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ORIGINAL ARTICLE

Mothers' and Fathers' Parenting and Other Family Context Variables Linked to Developmental Outcomes in Young Children With Intellectual Disability: A Two-wave Longitudinal Study

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Abstract

Parenting is a key factor for the development of children with intellectual and developmental disabilities. Therefore, early intervention programs should target parenting behaviors to improve children's developmental outcomes. The present study analyzed the effect of parental behaviors and other family factors on the cognitive and linguistic development of children with an intellectual disability (ID). Participants (n = 87, aged between 20 and 47 months) were recruited from several Spanish Early Intervention Centers. The children's development was assessed with the Bayley Scales of Infant Development (BSID-III) on two occasions. Besides questionnaires including family factors, 10-min mother–child and father-child interactions during free play were auto-recorded at home. Intensive statistical modeling on the two measurement occasions was used to select relevant predictors as well as their interactions. Child cognitive development models, including predictors such as mother's responsiveness and affection and father's teaching, had a predictive capacity between 22 and 26%. The language development models, including the mother's responsiveness and father's teaching scores amongst other predictors, yielded adjusted-R^2s between 26 and 28%. This study's findings evidence that parental behaviors during adult–child interaction affect the development of children with intellectual disabilities. The study also provides data that can be used to guide early intervention.

Keywords Intellectual disability · Longitudinal · Positive parenting · Parental psychological distress · Child Development · Early intervention

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Introduction

Parenting has a great influence on children's developmental outcomes. The way in which fathers and mothers conduct this parenting and how it affects the development of their children is a research topic of current interest, especially in families with very young children with some type of disability, such as Intellectual Disability (ID). Studies that compare mothers' and fathers' parenting in families with children with disabilities show both similarities (Crnic et al., 2009; Vilaseca et al., 2020) and differences (Hastings et al., 2005a, b; McStay et al., 2014). However, most find that maternal and paternal parental behaviors in families with children with ID are linked to the child's developmental outcomes (Davys et al., 2017), involving a complementary system of parenting, especially when the mother and father are living together.

In very young children with ID, different developmental outcomes may be affected, including neurological development, cognitive, motor, linguistic, socioemotional and behavioral development (Perrin et al., 2016; Provenzi et al., 2018). The role of parenting is crucial when infants and toddlers have specific support needs due to disabilities or are at risk of developing disabilities (Festante et al., 2019; Spiker et al., 2002). Parenting behaviors are very important from a clinical point of view because they can be modified through intervention. Many early intervention programs target parenting behaviors to improve children's developmental outcomes. Maximizing positive parenting with young children with disabilities during early interventions not only improves the quality of the interaction between parents and children, but also the progress in the child's development (Britto et al., 2017; Schuster & Fuentes-Afflick, 2017; Spittle et al., 2015). Despite the evidence that parenting behaviors promote child development, very little is known about the type, quality, and effects of parenting on the outcomes of children with intellectual disabilities over time. In order for Early Intervention to be effective with this population, we need to better understand how parenting exerts its influence in the early years and how it affects child development as well as whether there are other aspects of the family context that also promote child development and learning.

Intellectual disability is a condition that is associated with significant limitations in cognitive and adaptative skills and affects 2%-3% of children (Linn et al., 2019; Maulik et al., 2011). Eighty percent of people with disabilities live in developing countries (United Nations Development Programme, 2018). In Spain, *Plena Inclusión*, Spain's largest association of families with children with ID, estimates that approximately 1 percent of the Spanish population has some type of intellectual or developmental disability. According to the data collected by the Institute for the Elderly and Social Services (IMSERSO), at the end of 2015 there was a total of 268,633 people in Spain with a recognized intellectual disability (with a degree equal to or greater than 33%). This represents 9% of the total number of people with recognized disabilities in the country. By age groups, from 0 to 17 years old there was a total of 48,434 people. Among these, Early Intervention Centers (EIC) in Spain attend children from birth to six years of age

with developmental delays, developmental disorders, or children at risk of these. The child population with ID or at risk represents a total of 9% of the children attended in EICs in Spain (GAT, 2011). Therefore, for the aforementioned reasons, it is crucial to determine how parenting and other family variables affect development, given its subsequent application in EICs.

Systemic and Ecological models of parenting and child development (Belsky & Jaffee, 2006; Bronfenbrenner & Morris, 1998; Cabrera et al., 2014; Sameroff, 2009) suggest that parenting may be influenced by the parents' psychological and personal characteristics, the child's factors and some contextual characteristics that can generate stress or, on the contrary, cause them to feel supported in the parenting process. It is not clear whether the influence of these factors on parenting differs for mothers and fathers and, what is more important, how parenting can affect child development. Understanding these factors and how they interrelate is especially important when the family has a son or daughter with a disability due to the potential of using this information to guide the support that they receive from intervention professionals. Previous research (Vilaseca et al., 2019a) studied mothers and fathers in three crucial groups of variables that are related to developmental outcomes in children with an intellectual disability (ID): Positive parenting, parental psychological distress, and socio-demographic variables.

Parenting is a key factor for the development of children with intellectual and developmental disabilities for two reasons. First, children with disabilities are more dependent on their parents and they need more parental support over time; and second, these parents experience different stressors when they interact with their children (Dabrowska & Pisula, 2010; Totsika et al., 2014), an aspect that we will discuss later on.

Many research studies have shown that the presence of a child with ID is associated with negative parenting (Brown et al., 2011). This line of research is based on the assumption that the experience of parenting a child with a disability is inherently negative, which aligns with a deficit model of disability (Davys et al., 2017). This is not our approach, since we only consider those positive parental behaviors that are linked to developmental outcomes (Roggman et al., 2013b). Positive parenting refers to the adult's behaviors that promote development in face-to-face interactions in daily family routines (Roggman et al., 2013a). Positive parenting behaviors include behaviors in the domains of affection and warmth, responsiveness, encouragement and cognitive stimulation or teaching (Bernier et al., 2010; Roggman et al., 2008). Figure 1 shows the parental domains that research in the general population in the last decade has linked to children's developmental outcomes. It should be taken into account that, although the different dimensions of parenting may be biased and then used in a clinical intervention in this way, when mothers and fathers interact with their son or daughter in their natural environments through play or other activities of joint interaction, all these dimensions occur at the same time, complement each other and are related in a transversal way.

