

Cite this article

Balsa, A.I., Gómez Muzzio, E., González, M.L. et al. Crianza Positiva: Combining Group Workshops and E-Messages to Strengthen Parenting Competences. Child Youth Care Forum (2023).
<https://doi.org/10.1007/s10566-023-09768-3>

***Crianza Positiva: Combining Group Workshops and E-Messages to Strengthen Parenting Competencies
Among Uruguayan Parents of Infants and Toddlers***

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August 2023

Abstract

Background: Despite evidence on their short-term effectiveness, the long-term effects of group-based parenting interventions are unclear, programs are hard to scale up, and effects on parents of infants and toddlers are mixed.

Objective: We evaluate the impact of a parenting intervention, *Crianza Positiva*, that combines 8 group sessions with a 6-month e-messaging component. The program targets parents of infants and toddlers, is designed to be scalable by using low-cost delivery formats and a structured framework, and relies on a “top up” module to sustain the effects.

Methods: We analyze video-recordings of a free play activity to rate the quality of child-caregiver interaction.

We compare outcomes across three arms: a) workshop + messages, b) workshop only, and c) a weekly unstructured playgroup. Because assignment to treatment is not random, we use inverse probability weighting to address initial unbalances and differential attrition. Our sample includes 442 disadvantaged families with infants/toddlers enrolled in early childhood centers in Uruguay.

Results: Results show significant and sustained benefits of the program on child-caregiver interaction quality, with medium effect sizes in the affective ($d = 0.44$) and teaching dimensions ($d = 0.59$).

Conclusions: The data suggest that group parenting interventions may help improve the childrearing environment among parents of children aged 0-2. Due to its protocolized design and the low cost of integrating it into early-childhood centers, the program has a potential for widespread implementation. Still, definitive conclusions are precluded by the evaluation design. Future randomized designs are needed.

Keywords: Parenting Interventions; Positive Parenting; Impact Evaluation; E-messages; Crianza Positiva

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Highlights

- Parenting programs are not easily accessible to many families, show short-term effects, or are too expensive to scale-up.
- We present evidence of a positive parenting program, *Crianza Positiva*, that combines group workshops with e-messages sent to parents' mobile phones.
- The program targets families with children between the ages of 0 and 2, and integrates principles of positive parenting, rooted in attachment and ecological theories, with behavioral science insights.
- The data suggests the intervention improves the quality of the child-caregiver interaction, reinforcing parental affection and cognitive stimulation.
- Due to its highly protocolized design, and its use of existent infrastructure, the program has a large potential for replicability and scalability.
- Still, future randomized evaluation designs are needed to better assess the intervention effectiveness.

Introduction

The importance of a caring and nurturing environment for child development has been well established in the psychology, neuroscience, medical, and economics literature. Positive parenting styles promote the development of child language (Bus et al., 1995; Madigan et al., 2019) and executive functions (Valcan et al., 2018), contribute to affective regulation and empathy (Karreman et al., 2006; Cooke et al., 2019), predict the attachment style in infants, children and adolescents (De Wolff & van IJzendoorn, 1997; Zeegers et al., 2017; Koehn & Kerns, 2018), and are associated with improved mental health among children (Pinquart, 2017a, 2017b). Protective and nurturing parenting styles generate learning-enhancing conditions by leading children to explore and discover the world around them (Gershoff et al., 2007).

Despite this recognized body of knowledge, too many children lack the adequate conditions of care for an optimal development. As stated by Morris et al. (2017) “early exposure to the stresses associated with poverty and family dysfunction jeopardizes physical, cognitive, and social development” (2017, p. 395). It is not stress per se that damages child development, but its negative impact through parenting practices and processes associated with daily interactions (Patterson & Yoerger, 2002; Bronfenbrenner & Morris, 1998; Belsky & Jaffee, 2015). In Latin America, a large fraction of children lives in contexts marked by strong inequality and psychosocial, economic, and political vulnerability (CEPAL 2016) that endanger parenting competencies, and by extension, child development.

There is substantive evidence showing that parenting interventions –through strengthening parents’ social support, improving parental competencies, and increasing positive parent-child interactions– can have a significant impact on the development of at-risk children (Morris et al., 2017, Lundhal et al., 2006; Kaminski et al., 2008; Chen & Chan, 2016; Grantham-McGregor and Smith, 2016; Leijten et al., 2019; O’Hara et al., 2019). A meta-analysis by Bakermans-Kranenburg et al. (2003) found that parenting programs can impact relational parenting competencies, and specifically parenting sensitivity, with effect sizes between $d = 0.33$ and $d = 0.44$. In a systematic review, Barlow and Coren (2018) showed that parenting programs help improve the emotional and behavioral adjustment of children, in addition to enhancing aspects of parents’ psychosocial functioning (e.g., depression, anxiety, stress). Similar results have been encountered in various other meta-analyses (Benzies et al., 2013; Chen and Chan, 2016; Mountain et al., 2017; Mihelic et al., 2017). Regarding other areas of parenting, the meta-analysis by Chen and Chan (2016) found that these programs decrease child maltreatment by $d = 0.3$, while the meta-analysis by Shah et al. (2021) found a positive effect size of $d = 0.34$ on parental participation and involvement in children’s cognitive stimulation activities.

However, there are still areas that require further exploration. Barlow and Cohen (2018) identify at least three gaps in the literature. First, they suggest there has not been enough research on group-based interventions for parents of very young children. While there is evidence that group-based parenting programs are cost-effective at improving child behavior and parents' attitudes and skills when children are between 3 and 12 years old, the evidence of their effectiveness with parents of younger children is less conclusive. Second, it is not evident that the effects of parenting interventions can be sustained over time: "the available evidence shows only short-term effectiveness, and a number of reviews have concluded that further input may be required to ensure that these results are maintained. The use of 'top-ups' to maintain the benefits of these interventions needs formal evaluation" (Barlow & Coren 2018, p. 101). Third, more research is needed to understand the mechanisms through which parenting interventions affect childrearing practices and children's outcomes. Olofsson et al. (2016) also underscore that parenting interventions still face challenges in terms of replicability and scalability. Many programs are too costly to implement at a large scale or lose their effectiveness once they are scaled due to fidelity problems. An additional concern is that most program evaluations rely on self-reported parental outcomes, which are subject to desirability bias (a tendency to respond what the interviewer wants to listen).

