

# Dyadic Parent-Child Interaction Coding System (DPICS): Factorial Structure and Concurrent Validity

María Cañas, Izaskun Ibabe, Ignacia Arruabarrena, and Joaquín De Paúl  
Universidad del País Vasco UPV/EHU

## Abstract

**Background:** Comprehensive family assessments in Child Protection Services should include instruments with suitable psychometric characteristics. The present study aims to provide initial evidence of the factorial structure and other psychometric properties of the Dyadic Parent-Child Interaction Coding System (DPICS). **Method:** Participants were 80 mother-child dyads with children aged 4-8 who received family support from Child Protection Services in Spain. **Results:** Confirmatory factor analysis showed good fit for a four-factor solution (Praise, Questions, Clear commands and Negative talk) with 15 items. Inter-rater reliability indices were optimal. Evidence of concurrent validity found that DPICS factors were related to self-reported parenting and teacher-informed child behavior problems. **Conclusions:** This study provides preliminary evidence of the DPICS's psychometric properties for assessing mother-child interaction within Child Protection Services. Further research with larger samples of mother-child and father-child dyads is still needed to confirm the four-factor solution.

**Keywords:** Parent-child interaction, observation, child maltreatment, child behavior problems, psychometric properties.

## Resumen

**Dyadic Parent-Child Interaction Coding System (DPICS): Estructura Factorial y Validez Concurrente.** **Antecedentes:** la evaluación de familias en los Servicios de Protección Infantil debería incluir instrumentos con características psicométricas adecuadas. El objetivo principal de este estudio es proporcionar evidencia de la estructura factorial y otras propiedades psicométricas del Dyadic Parent-Child Interaction Coding System (DPICS). **Método:** la muestra estuvo formada por 80 díadas madre-hijo/a con niños/as de 4 a 8 años que recibieron servicios de apoyo familiar de los Servicios de Protección Infantil en España. **Resultados:** el análisis factorial confirmatorio mostró un buen ajuste para la estructura de cuatro factores (Elogio, Pregunta, Orden Clara y Verbalización Negativa) con 15 ítems. Los índices de fiabilidad interjueces fueron adecuados. Las evidencias de validez concurrente mostraron que los factores del DPICS estaban relacionados con las competencias parentales autoinformadas y con los problemas de conducta infantil informados por los profesores. **Conclusiones:** el presente estudio proporciona evidencia preliminar sobre las propiedades psicométricas del DPICS para la evaluación de la interacción madre-hijo/a en los Servicios de Protección Infantil. Sería necesario continuar investigando con muestras más amplias de díadas madre-hijo/a, así como díadas padre-hijo/a para confirmar la estructura de cuatro factores.

**Palabras clave:** interacción paterno/materno-infantil, observación, maltrato infantil, problemas comportamentales en la infancia, propiedades psicométricas.

The quality of parent-child interaction (PCI) has a critical influence on child cognitive development (Nilsen et al., 2020) and social-emotional adjustment (Werner et al., 2016). Research has shown that warm, sensitive, and supportive PCI dynamics enhance optimal child development (Mortensen & Mastergeorge, 2014), whereas dysfunctional PCI patterns heighten the risk of behavioral and emotional problems, academic underachievement, and low social competences (Pinquart, 2017). There is also robust evidence suggesting that dysfunctional PCI dynamics are

a strong predictor of child maltreatment (Stith et al., 2009). A meta-analysis conducted by Wilson et al. (2008) concluded that maltreating caregivers display higher levels of aversiveness (e.g., negative physical touch, humiliation) and lower levels of positive and involvement interactions (e.g., positive physical touch, praise) in PCI than non-maltreating ones. Given the consequences on children's well-being, enhancing PCI quality is a pivotal goal of early intervention programs (Werner et al., 2016). Therefore, as recommended by best practice guidelines, comprehensive family assessments should include PCI in early and preventive interventions (Early Head Start National Resource Center, 2000), as well as in rehabilitative programs (Office on Child Abuse and Neglect, 2018).

Direct behavior observation has been considered the gold standard method to assess PCI (Hawes & Dadds, 2006). Observational instruments designed to assess PCI can be

clustered into two large groups: (1) micro coding schemes, in which categories are narrowly defined by specific behaviors (e.g., commands, praise), and (2) macro coding systems, which provide global scores of broader constructs (e.g., reciprocity, sensitivity) (Margolin et al., 1998). The validity and reliability of both types of instruments are affected by methodological issues, such as task characteristics (e.g., free play, problem-solving, clean up), the setting (e.g., home, laboratory) and the length of time required to complete the observation (Gardner, 2000). In maltreating families, assessment accuracy is enhanced when the observation is conducted at home for more than 15 minutes (Wilson et al., 2008). Therefore, researchers and practitioners should consider these methodological issues when selecting observational instruments.

A recent systematic review (Cañas et al., 2020) has analyzed the psychometric properties of observational instruments to assess PCI in child protection settings using a thorough standardized method, the COSMIN checklist (Mokkink et al., 2018). The Dyadic Parent-Child Interaction Coding System (DPICS; Eyberg et al., 2013) was the most suitable observation tool for 4- to 8-year-old children. The DPICS was initially developed as a dyadic micro-coding measure of PCI quality directed at children with behavior problems and their caregivers (Robinson & Eyberg, 1981). The instrument is in its fourth edition and has been applied across different populations (e.g., children with behavior problems, autism spectrum disorders, maltreated children) as well as over a variety of settings (e.g., clinic, laboratory, home) with children aged 3-12 (Eyberg et al., 2013).

DPICS has been widely used for the assessment of PCI among maltreating caregivers. Comparing physically abusive and non-abusive mothers, DPICS has shown that negative behaviors toward the child were significantly more likely to occur with abusive ones (Borrego et al., 2004). Indeed, DPICS items of negative parental behaviors have been found to be a mediator for physical abuse recidivism (Chaffin et al., 2004). When applied to families at risk of maltreatment, DPICS has been sensitive to treatment changes compared to a waitlist group, detecting trajectory changes in observed parental behaviors with a decrease in harmful behaviors and an increase in positive ones (Thomas & Zimmer-Gembeck, 2012).