Although good parenting and positive parent–child interactions predict good developmental outcomes in families with children with disabilities (Assel et al., 2003; Dyches et al., 2012; Festante et al., 2019; Innocenti et al., 2013; Vilaseca et al., 2019a; Warren et al., 2010), we cannot ignore that having a child with ID may have

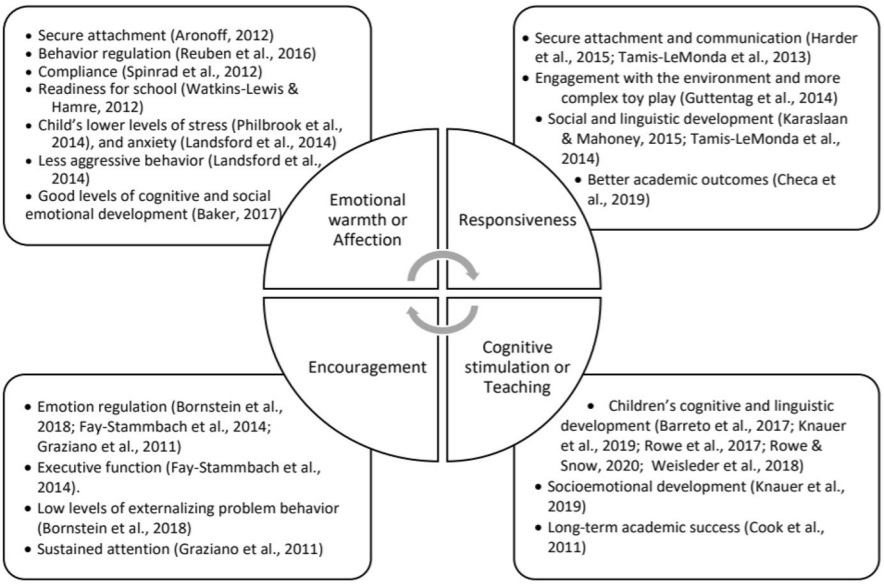

Fig. 1 Parental behavior domains that research in the last decade has related to children's developmental outcomes

an impact on the early interaction with the main caregivers. In this regard, mutual interaction processes that occur spontaneously in a natural context can become a real challenge and some imbalances may occur that make it difficult to promote child development (Feniger-Schaal et al., 2019; Spiker et al., 2005). For these children's parents, caregiving and good parenting are much more complex than in typical development conditions (Innocenti et al., 2013; Provenzi et al., 2020). On one hand, children with ID may present a significant delay in their development, experience problems in access to language and communication, or be affected by attention and behavioral problems, all of which may contribute to making it difficult for parents to respond appropriately and establish good interaction patterns (Pennington & McConachie, 2001; Salisbury & Copeland, 2013). Even in these circumstances, parents provide emotional support, cognitive and linguistic stimulation that have positive consequences and benefits for the cognitive, linguistic and socio-emotional development of children with some type of disability (Anderson et al., 2013; Totsika et al., 2020). On the other hand, parental psychological distress is another factor that may affect parenting. Parental psychological distress is higher in families of children with ID than in families of typically developing children (Baker et al., 2010; Hayes & Watson, 2013; Totsika et al., 2020). Furthermore, psychological distress may be different for fathers and mothers. Multiple research studies have shown that mothers showed higher levels of anxiety, depression and stress than fathers in families with children with disabilities (Hastings et al., 2005b; Saloviita et al., 2003; Vilaseca et al., 2014). It is very possible that parental psychological distress could negatively affect parenting, which, in turn, might influence the child's cognitive, linguistic and social development (Edwards & Hans, 2015; Feldman & Eidelman, 2009). Therefore, how

parental psychological distress might affect parenting is something that should be considered in this type of population, especially during the child's early years. However, previous research has shown that family support, specifically the partner's support, may be a protective factor against anxiety, depression or stress among mothers and fathers of children with disabilities (Cohen et al., 2016; Glidden & Schoolcraft, 2007) and this may again have an impact on the child's development.

Lastly, parenting and the mothers' and fathers' parenting roles can also be affected by the sociodemographic variables of the main caregivers, including education level, age, employment or the time spent caring for the son or daughter at home (Van Holland De Graaf et al., 2018). Levels of parental education have been associated with good developmental outcomes in children in many studies (Tamis-LeMonda et al., 2009; Trifan et al., 2014) but not in all of them (Cano et al., 2019). Moreover, parents' age and parenting roles may be related in the sense that the older the parents are, the more involved they may be with the child, the better their emotional stability and the more capable they may be to deal with the stress associated with raising a son or daughter with a disability (Castillo et al., 2011; Ferrer et al., 2016). Parental employment and more specifically the number of hours they work outside the home is also a determining factor in parental behavior. Research suggests that fathers spend less time on joint attention activities with their child when they work more hours (Roeters et al., 2009). In mothers, working outside the home can be a factor that reduces emotional distress in families with children with ID (Vilaseca et al., 2014). The hours that parents work outside the home is closely related to the time that parents spend caring for their son or daughter at home. In Spain, fathers are playing an increasingly important role in the education and care of their children, although in families with children with disabilities, this transformation process is a little slower. Nowadays, in Spain, mothers are still the ones who spend more time with their children. In the case of children with disabilities, they go with them to the EIC, the pediatrician or the school meetings (Vilaseca et al., 2020). This reality is part of the Spanish culture in which women are still the primary caregivers, and even more in the case of families with a child with a disability, similar to other western countries (Bianchi et al., 2012; Merens & Van den Brakel, 2014).

Besides the time mothers and fathers spend with their children, new evidence suggests that both parents are very similar in their parenting behaviors (Fagan et al., 2014; Vilaseca et al., 2020); however, it is not so clear what specific characteristics of parental behavior affect certain areas of the child's development, especially over time as the child gets older.

In previous research (Vilaseca et al., 2019a), both mother's and father's parenting and other parental factors were associated with better cognitive and linguistic development in children with ID. Specifically, children's cognitive development was predicted to be significantly higher when mothers are more responsive and fathers give a high level of teaching or cognitive stimulation. Linguistic development was positively correlated with the mother's responsiveness and their educational level, and was negatively associated with the mother's anxiety levels. It was also positively related to the father's teaching behaviors. The main limitation of the above-mentioned study was that it relied completely on a cross-sectional setting with a single measurement occasion. It would therefore be necessary to establish predictive models on several

measurement occasions, under a longitudinal framework, in order to adequately study the effects of the stability of parenting domains on developmental indicators at a range of different chronological ages of the children.

The present study aims to improve our understanding of how parenting behaviors defined in terms of affection, responsiveness, encouragement, and teaching, and other family factors (family-related demographic variables, parental anxiety, parental depression, parental stress and conjugality) are associated with cognitive and linguistic developmental outcomes for children with an intellectual disability (ID) in the first five years of life in Spain by means of a two-wave longitudinal study. Intensive statistical modeling of the studied developmental indicators (the child's cognitive and linguistic development) was carried out on two measurement occasions to systematically select relevant predictors, as well as their possible interactions.