In this paper, we contribute to fill some of these gaps by evaluating a parenting program, *Crianza Positiva*, that targets parents of children below the age of three. The program combines an intensive and highly structured group-based parenting workshop of eight sessions, with a subsequent "top-up" text and audio e-messaging component that incorporates insights from behavioral science. The program promotes positive parenting (Rodrigo et al., 2010; Rodrigo et al., 2015; Gómez, 2022), which refers to "parental behavior based on the best interests of the child, that provides nurturing, empowering, recognition and guidance, and involves setting boundaries to enable the full development of the child" (Council of Europe, 2006). We assess outcomes a year after workshop initiation and rely on objective measures of child-caregiver interaction using qualified scoring of video-recordings of a play activity.

While many parenting programs have been designed from a cognitive-behavioral approach, *Crianza Positiva* is heavily rooted on the attachment theory and the ecological approach to parenting. Attachment theory posits that children's relationships with caregivers, and the way caregivers react to children's stress and needs, largely influence developmental pathways from cradle to tomb. Experiences of emotional (in)security and (dis)organization with different attachment figures build the foundations of mental health and personality through the shaping of internal working models (Bowlby, 1969; Cassidy & Shaver, 2016; Fonagy et al., 2018).

Ecological theory expands this idea to include the reciprocal influences between all the systems that interact with child development, from micro to macro level, from family to school, from neurons to culture. It proposes that caregivers need opportunities to learn and that parenting competencies develop within an ecology that supports - or not- that learning (Bronfenbrenner, 1987; Rodrigo et al., 2010; Rodrigo et al., 2015; Gómez, 2021; Gómez, 2022). Yahlkoski et al. (2016) documented that a group model of parental intervention designed using the attachment theory framework (“Circle of Security”) achieved a medium-high effect on the safety of child attachment ($g = 0.65$), and on the quality of care, including parental sensitivity ($g = 0.60$).

The conceptual framework of the *Crianza Positiva* intervention was inspired on the ODISEA (Opportunities to Develop Interactions that are Sensitive, Effective and Affectionate) model of parenting competencies (Gómez & Muñoz, 2014; Gómez & Contreras, 2019; Gómez, 2021; Gómez, 2022). ODISEA is structured around four positive parenting competencies: relational, formative, protective, and reflective. Relational competencies include parental sensitive observation, mentalization, and responsiveness (stress regulation, emotional warmth, and frequent involvement). The formative or stimulating competencies include an adequate parental organization of the child’s experience, the development of progressive autonomy, mediation of learning, positive discipline, and socialization. The protective competencies have to do with ensuring a safe and well-treating environment (physical, emotional, and psychosexual), the provision of daily care, the organization of daily life, and connection with support networks. And the reflective competencies revolve around the construction of a life project, anticipation of relevant scenarios, meta-parenting, reflective function, and parental self-care. Each of these parenting competencies and sub-competencies has been linked to children’s well-being and mental health (Gómez, 2022). The design was also inspired by some elements of the Parents First program, replicated in Finland under the name of Families First (Goyette-Ewing et al., 2003), and on Canada’s Nobody is Perfect, adapted to Chile in Chile Crece Contigo (2010).

The “top-up” component of the *Crianza Positiva* intervention builds on a combination of Information and Communication Technologies (ICT) and behavioral science insights. It consists of 72 e-messages that are sent three times a week to the caregiver’s mobile phone for 6 months. It aims at helping parents take to action and sustain over time the competencies introduced in the workshop. In their design, messages take into consideration systematic biases that could lead to parental suboptimal behavior, such as present bias, cognitive fatigue or negative identities (Gennetian et al., 2016; Mayer et al., 2018; Ajzenman & Lopez Boo, 2019; Balsa et al., 2021, Bloomfield et al., 2022). Present bias is active when the caregiver undervalues costly activities in the present that imply rewards only in the future (Thaler, 2015), such as playing or talking to the child. Cognitive

inattention or fatigue occurs when parental stress or cognitive load due to family or personal problems impedes an optimal processing of information and leads parents to deviate cognitive resources from important parental decisions (Schilbach et al., 2016). Negative parental identities or perceptions of low parental efficacy can make parents attach a low value to their existing resources and low expectations to their parenting performance. For example, a parent may not react adequately to an attachment behavior of her baby or may stop thinking about how to stimulate the baby's future cognitive or language development due to the actual need to prepare lunch (present bias), marital problems (cognitive fatigue) or a perception that he/she "is not good enough" (negative parental identity).

Several studies have used behavioral messages to support parenting. Meuwissen et al. (2017), Hurwitz et al. (2015), and Doss et al. (2019a) showed that text-based interventions increased parental engagement in literacy and other learning activities with their children and improved child literacy skills. Doss et al. (2019b) report that personalized messages increased the likelihood that parents read to their children by 50%. These interventions however, were aimed at parents of older children.

We build our study around two questions that shed light on some of the gaps identified by Barlow and Coren (2018): a) Are group parenting programs effective at improving parental competencies of parents with infants and toddlers? This is important because reaching parents earlier is crucial for child development, and because group programs are easier to scale up and replicate than interventions targeting individuals. b) Can the effects of group parenting programs be sustained over time when using "top-up" components, such as text and audio e-messages? If effective, the use of personalized messages allows to extend the scope of initial face-to-face interventions at a low cost. Learning more about these issues is critical, in particular in regions such as Latin America, where the costs of parenting programs impede their widespread dissemination.

Method

The Crianza Positiva Intervention

Crianza Positiva is rooted on the principles of positive parenting, which involves the creation of strong bonds and a structured environment at the family level; promotes the stimulation, support and recognition of the value of children; is non-violent; and teaches parents to be competent agents of change and capable of positively influencing their own lives and their children's (Rodrigo et al., 2010; Rodrigo et al., 2015; Gómez, 2022). The positive parenting approach acknowledges, in addition, that: (a) there are some parenting practices that have better effects on child development than others; (b) caregivers need opportunities to learn about evidence-based positive parenting competencies; and (c) parenting competencies develop within an ecology of parenting that

must support that learning through positive parenting programs (Gómez, 2022). Below we highlight some of the key details of the intervention, including workshop delivery format, session number and structure, session content, requirements of facilitators and e-messaging as well as empirical evidence supporting the design.