Some of the DPICS psychometric properties have been confirmed, for instance, inter-rater agreement, discriminant validity between clinical and non-clinical populations, and sensitivity to change (for a review, see Eyberg et al., 2013). Even though DPICS is commonly used as an outcome measure in randomized control trials (Gridley et al., 2019), a meta-analysis has pointed out the lack of consensus among clinicians and researchers regarding the reporting of its outcomes (Thomas et al., 2017). Previous psychometric studies have not analyzed DPICS's factorial validity (Eyberg et al., 2013), and the lack of knowledge of its underlying factorial structure could be key to explaining such variability. Determining the DPICS's factor structure would help to establish standard criteria for reporting assessment outcomes.

Therefore, the present study's first goal was to carry out a comprehensive examination of the internal structure and concurrent validity of the DPICS in a Spanish sample of mothers at risk for child maltreatment. The factor model was based on a variation of the theoretical composite categories proposed by the DPICS authors (Eyberg et al., 2013). These composite categories have been widely used across studies with the DPICS, but have never been subjected to factorial structure validity analysis to our knowledge. The expected model was a three-factor solution

consistent with the three dimensions of parenting (Saklofske et al., 2013), based on seven from eight main categories of DPICS: Positive parenting (Praise, Questions, Reflection, and Behavior description), Negative parenting (Negative talk) and Control parenting (Direct and Indirect commands).

The DPICS concurrent validity was examined by analyzing its relationship with self-reported parenting and teachers' reports of child behavior problems. The results were expected to fit with the findings of a meta-analysis performed by Hendriks et al. (2017), yielding small but significant correlations among observed and self-reported parenting. The concurrent validity of DPICS was also tested by exploring its relationship with child behavior problems, which is a variable linked to PCI quality (Fleming et al., 2017). As maltreating parents' reports of child behavior problems could be vulnerable to bias (Lau et al., 2006), teachers were selected as informants for child behavior problems in the present study. Several longitudinal studies have found that PCI is strongly related to teachers' reports of child behavior problems (Bornstein et al., 2018; Fleming et al., 2017), so it was expected that negative DPICS scores would correlate with higher levels of child behavior problems informed by teachers.

## Method

### Participants

Participant families were recruited in a Randomized Control Trial (RCT) conducted from 2015 to 2018 within the Child Protection Services of Gipuzkoa (Spain) (De Paul et al., 2015). The total RCT participants were 112 families (122 children and 112 mothers) receiving parenting support services due to significant difficulties handling their 4- to 8-year-old children's behavior problems. According to Child Protection Services, these families were considered at risk for child maltreatment. Of these, 94 families (84%; 104 children, 94 mothers) provided favorable informed consent to take part in the RCT. Observational data were collected from 85 families (76%; 95 children, 85 mothers as the primary caregiver), who agreed to be videotaped with their children during the assessment. No significant differences were found in maternal disciplinary strategies or sociodemographic characteristics between families who provided consent and those who did not. After removing siblings ( $n = 10$ ) and discarding videotapes that did not fulfill the quality criteria for thorough coding (e.g., mother's language  $n = 3$ ; more people in the room  $n = 2$ ), the present study's final sample comprised 80 mother-child dyads. The sociodemographic characteristics of the participants are outlined in Table 1.

### Instruments

*Dyadic Parent-Child Interaction Coding System-IV* (DPICS-IV Clinical version; Eyberg et al., 2014). The DPICS-IV protocol requires videotaping 25 minutes of semi-structured PCI of three standardized situations with varying parental control levels. The procedure starts with a *Child-Led Play* (CLP) situation of 10 minutes, where the child plays freely and the caregiver is expected to follow the child. In the next 10 minutes, *Parent-Led Play* (PLP), the caregiver is encouraged to choose the activity and lead the play. In both situations, the first 5 minutes are for warming-up, and only the second 5 minutes are coded. The last 5 minutes includes the

Table 1

Sociodemographic Characteristics of Participants (N=80 Mother-Child Dyads)

Children	n (%)
<i>Child gender</i>	
Male	52 (65.0)
Female	28 (35.0)
<i>Child age</i>	
4-6 years	46 (57.5)
7-9 years	34 (42.5)
[M (SD)]	5.94 (1.2)
Families	n (%)
<i>Family income</i>	
Financial difficulties	29 (36.3)
Without financial difficulties	51 (63.7)
<i>Family structure</i>	
Two biological parents	34 (43.5)
One-parent family	4 (5.0)
Divorced	42 (52.5)
Mothers	n (%)
<i>Age</i>	
Between 20 and 25 years	5 (6.2)
Between 26 and 30 years	9 (11.2)
Between 31 and 39 years	40 (50.0)
More than 40 years	26 (32.5)
<i>Origin</i>	
Spanish	50 (62.5)
Immigrant	30 (37.5)
<i>Educational level</i>	
Elementary education	26 (32.5)
Professional training/ secondary education	40 (50.0)
University	14 (17.5)
<i>Employment status</i>	
Stable employment	36 (45.0)
Temporary employment	10 (12.5)
Unemployed/working at home	34 (42.5)

Clean-Up (CU) task, where the caregiver informs the child that it is time to pick up the toys. Therefore, the codification takes 15 minutes of the total videotaped time.

The clinical version of DPICS-IV comprises eight parental categories, but the present study used five main categories (*Praise, Questions, Negative talk, Direct commands and Indirect commands*). Table 2 shows descriptions of included and excluded DPICS categories. The exclusion of categories was based on theoretical or statistical grounds. *Behavior description* and *Reflection* were excluded from the analyses for exhibiting zero or extremely low variability. The *Neutral talk* category was excluded following the original author's recommendations since it is a highly prevalent category with lack of clinical utility (Eyberg et al., 2013). Command categories have three sub-categories: *No opportunity to comply, Compliance* and *Noncompliance*. The present study aimed to build a factor focused on measuring parents' ability to give effective directions to the child; thus, the *No Opportunity to Comply* sub-category was also discarded for being an ineffective way of issuing commands.

The DPICS scoring system is based on frequency counts of each category across the three tasks. For instance, the Praise category is computed through three Praise items, one for each 5-minute coded

segment (e.g., CLP Praise, PLP Praise, CU Praise). Praise global score reflects the total number of praises given by a parent within the 15 coded minutes. Therefore, the resulting DPICS variables are quantitative and their range of values depends on the frequency with which participants exhibit the behavior.