Materials and Methods

Participants

Participants were recruited from several Early Intervention Centers (EIC) in Spain. The criteria used for including children in the study were, firstly, children aged between 20 and 47 months, and secondly, having an intellectual disability (associated or not with another type of disability) diagnosed at least six months before the study began. The sample included 87 children, 60 males (69%) and 27 females (31%), aged from 20 to 47 months (M = 33.4, SD = 6.8), who were surveyed on two occasions: 86% of the initial sample also participated in the second measurement. The mean interval between measurement occasions was 9.76 months (SD = 2.8 months). Fifty-five percent of children were younger than three years old (M = 28.5, SD = 4.3, Range = 20–35), and 45% were three years or older (M = 39.6, SD = 3.5, Range = 36–47 months) on the first measurement occasion. The children's developmental age was obtained on the two measurement occasions by means of the BSID-III. The children's cognitive developmental age ranged between 1 and 42 months at Time 1 (T1) (M = 22.46, SD = 7.59), and also between 1 and 42 months at Time 2 (T2) (M = 29.12, SD = 9.28). Percentiles for the developmental cognitive scores were also obtained at the two measurement points (T1: M = 16.46, SD = 16.98; T2: M = 28.32, SD = 24.34). The receptive language developmental ages of the sample ranged between 1 and 42 months at T1 (M = 18.53, SD = 9.44) and between 4 and 42 months at T2 (M = 26.36, SD = 11.11). Expressive language developmental ages were also assessed, and the empirical range was between 1 and 35 months at T1 (M = 16.22, SD = 7.49) and 1 and 42 months at T2 (M = 22.62, SD = 10.69). Total language development was also transformed into percentile scores for the two measurement points (T1: M = 7.31, SD = 11.15; T2: M = 19.11, SD = 21.43). The degree of intellectual disability was mild (from 33 to 64%) in 44% of the sample, moderate (from 65 to 74%) in 48% of the sample, and severe (> 75%) in 8% of the children. in Spain, the assessment of the percentage of disability is a standardized process carried

out by a governmental agency: the Valuation and Guidance Services for People with Disabilities. After diagnosis, the agency issues an official certificate stating both the existence and degree of disability, with ID being graded as mild, moderate or severe. These services carried out the assessment and established the degree of disability. The children were also diagnosed with other associated disorders, such as hearing (4.5%), visual (4.5%) and motor (13.4%) disabilities; autism spectrum disorder (23.9%), language or speech disorders (28.4%); and other unspecified health problems (15%). Tables 1 and 2 contain additional demographic information regarding the participants.

Materials

Sociodemographic Questionnaire

A brief sociodemographic questionnaire [for further details see supplementary material in Vilaseca et al. (2019a)] was employed to gather social information for all participants, that is, both the parents and children.

Table 1 Descriptive table for the categorical sociodemographic variables obtained at the first measurement occasion of the study

Characteristic	N	%	Characteristic	N	%
Child's gender (male)	60	68.97			
Mother's depression			Father's depression		
Not at risk	58	66.67	Not at risk	66	83.54
At risk	29	33.33	At risk	13	16.46
Mother's anxiety			Father's anxiety		
Not at risk	45	51.72	Not at risk	51	64.56
At risk	42	48.28	At risk	28	35.44
Mother's civil status			Father's civil status		
Married or cohabiting	78	90.7	Married or cohabiting	77	96.25
Single/divorced/separated/widowed	8	9.3	Single/divorced/separated/widowed	3	3.75
Mother's employment			Father's employment		
Full-time job	45	52.33	Full-time job	72	88.89
Part-time job	24	27.91	Part-time job	2	2.47
Unemployed or housework	17	19.77	Unemployed or housework	7	8.64
Mother's education			Father's education		
University degree: No	52	59.77	University degree: No	53	65.43
University degree: Yes	35	40.23	University degree: Yes	28	34.57
Monthly family income					
Less than €1314	35	40.7			
€1314-€2450	15	17.44			
More than €2450	36	41.86			

Table 2 Descriptive table for the quantitative sociodemographic variables obtained at the first measurement occasion of the study. Empirical range for all variables (i.e. minimum and maximum) is shown within parentheses

Characteristic (Minimum–Maximum)	M	SD	Characteristic (Minimum—Maximum)	M	SD
Child's age (20–47 months):	33.44	6.8			
Mother's age (27–45 years):	36.98	4.11	Father's age (26–60 years):	38.94	4.94
Mother's caring time in the week (1–12 h/day):	8.2	3.32	Father's caring time in the week (0–12 h/day):	5.11	3.3
Mother's caring time on the weekend (4–18 h/day):	11.48	1.92	Father's caring time on the weekend (2–12 h/day):	10.18	3.05
Mother's stress (11–60):	27.91	8.45	Father's stress (12–39):	24.23	7.02
Mother's conjugality (27–69):	52.96	10.69	Father's conjugality (34–75):	54.67	9.45

Hospital and Depression Scale (HADS)

The Spanish version (Caro & Ibáñez, 1992) of the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) was used to assess anxiety and depression symptoms in mothers and fathers. The HADS is a self-reporting screening questionnaire composed of 14 items (seven items concerning depression symptoms and seven for anxiety symptoms) scored on a Likert scale from 0 to 3 points. In the current sample, the HADS showed a satisfactory internal consistency, with Cronbach's alphas for mother's and father's anxiety of 0.88 and 0.78, respectively; and 0.80 and 0.78 for mother's and father's depression (measured at T1). To adapt them for use in the predictive models, HADS subscale scores were dichotomized according to the clinical criterion in which scores higher than 7 points in the subscales, either for depression or anxiety symptoms, would indicate a risk of suffering health problems due to the mental issue assessed (Caro & Ibáñez, 1992). This categorization might be more informative in terms of clinical significance since it involves comparing at risk and normal groups with regard to the relationship between parenting styles and development.

Parental Stress Scale (PSS)

The extent to which family members, in this case mothers and fathers, perceive parental situations as stressful was assessed by means of the Spanish version (Oronoz et al., 2007) of the Parental Stress Scale (PSS) (Berry & Jones, 1995). This tool is composed of 12 items scored on a Likert scale, from 1 (total disagreement) to 5 (full agreement). The total score is the result of adding the scores for each item, considering whether the items are direct or indirect. The higher the score obtained, the higher the level of parental stress. In the current sample, the Cronbach's alphas for both mothers and fathers at the T1 were 0.83.

Conjugality Subscale of the Basic Family Relations Inventory (BFRI)

The Conjugality subscale on the Basic Family Relations Inventory (BFRI) (Ibáñez et al., 2012) was used to assess the perceptions of the quality of the couple's relationship, separately for mothers and fathers. This subscale consists of 14 items, Likert-type from 1 (never) to 5 (always). In the first measurement wave of the present study, the Cronbach's alphas were 0.91 for mothers and 0.90 for fathers.

Parenting Interactions with Children: Checklist of Observations Linked to Outcomes (PICCOLO)

Parent–child interactions were assessed by means of the Parenting Interactions with Children: Checklist of Observations Linked to Outcomes (PICCOLO) (Roggman et al., 2013b). This is an observational tool consisting of 29 items, scored as a frequency from 0 (absent), 1 (barely: brief, minor or emerging behavior) to 2 (clearly: strong or frequent behavior). Four dimensions are included in the scale: (a) Affection (expression of affection, positive emotions, positive evaluation of the child and

positive regard); (b) Responsiveness (reacting in a sensitive manner to a child's cues, expressions of needs or interests and behaviors); (c) Encouragement (parents' support of children's efforts, exploration, autonomy, choices, creativity, and initiative); and (d) Teaching (includes cognitive and linguistic stimulation, i.e., explanations about causal relations, talk about objects' characteristics and questions). In this study, we used the Spanish version of PICCOLO. A recent validation study (Vilaseca et al., 2019b) of this instrument found a high interrater reliability and satisfactory Cronbach's alpha coefficients in the four subscales and the total score. In the current study, 25% of mother–child interactions as well as 21% of father–child interactions were coded by two trained observers, and the interrater reliability scores for these were adequate (ICCs from 0.62 to 0.86). For the internal consistency reliability (measured at T1), the Cronbach's alpha values were 0.90 for mothers and 0.90 for fathers in the total scores. Concerning the instrument's subscales, alpha values for mothers and for fathers respectively were 0.58 and 0.57 for Affection; 0.81 and 0.84 for Responsiveness; 0.83 and 0.84 for Encouragement; and 0.69 and 0.66 for Teaching.

