statistics—how many mothers and children improved—and not on group means because the latter can obscure individual-level effects. See Table 2 for details.

Parent's knowledge and self-efficacy

Knowledge of development, as assessed with the KIDI (MacPhee, 1981), increased for more mothers in the Duet than in the standard-of-care group. The odds of an increase were 5:2 in the Duet group and 6:7 in the standard-of-care group. The resulting odds ratio was 2.92, a medium effect just below the threshold for a strong effect. Self-efficacy perceptions, as assessed with the SEPTI-TS (Coleman & Karraker, 2003), likewise increased for more mothers in the Duet than in the standard-of-care group. The odds of an increase were 4:4 in the Duet group and 4:9 in the standard-of-care group. The resulting odds ratio was 2.25, a medium effect.

Parent-child interaction quality and child's language

The quality of mother-infant interaction (Bakeman & Quera, 2011) increased for more mother-child dyads in the Duet than in the standard-of-care group. The odds of an increase were 7:2 in the Duet group and 7:4 in the standard-of-care group. The resulting odds

ratio was 2.0, which just meets the threshold for a medium effect. The child's language, as assessed with PLS-5 (Zimmerman et al., 2011), again increased for more children in the Duet group than in the standard-of-care group. The odds of an increase were 5:3 in the Duet group and 7:7 in the standard-of-care group. The resulting odds ratio was 1.67, a small effect.

Duet satisfaction surveys

Families reported high satisfaction levels with their experiences participating in Duet. Two-thirds of Duet parents who finished the study completed the survey. All parents agreed or strongly agreed that (a) they and their child enjoyed the intervention, (b) they learned more about the importance of talking to their child for development, (c) they learned new ways to talk and communicate with their child, (d) it was easier for them to find ways to communicate during daily life activities, (e) their child benefitted from participating, and (f) they shared what they learned with the other adults in their lives (e.g., relatives and friends). Four of the six parents reported that they had more fun playing with their child after participating in Duet; five of six reported that what they learned through Duet also improved how they communicated with their other children. There were no suggested changes to the Duet content, but one parent indicated that more sessions might be helpful.

DISCUSSION

Training focused on improving communication interaction quality can support positive parenting beliefs, perceptions, and behavior to improve language outcomes for children at risk. Clinical researchers have developed and tested many parent-implemented early interventions—with potential advantages including naturalistic interaction contexts, child engagement, increased dosage, efficiency, and generalizability (Heidlage et al., 2020; Roberts et al., 2019). However, many barriers—including inequitable

Table 2. Statistics for Key Variables at Baseline and Follow-Up

Variable	Group						Statistic	
	Duet		Standard-of-Care					
	Baseline, <i>M (SD)</i>	Follow-Up, <i>M (SD)</i>	No. and Percentage Who Increased	Baseline, <i>M (SD)</i>	Follow-Up, <i>M (SD)</i>	No. and Percentage Who Increased		Odds Ratio
Developmental knowledge ^a	41.0 (2.8)	41.6 (3.3)	5 of 7 (71%)	40.5 (4.2)	41.9 (6.4)	6 of 13 (46%)	2.92	0.41–20.9
Self-efficacy ^b	81.0 (10.5)	81.4 (9.3)	4 of 8 (50%)	78.6 (12.1)	78.2 (12.7)	4 of 13 (31%)	2.25	0.36–13.9
Interaction quality ^c	10.3 (1.5)	12.6 (1.6)	7 of 9 (78%)	9.6 (2.1)	12.5 (2.8)	7 of 11 (66%)	2.00	0.27–14.7
Child language ^d	87.2 (11.0)	89.2 (9.5)	5 of 8 (63%)	88.3 (14.5)	88.11 (13.0)	7 of 14 (50%)	1.67	0.28–9.82

Note. Numbers for mother and child variables vary due to missing data. CI = confidence interval.

^aSee MacPhee (1981); *n* = 7 and 13 for Duet and control groups, respectively.

^bSee Coleman and Karraker (2005); *n* = 8 and 13 for Duet and control groups, respectively.

^cSee Adamson et al. (2020); *n* = 9 and 11 for Duet and control groups, respectively.

^dPLS-5 total score, see Zimmerman et al. (2012); *n* = 8 and 14 for Duet and control groups, respectively.

early-childhood resource distribution, scalability, and access to the families who need the most support—limit parent-training effectiveness (Justice et al., 2020; Manz et al., 2010; Mol, Bus, de Jong, & Smeets, 2008; Prinz & Sanders, 2007).

To address these challenges, we developed and piloted Duet—an early communication parent-training program emphasizing high-quality early language interaction in daily life. Duet emphasized interaction quality over quantity (e.g., Thirty Million Words Initiative; Suskind et al., 2016). Like other quality-focused interventions, the Duet principles prioritized contingent, responsive parent contributions (e.g., PALS, Landry et al., 2006, 2008; Video Interaction Project, Mendelsohn et al., 2007) and cognitively stimulating, developmentally tailored, rich language input (e.g., Dialogic Reading; Lonigan & Whitehurst, 1998).