*Parent Practices Inventory* (PPI; Webster-Stratton, 2001). The PPI assesses caregiver disciplinary strategies on a seven-point scale (1 = Never to 7 = Always) self-report questionnaire. For the present study, we used a recent PPI adaptation with a Spanish sample (Rivas et al., 2020) with a four-subscales factor structure: *Praise and incentives* (7 items;  $\alpha = .70$ ), *Appropriate discipline* (7 items;  $\alpha = .72$ ), *Harsh and inconsistent discipline* (5 items;  $\alpha = .76$ ), and *Physical punishment* (6 items;  $\alpha = .80$ ). All the subscales showed adequate internal consistency. This model had a good fit to the data: TLI = .91; CFI = .926; RMSEA = .06, [90% CI .05 -.07].

*Sutter-Eyberg Student Behavior Inventory-Revised* (SESBI-R; Eyberg & Pincus, 1999). The SESBI-R measures the intensity of behavior problems assessed by teacher report (Intensity subscale, 38 items) and the extent to which teachers found the behaviors difficult to manage (Problem subscale, 38 items). The Intensity subscale is rated on a seven-point Likert scale (1 = Never; 7 = Always) and the Problem subscale is dichotomous (1 = Yes; 0 = No). The Spanish version used in this study was obtained by a back-translation method. Although the minimum number of cases per item (e.g., at least 5-10 participants) were not met, a CFA with the WLSMV estimator was conducted to test the original structure. The results suggested a good fit of the model: TLI = .924; CFI = .926; RMSEA = .069, [90% CI .06 - .08]. Also, Intensity ( $\alpha = .95$ ) and Problem to manage ( $\alpha = .91$ ) scales yielded high internal consistency.

*Socio-demographic data.* Age, country of origin, educational level, employment status, family structure, and family income were obtained from mothers' reports. Family income item had three options (1 = Money is not an issue; 2 = We can pay the bills, but we cannot save; 3 = We have difficulty making ends meet), that were dichotomized to create the financial difficulties variable (0 = mothers choosing the first and second option; 1 = mothers choosing the third option).

### Procedure

Families were referred to the RCT by Child Protection Services caseworkers, who informed of the study goals and the assessment protocol, and provided written informed consent from each family. After agreeing to participate, a trained clinical psychologist visited the families in their homes to conduct the assessment. The standard evaluation procedure involved two home sessions, which usually took over 120 minutes in total. The Ethics Committee of the University of the Basque Country (Spain) approved the study protocol.

To ensure the reliability of the DPICS video-coding, two Ph.D. candidates became trained and certified. One of them coded all the videotapes while the second coder viewed 15% of the videotapes to address inter-rater reliability. The videotapes were randomly selected, and both coders were blinded to them. The intraclass correlation indices obtained are described in the Results section.

### Data analysis

Data analysis was performed with 80 mother-child dyads for DPICS, mother-report on their disciplinary strategies ( $n = 80$ ), and teacher-report on child behavior problems ( $n = 40$ ). Descriptive

Table 2  
DPICS-IV main categories of parental behaviors (Eyberg et al., 2014)

Included categories	Description	Examples	Items used in this study
1. Praise	Labeled or unlabeled positive evaluation of an attribute, product, or behavior of the child	That's a great tower!	Praise-CLP Praise-PLP Praise-CU
2. Questions	A descriptive or reflective comment expressed in the form of a question	Are you building a tower?	Question-CLP Question-PLP Question-CU
3. Direct commands <sup>a</sup>	Straight requests to the child for performing a specific activity or behavior	Build a tower for me, please	Comply Direct Command-PLP Comply Direct Command-CU Noncompliant Direct Command-PLP Noncompliant Direct Command-CU
4. Indirect commands <sup>a</sup>	An indirect request to the child for performing a specific activity or behavior	How about if you build a tower?	Comply Indirect Command-PLP Comply Indirect Command-CU Noncompliant Indirect Command-PLP Noncompliant Indirect Command-CU
5. Negative talk	Disapproval of the child's attributes, activities, products, or choices	That tower is a mess	Negative Talk-CLP Negative Talk-PLP Negative Talk-CU
	Sassy, sarcastic, rude, or impudent speech	That's a tower, are you kidding?	
	Statements that tell the child what not to do	Don't make the tower so tall	
Excluded categories	Description	Examples	
6. Reflection <sup>b</sup>	A statement where a caregiver repeats or reflects what the child said		Child: I'm going to build a tower Parent: You're going to build a tower!
7. Behavior descriptions <sup>b</sup>	A sentence where a caregiver states what a child is doing or recently did		You are building a tower (while the child is performing the action)
8. Neutral talk <sup>c</sup>	Statements that describe information about people, objects, events, or activities		The tower is red and blue

<sup>a</sup> Command categories have three sub-categories: No opportunity to comply, Compliance or Noncompliance. *No opportunity for compliance* was excluded based on theoretical grounds, because the child is not given an adequate chance to comply (parent request is unspecific or issued more than one command within 5 sec). *Compliance* (when the child obeys or begins to obey) and *Noncompliance* (when the child does not obey or attempt to obey).<sup>b</sup> Excluded categories based on statistical grounds due to the variability rates. <sup>c</sup> Excluded category based on theoretical grounds

analyses (mean, standard deviation, skew, and kurtosis) were conducted for the DPICS items included in this study (Table 3). The final DPICS items showed a high variability in their range of values (e.g., CLP-Question ranging from 0 to 43, CLP-Praise from 0 to 11) and were non-normally distributed with severe positive skewness. We performed a square root transformation, which is recommended for count data positively skewed (McCune & Grace, 2002). This transformation intended to rescale items to make them comparable and to improve the assumptions of normality and homogeneity of variance. The subsequent data analysis of DPICS was performed with transformed items. Confirmatory factor analysis (CFA) was conducted to test two models. First, a three-factor structure (Positive interaction, Clear commands, Negative talk). There were two second-order factors: (1) Positive interaction, with two factors: Praise and Questions, and (2) Clear commands with two factors: Compliance and Noncompliance. The second model was a four-factor solution (Praise, Questions, Negative talk, Clear commands). Two items (Comply Indirect command-PLP = .17; Noncompliant Indirect command-PLP = .30) were removed from both models for showing a non-significant, low factor loading. Transformed items showed skewness and kurtosis values within acceptable ranges; therefore, the goodness-of-fit of the models was assessed with the normal theory maximum-likelihood (ML) chi-square, and the comparative fit index (CFI).