Bayley Scales of Infant Development-III (BSID-III)

Child development was assessed using the Spanish version of the Bayley Scales of Infant Development-III (BSID-III) (Bayley, 2015), a widely used scale to assess infant and child development between 1 and 42 months of age, and which can be used beyond 42 months to assess children with intellectual disabilities. BSID-III includes cognitive, language, and motor subscales, allowing researchers to obtain either percentile scores or developmental age. A previous study (Vilaseca et al., 2019a) did not find any relationships between parenting scores or other parental predictors and motor development. Therefore, the current study focuses on the remaining developmental subscales. In the present study, the Spanish adaptation of the Bayley-III Scales was used and the direct scores in the cognitive and language scales were transformed separately into Spanish percentile scores for each of the two scales. For the cognitive scale, Bayley offers tables to transform direct scores into scalar scores, according to the child's age, as well as to transform scalar scores into percentiles. Since the language scale is composed by two subscales (receptive and expressive language), direct scores on each one produce a scalar score according to the child's age. The sum of the scalar scores allows the assignment of the corresponding percentile (Bayley, 2015). The test–retest reliability scores, assessed by means of product-moment correlations between two measurement occasions, were 0.68 and 0.55 for cognitive and language percentiles, respectively.

Procedure

Ethical approval was first obtained from the University of Barcelona's Bioethics Commission (CBUB), in accordance with the International Ethical Guidelines for Health-related Research involving Humans prepared by the Council for International Organizations of Medical Sciences (CIOMS) in collaboration with the World Health

Organization (WHO), and the WMA Declaration of Helsinki – Ethical Principles for Medical Research involving Human Subjects.

Second, we contacted the Catalan Association of Early Intervention, an association that manages the majority of Early Intervention Centers (EIC) in Catalonia, in order to recruit participants. Then, we contacted 36 EICs by email and telephone and informed them of the nature of the study. The coordinators of the centers were asked to help in recruiting families for the study. Finally, twenty-three EICs accepted to participate in the research study.

To preserve confidentiality, each EIC that agreed to participate in the study was given documentation for the candidate families in a sealed envelope. This contained an information letter, an informed consent form, a sociodemographic questionnaire, and the rest of the instruments cited below (in duplicate) to be completed separately by the mothers and fathers. Families were informed that their participation would be entirely voluntary and anonymous. Mothers and fathers were asked to auto-record, separately, between 8 and 10 min of a normal play session with their child at home, with the following instructions: "Interact and play with your children as you normally do". Ninety-four per cent of the videos collected in this sample were more than nine minutes long. The father's and mother's recordings could be made on the same day or on different days, within a maximum period of one week. Both parents chose for themselves what to play with their child. Some games and materials were suggested in a brief guide: for example, books, toy animals, kitchens, dolls, or building blocks.

Finally, the videos were collected and scored according to the PICCOLO criteria by a small group of psychologists and specialists in child development. The first author of this paper, who has been trained by the authors of PICCOLO, trained the group of raters for this study. The trainees read the PICCOLO manual and watched and discussed the scores for four video recordings with the expert coder. After the training sessions, each observer scored four to six additional video recordings in order to establish reliability prior to collecting the study data. Observers were considered to have completed their training when they had an inter-rater agreement of 80% or more with the expert coder, following the same criteria as the PICCOLO user's guide (Roggman et al., 2013b). Each coder scored roughly 20 video recordings selected randomly, including both mothers and fathers from the same or different families. Only video recordings that had been filmed according to the researcher's instructions were scored (however, 99% were deemed satisfactory).

Once the parents had sent us the video self-recording, a member of the research team went to the EIC to administer the Bayley Scales of Infant Development-III (Bayley, 2015) to the child in the presence of the parents and, on some occasions, in the presence of the Early Intervention professional as well. After approximately 10 months (between 9 and 11 months, depending on the holiday period of the EICs) the researcher, together with the professional, called the parents again for a second administration of the Bayley Scale to the child in the EIC, under the same conditions as the first evaluation. The reference Early Intervention professionals received a written report with the results of the evaluation on both occasions. In no case did the EI professionals receive the results of the PICCOLO scale. The children continued to receive individual assistance at the EIC during the time of this study.

Statistical Analysis

Bivariate association between parenting behaviors, parents' psychological state indicators as well as sociodemographic predictors, and children's development scores were quantified and tested by means of correlation tests in the case of interval scales, and by using parametric tests based on means comparisons in the case of having categorical predictors. In order to complement the statistical decisions, effect sizes were computed by using Cohen's *d*, *eta*-squared, and product-moment correlations. In this regard, these analyses were useful for determining starting sets of predictors to be included in the predictive models for both cognitive and language percentile scores. More specifically, a significance (p) lower than 0.05 was used to retain the initial sets of predictors for all responses employed in the current study.

Linear regression models were estimated in order to predict cognitive and language development at times 1 and 2. All relevant exogenous variables concerning parenting behaviors (conjugality, PICCOLO scores, time spent during the week, time spent during the weekend), parents' psychological well-being (depression, anxiety, and stress), and sociodemographic factors (age, education, income) were used as potential predictors in the modeling procedure. The routine was based on a feasible solutions algorithm (Lambert et al., 2018), which is an intensive computing method that allows researchers to find an optimal solution amongst multiple possible solutions (i.e., candidate models). These multiple solutions correspond to different subsets of predictors, including high-order interaction terms. We followed the protocol detailed below to obtain an optimal solution:

1. Variables were specified according to their roles in the model, that is, as predictors or response variables. A full set of predictors was taken into account in the first runs, but checking that null models (i.e., models including any term but the intercept) yielded the same optimal solutions when a sufficient number of randomizations was employed. Those predictors that proved to be useful in the bivariate analyses were used as fixed variables, that is, were included in all subsets evaluated during this intensive procedure. However, these predictors could be removed in the final step depending on the goodness-of-fit index.
2. Routines were restricted to take into account 1,000 different initial random subsets of predictors. This allowed us to evaluate the model's space when searching for an optimal solution, and thus avoid finding a local solution.
3. Interactions were restricted to second order terms in order to ease interpretability of the final models.
4. The model's quality was assessed by means of the adjusted R-squared, a fit index that penalizes the model's complexity by correcting the model's predictive capacity depending on the number of predictors/terms included in the model.
5. Since different runs might produce the very same model as a final solution, we kept the specified model with a correspondingly larger number of times selected as the optimal model, as the final solution.
6. The complexity of the final solution obtained with the intensive procedure was reduced whenever possible by using Bayesian Information criterion (BIC). If a

reduced model (i.e., including less predictors or terms) still fitted the data at hand well, its specification was kept as the final model.