Workshop delivery format. The choice of a group format for the face-to-face encounters with parents was based on cost and potential for replicability and scalability, on top of evidence on the effectiveness of group delivery when targeting populations with no extreme risks (Yaholkoski et al., 2016; Schoemaker et al., 2020). Group-based interventions have been shown to work well on the general population. Schoemaker et al. (2020) found that interventions that used group format ($g = 2.47$) or individual and group combined ($g = 5.62$) showed significantly larger effects than those that only worked individually ($g=0.31$). Lundhal et al. (2006), on the other hand, found that in cases of child abuse, the individual format ($d = 0.49$ to 0.67) or the mixed format ($d = 0.64$ to 0.94) had better results than the only group format ($d = 0.41$ to 0.46).

Number of sessions. The choice of 8 sessions resulted from evidence suggesting that group parenting programs should last between 5 and 12 sessions. Bakermans-Kranenburg et al. (2003) documented that programs that offered less than 5 sessions had similar effects than 5-16 sessions, and both had better results ($d = 0.38$ to 0.42) than those with more than 16 sessions ($d = 0.21$). Schoemaker et al. (2020) documented programs with a duration closer to 12 sessions, had better results than those closer to 2 sessions.

Session length and structure. In terms of session length and structure, each session takes 2 hours and 45 minutes and aims at integrating learning and practice opportunities within each family's own life history. A typical session includes moments of interaction and practice with caregivers' children and relies heavily on helping the caregivers identify and reflect on their emotions. Kaminiski et al. (2008) found that programs that included child-caregiver interactions during the sessions achieved a larger effect size ($d = 0.91$) on parenting competencies, compared to those that did not ($d = 0.33$); they also found that addressing the emotions of caregivers in the intervention was associated with better outcomes.

Session content: In the first session, the discussion revolves around the challenges of parenting and parental competencies in general. Session 2 focuses on protective competencies (the importance of protecting and organizing the life of the baby). Sessions 3 and 4 deal with affective and relational competencies (the importance of observation, interpretation and sensitive response, affection and emotional warmth, availability to regulate the child's stress). Session 5 focuses on the importance of routines and the ability to anticipate situations as the foundation for positive discipline. Session 6 elaborates on teaching and stimulating competencies, free play and positive discipline. The importance of personal care and the well-being of the caregiver is emphasized

in week 7. The final session closes with a reflection on workshop learnings, the changes experienced, and the challenges that remain.

Workshop facilitators. Workshops are led by a pair of facilitators, ideally a psychomotor specialist or a psychologist, and a pre-school educator (someone with a high school diploma and some training in early childhood education). Because the workshop is heavily structured and protocolized, it can be delivered without imposing high training demands on facilitators. Specifically, facilitators must participate in a 12-hour training and are provided with a detailed manual and workshop materials (posters, handouts, and an activity magnet for families to take home).

Behavioral text and audio e-messages. The *Crianza Positiva* e-messaging intervention starts right after the end of the workshop and consists of 72 messages that are sent to the caregiver's mobile phones three times a week over 6 months (via text messaging and Whatsapp). The messages are organized around modules of two weeks, each of which focuses on a particular parental competency (relational, formative, protective, or reflective). The Monday message highlights the benefits of a certain parenting competence, contributing to address present bias. On Tuesday, parents receive a suggestion to engage in a specific activity with the child in relation to that competence. These action tips provide ideas and help parents focus on simple and positive choices (addressing cognitive inattention). The Friday message deals with parental identities: it invites parents to reflect on, and provides encouragement.

Recruitment Timing, Sampling Frame and Study Design

We advertised our program at regional monthly meetings held by administrators of public early childhood centers in Uruguay. We invited centers to implement the *Crianza Positiva* workshop with families with children between the ages of 0 and 2. The demand exceeded the program's training capacity: out of the 41 centers initially signing up (10% of all the country's public centers), only 24 could receive training that year. The training and participation of the other 17 centers was postponed for the following year. Assignment to training was based on a first come basis. The workshops were implemented three months after training. The workshop treatment group included families enrolled in centers eligible to implement the *Crianza Positiva* workshop, whereas the workshop control group consisted of families in centers that could not implement right away. Both treatment and control families were already attending a weekly playgroup at the early childhood center, aimed at discussing emerging childrearing concerns and providing stimulation to the child (note that the fact that the control families were already attending childhood centers reduces concerns about the effects being led by

continuous contact of the families with facilitators). These sessions were unstructured and absenteeism was high. The *Crianza Positiva* workshop was implemented in this space, but added a structured and intensive curriculum, and provided facilitators with new tools to strengthen parental competencies. The workshop was delivered by the same staff of the early childhood centers.

After the workshop finished, the 24 centers that implemented it were randomly assigned to receive the e-messaging intervention. Randomization was stratified by the center's average maternal education: 14 centers were assigned to the e-messaging treatment and 10 centers were assigned to a control group. Messages were sent to the mobile phones of the caregivers by SMS and WhatsApp two months after the end of the workshop, for a period of 6 months. Families could provide as many mobile phone numbers as desired, although mothers made most of recipients. 87% of families received either an SMS or a WhatsApp message; 79% of families read at least one WhatsApp message (out of the 72) and more than half read at least two thirds of the 72 messages.

In sum, our original evaluation study implied a design that led to two treatment arms and a control group (total N=759). Treatment arm 1 (workshop + messages or “W+M”) includes families that were assigned to the workshop and the messages (N=237); treatment arm 2 (workshop only or “Wo”) includes families assigned to the workshop, but not to the messages (N=292); and the control arm (or “C”) includes families neither assigned to the workshop nor to the messages (N=230), which continue attending the unstructured weekly playgroup provided at the center. Note that this latter group was never exposed to any of the program's components, as only families with younger children were offered the workshop in the following year in centers that had signed up later.