Moreover, the goodness-of-fit of the second model was tested with robust methodology (the Satorra-Bentler scaled chi-square statistic RML) using pre-transformed data. A value equal to or greater than .90 was acceptable for the CFI (Bentler, 2006). The root mean square error of approximation (RMSEA) was also used to assess goodness of fit; a value of .06 or less is desirable (Hu & Bentler, 1999).

Two dimensions of the DPICS reliability were analyzed. Inter-rater reliability was examined by the intraclass correlation coefficient (ICC), which is the preferred method for continuous scores (Mokkink et al., 2018). Internal consistency was tested by McDonald's omega ( $\omega$ ) coefficient, which is a sounder index of reliability (Hayes & Coutts, 2020), but Cronbach's alpha ( $\alpha$ ) was also calculated, since it is still the most reported internal consistency coefficient.

Concurrent validity was tested by the Pearson correlation coefficients between scores on the DPICS factors, the Parent Practices Inventory (PPI, Webster-Stratton, 2001) and the Sutter-Eyberg Student Behavior Inventory-Revised (SESBI-R; Eyberg & Pincus, 1999). As research hypotheses were theoretically driven, one-tailed tests of significance were conducted (Cho & Abe, 2013). Univariate data analyses were conducted using the IBM SPSS statistics package version 26. CFA was performed using the EQS 6.4 Structural Equation Program.



Results

Descriptive Analyses

Table 3 shows the descriptive analysis for DPICS items. Before transforming the data, seven items had a skew index higher than 2, and five items showed extreme kurtosis (kurtosis > 8). After square root transformation, the distribution of the transformed variables was within the assumption of normality.

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) assessed the adequacy of the proposed models. The three-factor model with Positive Interaction, Clear commands, and Negative talk was tested. The model fit indices were optimal: ML  $\chi^2$  (82,  $N = 80$ ) = 84.15,  $p = .41$ ; CFI = .956, RMSEA = .037, [90% CI .00 - .07] but the Positive Interaction second-order factor (Praise and Questions) was not statistically significant; therefore, the four-factor solution (Praise, Questions, Negative talk and Clear commands) was tested. This factorial structure adequately fitted the data: ML  $\chi^2$  (83,  $N = 80$ ) = 84.92,  $p = .42$ ; CFI = .959, RMSEA = .036, [90% CI .00 - .07], and all latent factors were significant ( $p < .05$ ). Factor loadings were also significant, with the exception of an item in the Negative talk factor (Figure 1). Although Negative Talk-CU showed a non-significant factor loading (.33) below the desirable level (factor loadings > .40), the item was retained due to its clinical utility, as well as for statistical requirements since a minimum of three indicators per latent variable is recommended (Brown, 2015). This model was also tested with the pre-transformed items, showing acceptable fit indicators based on the robust method: S-B  $\chi^2$  (80,  $N = 80$ ) = 85.34,  $p = .32$ ; RCFI = .954, RMSEA = .034, [90% CI .00 - .07].

The Negative talk factor showed an inverse correlation with the Praise ( $r = -.55, p = .020$ ) and Questions factors ( $r = -.47, p = .009$ ). Praise was positively correlated with the Clear commands ( $r = .46,$

$p = .049$ ) and Question factors ( $r = .70, p = .042$ ). Moreover, Clear commands showed a positive correlation with Questions ( $r = .56, p = .020$ ) but was not significantly correlated with Negative talk ( $r = .06, p = .199$ ).

Reliability

Table 3 summarises the inter-rater reliability coefficients of the 15 categories calculated by the Intraclass Correlation Coefficient, yielding optimal results ranging from .74 (Noncompliant Indirect commands-CU) to .99 (Praise PLP and other categories).

The internal consistency of the four-factor solution of DPICS showed mixed findings. Praise factor ( $\Omega = .75; \alpha = .74$ ) and Noncompliance commands ( $\Omega = .70 \alpha = .69$ ) proved to be reliable. Questions ( $\Omega = .68; \alpha = .68$ ) showed a slightly lower index, and Compliance commands ( $\Omega = .62; \alpha = .60$ ) internal consistency was lower than desirable. The Negative talk factor was unable to reach an acceptable level ( $\Omega = .50; \alpha = .49$ ). Nevertheless, the factor was retained due to its clinical utility and statistical justification since the model fitted well to the data.