All statistical models were assessed to improve their specification by adding non-linear terms (i.e. polynomials) as well as detecting possible issues concerning multi-collinearity (by inspecting variance inflation factors; VIF < 5 in all models).

All statistical analyses were carried out using the R environment (version 4.0.3) (R Core Team, 2021).

Results

Sociodemographic factors related to the parents' characteristics (i.e., age, civil status, employment, education, and income; see description in Tables 1 and 2 as well as Supplementary Materials for further visualization of the bivariate distributions) were used to evaluate their bivariate relationship with percentile scores concerning cognitive and language development at the two measurement occasions. The bivariate analyses included in Table 3 show that mother's education was significantly associated with the cognitive percentile scores (t(85) = -2.20, $p = 0.03$; d = 0.49) and language percentile scores (t(85) = -1.98, $p = 0.05$; d = 0.44) at T1. In both cases, a higher mother's education level was related to higher percentile scores, that is, to higher child's developmental levels. Father's education only was related to a language percentile scores at T2 (t(67) = 3.06, $p < 0.001$; d = 0.8), and the relationship was negative. That is, a higher father's education level was related to lower language percentile scores at T2.

With respect to parental behaviors, mother's responsiveness positively correlated with language development at T1 (r = 0.30, p = 0.006; 95% CI = [0.09;0.48]); father's teaching was significantly related to cognitive development at T1 (r = 0.33, p = 0.003; 95% CI = [0.12;0.52]) and T2 (r = 0.33, p = 0.003; 95% CI = [0.12;0.51]). In addition, father's teaching was positively associated with language percentile scores at T1 (r = 0.36, p = 0.003; 95% CI = [0.13;0.55]) and T2 (r = 0.25, p = 0.05; 95% CI = [0.01;0.46]).

Considering the parents' psychological state, that is the anxiety and depression variables (with values *Not at risk* and *At risk*), no predictors were found to be significantly associated with developmental scores.

Finally, taking into account time spent caring for children, a significant negative relationship was found between weekly time devoted by mothers to this task and cognitive percentiles at T1 (r = -0.22, $p = 0.05$; 95% CI = [-0.41;-0.001]). This unexpected finding would indicate that lower cognitive percentiles might be expected as mothers spend more time caring for their children during the week, although the estimated effect size was low and with a notable variability in the CI, which ranged from medium to very low (almost zero) intensity. Additionally, this negative association between time spent by mothers and cognitive development was not significant when controlling for age and disability level (b = -0.13; t(79) = -0.35, $p = 0.73$).

Table 4 summarizes the final predictive models found using the rFSA algorithm and including cognitive percentile scores of the BSID-III as response. At T1 the

Table 3 Bivariate analyses between parenting scores, parental stress scores, parental relationship scores, time devoted to caring, and children's developmental measurements

			Time 1		Time 2	
			Cognitive	**Language**	**Cognitive**	**Language**
PICCOLO	Affection	*Father*	-0.15	-0.11	-0.04	-0.02
		Mother	-0.16	-0.05	-0.21	-0.17
	Responsiveness	*Father*	0.14	0.2	0.18	0.19
		Mother	0.11	**0.3****	0.07	0.19
	Encouragement	*Father*	0.15	0.17	0.21	0.17
		Mother	0.08	0.17	-0.04	0.02
	Teaching	*Father*	**0.33****	**0.33****	**0.36****	**0.25***
		Mother	0.05	0.16	0.11	0.11
	Total	*Father*	0.17	0.21	0.23	0.2
		Mother	0.05	0.2	0.0	0.07
PSS	Stress	*Father*	0.08	0.03	-0.06	0.0
		Mother	0.04	-0.1	-0.1	-0.17
BFRI	Conjugality	*Father*	0.0	0.07	0.1	0.12
		Mother	0.11	0.13	0.11	0.16
Caring time	Week	*Father*	0.01	0.11	0.12	0.16
		Mother	**-0.22***	-0.08	0.03	-0.17
	Weekend	*Father*	0.11	0.16	0.04	0.07
		Mother	0.01	-0.05	-0.08	0.00
HADS	Anxiety	*Father*	-0.09	-0.14	-0.14	-0.13
		Mother	-0.06	-0.06	-0.11	-0.10
	Depression	*Father*	0.15	-0.08	-0.06	-0.14
		Mother	-0.09	0.04	-0.03	-0.09
Education		*Father*	-0.13	0.03	**-0.33****	-0.08
		Mother	0.19	**0.23***	-0.08	**0.21***

Biserial correlations tests were used for HADS subscales and Education, Pearson's correlations tests were employed for PICCOLO, PSSS, BFRI and Caring time

*$p < 0.05$; **$p < 0.01$

fathers' scores in PICCOLO's teaching subscale yielded a significant linear effect ($\beta = 0.34$, $p < 0.001$; 95% CI = [0.13;0.54]); whereas the mothers' affection scores showed a significant interaction with their employment situation at the first measurement occasion. The estimated effect of mother's affection on cognitive percentiles at T1 is clearly negative in families in which mothers have a full-time job ($\beta = -0.63$, $p < 0.001$; 95% CI = [-0.94;-0.33]), and negligible in families in which mothers have part-time jobs (unstandardized marginal B = -0.11 and 95% CI = [-3.25;3.03]) or are unemployed or do the house work (unstandardized marginal B = -0.29 and 95% CI = [-4.36;3.77]). In addition, the fathers' teaching scores ($\beta = 0.33$, $p = 0.01$; 95% CI = [0.10;0.56]) as well as mothers' affection ($\beta = -0.44$, $p = 0.001$; 95% CI = [-0.70;-0.18]) and responsiveness ($\beta = 0.29$, $p = 0.04$; 95% CI = [0.02;0.57])

Table 4 Summary table for the regression models obtained with the procedure based on a feasible solutions algorithm using Bayley's cognitive development scores as responses

Response: Time 1					
Variable	**Estimate**	**SE**	**Standardized Beta**	**t**	**P**
Intercept	27.37	9.54		2.87	.01
Father's Teaching Score	1.83	0.57	0.34	3.22	< .001
Mother's Affection Score	-5.51	1.34	-0.63	-4.11	< .001
Mother part-time work	-68.47	22.86	-1.75	-2.99	< .001
Mother unemployed or housework	-67.84	27.07	-1.44	-2.51	.01
Mother's Affection x Mother part time work	5.44	2.02	1.55	2.69	.01
Mother's Affection x Mother Unemployed or housework	5.14	2.39	1.23	2.15	.04
Adj. $R^2 = .26$					
Response: Time 2					
Variable	**Estimate**	**SE**	**Standardized Beta**	**t**	**P**
Intercept	48.57	15.23		3.19	.002
Father's Teaching Score	2.46	0.86	0.33	2.88	.01
Mother's Affection Score	-5.24	1.57	-0.44	-3.33	.001
Mother's Responsiveness Score	2.15	1	0.29	2.14	.04
Adj. $R^2 = .22$					

scores were found to be useful predictors of cognitive development at T2, and the estimated effect of affection was negative. Linear models obtained in the present study in the case of using cognitive percentile scores from BSID-III yielded a predictive capacity between 22 and 26%.