Duet differed from some other parent-implemented interventions targeted at families in low-SES households by focusing on interaction across daily life contexts rather than only play or reading (e.g., Levin & Aram, 2012). However, one of the most important distinguishing features of Duet was its CBPR framework. Specifically, Duet's co-constructed intervention goals, principles, materials, procedures, and outcomes are a unique contribution toward culturally responsive and ecologically valid preventative early language intervention.

The purpose of this exploratory study was to compare Duet with the standard-of-care home-visiting services received by families in low-income households. We asked whether Duet improved (a) parent developmental knowledge and perceived self-efficacy, (b) communication interaction quality, and (c) child's language skills. Across these domains, a larger percentage of Duet participants made gains than the standard-of-care group. Effect sizes ranged from small (child language) to moderate (developmental knowledge, self-efficacy, and interaction quality).

Our observed effect sizes are generally consistent with other comparable studies. Two

recent meta-analyses have examined the effects of parent training on use of trained strategies, interaction quality, and child's language outcomes for with or at risk for language impairment. Examining outcomes with families across SES groups, Roberts et al. (2019) reported a large effect of training on parents' use of target strategies. There were moderate effect sizes of intervention on child's engagement and receptive language for children at risk for language impairment. Heidlage et al. (2020) reported on parent-training studies targeted at families who met the criteria for low SES with children who had or were at risk for language impairment. Heidlage et al. (2020) also demonstrated a large effect of training on parent use of strategies. Their meta-analysis revealed small-to-moderate effects of parent-implemented intervention on child's expressive language outcomes. Importantly, Heidlage et al. (2020) emphasized the need for more thorough reporting of parent's outcomes. Neither meta-analysis reported on parents' self-efficacy perceptions or developmental knowledge as these are not commonly included as outcomes.

In the present study, we observed comparable effect sizes despite a small sample, participants facing adversity, low dosage (around 5 hr for more than 6 months), and intragroup variability. The present research also expanded on the type and number of parent and dyadic interactional outcomes reported in this type of research. Duet built on previous research by including more diverse families with income levels placing them at the lower end of the low-SES range (Landry et al., 2012; Suskind et al., 2016). Furthermore, we compared Duet with a rigorous, standard-of-care group and demonstrated the feasibility of CBPR for preventative early communication intervention research.

Our pilot findings must be interpreted cautiously, but the promising data support further Duet research. Furthermore, there are preliminary implications for research and clinical services based on our findings. Specifically, we demonstrated that the CBPR model

is feasible for preventative early language intervention, but that additional supports are needed to overcome barriers to recruitment and retention. For instance, the high turnover rate of advocates and families in the community organization was a barrier to participant recruitment and retention. Strategies such as reaching out to families during pediatrician wellness checkups, offering remote intervention opportunities, and sending reminder text messages might facilitate engagement for some families.

Limitations

This study had several limitations, especially recruitment and retention. Implementing Duet through an existing home-visiting paradigm had the benefit of recruiting the intervention and standard-of-care groups from the same community-based programs. However, it also limited recruitment to families participating in that program. In addition, the number of families served by each advocate changed drastically between randomization and enrollment. Families often experienced multiple forms of adversity (e.g., frequent moving, health issues, food insecurity, unemployment), which led to high home-visiting dropout rates and study attrition. This was common across the home-visiting programs, not specific to our study. These challenges resulted in a small sample size and significantly reduced power.

Duet was implemented within an existing home-visiting program, which was critical to the CBPR framework and access to families. However, given that families were participating in a variety of different programs within the home-visiting services, this increased the potential variability in the standard-of-care content and dosage.

In addition, there were limitations associated with the scope of the fidelity data we were able to collect. Specifically, we asked advocates to record sessions for fidelity analyses, because the community-academic research team decided that this would be less obtrusive in families' homes than sending in an unfamiliar data collector. Although

this was the most ecologically responsive decision, it resulted in less consistently available fidelity data from the advocates as they balanced many different responsibilities. These factors limit the generalizability of the findings.

Future directions

Future research will require expanded community partnerships, more flexible intervention delivery, and increased family supports. For example, we expanded our partnership with community organization to working directly with families living in the community. We have created a culturally responsive, Spanish version of Duet via conducting focus groups with Spanish-speaking caregivers. In addition, we have established a new partnership with the department of pediatrics at a local hospital, which has supported family recruitment. We are currently testing Duet using a light-touch, remote intervention delivery model to increase access and scalability. Participants review Duet-training modules on a tablet and attend virtual meetings with interventionists to discuss what they have learned and how to apply Duet strategies in their daily activities. We plan to further explore and compare the effectiveness of group-based and one-on-one delivery. These models may be beneficial for families from different backgrounds and will allow families to receive services in a way that meets their individual needs.

CONCLUSIONS

Preventative early language intervention to support children and families experiencing economic adversity is a public health need. Specifically, there is a need to provide culturally appropriate and ecologically valid services for families in low-income households and traditionally underserved groups. Using an innovative CBPR framework, we collected promising preliminary data about Duet's potential to support parent knowledge and self-efficacy, parent-child interaction, and child's language skills. Our findings must

be interpreted cautiously, but they are encouraging considering the small sample size, low intervention dose, and our sample's sociodemographic composition. Additional

studies are needed to test Duet's efficacy and effectiveness with culturally and linguistically diverse families and to assess more flexible service-delivery models.

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