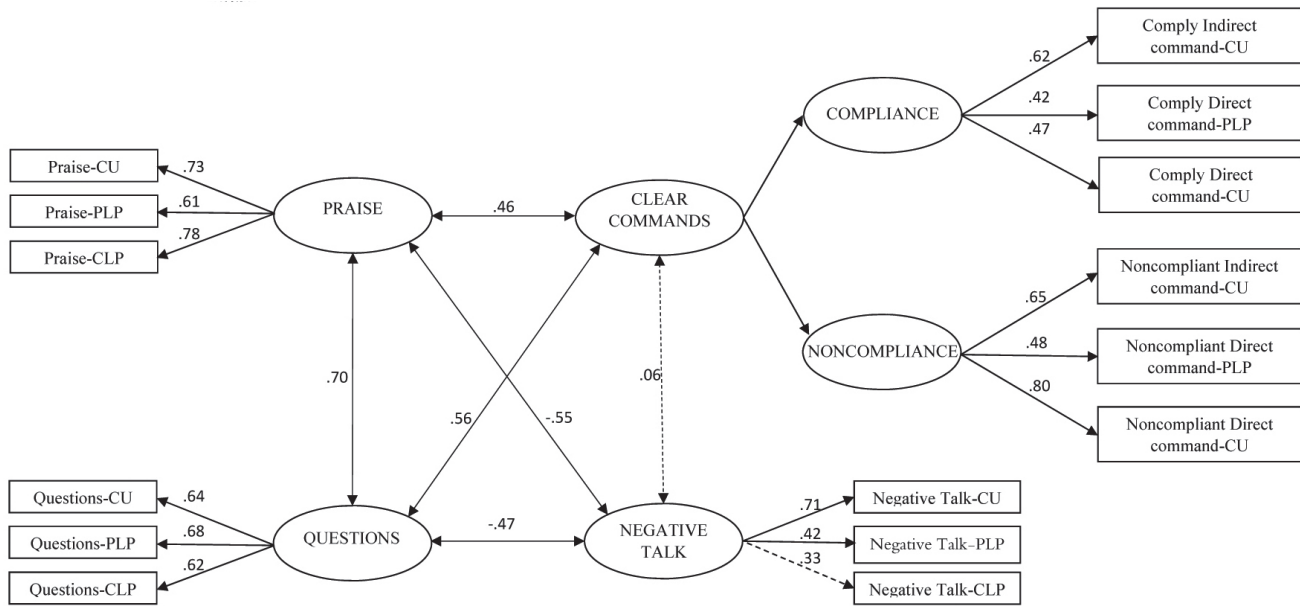
Concurrent Validity

Table 4 shows the Pearson correlation coefficients between the DPICS factors and self-reported parenting (PPI; Webster-Stratton, 2001) and child behavior problems reported by teachers (SESBI-R; Eyberg & Pincus, 1999). DPICS Praise factor yielded a significant medium correlation with PPI Praise and incentives scale ( $r = .37$ ), and DPICS Questions factor showed a weak but significant correlation with PPI Praise and incentives scale ( $r = .20$ ). DPICS Negative talk factor showed a quite weak but significant correlation with PPI Harsh and inconsistent discipline scale ( $r = .27$ ) and correlated inversely with PPI Praise and incentives scale ( $r = -.21$ ). Moreover, the DPICS Negative talk factor was significantly and moderately correlated with the SESBI-R Intensity ( $r = .42$ ) and Problem ( $r = .53$ ) scales reported by teachers. The DPICS

Table 3  
Descriptive statistics for DPICS items Mother-child dyads (N = 80)

Variable	M (SD)	Rg	Pre-transformation		Post-transformation		ICC
			Skw	Krt	Skw	Krt	
1. Praise-CLP	2.15 (2.67)	0-11	1.51	1.72	0.37	0.91	.93
2. Praise-PLP	2.84 (4.16)	0-20	1.99	4.10	0.72	0.41	.99
3. Praise-CU	1.92 (3.07)	0-16	2.70	8.82	0.88	0.20	.99
4. Question-CLP	15.33 (10.46)	0-43	0.88	0.28	0.16	0.08	.99
5. Question-PLP	13.31 (8.47)	0-40	0.86	0.97	0.18	0.09	.96
6. Question-CU	7.32 (6.23)	0-25	1.00	0.20	0.02	0.47	.89
7. Comply Indirect command-CU	0.70 (1.16)	0-6	2.35	6.75	0.93	0.31	.78
8. Comply Direct command-PLP	2.14 (2.17)	0-10	1.60	3.24	0.01	0.58	.81
9. Comply Direct command-CU	2.20 (2.08)	0-9	1.36	2.10	0.58	0.01	.82
10. Noncompliant Indirect command-CU	1.30 (2.12)	0-11	2.70	8.11	0.90	0.25	.74
11. Noncompliant Direct command-PLP	1.22 (1.97)	0-12	2.66	10.64	0.85	0.20	.85
12. Noncompliant Direct command-CU	2.30 (3.33)	0-17	2.13	4.94	0.70	0.25	.88
13. Negative Talk-CLP	5.83 (7.85)	0-48	3.00	11.47	0.87	1.49	.89
14. Negative Talk-PLP	6.06 (5.22)	0-26	1.47	2.30	0.07	0.12	.80
15. Negative Talk-CU	5.22 (6.40)	0-40	3.20	13.57	0.67	1.67	.98

Note: Rg = Range of scores; Skw = Skewness; Krt = Kurtosis; CLP = Child-Led Play; PLP = Parent-Led Play; CU = Clean-Up; ICC = Intraclass Correlation Coefficient



**Figure 1.** Confirmatory Factor Analysis of DPICS. Note: ML  $\chi^2$  (83, N = 80) = 84.92,  $p$  = .42; CFI = .959, RMSEA = .036, [90% CI .00 -.07]. All estimated parameters are standardized. When the line is continuous, factor loadings and coefficient correlations were significant ( $p < .05$ ). The discontinuous line represents non-significant factor loadings and coefficient correlations

*Table 4*

Pearson Correlations between DPICS factors (N = 80), Parent practices PPI (N = 80) and Child behavior problem SESBI-R (n = 40)

Parent practices/Child behavior problem	Praise	Questions	Compliance	Noncompliance	Negative talk
<i>Parent Practices Inventory PPI</i> (Mother report)					
1. Praise and incentives	.37**	.20*	.11	-.09	-.21*
2. Appropriate discipline	.12	.16	.06	-.01	.07
3. Harsh and inconsistent discipline	-.06	-.07	.02	.03	.27*
4. Physical punishment	.02	-.09	.06	.09	.09
<i>Sutter-Eyberg Student Behavior Inventory-Revised SESBI-R</i> (Teacher report)					
5. Intensity scale	-.08	-.15	-.30*	.16	.42**
6. Problem scale	-.12	-.28*	.08	.08	.53**

Note: \*\*  $p < .01$ ; \*  $p < .05$

Compliance factor was significantly and inversely associated with the SESBI-R Intensity scale ( $r = -.30$ ), and the DPICS Questions factor was also negatively correlated with the SESBI-R Problem scale ( $r = -.28$ ). DPICS Noncompliance factor was not significantly correlated with any of the measured scales.

### Discussion

Dysfunctional parent-child interaction (PCI) dynamics are associated with problems in multiple areas of child development and even with child maltreatment (Wilson et al., 2008), so they are a main intervention goal in preventive and rehabilitation programs. Valid and reliable assessment instruments targeting PCI would help practitioners and researchers working in this field, particularly in Child Protection Services. The DPICS has been shown to be a useful clinical and research tool for assessing PCI in maltreating and at-risk families (Chaffin et al., 2004; Thomas & Zimmer-Gembeck, 2012). Some of its psychometric properties have been widely studied (e.g., inter-rater reliability or discriminant validity),

but its factorial validity has never been reported (Eyberg et al., 2013). To our knowledge, this is the first research to examine the factor structure of the DPICS.