Considering, now, language development scores from BSID-III (see Table 5), and using these scores assessed at T1 as responses, the final model included mothers' responsiveness scores ($\beta = 1.20$, $p < 0.001$; 95% CI = [0.12;0.54]) as well as the interaction between fathers' teaching scores and mothers' anxiety levels as useful predictors. Regarding the mother's responsiveness, higher scores in this parenting subscale predicted higher language development percentile scores. Considering the interaction, the positive effect of the father's teaching behaviors is more intense when the mother's anxiety levels are categorized as not at risk (unstandardized marginal B = 2.54 and 95% CI = [1.34;3.38]) than when the mother's anxiety scores might indicate a health risk, for which the marginal effect is not significant (unstandardized marginal B = -0.51 and 95% CI = [-1.53;0.52]).

When language percentile scores derived from BSID-III at T2 were used, the father's teaching scores ($\beta = 0.25$, $p = 0.03$; 95% CI = [0.03;0.48]), father's education ($\beta = -0.42$, $p < 0.001$; 95% CI = [-1.38;-0.42]), time spent by the father during the week caring for his child ($\beta = 0.29$, $p = 0.01$; 95% CI = [0.07;0.52]), as well as mother's stress scores ($\beta = -0.27$, $p = 0.02$; 95% CI = [-0.49;-0.04]) were kept in the final model. Consistent findings were obtained with this model in relation to father's teaching score, and the relationship with language development scores was positive. Contrary to what might be expected, fathers having a higher education predicted lower language development scores at T2. Lower language development scores

Table 5 Summary table of the regression models obtained with the procedure based on a feasible solutions algorithm using Bayley's language development scores as dependent variables

Response: Time 1					
Variable	**Estimate**	**SE**	**Standardized Beta**	**t**	**P**
Intercept	-20.42	5.50		-3.71	< .001
Mother's Responsiveness Score	1.20	0.38	0.33	3.19	< .001
Father's Teaching Score	2.36	0.51	0.65	4.59	< .001
Mother's Anxiety: At risk	18.06	5.45	0.78	3.31	< .001
Father's Teaching Score × Mother's Anxiety: At risk	-2.87	0.72	-0.99	-3.97	< .001
Adj. $R^2 = .28$					
Response: Time 2					
Variable	**Estimate**	**SE**	**Standardized Beta**	**t**	**P**
Intercept	22.11	10.56		2.09	.04
Father's Teaching Score	1.68	0.74	0.25	2.28	.03
Father's education	-19.37	5.17	-0.42	-3.75	< .001
Father's caring time during the week	1.90	0.73	0.29	2.61	.01
Mother's stress	-0.66	0.28	-0.27	-2.37	.02
Adj. $R^2 = .26$					

would be expected, according to the resulting model, when mothers present higher stress levels at T2. Linear models found for predicting language percentile scores accounted for between 26 and 28% of the total variability.

Discussion

In the present study, we examined associations between parenting behaviors defined in terms of affection, responsiveness, encouragement, and teaching, and other family factors (family-related demographic variables, parental anxiety, parental depression, parental stress and conjugality), as well as their interactions with cognitive and linguistic developmental outcomes for children with an intellectual disability in the first five years of life by means of a two-wave longitudinal study in a sample of Spanish families.

Sociodemographic Factors and Child Development

The results related to sociodemographic factors referring to parents' characteristics were evaluated in association with cognitive and language development at the two measurement occasions. Previous research has shown that the parents' educational level contributes to differences in parental behavior (Gracia, 2015; Trifan et al., 2014), which in turn may have a predictive influence on child development. Our results showed that children whose mothers had a higher educational level had a higher linguistic and

cognitive development at the first measurement occasion but not at T2. On the contrary, it seems that the father's educational level does not influence development at the first measurement occasion, but it does almost ten months later. Surprisingly, however, this relationship is negative: thus, lower linguistic and cognitive development at the second measurement would be expected with higher paternal educational levels. This is an aspect that needs to be properly discussed.

The positive relation between mother's educational level and child development has been well established in the literature (Haveman & Wolfe, 1995; Smith et al., 1997). This relationship would be mediated by parents' beliefs and behaviors (Davis-Kean, 2005). In addition, the literature suggests that fathers could be more strongly influenced by their educational level than mothers (Roeters et al., 2009). Therefore, it would be expected that both the mother's and father's educational level would be related to better developmental outcomes in their child. However, it should be taken into account that families with a child with ID might be exposed to other unobserved factors that affect their parenting and the impact may vary according to other characteristics of the father, such as paternal self-efficacy, the expectations that the father has about their child's development or being able to adjust shared activities to the age and developmental stage of their children, which may be associated with linguistically or cognitively stimulating father-child interactions, and consequently, with a better development of their child. We have to consider that this study included very young children, with cognitive and language developmental ages below their chronological age, which can result in not entirely optimal parental educational practices. Moreover, it is known that this affects fathers more than mothers (Cano et al., 2019). In addition, as we have commented before, the time and type of activities that parents share with their children may also be determined by social and cultural aspects of each country. Currently in Spain, in families with children with disabilities, although the father is increasingly present, it is still the mother who takes care of the child and who regularly attends early intervention centers (Vilaseca et al., 2020). In most Western countries, women are still the primary caregiver (Bianchi et al., 2012; Merens & Van den Brakel, 2014). Women tend to receive more socialization for the parenting role than men and it seems that women are more likely to feel an obligation to engage in parenting than men (Elam et al., 2017; Parke, 2000). Fathers may have more discretion in defining their caring role than women, leading to more variation and heterogeneity in how fathers fulfill their parenting role (Roeters et al., 2009). We suggest that all these factors could contribute to partially shadowing, or even subverting, in the case of fathers with a child with ID, the well-established relation between parents' educational level and child development. Therefore, it is clear that the influence of the father's educational level on the developmental outcomes of the child remains an open question to be addressed in future research, especially in families with children with disabilities, where the mother still seems to play a leading role.

Parenting and Child Development

Interestingly and surprisingly, a significant negative correlation was found between weekly time devoted by mothers and cognitive percentiles at first measurement, although we have to consider that the estimated effect was low and non-significant

when controlling for other factors such as children's age and severity of the disability. Therefore, we should consider these data with great caution. Judging by the average time that mothers and fathers in our sample spend with their child, it is the mother who clearly takes on the role of main caregiver, especially if the son or daughter has low cognitive levels. Mothers of children with disabilities are generally more involved in caregiving than fathers and also take more responsibility for other domestic tasks. This caregiving role was found to generate both positive and negative perceptions among mothers of children with IDs [43]. Mothers who perform the majority of caregiving tasks may have more interactions with their children than fathers do, but her participation may be seen as "obligatory" [see (Craig, 2006; Kühhirt, 2012)]. Therefore, the increased number of interactions with their children with IDs may also lead mothers to experience higher levels of psychological distress or a more intrusive style of parenting that does not promote development (Kuppens & Ceulemans, 2019; Love et al., 2005), especially if we take into account that most of our sample's mothers do not work outside the home, which on many occasions can counteract this less-than-optimal parenting (Vilaseca et al., 2014). Due to the sample size, we were unable to check all the effects found when controlling for the level of disability. Further research is therefore necessary to determine whether the association patterns between parental styles and development might remain when factors such as the severity of the disability are considered.