At baseline we collected information on sociodemographic characteristics of the families. The follow-up assessment was conducted more than 9 months after families completed the workshop, and between 1 and 3 months after completion of the e-messaging intervention, leaving a sufficiently large interval of time to identify possible fading out effects of the workshop. Because we follow a cross sectional statistical design, below we carefully follow the TREND guidelines for reporting evaluations with non-randomized designs.

The intervention protocol was approved by the Ethics Committee of the Universidad Católica del Uruguay. None of the authors has conflicts of interest to declare.

Hypothesis

We pose two hypotheses:

- a) *Crianza Positiva*, a group-based parenting intervention targeting parents of infants at toddlers, is effective at improving the quality of parent-child interaction.

- b) The availability of a “top-up” component, based on e-messages sent to caregivers’ mobile phones contributes to enhance the impact of the intervention and sustain it over time.

Outcomes and Measurements

We measured the quality of parent-child interaction by rating video-recordings of a child-caregiver free play activity using the PICCOLO scale (Roggman et al., 2013; Vilaseca et al., 2019, for a Spanish validation). In the follow-up assessment, evaluators (psychologists, social workers, or advanced students of these specialties) provided the dyad with a set of toys that they could use during the activity. The caregiver (mostly the mother) received instructions to play freely while being recorded, and the evaluator was instructed not to interfere with the activity while recording. The evaluator was blind to the family’s treatment arm at the time the video was recorded. We managed to collect videos on 58% of the families at follow-up, so our working sample includes 126 families assigned to W+M, 193 families assigned to Wo, and 123 families in the C group. The main reason for the low response rate is that some caregivers did not consent to be video-recorded. When considering the entire sample (workshop vs. untreated), there are statistically significant differences (albeit weak) in the attrition rate between the two treatment arms, with treated families more likely to have a video recording (see Appendix Table A1, Supplementary Materials). We address differential attrition in our statistical analysis.

The original PICCOLO reliability was good, with an average of 0.77 inter-rater reliability for total score and Cronbach’s Alpha of 0.91 for the total instrument (Roggman et al., 2013). The Spanish validation of PICCOLO shows good inter-rater reliability (with an average of 0.84 for total score and an 80% of agreement for all the items) and good internal consistency reliability (with an average of 0.88 for total Spanish PICCOLO score). Confirmatory factor analysis supported the structure of four factors originally proposed by Vilaseca et al. (2019). As stated by these authors, “The psychometric properties of the instrument make it appropriate for general research purposes, but also for program evaluation of Early Intervention and other parenting support interventions” (p. 1).

The PICCOLO scale allowed us to assess three domains of positive parenting: affection (emotional warmth), responsiveness (sensitivity), and teaching (cognitive stimulation). The encouragement subscale was excluded because it had low inter-rater reliability in our sample. Each domain has a list of 7-8 behaviors, each of which is scored on a 0-2 scale using operational definitions listed on a Manual, with 0 meaning that the behavior was “not observed/absent”, 1 being “observed barely/sometimes”, and 2 implying that the behavior is consistently there. Examples of the items are “Speaks in a warm tone of voice” (Affection), “Follows what child is trying to do” (Responsiveness), and “Labels objects or actions for child” (Teaching). PICCOLO was applied

by professional coders who received specific training on the scale, were not in the research team, and had no information on the dyad's treatment arm. The PICCOLO's inter-rater reliability was established calculating the Kappa index item by item, using a set of 10 videos from the actual study data, encoded by professionals trained by the authors of the scale and with extensive experience using the PICCOLO scale in Chile.

Population and Data Description

The population under study consists of 442 child-caregiver dyads attending early childhood centers in Uruguay. Table 1 shows sociodemographic characteristics for dyads that consented to be video-recorded at follow-up (response rates were 53%, 66% and 53% for the treated with W+M, Wo and C, respectively). For most participants, these variables were collected at baseline (before workshop initiation), although at follow-up we repeated some questions to fill in missing data. 46% of children were female and the average age of children at workshop initiation was 19 months old. 77% of children lived with both biological parents and 35% were an only child. A large fraction of families was of low socioeconomic status: two out of three caregivers reported receiving government aid and only one out of four mothers was a high school graduate. 58% of caregivers reported being exposed to a negative shock in the past 12 months (including death of a friend or family member, unemployment, debts, income falls, problems with the law, divorce, or problems with drugs) and 38% reported at least one unmet basic need (material problems in the house, overcrowding, inappropriate cooking space, no supply of drinking water in the household, no access to sanitation).

<INSERT TABLE 1>

Statistical Analysis

Our main outcomes were only measured at follow-up, so we must rely on a cross section analysis to estimate the impact of the intervention. Because workshop assignment was not random, but defined on a first come basis, centers signing up first for *Crianza Positiva* (our treatment groups) could differ from centers that signed up later (the control group). In addition, as mentioned before, we faced differential attrition across treatment arms (participants of the Wo treatment were more likely to report a video recording than those not treated). The three columns on the right of Table 1 show standardized mean differences in sociodemographic characteristics across the three treatment arms and their statistical levels of significance (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$). When compared to untreated participants, families participating in the Wo treatment arm show a larger number of adults in the household, more unmet basic needs, less household assets, and fathers with lower involvement in the labor market. Families participating in the W+M treatment arm also appear more vulnerable than those in the untreated arm: they show fewer household assets and are more likely to have experienced

negative shocks in the past 12 months (such as deaths in the family, unemployment, increases in debt, problems with the law, divorce). In addition, children are slightly younger. The size of these statistically significant differences ranges between 0.2 and 0.4 standard deviations.

In order to address these differences, we estimate treatment effects by using propensity score (matching) techniques that balance family characteristics (measured at baseline) across treatment and comparison arms. Our core analysis estimates average treatment effects (ATE) of the *Crianza Positiva* intervention on the PICCOLO measures of interaction quality (measured at follow-up) using an Inverse Probability Weighting Model (IPW) (Horvitz Thompson, 1952). IPW makes treated and control subjects more similar by placing more weight on control individuals who have a high conditional probability of being treated (a high propensity score) and on treated individuals with a low conditional probability of treatment. To avoid extreme cases, we work with observations with a propensity score between 0.10 and 0.90.