The present study provides preliminary evidence of the validity and reliability of the DPICS in a Spanish sample of mother-child dyads at risk of child maltreatment with children aged from 4 to 8 years with significant behavior problems. Confirmatory factor analysis (CFA) provides evidence to support the validity of the internal structure of DPICS, according to Rios and Wells (2014). As the construct was intended to be multidimensional, the four-factor model (Praise, Questions, Negative Talk, and Clear commands) fits the data well. The four-factor solution captures the three main theoretical dimensions of parenting consistently reported in the literature (Saklofske et al., 2013): Positive parenting (Praise and Questions), Negative parenting (Negative talk), and Controlling parenting (Clear commands). This structure could be helpful for addressing the lack of a standard for reporting and scoring DPICS variables pointed out in a recent meta-analysis (Thomas et al., 2017).

The DPICS Clear commands second-order factor, composed of DPICS Compliance and DPICS Noncompliance, is focused on the parental ability to provide clear directions and the children's responses to them. Patterson's coercive cycle posited that the patterns of dysfunctional interaction defined by parental harsh control strategies attempting to obtain child compliance were a robust predictor of child maltreatment and child behavior problems (Granic & Patterson, 2006). On the other hand, child compliance, which is an indicator of adjustment across childhood, is gained in the child socialization process in the context of warm and positive parenting (Lincoln et al., 2017). Therefore, providing a measure able to capture a dyadic perspective of this interaction pattern could be useful for practitioners working with clinical families.

The four-factor solution accords with the DPICS's categorization of parental behaviors as "to promote or to avoid" during interaction except for Questions (Eyberg et al., 2013). Although original DPICS authors conceptualized questions as a behavior to be avoided (McNeil & Hembree-Kigin, 2010), the results of the present study suggest that questions are an indicator of positive parenting, consistent with other studies which indicate that questions are a signal of high parental involvement (e.g., Cotter & Brestan-Knight, 2020; Timmer et al., 2002; Wilson et al., 2008). Timmer et al. (2002) analyzed the role of Questions in the interaction dynamics of abusive and non-abusive parents assessed by DPICS, finding that questions triggered involvement in the dyad. In the same direction, a recent study with a sample of families seeking treatment for diverse clinical problems found that children who exhibited a higher frequency of questions during interaction were perceived as more adaptive by their caregivers (Cotter & Brestan-Knight, 2020). Therefore, the present study's statistical evidence is in line with this body of research, pointing out that questions during PCI could act as a dyad involvement enhancer.

Our results also indicate optimal inter-rater reliability for all items. The concurrent validity of DPICS was analyzed through its relationship with parenting reported by mothers (Parent Practices Inventory, PPI) and child behavior problems reported by teachers (Sutter-Eyberg Student Behavior Inventory-Revised, SESBI-R). As expected, and in line with previous research (Hendriks et al., 2017), the results showed a quite weak but significant correlation between observed and reported positive and negative parenting, and a marginal correlation between observed and reported controlling parenting. The DPICS Praise factor was significantly and positively related to the PPI Praise and incentives scale. The DPICS Negative talk factor was significantly and positively related to the PPI Harsh inconsistent discipline scale, and significantly and negatively related to the PPI Praise and incentives scale. The small correlation coefficients yielded among the DPICS Negative talk factor and PPI scales are in accordance with the evidence showing that caregivers tend to under-report negative parenting (Swenson et al., 2016). In particular, this bias has been found to be more acute for aggressive behaviors, such as hitting the child (Waylen et al., 2008), which could explain the lack of significant correlations between the DPICS factors and the PPI Physical punishment scale. In any case, complementing parents' reports with live observational

methods may capture a more complete representation of the parent-child interaction.

The correlation between DPICS Negative talk factor and teacher-reported child behavior problems (SESBI-R) was particularly strong. This finding is consistent with the significant and negative correlation of the DPICS Compliance factor with SESBI-R Intensity of child behavior problems. The results are in line with previous studies that have found that negative PCI was a strong predictor of behavior problems reported by teachers (Fleming et al., 2017), and that supportive and warm PCI predicted teacher reports of behavior adjustment (Bornstein et al., 2018).

The findings of the present study should be interpreted in the light of some limitations. First, the sample was composed of families referred by Child Protection Services to parenting support services. As in every study conducted with participants receiving services, only parents who agreed voluntarily to participate in the study were included in the sample. Second, the low internal consistency showed by the Negative talk factor warrants attention. The small number of items comprising the factor could be behind this issue (Kopalle & Lehmann, 1997). Nevertheless, recent research findings point out that low internal consistency indices do not necessarily indicate a higher measurement error of a subscale and could be explained by the low base rates of items (Lorber & Slep, 2018). In any case, future studies should include more items relevant to the Negative talk factor and analyze its internal consistency issues in detail. Third, SESBI-R results may be unstable since the number of cases to estimate the parameters is clearly insufficient. Thus, these findings should be interpreted with great caution.

Our study contributes to the literature in several ways. First, it features a novel empirical effort to identify the factorial structure of DPICS. Second, it assesses concurrent validity through multiple sources, such as caregivers' self-reported parenting and teachers' reported measures of child behavior problems. Third, it helps to address the scarcity of reliable and valid observation tools targeting caregivers and school-aged children interaction. Finally, the results provide preliminary evidence supporting the use of DPICS in Spanish Child Protection Services with mother-child (4 to 8 years) dyads to complete family interaction and parenting assessments, set interventions' goals, monitor progress, and evaluate intervention outcomes.

Considering the impact that dysfunctional patterns of parent-child interaction have on children's well-being, further research is needed to keep strengthening DPICS psychometric properties among mother-child dyads to confirm the four-factor solution (Praise, Questions, Negative talk and Clear commands) and extend the study to father-child dyads, which continues to be a neglected area of study in the field of observed parenting behavior.

#### Acknowledgments

This work was financially supported by a grant from the Ministry of Economy and Competitiveness (MINECO) of Spain [Reference: PSI2013-46272-P], and the Basque Government Research Personnel Education and Training Program scholarship granted to María Cañas [PRE\_2017\_2\_050].