The findings reported here for early parenting behaviors measured with PICCOLO confirm our previous results (Vilaseca et al., 2019a). Mother's responsiveness and father's teaching proved to be useful for predicting linguistic development at the first measurement, which supports the idea that the quality of parenting is associated with children's developmental outcomes even in children with an intellectual disability (Assel et al., 2003; Festante et al., 2019; Spiker et al., 2002). What seems really interesting is the importance that teaching or cognitive stimulation from the father has for long-term development. In this study, father's teaching significantly predicted language and cognitive development at the first and second measurements. Therefore, besides social interaction and emotional support, fathers also provide cognitive and linguistic stimulation during their exchanges with their children, with long-term benefits for cognitive and language outcomes up to preschool and school age (Anderson et al., 2013; Innocenti et al., 2013; Totsika et al., 2020). This is consistent with the findings of Cano et al. (2019), who found that father-child time is more strongly associated with children's cognitive and linguistic outcomes when that time is spent in educational activities, such as educational play, in typically developing children. This contribution in relation to the importance of father's teaching for cognitive and linguistic development is particularly relevant for early intervention practices, because the father's involvement needs to be increased in early intervention programs (Fitzgerald et al., 2020; Meuwissen & Carlson, 2015; Peterson et al., 2018).

Against our predictions, in correlational analyses, parental psychological distress was not related to any of the child developmental scores even considering that the risk levels in relation to anxiety, depression and stress in our sample were high, especially in mothers. Our results are consistent with different studies in which it has been shown that mothers of children with ID report higher levels of anxiety,

depression and stress than fathers in the same family (Hastings et al., 2005a, b; Vilaseca et al., 2014).

Predictive Models for Child's Cognitive and Linguistic Development

Lastly, our results in relation to the final predictive models for cognitive and for language development in children with ID, showed very interesting patterns. In relation to children's cognitive developmental outcomes at the first measurement, father's teaching and mother's affection predicted the cognitive development of the child with an intellectual disability. As previously mentioned, children with ID whose fathers display more teaching behaviors during the early years achieve better cognitive development (Festante et al, 2019; Totsika et al., 2020), which are results similar to those found in the general population (Cabrera et al., 2007; Lamb, 2010; Pleck, 2010). However, the mother's affection is clearly negative for the child's cognitive development in families in which mothers have a full-time job. These results are perhaps surprising and might have emerged for different reasons. First, as we mentioned in previous research (Vilaseca et al., 2020), mothers and fathers of children with disabilities engage in more types of affective behaviors (warmth, closeness…) and fewer teaching behaviors (educational play, conversation, cognitive stimulation…). In mothers who had a full-time job with less time for the care of the child with a disability, affection may turn into overprotection (Gray, 2003; Sanders, 2006). As mentioned above, in Spain, a traditional division of labor predominates in couple households. Even when women are working on a full-time basis, mothers combine other roles, such as simultaneously caring for the child with a disability, which is similar to other countries (Essex & Hong, 2005; Pelchat et al., 2009; Rowbotham et al., 2011). Mothers typically take on more care-giving responsibility than fathers, as well as more responsibility for other domestic tasks (Crowe & Florez, 2006; Schneider, 2009). Most mothers talked of the demands of providing the constant care and attention required by a child with a disability, the increased responsibilities and the problems associated with the child's development. Note that caring for and parenting a child with an ID may be complex since maintaining a high level of communication or playing can be challenging. In relation to affection, if it is not accompanied by other parental behaviors, such as responsiveness or teaching, it can become overprotective, and this is not beneficial for cognitive development. These results are consistent with the significant negative relationship found in the bivariate analysis of the current study in relation to weekly time devoted by mothers and cognitive percentiles at first measurement, although we have to bear in mind that the estimated effect was low. Finally, with respect to the negative relation between affection and child's cognitive development, it is interesting to note that a study by Dave et al. (2018) found a negative effect of maternal dominance on early mother–child interactions and child language outcomes. Dominant affection is defined as a demonstration of control or exertion of influence by the mother over the infant. Our measure of affective behavior does not directly assess dominant affection; however, the results of Dave et al. (2018) and our own results indicate that the relationships between parental affective behaviors and child development are more complex than expected.

In relation to children's cognitive developmental outcomes at the second measurement, the father's teaching and mother's responsiveness proved to be useful predictors of children's cognitive development. These findings are consistent with previous research into the effect of parental behaviors on child development. In this respect, previous studies have related paternal teaching (Cabrera et al., 2017; Rowe et al., 2017) and maternal responsivity (Erickson et al., 2018) to the child's cognitive outcomes. Consequently, mothers and fathers should be taken into account in early intervention plans (Peterson et al., 2018; Roggman & Cardia, 2016). In previous studies by our research team (Vilaseca et al., 2019a), parents' affection was not shown to be related to children's cognitive or linguistic development. However, in this study when mother's affection is evaluated longitudinally it is related to lower cognitive percentile scores when mothers are employed full-time at T1, as mentioned above. This is clearly an open question to be addressed in further research.

Finally, the predictive models for language development in children with ID included mother's responsiveness scores as well as the interaction between father's teaching scores and mother's anxiety levels as useful predictors. Higher children's language development might be expected when mothers scored higher on the responsiveness scale. This finding is consistent with a large body of literature on both normative children (Dave et al., 2018; Levickis et al., 2018; Prime et al., 2020; Tamis-LeMonda et al., 2014) and children with disabilities (Kim & Mahoney, 2005; Siller & Sigman, 2008; Warren et al., 2010). However, interestingly, the positive effect of father's teaching behaviors is more intense when the mother's anxiety levels are categorized as not at risk. It has been clearly argued (Ashbourne et al., 2011; Cabrera et al., 2018; Fagan et al., 2014) that parenting is influenced by the psychological and personal characteristics of both parents and of the perception and support of the partner (Castillo & Frenzl-Crossman, 2010). In a previous study also carried out with families with children with ID (Vilaseca et al., 2019a), children's linguistic development was negatively correlated with the mother's anxiety score. Therefore, it is clear that in relation to parental psychological distress, the mother's anxiety is one of the aspects that should be considered in home visiting programs (Olds et al., 2004; Roggman et al., 2016). Our findings illustrate that the mother's anxiety levels, among other aspects of emotional well-being in families with children with ID, play a crucial role in infant language development together with father teaching behaviors. Teaching behaviors involve activities that include cognitive stimulation, shared conversation and play, explanations and joint attention. If the father can carry out these activities with the child, under apparent anxious pressure from the mother, the influence on development is clearly greater.