We run different IPW models that compare W+M versus C, Wo versus C, and Wo + W+M (“workshop” regardless of message recipient status) versus C (“no treatment”). In addition, to understand more precisely the differential effects attributable to the e-messaging intervention, we compare W+M vs. Wo.

We check for robustness by a) explicitly showing the balance of covariates after reweighting observations; and b) using other matching methods such as Propensity Score Matching and Nearest-Neighbor Covariate Matching. As additional robustness checks we apply IPW by varying the covariates used to calculate the propensity score. Results from these robustness checks are shown in the Supplementary Material. To construct the propensity score, we follow the algorithm proposed by Imbens (2015) and select first order terms from the list of covariates displayed in Table 1.

Inverse probability weighting techniques rely on balancing treatment arms on the basis of observable characteristics. Still, estimates of treatment effects could be biased due to unobserved selection. We address this in two ways. First, we inquire about the sign of the potential bias by considering the correlation between socio-demographic characteristics at baseline and the PICCOLO scale among untreated individuals. As mentioned above, treated participants were less well-off than untreated ones. A positive association between socioeconomic status and the quality of child-caregiver interaction would imply that our estimates would be conservative.

Second, we assess how large selection on unobservable characteristics should be in order to overturn our findings. We use the methodology proposed in Oster (2017) which relies on the comparison of the coefficient of interest and the R-squared between regressions with and without control variables to judge the importance of selection on unobservables. We focus on the parameter delta, which equals the ratio of the impact

of unobservables to the impact of observable characteristics that would drive the coefficient on the treatment variable to zero. As a benchmark, we use Oster's (2017) criterion and consider that an effect is very hard to overturn when delta is larger than 1 (when selection on unobservables should be higher than selection on observables).

Results

Main Results

Table 2 describes the study outcomes, measured at follow up, by treatment arm. PICCOLO subscales range between 10 and 11, with maximums of 14 for affection and responsiveness, and 16 for teaching.

<INSERT TABLE 2>

Table 3 shows average treatment effects on the quality of the parent-child interaction (PICCOLO scale) from the IPW model. For each outcome variable (row) and sample (column), the table shows the average treatment effect measured in units of the PICCOLO scale, its standard error in parentheses, and effect sizes (Cohen's d) in squared brackets. Participation in the Wo group increases the PICCOLO scale by 3.47 points ($d = 0.46$; $p < 0.01$), a 12% increase relative to the untreated sample mean. A slightly larger positive effect is present among those participating in both the W+M intervention ($d = 0.53$; $p < 0.01$). These aggregate effects capture positive impacts on the three subdimensions. The PICCOLO affection subscale increases by 1.197 ($d = 0.44$, $p < 0.01$) for the Wo sample, an increase of 13% relative to the untreated sample mean, while the responsiveness and teaching subscales increase respectively by 0.7 points ($d = 0.24$, $p < 0.1$), 7% above the control mean, and by 1.57 ($d = 0.44$, $p < 0.01$), 16% above the control mean. The affection and responsiveness effects are larger for families participating in the W+M arm ($d = 0.59$, $p < 0.01$ and $d = 0.37$, $p < 0.01$ respectively), but the teaching effects are smaller than for Wo caregivers ($d = 0.37$, $p < 0.05$).

When comparing those who participated in the W+M intervention with those who participated in Wo (Column 3), we find that the additional treatment coming from the messages boosts the affection and responsiveness dimensions by $d = 0.20$ ($p < 0.05$). Our analysis suggests the effects of the program are strong even 9 months after the intervention ended. Furthermore, we find the workshop accounts for most of the improvements in the quality of the caregiver-child interactions, although messages contribute to enhance them (or to mitigate fading out effects).

<INSERT TABLE 3>

Robustness

In Appendix Table A2 we present normalized differences between each treatment arm and the untreated group. All covariates are balanced once we allow for inverse probability weighting.

In Appendix Tables A3, A4, A5, A6 and A7 (Supplementary Materials) we show that results are qualitatively similar when using other matching methods. The workshop with or without messages improves the quality of the caregiver-child interaction, with strongly robust results on the affection and the teaching subscales.

We next seek to answer the question: if the bias on unobservables runs in the same direction as the bias in observables, what would that direction be? Appendix Table A8 shows the coefficients of bivariate regressions of the PICCOLO scale on each of a set of sociodemographic covariates. We observe that the PICCOLO scale is lower in families with unmet basic needs and in families with negative shocks in the past. We mentioned before that our treated families had more unmet basic needs and were more likely to experience negative shocks. Thus, if there were any bias on unobservables remaining and it had the same sign as the bias in observables, we would expect that bias to be negative (to push our estimates downwards) and our results to be conservative.

Finally, using Oster (2017), we explore how large selection on unobservables would need to be in order to overturn our findings. Results are displayed in Appendix Table A9. The test compares unadjusted and adjusted regressions of each of the PICCOLO outcomes on the treatment variable (with the same covariates used in the IPW estimator). When comparing participants in Wo vs. C, adding covariates to the regression leads always to increases in absolute value in the estimated coefficient and in the R-squared. For the PICCOLO scale, and the affection and responsiveness dimensions, the corresponding δ suggest that selection on unobservables should be as large as selection on observables to overturn the effect in Column (2). In the case of the PICCOLO scale, to explain away the impact in Column (2), unobservables would have to move the coefficient in the opposite direction than observables. Columns (3) and (4) show comparisons between the W+M sample and the C. In sum, we tend to find very robust results when comparing these two arms. Results are less robust when comparing W+M vs. untreated. We find δ 's below 1 for the PICCOLO scale, and for the affection and responsiveness subscales. However, results are very robust for the teaching subscale, with $\delta = -0.965$.

Heterogeneity

We explore heterogeneous effects by mother's education, child's age and gender, household's exposure to negative shocks, and any unmet basic need (see Tables 4, 5, and 6). Table 4 shows strong and statistically significant effects of the intervention (Treatment arms 1 and 2) across all PICCOLO dimensions for the subsample of mothers with low educational attainment (Panel B). The PICCOLO scale increases by 11% ($p < 0.01$) for the Wo sample when compared to C individuals, and by 16% ($p < 0.01$) for the W+M sample. The

affection, responsiveness and teaching subscales increase by 11% ($p < 0.01$), 7% ($p < 0.1$) and 16% ($p < 0.01$), respectively, for Wo caregivers, while the impact on affection and responsiveness is doubled for households participating in the W+M intervention ($p < 0.01$ and $p < 0.05$ respectively). In households with more educated mothers, we observe statistically significant but smaller effects for the W+M sample, but not for the Wo sample.