## References

- Bentler, P. M. (2006). EQS 6 *Structural Equations Program Manual*. Multivariate Software Inc.
- Bornstein, M. H., Putnick, D. L., & Suwalsky, J. T. D. (2018). Parenting cognitions - parenting practices - child adjustment? The standard model. *Development and Psychopathology, 30*(2), 399-416. <https://doi.org/10.1017/S0954579417000931>
- Borrego, J., Timmer, S. G., Urquiza, A. J., & Follette, W. C. (2004). Physically Abusive Mothers' Responses Following Episodes of Child Noncompliance and Compliance. *Journal of Consulting and Clinical Psychology, 72*(5), 897-903. <https://doi.org/10.1037/0022-006X.72.5.897>
- Brown, T. A. (2015). *Confirmatory Factor Analysis for Applied Research* (2nd ed.). The Guilford Press.
- Cañas, M., Ibabe, I., & De Paúl, J. (2020). Promising observational instruments of parent-child (0-12 years) interaction within the child protection system: A systematic review. *Child Abuse and Neglect, 109* (August). <https://doi.org/10.1016/j.chiabu.2020.104713>
- Chaffin, M., Silovsky, J. F., Funderburk, B., Valle, L. A., Brestan, E. V., Balachova, T., Jackson, S., Lensgraf, J., & Bonner, B. L. (2004). Parent-Child Interaction Therapy with Physically Abusive Parents: Efficacy for Reducing Future Abuse Reports. *Journal of Consulting and Clinical Psychology, 72*(3), 500-510. <https://doi.org/10.1037/0022-006X.72.3.500>
- Cho, H. C., & Abe, S. (2013). Is two-tailed testing for directional research hypotheses tests legitimate? *Journal of Business Research, 66*(9), 1261-1266. <https://doi.org/10.1016/j.jbusres.2012.02.023>
- Cotter, A. M., & Brestan-Knight, E. (2020). Convergence of Parent Report and Child Behavior Using the Dyadic Parent-Child Interaction Coding System (DPICS). *Journal of Child and Family Studies, 29*(11), 3287-3301. <https://doi.org/10.1007/s10826-020-01813-2>
- De Paul, J., Arruabarrena, I., & Indias, S. (2015). Implantación piloto de dos programas basados en la evidencia (SafeCare e Incredible Years) en los Servicios de Protección Infantil de Gipuzkoa (España). *Psychosocial Intervention, 24*(2), 105-120. <https://doi.org/10.1016/j.psi.2015.07.001>
- Early Head Start National Resource Center (2000). *Developmental Screening, Assessment, and Evaluation: Key Elements for Individualizing Curricula in Early Head Start Programs*. U.S. Department of Health and Human Services. <https://www.researchconnections.org/childcare/resources/880>
- Eyberg, S. M., Chase, R. M., Fernández, M. A., & Nelson, M. M. (2014). *Dyadic Parent-Child Interaction Coding System (DPICS): Clinical Manual* (4th ed.). PCIT International.
- Eyberg, S. M., Nelson, M. M., Ginn, N. C., Bhuiyan, N., & Boggs, S. R. (2013). *Dyadic Parent-Child Interaction Coding System (DPICS): Comprehensive Manual For Research And Training* (4th ed.). PCIT International.
- Eyberg, S. M., & Pincus, D. (1999). *Eyberg Child Behavior Inventory and Sutter-Eyberg Student Behavior Inventory-Revised: Professional Manual*. Psychological Assessment Resources.
- Fleming, A. P., McMahon, R. J., & King, K. M. (2017). Structured Parent-Child Observations Predict Development of Conduct Problems: The Importance of Parental Negative Attention in Child-Directed Play. *Prevention Science, 18*(3), 257-267. <https://doi.org/10.1007/s11121-016-0672-1>
- Gardner, F. (2000). Methodological Issues in the Direct Observation of Parent-Child Interaction: Do Observational Findings Reflect the Natural Behavior of Participants? *Clinical Child and Family Psychology Review, 3*(3), 185-198. <https://doi.org/10.1023/A:1009503409699>
- Granic, I., & Patterson, G. R. (2006). Toward a comprehensive model of antisocial development: A dynamic systems approach. *Psychological Review, 113*(1), 101-131. <https://doi.org/10.1037/0033-295X.113.1.10>
- Gridley, N., Blower, S., Dunn, A., Bywater, T., Whittaker, K., & Bryant, M. (2019). Psychometric Properties of Parent-Child (0-5 Years) Interaction Outcome Measures as Used in Randomized Controlled Trials of Parent Programs: A Systematic Review. *Clinical Child and Family Psychology Review, 22*(2), 253-271. <https://doi.org/10.1007/s10567-019-00275-3>
- Hawes, D. J., & Dadds, M. R. (2006). Assessing Parenting Practices Through Parent-Report and Direct Observation During Parent-Training. *Journal of Child and Family Studies, 15*(5), 554-567. <https://doi.org/10.1007/s10826-006-9029-x>
- Hayes, A. F., & Coutts, J. J. (2020). Use Omega Rather than Cronbach's Alpha for Estimating Reliability. But.... *Communication Methods and Measures, 14*(1), 1-24. <https://doi.org/10.1080/19312458.2020.1718629>
- Hendriks, A. M., Van der Giessen, D., Stams, G. J. J. M., & Overbeek, G. (2018). The association between parent-reported and observed parenting: A multi-level meta-analysis. *Psychological Assessment, 30*(5), 621-633. <https://doi.org/10.1037/pas0000500>
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- Kopalle, P. K., & Lehmann, D. R. (1997). Alpha Inflation? The Impact of Eliminating Scale Items on Cronbach's Alpha. *Organizational Behavior and Human Decision Processes, 70*(3), 189-197. <https://doi.org/10.1006/obhd.1997.2702>
- Lau, A. S., Valeri, S. M., McCarty, C. A., & Weisz, J. R. (2006). Abusive parents' reports of child behavior problems: Relationship to observed parent-child interactions. *Child Abuse and Neglect, 30*(6), 639-655. <https://doi.org/10.1016/j.chiabu.2005.11.009>
- Lincoln, C. R., Russell, B. S., Donohue, E. B., & Racine, L. E. (2017). Mother-Child Interactions and Preschoolers' Emotion Regulation Outcomes: Nurturing Autonomous Emotion Regulation. *Journal of Child and Family Studies, 26*(2), 559-573. <https://doi.org/10.1007/s10826-016-0561-z>
- Lorber, M. F., & Slep, A. M. S. (2018). The reliability paradox of the parent-child conflict tactics corporal punishment subscale. *Journal of Family Psychology, 32*(1), 145-150. <https://doi.org/10.1037/fam0000307>
- Margolin, G., Oliver, P. H., Gordis, E. B., O'Hearn, H. G., Medina, M., Ghosh, C. M., & Morland, L. (1998). The Nuts and Bolts of Behavioral Observation of Marital and Family Interaction. *Clinical Child and Family Psychology Review, 1*(4), 195-213. <https://doi.org/10.1023/a:1022608117322>
- McCune, B., & Grace, J. B. (2002). *Analysis of Ecological Communities*. MjM Software Design.
- McNeil, C. B., & Hembree-Kigin, T. L. (2010). *Parent-Child Interaction Therapy* (2nd ed.). Springer. <https://doi.org/10.1007/978-0-387-88639-8>
- Mokkink, L. B., de Vet, H. C. W., Prinsen, C. A. C., Patrick, D. L., Alonso, J., Bouter, L. M., & Terwee, C. B. (2018). COSMIN Risk of Bias Checklist for systematic reviews of Patient-Reported Outcome Measures. *Quality of Life Research, 27*(5), 1171-1179. <https://doi.org/10.1007/s11136-017-1765-4>
- Mortensen, J. A., & Mastergeorge, A. M. (2014). A meta-analytic review of relationship-based interventions for low-income families with infants and toddlers: facilitating supportive Parent-Child Interactions. *Infant Mental Health Journal, 35*(4), 336-353. <https://doi.org/10.1002/imhj.21451>
- Nilsen, F. M., Ruiz, J. D. C., & Tulve, N. S. (2020). A Meta-Analysis of Stressors from the Total Environment Associated with Children's General Cognitive Ability. *International Journal of Environmental Research and Public Health, 17*(15), 1-34. <https://doi.org/10.3390/ijerph17155451>
- Office on Child Abuse and Neglect (2018). *Child Protective Services: A Guide For Caseworkers*. U.S. Department of Health and Human Services. <https://www.childwelfare.gov/pubPDFs/cps2018.pdf>
- Pinquart, M. (2017). Associations of parenting dimensions and styles with externalizing problems of children and adolescents: An updated meta-analysis. *Developmental Psychology, 53*(5), 873-932. <https://doi.org/10.1037/dev0000295>
- Rios, J., & Wells, C. (2014). Validity evidence based on internal structure. *Psicothema, 26*(1), 108-116. <https://doi.org/10.7334/psicothema2013.260>
- Rivas, G. R., Arruabarrena, I., & Paúl, J. de (2020). Parenting Practice Interview (PPI): Spanish version for at-risk families with children aged 4 to 9 years [Manuscript submitted for publication]. Department of Social Psychology, University of the Basque Country.
- Robinson, E. A., & Eyberg, S. M. (1981). The dyadic parent-child interaction coding system: Standardization and validation. *Journal of Consulting and Clinical Psychology, 49*(2), 245-250. <https://doi.org/10.1037//0022-006X.49.2.245>