Our findings in relation to the final predictive models for language development in children with ID on the second measurement occasion showed consistent relationships between the child's linguistic levels and the father's teaching scores, the father's educational level and the mother's anxiety levels. Our findings for father's teaching scores are consistent with the results of previous research that related parental behaviors of linguistic stimulation (e.g., comments, questions, explanations…) with child language development in typically developing children (Weisleder & Fernald, 2013; Schwab & Lew-Williams, 2016: Rowe et al., 2017; Rowe & Snow, 2020) and in children with disabilities (Oakes et al., 2015; Seager

et al., 2018). Contrary to what might be expected, a higher education level in the case of the fathers predicted lower linguistic development scores at T2, which we discuss above. Clearly the effect of the father's education on the development of the child with a disability remains an open question to be addressed in future studies. With respect to the mother's parental stress, it is well established that parental stress, conceived as self-perceived difficulties to adjust to the parental role, negatively affects parenting quality (Cappa et al., 2011; Pérez-López et al., 2012) and child development (Harewood et al., 2017). According to our results, children's language development is predicted to be lower when mothers' stress levels are higher, which is consistent with other previous studies (Chamberland et al., 2015; Farver et al., 2006).

Although this study contributes to a better knowledge of parenting and child development in families of children with ID, it has several limitations that should be considered. First, the sample is not probabilistic. Participants were recruited at Early Intervention Centers, but they were volunteers. It is reasonable to assume that the parents who decided to participate were the ones who were the most informed about child development and the relevance of parental interactions, or even the most confident about their parenting skills. Additionally, in all families the parents were heterosexual male and female couples. Another measure that should be reviewed and improved is the time spent caring for the child, that is, it would be interesting to gain more detailed information about the time parents spend with their child (activities, frequency, participants, ideas about the relevance of these activities for child development). Other variables related to parenting should also be considered (e.g., the parents' ideas about child development, parental self-efficacy or parental sense of competence) in order to include these variables in the models. In the current study we obtained low reliability on some of the parenting scales, specifically the affection and teaching scales. Although this might appear to be a limitation of the study, it is consistent with previous findings; for instance, the Spanish validation with a sample of 203 mothers () reported internal consistencies of 0.59 and 0.68 on the affection and teaching scales respectively. Additionally, in the validation study for the fathers' version of the scale carried out by Anderson et al. (2013), with a sample of 428 participants, the lowest reliabilities were consistently observed on the affection (αs from 0.61 to 0.70) and teaching (αs from 0.58 to 0.67) scales. As for the analytical approach used, here we decided to estimate separately the different patterns of associations between parenting styles, parents' state, and children's development at the two measurement scales. Although other analytical possibilities might seem better suited to quantifying temporal change (for example, modeling T2-T1 changes or assessing differences in T2 while controlling for baseline at T1), we decided to adopt the methodology presented here for several reasons. First, we found unstable and non-consistent results in the models' estimated effects concerning parenting styles and parents' characteristics when predicting developmental change (T2-T1 differences) or differences in the second wave controlled for at baseline (differences at T2 controlling for T1 measurements). Secondly, with regard to the modeling routine executed in the present study, an intensive procedure was used in order to avoid obtaining models that corresponded to local solutions or overfitting the obtained models and, thus, to maintain the factors that consistently appeared as

useful predictors of child development. Nevertheless, the sample size was not large enough to guarantee that all the models included stable terms and that all the coefficient estimates were sufficiently accurate, that is, will small standard errors. For these reasons, the final results should be assessed with care, and further research is required in order to replicate (if possible) the findings discussed here – something that might appear challenging in the light of previous studies.

In future research, other techniques, such as semi-structured interviews, could be included, along with the self-administered questionnaires we used to assess anxiety, depression, stress and conjugality. This would make it possible to obtain complementary information and to compare the results with those obtained in the present study. It would also be interesting to include new measures of parental behaviors and child development in a longitudinal design to analyse the continuity and changes in these behaviors and their relations. To capture developmental change in children with disabilities, the time distance between measurement points should be wider than in this study. For instance, the original PICCOLO study followed up children with a disability up to nine years after the first assessment (Innocenti et al., 2013). Finally, it would be interesting to analyse the relations between parental behaviors, family emotional wellbeing, sociodemographic factors, and the child's development in other domains that are especially relevant for intellectual disabilities, such as adaptative functioning or socio-emotional development.

Conclusions

We conducted a longitudinal study with families with young children with an intellectual disability, taking into account the stability of the effects on child development of certain characteristics of the parents as well as parental interactions. Interestingly, our results showed that some effects are maintained over time while others are not. An intensive statistical modeling of the studied developmental indicators (child's cognitive and linguistic development) was carried out on two measurement occasions to select relevant predictors and their possible interactions. Linear models for child cognitive development yielded predictive capacities between 22 and 26%. In these models, the mother's responsiveness showed a positive association with the child's cognitive development at Time 2 (T2). The father's teaching predicted cognitive development at T1 and T2, whereas the mother's affection was related to lower child cognitive development at both times, but only when mothers were employed full-time at T1. Linear models found that using language percentile scores accounted for between 26 and 28% of the total variability. At Time 1, the mother's responsiveness and the father's teaching scores were positively associated with the child's language development; the positive effect of father's teaching was higher when the mother's anxiety levels were not at risk. At Time 2, father's teaching was positively associated with language development. Contrary to what might be expected, a higher father's education level was associated with lower language development. As expected, the mother's stress levels were negatively associated with language development.

As previously discussed, some of our results were not expected. When studies are in isolation, using correlations, this effect may go unnoticed. These partial effects have been detected by using an intensive modeling process. Significant interactions between parental behaviors, demographic variables and emotional states have been found by means of this intensive exploratory procedure. Nevertheless, further research is needed to determine the consistency of these results.

This exploratory study could contribute to the development of theoretical models about the effect of parental factors on developmental outcomes of children with intellectual disabilities at early ages. In addition, this research has some implications for early intervention practices, in which professionals following a family-centered model should promote positive parenting, in collaboration with mothers, fathers and professionals in home visits. Parenting behaviors that can be easily identified through PICCOLO can help early intervention professionals incorporate these behaviors into intervention plans to promote better child development. As we have seen in this study, parenting is a complex construct, especially in families with children with disabilities. This often makes it difficult for healthcare practitioners to identify the highest priority objectives for early intervention with families. Recently, Provenzi et al. (2021) proposed a pragmatic framework that provides professionals with a decision-making-oriented tool for the identification of priority goals and suitable actions for supporting parents of infants with developmental disabilities, which takes into account affective and emotional variables, parental behaviors and skills and parental cognitions and representations, including their ideas and beliefs regarding their child and themselves as mothers and fathers. We agree with those authors that these three dimensions of parenting should be considered in any intervention, especially in families with young children with disabilities. In this context, video-feedback interventions for parents represent a very promising initiative that can provide parents with opportunities to promote positive parenting behaviors and modified mental representations, with potential benefits for parenting emotional well-being and child development (Montirosso et al., 2020; Roggman et al., 2020).

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Data Availability The data presented in this study are not publicly available due to confidentiality agreements but they are available on request from the corresponding author subject to a non-disclosure agreement.

Compliance with Ethical Standards

Conflicts of Interest The authors declare no conflict of interest.

Ethics of Approval The study was conducted according to the guidelines of the Declaration of Helsinki and according to the International Ethical Guidelines for Health-related Research Involving Humans prepared by the Council for International Organizations of Medical Sciences (CIOMS) in collaboration with the World Health Organization (WHO) and approved by the University of Barcelona's Bioethics Commission (CBUB) (Approval number IRB00003099).

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