<INSERT TABLE 4>

Table 5 suggests that the program has a slightly stronger impact among families with children older than 20 months old at baseline, although we still find statistically significant effects at younger ages, in particular for affection and teaching. Effects are positive and statistically significant both in the girls' and boys' samples, but estimates are more precise and of larger size for girls.

<INSERT TABLE 5>

Because families facing higher levels of stress are likely to devote less attention to parenting, we expected families facing negative shocks in the past 12 months to fare better from the intervention. As expected, we find stronger effects in the subsample of households that were exposed to some type of negative shock relative to other households (see Table 6). All subscales improve for this group of families and the overall scale increases by around 11% for families attending Wo and by 12% for families participating in W+M ($p < 0.01$). Table 6 also shows that the effects are somehow stronger among households that present at least one unsatisfied basic need.

<INSERT TABLE 6>

In sum, we find that the program favors all groups, but the magnitudes of the effects are slightly higher among less educated mothers, households with older and female children, households facing higher levels of stress, and households with at least one unmet basic need.

Discussion and Conclusions

In this paper we evaluate the impact of *Crianza Positiva*, a program aimed at strengthening parenting competencies and enhancing child development in families with very young children (aged 0 – 2). The intervention combines an 8-week group-based parenting workshop with e-messages delivered to the parents' mobile phone during a period of 6 months. The intervention integrates concepts of positive parenting with behavioral science. Positive parenting aims at promoting parental affection, teaching and responsiveness, and is rooted in the attachment and ecological theories. Behavioral science seeks to help parents minimize suboptimal decisions based on behavioral biases.

This program evaluation of *Crianza Positiva* adds evidence to the utility of the ODISEA framework (Gómez, 2022) designed to work with parents from different ecologies and cultures in Latin America. The proposed structure of four parenting competencies (relational, formative, protective and reflective) organizes the workshop structure, content of sessions and messages, practice exercises, and training of facilitators. The study also adds evidence to the role of low-cost behavioral messages in helping sustain workshop effects over time (Balsa et al., 2021, Bloomfield et al., 2022). Having programs that serve as support for public parenting policies during early childhood is extremely important (Barlow et al., 2019), especially considering the critical window that this period has for human development (Cordero et al., 2017; Shonkoff, 2010).

We assess the program's impact using propensity score techniques, measuring outcomes nine months after the workshop ended. Our results show that the *Crianza Positiva* intervention had a positive effect on the quality of the child-caregiver interaction. This result is particularly noteworthy because it focuses on an outcome externally assessed rather than self-reported, reducing the potential incidence of desirability bias. It is also based on a scale that has been extensively used and validated internationally (PICCOLO), and that has been associated with child well-being and development (Roggman et al., 2013; Innocenti, Roggman & Cook, 2013). Furthermore, the magnitude of the impact is quite significant, with affection scale scores (i.e., relational competencies) increasing by $d = 0.44$ for Wo and $d = 0.59$ for W+M intervention, compared to the C group. These results are larger than those in Bakermans-Kranenburg et al.'s (2003) meta-analysis for parenting sensitivity (i.e., relational competencies), where effect sizes were between $d = 0.3$ and $d = 0.4$. On the other hand, compared to control group, caregivers who completed *Crianza Positiva* obtained an effect size on teaching scale (i.e., formative competencies) of $d = 0.44$ for workshop only and $d = 0.37$ for workshop plus messages intervention, again in line but a bit larger than Shah et al (2021) meta-analysis for cognitive stimulation (i.e., formative competencies) who reported an effect size $d = 0.34$.

Our study contributes to address several of the gaps in the literature (Barlow and Coren, 2018) and adds knowledge that can be relevant to public policies. It suggests that parental competencies can be strengthened using a group format even when focusing on families with children below the age of 2. It also shows that program results are strong enough at least 9 months after the intervention has ended, and that "top-up" low-cost programs, such as messages sent to the families' mobile phones, contribute to enhance the value of parenting workshops. Finally, several features of the program add to its scalability and replicability: a) the intervention is group-based; b) it exploits already existent resources of early childhood centers; c) it includes mobile e-messaging, an affordable and accessible intervention to even the most vulnerable populations; and d) it does not

require an intensive and extensive use of professionals. Because the intervention protocols of both components of *Crianza Positiva* (workshop and messages) are fully structured and documented in detail, the program works well with a brief initial training and peer supervision during the first time that it is implemented. Our analysis also focused in an understudied population: Latin American families of low socioeconomic status.

Overall, our results suggest significant and sustained benefits of the *Crianza Positiva* program on interaction quality, with medium effect sizes in the affective and teaching dimensions. A drawback of our analysis is that we rely on a cross section approach, which may be subject to selection on un-observables. Although we provide some evidence that our estimates are likely to be biased downwards (to be conservative), future research should assess the efficacy and effectiveness of the program using randomized techniques.

Regarding external validity, the intervention was implemented in early childhood centers in Uruguay, which tend to assist families of low socioeconomic status. But it was designed for any socioeconomic and cultural setting (in fact it was co-designed by professionals in Chile and Uruguay) and would need little adaptation to be delivered in other contexts (as it has been recently done in Guanajuato, and also in Nuevo León, México by Fundación América por la Infancia). Moreover, the intervention was embedded directly in a governmental-provided program (Plan CAIF), which made the implementation and results close to a “real-life” intervention. In future research, we intend to assess longer-term child development outcomes, as well as parental well-being, and initiate interventions at the stage of pregnancy.

Acknowledgements. The authors would like to thank all participants and to CAIF centers of Uruguay for their cooperation, to Catalina Figueroa and Francisca Montedonico for their work in the design of the workshop's materials, and to Eugenia Donegana for her help with the study implementation.

Data Analysis. The authors take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding Information. Funding for the study was provided by Reaching U.