- Saklofske, D., Reynolds, R., & Schwann, V. (2013). *The Oxford Handbook of Child Psychological Assessment*. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199796304.001.0001>
- Stith, S. M., Liu, T., Davies, L. C., Boykin, E. L., Alder, M. C., Harris, J. M., Som, A., McPherson, M., & Dees, J. E. M. E. G. (2009). Risk factors in child maltreatment: A meta-analytic review of the literature. *Aggression and Violent Behavior, 14*(1), 13-29. <https://doi.org/10.1016/j.avb.2006.03.006>
- Swenson, S., Ho, G. W. K., Budhathoki, C., Belcher, H. M. E., Tucker, S., Miller, K., & Gross, D. (2016). Parents' Use of Praise and Criticism in a Sample of Young Children Seeking Mental Health Services. *Journal of Pediatric Health Care, 30*(1), 49-56. <https://doi.org/10.1016/j.pedhc.2015.09.010>
- Thomas, R., Abell, B., Webb, H. J., Avdagic, E., & Zimmer-Gembeck, M. J. (2017). Parent-Child Interaction Therapy: A Meta-Analysis. *Pediatrics, 140*(3), e20170352. <https://doi.org/10.1542/peds.2017-0352>
- Thomas, R., & Zimmer-Gembeck, M. J. (2012). Parent-Child Interaction Therapy. *Child Maltreatment, 17*(3), 253-266. <https://doi.org/10.1177/1077559512459555>
- Timmer, S. G., Borrego, J., & Urquiza, A. J. (2002). Antecedents of Coercive Interactions in Physically Abusive Mother-Child Dyads. *Journal of Interpersonal Violence, 17*(8), 836-853. <https://doi.org/10.1177/0886260502017008003>
- Waylen, A., Stallard, N., & Stewart-Brown, S. (2008). Parenting and health in mid-childhood: A longitudinal study. *European Journal of Public Health, 18*(3), 300-305. <https://doi.org/10.1093/eurpub/ckm131>
- Webster-Stratton, C. (2001). *Parenting Practices Inventory*. <https://www.incredibleyears.com/for-researchers/measures/>
- Werner, C. D., Linting, M., Vermeer, H. J., & Van Ijzendoorn, M. H. (2016). Do Intervention Programs in Child Care Promote the Quality of Caregiver-Child Interactions? A Meta-Analysis of Randomized Controlled Trials. *Prevention Science, 17*(2), 259-273. <https://doi.org/10.1007/s11121-015-0602-7>
- Wilson, S. R., Rack, J. J., Shi, X., & Norris, A. M. (2008). Comparing physically abusive, neglectful, and non-maltreating parents during interactions with their children: A meta-analysis of observational studies. *Child Abuse and Neglect, 32*(9), 897-911. <https://doi.org/10.1016/j.chiabu.2008.01.003>