Conflict of interest. None of the authors has conflicts of interest to declare.

Ethics approval. The intervention protocol was approved by the Human Research Ethics Committee of the Universidad Católica del Uruguay (22-08-17).

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Table 1*Descriptive Statistics of Family Characteristics at Baseline, by Treatment Arm*

	Untreated families		Workshop only		Workshop + messages		Normalized differences		
	N	Mean	N	Mean	N	Mean	Workshop only vs. untreated	Workshop + messages vs. untreated	Workshop + messages vs. workshop only
Child's gender (female=1)	123	0.415	193	0.482	126	0.484	0.135	0.140	0.005
Child's age at workshop initiation (months)	122	20.177 (4.996)	193	19.315 (6.038)	125	17.738 (6.942)	-0.156	-0.404***	-0.243**
Only child	123	0.341	189	0.407	122	0.287	0.136	-0.118	-0.255**
Born premature (<37 weeks)	123	0.098	191	0.099	125	0.048	0.006	-0.191	-0.198*
Breastfed	123	0.130	189	0.212	121	0.231	0.054*	0.113*	0.059
Respondent = mother	123	0.951	192	0.911	125	0.944	-0.047	0.046	0.093
Intact biological family	122	0.811	187	0.759	122	0.762	-0.140	-0.102	0.038
Number of other children in hhld	117	0.932 (1.096)	184	0.875 (1.160)	117	1.239 (1.350)	-0.050	0.251*	0.290**
Other adults in hhld	121	0.116	184	0.261	118	0.144	0.377***	0.084	-0.293**
Any unmet basic need	123	0.309	192	0.422	122	0.393	0.240**	0.179	-0.061
Household assets index	116	0.285 (0.149)	189	0.248 (0.134)	112	0.240 (0.126)	-0.263**	-0.329**	-0.063
Government aid beneficiary	123	0.642	193	0.642	125	0.688	0.000	0.097	0.096
Mother completed high school	123	0.268	193	0.290	124	0.242	0.049	-0.060	-0.109
Mother works part time	123	0.244	184	0.196	124	0.169	-0.117	-0.185	-0.068
Mother works full time	123	0.390	184	0.375	124	0.379	-0.031	-0.023	0.008
Father works full time	121	0.868	183	0.781	114	0.860	-0.228**	-0.024	0.205*
Any negative shock past 12 mo.	114	0.482	182	0.588	120	0.667	0.255*	0.307***	0.051
Number negative shocks past 12 mo.	114	0.877 (1.184)	182	1.071 (1.189)	120	1.442 (1.587)	0.223	0.310***	0.085**
Metropolitan area	123	0.285	193	0.399	126	0.722	0.243**	0.972***	0.688***

Note: The table displays sample sizes and sociodemographic means (including standard deviations in parentheses for non-dichotomous variables) for families that consented to be video-recorded in the three treatment arms. The three columns on the right show normalized differences in sociodemographic characteristics across the different treatment arms (**p<0.01, *p<0.05, *p<0.1). Intact family is a dichotomous variable that equals 1 if the child lives with both biological parents. The household has an unmet basic need when reporting at least one of the following: material problems in the house, overcrowding, inappropriate cooking space, no supply of drinking water in the household, no access to sanitation. The household asset index is the weighted summation of a number of assets in the household (water heater, fridge, washing machine, dishwasher, drying machine, microwave, air conditioning, laptop or computer, motorcycle, car, TV), where each asset is weighted by the inverse of its frequency in the full sample. Any negative shock in the past 12 months equals 1 if the caregiver reported being exposed in the past 12 months to any of the following shocks: divorce, increase in debts, problems with drugs in the family, income fall, death of a friend or family member, unemployment, problems at work, problems at school, problems with the law. Metropolitan area stands for Montevideo and Canelones.

Table 2*Descriptive Statistics of Outcomes at Follow-Up by Treatment Arm*

	Untreated families	Workshop only	Workshop + messages	Full sample	
	Mean (Std.)	Mean (Std.)	Mean (Std.)	Min.	Max.
PICCOLO scale	30.17 (7.57)	33.09 (7.53)	33.56 (6.96)	5.0	44.0
PICCOLO affection	9.26 (2.83)	10.37 (2.66)	10.89 (2.57)	2.0	14.0
PICCOLO responsiveness	10.80 (3.02)	11.5 (2.75)	11.90 (2.54)	2.0	14.0
PICCOLO teaching	10.11 (3.19)	11.22 (3.84)	10.76 (3.37)	0.0	16.0
Sample size	123	193	126	442	

Note: Standard deviations are displayed in parentheses below the means

Table 3*Average Treatment Effects on The Quality of Parental Involvement. Inverse Probability Weighting Model*

		Workshop only vs. non-treated	Workshop + messages vs. non-treated	Workshop + messages vs. only workshop	Mean outcome untreated sample
PICCOLO Scale	ATE	3.471***	3.850***	0.947	30.17
	Std. Error	(1.088)	(0.849)	(0.709)	
	Cohen's d	[0.46]	[0.53]	[0.13]	
PICCOLO Affection	ATE	1.197***	1.601***	0.531**	9.26
	Std. Error	(0.374)	(0.352)	(0.212)	
	Cohen's d	[0.44]	[0.59]	[0.20]	
PICCOLO Responsiveness	ATE	0.703*	1.028**	0.535**	10.80
	Std. Error	(0.383)	(0.427)	(0.244)	
	Cohen's d	[0.24]	[0.37]	[0.20]	
PICCOLO Teaching	ATE	1.570***	1.221***	-0.118	10.11
	Std. Error	(0.549)	(0.466)	(0.409)	
	Cohen's d	[0.44]	[0.37]	[-0.03]	
Sample size		309	235	314	

*** p<.01; ** p<.05; * p<.1.

Note: ATE = average treatment effect. We report standard errors adjusted for intra-cluster correlation (intra-center correlation).

Table 4*Heterogeneous Effects by Mother's Education. Inverse Probability Weighting Model*

		Workshop only vs. non-treated	Workshop + messages vs. non-treated	Mean outcome untreated
A. Mother completed high school				
PICCOLO scale	HTE	3.107	3.112***	33.79
	Std. Error	(1.618)	(1.019)	
PICCOLO affection	HTE	1.591*	1.004**	10.71
	Std. Error	(0.695)	(0.497)	
PICCOLO responsiveness	HTE	0.740	1.403***	11.84
	Std. Error	(0.509)	(0.474)	
PICCOLO teaching	HTE	0.776	0.705	11.24
	Std. Error	(0.869)	(0.769)	
Sample size		81	44	
B. Mother did not complete high school				
PICCOLO scale	HTE	3.510***	5.226***	31.87
	Std. Error	(1.057)	(1.177)	
PICCOLO affection	HTE	1.091***	2.042***	10.01
	Std. Error	(0.355)	(0.404)	
PICCOLO responsiveness	HTE	0.726*	1.493**	11.25
	Std. Error	(0.413)	(0.591)	
PICCOLO teaching	HTE	1.693***	1.691***	10.61
	Std. Error	(0.581)	(0.464)	
Sample size		220	145	

*** p<.01; ** p<.05; * p<.1.

Note: HTE = Heterogeneous Effects. We report standard errors adjusted for intra-cluster (intra-center) correlation.

Table 5*Heterogeneous Effects by Child's Age and Gender at Baseline. Inverse Probability Weighting Model*

		Workshop only vs. non-treated	Workshop + messages vs. non- treated	Mean of the outcome -Non- treated
A. Child's age < 20 months				
PICCOLO scale	HTE	2.511*	3.086**	31.83
	Std. Error	(1.484)	(1.208)	
PICCOLO affection	HTE	1.201**	1.022*	10.25
	Std. Error	(0.580)	(0.559)	
PICCOLO responsiveness	HTE	0.402	0.495	11.16
	Std. Error	(0.529)	(0.641)	
PICCOLO teaching	HTE	0.908	1.569***	10.42
	Std. Error	(0.699)	(0.562)	
Sample size		128	90	
B. Child's age ≥ 20 months				
PICCOLO scale	HTE	3.600***	3.855***	32.93
	Std. Error	(1.212)	(1.423)	
PICCOLO affection	HTE	0.958*	1.615***	10.18
	Std. Error	(0.520)	(0.530)	
PICCOLO responsiveness	HTE	0.806**	1.109***	11.66
	Std. Error	(0.336)	(0.409)	
PICCOLO teaching	HTE	1.835***	1.131	11.10
	Std. Error	(0.573)	(0.708)	
Sample size		163	128	
C. Female				
PICCOLO scale	HTE	4.196**	4.548***	32.57
	Std. Error	(1.882)	(1.107)	
PICCOLO affection	HTE	1.583***	1.910***	10.20
	Std. Error	(0.594)	(0.373)	
PICCOLO responsiveness	HTE	0.955	1.528***	11.60
	Std. Error	(0.725)	(0.550)	

PICCOLO teaching	HTE	1.657**	1.110*	10.78
	Std. Error	(0.689)	(0.586)	
Sample size		118	90	
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D. Male				
PICCOLO scale	HTE	2.758**	2.852**	32.27
	Std. Error	(1.331)	(1.155)	
PICCOLO affection	HTE	0.962**	1.075*	10.22
	Std. Error	(0.478)	(0.558)	
PICCOLO responsiveness	HTE	0.595	0.604	11.27
	Std. Error	(0.430)	(0.539)	
PICCOLO teaching	HTE	1.200*	1.174**	10.78
	Std. Error	(0.626)	(0.531)	
Sample size		163	91	

*** p<.01; ** p<.05; * p<.1.

Note: HTE = Heterogeneous Effects

Table 6*Heterogeneous Effects by Exposure to Negative Shocks and Basic Needs. Inverse Probability Weighting Model*

		Workshop only vs. non-treated	Workshop + messages vs. non-treated	Mean of the outcome non- treated
A. Exposure to negative shocks				
PICCOLO scale	HTE	3.453***	3.829**	31.75
	Std. Error	(1.314)	(1.730)	
PICCOLO affection	HTE	1.281***	1.572***	10.21
	Std. Error	(0.395)	(0.588)	
PICCOLO responsiveness	HTE	0.668	1.306*	11.14
	Std. Error	(0.499)	(0.782)	
PICCOLO teaching	HTE	1.504**	0.952	10.40
	Std. Error	(0.730)	(0.697)	
Sample size		155	77	
B. No exposure to negative shocks				
PICCOLO scale	HTE	1.566	2.821**	33.37
	Std. Error	(1.493)	(1.421)	
PICCOLO affection	HTE	0.570	0.866*	10.26
	Std. Error	(0.578)	(0.463)	
PICCOLO responsiveness	HTE	0.116	1.018**	11.77
	Std. Error	(0.455)	(0.427)	
PICCOLO teaching	HTE	0.880	0.936	11.34
	Std. Error	(0.627)	(0.849)	
Sample size		128	84	
C. Any unmet basic need				
PICCOLO scale	HTE	4.012**	3.501	31.22
	Std. Error	(1.792)	(2.485)	
PICCOLO affection	HTE	1.242**	2.001***	9.86
	Std. Error	(0.584)	(0.543)	
PICCOLO responsiveness	HTE	0.895	0.869	11.03
	Std. Error	(0.659)	(1.215)	

PICCOLO teaching	HTE	1.875**	0.631	10.33
	Std. Error	(0.755)	(0.932)	
Sample size		88	45	
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D. No basic need unmet				
PICCOLO scale	HTE	2.816**	2.668**	33.06
	Std. Error	(1.197)	(1.315)	
PICCOLO affection	HTE	1.090**	1.299***	10.40
	Std. Error	(0.447)	(0.491)	
PICCOLO responsiveness	HTE	0.587	0.808	11.63
	Std. Error	(0.436)	(0.547)	
PICCOLO teaching	HTE	1.139*	0.561	11.03
	Std. Error	(0.604)	(0.487)	
Sample size		194	113	

*** p<.01; ** p<.05; * p<.1.

Note: HTE = Heterogeneous Effects

Supplementary material

<https://docs.google.com/document/d/1U6wscIJQ-45xIRMa0AwhJfkf-RCUhzOG/edit?usp=sharing&oid=111164456398888830950&rtpof=true&sd=true>